1250 West Century Avenue
Mailing Address:
P.O. Box 5601
Bismarck, ND 58506-5601
(701) 530-1600

September 28, 2020

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE, Room 1A
Washington, D.C. 20426

Re: WBI Energy Transmission, Inc.
North Bakken Expansion Project, Supplemental Filing
Docket No. CP20-52-000
Docket No. CP20-52-001

Dear Ms. Bose:

WBI Energy Transmission, Inc. (WBI Energy), herewith submits updated agency correspondence in the above referenced dockets to assist Federal Energy Regulatory Commission (Commission) staff in the preparation of the environmental assessment for the North Bakken Expansion Project.

The filing includes the following volumes:

Volume I – contains previously unfiled updated agency correspondence. The information contained in Volume I is public.

Volume II – contains certain agency correspondence for which, pursuant to 18 CFR § 388.112, and consistent with the Commission's precedent and other applicable regulations with respect to sensitive information, WBI Energy requests privileged and confidential treatment of, and is labeled as "CUI//PRIV – DO NOT RELEASE.'

Pursuant to the Commission's guidelines for eFiling,[1] WBI Energy is hereby eFiling the supplemental information and will provide two complete copies of the information to the Office of Energy Projects (OEP) Room 62-46 and one complete copy to the Office of General Council – Energy Projects (OGC-EP) Room 101-56.

Pursuant to 18 CFR § 385.2010 of the Commission's regulations, copies of this response are being served to each person whose name appears on the official service list for this proceeding.

[1] Federal Energy Regulatory Commission Filing Guide/Qualified Documents List (February 14, 2017).

Any questions regarding this filing should be addressed to the undersigned at (701) 530-1563.

Sincerely,

/s/ Lori Myerchin

Lori Myerchin
Director, Regulatory Affairs and
Transportation Services

Attachment

Courtesy Copies:

Dawn Ramsey, FERC Environmental Project Manager
Shannon Crosley, FERC Environmental Deputy Project Manager
Official Service List
OEP Room 61-46 (2 copies)
OGC-EP Room 101-56 (1 copy)

CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Secretary in this proceeding.

Dated this 28th day of September 2020.

By /s/ Lori Myerchin
Lori Myerchin
Director, Regulatory Affairs
and Transportation Services
WBI Energy Transmission, Inc.
1250 West Century Avenue
Bismarck, ND 58503
Telephone: (701) 530-1563

North Bakken Expansion Project
Summary of Previously Unfiled Agency Correspondence through September 18, 2020 (Public)

Agency	Contact Name(s)	Date of Correspondence	Format	Summary
Multiple Agencies				
Bureau of Land Management (BLM), U.S. Army Corps of Engineers (USACE), U.S. Forest Service (USFS), Federal Energy Regulatory Commission	Cale Bickerdyke, Kim Grotte, Liv Fetterman, Elizabeth Bigelow, Andrea Kruse, Jeremy Thury, Richard Rogers, Reece Nelson, Michael Morris, Lisa Scheirer, Katherine West	09/16/20	Email	Email submitting electronic copies of supplemental filing documents to cooperating agencies. *These files were included as Appendix 3A, 3B, 4A-1, 4A-2, and 4E in the September 11, 2020 Supplemental Filing and are not provided as part of this filing.*
SHSND, USFS, and BLM	Andrew Clark, Fern Swenson, Andrea Kruse, and Katie West	09/11/20	Meeting Notes	Minutes from site visits to review features identified at 32MZ3379, 32MZ3380, 32MZ3382, 32MZ3383, and 32MZ3385.
BLM, USACE, USFS	Lisa Scheirer, Cale Bickerdyke, Kim Grotte, Reece Nelson, Jeremy Thury	09/18/20	Email	Email submitting an updated Plan of Development for the project.
Bureau of Land Management (BLM)				
BLM	Lisa Scheirer	08/12/20	Email	Email discussing meeting coordination.
BLM	Lisa Scheirer	08/12/20	Call Log	Call to discuss project updates.
BLM	Lisa Scheirer	09/17/20	Email	Email file transmittal and providing contact information to BLM.
BLM	Katie West	09/17/20	Meeting Notes	Minutes from site visits to review features identified at 32MZ3382, 32MZ3383, and 32MZ3385.
U.S. Army Corps of Engineers (USACE)				
USACE	Jeremy Thury	07/21/20	Email	Email inquiring about Lake Sakakawea access for contingency planning.
USACE	Rick Rogers	07/22/20	Phone Log	Telephone call from the COE to WBI Energy to discuss the results of the gradiometer survey conducted at site 32WI976.
USACE	Rick Rogers	07/27/20	Email	Email from WBI Energy to the COE transmitting the results of a gradiometer survey and a revised testing plan for 32WI976. (Note: The attachments referenced in this email contain location and character information for an archaeological site. The attachments have been filed under separate cover and are labelled "CUI//PRIV – DO NOT RELEASE.")
USACE	Rick Rogers	07/30/20	Phone Log	Telephone calls between the COE and WBI Energy to discuss the testing plan for 32WI976 and agency and tribal review of the plan.

North Bakken Expansion Project
Summary of Previously Unfiled Agency Correspondence through September 18, 2020 (Public)

Agency	Contact Name(s)	Date of Correspondence	Format	Summary
USACE	Rick Rogers	07/31/20	Email	Email from WBI Energy to the COE transmitting an updated testing plan for 32WI976. (Note: The attachment referenced in this email contains location and character information for an archaeological site. The attachment has been filed under separate cover and is labelled "CUI//PRIV – DO NOT RELEASE.")
USACE	Rick Rogers	08/05/20	Phone Log	Telephone call from the COE to WBI Energy regarding the testing plan for 32WI976.
USACE	Jason Renschler	08/10/20	Meeting Invite	Email meeting invitation to discuss Nationwide 12 Permit.
USACE	Jason Renschler	08/10/20	Meeting Notes	Meeting to discuss updates on Nationwide 12 versus use of Individual Permit.
USACE	Reece Nelson	08/11/20	Email	Email discussing logistics of 408 permit submittal.
USACE	Reece Nelson and Jeremy Thury	08/12/20	Email	Email providing WBI Energy's 408 Permit Submittal.
USACE	Rick Rogers	08/17/20	Phone Log	Telephone call from WBI Energy to the COE to discuss the planned schedule for completing site testing at 32WI976.
USACE	Reece Nelson, Jeremy Thury, and Robert Kruger	08/18/20	Email	Email from USACE providing draft schedule of 408 review.
USACE	Reece Nelson, Jeremy Thury, and Robert Kruger	08/19/20	Email	Email discussing draft 408 review schedule.
USACE	Reece Nelson, Jeremy Thury, Jason Renschler, Kody Green, Shenille Lillejord	08/20/20	Meeting Notes	Monthly meeting to discuss status of 408 review and schedule.
USACE	Jason Renschler	08/24/20	Meeting Notes	Meeting to discuss updates on Nationwide 12 and decision to move forward with Nationwide 12 for the project.
USACE	Rick Rogers	09/01/20	Phone Log	Telephone calls between the COE and WBI Energy to discuss site testing at 32WI976.
USACE	Jeremy Thury, Michael Tietz, Reece Nelson	09/02/20	Email	Email from Jeremy Thury providing PVQ document to be completed by WBI prior to site visit.

North Bakken Expansion Project
Summary of Previously Unfiled Agency Correspondence through September 18, 2020 (Public)

Agency	Contact Name(s)	Date of Correspondence	Format	Summary
USACE	Rick Rogers	09/03/20	Email	Email from WBI Energy to the COE providing an updated testing plan for 32WI976. (Note: The attachment referenced in this email contains location and character information for an archaeological site. The attachment has been filed under separate cover and is labelled "CUI//PRIV – DO NOT RELEASE.")
USACE	Rick Rogers	09/16/20	Call Log	Call from WBI Energy to the COE providing an update on the status of site testing at 32WI976.
USACE	Rick Rogers	09/16/20	Letter	Letter from WBI Energy to the COE transmitting the updated Class III Archaeological Survey Report, Geomorphology Report, and Addendum Class III Structures Report.
USACE	Reece Nelson	09/16/20	Email	ProjNet 408 review status and schedule.
USACE	Jeremy Thury	09/16/20	Email	Submitting completed PVQ document to Jeremy Thury.
USACE	Jason Renschler	09/18/20	Email	Email submitting WBI Energy's updated Nationwide Permit 12 Pre-Construction Notification.
USACE	Rick Rogers	09/18/20	Call Log	Call from the COE to WBI Energy requesting an update on the status of site testing at 32WI976.
USACE	Rick Rogers	09/18/20	Email	Email from WBI Energy to the COE providing an update on the status of site testing at 32WI976. (Note: The attachment referenced in this email contains location and character information for an archaeological site. The attachment has been filed under separate cover and is labelled "CUI//PRIV – DO NOT RELEASE.")
U.S. Forest Service (USFS)				
USFS	Cale Bickerdyke	07/20/20	Call Log	Call to discuss the potential need for additional paleontological surveys on USFS lands.
USFS	Cale Bickerdyke	07/21/20	Email	Email discussing meeting coordination.
USFS	Cale Bickerdyke and Kim Grotte	07/23/20	Meeting Notes	Meeting to review the current alignment across USFS land and routing constraints.
USFS	Liv Fetterman	07/24/20	Email	Email from WBI Energy to the USFS regarding survey activities on USFS lands.
USFS	Cale Bickerdyke and Kim Grotte	08/25/20	Email	Email chain discussing meeting coordination.
USFS	Cale Bickerdyke	08/27/20	Meeting Notes	Meeting to review the current alignment across USFS land and routing constraints.

North Bakken Expansion Project
Summary of Previously Unfiled Agency Correspondence through September 18, 2020 (Public)

Agency	Contact Name(s)	Date of Correspondence	Format	Summary
USFS	Liv Fetterman	09/09/20	Email	Email from WBI Energy to the USFS regarding a site visit on USFS lands with tribal representatives.
USFS	Liv Fetterman and Beth Bigelow	09/09/20	Email	Email from the USFS to WBI Energy acknowledging the planned site visit on USFS lands and providing alternate contact information for USFS staff.
USFS	Liv Fetterman and Beth Bigelow	09/09/20	Email	Email from WBI Energy to the USFS acknowledging receipt of the alternate contact information for USFS staff.
USFS	Andrea Kruse	09/10/20	Email	Email from the USFS to WBI Energy regarding a site visit on USFS lands with tribal representatives.
USFS	Cale Bickerdyke, Kim Grotte, Sarah Bickerdyke	09/11/20	Email	Email submitted an update Biological Evaluation for the project. *This file was included as Appendix 3B in the September 11, 2020 supplemental filing and is not included as part of this filing.*
USFS	Liv Fetterman	09/16/20	Letter	Letter from WBI Energy to the USFS transmitting the updated Class III Archaeological Survey Report, Geomorphology Report, and Addendum Class III Structures Report.
U.S. Fish and Wildlife Service (USFWS)				
USFWS	Jerry Reinisch	08/11/20	Email	Email providing USFWS with an update on project and supplemental filings.
USFWS	Jacob Krebsbach	09/01/20	Email	Email chain discussing USFWS wetland easements.
USFWS	Jerry Reinisch	09/11/20	Email	Email submitted an update Biological Assessment for the project. *This file was included as Appendix 3A in the September 11, 2020 supplemental filing and is not included as part of this filing.*
USFWS	Jerry Reinisch	09/18/20	Email	Email checking on receipt of Biological Assessment files.
U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS)				
USDA NRCS	Tighe Teets	08/18/20	Email	Email inquiring on seed mix recommendations.
USDA NRCS	Todd Hagel	08/28/20	Email	Email providing updated project shapefiles for NRCS easement review.
USDA NRCS	Todd Hagel	09/18/20	Email	Email checking in on the status of shapefile review.
North Dakota Department of Environmental Quality (NDDEQ)				
NDDEQ	Pete Wax and Chuck Hyatt	08/14/20	Email	Email chain inquiring about permitting requirements for disposal of drilling fluid.
NDDEQ	Brad Torgerson	08/14/20	Call Log	Call discussing permitting requirements for disposal of drilling fluid.
NDDEQ	Brad Torgerson	08/14/20	Email	Email following up after call to provide data sheets for possible drilling fluid additives.

North Bakken Expansion Project
Summary of Previously Unfiled Agency Correspondence through September 18, 2020 (Public)

Agency	Contact Name(s)	Date of Correspondence	Format	Summary
NDDEQ	Rheanna Kautzman	08/21/20	Email	Email chain discussing the review of the Tioga Compressor Station air permit modeling.
North Dakota State Water Commission (ND SWC)				
ND SWC	Gerald Heiser	07/24/20	Call Log	Call discussing the project and status of the review of the potential need for a scour analysis.
ND SWC	Gerald Heiser	07/30/20	Email	Email checking in on updates to the potential need of a scout analysis.
ND SWC	Sovereign Lands Permit Review and Gerald Heiser	08/12/20	Email	Email submitting the updated Sovereign Land Permit for the project.
ND SWC	Gerald Heiser	08/17/20	Call Log	Call log checking in on receipt of permit files and potential need for a scout analysis.
State Historical Society of North Dakota (SHSND)				
SHSND	Andrew Clark	07/20/20	Email	Email from WBI Energy to the SHSND regarding bone fragments recovered from 32MZ3313 in 2019.
SHSND	Andrew Clark	08/11/20	Email	Email from WBI Energy to the SHSND regarding pipeline routing around prehistoric stone feature sites near Tioga.
SHSND	Andrew Clark	08/13 and 08/14/20	Email	Emails between WBI Energy and the SHSND coordinating a call to discuss pipeline routing around prehistoric stone feature sites near Tioga.
SHSND	Andrew Clark	08/14/20	Email	Email from the SHSND directing WBI Energy to mail the bone fragments recovered from 32MZ3313 in 2019 to the THPO for the Three Affiliated Tribes.
SHSND	Andrew Clark	08/14/20	Meeting Notes	Teleconference between WBI Energy and the SHSND to discuss pipeline routing around prehistoric stone feature sites near Tioga.
SHSND	Andrew Clark and Amy Bleir	08/25/20	Phone Log	Teleconference between WBI Energy and the SHSND to discuss site form submittals.
SHSND	Andrew Clark	08/26/20	Phone Log	Telephone call from WBI Energy to the SHSND to discuss reporting requirements for archaeological resources and cultural heritage sites as well as effects assessments for the Project.
SHSND	Andrew Clark	08/31/20	Phone Log	Telephone call from WBI Energy to the SHSND to discuss the testing methodology for 32WI976.
SHSND	Andrew Clark	09/4/20	Phone Log	Telephone call from WBI Energy to the SHSND to discuss the testing methodology for 32WI976.

North Bakken Expansion Project
Summary of Previously Unfiled Agency Correspondence through September 18, 2020 (Public)

Agency	Contact Name(s)	Date of Correspondence	Format	Summary
SHSND	Andrew Clark	09/16/20	Letter	Letter from WBI Energy to the SHSND (state archaeologist) transmitting the updated Class III Archaeological Survey Report, Geomorphology Report, and Addendum Class III Structures Report.
SHSND	Fern Swenson	09/16/20	Letter	Letter from WBI Energy to the SHSND (director) transmitting the updated Class III Archaeological Survey Report, Geomorphology Report, and Addendum Class III Structures Report.
SHSND	Andrew Clark	09/17/20	Phone Log	Telephone call from WBI Energy to the SHSND to discuss the site visits conducted on 9-11-20.

NORTH BAKKEN EXPANSION PROJECT

Agency Correspondence – Multiple Agencies

Andrea Thornton

From: Andrea Thornton
Sent: Wednesday, September 16, 2020 12:44 PM
To: Bickerdyke, Cale E -FS; Grotte, Kim -FS; liv.fetterman@usda.gov; elizabeth.e.bigelow@usda.gov; andrea.kruse@usda.gov; Thury, Jeremy J CIV USARMY CENWO (USA); Rogers, Richard R II CIV USARMY CENWO (US); Nelson, Reece E CIV USARMY CENWO (USA); Morris, Michael P CIV USARMY CENWO (USA); Scheirer, Lisa L; West, Katherine J
Cc: Dawn Ramsey; Myerchin, Lori
Subject: WBI Energy September 11 2020 Supplemental Filing Privileged and Confidential Documents

Importance: High

Hello Everyone –

The following reports were filed with FERC on September 11, 2020 as Privileged and Confidential as part of WBI Energy's Supplemental Filing.

- Appendix 3A – Biological Assessment
- Appendix 3B – Biological Evaluation
- Appendix 4A-1 – ERM Arch Report
- Appendix 4A-2 – BCA Arch Report
- Appendix 4E - Geomorphology Assessment Report

Hard copies of the cultural reports are being mailed out which will contain copies of the formal submittal letters.

I have set up a OneDrive folder to give you access to electronic copies of these files. Please note that the link to this page will only work for one week so please pull the documents onto your computer and server for storage and distribution with your team as needed. Please also note that the documents are CUI/PRIV and should not be shared with the public.

https://theermgroup-my.sharepoint.com/:f:/g/personal/andrea_thornton_erm_com/Etj2B4g1Dz9Ni7u60tkIgH8BoiusAGBrUlNGD6aWi1_2tw?e=hgEwJk

Please let me know if you have any questions or issues accessing the files.

Thanks,
Andrea

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

Environmental Resources Management (ERM)
1050 SW 6th Avenue, Suite 1650 | Portland, Oregon | 97204
M 503-459-6864
E andrea.thornton@erm.com | **W** www.erm.com

MEETING NOTES

LOG OF IN PERSON MEETING

MEETING ATTENDEES:

Dyan Youpee – Assiniboine & Sioux Tribes Tribal Historic Preservation Officer
Eugene Ryan – Assiniboine & Sioux Tribes Tribal Cultural Specialist
Andrea Kruse – U.S. Forest Service (USFS)
Lucas - USFS
Katie West – Bureau of Land Management (BLM)
Jill Linn – WBI Energy Transmission, Inc. (WBI Energy)
Andrew Clark – State Historical Society of North Dakota (SHSND)
Fern Swenson - SHSND
Wade Burns – Beaver Creek Archaeology (BCA)
Raina Hanley – BCA
Larry Pallozzi – BCA
Jayson Zoino – Environmental Resource Group (ERM)

DATE:	TIME OF CONVERSATION:
September 11, 2020	11:30 am to 4:30 pm

RE:

North Bakken Expansion Project

LOG OF CONVERSATION:

ERM visited sites 32MZ3379, 32MZ3380, 32MZ3382, 32MZ3383, and 32MZ3385 on USFS lands with representatives of the Assiniboine & Sioux Tribes, SHSND, USFS, BLM, WBI Energy, and BCA. ERM documented these sites in the summer of 2020 during survey for WBI Energy's North Bakken Expansion Project. Tribal cultural specialists representing the Assiniboine & Sioux Tribes, Standing Rock Sioux Tribe, Rosebud Sioux Tribe (including one specialist working on behalf of the Sisseton Wahpeton Oyate Tribe), and Turtle Mountain Band of Chippewa Indians monitored ERM's delineation of the sites; however, the specialists did not uniformly concur with the interpretation of the finds as archaeological. Some of the specialists concluded that the finds documented by ERM are non-cultural.

The visits to 32MZ3379, 32MZ3380, 32MZ3382, 32MZ3383, and 32MZ3385 allowed Ms. Youpee and Mr. Ryan to inspect the sites and features recorded by ERM. Ms. Youpee did not concur with the interpretation of the finds as archaeological, instead concluding that the features are either natural or the result of modern disturbances.

The meeting participants also discussed: processes for addressing sites where tribal cultural specialists do not concur with interpretations by archaeologists; the roles of the different agencies reviewing the North Bakken Expansion Project; the different expertise provided by tribal cultural specialists and archaeologists; and the qualifications of ERM's archaeologists.

Andrea Thornton

From: Andrea Thornton
Sent: Friday, September 18, 2020 10:50 AM
To: Scheirer, Lisa L
Cc: Bickerdyke, Cale E -FS; Grotte, Kim -FS; Nelson, Reece E CIV USARMY CENWO (USA); Thury, Jeremy J CIV USARMY CENWO (USA); Linn, Jill; Huncovsky, Greg; Linn, Dave
Subject: North Bakken Expansion Project - Plan of Development Submittal
Attachments: BLM_WBI POD Transmittal Letter_091820.pdf

Hi Lisa –

Attached is our transmittal letter for submitting the revised Plan of Development for the North Bakken Expansion Project. Due to the size of the files we have created a One Drive folder for you to access the document. Please note that the link to this page will only work for one week so please pull the documents onto your computer and server for storage. Please also note that appendices L and M of the document are being submitted as CUI/PRIV and should not be shared with the public.

https://theermgroup-my.sharepoint.com/:f:/g/personal/andrea_thornton_erm_com/EmFlJc8SuPdFmlBzWUJr07MBoJAoZPDBFZlo7kLoF-GW4w?e=eqauP7

The appendices included with the Plan of Development are the same versions of files that were included in the September 11 FERC Supplemental Filing. A few of the appendices have not had any changes since we filed the first draft of the Plan of Development in February. These include:

- Appendix B – Typical Construction Drawings
- Appendix E – Blasting Plan
- Appendix F – FERC Plan and Procedures
- Appendix G – Fugitive Dust Control Plan
- Appendix I – Plan for Unanticipated Discovery of Contaminated Environmental Media
- Appendix O - USFS Recommended Seed Mixture

Please let me know if you have any questions or issues accessing the file.

Thank you,
Andrea

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

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M 503-459-6864
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WBI ENERGY TRANSMISSION, INC.
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Bismarck, ND 58506-5601
(701) 530-1600
www.wbienergy.com

September 18, 2020

Lisa Scheirer
Bureau of Land Management
North Dakota Field Office
99 23rd Ave West, Suite A
Dickinson, ND 58601

Re: WBI Energy Transmission, Inc.
North Bakken Expansion Project
Bureau of Land Management Right-of-Way Grant

Ms. Scheirer,

Enclosed is an updated Plan of Development being submitted by WBI Energy Transmission Inc. (WBI Energy) for the North Bakken Expansion Project (Project). This Plan of Development supports WBI Energy's SF-299 application submitted on November 22, 2019 for a Right-of-Way Grant to cross two federal lands:

- U.S. Army Corps of Engineers (USACE) Garrison Project - Lake Sakakawea and;
- U.S. Forest Service (USFS) Little Missouri National Grassland.

The enclosed Plan of Development conforms to the outline described in the Bureau of Land Management's regulations (43 CFR Subpart 2884) and identified potential Project impacts and proposed mitigation on federal lands. Additional information related to the Project off federal lands is provided in WBI Energy's application to Federal Energy Regulatory Commission.

We look forward to working with you as the Project moves forward. WBI Energy appreciates your assistance and review of the enclosed materials and should you have questions or require additional information during your review, please contact Jill Linn (406) 359-7332 or Andrea Thornton of Environmental Resources Management at (503) 459-6864 or andrea.thornton@erm.com.

Respectfully submitted,

Jill Linn
Environmental Manager
WBI Energy Transmission, Inc.

Enclosure:
Bureau of Land Management Plan of Development

Cc:

Greg Huncovsky, WBI
Andrea Thornton, ERM
Mark Cline, ERM

WBI ENERGY TRANSMISSION, INC.

North Bakken Expansion Project

Bureau of Land Management
Plan of Development

September 2020

Version 2

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT
PLAN OF DEVELOPMENT

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Appendix E Blasting Plan
Appendix F FERC Plan and Procedures
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Appendix I Plan for Unanticipated Discovery of Contaminated Environmental Media
Appendix J Spill Prevention, Control, and Countermeasure Plan
Appendix K Noxious Weeds Management Plan
Appendix L Biological Evaluation (*filed under separate cover as CUI/PRIV – Do Not Release*)
Appendix M Biological Assessment (*filed under separate cover as CUI/PRIV – Do Not Release*)
Appendix N Plan for Unanticipated Discovery of Historic Properties or Human Remains During Construction
Appendix O USFS Recommended Seed Mixture

ACRONYMS AND ABBREVIATIONS

Alliance	Alliance Pipeline
BLM	Bureau of Land Management
Certificate	Certificate of Public Convenience and Necessity
CFR	Code of Federal Regulations
COE	U.S. Army Corps of Engineers
Commission	Federal Energy Regulatory Commission
EI	environmental inspector
EO	Executive Order
FDR	Forest Development Road
FERC	Federal Energy Regulatory Commission
FWS	U.S. Fish and Wildlife Service
HDD	horizontal directional drill
hp	horsepower
LRMP	Land and Resource Management Plan
MP	milepost
NFS	National Forest System
NGA	Natural Gas Act
Northern Border	Northern Border Pipeline Company
Plan	Upland Erosion Control, Revegetation, and Maintenance Plan
POD	Plan of Development
Procedures	Wetland and Waterbody Construction and Mitigation Procedures
Project	North Bakken Expansion Project
USC	United States Code
USDOT	U.S. Department of Transportation
USFD	U.S. Forest Service
WBI Energy	WBI Energy Transmission, Inc.

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT

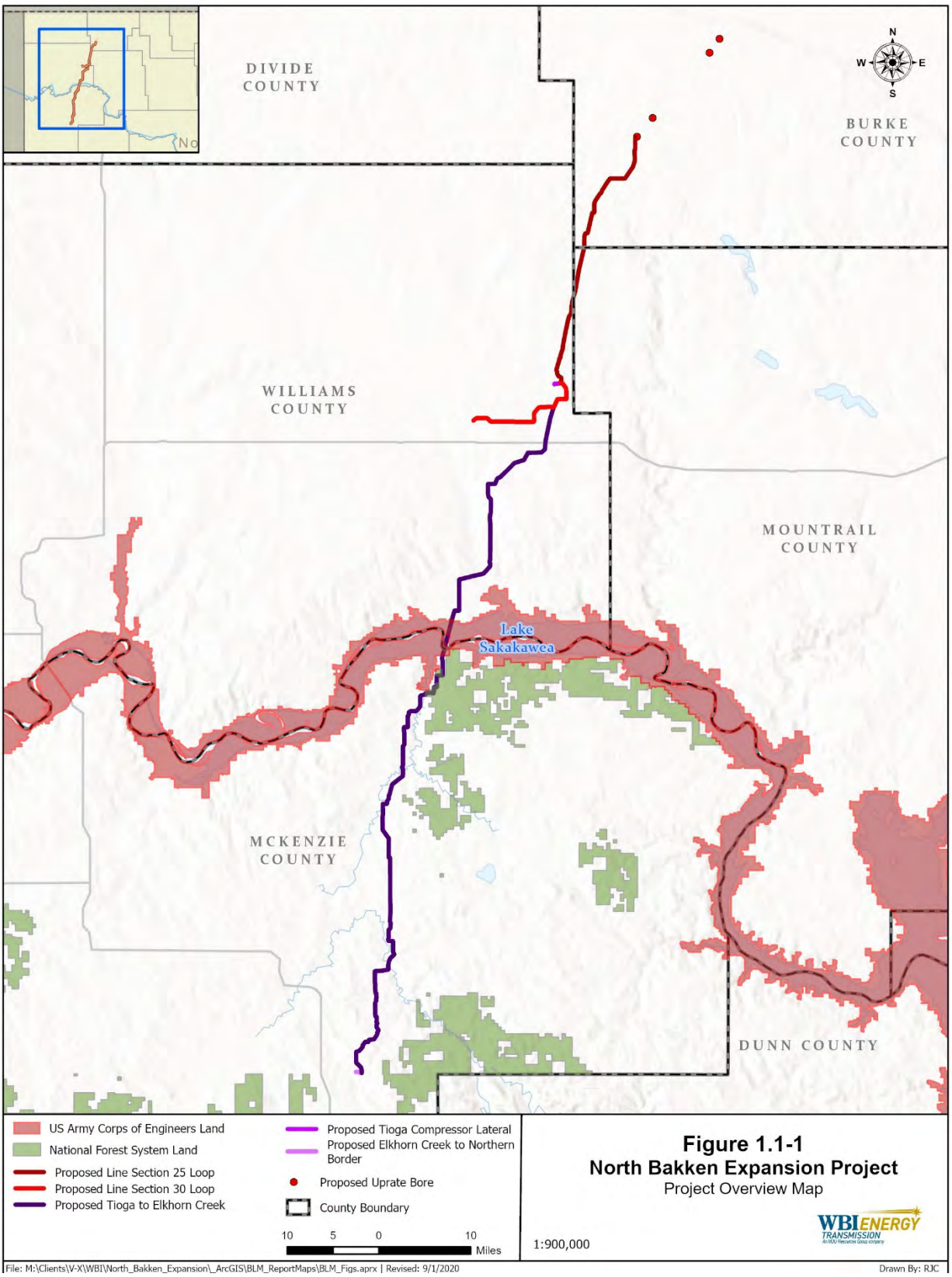
1.0 PURPOSE AND NEED

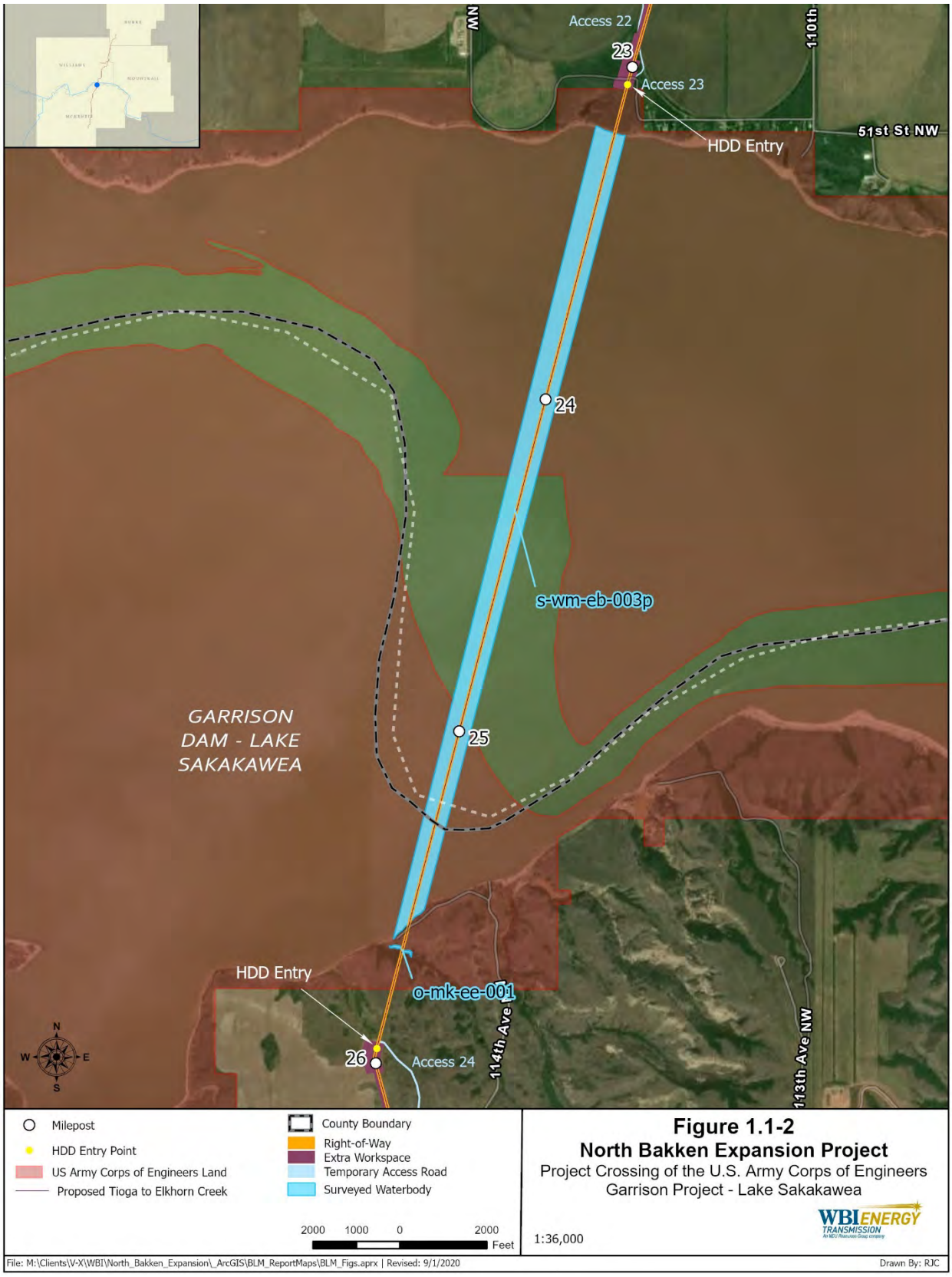
This section describes the purpose and need for the proposed North Bakken Expansion Project (Project). Below is a description of the facilities proposed for construction, the commodity transported in the pipeline, the type of transmission system, depth of cover, right-of-way requirements, relation to existing rights-of-way, and alternative considered.

1.1 PROJECT OVERVIEW

WBI Energy Transmission, Inc. (WBI Energy) is seeking a Certificate of Public Convenience and Necessity (Certificate) from the Federal Energy Regulatory Commission (FERC or Commission) pursuant to Section 7(c) of the Natural Gas Act (NGA) authorizing it to construct and operate the Project located in McKenzie, Williams, Mountrail, and Burke Counties, North Dakota. WBI Energy plans to construct and operate the Project, which consists of an approximately 62.8-mile-long, 24-inch-diameter natural gas pipeline from WBI Energy's existing Tioga Compressor Station near Tioga, North Dakota, to a new interconnect with Northern Border Pipeline Company's (Northern Border) mainline southeast of Watford City, North Dakota. A new compressor station (Elkhorn Creek Compressor Station) will be constructed near this interconnect.

The Project also involves construction of approximately 0.3 mile of new 24-inch-diameter natural gas pipeline between WBI Energy's new Elkhorn Creek Compressor Station and the Northern Border Interconnect, approximately 20.3 miles of new 12-inch-diameter natural gas pipeline looping between the existing Tioga Compressor Station and an existing receipt station along WBI Energy's existing Line Section 25, including replacement of 0.1 mile of the existing pipeline lateral with new 8-inch-diameter natural gas pipeline, approximately 9.6 miles of new 12-inch-diameter natural gas pipeline looping along WBI Energy's existing Line Section 30, and approximately 0.5 mile of new 20-inch-diameter receipt lateral at the Tioga Compressor Station. Additionally, the Project includes the addition of horsepower at the existing Tioga Compressor Station, uprates to WBI Energy's existing Line Section 25, and the installation of new and modifications to existing receipt/delivery points and lateral pipeline facilities along the pipeline routes. The proposed Project facilities are depicted below in figure 1.1-1. Of the 62.8 miles proposed for the Tioga-Elkhorn Creek pipeline, the Project crosses 4.8 miles of federal land; including 2.7 miles of U.S. Army Corps of Engineers (COE) Garrison Project – Lake Sakakawea (see figure 1.1-2) (referred to herein as COE-managed land) and 2.1 miles of U.S. Forest Service (USFS) Little Missouri National Grassland (see figure 1.1-3) (referred to as herein National Forest System [NFS] land).


DIVIDE COUNTY
BURKE COUNTY
WILLIAMS COUNTY
MOUNTRAIL COUNTY
MCKENZIE COUNTY
DUNN COUNTY
Lake Sakakawea
N
W
E
S
US Army Corps of Engineers Land
National Forest System Land
Proposed Line Section 25 Loop
Proposed Line Section 30 Loop
Proposed Tioga to Elkhorn Creek
Proposed Tioga Compressor Lateral
Proposed Elkhorn Creek to Northern Border
Proposed Uprate Bore
County Boundary
10 5 0 10
Miles
1:900,000
Figure 1.1-1
North Bakken Expansion Project
Project Overview Map
WBI ENERGY TRANSMISSION
File: M:\Clients\V-X\WBI\North_Bakken_Expansion_ArcGIS\BLM_ReportMaps\BLM_Figs.aprx | Revised: 9/1/2020
Drawn By: RJC


Access 22
23
Access 23
HDD Entry
110th
51st St NW
24
s-wm-eb-003p
GARRISON
DAM - LAKE
SAKAKAWEA
25
HDD Entry
o-mk-ee-001
26
Access 24
114th Ave
113th Ave NW
N
W
E
S
Milepost
HDD Entry Point
US Army Corps of Engineers Land
Proposed Tioga to Elkhorn Creek
County Boundary
Right-of-Way
Extra Workspace
Temporary Access Road
Surveyed Waterbody
2000 1000 0 2000
Feet
1:36,000
Figure 1.1-2
North Bakken Expansion Project
Project Crossing of the U.S. Army Corps of Engineers
Garrison Project - Lake Sakakawea
WBI ENERGY TRANSMISSION
File: M:\Clients\V-X\WBI\North_Bakken_Expansion_ArcGIS\BLM_ReportMaps\BLM_Figs.aprx | Revised: 9/1/2020
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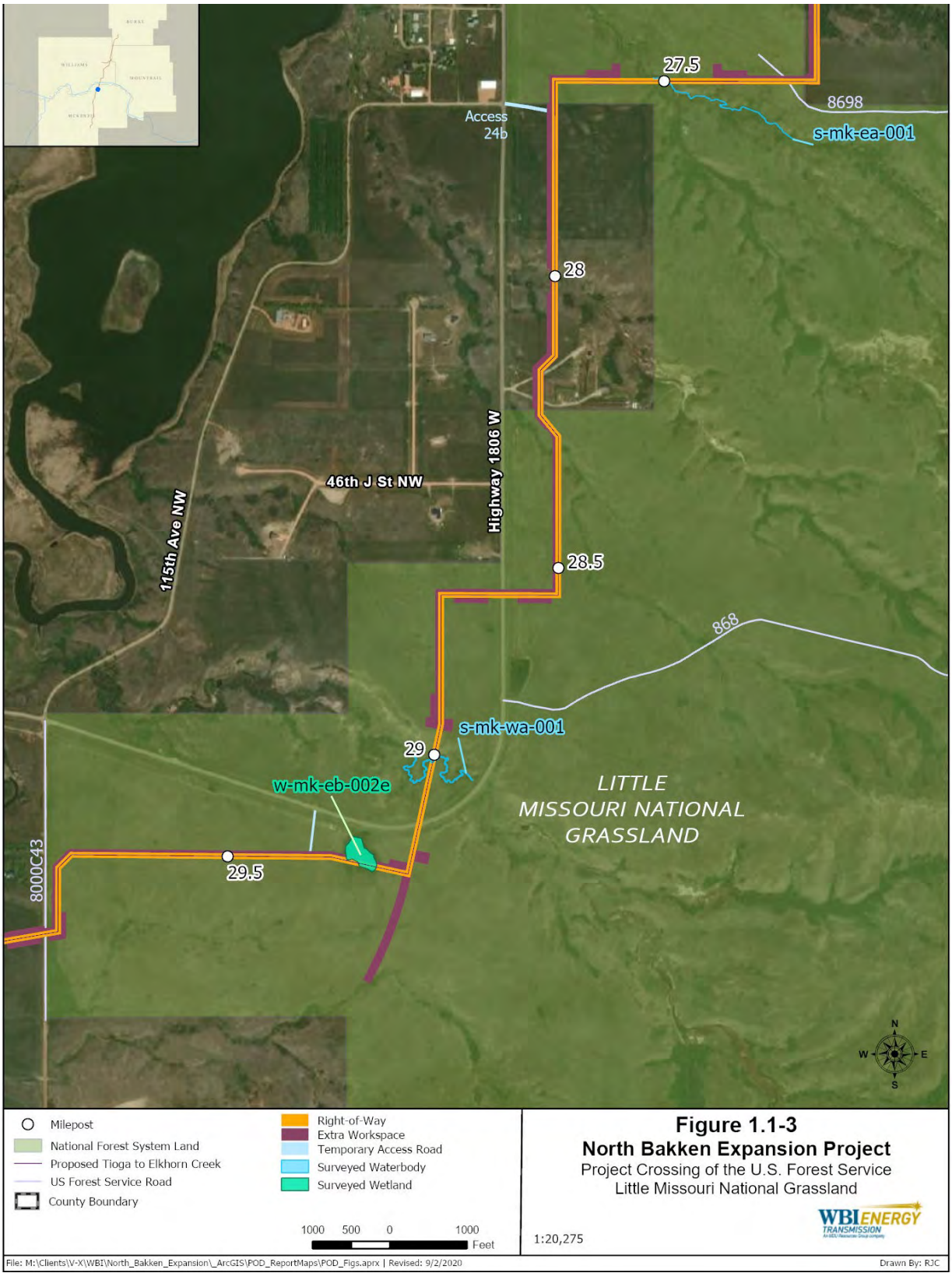


Figure 1.1-3
North Bakken Expansion Project
Project Crossing of the U.S. Forest Service
Little Missouri National Grassland

This Plan of Development (POD) outlines the steps that must be followed during construction and operation of the Project on federal lands. For an analysis of the environmental impacts for the Project as a whole, the FERC Application and associated Resource Reports will be available on the FERC website at http://ferc.gov. The POD is an iterative document that will evolve throughout the design and implementation process. All versions of the POD, appendices of the POD, and supporting documents will contain the date of issuance on each page. Should a Right-of-Way Grant be issued for the Project, the final POD will be incorporated into the Grant.

1.2 PROJECT PURPOSE

The Bakken Formation of the Williston Basin, which spans parts of North Dakota, Montana, and Saskatchewan, Canada, has been producing hydrocarbons since the first well was drilled in 1953. Recent advances in horizontal drilling technologies, however, have led to a resurgence of drilling activity in the area resulting in exponential growth since 2003. Although the formation primarily is an oil play, there is associated rich natural gas that is produced along with the oil. Rich gas generally requires investments in gas processing infrastructure before it can be delivered to market. As a result, some of the gas currently produced is flared because the producer focus has been on the higher value oil, and the economics have not historically supported gas-processing infrastructure. According to the North Dakota Department of Mineral Resources, flaring of natural gas in the state is at approximately 19 percent as of October 2019. The historical high of gas flared (36 percent) occurred in September 2011 (North Dakota Department of Mineral Resources, 2019).

As more natural gas processing infrastructure is being built in the region to meet state gas capture goals, natural gas pipeline infrastructure is needed to provide an outlet for the processed natural gas. WBI Energy intends to construct, own, operate, and maintain the proposed Project to transport processed natural gas from the Bakken region of northwest North Dakota to Northern Border's existing mainline for transit on that system. The Project will help to satisfy natural gas demand in the midcontinent region of the United States, and the proposed transportation capacity of the Project is at least an additional 250 million cubic feet per day.

1.3 DIMENSIONS OF THE RIGHT-OF-WAY AND RELATED FACILITIES ON FEDERAL LANDS

The entirety of the COE-managed land crossing will be accomplished using the horizontal directional drill (HDD) method; therefore, ground disturbance is not anticipated within COE-managed land. The proposed 50-foot-wide long-term easement will be retained for pipeline operations.

Construction of the proposed 24-inch-diameter Tioga-Elkhorn Creek pipeline on NFS land will consist of a 50-foot-wide right-of-way and a 25-foot-wide temporary workspace. Following construction, a 50-foot-wide long-term easement will be retained for pipeline operations; the remainder of the construction workspace will be restored to pre-existing conditions. Additionally, some temporary extra workspace will be required for certain road crossings, points of inflection along the route, and areas where special construction methods will be implemented (e.g., the HDD or guided bore method). On NFS land, the pipeline will be buried at a depth of 3 feet.

One temporary access road, (Access 24c) will be used during construction of the Project on the Little Missouri National Grassland. This temporary access road is not a USFS road. Portions of this access road are existing, but will be extended to connect to the proposed

construction workspace. The access road is approximately 354 feet long by 20 feet wide. Following construction, the road will be restored to pre-construction conditions.

The Project facilities and land requirements for federal lands are shown in table 1.3-1.

TABLE 1.3-1

North Bakken Expansion Project
Project Facilities on Federal Lands (in acres)

Agency	Long-term Easement	Temporary Workspaces	Temporary Access Road
COE	12.0	0.0	0.0
USFS	12.9	10.0	0.2

1.4 EXISTING RIGHTS-OF-WAY

The proposed Project is not an ancillary facility to any existing rights-of-way; it is independent of any other action currently taking place on either COE-managed or NFS land. Where feasible, WBI Energy has co-located the Project with existing infrastructure. Within NFS lands, the Project is collocated with ONEOK Inc.'s natural gas pipeline from milepost (MP) 27.3 to 27.6 as well as Highway 1806 W from approximately MPs 28.2 to 29.9. Co-location the Project complies with the 2001 Land and Resource Management Plan (LRMP) for the Dakota Prairie Grasslands Northern Region (USFS, 2019) (LRMP Guideline D.14).

1.5 ALTERNATIVE ROUTES OR LOCATIONS

WBI Energy has evaluated alternatives to determine whether they will be reasonable and environmentally preferable to the proposed Project. Alternatives considered include the no-action alternative, alternative energy sources and energy conservation, system alternatives, and facility alternatives.

To be considered preferable to the proposed Project, an alternative must provide a significant environmental advantage over the Project; meet the objectives and timeframes of the Project; and be technically and economically feasible and practicable.

1.5.1 No-action Alternative

The Williston Basin is one of the most prolific oil and associated natural gas production areas within the United States, due to the presence of the Bakken and Three Forks Formations. The Bakken and Three Forks Formations are primarily targeted for oil production (Energy of North Dakota, 2020a); however, there are significant volumes of associated rich natural gas produced in conjunction with the oil (Energy Information Administration, 2020). Rich natural gas generally needs to be processed by the appropriate natural gas processing infrastructure before it can be delivered to market (Energy of North Dakota, 2020b). The Project will provide an outlet for this natural gas. Under the no-action alternative, the Project would not be built, and the environmental impacts associated with construction and operation of the proposed facilities would not occur.

By not constructing the Project, however, WBI Energy would be unable to provide the incremental firm transportation capacity requested by shippers through the open season process. In particular, WBI Energy would be unable to transport incremental volumes of processed natural

gas, which would leave the processed natural gas stranded, possibly flared and unable to reach markets. In November 2019, natural gas production from the Bakken and Three Forks Formations was approximately 3.1 billion cubic feet per day, of this amount, approximately 2.6 billion cubic feet per day was captured and processed. Conversely, approximately 0.5 billion cubic feet per day, or approximately 17 percent, was flared due to limited or insufficient field gathering facilities, inadequate natural gas processing capacity and/or pipeline infrastructure (North Dakota Department of Mineral Resources, 2020). In addition, North Dakota has established state-mandated natural gas capture targets (North Dakota Industrial Commission, 2014). These targets require producers to capture a certain percentage of natural gas production on an annual basis. The current state-mandated target is 12 percent flared. Under the no-action alternative, other natural gas pipeline companies could propose to construct similar, new facilities to meet the contracted demand for the transportation of processed natural gas from the Williston Basin area. Such actions would likely result in impacts similar to or greater than the proposed Project, and might not meet the Project's objectives within the proposed timeframe. Therefore, the no-action alternative does not meet the primary objectives of the Project and provides no advantage over the proposed Project.

1.5.2 Alternative Energy Sources and Energy Conservation

The use of alternative energy sources, such as solar, wind, geothermal or biofuels, or the use of energy conservation measures are not reasonable options to meet the objectives of the Project, which is to transport gas from the Williston Basin area to Northern Border's interstate pipeline system. The natural gas that will be transported by the proposed Project is associated natural gas resulting from oil drilling in the Bakken and Three Forks Formations and neither alternative energy sources nor energy conservation would provide an outlet for the gas after it is processed.

1.5.3 System Alternatives

System alternatives would make use of other existing, modified, or proposed pipeline systems to meet the objectives of the Project. Use of a system alternative would make it unnecessary to construct all or part of the proposed Project, though some modifications or additions to the existing or proposed systems may be required. Such modifications or additions would result in environmental impacts; however, the impacts could be less than, similar to, or greater than those associated with construction of the proposed Project.

North Dakota has a broad network of high-pressure, high-volume, natural gas pipelines operating throughout the state. Of these, WBI Energy identified two existing systems that potentially could meet the objectives of the Project: the Alliance Pipeline (Alliance) and Northern Border. Each of these existing pipeline systems is described below, followed by a discussion of the potential for these pipelines to serve as system alternatives to the proposed Project. WBI Energy is not aware of any proposed pipeline systems in northwestern North Dakota that could meet the objectives of the Project.

Alliance Pipeline System Alternative

According to its website, the Alliance pipeline system consists of 2,391 miles of integrated Canadian and U.S. natural gas transmission pipelines, delivering liquids rich natural gas from the Western Canadian Sedimentary Basin and the Williston Basin in North Dakota to the Chicago market hub. The U.S. portion of the system consists of approximately 887 miles of 36-inch-

diameter pipeline with a maximum operating pressure of 1,935 pounds per square inch. The system has been in commercial service since December 2000 and delivers an average of 1.6 billion standard cubic feet of natural gas per day to the Chicago market.

As an alternative to the proposed Project, WBI Energy examined a connection with Alliance in northcentral North Dakota. This alternative would consist of approximately 124 miles of 24-inch-diameter pipeline from WBI Energy's Tioga Compressor Station traversing east to an interconnect with the Alliance pipeline system near Towner, North Dakota, and construction of a new compressor station near the interconnect. Construction of the proposed Line Section 25 and 30 pipeline loopings, the Tioga Compressor Lateral, and the required additional compression at the Tioga Compressor Station would be required for this alternative. The new compressor station near the Alliance interconnect would be much larger than the proposed Elkhorn Creek Compressor Station (estimated at 6,300 horsepower [hp] higher) due to the higher operating pressure of the Alliance pipeline as well as the additional distance to the Alliance interconnect. Due to the increased costs for the longer pipeline, the additional environmental impacts associated with the longer pipeline, as well as the increased costs for compressor horsepower, associated fuel and operating costs as well as construction and operational environmental impacts, this alternative was not selected.

Northern Border System Alternative

According to its website, the Northern Border pipeline system, owned by TC Pipelines, LP and ONEOK Partners, is a major natural gas transportation system that links the Midwestern United States with reserves in the Western Canadian Sedimentary Basin and transports natural gas produced in the Williston and Powder River Basins in the United States to the Chicago area (Northern Border, 2019). WBI Energy currently has five interconnects with the Northern Border pipeline system in northwestern and central North Dakota. The system has a total design capacity of about 2.4 billion cubic feet per day. Although the Northern Border Pipeline serves the Chicago market area.

WBI Energy examined constructing a 24-inch-diameter pipeline from the Tioga Compressor Station traversing west to its interconnection with Northern Border west of Williston, North Dakota that would be about 2 miles longer than the proposed Tioga-Elkhorn Creek pipeline. The pipeline would be routed around the north side of Williston, North Dakota and traverse southwest towards WBI Energy's Stateline interconnect with Northern Border. Construction of the proposed Line Section 25 and 30 pipeline looping, the Tioga Compressor Lateral, Northern Border Interconnect, and the required additional compression at the Tioga Compressor Station would be the same as the proposed Project. This alternative has the advantage of avoiding the crossing of Lake Sakakawea; however, the route is slightly longer than the Tioga-Elkhorn Creek pipeline, reduces pipeline collocation opportunities, and increased the length of the pipeline that would be constructed through less heavily oil- and gas-developed areas. Furthermore, the interconnect location is further upstream on Northern Border's system; therefore, customers on Northern Border would incur additional fuel and transportation costs on its system when compared to the Project's proposed tie-in to Northern Border's existing mainline near the proposed Elkhorn Creek Compressor Station. In addition, the town of Williston is considered a hub city within the region. The town's population has tripled over that last 10 years and expanded to provide new housing and infrastructure to meet the demands of a growing city (City of Williston, 2019). This alternative route would be in close proximity to Williston and would increase the likelihood of

encroachment. Due to reduced flexibility, encroachment of the town of Williston, and increased fuel and transportation costs, this alternative was not selected.

1.5.4 Avoidance of Federal Lands

The goal of the proposed route selection analysis was to identify a Project alignment that represents a minimal and acceptable level of environmental impact coupled with attainment of the Project goals. Through the identification of the proposed Project pipeline facility routes, WBI Energy worked to co-locate the proposed pipeline facilities with existing utility corridors and minimize impacts on environmental resources and stakeholders.

U.S. Army Corps of Engineers Garrison Project - Lake Sakakawea

Since the COE Garrison Project - Lake Sakakawea extends approximately 45 miles west and over 100 miles southeast of the proposed Lake Sakakawea crossing location, route alternatives to avoid COE-managed land were deemed impracticable. A major route alternative around Lake Sakakawea would add a minimum of between 90 and 200 miles to the Project, which in turn would add additional environmental constraints including but not limited to additional wetland crossings, waterbody crossings, wetland easements, and vegetation impacts.

U.S. Forest Service Little Missouri National Grassland

To avoid crossing USFS Little Missouri National Grassland, WBI Energy considered two major route alternatives: the Western Alternative and the Eastern Alternative.

Western Alternative

The Western Alternative would extend west from MP 22.4 of the Tioga-Elkhorn Creek pipeline, follow the north side of 51st Lane NW until it connects with Highway 1804, and then continues along the north side of Highway 1804 for an additional 2 miles. The alternative route would then head southwest through steep topography along the north side of Lake Sakakawea between existing oil and gas well pad development. The alternative route then crosses Lake Sakakawea following an existing ONEOK Rockies Midstream gathering line through a valley on the south side of the lake. The route then continues south paralleling Highway 1806 west for about 1 mile before turning east and following 45th Street NW for an additional 0.9 mile. At this point, the alternative would rejoin the Tioga-Elkhorn Creek pipeline route near MP 30.8.

The Western Alternative is 12.1 miles in length, compared with the 8.4-mile corresponding segment of the proposed Tioga-Elkhorn Creek pipeline route. In addition to the crossing of Lake Sakakawea, the Western Alternative would cross a total of 3.8 miles of COE-owned land compared with 2.7 miles of the proposed Tioga-Elkhorn Creek pipeline route including COE-owned lands that extend on the north side of Highway 1804 near Lund's Landing Boat Ramp. The Western Alternative would be within 0.25 mile of both Lund's Landing and 3 D's Campground, which would have temporary impacts (visual, noise, traffic) on these existing recreation area during construction.

Review of National Wetlands Inventory data shows that the Western Alternative would cross three additional emergent wetlands compared to the proposed route. Review of National Hydrography Dataset data indicates that the same amount of intermittent and perennial waterbodies would be crossed by the Western Alternative as the proposed segment of the Tioga-

Elkhorn Creek pipeline. The crossing of Lake Sakakawea (waterbody itself) would be 2.7 miles compared to 2.4 miles for the proposed route. While a configuration of a HDD layout was not developed for the Western Alternative, it is anticipated that the drill itself would need to extend north and south of the lake proper, making the drill a minimum of 0.3 mile longer than that of the proposed lake crossing. As previously mentioned, the topography on the north shore of Lake Sakakawea on the Western Alternative is much steeper than that of the proposed route and could potentially require grading for placement of the pipe pullback for the HDD. The south shore of Lake Sakakawea has the potential viability of a pipe pullback area for the Western Alternative; however, only approximately 0.7 mile of contiguous agricultural fields are present versus 2.7 miles on the proposed route. Additional shrub/tree clearing would be required for a pullback on the south shore.

While the Western Alternative would avoid the crossing of the USFS Little Missouri National Grassland, it would add approximately 4 miles to the pipeline route, increase the length of COE-lands crossed, be in close proximity to two existing recreation areas, cross additional wetland areas, and require a longer HDD crossing of Lake Sakakawea. For these reasons, the Western Alternative was not selected as a viable route alternative.

Eastern Alternative

The Eastern Alternative would extend south from MP 17.6 of the Tioga-Elkhorn Creek pipeline for approximately 1 mile before heading east following 54th and 55th Streets NW for an additional 16 miles, head south following 96th Avenue NW for about 4 miles and turn east along 51st Street NW for an additional 4 miles. The Eastern Alternative would then head southeast along Highway 1804 for approximately 8 miles before heading southwest across Lake Sakakawea. The alternative would then head west for about 21 miles generally following existing roads where possible and following existing utility rights-of-way for another 5 miles before rejoining the Tioga-Elkhorn Creek pipeline route near MP 34.7.

The Eastern Alternative is approximately 61.8 miles in length, compared with the 17.1 mile corresponding segment of the proposed Tioga-Elkhorn Creek pipeline route. The Eastern Alternative would cross a total of 3.2 miles of COE-owned land compared with 2.7 miles of the proposed route and would avoid crossing of USFS-owned land. While the alternative was routed to follow existing roads for the majority of the route, this does put the alternative in close proximity to various homes and businesses primarily along 54th Street NW, 92nd Avenue NW, 91st Avenue NW, 43rd Avenue NW, and 42nd Avenue NW. While the Eastern Alternative would not extend into the Fort Berthold Indian Reservation, it would be located approximately 2 miles west of the reservation boundary for approximately 10 miles along the route. The Eastern Alternative crossing of Lake Sakakawea would be just upstream of the reservation boundary.

Review of National Wetlands Inventory data shows that the Eastern Alternative would cross approximately 25 additional emergent wetlands compared to the proposed route. Review of National Hydrography Dataset data indicates that the Eastern Alternative would cross over 40 additional intermittent waterbodies compared with the corresponding segment of the proposed segment of the Tioga-Elkhorn Creek pipeline. The crossing of Lake Sakakawea (waterbody itself) would be 2.6 miles compared to 2.4 miles for the proposed route. While a configuration of an HDD crossing was not developed for the Eastern Alternative, it is anticipated that the HDD would need to extend on either side of the lake proper, making the drill a minimum of 0.2 mile longer than that of the proposed lake crossing. Similar to the Western Alternative, the topography on

both shores of Lake Sakakawea is much steeper than that of the proposed route and could potentially require grading and/or tree clearing for placement of the HDD pipe pullback.

While the Eastern Alternative would avoid crossing the USFS Little Missouri National Grassland, it would add over 50 miles to the pipeline route, increase the length of COE lands crossed, be in close proximity to homes and businesses, cross additional wetland and waterbody areas, and would require a longer HDD crossing of Lake Sakakawea. For these reasons, the Eastern Alternative was not selected as a viable route alternative.

2.0 RIGHT-OF-WAY LOCATION

This section provides the legal description of the federal land right-of-way, land surveys, maps, and the land status of area calculations listed in section 1.3.

2.1 LEGAL DESCRIPTION

A legal description of COE-managed land and NFS land crossed by the Project is presented in table 2.1-1.

TABLE 2.1-1

North Bakken Expansion Project
Legal Description of the Federal Lands Crossed by the Project

Parcel Number	Main Contact	Legal Description	Title Comments
154-96-18-066	Corps of Engineers	S1/2 SE1/4 SW1/4 IN SEC. 18, T154N, R96W	Assessors Property ID 07-154-96-00-18-060
154-96-19-068	Corps of Engineers	E1/2 SW1/4, LOTS 3 & 4 IN SEC. 19, T154N, R96W	Assessors Property ID 07-154-96-00-19-030
154-96-30-071	Corps of Engineers	LOTS 2 THROUGH 5 AND THE 1896 GLO DEPICTED MISSOURI RIVER BED IN SEC. 30, T154N, R96W	Assessors Property ID 07-154-96-00-30-030
154-97-25-073a	Corps of Engineers	LOT 7 AND THE 1896 GLO DEPICTED MISSOURI RIVER BED IN SEC. 25, T154N, R97W	N/A
154-97-36-074a	Corps of Engineers	NW1/4, NE1/4 IN SEC. 36, T154N, R97W	Assessors Property ID 22-00-14160
153-97-01-077a	US Forest Service	S1/2W1/2SE1/4, S1/2E1/2SW1/4 IN SEC. 1, T153N, R97W	Assessors Property ID 22-00-00760
153-97-12-078	US Forest Service	E1/2 SW1/4, SW1/4 SW1/4 IN SEC. 12, T153N, R97W	Assessors Property ID 22-00-04690
153-97-13-081	US Forest Service	W1/2NW1/4 IN SEC. 13, T153N, R97W	Assessors Property ID 22-00-04695
153-97-14-082	US Forest Service	NE1/4 IN SEC. 14, T153N, R97W	Assessors Property ID 22-00-04910

2.2 SITE-SPECIFIC ENGINEERING SURVEYS FOR CRITICAL AREAS

WBI Energy has completed land boundary and monument surveys in locations crossed or adjacent to COE-managed land and NFS land. The information collected is included on the Alignment Sheets in appendix A. These maps depict the property boundary, any relevant property corners, monuments, and the proposed disturbance footprint of the Project and water crossings (e.g., wetlands and waterbodies). Surveys were conducted by a professional land surveyor

licensed in North Dakota. Following construction of the pipeline, WBI Energy will reestablish any boundary lines, corners, and monuments necessary and provide as-built drawings to the COE and USFS depicting the location of the pipeline on each property.

2.3 ACRE CALCULATION OF THE RIGHT-OF-WAY BY LAND STATUS

Table 1.3-1 lists the acres within the right-of-way by workspace type. On COE-managed land, the Project will cross Lake Sakakawea, which is a reservoir created by the Garrison Dam/Lake Sakakawea Project. On NFS land, the Project is located within Management Area 6.1 – Rangeland with Broad Resource Emphasis as described in the LRMP.

3.0 FACILITY DESIGN FACTORS

The pipeline and aboveground facilities described in this POD will be designed, constructed, tested, operated, and maintained in accordance with the requirements of 49 Code of Federal Regulations (CFR) Part 192, Transportation of Natural Gas and Other Gas by Pipeline; Minimum Safety Standards; 18 CFR 380.15, Site and Maintenance Requirements; and other applicable federal and state regulations.

DOT regulations define area classifications (called class location units) based on population density in the vicinity of a pipeline, and specify more rigorous safety requirements for populated areas. Each class location unit covers the area extending 220 yards on either side of the centerline of any continuous 1-mile length of pipeline. The proposed Project will fall under a Class 1 designation for its entire length, which is specified by any class location unit that has 10 or fewer buildings intended for human occupancy. The pipe specifications for the Project are identified in table 3.0-1.

TABLE 3.0-1

North Bakken Expansion Project
Pipe Specifications

Construction Method/Design Parameter	Specification
HDD Pipe Specifications	
Maximum Allowable Operating Pressure	1,480 pounds per square inch gauge
Wall thickness	0.990 inches
Grade of steel	API-5L-X60 PSL2
Design Factor	0.3
Guided Bore Pipe Specifications	
Maximum Allowable Operating Pressure	1,480 pounds per square inch gauge
Wall thickness	0.580 inches
Grade of steel	API-5L-X65 PSL2
Design Factor	0.5
Standard Pipe Specifications	
Maximum Allowable Operating Pressure	1,480 pounds per square inch gauge
Wall thickness	0.480 inches
Grade of steel	API-5L-X65 PSL2
Design Factor	0.6

The product transported by the Project will be natural gas. Methane, the primary component of natural gas, is colorless, odorless, and tasteless. It is not toxic and is inactive biologically, but is classified as a simple asphyxiate, possessing a slight inhalation hazard.

The pipeline operating temperature is expected to be that of the ground temperature. Slight temperature variations may occur immediately downstream of compression, but the pipeline temperature will normalize with the surrounding soil within a relatively short distance.

On NFS land, the pipeline will be buried at a depth of 3 feet, per the requirements of the U.S. Department of Transportation (USDOT) Pipeline and Hazardous Materials Safety Administration regulations, 49 CFR Part 192. There will not be any aboveground appurtenances within COE or NFS land such as compressor stations, measuring stations, receipt/transfer stations, or valve settings. On COE-managed land the pipeline will be installed using the HDD crossing method to cross under Lake Sakakawea. The depth of cover is approximately 250 feet based on the over water geotechnical analysis completed in the spring of 2020.

As described in section 1.3 above, the construction right-of-way on NFS land would be 50 feet wide with an additional 25 feet of temporary workspace for topsoil segregation and travel lane and extra workspace at guided bore crossings. The long-term operational easement would be 50 feet wide.

4.0 ADDITIONAL COMPONENTS OF THE RIGHT-OF-WAY

Project components, on and off federal land, is described in section 1.1. The pipeline will not connect to any existing pipeline rights-of-way on COE-managed land or NFS land. Section 1.4 describes other corridors adjacent to the proposed pipeline right-of-way. No additional components are proposed for future development on either COE-managed land or NFS land. There will be no pumping, metering, compressor stations, mainline valves, or cathodic protection sites on either COE-managed land or NFS land. The nearest compressor station is 16.9 miles from the COE-managed land and 20.8 miles from NFS land.

Extra workspace that will be used to support construction activities are shown on the Alignment Sheets included in appendix A. Extra workspace will be returned to pre-construction conditions and is not required for operation of the Project. Contractor and pipe storage yards will not be located on federal land. In order to efficiently move equipment and materials, WBI Energy intends to use one temporary access road (Access 24c) during construction of the Project. This temporary access road is not a USFS road. This access road will be returned to pre-construction conditions and is not required for operation of the Project. A discussion of road upgrades and reclamation can be found in sections 6.3.2 and 8.4, respectively.

WBI Energy does not anticipate importing fill material (sand or gravel) to construct the Project. If fill material is needed on NFS land, WBI Energy will coordinate with the USFS.

5.0 GOVERNMENT AGENCIES INVOLVED

Table 5.0-1 lists the agencies that are involved with the permitting and regulatory processes for the Project. WBI Energy has provided the Bureau of Land Management (BLM), COE, and USFS with copies of all relevant filings, including the FERC 7(c) Application and will continue to provide copies of relevant filings.

TABLE 5.0-1

North Bakken Expansion Project
Environmental Permits, Approvals, and Consultations

Agency	Permit/Approval/Consultation	Anticipated Submittal Date	Anticipated Approval Date
Federal			
Federal Energy Regulatory Commission	Certificate under Section 7(c) of the NGA	February 2020	February/March 2021
U.S. Army Corps of Engineers – Omaha District and U.S. Army Corps of Engineers – Garrison Project Office	Issuance of a Section 404 permit for discharges of dredged or fill material into waters of the United States, including jurisdictional wetlands Issuance of a Section 408 permit for projects that impact (i.e., modify of occupy) any COE-constructed public works projects that include dams, basins, levees, channels, navigational channels, or other local flood protection works Clearance to work on any COE-controlled property Issuance of a Section 10 permit for structures or work in or affecting navigable Waters of the United States	Initial 408 and 404 Applications submitted February 2020 Revised Applications August 2020 (408) and September 2020 (404)	February/March 2021
U.S. Fish and Wildlife Service – Region 6 – North Dakota Field Office and U.S. Fish and Wildlife Service Crosby Wetland Management District	Consultations for impacts on federally listed threatened and endangered species and critical habitat under Section 7 of the Endangered Species Act, the Migratory Bird Treaty Act, the Bald and Gold Eagle Protection Act, and the Fish and Wildlife Coordination Act Consultation for impacts on federal conservation easements for grasslands and wetlands	Initial Application February 2020 Revised Application September 2020	December 2020
U.S. Department of the Interior, Bureau of Land Management – Eastern Montana/Dakotas District Office	Coordination of National Environmental Policy Act process when more than one federal land management agency's lands are crossed. The BLM is responsible for issuing rights-of-way over lands managed by two or more federal agencies	Initial Application February 2020 Revised Application September 2020	February/March 2021
U.S. Forest Service – Dakota Prairie Grasslands Little Missouri National Grassland	Consultation to cross USFS Lands and issuance of a Special Use Permit through the U.S. Bureau of Land Management right-of-way process.	Initial Application February 2020 Revised Application September 2020	February/March 2021
U.S. Department of Agriculture, Natural Resources Conservation Service – North Dakota	Consultations regarding erosion and sedimentation controls and seed mixes, and Agricultural Conservation Easement Program	Ongoing	December 2020
Advisory Council on Historic Preservation	Consultation under Section 106 of the National Historic Preservation Act if the Project would affect historic properties	-	-
North Dakota			
North Dakota Department of Health, Division of Air Quality	Permits to Construct an Air Contaminant Source –Tioga Compressor Station and Elkhorn Creek Compressor Station	Initial Applications February 2020 Revised Application for Tioga Compressor Station July 2020	Permit to Construct for Elkhorn Compressor Station Received March 2020.

TABLE 5.0-1

North Bakken Expansion Project
Environmental Permits, Approvals, and Consultations

Agency	Permit/Approval/Consultation	Anticipated Submittal Date	Anticipated Approval Date
			Anticipated permit for Tioga in November 2020
	Permits to Operate – Tioga Compressor Station and Elkhorn Creek Compressor Station	Between October 2021 and October 2022	Between January 2022 and January 2023
North Dakota Department of Health, Division of Water Quality	General Permit for Construction Stormwater Discharge under the National Pollutant Discharge Elimination System	October/November 2020	January 2021
	General Permit for Construction Dewatering and Discharge of Hydrostatic Test Water under the National Pollutant Discharge Elimination System		
	Water Quality Certificate under Section 401 of the Clean Water Act	Initial Application February 2020	
		Revised Application September 2020	February/March 2021
North Dakota State Water Commission	Navigable Water Crossing Permit under North Dakota Century Code Chapter 61-33 (Sovereign Lands)	Initial Application February 2020	
		Revised Application August 2020	November 2020
	Temporary Water Permit – Water appropriation permit for withdrawals associated with hydrostatic test water and drilling mud	October/November 2020	January 2021
North Dakota Department of Game and Fish	Consultation for impacts on fisheries and wildlife	February 2020	March 2020
North Dakota Parks and Recreation Department	Consultation under the North Dakota Natural Heritage Program	June 2019	May 2019
State Historical Society of North Dakota	Consultation for impacts on historic properties under Section 106 of the National Historic Preservation Act	February 2020	January 2021
North Dakota State Lands Board	Right-of-Way Grant to cross state lands	November 2020	December 2020

6.0 CONSTRUCTION OF THE FACILITIES

This section provides the construction sequence, work force, access, typical engineering drawings, special equipment for the HDD and guided bore, construction contingency plans, construction safety requirements, and anticipated industrial waste or toxic substances.

6.1 CONSTRUCTION PLANNING AND PREPARATION

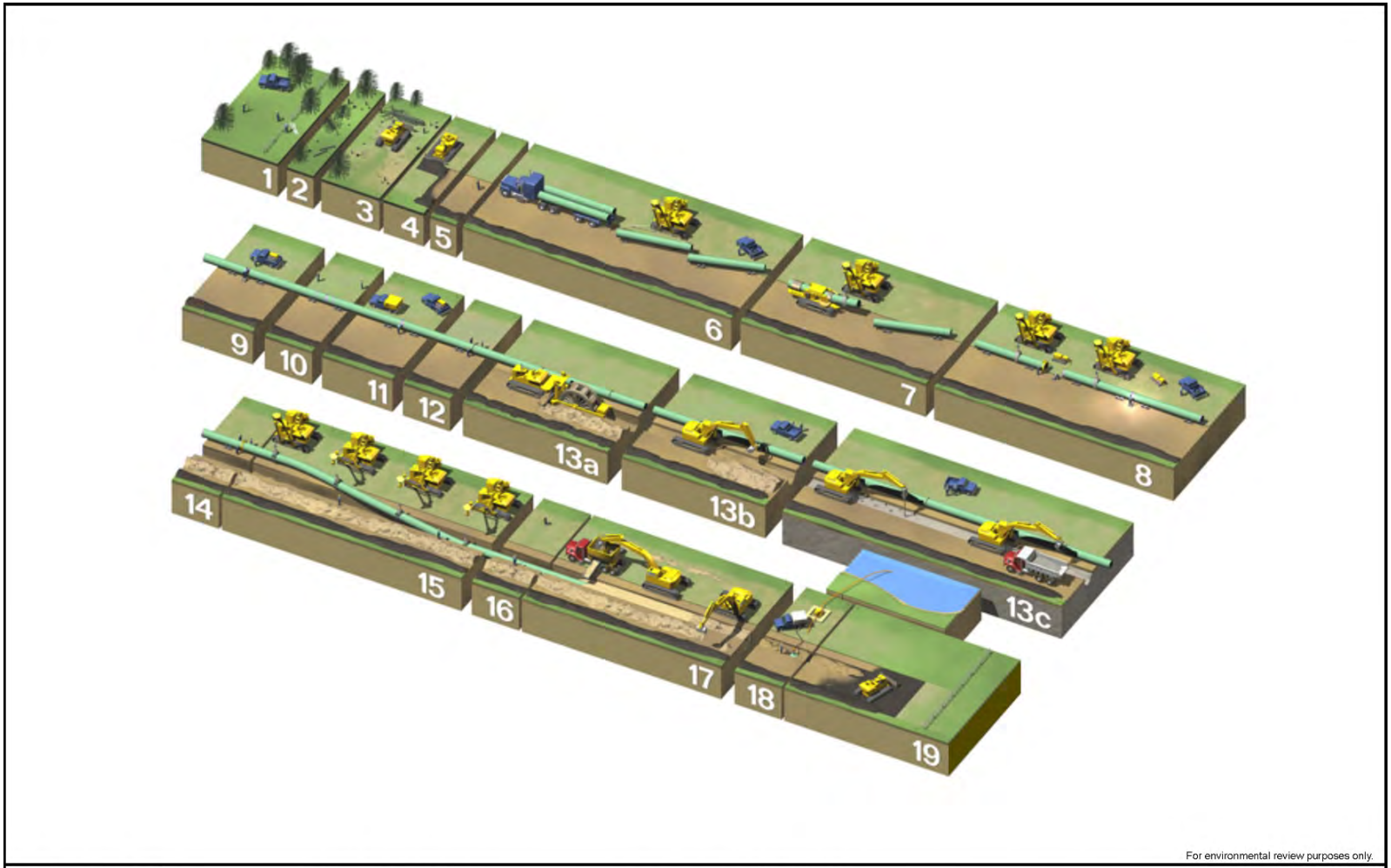
Construction is anticipated to commence in March 2021 for aboveground facilities and May 2021 for pipeline facilities. WBI Energy will provide a written request to proceed with construction to the BLM (for federal lands) and FERC prior to the start of construction. The notice to proceed will be evaluated by the BLM (in coordination with the COE and USFS) and FERC. Construction will begin only after receipt of the notice to proceed from both BLM and FERC. WBI Energy will ensure that construction personnel are adequately trained in the environmental restrictions and/or requirements applicable to their job duties. Anyone that will be on-site during construction of the Project will be required to have environmental training specific to the Project. A log will be kept in the construction trailer documenting that everyone on-site during construction has participated in the necessary training sessions.

WBI Energy will implement an environmental compliance program for the Project. WBI Energy's environmental inspectors (EIs) and the construction contractor will receive copies of all applicable environmental permits, plans, and procedures, as well as any conditions agreed to by WBI Energy and relevant landowners.

Further, the construction contractor will receive any Project-specific alterations to FERC's Upland Erosion Control, Revegetation, and Maintenance Plan (Plan) and FERC's Wetland and Waterbody Construction and Mitigation Procedures (Procedures) as approved by the appropriate agencies. The construction contractor will also be provided with detailed and specific environmental procedures and drawings to ensure compliance with the FERC requirements for this Project, as they relate to notification requirements issued, mitigation measures approved by FERC, and other related environmental permits.

6.2 STANDARD CONSTRUCTION AND RESTORATION TECHNIQUES

WBI Energy will conduct all construction activities in accordance with the conditions outlined in the FERC Certificate, BLM Right-of-Way Grant, 2001 LRMP for the Dakota Prairie Grasslands Northern Region, COE Section 10, 404, and 408 permits, and all other federal, state, and local approvals as minimum standards during construction. Pipeline construction will follow industry-standard practices and procedures as described below. Typical construction drawings are included in appendix B. Conventional open-ditch construction methods will be used to install most of the proposed pipelines. In a typical scenario, construction involves a series of discrete activities conducted in a linear sequence. These include survey and staking; right-of-way clearing and grading; pipe stringing, bending, and welding; trenching; lowering-in and backfilling; hydrostatic testing; final tie-in; commissioning; and right-of-way cleanup and restoration. Figure 6.2-1 illustrates each of the steps in a typical construction scenario. A description of each step in the process is provided in the following sections.



For environmental review purposes only.

1. Survey and Staking
2. Clearing
3. Front-End Grading
4. ROW Topsoil Stripping
5. Restaking Centerline of Trench
6. Stringing Pipe
7. Field Bending Pipe
8. Line-Up, Initial Weld
9. Fill & Cap, Final Weld
10. As-Built Footage
11. X-Ray Inspection, Weld Repair
12. Coating Field Welds
13a. Trenching (wheel ditcher)
13b. Trenching (backhoe)
13c. Trenching (rock)
14. Inspection & Repair of Coating
15. Lowering Pipe into Trench
16. As-Built Survey
17. Pad, Backfill, Rough Grade
18. Hydrostatic Testing, Final Tie-in
19. Replace Topsoil, Final Clean-Up, Full Restoration

Figure 6.2-1
Typical Pipeline Construction Sequence
North Bakken Expansion Project
WBI Energy Transmission, Inc.

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6.2.1 Survey and Staking

Affected landowners will be notified before preconstruction survey and staking are conducted. After these notifications, WBI Energy's survey crews will stake the pipeline centerline and the limits of the right-of-way and extra workspace. Additionally, the survey crew will flag the location of approved access roads. Wetland boundaries and other environmentally sensitive areas will also be marked at this time.

6.2.2 Clearing and Grading

Prior to beginning ground-disturbing activities, WBI Energy's contractor will coordinate with the North Dakota One-Call system to have existing underground utilities (i.e., cables, conduits, and pipelines) identified and flagged. Once this process is complete, a clearing crew will clear the work area of vegetation and other obstacles, including trees (if necessary), stumps, logs, brush, and rocks. If tree removal is required, to the extent feasible, WBI Energy will minimize tree removal during construction. Cleared vegetation and stumps will be chipped (except in wetlands), put to beneficial use such as mulch for erosion control, or hauled offsite to a commercial disposal facility. As needed, snow will be plowed to the edge of the construction right-of-way and stockpiled.

Following clearing (and snow removal as necessary), the right-of-way and extra workspace will be graded where necessary to provide a level work surface to allow safe passage of construction equipment and emergency vehicles. Topsoil will be segregated in accordance with the FERC Plan and Procedures. If the ground is relatively flat and does not require topsoil segregation or grading, rootstock will be left in the ground to facilitate restoration of the right-of-way. In areas disturbed by grading, and as required by the FERC Plan and Procedures, temporary erosion and sediment controls will be installed within the right-of-way to minimize erosion. These erosion and sediment controls will be inspected and maintained throughout the construction and restoration phases of the Project, as appropriate, and as required by the FERC Plan and Procedures.

6.2.3 Pipe Stringing, Bending, and Welding

Individual joints of pipe will be trucked to the right-of-way and strung along the trenchline in a single, continuous line. Individual sections of pipe will be bent, where necessary, to allow for a uniform fit with the contours at the bottom of the trench and horizontal points of inflection. Typically, a track-mounted, hydraulic pipe-bending machine will tailor the shape of the pipe to conform to the contours of the terrain. After the pipe sections are bent, they will be welded together into long sections and placed on temporary supports. Welding will be conducted in compliance with 49 CFR 192 and American Petroleum Institute Standard 1104 Welding of Pipelines and Related Facilities. Completed welds will be visually and non-destructively inspected, and all pipe welds will be coated in accordance with required specifications. The coating will be inspected for defects and repaired, if necessary, prior to lowering the pipe into the trench.

6.2.4 Trenching

Trenching, which involves excavating a ditch for the pipeline, will be conducted with rotary trenching machines, track-mounted backhoes, or other similar equipment. Trench spoil will be deposited adjacent to the trench within the construction right-of-way, and adjacent to the topsoil

pile. The trench will be excavated to a depth that provides sufficient cover over the pipeline after backfilling. Typically, the trench will be excavated to a depth of about 5 feet to allow for a normal depth of cover of 3 feet over the pipeline, or any appurtenances, after construction. Additional cover will be provided at road crossings for a minimum depth of cover of 5 feet. The bottom width of the trench will be sufficient to accommodate the pipeline. The width at the top of the trench will vary to allow the side slopes to be adapted to local conditions at the time of construction. In saturated areas, the open trench may become filled with groundwater and necessitate trench dewatering. In accordance with the FERC Procedures, WBI Energy will dewater the trench (either on or off the construction right-of-way) in a manner that does not cause erosion and does not result in silt-laden water flowing into any waterbody. Dewatering structures will be removed as soon as practicable after the completion of dewatering activities.

Based on a preliminary review of the soils present in the Project area, WBI Energy does not expect that blasting will be required to excavate the trench. If shallow bedrock or boulders are encountered that cannot be removed by conventional methods, blasting may be necessary and discussed further in section 6.4.6.

6.2.5 Lowering-in and Backfilling

Prior to lowering-in, the trench will be inspected to ensure it is free of rocks and other debris that could damage the pipe or its protective coating. It also will be checked for wildlife that may be trapped at the bottom of the trench. The pipe will then be lifted from the temporary supports and lowered into the trench using side-boom tractors. As necessary, trench breakers will be installed in the trench around the pipe in steeply sloped areas to prevent movement of subsurface water along the pipeline. After lowering-in, the trench will be backfilled with previously excavated materials using bladed equipment or backhoes. If the excavated material is rocky, the pipeline will be protected with a rock shield or covered with more suitable fill. Clean fill may be obtained by removing rock from the excavated spoil. Topsoil will not be used to pad the pipe.

6.2.6 Hydrostatic Testing

After backfilling, hydrostatic testing activities will occur. WBI Energy anticipates that water for hydrostatic testing will be sourced from a water depot. The total volume of hydrostatic test water required for the Project will be about 4.9 million gallons. After the test is complete, water will be discharged to an approved well-vegetated upland area(s) in accordance with permit conditions and the FERC Plan.

6.2.7 Final Tie-in and Commissioning

After hydrostatic testing, final pipeline tie-ins will be completed, and commissioning will commence. Commissioning involves activities to verify that equipment is properly installed and working, controls and communications systems are functional, and the pipeline is ready for service. The pipelines will be cleaned, dried, and inspected using in-line inspection tools (pigs) to detect anomalies in the pipe that may have been introduced during construction, and prepared for service by purging the line of air and loading the line with natural gas.

6.2.8 Cleanup and Restoration

Final cleanup will begin after backfilling and as soon as weather and site conditions permit. Every reasonable effort will be made to complete final cleanup (including final grading and

installation of permanent erosion control devices) within timeframes required by permits, in accordance with landowner or land management agency requests, or as required by the FERC Plan and Procedures.

During cleanup, construction debris will be collected and taken to a disposal facility. Project area contours will be restored to pre-existing conditions as closely as possible. Segregated topsoil will be spread over the surface of the right-of-way and permanent erosion controls will be installed. Revegetation measures will be implemented in accordance with the FERC Plan and Procedures and land management agency requirements.

Markers showing the location of the pipelines will be installed at fence crossings, road crossings, points of inflection, and other areas as necessary to identify WBI Energy as the owner of the pipelines and convey emergency information in accordance with applicable government regulations, including USDOT safety requirements.

6.3 ACCESS TO AND ALONG RIGHT-OF-WAY DURING CONSTRUCTION

WBI Energy does not intend to build any new roads on COE-managed land. The Project will use existing access roads for work in these areas. As discussed in section 4.0 above, WBI Energy intends to use one temporary access road (Access 24c) during construction of the Project on NFS land. This temporary access road is not a USFS road. This access road will be returned to pre-construction conditions and is not required for operation of the Project.

6.3.1 Road Closures

WBI Energy will cross one USFS road (Forest Development Road [FDR] 8689) using the open-cut method and may be closed for up to 72 hours to allow for trenching and pipe placement; however, WBI Energy will attempt to complete construction across this road within 24 hours. Prior to closing roads, a road closure schedule will be arranged with the USFS. Local businesses or residents that may be affected by the closures as well as law enforcement agencies will be notified and appropriate signage will be posted as needed.

WBI Energy will use the guided bore method for one USFS/county road (FDR 8000C43/115th Ave NW) crossing to minimize the impacts to vehicle traffic. Where required by the landowner, a temporary bridge or bypass may be established on small roads or driveways. Impacts on the existing transportation system are anticipated to be temporary and minimal. The pipeline routes are located in areas that are primarily rural and do not experience heavy traffic volumes.

6.3.2 Road Improvements

WBI Energy will restore all roads to pre-existing conditions or better as described in section 8.4. WBI Energy will work with USFS regarding any road improvements.

6.4 SPECIALIZED PIPELINE CONSTRUCTION PROCEDURES

In addition to standard pipeline construction methods, WBI Energy will use special construction techniques where warranted by site-specific conditions. These special techniques will be used when constructing across waterbodies, wetlands, and roads. Each of these specialized measures is described below.

The Project does not cross residential areas or pass within 50 feet of a residence. In the event that changes in the Project design require construction in residential areas or within 50 feet of a residence, WBI Energy will comply with Commission regulations and file the necessary information for these crossings.

6.4.1 Waterbody Crossings

For waterbodies that are not proposed to be crossed using the HDD or guided bore methods, WBI Energy proposes to use conventional upland techniques if no flow is present at the time of the crossing. For waterbodies currently proposed to be crossed using the open-cut method, the guided bore crossing method may be implemented based on site conditions at the time of construction. Although dry crossing methods, such as the flume and dam-and-pump methods, are not proposed for the Project, they may be considered if warranted by site-specific conditions at the time of construction. In each case and for each method, WBI Energy will adhere to measures specified in the FERC Procedures as well as any additional requirements which may be specified in federal or state waterbody crossing permits.

Waterbody crossings on COE-managed land and NFS land are shown below in table 6.4.1-1. A complete list of the waterbodies along the pipeline routes, and the construction method proposed for each crossing is included in Resource Report 2 of the FERC Application and applicable Project supplemental filings.

TABLE 6.4.1-1

North Bakken Expansion Project
Waterbodies on Federal Lands Crossed by the Project [a]

Agency	Milepost	Waterbody Name b	Waterbody ID	Flow Regime	Width (feet)	Crossing Method c
COE	24.4	Lake Sakakawea	s-wm-eb-003p	PN	12,559	HDD
COE	25.7	Natural Pond	o-mk-ee-001	NA	34	HDD
USFS	27.5	UNT to Sand Creek	s-mk-ea-001	E	<10	Guided Bore
USFS	29.0	UNT to Tobacco Garden Creek	s-mk-wa-001	I	25	Guided Bore

[a] Based on Project field surveys.
[b] Waterbody names are based on USGS topographic maps.
[c] The HDD and guided bore crossing methods are both trenchless methods used to install pipelines across sensitive areas such as wetlands and waterbodies, roads, and other utility crossings to avoid direct impacts on those features. See discussion in section 6.3.1.

Note: PN = Perennial; I = Intermittent; E = Ephemeral; NA = Not applicable; UNT = Unnamed Tributary

Open-Cut Method

No waterbodies on federal lands are proposed to be crossed using the open cut method. The open-cut method involves backhoe-type excavators operating from the banks of the waterbody to open a trench. The pipeline alignment will be perpendicular to the waterbody to minimize the crossing length and facilitate long-term stability (LRMP Guideline B.2 and 9). Excavated spoil will be stockpiled on the bank above the high water mark, at least 10 feet from the edge of the waterbody, for use as backfill (LRMP Guidelines B.5 and 6). A prefabricated segment of pipeline will then be placed into the trench using side-boom tractors. Concrete coating

or set-on weights will be utilized, as necessary, to provide negative buoyancy for the pipeline. Once the trench is backfilled, the banks will be restored as near as practicable to preconstruction contours and stabilized (LRMP Standard B.2). Stabilization measures will include seeding, installation of erosion control blankets, or installation of riprap materials, as appropriate (LRMP Standards B.1 and 8). Excavated material not required for backfill will be removed and disposed of at upland disposal sites. When complete, the pipeline crossing will be restored to maintain the pre-construction flow regime (LRMP Standards B.7 and 10).

Throughout the construction process, WBI Energy will follow the FERC Procedures to avoid or minimize impacts on water quality and protect the riparian ecosystem by maintaining the quantity and quality of the surface and groundwater (LRMP Standards B.3 and 7). Construction activities will be scheduled so that the trench is not excavated across the waterbody until immediately prior to pipe laying activities. The duration of in-stream construction activities (excluding blasting, if required) will be limited to 24 hours across minor waterbodies (those 10 feet wide or less) and 48 hours across intermediate waterbodies (those between 10 and 100 feet wide). Excavated spoil will be stockpiled at least 10 feet from the edge of the waterbody, and appropriate erosion control devices will be installed in the field.

Horizontal Directional Drill and Guided Bore Methods

The HDD and guided bore crossing methods are both trenchless methods used to install pipelines across sensitive areas such as wetlands and waterbodies, roads, and other utility crossings to avoid direct impacts on those features. The HDD method is used for crossings that are typically longer and deeper than the guided bore method, which is used for relatively short crossings (i.e., less than 1,000 feet) that are relatively shallow with a small arc bore path. HDD construction consists of much larger stationary equipment, requiring onsite assembly. Whereas, guided bores will be constructed with self-contained, mobile equipment with a smaller footprint. Both methods consist of drilling a small diameter pilot hole under the sensitive area and enlarging the hole through successive reaming until it is large enough to accommodate a prefabricated segment of pipe. In the process of drilling and/or reaming the hole, a slurry of drilling mud will be circulated through the drilling tools to lubricate the drill bit, remove drill cuttings, and promote drillhole stability. Drilling mud primarily consists of water mixed with in-situ material or bentonite, a non-toxic, naturally occurring sedimentary clay. The site-specific HDD crossing drawing for Lake Sakakawea on the COE-managed land is provided in appendix C.

To begin each crossing, a drill rig will be placed on the entry side of the HDD or guided bore and a small pilot hole will be drilled along a predetermined path beneath the feature. For the HDD crossing of Lake Sakakawea, WBI Energy anticipates using the intersect method, where a single alignment is achieved by drilling from both ends so as to connect the drills underground. Electromagnetic sensors located on the tip of the drill bit will allow the operator to follow the sensor grid along the prescribed path. Once the pilot hole is completed, the sensor grid will be removed and the hole will be enlarged through a process called reaming. A reaming tool will be installed at one end of the drill string on the exit side of the pilot hole, and then pushed or drawn back to the drill rig to enlarge the hole. Several passes with progressively larger reaming tools may be required to enlarge the hole to a sufficient diameter to accommodate the pipeline. During this process, drilling fluid, or mud, consisting of in-situ material and water (and possibly bentonite clay) will be circulated through the hole to remove drill cuttings and maintain the integrity of the hole. Once the reaming process is complete, a prefabricated segment of pipe will be attached to the drill string on the exit side of the crossing, and pulled back through the hole toward the drill rig.

The pipe segment will generally be hydrostatically tested prior to its installation, and once installed, connected on either side of the crossing to adjoining sections of pipe. The pipe segment will be hydrostatically tested a second time with the remainder of the pipeline system.

Although the HDD and guided bore method typically avoids impacts on water quality by precluding disturbance of the waterbody bed and banks, an unintended release of drilling mud (referred to as an inadvertent return) could occur if drilling fluids escape the drill hole and are forced through the subsurface substrate to the ground surface. In order to minimize potential impacts of inadvertent releases of drilling fluids, WBI Energy will implement the measures identified in its Horizontal Directional Drill/Guided Bore Drilling Fluid Monitoring and Operations Plan (HDD Plan). This plan describes procedures to be used to monitor, contain, and clean up any potential releases of drilling fluid. It also identifies contingency measures to be implemented in the event that an HDD or guided bore is unsuccessful. A copy of the plan is provided in appendix D which includes Michel's HDD Plan specific to the crossing of Lake Sakakawea as an attachment.

6.4.2 Wetland Crossings

Construction across wetlands will be conducted in accordance with the FERC Procedures, site-specific modifications to the FERC Procedures as requested by WBI Energy and approved by the FERC, and any additional requirements specified in federal or state water crossing permits. Typical methods for construction across wetlands are described below.

Wetland boundaries will be delineated and marked in the field prior to construction activities. Temporary erosion control devices will be installed as necessary after initial disturbance of wetlands or adjacent upland areas to prevent sediment flow into wetlands (LRMP Standard B.1). These devices will be maintained until revegetation of wetlands is complete. Trench plugs will be installed as necessary to maintain wetland hydrology (LRMP Standard B.4). Construction equipment operating in wetland areas will be limited to what is needed to clear the right-of-way, dig the trench, install the pipeline, backfill the trench, and restore the right-of-way.

Up to the top 12 inches of topsoil will be stripped from the area directly over the trenchline (except in standing water or in saturated conditions) and stockpiled separately from the subsoil. The segregated topsoil will be restored to its original location following installation of the pipe and backfilling of the trench in accordance with the FERC Procedures. Materials such as timber mats placed in wetlands during construction will be removed during rough grading and final cleanup, and the preconstruction contours of the wetland will be restored. Permanent erosion control measures will then be installed in accordance with the FERC Procedures, and disturbed areas within wetlands will be temporarily stabilized with a cover species such as annual ryegrass as soon as weather conditions permit. Wetland areas will then be allowed to return to preconstruction conditions using the original seed stock contained in the conserved topsoil layer.

The specific crossing procedures used to install a pipeline across wetlands will depend on the level of soil stability and saturation encountered during construction. Construction across unsaturated wetlands that can support the weight of equipment will be conducted in a manner similar to the upland construction procedures described above. In areas that are proposed for conventional open trench construction, but where soil conditions may not support the weight of equipment, timber mats will be used to minimize disturbance to wetland hydrology and maintain soil structure.

The pull method of construction may be used in inundated or saturated conditions where wetland soils and hydrology cannot support conventional pipe laying equipment, or in areas that have significant quantities of water that will allow for the pipe to be floated through the open ditch. With this method, construction and excavation equipment will work from temporary work surfaces and a prefabricated pipeline segment will be pulled or floated into position, or carried into place, then sunk with buoyancy control devices and placed in the trench.

Wetland crossings on COE-managed land and NFS land are shown below in table 6.4.2-1. A complete list of the wetlands along the pipeline routes, and the construction method proposed for each crossing is included in Resource Report 2 of the FERC Application and applicable Project supplemental filings.

TABLE 6.4.2-1

North Bakken Expansion Project
Wetlands on Federal Lands Crossed by the Project [a]

Agency	Milepost	Wetland ID b	Cowardin Classification	Width (feet) a	Construction Impact (acres)	Crossing Method c
USFS	29.3	w-mk-eb-002e	PEM	158.3	0.3	Open Cut

[a] Based on Project field surveys.

[b] Waterbody names are based on USGS topographic maps.

[c] Guided Bore = The HDD and guided bore crossing methods are both trenchless methods used to install pipelines across sensitive areas such as wetlands and waterbodies, roads, and other utility crossings to avoid direct impacts on those features. See discussion in section 6.4.1.

Open Cut = The specific crossing procedures used to install a pipeline across wetlands will depend on the level of soil stability and saturation encountered during construction. See discussion in section 6.4.1.

Note: PEM = palustrine emergent wetland

6.4.3 Road Crossings

One dirt two-track USFS roads will be crossed using the open-cut method and then restored to preconstruction condition. This road is FDR 8689, located near MP 27.3, which will be crossed for approximately 40 feet. Open-cut road crossings are anticipated to be completed and restored in a few days. Additionally, one graveled USFS road will be crossed near MP 29.9 via the guided bore method. This road is also known as 115th Ave NW and is primarily managed by McKenzie County. While not a USFS road, the Project will cross Highway 1806 West in two locations (MPs 28.6 and 29.1) using the guided more method. Construction across roads will be conducted in accordance with the FERC Plan and requirements identified in road crossing permits or approvals.

Crossings of roads will be uncased unless a casing is required by the appropriate regulatory authority with jurisdiction over the crossing. For all road crossings, the pipeline has been designed in accordance with USDOT regulations at 49 CFR 192, the American Society of Mechanical Engineers' code (B31.8) for gas transmission and distribution piping systems. Uncased crossings are preferred over cased crossings due to the increased potential for problems with installation, the cathodic protection system, and corrosion on cased crossings.

Road crossings on COE-managed land and NFS land are shown below in table 6.4.3-1. A complete list of the roads along the pipeline routes, and the construction method proposed for

each crossing is included in Resource Report 8 of the FERC Application and applicable Project supplemental filings.

TABLE 6.4.3-1

North Bakken Expansion Project
Roads on Federal Lands Crossed by the Project

Agency	Milepost	Road Name	Width (feet)	Crossing Method a
USFS	27.3	(FDR) 8698	40	Open Cut
USFS	28.6	Highway 1806 West	40	Guided Bore
USFS	29.1	Highway 1806 West	40	Guided Bore
USFS	29.9	(FDR) 8000C43/115th Ave NW	25	Guided Bore

[a] Guided Bore = The HDD and guided bore crossing methods are both trenchless methods used to install pipelines across sensitive areas such as wetlands and waterbodies, roads, and other utility crossings to avoid direct impacts on those features. See discussion in section 6.3.1.
Open Cut = Construction across roads will be conducted in accordance with the FERC Plan and requirements identified in road crossing permits or approvals. See discussion in section 6.3.1.

6.4.4 Typical Topsoil Segregation

Topsoil and subsoil will be disturbed as a result of topsoil removal, grading, trench excavation, and heavy equipment moving along the right-of-way. These activities could cause mixing of topsoil or surface soil with the subsoil and potentially result in a loss of soil productivity. To prevent mixing of the soil horizons or incorporation of additional rock into the topsoil, topsoil segregation will be performed along the entire length of the right-of-way throughout NFS land. Topsoil will be segregated from the subsoil and will be replaced in the proper order during backfilling and final grading. Implementation of proper topsoil segregation will help promote post-construction revegetation success, thereby minimizing loss of soil productivity and the potential for long-term problems with erosion.

6.4.5 Steep and Side Slopes

Although the Project will not require construction in rugged terrain (e.g., in mountains or canyons), portions of the pipeline may cross areas of steep side slope or rolling terrain that may require the use of cut-and-fill grading to provide for safe working conditions. In these areas, grading activities will cut down the upslope side of the construction right-of-way. Material from the cutting will be used to fill the downslope side of the construction right-of-way to create a safe and level surface for travel lanes and equipment operation. Additional temporary right-of-way may be required on steep side slopes to allow for passage of construction equipment and emergency vehicles. The trench will be excavated from the newly graded right-of-way. Following pipeline installation and backfilling, the excavated material will be placed back on the area of the cut and compacted to restore the surface of the right-of-way to original contours. Stabilization of the surface will be conducted in accordance with the FERC Plan.

In areas of steep side slope or rolling terrain, temporary sediment barriers such as silt fences and straw bales will be installed to prevent the movement of disturbed soil off the right-of-way. Temporary slope breakers consisting of mounded and compacted soil will be installed across the right-of-way during construction in accordance with the FERC Plan. Permanent slope

breakers will be installed during final cleanup or as soon as weather conditions permit. Following construction, restoration will be completed in accordance with the FERC Plan.

WBI Energy consulted with the USFS and determined that the Project on NFS land will avoid slopes greater than 40 percent and soils susceptible to mass failure (LRMP Guideline C.4).

6.4.6 Blasting

WBI Energy does not expect that blasting will be required during construction; however, if shallow bedrock or boulders are encountered that cannot be removed by conventional methods, blasting may be necessary. WBI Energy has prepared a Blasting Plan that it will implement in the event that blasting is necessary during construction (see appendix E). Strict safety precautions will be adhered to if blasting is required to clear the right-of-way and fracture the ditch. Extreme care will be exercised to avoid damage to underground structures, cables, conduits, pipelines, and underground watercourses or springs. WBI Energy will provide adequate notice to adjacent landowners or tenants in advance of blasting to protect property or livestock. Blasting activity will be performed during daylight hours and in compliance with federal, state, and local codes and ordinances, the manufacturers' prescribed safety procedures, and standard industry practices.

6.5 CONSTRUCTION SCHEDULE AND WORKFORCE

WBI Energy anticipates that construction of the Project will commence in March 2021 for the aboveground facilities and May 2021 for the pipeline facilities, subject to the receipt of necessary permits and regulatory approvals. The HDD of Lake Sakakawea is anticipated to begin in May 2021. The timing for construction activities in NFS land will adhere to sensitive species requirements. WBI Energy anticipates that construction of the Project facilities will be completed by October 2021 with all facilities being placed into service by November 2021.

WBI Energy currently anticipates that construction of the proposed pipelines will be accomplished using a peak temporary workforce of about 450 people and an average workforce of about 350 people, including inspection crews. Pipeline construction will occur using three construction spreads and an average temporary workforce of 250 people, including inspection crews. Construction of the aboveground facilities will require an average of about 75 additional people. An estimated 20 additional temporary employees will be required to construct and upgrade various measurement stations. Once construction of the Project is complete, WBI Energy anticipates hiring four new employees to assist in operation and maintenance of the new facilities.

6.6 ROLES AND RESPONSIBILITIES

During construction, WBI Energy will provide contractors with all Project design documents, including environmental alignment sheets, and copies of all applicable federal, state, and local permits. Construction will be supervised by a contractor selected by WBI Energy. WBI Energy will file weekly status reports with FERC. Weekly reports will also be submitted to the COE and USFS when work is being completed on their respective lands. These weekly reports will be available to the public on the FERC eLibrary system.

6.6.1 Federal Energy Regulatory Commission

FERC is an independent federal agency responsible for evaluating applications for authorization to construct and operate interstate natural gas pipeline facilities. If the Commission determines a project is required by the public convenience and necessity, a Certificate is issued under section 7(c) of the NGA and Part 157 of the Commission's regulations. WBI Energy will be required to comply with the environmental conditions contained in the FERC Certificate. FERC will assign a project manager to oversee construction of the Project.

6.6.2 U.S. Forest Service and U.S. Army Corps of Engineers

The USFS is a civilian federal agency within the U.S. Department of Agriculture that administers the nation's national forests and national grasslands. The mission of the USFS is to sustain the health, diversity, and productivity of the national forests and grasslands to meet the needs of present and future generations. It is the responsibility of the USFS to manage the national forests for multiple uses of resources such as water, forage, wildlife, wood, recreation, minerals, and wilderness; and to provide products and benefits to the American people while ensuring the productivity of the land and protecting the quality of the environment.

Executive Order (EO) 13212, May 18, 2001, directed federal agencies to take appropriate actions, consistent with applicable law, to expedite reviews of authorizations for energy-related projects and to take other action necessary to accelerate the completion of such projects while maintaining safety, public health, and environmental protections. To facilitate EO 13212, the Secretaries of Agriculture, Interior, and Energy, and other federal agencies have agreed, through a formal Memorandum of Understanding, to coordinate their efforts and cooperate in the expeditious processing of authorizations for construction of natural gas pipelines. Pursuant to the Mineral Leasing Act of 1920 and in accordance with federal regulations in 43 CFR 2880, WBI Energy must secure a special use permit from the USFS to cross NFS land. Issuance of a special use permit must be in accordance with 36 CFR 251 Subpart B, the Mineral Leasing Act of 1920 (as amended), relevant USFS manual and handbook direction, and other applicable laws and regulations.

The COE is a federal agency within the U.S. Department of Defense with jurisdictional authority pursuant to section 404 of the Clean Water Act (Title 33 of the United States Code [USC], section 1344), which governs the discharge of dredged or fill material into waters of the United States and section 10 of the Rivers and Harbors Act (33 USC 403), which regulates any work or structures that potentially affect the navigable capacity of a waterbody. Section 401 of the Clean Water Act requires that proposed dredge or fill activities permitted under section 404 be reviewed and certified by the designated state agency (in this case, the North Dakota Department of Environmental Quality, Division of Water Quality) to ensure the Project meets state water quality standards. The proposed Project is within the Omaha District of the COE.

The Project also involves a proposed HDD crossing of Lake Sakakawea and associated COE-managed land. Lake Sakakawea is a reservoir created by the Garrison Dam/Lake Sakakawea Project as part of the Missouri River Mainstem Reservoir System authorized under the Flood Control Act of 1944 (Public Law 78-534) and managed by the COE. The Garrison Dam/Lake Sakakawea Project provides for the following congressionally authorized purposes: flood control; navigation; irrigation; hydropower; water quality; municipal and industrial water supply; fish and wildlife; and recreation (COE, 2018). Because the Project will cross Lake Sakakawea and the associated COE-managed land, a section 408 permit and a COE real estate

easement will be required. Section 408, which is authorized in section 14 of the Rivers and Harbors Act (33 USC 408), allows the COE to "grant permission for the alteration of a public work so long as that alteration is not injurious to the public interest and will not impair the usefulness of the work" (COE, 2016).

6.6.3 Bureau of Land Management

The BLM is the federal agency responsible for certain land-use authorizations on BLM-managed lands. The authority for management of the land and resource development options comes from several statutes, including the Federal Land Policy and Management Act of 1976, the Mineral Leasing Act of 1920, and the National Trails Systems Act of 1968 (916 USC 1241–1251).

Under the Federal Land Policy and Management Act, the BLM has authority to regulate the use, occupancy, and development of federal public lands and take whatever action is required to prevent unnecessary or undue degradation of these lands (43 USC 1732). Under section 28 of the Mineral Leasing Act of 1920 (30 USC 185) and 43 CFR 2881.11, the BLM has the authority to issue grants to oil or gas pipelines or related facilities to cross federal lands under BLM jurisdiction or the jurisdiction of two or more federal agencies, except land in the National Park System, land held in trust for Indians, or land within the Outer Continental Shelf. In accordance with the Mineral Leasing Act of 1920, the BLM must respond to a right-of-way application submitted by WBI Energy to cross federally managed lands. The BLM will decide whether to approve, approve with modification, or deny issuance of a right-of-way grant for the Project, and, if so, under what terms and conditions.

6.6.4 WBI Energy Transmission, Inc.

WBI Energy is responsible for the administration of the right-of-way and coordination with the construction contractor. WBI Energy will be responsible for activities associated with construction, operation, and maintenance of the pipeline and aboveground facilities and will need to comply with all conditions outlined in the FERC Certificate, BLM Right-of-Way Grant, and other necessary authorizations.

6.7 CONTINGENCY PLANNING

WBI Energy has prepared a HDD Plan for the HDD and guided bore crossings associated with the Project (see appendix D). The intent of the HDD Plan is to identify procedures to be implemented that minimize environmental impacts in the event that an inadvertent return of drilling fluids occurs during construction of the Project. The HDD Plan communicates the roles and responsibilities of personnel involved with the HDD, provides monitoring procedures, and describes contingency plans in the event of an unsuccessful HDD.

Should issues be identified during an HDD or guided bore, WBI Energy may opt to implement mitigation measures, select a new drill path, or abandon the drill and consider alternate crossing measures. Abandonment procedures and alternative crossing measures will be discussed with appropriate permitting and regulatory agencies, and required approvals will be obtained prior to implementing alternative crossing measures.

Before identifying alternative crossing locations or techniques, an attempt will be made to identify and assess the reason for the drill failure and implement measures to reduce additional inadvertent returns. Potential mitigation measures include:

- utilize surface (conductor) casing(s);
- use the intersect drill method;
- pre-grout permeable ground or fractured rock;
- install relief wells to provide a preferential pathway for drilling fluids to migrate to the surface; and/or
- plan for use of special drilling fluids, viscosity, pressure, and/or drill speed.

Depending on the nature of the problem, WBI Energy may choose to select a new drill path that mitigates the cause of the problem. This would result in an altered alignment or depth of drill path and may retain sections of the original drilled path which are not at risk to the problem. For any section of abandoned hole, the abandonment procedures identified below would apply only to the abandoned section of the hole.

In the event a drill hole is to be abandoned, the following procedures will be implemented:

- heavy drilling mud or cement mixture will be pumped into the hole as the drill assembly is extracted to seal the abandoned drill hole; and
- the drill end points will be cut and sealed within approximately 5 feet of the surface, filled with soil, and graded to the original contour.

WBI Energy's preferred crossing method of Lake Sakakawea is via HDD; however, in the event that the above options have been exhausted WBI Energy is committed to completing the Project in an effective and timely manner and will consider alternative crossing options. In developing an appropriate alternative, consideration will be given to:

- stream bank type, flow width, depth, velocity, and flow volume;
- surrounding topography;
- lakebed substrate;
- condition of riparian areas;
- condition and extent of wetlands, if any, on each side of the crossing; and
- aquatic biota.

These and other factors will be considered and discussed with the appropriate regulatory agencies to minimize environmental impact and secure appropriate approvals. WBI Energy will conduct a site-specific analysis to select other feasible crossing methods that do not utilize the

HDD method. This could include a new route alignment, trenching and backfilling the pipeline across the lake bed (using plowing, jetting, or conventional bucket dredging), direct-lay, and/or utilizing concrete coating or articulated block mattresses. Final selection of an alternative crossing method will be submitted to the FERC and other jurisdictional agencies with supporting data.

Should a need for additional contingency plans become necessary prior to or during construction, WBI Energy will work with the COE and USFS to complete the required plans.

6.8 SAFETY REQUIREMENTS

WBI Energy is committed to protecting the safety of those living or working near its pipeline system and working proactively to keep its system operating safely and effectively. Accordingly, the Project will be designed, constructed, tested, operated, inspected, and maintained to meet or exceed the DOT's Minimum Federal Safety Standards specified in 49 CFR 192. These regulations are intended to ensure adequate protection of the public from natural gas pipeline facility accidents and failures; in addition, 49 CFR 192 specifies the minimum material, design, welding, construction, testing, protection from corrosion, operations, maintenance, and personnel qualifications for pipelines. Further, Subpart O requires each pipeline operator to have a detailed integrity management program. As a part of the integrity management program, high-resolution in-line inspection tools (i.e., smart pigs), pressure tests, or direct assessments are periodically performed on the line to assess the pipe for any features requiring remediation (e.g., corrosion, dents, gouges).

DOT regulations in 49 CFR 192 define area classifications (called class location units) based on population density in the vicinity of a pipeline, and specify more rigorous safety requirements for populated areas. Each class location unit covers the area extending 220 yards on either side of the centerline of any continuous 1-mile length of pipeline. The proposed Project will fall under a Class 1 designation for its entire length, which is specified by any class location unit that has 10 or fewer buildings intended for human occupancy. The Project has been designed the meet or exceed DOT specifications for Class 1 areas (see section 3.0).

WBI Energy will monitor population changes in the vicinity of the pipeline over the life of the pipeline system. If an increase in population density adjacent to the right-of-way is detected, WBI Energy will evaluate whether a change in class location is required and respond accordingly while meeting requirements of 49 CFR 192.

At all locations where the general public can access the construction perimeter, such as roads and trails, high-visibility warning signs will be installed before and at the point of entry. Warning signs are typically no smaller than two feet by two feet and come in various high-visibility colors. The construction perimeter will also be flagged in high-visibility colors and, if needed, safety fencing. WBI Energy will also post public announcement on COE and USFS information kiosks and the COE and USFS websites, as permitted. WBI Energy will also place construction notifications related to federal properties in the local papers in Williams and McKenzie Counties.

WBI Energy has coordinated with the USFS regarding typical fire suppression requirements on NFS land and will adhere to the USFS fire prevention and suppression requirements. If requested by the District Ranger, WBI Energy will prepare a Fire Suppression Plan for the Project. If requested, copies of the fire control plan will be appended to this POD when approved by the USFS.

6.9 INDUSTRIAL WASTES AND TOXIC SUBSTANCES

Construction and operation of the Project will comply with the Toxic Substances Control Act regulations in 40 CFR Part 761. WBI Energy does not anticipate using or storing industrial wastes on federal land. Pipeline facilities on federal land crossings will be new pipe and constructed without using toxic substances.

6.10 ENVIRONMENTAL COMPLIANCE, TRAINING, AND INSPECTION

WBI Energy is committed to constructing and operating the Project in a manner that will minimize environmental impacts and comply with applicable permits and approvals, the FERC Plan and Procedures and other environmental plans or requirements. WBI Energy will train company and contractor personnel to familiarize them with environmental plans and other conditions, and provide EIs to monitor compliance during construction. WBI Energy will be responsible for implementation of environmental requirements during construction of all Project facilities.

6.10.1 Environmental Compliance

WBI Energy will incorporate relevant environmental requirements and Project-specific environmental mitigation plans into the construction bid documents for the Project. Additionally, WBI Energy will review these requirements with prospective contractors in a pre-bid meeting. These steps notwithstanding, the contractor selected for the Project will be required to comply with all relevant requirements regardless of whether they were described in bid documents or discussed at the meeting. During construction, if the contractor does not comply with environmental requirements, WBI Energy will direct the contractor to comply and may take other corrective actions as necessary, including issuing stop-work orders, until the contractor is in compliance.

6.10.2 Environmental Training

Prior to construction, WBI Energy will conduct environmental training for company and contractor supervisory personnel. The training program will focus on the FERC Plan and Procedures; Project-specific Certificate and permit conditions; and Project-specific construction, restoration, and mitigation plans. In addition, WBI Energy will provide large-group training sessions before each work crew begins construction. Periodic follow-up training for groups of newly assigned personnel will be provided as necessary by the EIs.

6.10.3 Environmental Inspection

WBI Energy will assign EIs to the Project, with additional inspectors as necessary, to monitor environmental compliance. WBI Energy's EIs will have peer status with other inspectors and will report directly to the WBI Energy environmental personnel. EIs will monitor environmental compliance with FERC's Order, BLM's Right-of-Way Grant, and any other environmental plans. The EIs' responsibilities will be as specified in the FERC Plan, and will include, but not be limited to, the following: (1) monitoring the contractor's compliance with environmental measures required by the Certificate, other permits or approvals, FERC's Plan and Procedures, and any other plans described in POD; (2) taking corrective actions, including issuing stop-activity orders; (3) documenting compliance with environmental requirements; and (4) preparing status reports for submittal to the Commission's environmental staff. The EIs will also act as liaisons between

WBI Energy and representatives of environmental regulatory agencies that may visit the Project during construction.

7.0 RESOURCE VALUES AND ENVIRONMENTAL CONCERNS

This section discusses the resources that could be affected due to the Project crossing of federal lands. Additionally, this section provides a summary of the procedures and measures proposed in the environmental plans that are attached as appendices to this POD. WBI Energy, and its contractors, will use these plans to ensure and maintain environmental protection during construction, operation, and maintenance of the Project. WBI Energy will adhere to FERC's Plan and Procedures (appendix F), as well as independent plans that have been developed. The environmental analysis below describes the resources and potential impacts of the Project on federal lands. For an analysis of the environmental impacts for the Project as a whole, the FERC Application and associated Resource Reports and Project supplemental filings, will be available on the FERC website at http://ferc.gov.

7.1 AIR QUALITY

Pipeline construction activities are considered temporary and transient in nature and are not expected to cause or contribute to any significant degradation of air quality. Air quality impacts associated with construction of the Project will include emissions from fossil-fueled construction equipment, vehicle traffic exhaust, and fugitive dust. However, such air quality impacts will generally be temporary, short-term, and localized and will not significantly affect regional air quality.

Emissions from construction equipment will depend on the duration and type of construction activity, together with the number and type of vehicles and engine-powered equipment in use at any point in time. Earth-moving equipment and other mobile sources may be powered by diesel or gasoline engines that are sources of combustion-related emissions. Emissions from equipment will be short-term and localized in an area as equipment and activities move along the route. Fugitive dust emissions may result from vehicular traffic and from soil disruption associated with land clearing, grading, excavation, and backfilling.

WBI Energy has prepared a Fugitive Dust Control Plan (appendix G), which describes the measures and techniques that will be used to control fugitive dust during construction and operation of the Project. The measures and techniques within this plan were developed to minimize dust and emissions related to Project activities. The amount of fugitive dust generated will depend on a variety of factors including: duration and type of construction activity; moisture content and type of soils that will be disturbed; wind speed and frequency of precipitation; and the number and types of vehicles traveling over the construction areas.

7.2 NOISE

The principal noise sources associated with construction of the Project will be operation of heavy equipment (e.g., bulldozers, backhoes, cranes, rollers, and trucks). Noise will be intermittent during most of the 8-month construction period and will occasionally exceed background noise levels that currently characterize the area. Construction activities will generally occur Monday through Saturday from 7:00 a.m. to 7:00 p.m. However, certain activities will occur up to 24 hours per day, including Sundays and potentially federal holidays. These activities will include HDD and guided bore crossings, and hydrostatic testing and associated activities.

Additionally, certain unforeseen circumstances may require unplanned construction activities outside the typical work hours. These activities may include, but are not limited to, completing in-progress construction activities and wetland/waterbody crossings delayed by an unanticipated event (e.g., severe weather, constructability issues), incident response procedures/measures, and emergency equipment repairs/maintenance.

Noise associated with construction of the pipeline will be short-term and temporary at any given location because of the assembly-line method of pipeline installation. While the noise levels attributable to construction equipment could noticeably increase ambient noise levels near the workspace, this noise will be temporary and localized. Additionally, construction activities are temporary, no long-term impacts on noise levels are anticipated.

WBI Energy proposes to perform one HDD at Lake Sakakawea. The intersect method will be used, in which drilling will occur from both ends of the crossing and intersect near the middle of Lake Sakakawea. Because drilling will occur from both ends of the crossing, both ends will be considered entry sites for the purposes of the noise impact analysis. Construction activities at the HDD location are expected to occur for five months. Operations are expected to occur for 12 to 14 hours per day, seven days per week, unless site conditions require 24 hours per day operation. Working 24 hours per day will be required during pullback operations, which should not exceed one week. Additional nighttime activities may occur as necessary based on site conditions.

7.3 GEOLOGIC, MINERAL AND ENERGY, AND PALEONTOLOGIC RESOURCES

The bedrock underlying surficial deposits in the Project area consists of the Tertiary Sentinel Butte and Bullion Creek formations. These formations consist primarily of sandstone, shale, and siltstone, with many lignite beds formed from prehistoric swamps. Surficial geology consists primarily of Pleistocene glacial sediments of Late Wisconsin-age and fluvial sediments including sand, silt, and clay of late Quaternary age.

The Project's effect on geology will be minor. Effects will be limited to construction activities and temporary disturbance of surficial geologic materials within the right-of-way and extra workspace. WBI Energy will minimize the impact on surficial geology by restoring topographic contours to preconstruction conditions in areas of temporary disturbance.

Construction and operation of the proposed Project is not anticipated to have an impact on mineral and energy resources. The trench excavations and HDD for the pipeline route will not be deep enough to affect oil and gas deposits, which occur thousands of feet below ground surface. With regard to surface infrastructure, WBI Energy is working with producers to avoid or otherwise accommodate active or potential well sites and any feeder or gathering pipelines serving oil or gas wells in the vicinity of the proposed pipeline routes to minimize the potential for inadvertent damage to these facilities. Future oil and gas exploration within the new permanent right-of-way for the pipelines will be prohibited. The Project will be located near several former or currently active quarries; however, the Project is not expected to result in any significant impacts on industrial sand and gravel, scoria, or other mineral resources (e.g., lignite, salt,). Future extractive activities will be prohibited within the pipeline rights-of-way and aboveground facility footprints.

WBI Energy obtained an Archaeological Resources Protection Act permit and conducted paleontological surveys within COE-managed land and NFS land in October 2019. No fossil

localities were identified during the paleontological surveys (LRMP Standard E.1 and 3). Multiple isolated and poorly preserved fossils of unidentifiable plant fragments and one incomplete invertebrate shell cast were identified; however, these fossils were not determined to be significant paleontological resources. No other paleontological resources were identified during the surveys. Following the initial Project surveys, WBI Energy relocated a portion of the Project crossing U.S. Forest Service lands. Most of the modified area contains vegetation with no bedrock exposures. One drainage with small areas of potential exposed bedrock, in the northwestern corner of Section 13, T. 153 N., R. 97 W., is within the final Project area. This drainage will be crossed via the guided bore method, resulting in primarily subsurface disturbance. Based on the results of the original field surveys, few previous paleontological finds in this portion of the Little Missouri National Grassland, and the lack of bedrock exposures in the final Project area, U.S. Forest Service McKenzie Ranger District Minerals and Lands Supervisor Cale Bickerdyke (2020) confirmed in a telephone conversation with ERM that additional survey of the relocated Project area within the Little Missouri National Grassland is not required

If paleontological resources are discovered during construction of the Project, they will be treated as cultural resources in accordance with WBI Energy's Plan for Unanticipated Discovery of Paleontological Resources During Construction, which is provided in appendix H.

7.4 SOILS AND AGRICULTURE

Soils on NFS land is classified as Farmland of Statewide Importance in the Rolling Soft Shale Plain (MLRA 54). However, none of federal land affected is actively cultivated or would be precluded from future agricultural use. Prime farmland was not identified on NFS or COE federal lands.

Additionally, WBI Energy recognizes there is potential to encounter contaminated soil or sediment during construction activities and has developed a Plan for Unanticipated Discovery of Contaminated Environmental Media (appendix I). This plan describes the steps that WBI Energy and its Contractors will implement in the unanticipated event that contaminated environmental media is encountered during construction.

7.5 WATERBODIES AND WETLANDS

The COE Garrison Project - Lake Sakakawea will be crossed using the HDD method, which will avoid ground disturbance and direct impacts to waterbodies. The HDD path will cross under one pond and Lake Sakakawea. Lake Sakakawea is considered a Section 10 navigable water under the Rivers and Harbors Act. There are no wetlands along the HDD path. On NFS land, the Project will cross one ephemeral waterbody (Unnamed Tributary to Sand Creek), one intermittent waterbody (Unnamed Tributary to Tobacco Garden Creek), and one wetland (palustrine emergent). See Section 6.3.1 and 6.3.2 for waterbody and wetland crossing information, respectively.

WBI Energy has developed the Spill Prevention, Control, and Countermeasure Plan (appendix J), which outlines prevention measures and practices to reduce the likelihood of an accidental release of a hazardous or regulated liquid and, in the event of a release, to expedite the response to and remediation of the release (LRMP Standard B.12). It describes the requirements that contractors will be held responsible for when working on the Project.

7.5.1 Surface Water Quality

Surface Water Intakes and Surface Water Protection Areas

According to water permits on file with the North Dakota State Water Commission, there are no potable surface water intakes within 3 miles downstream of the pipeline route. The nearest surface water intake is a rural water permit for the Paradise Point Association. This permit is located approximately 2.8 miles upstream from the northern Lake Sakakawea HDD entry point. Likewise, based on the review of the source water protection status list of North Dakota's public water systems, no surface water-dependent communities, non-transient non-communities, or transient non-community systems exist within the Project area. WBI Energy will not divert or appropriate water from the Missouri River during Project construction or operation; therefore, the Project will not have any impacts on the reservoir water capacity.

Water Quality and Contaminated Sediments

Lake Sakakawea is listed in North Dakota's 2018 Integrated Section 305(b) Water Quality Assessment Report and Section 303(d) List of Waters Needing Total Maximum Daily Loads. Lake Sakakawea is listed as not supporting its designated use of fish consumption due to the presence of methylmercury within the lake. Lake Sakakawea is considered a low priority for total maximum daily loads.

According to the U.S. Environmental Protection Agency's List of Sediment Sites with Substantial Contamination, there are no sites identified in North Dakota.

Hydrostatic Test Water Withdrawal and Discharge

No hydrostatic test water will be sourced or discharged on the COE-managed land or NFS land.

Sensitive Surface Waters

The Project does not cross any designated National Wild and Scenic Rivers or state-designated high quality or outstanding natural resource waters. Likewise, there are no potable surface water intakes within 3.0 miles downstream of the pipeline route. The North Dakota Department of Environmental Quality classifies waterbodies into categories based on water quality, flow regime, and beneficial uses. At the COE Garrison Project – Lake Sakakawea, Lake Sakakawea is designated as a Class I waterbody. On NFS land, the unnamed tributary to Sand Creek is designated as a Class III waterbody.

7.5.2 Groundwater Quality

Designated Sole Source Aquifers

There are currently no designated sole source aquifers in North Dakota.

Public and Private Water Supply Wells

WBI Energy reviewed the North Dakota State Water Commission well permit database and online map system to evaluate the potential presence of wells within 150 feet of the Project

footprint. This review determined that based on the data available no water supply wells exist adjacent to the proposed pipeline route. WBI Energy also recorded the location of private wells identified during civil surveys and through landowner interviews. One private well was identified within 150 feet of the proposed Project footprint. This well is about 30 feet from MP 25.9 of the Tioga-Elkhorn Creek pipeline on private land.

Contaminated Groundwater

The primary potential sources of groundwater contamination in the vicinity of the Project are related to agricultural and industrial activities. Based on a review of recent aerial photographs and 2019/2020 field surveys, WBI Energy did not identify any potential sources within 0.25 mile of the construction workspace. In addition, a review of the EPA's Facility Registration System map service and the North Dakota Department of Environmental Quality underground storage tank data identified no known sites of potential contamination within 500 feet of the Project area.

7.6 VEGETATION

This Project has the potential to affect soils and revegetation through clearing of vegetation, topsoil stripping, grading, trenching, backfilling and restoration. Most of the federal land crossed by the Project is agricultural land (primarily cropland) or open land (non-native and native grassland). On USAC-managed land, the Project crosses four locations of native prairie. On NFS land, the Project crosses four locations of native prairie.

On both federal lands, the only noxious species observed during surveys was leafy spurge (*Euphorbia esula*). WBI Energy developed a Noxious Weeds Management Plan (appendix K). This plan prescribes methods to prevent and control the spread of noxious weeds during and following construction of the Project (LRMP Guideline and Standard J.1 and 2). WBI Energy will consult with USFS staff to determine if the plan adequately controls leafy spurge (LRMP Guidelines J.4). WBI Energy and their contractors will be responsible for carrying out the methods described in the plan (LRMP Guideline J.2). A seed mix was recommended by the USFS and is described in section 8.2.

7.7 FISH AND WILDLIFE HABITAT

On federal land, the Project will cross the following two primary vegetation classes and their associated habitats:

- agricultural land (cultivated crops, hayfields, and pastureland); and
- open land or grasslands (short- and mixed-grass prairie, shrubland, and non-forested wetlands).

These vegetation classes provide food, protective cover, and young-rearing habitat for wildlife. Table 7.7-1 lists the characteristic wildlife species present that are not classified as species of conservation concern.

TABLE 7.7-1

North Bakken Expansion Project
Representative Wildlife Species in the Project Area

Species	Agricultural Land	Open Land
Mammals		
American badger (*Taxidea taxus*)		X
American beaver (*Castor canadensis*)		X
American mink (*Neovision vision*)		X
Common muskrat (*Ondatra zibethicus*)		X
Coyote (*Canis latrans*)	X	X
Deer mouse (*Peromyscus maniculatus*)		X
Eastern cottontail (*Sylvilagus floridanus*)		X
Eastern fox squirrel (*Sciurus niger*)		X
Elk (*Cervus elaphus*)		X
Long-tailed weasel (*Mustela frenata*)		X
Meadow vole (*Microtus pennsylvanicus*)		X
Mule deer (*Odocoileus hemionus*)	X	X
Pronghorn (*Antilocaptra americana*)	X	X
Raccoon (*Procyon lotor*)	X	X
Red fox (*Vulpes vulpes*)		X
Striped skunk (*Mephitis mephitis*)	X	X
White-footed mouse (*Peromyscus leucopus*)		X
White-tailed deer (*Odocoileus virginianus*)	X	X
White-tailed jackrabbit (*Lepus townsendii*)	X	X
Birds		
American wigeon (*Anas americana*)		X
Blue-winged teal (*Anas discors*)		X
Canada goose (*Branta canadensis*)	X	X
Clay-colored sparrow (*Spizella pallida*)		X
Gadwall (*Anas strepera*)		X
Greater white-fronted goose (*Anser albifrons*)	X	X
Gray Partridge (*Perdix perdix*)	X	X
Least flycatcher (*Empidonax minimus*)		X
Magpie (*Pica hudsonia*)	X	X
Mallard (*Anas platyrhynchos*)	X	X
Mourning dove (*Zenaida macroura*)	X	X
Northern harrier (*Circus cyaneus*)	X	X
Northern shoveler (*Anas clypeata*)		X
Prairie falcon (*Falco mexicanus*)	X	X
Red-eyed vireo (*Vireo olivaceus*)		X
Redhead (*Aythya americana*)		X
Red-tailed hawk (*Buteo jamaicensis*)	X	X
Ring-necked pheasant (*Phasianus colchicus*)	X	X
Sandhill crane (*Grus canadensis*)	X	X
Sedge wren (*Cistothorus platensis*)		X
Snow goose (*Chen caerulescens*)	X	X
Western kingbird (*Tyrannus verticalis*)		X
Yellow warbler (*Dendroica petechial*)		X
Reptiles and Amphibians		
Boreal chorus frog (*Pseudacris maculate*)	X	X
Bullsnake (*Pituophis catenifer*)		X

TABLE 7.7-1

North Bakken Expansion Project
Representative Wildlife Species in the Project Area

Species	Agricultural Land	Open Land
Common gartersnake (*Thamnophis sirtalis*)		X
Eastern yellow-bellied racer (*Coluber constrictor*)		X
Great Plains toad (*Bufo cognatus*)		X
Northern leopard frog (*Rana pipiens*)		X
Plains gartersnake (*Thamnophis radix*)		X
Plains spadefoot toad (*Spea bombifrons*)	X	X
Prairie rattlesnake (*Crotalus viridis*)		X
Sharp-tailed grouse (*Tympanuchus phasianellus*)		X
Short-horned lizard (*Phrynosoma douglassi*)		X
Tiger salamander (*Ambystoma tigrinum*)		X
Western painted turtle (*Chrysemys picta*)		X
Woodhouse's toad (*Anaxyrus woodhousii*)		X

None of the waterbodies crossed on federal land contains or has the potential to contain species managed by the National Oceanic and Atmospheric Administration, National Marine Fisheries Service, nor do they support essential fish habitat as defined under the Magnuson-Steven Fishery Conservation and Management Act. Therefore, the Project will not affect any essential fish habitat or marine mammals.

Since there are no above ground facilities on federal lands, WBI Energy does not propose to install fencing, which will avoid big game movement in the Project area (LRMP Guideline F.3). WBI Energy will coordinate with the USFS to determine the earliest mowing dates to avoid ground-nesting birds (LRMP Guideline F.4). The USFS recommended seed mix described in section 8.2 will facilitate wildlife foraging (LRMP Guideline F.5).

Using the HDD method to cross the COE Garrison Project - Lake Sakakawea will avoid potential impacts to fisheries. Likewise, the one ephemeral waterbody and one intermittent waterbody crossed on the NFS land are unlikely to support fisheries and will be crossed using the guided bore crossing method to minimize impacts.

7.8 SPECIES OF CONSERVATION CONCERN

At the request of the USFS, a separate Biological Evaluation have been prepared for NFS land and is provided in appendix L.

7.8.1 Unique, Sensitive, and Protected Vegetation Communities

WBI Energy conducted sensitive plant surveys along the Project on the NFS land. In addition to surveying for sensitive plant species, biologists also surveyed for any occurrence of USFS watch list plant species. Table 7.8-1 lists sensitive plant species and habitat that may occur.

TABLE 7.8-1

North Bakken Expansion Project
Sensitive Plant Species and Habitat for the Little Missouri National Grassland that May Occur in the Project Area

Species	Habitat
Alkali sacaton (*Sporobolus airoides*)	Found in areas with clay outwash; tolerant of saline conditions; dry to moist sandy or gravely soil
Alyssum-leaved phlox (*Phlox alyssifolia*)	Sandy or gravely soil; found around Bullion Butte in North Dakota (about 69 miles southwest of the Project area) and on clay banks and limestone ridges of open prairie
Blue lips (*Collinsia parviflora*)	Found in wooded understories (e.g., green ash and elms); rocky mountain juniper, mesic shrub communities, and occasionally xeric shrub communities
Dakota buckwheat (*Eriogonum visheri*)	Found in clay and silty substrates with low plant cover (e.g., outwash zones, eroding buttes, saddles, steep slopes, and erosional breaks on prairie slopes); occasionally found in saltgrass communities
Dwarf mentzelia (*Mentzelia pumila*)	Found on slopes and sandy plains; occasionally on hard clays and rocky soils
Easter daisy (*Townsendia exscapa*)	Dry plains and hillsides typically with loamy or increased soil development
Hooker's townsendia (*Townsendia hookeri*)	Dry plains and hillsides; gravely beaches and weathered scoria, often in clay matrix subsoils
Lanceleaf cottonwood (*Populus x acuminate*)	Mesic, woody draws typically with springs and seeps; occasionally near springs on open hillsides; floodplains and stream banks
Limber pine (*Pinus flexillis*)	Semi-arid exposed rocky ridges and foothills
Nodding buckwheat (*Eriogonum cernuum*)	Exposed sand substrates with low plant cover typically in grasslands, hillsides, and sandstone outcrops
Sand lily (*Leucocrinum montanum*)	Found in a variety of habitats including shortgrass and crested wheatgrass communities; open coniferous woodlands and hillsides; and sagebrush scrub and sandy flats
Smooth goosefoot (*Chenopodium subglabrum*)	Found in a variety of habitats including sandbars, terraces, and dune complexes along rivers and creeks; exposed sandy substrates in uplands, and outcrops
Torrey's cryptantha (*Cryptantha torreyana*)	Two populations discovered and documented in 2013 along scoria ridgelines; found in dry plains, rock outcrops, escarpments, and pine slopes

7.8.2 Significant Wildlife Habitats

Table 7.8-2 provides the USFS Region 1 sensitive and watch list wildlife species of interest that may occur within the Project area on the USFS Little Missouri National Grassland.

TABLE 7.8-2

North Bakken Expansion Project
Sensitive and Watch List Species for the Little Missouri National Grassland that May Occur in the Project Area

Species	USFS Status	Habitat
Mammals		
Bighorn sheep (*Ovis canadensis*)	Sensitive	Dependent on open grasslands that are adjacent to rugged terrain.
Black-tailed prairie dog (*Cynomys ludovicianus*)	Sensitive	Inhabit short and mixed grasslands; prefers well-grazed lands.
Sagebrush vole (*Lemmiscus curtatus*)	Watch List	Prefers semi-arid areas with loose soil and a combination of grass and sagebrush habitats.
Birds		

TABLE 7.8-2

North Bakken Expansion Project
Sensitive and Watch List Species for the Little Missouri National Grassland that May Occur in the Project Area

Species	USFS Status	Habitat
American bittern (*Botaurus lentiginosus*)	Watch List	Freshwater wetlands dominated by tall, emergent vegetation.
Baird's sparrow (*Centronyx bairdii*)	Sensitive	Mixed-grass and fescue prairie with scattered low shrubs and vegetation from previous year's growing season. Associated with club moss (*Lycopodium* spp.), pasture sage (*Artemisia frigida*), prairie junegrass (*Koeleria macrantha*), and green needlegrass (*Nassella viridula*) in North Dakota.
Bald eagle (*Haliaeetus leucocephalus*)	Sensitive	Typically breeds in forested areas adjacent to large bodies of water. Nests in trees, and will occasionally nest on cliff faces and ground nest in treeless areas. Stopover habitat during migration includes roosting sites with deciduous trees that are in or near riparian areas, protected from human disturbance, and in proximity to foraging habitat.
Black-billed cuckoo (*Coccyzus erythropthalmus*)	Watch List	Groves of trees, forest edges, and thickets that are associated with water. Found in beech (*Fagus* spp.)-oak (*Quercus* spp.) forests and wooded wetlands within drier landscapes in the prairie hardwood transition of the Upper Midwest.
Brewer's sparrow (*Spizella breweri*)	Watch List	Uncommon in North Dakota. Habitat dominantly big sagebrush mixed within shortgrass prairie.
Burrowing owl (*Athene cunicularia*)	Sensitive	Uncommon in North Dakota. Habitat includes shortgrass or grazed mixed-grass prairie with mammals burrows present.
Chestnut-collared longspur (*Calcarius ornatus*)	Watch List	Primarily found in grazed or hayed mixed-grassed prairie and/or shortgrass prairie.
Dickcissel (*Spiza americana*)	Watch List	Found in open grassland habitats with dense cover; suitable habitat found in native prairies, restored grasslands, hayfields, lightly grazed pastures, and agricultural landscapes.
Grasshopper sparrow (*Ammodramus savannarum*)	Watch List	Lightly grazed tall or mixed-grass prairie, shrub prairie meadows, and hayfields.
Lark bunting (*Calamospiza melanocorys*)	Watch List	Prefers sagebrush (*Artemisia* spp.) communities or mixed-grass prairie that is interspersed with shrubs, roadsides, and retired cropland.
Loggerhead shrike (*Lanius ludovicianus*)	Sensitive	Associated with open country including thickets of small trees and shrubs.
Long-gilled curlew (*Numenius americanus*)	Sensitive	Uncommon in North Dakota. Habitat includes shortgrass or shrub steppe prairie and gently rolling terrain.
McCown's longspur (*Rhynchophanes mccownii*)	Watch List	Uncommon in North Dakota. Primary habitat includes arid, shortgrass prairie, or heavily grazed mixed-grass prairie.
Red-headed woodpecker (*Melanerpes erythrocephalus*)	Watch List	Occurs in stands of mature deciduous trees along river bottoms, shelterbelts, and wooded areas of towns.
Sage thrasher (*Oreoscoptes montanus*)	Watch List	Prefers big sagebrush habitat.
Sprague's pipit [a] (*Anthus spragueii*)	Sensitive	Habitat includes grazed native prairie with few shrubs. Preferred habitat species include blue grama (*Bouteloua gracilis*), threadleaf sedge (*Carex filifolia*), prairie junegrass, and plains muhly (*Muhlenbergia cuspidate*).
Fish		

TABLE 7.8-2

North Bakken Expansion Project
Sensitive and Watch List Species for the Little Missouri National Grassland that May Occur in the Project Area

Species	USFS Status	Habitat
Redbelly dace (*Chrosomus* (*Phoxinus*) *eos*)	Sensitive	Uncommon in North Dakota. Prefers slow-moving stretches of rivers with clear water over silt bottom and near vegetation. Historically found in northeastern and east-central North Dakota.
Reptiles and Amphibians		
Great plains toad (*Bufo cognatus*)	Watch List	Inhabit prairie, grasslands, and agricultural landscapes. Will use ephemeral waterbodies during reproduction (e.g., flooded fields).
Northern leopard frog (*Rana pipiens*)	Watch List	Common frog in North Dakota found along ponds and lakes.
Plains spadefoot (*Spea bombifrons*)	Watch List	These toads inhabit dry grasslands, with sandy or loose soil generally south and west of the Missouri River. Some scattered populations have been found in central and northern North Dakota.
Sagebrush lizard (*Sceloporus graciosus*)	Watch List	Prefer rocky areas near water and adjacent to sandy soil and sagebrush in the badlands.
Short-horned lizard (*Phrynosoma hernandesi*)	Watch List	Found in the badlands in sagebrush habitats; rocky or sparsely vegetation areas where there is an abundance of prey (e.g., ants, spiders, and sowbugs).
Smooth green snake (*Opheodrys vernalis*)	Watch List	Found statewide in North Dakota; prefer to be in close proximity to wetlands surrounded by grassy uplands.
Insects		
Monarch butterfly (*Danaus plexippus*)	Watch List	Female monarchs depend on milkweed species (e.g., common milkweed [*Asclepias syriaca*] and showy milkweed [*Asclepias speciose*]); found in prairies and open grasslands.
Ottoe skipper (*Hesperia ottoe*)	Sensitive	Found in mixed-grass prairies such as those dominated by little bluestem (*Schizachyrium scoparium*) and sideoats grama (*Bouteloua curtipendula*); also found in dry-mesic tallgrass prairie with mixed grasses.
Regal fritillary (Speyeria idalia)	Sensitive	Preferred habitats include tallgrass prairie, wet meadows, and marshy areas.
Tawny crescent (*Phyciodes batessi*)	Sensitive	Often associated with moist meadows and stream bottoms near forest openings; mixed-grass prairies including big (*Andropogon gerardii*) and little bluestem grasses.

7.9 FEDERALLY LISTED SPECIES

In accordance with the FERC guidelines and for purposes of complying with the requirements of section 7(a)(2) of the Endangered Species Act, WBI Energy has initiated consultation with the U.S. Fish and Wildlife Service (FWS) regarding federally listed species that may occur or potentially be affected by construction and operation of the Project. WBI Energy has evaluated the potential for the proposed Project to affect federally listed and threatened and endangered species as well as candidate species and designated critical habitat. As part of the consultation process with the FWS, WBI Energy has prepared a Biological Assessment (provided in appendix M) to assess potential Project impacts on endangered and threatened species and critical habitat based on completed field surveys.

Eight species either federally listed as threatened or endangered or identified as candidate species have the potential to occur within the Project area. Designated critical habitat for the

federally threatened piping plover was also identified within the Project area. The species lists were compiled from a review of the FWS and agency consultations. Table 7.9-1 provides a summary of the federally listed species that potentially occur in the Project area.

TABLE 7.9-1

North Bakken Expansion Project
Federally Listed Species in the Project Area

Species	Federal Status	Habitat Notes
Mammals		
Gray wolf [a] (*Canis lupus*)	Endangered	Rare to uncommon in North Dakota. Occasional sightings. No known breeding population. Occupy wide variety of habitats where large ungulates (e.g., elk and deer) are found. Is known to cross into North Dakota from neighboring states and Manitoba, Canada.
Northern long-eared bat (*Myotis septentrionalis*)	Threatened	Rare in North Dakota. Primarily found in woodland habitats. A significant loss of individuals to white-nose syndrome in eastern and Midwestern United States and Canada have cause population concern throughout this species' range.
Birds		
Interior least tern [b] (*Sterna antillarum)*	Endangered	Inhabits sparsely vegetated sandbars on the Missouri and Yellowstone Rivers.
Piping plover (*Charadrius melodus*)	Threatened (Designated Critical Habitat)	Inhabits barren sand and gravel shores or rivers, prairie alkali wetlands, natural lakes with salt-encrusted, white beaches, and rangeland with mid- or short-grass prairie during the non-winter season.
Red knot (*Calidris canutus rufa*)	Threatened	Migrant species occurring in North Dakota during the spring and fall seasons (mid-May and mid-September to October). Utilize alkaline and freshwater lakes in North Dakota during migration. Red knots have been observed in the Missouri River system as well as sewage lagoons and large permanent freshwater wetlands.
Whooping crane (*Grus americana*)	Endangered	Migrant species occurring in North Dakota during the spring and fall seasons (April to mid-May and September to early November). Utilize wetlands, lakes, riverine areas, and a variety of cropland for roosting and foraging.
Insects		
DASK (*Hesperia dacotae*)	Threatened	Dependent on high-quality tall-grass and mixed-grass prairie. Habitat includes wet prairie dominated by bluestem grasses, wood lily (*Lilium philadelphicum*), harebell (*Campanula rotundifolia*), and smooth camas (Zygadenus elegans); dry prairie on ridges and hillsides dominated by bluestem grasses, green needlegrass, pale purple coneflower (*Echinacea* spp.), upright coneflower (*Ratibida columnaris*), and blanketflower (*Gaillaridia aristata*).
Fish		
Pallid sturgeon (*Scaphirhynchus albus*)	Endangered	Utilizes main channel areas with island or sandbars present within the upper Missouri River. Dams have substantially fragmented the pallid sturgeon's range in the upper Missouri River basin.

[a] The initial 2019 FWS IPaC report included the gray wolf as a federally listed species potentially affected by activities in the Project Area; however, an updated IPaC report generated in September 2020 did not include the gray wolf.

[b] Proposed for delisting.

7.10 CULTURAL AND HISTORIC RESOURCES

The Plan for Unanticipated Discovery of Human Remains (appendix N) and the Plan for Unanticipated Discovery of Paleontological Resources (appendix H) identify measures WBI Energy will implement if human remains or paleontological resources are discovered unexpectedly during construction. WBI Energy has developed these plans in cooperation with

the appropriate agencies, include the COE and USFS. WBI Energy will continue consultation with the COE and USFS through the construction phase of the Project.

On NFS land, multiple routes and/or expanded inventory corridors were examined to avoid archaeological sites or resolve other routing constraints, such as land use conflicts, other proposed pipelines, and habitat for sensitive species.

Survey of NFS lands identified 23 archaeological sites, of which 16 sites contain prehistoric features; two sites contain prehistoric and historic artifacts and/or features; and five sites contain historic artifacts and/or features. Recommendations for these sites are as follows:

- Three sites are recommended ineligible for listing in the NRHP. No additional work at these sites is recommended.
- Twenty sites remain unevaluated for listing in the NRHP. Of these:
    - Fourteen sites are located greater than 100 feet from the proposed construction workspace for the Project. No further work at these sites is recommended at this time. WBI Energy suggests a finding of “no effect” for the 14 sites.
    - Six sites are located between 50 and 100 feet from the proposed construction Project workspace for the Project. Fencing of the construction corridor and monitoring in the vicinity of the sites is recommended. With implementation of these measures, WBI Energy suggests a finding of “no effect” for the six sites.

The updated Class III report filed with FERC includes information on one site (32MZ2347) located adjacent to, but outside of, the inventory area for the Project on USFS lands. The information on this site, which was not relocated, was included in the report at the request of the USFS. This site is included in the 23 sites identified for USFS lands.

WBI Energy will prepare a monitoring and avoidance plan for the Project incorporating the recommendations of the archaeological inventory. WBI Energy anticipates filing the monitoring plan in October 2020. Copies of the monitoring and avoidance plan also will be provided to the SHSND and USFS for review.

On COE-managed land, surveys identified one prehistoric site one multicomponent (prehistoric and historic) site was revisited. Neither site has been evaluated for listing in the NRHP. Additional testing is planned to occur at one site (32WI976) in September 2020. As the other site (32MZ598) is located greater than 100 feet from the Project area, no further work is recommended and a finding of “no effect” is suggested. Testing results for 32WI976 will be provided in an addendum report.

7.11 VISUAL IMPACT

In general, visual and aesthetic impacts associated with the Project will be temporary and limited to the period of active construction (e.g., construction equipment, personnel, and disturbed soil). After pipeline construction is complete, the landscape will be re-contoured to as near preconstruction conditions as practicable and revegetated.

WBI Energy will be crossing Lake Sakakawea using the HDD crossing method. Temporary visual impacts will occur during construction due to the entry/exit points on either side of the lake. These entry and exit points are offset from the lake itself by approximately 900 feet on the north side of the lake and 2,200 feet on the south side of the lake. It is not anticipated that the HDD equipment will be visible to recreationalists on the lake; however, short-term temporary visual impacts could occur to visitors traveling to the lake. Because the HDD entry/exit sites will be restored to preconstruction condition, the Project will have no permanent visual impacts on Lake Sakakawea.

For the crossing on NFS land, publicly available mapping indicates that the portion of the crossing has a Low Scenic Integrity Objective, which generally means that visual disturbances are allowed (USFS, 2019). The route will not cross any forested areas NFS land. WBI Energy will revegetate and restore the right-of-way after construction in accordance with USFS requirements and no permanent visual impacts are anticipated on NFS land.

7.12 TOURISM

Minor, short-term impacts on users of tourist resources may occur at the COE Garrison Project - Lake Sakakawea and the USFS Little Missouri National Grassland. These impacts primarily will be associated with increased traffic, noise, and visual impacts caused by construction equipment and activities. Impacts on tourism may be increased due to the timing of the construction schedule (March 2021 to late fall 2021), which is within summer peak tourist season. On NFS land, the Project is not within 0.25 mile of a developed recreational site (LRMP Guideline D.13). While construction will coincide with spring, summer, and fall activities such as hunting and fishing, impacts will be short-term and localized. Opportunities to hunt, fish, and engage in other seasonal activities will be available in surrounding areas, including other areas of the reservoir. Therefore, the Project is not expected to affect tourism industry revenues at the state or local levels, primarily because of the relatively short period (around 8 months) of construction.

7.13 ECONOMY AND EMPLOYMENT

As discussed in Section 6.4, WBI Energy anticipates that peak construction workforce will total 450 workers with an average of approximately 350 temporary construction workers. The workforce will consist of local residents, commuters, and workers who will temporarily relocate to the Project area. Construction of the pipeline will be accomplished using three construction spreads with an average temporary workforce of 250 workers over the 8-month (192 working days) construction period for the pipeline; approximately 24 of these workers may be hired locally. Construction of the aboveground facilities will require an average of about 75 people, consisting of a mix of local residents and workers who will temporary relocate to the Project area.

The workforce will consist of local residents, commuters, and workers who will temporarily relocate to the Project area. Following construction, WBI Energy anticipates that four new permanent employees will be required to assist with operation and maintenance of the proposed facilities. Construction of the Project will result in a temporary increase in the population of the Project area. A portion of the construction workforce will be non-local skilled labor that will reside in the Project area during construction and then move out once construction is complete. Consequently, there will be no long-term significant impacts on population resulting from the Project.

7.14 CONGRESSIONALLY AUTHORIZED PURPOSES OF THE GARRISON PROJECT

As discussed above, the Project crosses 2.7 miles of COE Garrison Project – Lake Sakakawea, an area with congressionally authorized purposes. These include: flood control; navigation; irrigation; hydropower; water quality; municipal and industrial water supply; fish and wildlife; and recreation. These purposes are discussed in further detail below.

7.14.1 Flood Control

The Garrison Project is approximately 75 miles upstream from Bismarck, North Dakota at river mile 1,389.9. Lake Sakakawea is one of six major reservoirs on the Missouri River created in effort to minimize annual flooding on adjacent river lowlands. The maximum storage capacity of the lake reaches 1,854.0 feet mean sea level (24,200,000 acre-feet). As of September 2005, the Missouri River main stem dams (including the Garrison Project) had prevented over $30 billion in flood damages, $9 billion of which is directly attributed to the Garrison Project (COE, 2007).

As part of the COE permitting process, the proposed Project will be reviewed by the COE Floodplain office for its compliance with Executive Order 11988. Results of the COE review on floodplain compliance, and any measures taken by WBI Energy resulting from the review, will be submitted to FERC in a subsequent filing, as necessary.

The proposed pipeline will be installed under the Missouri River floodplain using the HDD method. The northern drill location will be about 800 feet from the shoreline at an elevation of about 1,850 feet. The southern drill location will be approximately 2,150 feet from the shoreline at an elevation of about 1,925 feet. No aboveground structures will be installed within the floodplain. Project construction and operation will not affect floodplain elevations, river flows, or flood storage capacities. Additionally, project construction and operation will not affect the occupancy of the floodplain, nor will it result in modifications to the floodplain or promote floodplain development.

7.14.2 Navigation

The Missouri River does not support commercial navigation in the portion of the river that will be crossed by the proposed Project. Gavins Point Dam (at river mile 811.1 in South Dakota) is the northernmost point that commercial vessels can travel on the river. While commercial navigation does not occur in the proposed Project area, the entire mainstem dam system is operated to provide adequate flows to support navigation in the southern reaches (COE, 2007).

WBI Energy will install the pipeline under the Missouri River/Lake Sakakawea using the HDD method. Project construction will not require the use of any barges or other structures within Lake Sakakawea. Depth of this crossing will be finalized based on the over water geotechnical analysis to be completed in the spring of 2020. The depth of cover will be approximately 250 feet; therefore construction and operation of the Project will not interference with navigation on Lake Sakakawea.

7.14.3 Irrigation

The Garrison Diversion Unit was authorized in 1965 with the purpose of diverting Missouri River water to central and eastern North Dakota for irrigation, water supply (industrial and municipal), fish and wildlife conservation, flood control, and recreation. Construction of the

Garrison Diversion Unit was started in 1967. Various projects have been completed (including the Snake Creek Pumping Plant, New Rockford Canal, and McClusky Canal) as part of the Garrison Diversion Unit. Additionally, over 30 agricultural irrigation water systems have intakes for withdrawing water from Lake Sakakawea (COE, 2007). Project construction and operation would not divert or appropriate water from the Missouri River; therefore, the Project would not affect the lake water volumes.

7.14.4 Hydropower

The Garrison power plant is operated to assist meeting peak-load demands for hydropower in the Upper Missouri River basin. The plant contains five turbines and generators with a generating capacity of 517,750 kilowatts, which produces about 2.5 billion kilowatt-hours of energy each year. The power is marketed by the Western Area Power Administration and is integrated with the generation provided from other mainstem projects along with other public and private facilities in the market area (COE, 2007).

Project construction and operation will not divert or appropriate water from the Missouri River/Lake Sakakawea; therefore, the Project will not affect lake water volumes or the ability to generate hydropower.

7.14.5 Water Quality

Water quality in Lake Sakakawea must comply with the State of North Dakota's standards for a Class 1 lake. The COE has a water quality monitoring program in place. The Garrison Project has identified silt control; soil erosion prevention; pollution abatement; adequate and safe municipal water supplies; improving quality of water for irrigation; provision of water suitable for domestic, sanitary, and industrial purpose; and improving clarity of water for recreation and for fish and wildlife as means of maintaining and improving water quality (COE, 2007). WBI Energy will cross Lake Sakakawea using the HDD crossing method. With implementation of this crossing method and adherence to the mitigation measures set for in the FERC Plan and Procedures, SPCC Plan, and HDD Plan, impacts on water quality of the lake are expected to be minimal.

7.14.6 Municipal and Industrial Water Supply

In 2007, according to the COE, the cities of Garrison, Parshall, Pick City, and Riverdale, along with three industrial water systems, were obtaining water from Lake Sakakawea or Garrison Dam's penstocks for industrial and municipal uses. Additionally, 19 communities and 186 homes located close to the lake had water supply intakes for withdrawing water from Lake Sakakawea (COE, 2007). WBI Energy will not divert or appropriate water from the Missouri River during Project construction or operation; therefore, the Project will not have any impacts on the reservoir water capacity.

7.14.7 Fish and Wildlife

WBI Energy proposes to use the HDD method to cross Lake Sakakawea and a natural pond on COE land, and the guided bore method to cross an unnamed tributary to Sand Creek and an unnamed tributary to Tobacco Garden Creek on NFS land. These methods will reduce or eliminate potential impacts on fisheries in these waterbodies because it will not require disturbance of the streambeds or banks. While HDDs and guided bores generally minimize impacts on aquatic resources, an inadvertent release of drilling fluids to a waterbody will cause

increased turbidity that could adversely affect fish in the vicinity of the release. If a release were to occur, it could cause short-term increases in turbidity and sedimentation that in turn could reduce dissolved oxygen levels in the water column. Increased turbidity could also reduce the ability for aquatic species to find food sources or avoid prey as well as cause physiological effects in fish such as gill clogging. WBI Energy will implement the measures in its HDD Plan to prevent, detect, contain, and clean up any drilling fluid releases.

All lands associated with the Garrison Project are managed to benefit and enhance wildlife species. The Lake Audubon and Lake Sakakawea General Plans identify 51,000 acres at Lake Sakakawea to be used primarily for the conservation and management of wildlife. All Garrison Project lands will be crossed within the span of the proposed HDD crossing of Lake Sakakawea. Impacts associated with general wildlife species on COE-managed land will be similar in scale to those for the Project as a whole (COE, 2007).

7.14.8 Recreation

Recreational use of Garrison Project lands is encouraged through the availability of public parks and recreational facilities and the Garrison Project is managed to provide a diverse and high quality outdoor recreation experience. Planning for the development and use of recreation facilities is coordinated with Tribal, state, county, municipal, and local non-government entities, who lease and manage most of the higher use recreation sites on Lake Sakakawea (COE, 2007). WBI Energy proposes to cross Lake Sakakawea via the HDD method (see Resource Report 2 of the FERC Application). Lake Sakakawea is a reservoir on the Missouri River and is about 368,000 acres in size. The land crossed by the proposed Project does not have public access to the COE land or the lake; all access is private. Therefore, Project construction will not have a direct impact on recreational opportunities on Lake Sakakawea. The lake crossing will occur approximately 1.3 miles from Tobacco Garden Bay, which has a restaurant, convenience store, bait and tackle shop, as well as 100 campsites, two log cabins, and picnic shelters. This area also provides access to the Birnt Hills Trail and a boat launch located on the north side of this site, which is one of the main access points to recreate on the river. Temporary impacts on recreational opportunities on Lake Sakakawea would be limited to noise, visual, and traffic impacts during HDD construction.

8.0 STABILIZATION AND REHABILITATION

This section provides soil management and stabilization, disposal of vegetation cleared during construction, revegetation procedures, and access road reclamation.

8.1 SOIL REPLACEMENT AND STABILIZATION (RESTORATION)

On COE-managed land, no earth moving activities are proposed; therefore, soils are anticipated to remain stable.

On NFS land, WBI Energy will comply with the LRMP standards and guidelines. As described in section 6.2, WBI Energy will clear the work area of vegetation and other obstacles. Following clearing, the construction right-of-way and extra work space will be graded where necessary to provide a level work surface to allow safe passage of construction equipment and emergency vehicles. As needed during winter months, snow will be plowed and stockpiled at the edge of construction right-of-way. Topsoil will be segregated in accordance with the FERC Plan and Procedures. If the ground is relatively flat and does not require topsoil segregation or grading,

rootstock will be left in the ground to facilitate restoration of the right-of-way. In areas disturbed by grading, and as required by the FERC Plan and Procedures, temporary erosion and sediment controls will be installed within the right-of-way to minimize erosion (LRMP Standard B.1 and C.2). These erosion and sediment controls will be inspected and maintained throughout the construction and restoration phases of the Project, as appropriate, and as required by the FERC Plan and Procedures.

8.2 SEEDING SPECIFICATIONS AND SOIL AMENDMENTS

Following final grading and cleanup, WBI Energy will make every effort to ensure the rapid, successful establishment of vegetation on areas requiring revegetation as described in the FERC Plan. During the appropriate season, WBI Energy will condition the construction right-of-way for planting, prepare a seedbed, and incorporate soil amendments, where necessary. WBI Energy will determine appropriate soil amendment application rates to facilitate the seed mix described below.

The USFS provided seeding rate guidelines for the Project (LRMP Guideline J.5 and 6). WBI Energy will adhere to the USFS recommendation (#37-28A Seed Mixture revised 07/18/2013). A copy of the seed mix is presented in appendix O.

8.3 DISPOSAL OF VEGETATION REMOVED DURING CONSTRUCTION

There is no merchantable timber on NFS land. Cleared woody vegetation and stumps will be chipped (except in wetlands), put to beneficial use such as mulch for erosion control, or hauled offsite to a commercial disposal facility.

8.4 ACCESS ROAD RECLAMATION

WBI Energy proposes to use one temporary access road (Access 24c) to connect the construction right-of-way with Highway 1806 West. No USFS roads on NFS land will be used during construction or operation of the Project.

9.0 OPERATIONS AND MAINTENANCE

In general, WBI Energy will adhere to the operations and maintenance procedures described in the FERC Plan and Procedures, subject to any modifications approved by FERC, in the vicinity of waterbodies, wetlands, and upland areas.

The pipeline will be inspected periodically on foot, by all-terrain vehicle, or other vehicle as required by applicable regulatory requirements to identify potential concerns that may affect the safety and operation of the pipeline. Pipeline markers and signs will be inspected and maintained or replaced, as necessary, to ensure that pipeline locations are clearly identified. Field personnel will advise the appropriate operations personnel of new construction along or near the pipeline system. If pipeline patrols or vegetation maintenance identify areas on the right-of-way where erosion is occurring, WBI Energy will repair existing erosion control devices or install additional devices as necessary to stabilize the area and prevent future erosion.

In order to maintain accessibility of the right-of-way and to accommodate pipeline integrity surveys, vegetation along the pipeline right-of-way will be cleared periodically, and as necessary, in accordance with the FERC Plan and Procedures (except in areas crossed by HDD or guided

bore where vegetation maintenance will not be conducted). In non- uplands, the entire 50-foot-wide long-term easement will be maintained in an herbaceous state. In wetlands, the FERC Procedures allows for a 10-foot-wide corridor centered over the pipeline to be permanently maintained in an herbaceous state, and trees greater than 15 feet in height within 15 feet of the pipeline may be cut and removed from the right-of-way. Where necessary and when required, WBI Energy typically will use mechanical mowing or cutting along its right-of-way for normal vegetation maintenance.

The pipeline's cathodic protection system will also be monitored and inspected in accordance with 49 CFR Part 192 requirements to ensure proper and adequate corrosion protection. The pipeline will be designed for internal inspection technology. Appropriate responses to conditions observed during internal inspections will be taken as necessary.

Further, operation and maintenance procedures, including record keeping, will be performed in accordance with USDOT requirements. Operation and maintenance of block valves will be performed in accordance with information provided by the valve manufacturers.

9.1 ACCESS NEEDED FOR OPERATION AND MAINTENANCE

Access 24c used during construction will be reclaimed when construction is complete and not used for operation of the Project. However, WBI Energy will require access along the long-term right-of-way for operation and maintenance activities (including inspections). If additional unforeseen access is required at a future time, WBI Energy will coordinate with the COE and USFS.

9.2 HYDROSTATIC TESTING DURING OPERATION

Hydrostatic testing will be performed along the portion of the pipe on both federal lands; however, no water will be withdrawn or released on federal land. Should hydrostatic testing be necessary during operations of the Project, no water will be withdrawn or released on federal lands.

9.3 REMOVAL OR ADDITION OF INFRASTRUCTURE DURING PIPELINE MAINTENANCE

No aboveground facilities are proposed on federal land. Additionally, WBI Energy does not anticipate adding or removing pipeline facilities on federal land during operation of the Project. If unforeseen infrastructure maintenance is required at a future time, WBI Energy will coordinate with the COE and USFS prior to repair.

9.4 SAFETY AND HAZARDOUS MATERIAL STORAGE

WBI Energy will operate and maintain the new pipeline in accordance with all applicable federal and state requirements, including the minimum federal safety standards identified in 49 CFR 192 Transportation of Natural and Other Gas by Pipeline. Operation and maintenance of the facilities will be performed by or at the direction of WBI Energy.

Regularly scheduled inspections, as described above, are key to identifying potential concerns that may affect the safety and operation of the pipelines. However, in the event of an emergency response, where public safety and/or property are threatened, or to prevent imminent

damage to the pipeline, WBI Energy will adhere to the protocol described in WBI Energy Transmission - Gas System Operations and Maintenance Manual dated December 30, 2019. Since this plan contains critical energy infrastructure information, it has not been included with this POD. WBI Energy will coordinate with the COE and USFS to provide relevant details if requested.

Since no aboveground facilities are located on federal land, no hazardous material will be stored on federal land during operation of the Project.

9.5 INSPECTION AND MAINTENANCE SCHEDULES

WBI Energy anticipates inspections/patrols of the long-term easement every 7.5 months or at least twice within each calendar year (complies with 49 CFR 192.705 for class 1 pipe on federal lands).

9.6 WORK SCHEDUES

Following construction, WBI Energy anticipates that four new permanent employees will be required to assist with operation and maintenance of the proposed facilities. Work schedules would typically follow the inspection cycle described in section 9.5.

9.7 FIRE CONTROL

In the unforeseen event of fire during operation of the Project, WBI Energy will adhere to the protocol described in WBI Energy Transmission - Gas System Operations and Maintenance Manual dated December 30, 2019. Since this plan contains critical energy infrastructure information, it has not been included with this POD. WBI Energy has coordinated with the USFS regarding typical fire suppression requirements on NFS land and will adhere to the USFS fire prevention and suppression requirements. If requested by the District Ranger, WBI Energy will prepare a Fire Suppression Plan for the Project. WBI Energy will coordinate with the COE and USFS to provide relevant details if requested.

9.8 CONTINGENCY PLANNING

WBI Energy has worked on contingency planning efforts for the HDD crossing of Lake Sakakawea, unanticipated discoveries (contaminated soil, cultural resources, and paleontological resources), exotic and invasive species, and spills. Should a need for additional contingency plans become necessary during operation of the pipeline, WBI Energy will work with the COE and USFS to complete the required plans.

10.0 TERMINATION AND RESTORATION

This section provides information on the useful life span of the Project including structures to be removed, road reclamation, and restoration of disturbed areas associated with abandonment.

10.1 REMOVAL OF STRUCTURES

While FERC Certificates do not have a termination date, at the end of the useful lifespan for the Project, WBI Energy may need to repair, replace, or abandon facilities associated with the

proposed Project. Any of those actions would require permission from FERC in response to new applications. WBI Energy would also coordinate with the BLM, COE, and USFS as appropriate. Any abandonment activities would require an application to FERC under Section 7(b) of the NGA. Typically, agencies would conduct a separate review under the National Environmental Policy Act for a new application. Under the National Environmental Policy Act, the public would have the opportunity to comment on these applications.

10.2 OBLITERATION OF ROADS

WBI Energy does not propose to construct new access roads on federal land. The one temporary access road on NFS land will be reclaimed as described in section 8.4.

10.3 STABILIZATION AND REVEGETATION OF DISTURBED AREAS

The stabilization and revegetation of disturbed areas associated with abandonment would comply with FERC's Plan and Procedures and all requirements outlined in the BLM Right-of-Way Grant. If different standards, either equivalent or more advanced, have been developed at the time of abonnement, WBI Energy would comply with those.

11.0 REFERENCES

Bickerdyke, C. 2020. United States Forest Service Little Missouri National Grasslands. Personal Communication with A. Thornton, ERM. July 20, 2020

City of Williston. 2019. City of Williston Website. Available online at: https://www.cityofwilliston.com/. Accessed January 2020.

Energy of North Dakota. 2020a. How Oil is Produced: About the Resource. Available online at: https://energyofnorthdakota.com/home-menu/how-oil-is-produced/about-the-resource/. Accessed January 2020.

Energy of North Dakota. 2020b. Impacts & Solutions: Flaring. Available online at: https://energyofnorthdakota.com/home-menu/impacts-solutions/flaring/. Accessed February 2020.

North Dakota Department of Mineral Resources. 2019. Director's Cut, Lynn Helms, North Dakota Industrial Commission Department of Mineral Resources. Available online at https://www.dmr.nd.gov/oilgas/directorscut/directorscut-2019-10-17.pdf. Accessed January 2020.

North Dakota Department of Mineral Resources. 2020. Director's Cut, Lynn Helms, North Dakota Industrial Commission Department of Mineral Resources. Available online at https://www.dmr.nd.gov/oilgas/directorscut/directorscut-2020-01-17.pdf. Accessed January 2020.

North Dakota Industrial Commission. 2014. North Dakota Industrial Commission Order 24665 Policy/Guidelines.

U.S. Army Corps of Engineers. 2007. Garrison Lake/Lake Sakakawea Master Plan with Integrated Programmatic Environmental Assessment. Update of Design Memorandum MGR-107D. Available online at: https://usace.contentdm.oclc.org/digital/collection/p16021coll7/id/2348/. Accessed: January 2020.

U.S. Army Corps of Engineers. 2016. U.S. Army Corps of Engineers Section 408 Overview. Regulatory Workshop. July 22, 2016. Available online at: https://www.spk.usace.army.mil/Portals/12/documents/regulatory/Reg_workshop/2016-07-22/408-Overview-Regulatory-Workshop-7-19-16.pdf?ver=2016-08-02-134604-830. Accessed: January 2020.

U.S. Army Corps of Engineers. 2018. Missouri River Mainstem Reservoir System, Water Control Manual, Garrison Dam – Lake Sakakawea. Available online at: http://www.nwd-mr.usace.army.mil/rcc/reports/pdfs/GarrisonDamWCM_Final_Dec2018.pdf. Accessed: January 2020.

U.S. Energy Information Administration. 2019. Annual Energy Outlook 2019 with Projections into 2050. U.S. Department of Energy. Available online at: https://www.eia.gov/outlooks/aeo/. Accessed July 2019.

U.S. Energy Information Administration. 2020. Natural Gas Production in Bakken Region Increases at a Faster Rate Than Oil Production. Available online at: https://www.eia.gov/todayinenergy/detail.php?id=33892. Accessed January 2020.

U.S. Forest Service. 2019. Land and Resource Management Plan for the Dakota Prairie Grasslands Northern Region. Available online at: https://www.fs.usda.gov/main/dpg/landmanagement/planning. Accessed: January 2020.

NORTH BAKKEN EXPANSION PROJECT

Plan of Development

APPENDIX A

Select Arial Photo-based Alignment Sheet Mapping

Co, State	SECTIONS 18, 19, T154N, R96W, WILLIAMS COUNTY, NORTH DAKOTA

OWNER

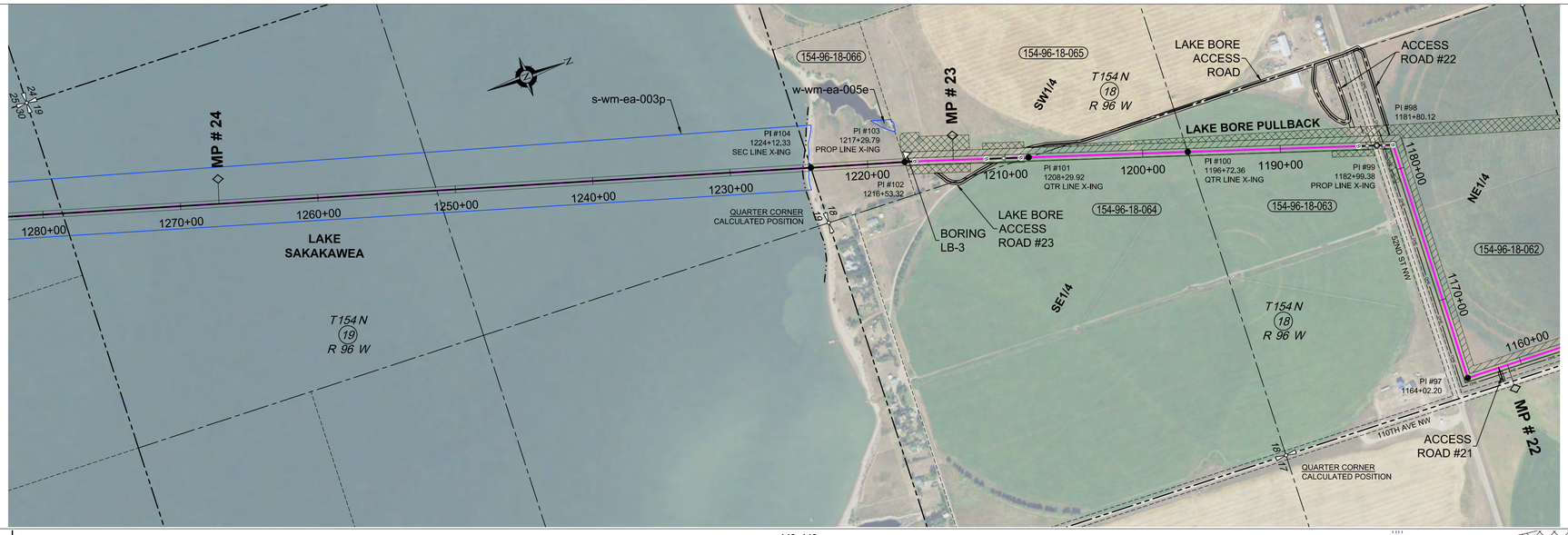
1224+12	154-96-18-066	1217+30	154-96-18-065	1208+30	154-96-18-064	1196+72	154-96-18-063	1182+99	154-96-18-062
	S1/2 SE1/4 SW1/4 SEC. 18, T154N, R96W		E1/2 SW1/4, LOTS 3-4 EX. DD PTS SEC. 18, T154N, R96W		SE1/4 SEC. 18, T154N, R96W		S1/2 NE1/4 EX. SUBLOT 6 SEC. 18, T154N, R96W		N 1/2 NE1/4 SEC. 18, T154N, R96W
	683' Uncultivated		152 Cultivated - 748' Uncultivated		1158 Cultivated		1264 Cultivated - 109' Uncultivated		3092 Cultivated - 17' Uncultivated
RODDAGE	682.54' / 41.37 Rods		899.85' / 54.54 Rods		1157.56' / 70.16 Rods		1372.98' / 83.21 Rods		3108.84' / 188.41 Rods

PIPE SCHMATIC

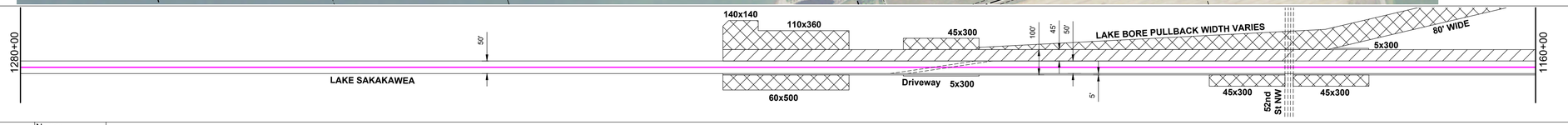
FEATURES

1216+53 End Bore
1211+36 End Bore
1210+11 Driveway
1208+86 Begin Bore
1184+30 End Bore
1183+68 Waterline
1182+99 52nd St NW
1182+47 OHE
1181+80 Begin Bore

ALIGN



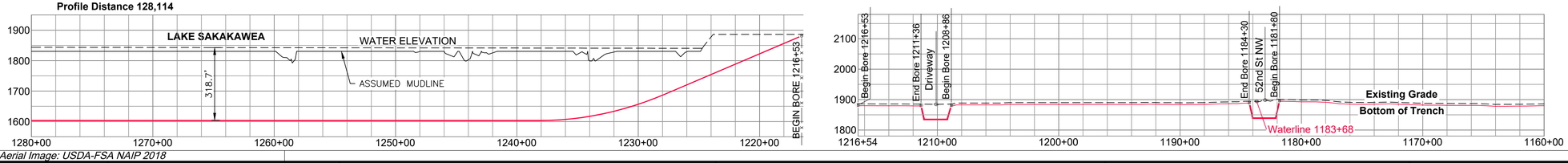
WORK SPACE N.T.S.



ENVIRO

Water Crossing	Name	
	Crossing Method	
	Bridge	
Wetland Crossing	Name	
	Survey Extent	
Environmental Feature		
Miscellaneous/Comments		
Seeding Mix		

PROFILE



Ref. Dwgs. Aerial Image: USDA-FSA NAIP 2018

PI TABLE

PI #	STATION	DEFLECTION
PI #97	1164+02.20	90° 00'R
PI #98	1181+80.12	74° 00'L
PI #99	1182+99.38	00° 00'
PI #100	1196+72.36	00° 00'
PI #101	1208+29.92	00° 00'
PI #102	1216+53.32	01° 30'
PI #103	1217+29.79	00° 00'
PI #104	1224+12.33	00° 00'

Wetlands
Waterbodies

Noxious Weeds

Dask Reproductive Habitat

Permanent Easement

Temporary Workspace

Additional Temp. Workspace

ENVIRONMENTAL NOTES:
1. Wetlands depicted on these sheets represent actual field survey data or NWI.
2. Actual wetland or stream width may vary at time of construction.

* Open ("WET") trench if no distinguishable flow at the time of construction, dry crossing method if distinguishable flow at time of construction

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ERICKSON CONTRACT SURVEYING
333 10th Ave. SE Sidney, Montana
Office 406-482-6606 / Fax 406-482-6600

ECS Project # 2018-23-0200

SURVEY DATUM

North Dakota North (NAD 83)(2011)
International Foot
*Distances are Grid Distances.
Combined Scale Factor = 0.999846363
Grid Dist. x 1.000153661 = Ground Dist.

Drawing Date:	01-31-2019
Drawn By:	D. Smith
Checked by:	J. Harned

LEGEND:

- Proposed Block Valve
- Proposed Bore
- CTP test station
- Alignment PI
- Utility Pole
- Well
- Valve
- Alignment
- Section Line
- Quarter Line
- Fence Line
- UG Fiber Optic
- UG Electric
- Overhead Elec
- Existing Pipeline
- Dirt Road

SUMMARY of MATERIALS

Mark	Quantity	Description
1	5153	24" 0.312" W.T., API 5L-X65, ERW, w/FBE
2	6,847	24" 0.375" W.T., API 5L-X65, ERW, w/FBE & ARO

REVISIONS

No.	Date	Description
1	1/17/20	Cultural / Dask Re-routes
2	5/22/20	Re-routes
3	9/3/20	Re-routes

500 0 500 1000 feet
scale 1" = 500' - 22 x 34
1" = 1000' - 11 x 17

NORTH BAKKEN EXPANSION PIPELINE
TIOGA-ELKHORN CREEK LINE

WBI ENERGY TRANSMISSION
An MDU Resources Group company

Sec. 18, 19, T154N, R96W,
5th P.M., Williams Co., North Dakota

1" = 500' HORIZ.
1" = 200' VERT.

Sheet 11 | R3

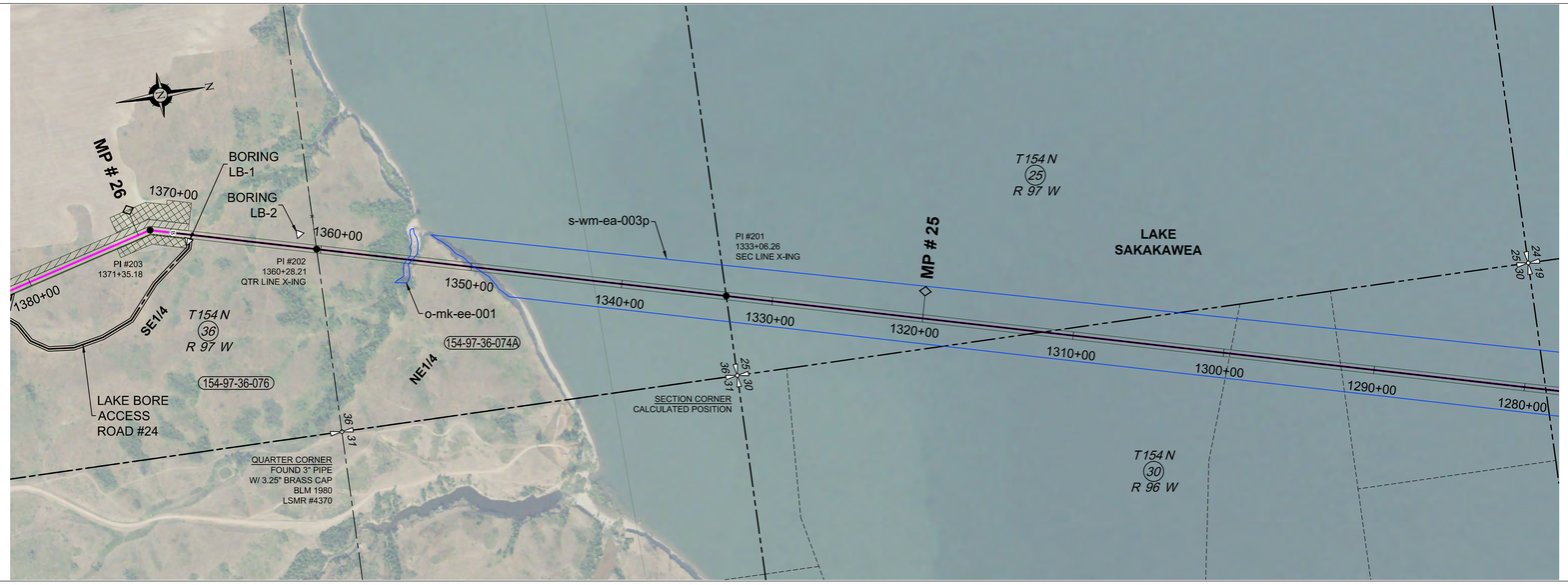
Co, State	SECTION 30, T154N, R96W, SECTIONS 25, 36, T154N, R97W, MCKENZIE COUNTY, NORTH DAKOTA
OWNER	**154-97-36-076** SE1/4 SEC. 36, T154N, R97W — 568' Cultivated - 2142' Uncultivated — 1360+29
	154-97-36-074A ALL LESS DEEDED PORTIONS SEC. 31, T154N, R96W — 2723' Uncultivated — 1333+06
RODDAGE	2709.39' / 164.21 Rods — 2723.10' / 165.04 Rods

PIPE SCHMATIC

FEATURES

1369+84 Begin Bore

ALIGN



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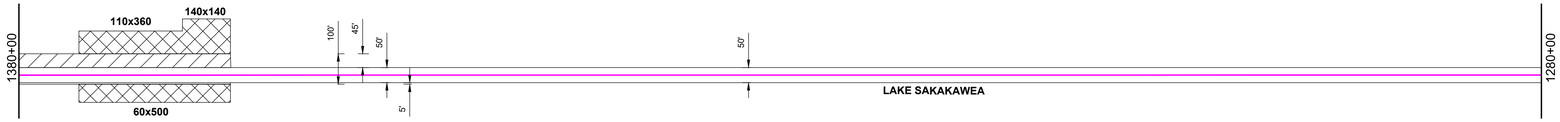
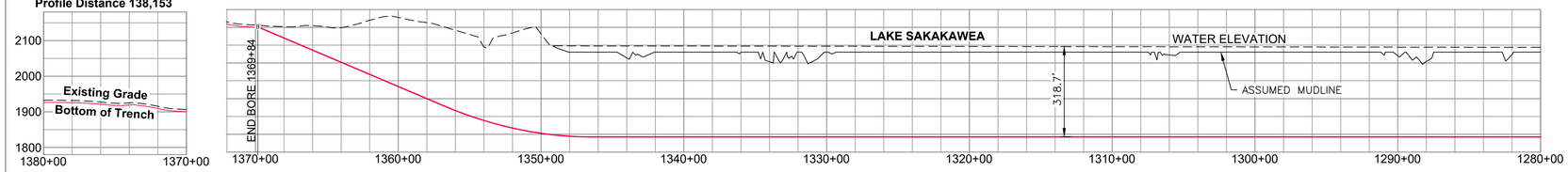


ENVIRO

Water Crossing	Name		
	Crossing Method		
	Bridge		
Wetland Crossing	Name		o-mk-ee-001
	Survey Extent		1354+13
Environmental Feature			Wetland
Miscellaneous/Comments			
Seeding Mix			

PROFILE



Ref. Dwgs. Aerial Image: USDA-FSA NAIP 2018

PI TABLE

PI #	STATION	DEFLECTION
PI #201	1333+06.26	00° 00'
PI #202	1360+28.21	00° 00'
PI #203	1371+35.18	30°00'L

Wetlands Waterbodies

Noxious Weeds

Dask Reproductive Habitat

Permanent Easement

Temporary Workspace

Additional Temp. Workspace

ENVIRONMENTAL NOTES:

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- UG Electric
- Overhead Elec
- Existing Pipeline
- Dirt Road

SUMMARY of MATERIALS

Mark	Quantity	Description
1	1,016	24" 0.312" W.T., API 5L-X65, ERW, w/FBE
2	8,984	24" 0.375" W.T., API 5L-X65, ERW, w/FBE & ARO

REVISIONS

No.	Date	Description
1	1/17/20	Cultural / Dask Re-routes
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NORTH BAKKEN EXPANSION PIPELINE

TIOGA-ELKHORN CREEK LINE

WBI ENERGY TRANSMISSION
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500 0 500 1000
scale 1" = 500' - 22 x 34 feet
1" = 1000' - 11 x 17

1" = 500' HORIZ.
1" = 200' VERT.

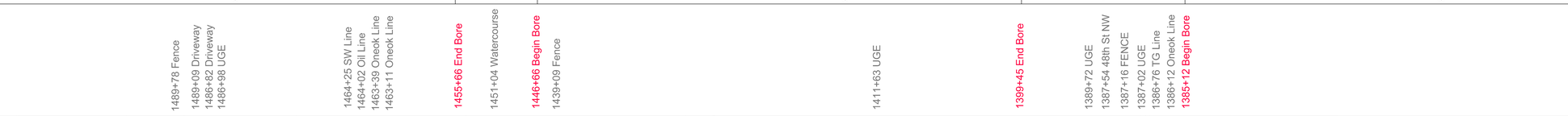
Sec. 30, T154N, R96W,
Sec. 25, 36,T154N, R97W,
5th P.M., Mckenzie Co., North Dakota

Sheet 12 | R3

Co, State	SECTION 36, T154N, R97W, SECTIONS 1, 12, T153N, R97W, MCKENZIE COUNTY, NORTH DAKOTA					
OWNER	**153-97-12-078** E1/2 SW1/4 SEC. 12, T153N, R97W 3711' Uncultivated 1489+75	**153-97-01-079** E1/2 NW1/4 EX RW, IT1388 & IT2044 SEC. 12, T153N, R97W 1554' Cultivated - 1136' Uncultivated 1462+85	**153-97-01-077A** NE1/4 SEC. 1, T153N, R97W 2378' Uncultivated 1439+07	**153-97-01-077** E1/2 SE1/4 SEC. 1, T153N, R97W 2531' Uncultivated 1413+76	**153-97-01-077** SE1/4 NE1/4, GOV'T LOT 1 SEC. 1, T153N, R97W 2638' Uncultivated 1387+38	**154-97-36-076** SE1/4 SEC. 36, T154N, R97W 567' Cultivated - 2142' Uncultivated
RODDAGE	3710.67' / 224.89 Rods	2690.26' / 163.05 Rods	2378.34' / 144.14 Rods	2530.98' / 153.39 Rods	2637.92' / 159.87 Rods	2709.39' / 164.21 Rods

PIPE SCHMATIC

FEATURES



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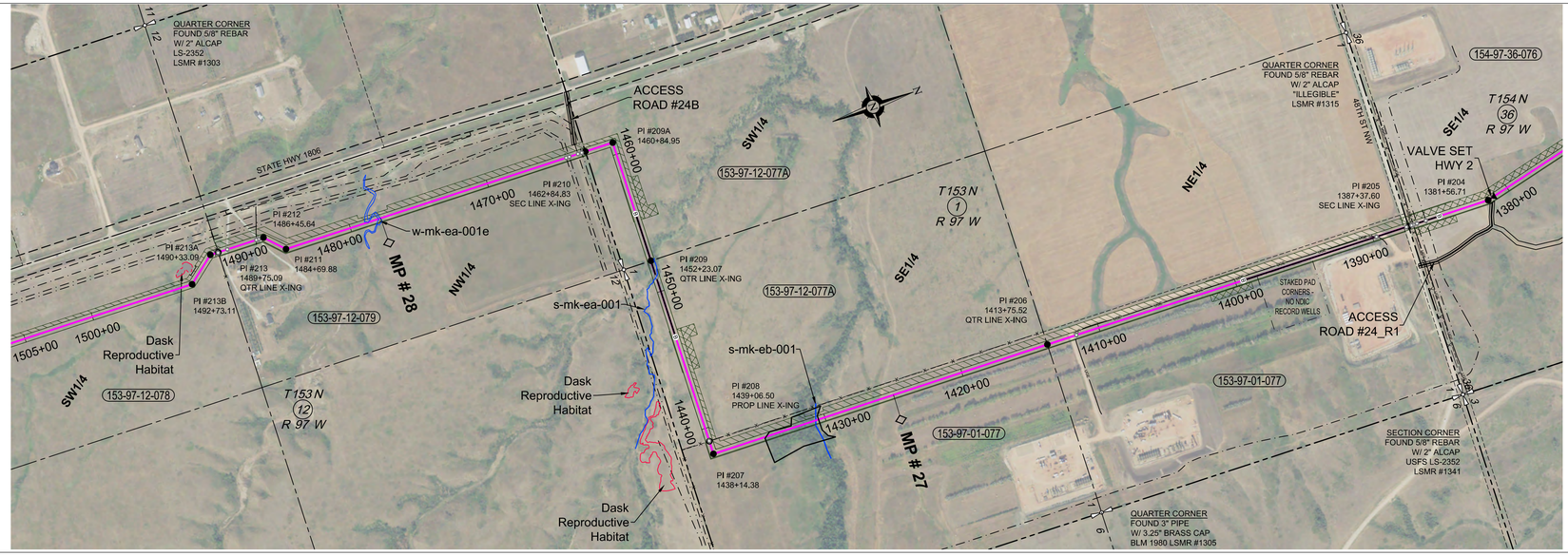
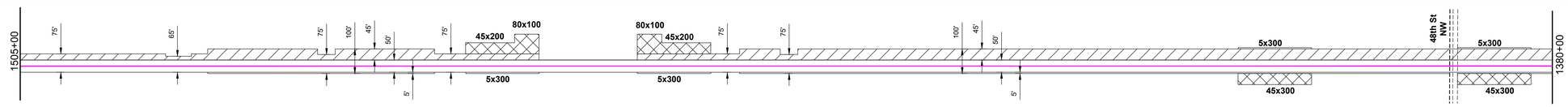


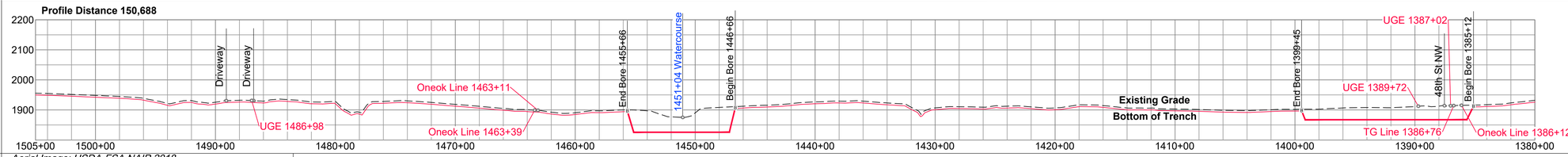
WORK SPACE N.T.S.



ENVIRO

Water Crossing	Name				s-mk-ea-001		s-mk-eb-001
	Crossing Method				Bore		Open-Cut
	Bridge				No		Yes
Wetland Crossing	Name			w-mk-ea-001e			
	Survey Extent	1492+90	1479+03	1478+85	1451+04		1430+67
Environmental Feature		Dask RH	Wetland		Minor Stream		Minor Stream
Miscellaneous/Comments		Approx. 89' LF Dask Fencing	Approx. 30' ECD Approx. 30' mats				Spoil Setback 10' min. from bank
Seeding Mix							

PROFILE



Ref. Dwgs. Aerial Image: USDA-FSA NAIP 2018

PI TABLE

PI #	STATION	DEFLECTION
PI #204	1381+56.71	15° 00'R
PI #205	1387+37.60	00° 00'
PI #206	1413+75.52	00° 00'
PI #207	1438+14.38	90° 00'R
PI #208	1439+06.50	00° 00'
PI #209	1452+23.07	00° 00'
PI #209A	1460+84.95	90° 00'L
PI #210	1462+84.83	00° 00'
PI #211	1484+69.88	45° 00'R
PI #212	1486+45.64	45° 00'L
PI #213	1489+75.09	00° 00'
PI #213A	1490+33.09	45° 00'L
PI #213B	1492+73.11	45° 00'R

Wetlands Waterbodies
Noxious Weeds
Dask Reproductive Habitat
Permanent Easement
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Additional Temp. Workspace

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- Well
- Valve
- Alignment
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- Quarter Line
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- UG Electric
- Overhead Elec
- Existing Pipeline
- Dirt Road

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2	2333	24" 0.375" W.T., API 5L-X65, ERW, w/FBE & ARO

REVISIONS

No.	Date	Description
1	1/17/20	Cultural / Dask Re-routes
2	5/22/20	Re-routes
3	9/3/20	Re-routes

NORTH BAKKEN EXPANSION PIPELINE
TIOGA-ELKHORN CREEK LINE

WBI ENERGY TRANSMISSION
An MDU Resources Group company

500 0 500 1000
scale 1" = 500' - 22 x 34 feet
1" = 1000' - 11 x 17

1" = 500' HORIZ.
1" = 200' VERT.

Sec. 36, T154N, R97W,
Sec. 1, 12, T153N, R97W,
5th P.M., Mckenzie Co., North Dakota

Sheet 13 | R3

Co, State: SECTIONS 13, 14, 22, 23, T153N, R97W, MCKENZIE COUNTY, NORTH DAKOTA

OWNER	153-97-23-086	153-97-23-085	153-97-14-084	153-97-14-083	153-97-14-082	153-97-13-081	153-97-12-078
Station	1639+14	1629+83	1616+22	1589+82	1574+07	1546+33	1526+86
Description	SW1/4 NW1/4 SEC. 23, T153N, R97W	NW1/4NW1/4 SEC. 23, T153N, R97W	SW1/4 SEC. 14, T153N, R97W	NW1/4 SEC. 14, T153N, R97W	NE1/4 SEC. 14, T153N, R97W	NW1/4 SEC. 13, T153N, R97W	E1/2 SW1/4 SEC. 12, T153N, R97W
Cultivation	931' Uncultivated	1849' Cultivated - 433' Uncultivated	1849' Cultivated - 791' Uncultivated	1658' Cultivated - 527' Uncultivated	3251' Uncultivated	1947' Uncultivated	3711' Uncultivated
RODDAGE	930.87' / 56.42 Rods	1360.79' / 82.47 Rods	2639.98' / 160.00 Rods	2184.78' / 132.41 Rods	3251.42' / 197.06 Rods	1947.27' / 118.02 Rods	3710.67' / 224.89 Rods

PIPE SCHMATIC

1640+00 ① 1617+47 ② 1614+97 ① 1593+67 ② 1591+17 ① 1576+00 ② 1573+46 ① 1539+58 ② 1527+94 ① 1513+11 ② 1507+98 ① 1505+00

FEATURES

1639+08 Fence
1629+78 Fence
1626+02 Oneok Line
1624+94 Oneok Line
1617+47 End Bore
1616+66 OHE
1616+55 Fence
1616+22 45th St NW
1614+97 Begin Bore
1610+30 Goodnight Line
1597+40 Fence
1594+00 UGE
1589+79 OHE
1593+67 End Bore
1592+42 Tob-Gar Crk
1591+70 Fence
1591+17 Begin Bore
1576+00 End Bore
1574+83 UFO
1574+53 Fence
1574+07 Hwy 43
1573+67 OHE
1573+67 Fence
1573+46 Begin Bore
1539+50 Begin Bore
1538+61 SW Line
1538+39 Oneok Line
1538+22 Oneok Line
1537+83 Fence
1536+75 Hwy 1806
1531+26 Watercourse
1527+86 End Bore
1513+04 End Bore
1511+29 Hwy 1806
1510+51 Fence
1509+72 Oneok Line
1509+01 SW Line
1509+24 Oil Line
1507+98 Begin Bore

ALIGN

PI TABLE		
PI #	STATION	DEFLECTION
PI #213C	1506+50.77	90° 00'R
PI #213D	1516+66.89	90° 00'L
PI #213E	1526+85.77	00° 00'
PI #213F	1527+85.77	12° 30'R
PI #214	1541+17.42	90° 00'R
PI #215	1546+33.04	00° 00'
PI #216	1548+01.78	12° 00'L
PI #216A	1570+51.90	45° 00'L
PI #216B	1572+13.35	45° 30'L
PI #216C	1572+90.03	80° 00'R
PI #217	1574+06.82	00° 00'
PI #217A	1590+48.83	34° 30'L
PI #218	1588+89.25	45° 00'L
PI #219	1589+82.02	00° 00'
PI #220	1616+22.00	00° 00'
PI #221	1627+05.78	31° 30'R
PI #222	1629+82.80	00° 00'
PI #223	1637+28.95	12° 00'R
PI #224	1639+13.67	00° 00'

Wetlands Waterbodies
Noxious Weeds
Dask Reproductive Habitat

WORK SPACE N.T.S.

Permanent Easement
Temporary Workspace
Additional Temp. Workspace

ENVIRO

Water Crossing	Name			s-mk-eb-003	s-mk-eb-002		s-mk-wa-001
	Crossing Method			Bore	Bore		Bore
	Bridge			Yes	Yes		Yes
Wetland Crossing	Name	s-mk-eb-004	o-mk-eb-001			w-mk-eb-002e	
	Survey Extent	1632+98	1620+42	1594+55	1582+24	1544+85	1531+26
Environmental Feature		Wetland	Wetland	Int Stream	Int Stream	Wetland	Int Stream
Miscellaneous/Comments				Spoil Setback 10' min. from bank	Spoil Setback 10' min. from bank		Spoil Setback 10' min. from bank
Seeding Mix							

ENVIRONMENTAL NOTES:
1. Wetlands depicted on these sheets represent actual field survey data or NWI.
2. Actual wetland or stream width may vary at time of construction.
* Open ("WET") trench if no distinguishable flow at the time of construction, dry crossing method if distinguishable flow at time of construction

PROFILE

Ref. Dwgs. Aerial Image: USDA-FSA NAIP 2018

Surveying & Drafting Services By:
ECS INC.
ERICKSON CONTRACT SURVEYING
333 10th Ave. SE Sidney, Montana
Office 406-482-6606 / Fax 406-482-6600

ECS Project # 2018-23-0200

SURVEY DATUM

North Dakota North (NAD 83)(2011)
International Foot
*Distances are Grid Distances.
Combined Scale Factor = 0.999846363
Grid Dist. x 1.000153661 = Ground Dist.

Drawing Date: 01-31-2019
Drawn By: D. Smith
Checked by: J. Harned

LEGEND:

Proposed Block Valve
Proposed Bore
CTP test station
Alignment PI
Utility Pole
Well
Valve
Alignment
Section Line
Quarter Line
Fence Line
UG Fiber Optic
UG Electric
Overhead Elec
Existing Pipeline
Dirt Road

SUMMARY of MATERIALS

Mark	Quantity	Description
1	12,174	24" 0.312" W.T., API 5L-X65, ERW, w/FBE
2	2421	24" 0.375" W.T., API 5L-X65, ERW, w/FBE & ARO

REVISIONS

No.	Date	Description
1	1/17/20	Cultural / Dask Re-routes
2	5/22/20	Re-routes
3	9/3/20	Re-routes

scale 500 0 500 1000 feet
1" = 500' - 22 x 34
1" = 1000' - 11 x 17

1" = 500' HORIZ.
1" = 200' VERT.

NORTH BAKKEN EXPANSION PIPELINE
TIOGA-ELKHORN CREEK LINE

WBI ENERGY TRANSMISSION
An MDU Resources Group company

Sec. 13, 14, 22, 23, T153N, R97W, 5th P.M., Mckenzie Co., North Dakota

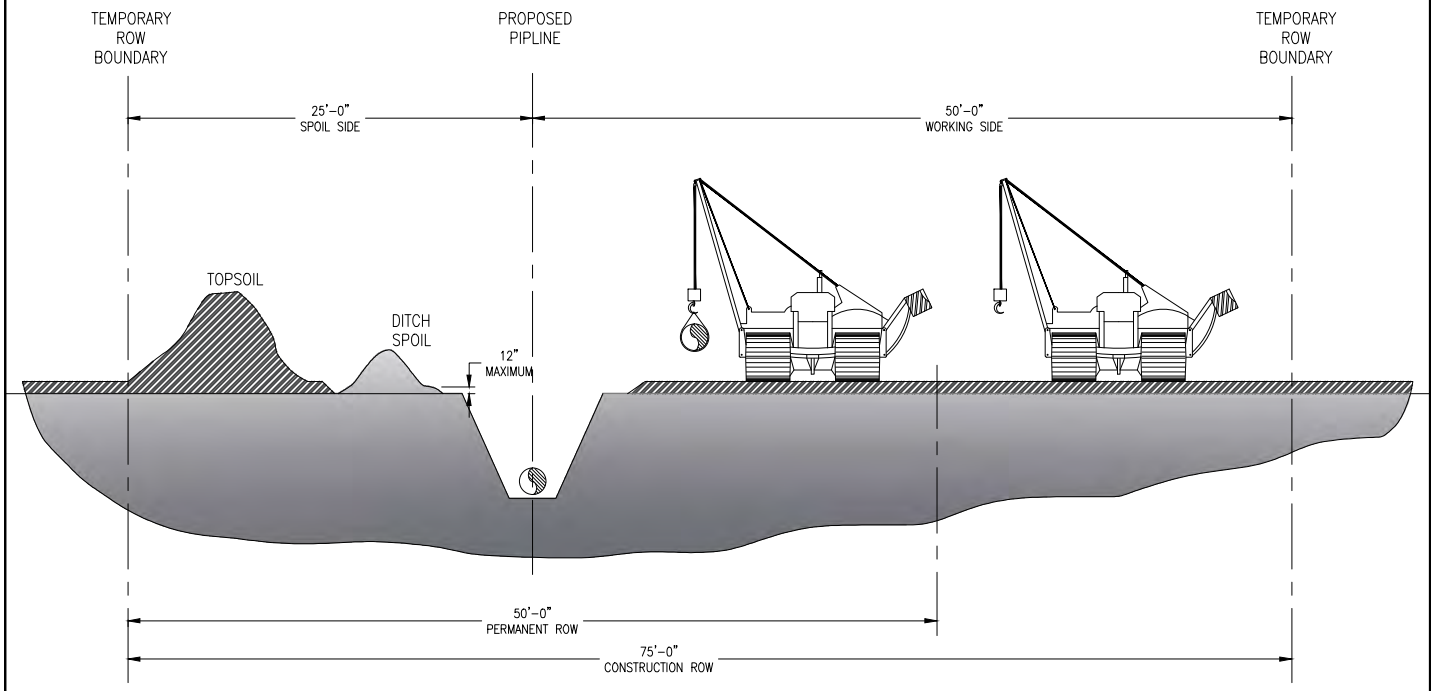
Sheet 14 | R3

North Bakken Expansion Project

Plan of Development

APPENDIX B

Typical Construction Drawings



PROFILE

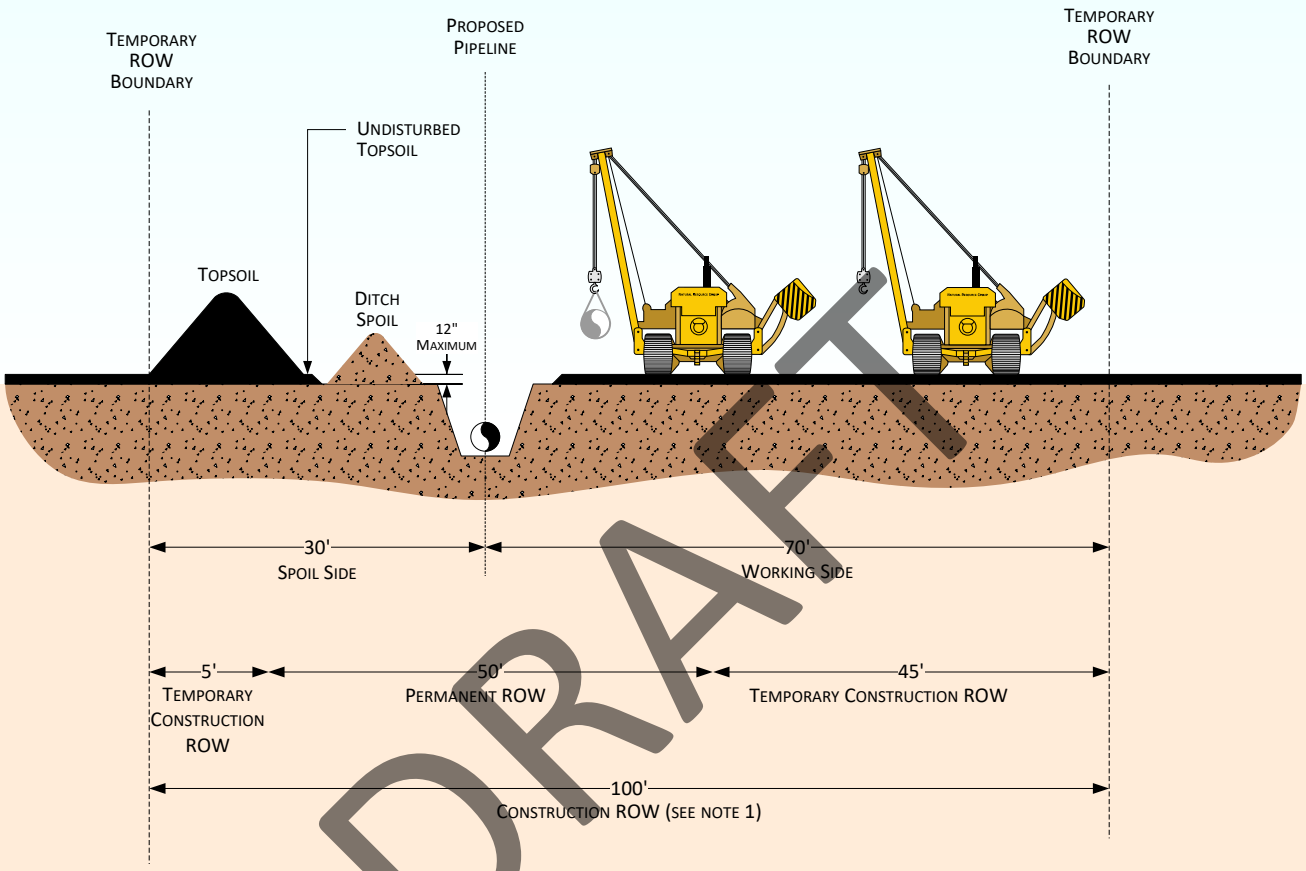
NO.	DATE	DRWN BY	DSGN BY	CHKD BY	DESCRIPTION
–	–	–	–	–	–

WBI ENERGY TRANSMISSION
An MDU Resources Group Company

TYPICAL CONSTRUCTION ROW

W.O. #	XXXXXXX.XXXX.XXXX
DESIGNED BY	TJR
DRAWN BY	TJR
CHECKED BY	–
DATE CREATED	4/7/15

SCALE	FILE NAME	DWG. NO.	SHEET NO.
NONE	A-8-9670	A9670	1 OF 1



DRAFT

PROFILE

NOTES:

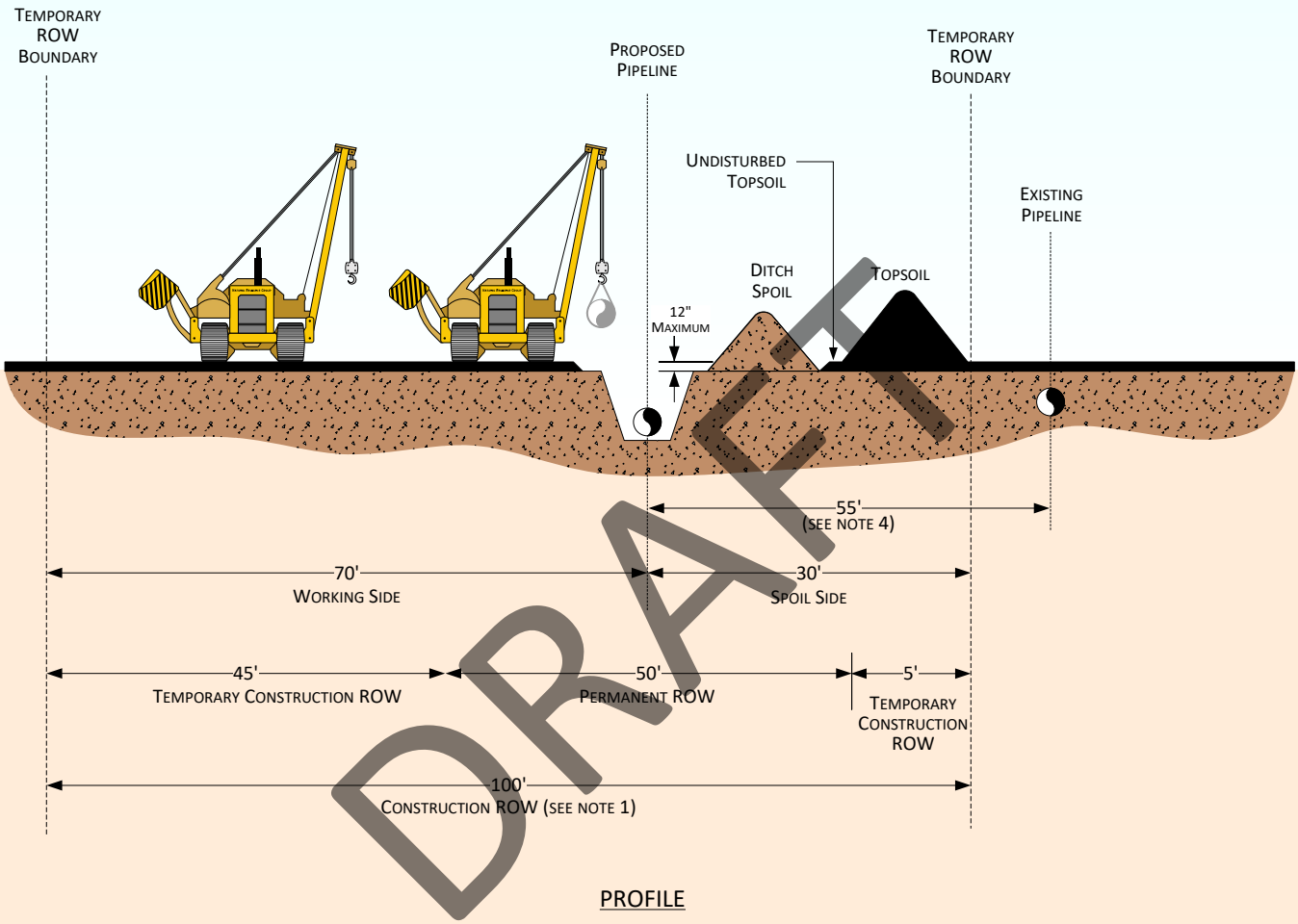
1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 100' WIDE. THE PERMANENT RIGHT-OF-WAY WILL BE 50'. ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT MAJOR ROAD, RAIL, RIVER CROSSINGS, SIDESLOPES, WHERE FULL RIGHT-OF-WAY TOPSOIL STRIPPING IS CONDUCTED, AND OTHER SPECIAL CIRCUMSTANCES AS REQUIRED.
2. THIS DRAWING REFLECTS "TRENCH AND SPOIL SIDE" TOPSOIL STRIPPING PROCEDURE.
3. STOCKPILE TOPSOIL SEPARATELY FROM DITCH SPOIL AS SHOWN OR IN ANY CONFIGURATION APPROVED BY THE ENVIRONMENTAL INSPECTOR.

For environmental review purposes only.

WBI ENERGY TRANSMISSION
An MDU Resources Group company

North Bakken Expansion Project

Typical Construction ROW
100 foot ROW



DRAFT

PROFILE

NOTES:

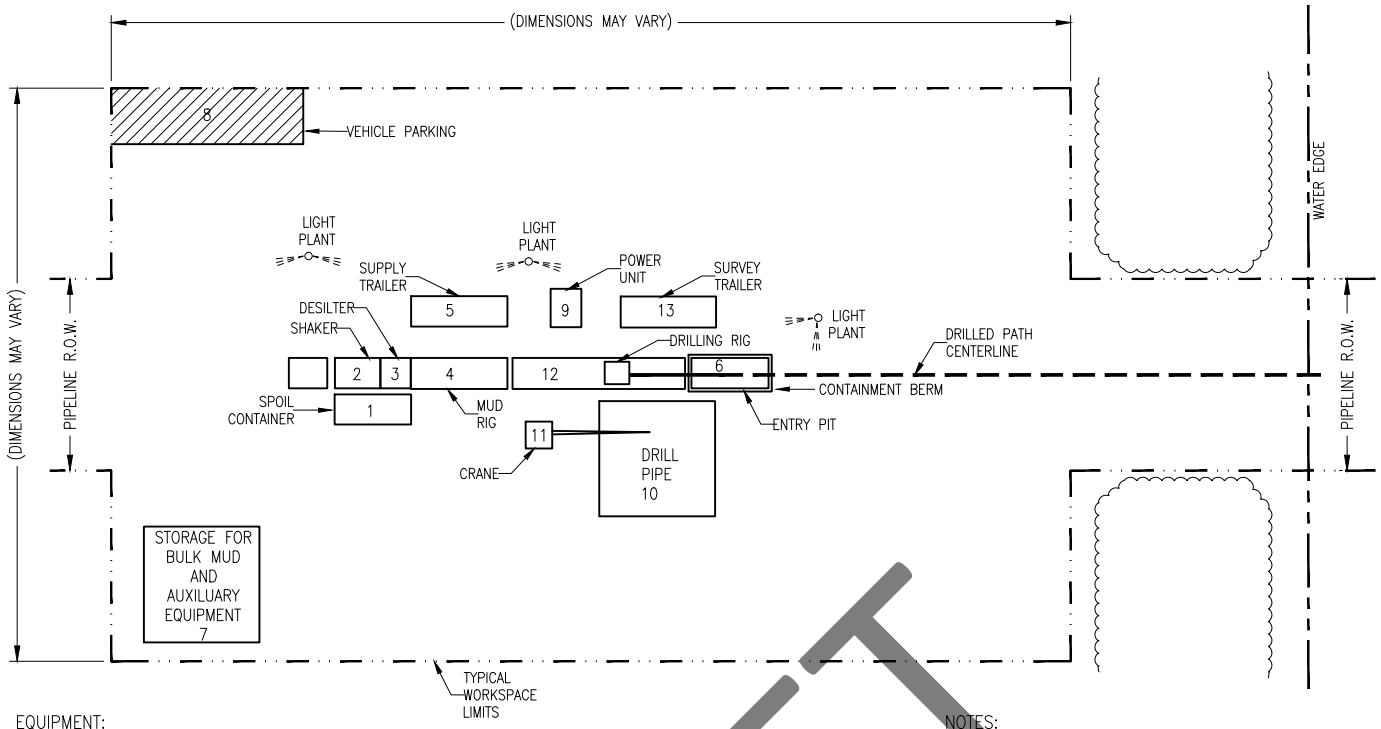
1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 100' WIDE. THE PERMANENT RIGHT-OF-WAY WILL BE 50'. ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT MAJOR ROAD, RAIL, RIVER CROSSINGS, SIDESLOPES, WHERE FULL RIGHT-OF-WAY TOPSOIL STRIPPING IS CONDUCTED, AND OTHER SPECIAL CIRCUMSTANCES AS REQUIRED.
2. THIS DRAWING REFLECTS "TRENCH AND SPOIL SIDE" TOPSOIL STRIPPING PROCEDURE.
3. STOCKPILE TOPSOIL SEPARATELY FROM DITCH SPOIL AS SHOWN OR IN ANY CONFIGURATION APPROVED BY THE ENVIRONMENTAL INSPECTOR.
4. THE OFFSET FROM ACTIVE PIPELINE, WHERE APPLICABLE, WILL BE 55' FOR MOST LOCATIONS BUT MAY BE INCREASED OR DECREASED DEPENDING ON THE SITE SPECIFIC CONSTRUCTION REQUIREMENTS.

For environmental review purposes only.

WBI ENERGY TRANSMISSION
An MDU Resources Group company

North Bakken Expansion Project

Typical Construction ROW
Collocated Pipeline



EQUIPMENT:
1. SPOIL CONTAINMENT
2. SHAKER
3. DESILTER
4. MUD RIG
5. SUPPLY TRAILER
6. ENTRY PIT
7. STORAGE
8. VEHICLE PARKING
9. POWER UNIT
10. DRILL PIPE
11. CRANE
12. DRILLING RIG
13. SURVEY TRAILER

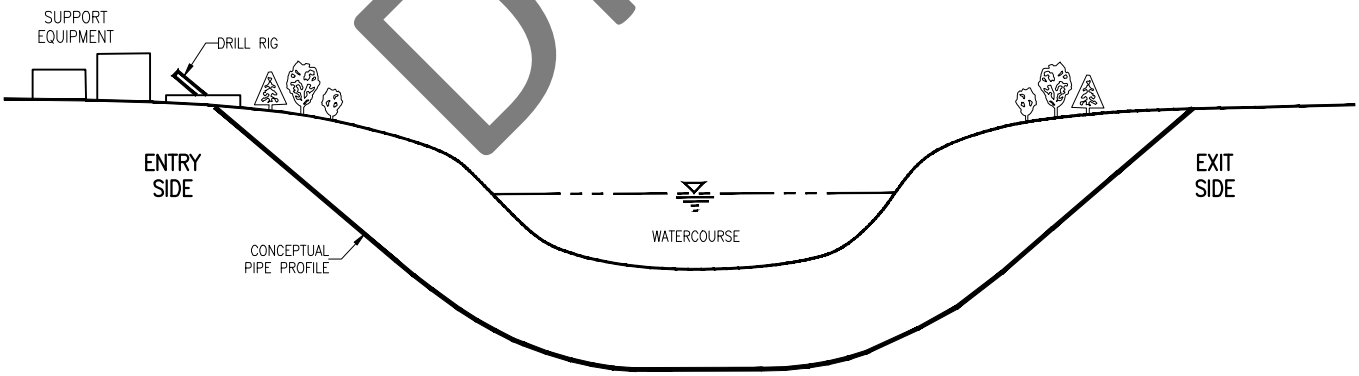
ENTRY SITE PLAN

NOTES:
1. TYPE OF EQUIPMENT AND EQUIPMENT ORIENTATION MAY VARY DEPENDING ON CONTRACTOR OR SITE CONDITIONS.

2. EQUIPMENT TO BE SUPPORTED ON THE GROUND SURFACE OR TIMBER MATS AS CONDITIONS DICTATE.

3. SILT FENCE, BERMS AND/OR STRAW BALE BARRIER TO BE USED AS REQUIRED TO PREVENT IMPACTS FROM OCCURRING OUTSIDE OF PROJECT LIMITS.

DRAFT



PROFILE

GENERAL NOTES:
1.) PIPE DEPTHS MAY VARY.

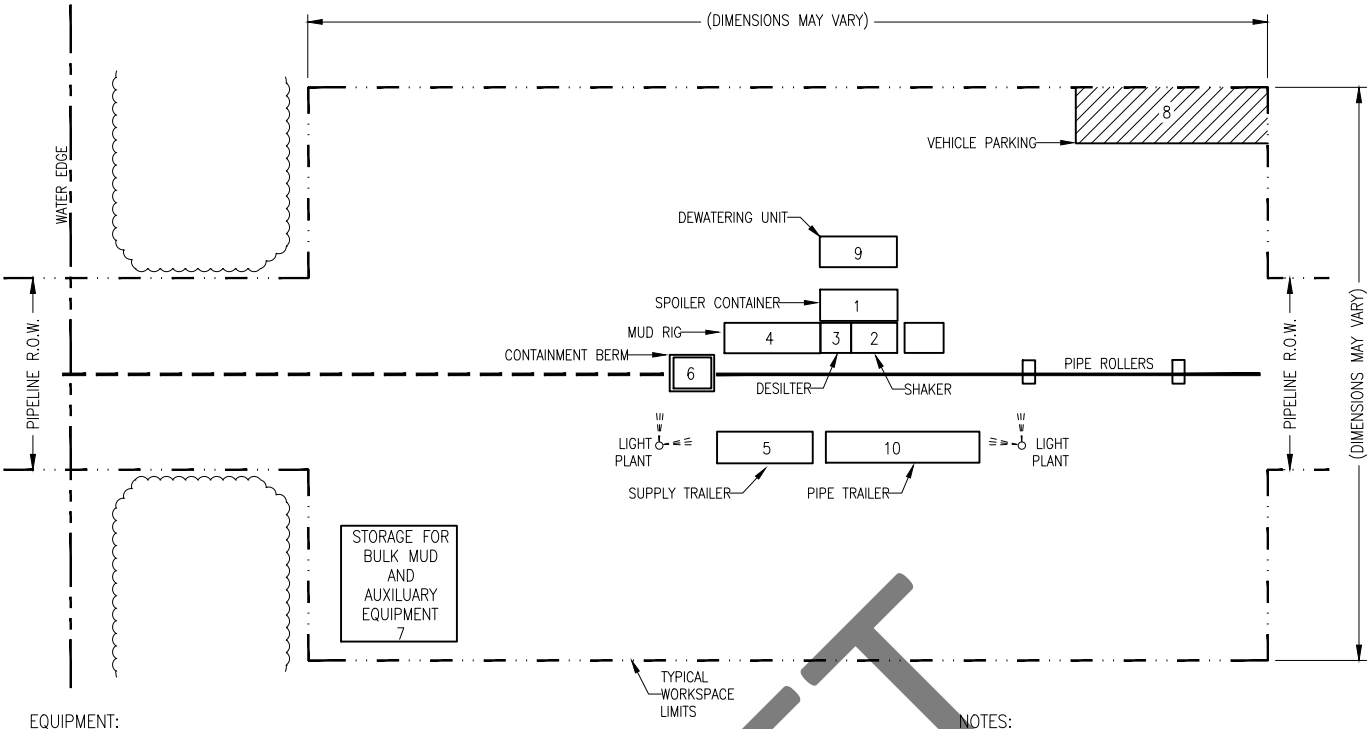
NO.	DATE	DRWN BY	DSGN BY	CHKD BY	DESCRIPTION
–	–	–	–	–	–

WBI ENERGY TRANSMISSION
An MDU Resources Group Company

MAINLINE CONSTRUCTION
TYPICAL DIRECTIONAL DRILL
ENTRY SITE PLAN & PROFILE

W.O. #	XXXXXXX.XXXX.XXXX
DESIGNED BY	J.L.
DRAWN BY	TJR
CHECKED BY	–
DATE CREATED	4/8/15

SCALE	FILE NAME	DWG. NO.	SHEET NO.
NONE	A-8-9671	A9671	2 OF 2



EQUIPMENT:
1. SPOIL CONTAINMENT
2. SHAKER
3. DESILTER
4. MUD RIG
5. SUPPLY TRAILER
6. EXIT PIT
7. STORAGE
8. VEHICLE PARKING
9. DEWATERING UNIT
10. PIPE TRAILER

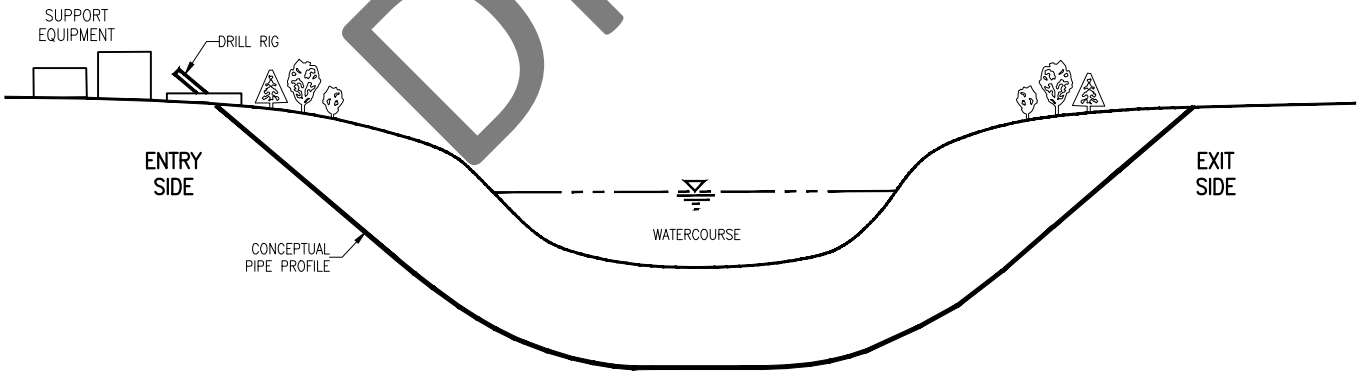
EXIT SITE PLAN

NOTES:
1. TYPE OF EQUIPMENT AND EQUIPMENT ORIENTATION MAY VARY DEPENDING ON CONTRACTOR OR SITE CONDITIONS.

2. EQUIPMENT TO BE SUPPORTED ON THE GROUND SURFACE OR TIMBER MATS AS CONDITIONS DICTATE.

3. SILT FENCE, BERMS AND/OR STRAW BALE BARRIER TO BE USED AS REQUIRED TO PREVENT IMPACTS FROM OCCURRING OUTSIDE OF PROJECT LIMITS.

DRAFT



PROFILE

GENERAL NOTES:
1.) PIPE DEPTHS MAY VARY.

NO.	DATE	DRWN BY	DSGN BY	CHKD BY	DESCRIPTION
–	–	–	–	–	–

WBI ENERGY TRANSMISSION
An MDU Resources Group Company

MAINLINE CONSTRUCTION
TYPICAL DIRECTIONAL DRILL
EXIT SITE PLAN & PROFILE

W.O. #	XXXXXXX.XXXX.XXXX
DESIGNED BY	J.L.
DRAWN BY	TJR
CHECKED BY	–
DATE CREATED	4/8/15

SCALE	FILE NAME	DWG. NO.	SHEET NO.
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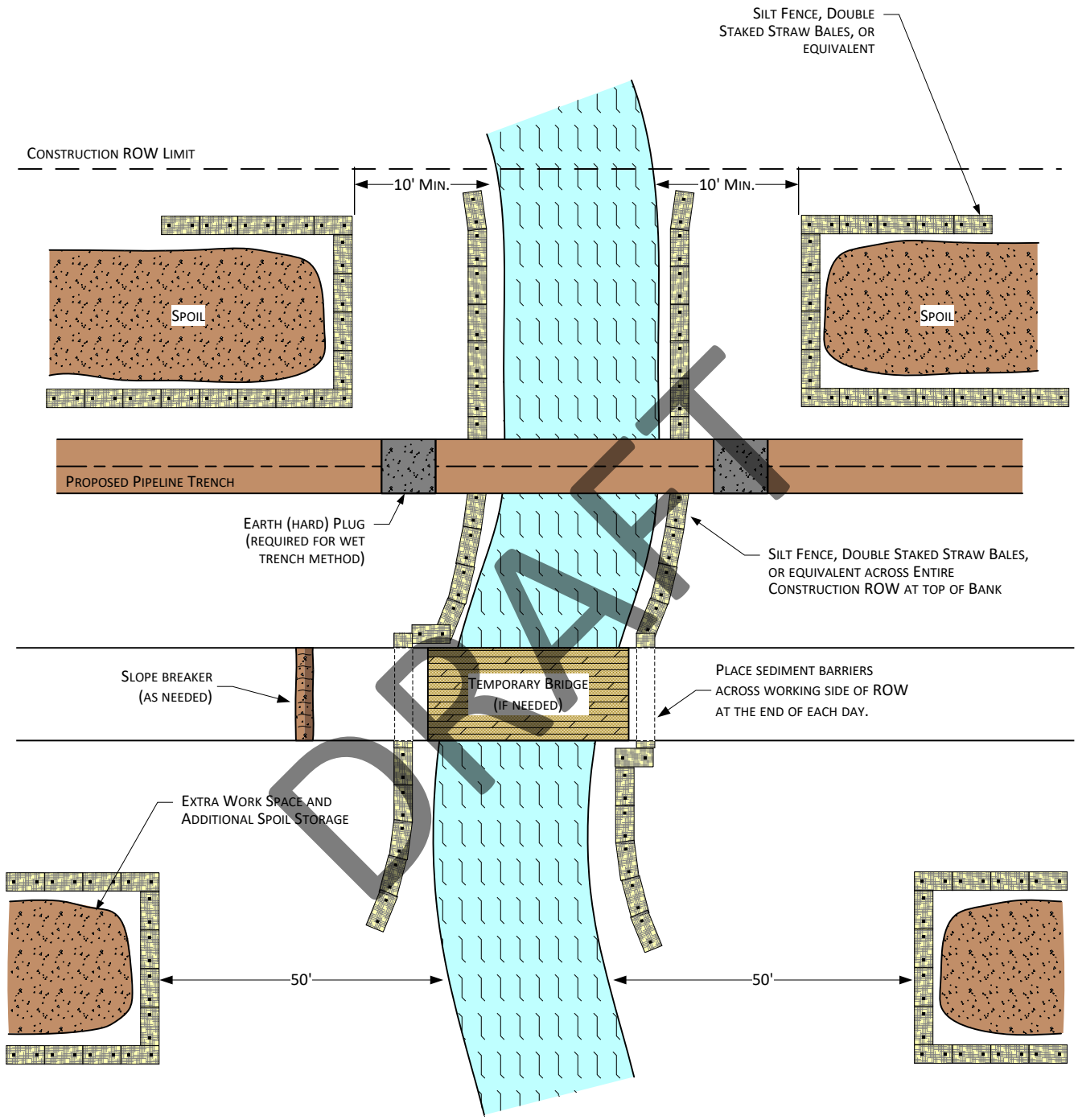


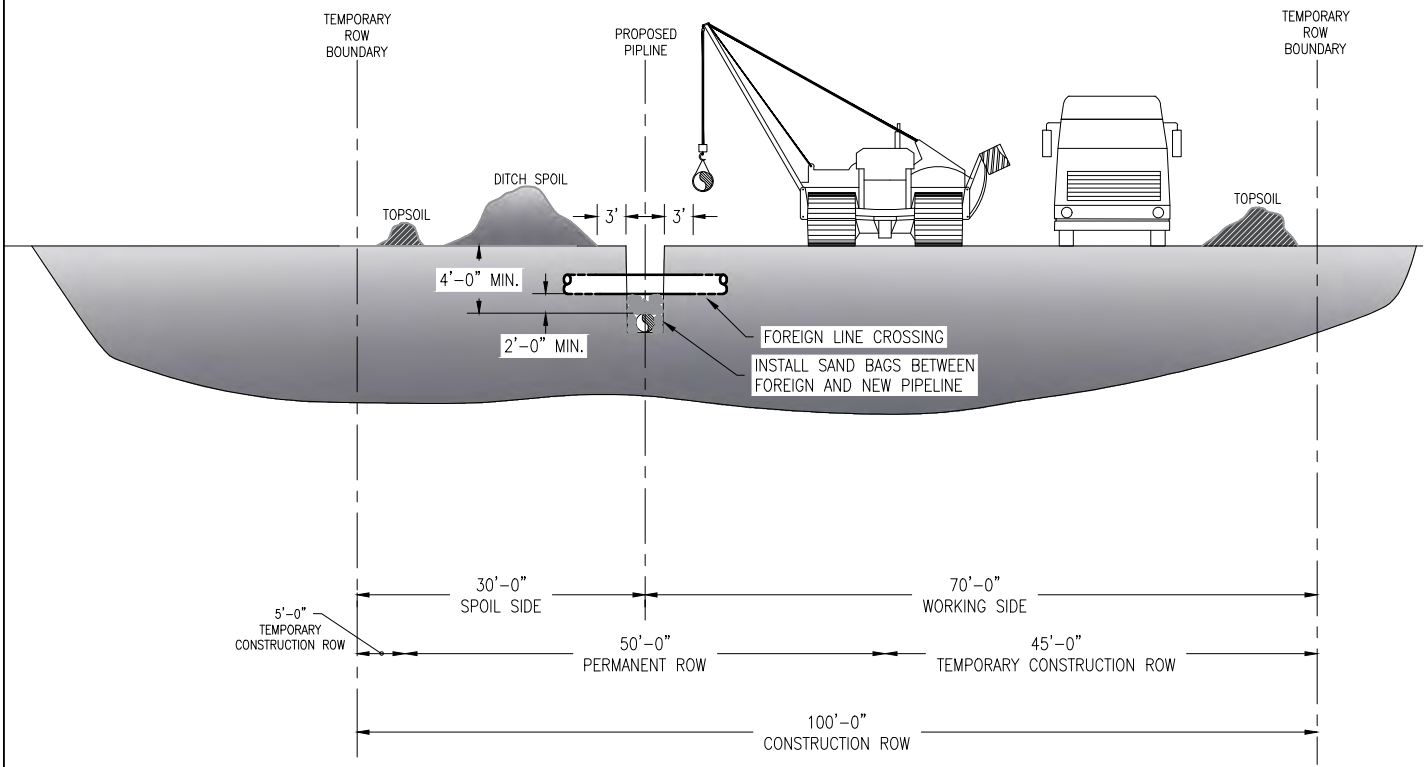
DRAFT

For environmental review purposes only.

WBI ENERGY TRANSMISSION
An MDU Resources Group company

North Bakken Expansion Project

Typical Water Body Crossingg
Open Cut Method



PROFILE

NO.	DATE	DRWN BY	DSGN BY	CHKD BY	DESCRIPTION
2	11/30/18	GWH	JH	GWH	REMOVED PROJECT SPECIFIC INFO FROM TITLEBLOCK
1	1/12/18	TJR	J.H.	D.T.	DRAWN TO SCALE

APPROVED AS FINAL

BY: JOSH HELM

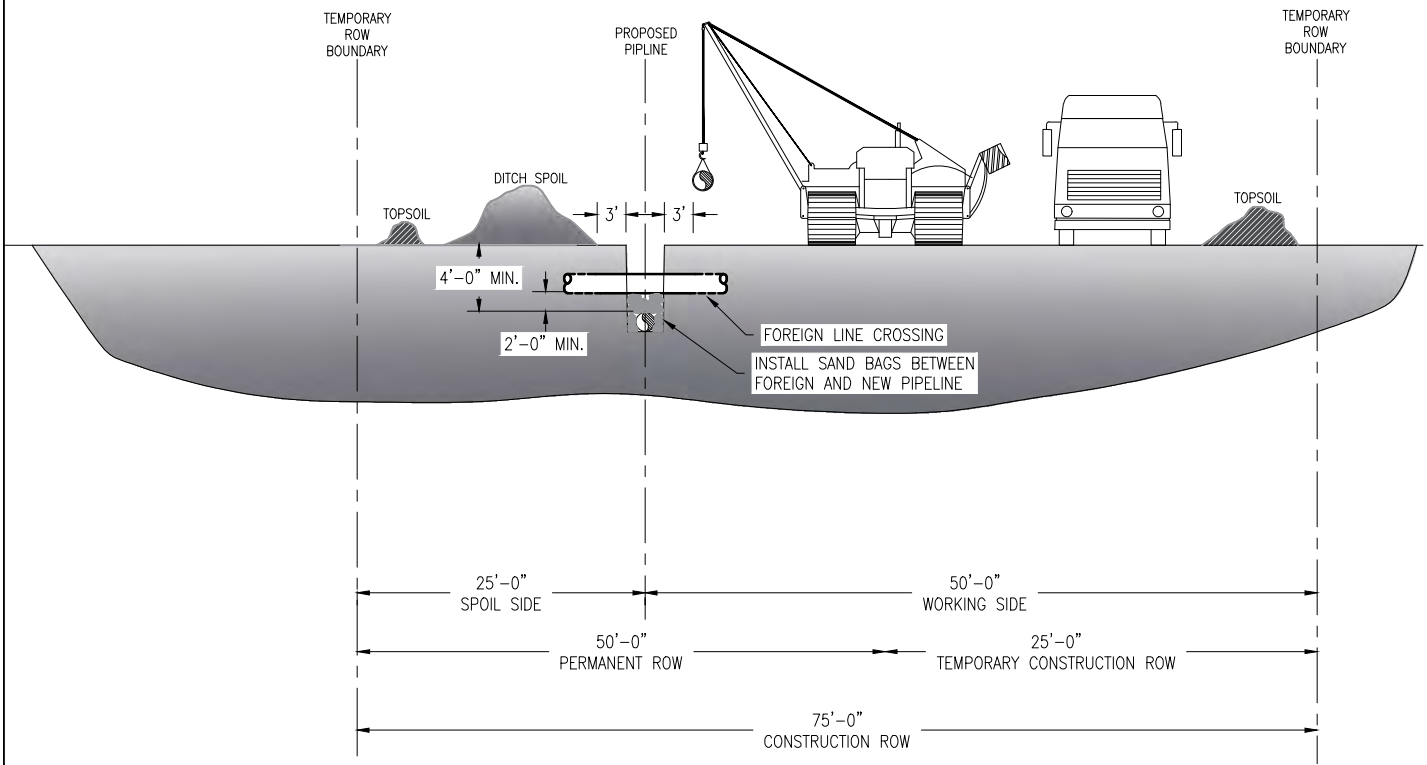
DATE: 2/7/18

WBI ENERGY TRANSMISSION
An MDU Resources Group Company

TYPICAL FOREIGN LINE CROSSING

W.O. #	XXXXXXX.XXXX.XXXX
DESIGNED BY	J.H.
DRAWN BY	TJR
CHECKED BY	D.T.
DATE CREATED	11/20/17

SCALE	FILE NAME	DWG. NO.	SHEET NO.
1'=20'-0"	A9741	A-8-9741	10 OF 11



PROFILE

NO.	DATE	DRWN BY	DSGN BY	CHKD BY	DESCRIPTION
–	–	–	–	–	–

APPROVED AS FINAL
BY: KYLE STEFKA
DATE: 1/23/20

WBI ENERGY TRANSMISSION
An MDU Resources Group Company

TYPICAL FOREIGN LINE CROSSING 75' CONSTRUCTION R.O.W.

W.O. #	XXXXXXX.XXXX.XXXX
DESIGNED BY	K.S.
DRAWN BY	TJR
CHECKED BY	J.L.
DATE CREATED	1/23/20

SCALE	FILE NAME	DWG. NO.	SHEET NO.
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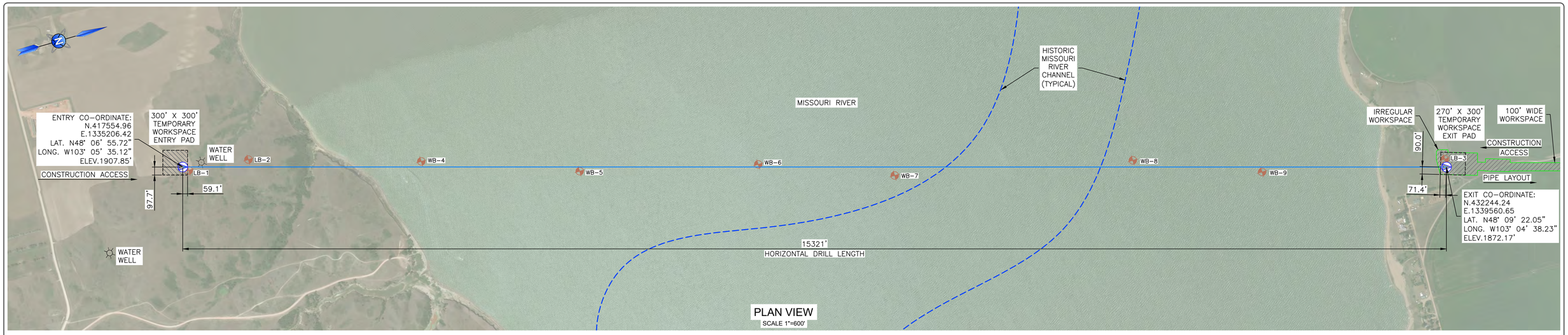
North Bakken Expansion Project

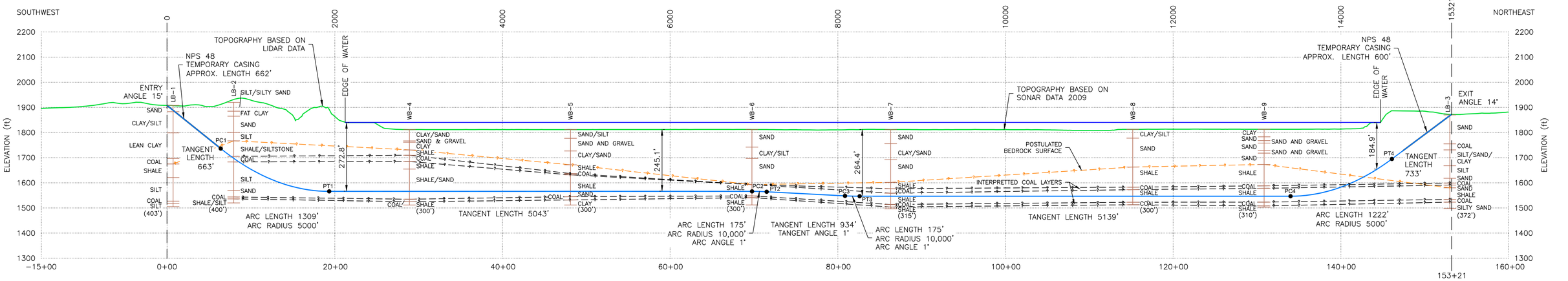
Plan of Development

APPENDIX C

Site-Specific HDD Crossing Drawing



PLAN VIEW
SCALE 1"=600'



PROFILE ALONG PROPOSED PIPELINE
SCALE 1"=600' HORIZONTAL
SCALE 1"=200' VERTICAL

TOTAL DRILL LENGTH 15393'

HORIZONTAL DIRECTIONAL DRILL DATA MISSOURI RIVER HDD		
DESCRIPTION	STATION (ft)	ELEVATION (ft)
ENTRY @ 15°	0+00.00	1907.85
PC1 = 5000' RADIUS	6+40.51	1736.23
PT1	19+34.61	1565.86
PC2 = 10,000' RADIUS	69+78.43	1565.86
PT2	71+52.95	1564.33
PC3 = 10,000' RADIUS	80+87.31	1548.02
PT3	82+61.83	1546.50
PC4 = 5000' RADIUS	134+00.95	1546.50
PT4	146+10.56	1695.02
EXIT @ 14°	153+21.04	1872.17
HORIZONTAL DISTANCE (ft) = 15321.04		
DIRECTIONAL DRILL PIPE LENGTH (ft) = 15392.57		

Pilot Hole Tolerances	
Item	Tolerance
Pilot Entry Angle	Increase in angle up to 1° (deeper), but no decrease in angle allowed as long as minimum 3-joint bending radius is not compromised.
Pilot Entry Location	As staked by COMPANY. No change without COMPANY approval.
Pilot Exit Angle	Change in angle up to +/-1° allowed as long as minimum 3-joint bending radius is not compromised.
Pilot Exit Location	Up to 40 feet longer or 10 feet shorter than exit stake. Between 10 feet left and 10 feet right of COMPANY survey centerline.
Pilot Depth	Up to 5 feet decrease in design depth (shallower) allowed except under critical areas such as roads, utilities, levees etc. near the entry and exit points. Up to 10 feet increase in depth (deeper) allowed. Best efforts shall be made to stay at or below pipe design profile depth.
Pilot Alignment	Shall remain within 10 feet left or right of COMPANY centerline survey.

GEOTECHNICAL BORE HOLE INFORMATION			
BOREHOLE	LATITUDE	LONGITUDE	DEPTH (ft)
LB-1	48° 6' 56.33"	-103° 5' 34.23"	403
LB-2	48° 7' 3.56"	-103° 5' 33.40"	400
LB-3	48° 9' 22.10"	-103° 4'39.62"	372
WB-4	48° 7' 23.30"	-103° 5'25.93"	300
WB-5	48° 7' 42.24"	-103° 5' 15.52"	300
WB-6	48° 8' 2.38"	-103° 5' 10.74"	300
WB-7	48° 8' 17.93"	-103° 5' 1.65"	315
WB-8	48° 8' 45.61"	-103° 4' 53.93"	300
WB-9	48° 9' 0.54"	-103° 4' 45.08"	310

REFERENCE DOCUMENT NO.	DATE
1. NBE_PL-PROPOSED_ROUTES 190824	2019-08-24
2. 2386-01-IMP STEEL STRESS-24-inch-02	2020-07-30

ENGINEER AND PERMIT STAMPS

PIPELINE SPECIFICATIONS	NPS 24
OUTSIDE DIAMETER (OD)(in)	24
WALL THICKNESS (WT)(in)	0.99
GRADE (psi)	60,000
PRODUCT	NATURAL GAS
MATERIAL	STEEL
SPECIFICATIONS	API 5L
INTERNAL COATING	N/A
OUTER COATING	DUAL FBE
MAX. OPER. PRESSURE (psi)	1,480
MIN. TEST PRESSURE (psi)	1,850
MAX. OPER. TEMP (°F)	100
MIN. INSTALLATION TEMP (°F)	60

STEERING TOLERANCES	30ft	100ft	DESIGN
MINIMUM RADIUS (ft)	1100	2000	5000

PULL FORCE / RIG SIZE / STRESS	
PULL FORCE (w/o BUOYANCY CONTROL):	752,000 lbs (w/sf)
MINIMUM RECOMMENDED RIG SIZE:	1,000,000 lbs
COMBINED STRESS UNITY CHECK:	0.29
OPERATING STRESS	48.1%

DRAWING STATUS	DATE	DRN	CHK	DES	GEO	APR	CR
ISSUED FOR PERMIT	2020-07-31	MS	EY	CG	LC	KP	NM

LOCATION PLAN (1"=7000')

NAD83.ND-Nft

WBI ENERGY TRANSMISSION
An MDU Resources Group company

WBI NORTH BAKKEN EXPANSION PROJECT
MISSOURI RIVER HDD CROSSING
PLAN AND PROFILE
WATFORD CITY / TIOGA, MCKENZIE COUNTY, NORTH DAKOTA

SCALE	DWG. #	REVISION	SHEET
AS SHOWN	2386-EG-0101	G	1 OF 3

CCI & Associates Inc.
20445 State Highway 249, Suite 250
Houston, TX 77070
COCP 27692PE

1"=600'
FT 0 600 1200 2400

1"=200'
FT 0 200 400 800

NORTH BAKKEN EXPANSION PROJECT

Plan of Development

APPENDIX D

Horizontal Directional Drill/Guided Bore Drilling Fluid Monitoring and Operations Plan

WBI ENERGY TRANSMISSION, INC.

North Bakken Expansion Project

Plan of Development

Appendix D

Horizontal Directional Drill/Guided Bore Drilling Fluid Monitoring and Operations Plan

Final

September 2020

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT
HORIZONTAL DIRECTIONAL DRILL/GUIDED BORE
DRILLING FLUID MONITORING AND OPERATIONS PLAN

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3.0 PRECONSTRUCTION ACTIVITIES 2
3.1 TRAINING 2
3.2 INSPECTION 2
3.3 NOTIFICATION PROCEDURES 2
3.3.1 Landowner Notification 2
3.3.2 Agency Notification 2
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7.1 MATERIALS AND EQUIPMENT 8
7.2 RETURNS WITHIN CERTIFICATED WORKSPACE 9
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8.0 RESTORATION 9
9.0 CONTINGENCY PLANNING 9
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9.3 ABANDONMENT 10
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Attachment B North Bakken Expansion HDD Design Report Missouri River NPS 24 HDD Crossing, Prepared by CCI & Associates Inc.

ACRONYMS ABD ABBREVIATIONS

EI	environmental inspector
FERC	Federal Energy Regulatory Commission
HDD	horizontal directional drill
HDD Plan	Horizontal Directional Drill Monitoring, Inadvertent Return Response, and Contingency Plan
Project	North Bakken Expansion Project
WBI Energy	WBI Energy Transmission, Inc.

1.0 INTRODUCTION

This *Horizontal Directional Drill/Guided Bore Drilling Fluid Monitoring and Operations Plan* (HDD Plan) describes procedures that WBI Energy Transmission, Inc. (WBI Energy) and its contractors will follow during horizontal directional drill (HDD) and guided bore crossings associated with the proposed North Bakken Expansion Project (Project). The intent of the HDD Plan is to identify procedures to be implemented that minimize environmental impacts in the event that an inadvertent return of drilling fluids occurs during Project construction. The HDD Plan communicates the roles and responsibilities of personnel involved with the HDD/guided bores, provides monitoring procedures, and describes contingency plans in the event of an unsuccessful HDD/guided bore.

As part of the Project, WBI Energy proposes to install a 24-inch-diameter natural gas pipeline, referred to as the Tioga-Elkhorn Creek pipeline, beneath Lake Sakakawea using the HDD intersect method in Williams and McKenzie Counties, North Dakota. Refer to Attachment A for the HDD plan specific to the crossing of Lake Sakakawea completed by Michels, the contractor for that HDD crossing. The plan includes detailed scaled HDD plan and profile drawings, drilling additive Safety Data Sheets, and additional details regarding the Lake Sakakawea crossing. Refer to Attachment B for the HDD Design Report specific to the crossing of Lake Sakakawea including the risk assessment and geotechnical reports.

2.0 PERSONNEL AND RESPONSIBILITIES

This section lists the personnel that will be involved with planning and performing the HDD and guided bores, and specifies the responsibilities of WBI Energy and its contractors. Qualified contractors will be retained for completion of HDD and guided bore activities associated with the Project. The contractors (hereafter collectively referred to as “HDD Contractors”) will be trained and knowledgeable of requirements and procedures outlined in this HDD Plan. Environmental inspectors (EI) will work with the HDD Contractors to monitor drilling activities and conduct inspections for potential signs of inadvertent returns. The EI will work with WBI Energy personnel to notify regulatory and/or resource agency staff of any releases that occur. More detailed descriptions of the roles and responsibilities of personnel involved in HDD/guided bore activities are described below.

- HDD Contractors – The HDD Contractors will be responsible for overall operation and monitoring of drill equipment and drilling conditions. The HDD Contractors must be trained and knowledgeable of the requirements and procedures described in this HDD Plan. The HDD Contractors will continually monitor drilling conditions and maintain the records described in this HDD Plan. The HDD Contractors are responsible for communicating loss of drilling fluid circulation and stopping or changing the drill program in the event of an observed or anticipated inadvertent return. Michels will be completing the HDD of Lake Sakakawea. The contractor information for the remaining guided bores is currently pending and will be provided prior to construction.

- Environmental Inspector – The EI, in conjunction with the HDD Contractors, will periodically visually inspect the bore alignment for signs of inadvertent returns. In the event of an inadvertent return, the EI will work with the HDD Contractors to implement the remediation activities described in this HDD Plan. The EI will report

any inadvertent returns to the designated WBI Energy Representative and work with the WBI Energy Representative to notify regulatory and/or resource agencies of the inadvertent return, as required. The EI will document response and remediation actions taken for the inadvertent return.

- WBI Energy Representative – A designated WBI Energy Representative will be responsible for notifying regulatory and/or resource agencies of inadvertent returns, as required, and working with the agencies, HDD Contractors, EIs, and other Project personnel, as appropriate, to develop and implement any corrective actions associated with an inadvertent return.

3.0 PRECONSTRUCTION ACTIVITIES

3.1 TRAINING

Prior to initiation of Project activities, all contractors and WBI Energy personnel involved in Project construction will be required to attend formal environmental training. The training will include review of the elements and procedures described in this HDD Plan. The WBI Energy Representative will maintain documentation of training topics and personnel in attendance. The EI will provide subsequent training to personnel who arrive on the Project during construction. The level of training received will be commensurate with the roles and responsibilities of the individuals, and will focus on measures to be implemented to minimize risk of an inadvertent return, HDD/guided bore-specific health and safety topics, and inadvertent return containment equipment and materials.

Additional training will be completed in the event that personnel changes or conditions change that affect the implementation of the HDD/guided bore (e.g., weather, scope changes).

3.2 INSPECTION

HDD Contractor personnel and the EI will inspect the land-based portions of the drill path prior to construction to identify any conditions that would impede the visual and pedestrian field inspection and develop modifications to the inspection routine, as needed.

3.3 NOTIFICATION PROCEDURES

3.3.1 Landowner Notification

Prior to commencing the HDD/guided bore, landowners will be notified in writing of the upcoming construction, which will include the anticipated start and end dates, planned access routes to the construction sites, and contact information for WBI Energy personnel. Landowner permission will be obtained prior to conducting the pedestrian survey and land-based inspection of the drill path.

3.3.2 Agency Notification

WBI Energy will notify appropriate agencies, including FERC, the U.S. Army Corps of Engineers, and state agencies, prior to the commencement of the HDD and guided bore crossings in accordance with agency requirements. The notification will include the anticipated duration of drilling and contact information for appropriate WBI Energy personnel.

4.0 DOCUMENTATION

This HDD Plan will be available and accessible to all personnel on site during HDD and guided bore activities. Additional documentation that will be available and accessible on site is described in table 4-1.

TABLE 4-1

North Bakken Expansion Project
Documentation to Be Available/Accessible On Site

Procedure	Responsible Party	Documentation
Employee Training	WBI Energy Representative and EI	Record of employee training detailing when training was conducted, material covered, and employees in attendance.
Visual Monitoring	HDD Contractor and EI	Record name of inspector, time of inspection, and observations for each inspection.
Instrument Logs	HDD Contractor	Logs that document pilot hole progression, drill string axial and torsional loads, annulus pressures, and drilling fluid discharge rate and pressure.
Drilling Fluid Composition	HDD Contractor	Logs of drilling fluid composition and physical properties throughout drilling activities. Safety Data Sheets for drilling fluid and any additives will be maintained.
Public and Agency Correspondence	WBI Energy Representative and EI	Records of communication with the public and agencies and any response actions taken if required.

A summary of HDD/guided bore activities will be included in construction status reports provided to the FERC.

5.0 DRILLING FLUID MANAGEMENT

Drilling fluid (also referred to as drilling mud) will consist of water mixed with in-situ material and/or bentonite, a non-toxic, naturally occurring sedimentary clay. Although not currently proposed, there is potential that the HDD Contractors may propose to use drilling fluid additives. Drilling fluid additives used during construction will be limited to non-petrochemical-based, non-hazardous additives currently certified to the American National Standards Institute/National Sanitation Foundation International Standard 60. Use of additives other than those certified to the American National Standards Institute/National Sanitation Foundation International Standard 60 would not be allowed unless approved by appropriate regulatory authorities. In addition, use of any drilling fluid additive or lost circulation material that has not been previously disclosed would require advance notification to and approval by FERC. Documentation of the composition and properties of all drilling fluids to be used will be maintained at the job site and available for review by WBI Energy and the EI, as well as by any jurisdictional authorities. No fluid additives will be used that do not comply with the permit requirements and environmental regulations applicable to the Project.

WBI Energy will be obtaining water from a local water depot and transporting the water either by lay flat line or truck to various project HDD and guided bore locations. Attachment A includes potential drilling fluid additives and Safety Data Sheets for the HDD crossing of Lake Sakakawea. If drilling fluid additives are deemed necessary for any guided bore crossings, this information would be provided to the appropriate agencies (e.g., North Dakota Department of Environmental Quality) for approval prior to use. WBI Energy is coordinating with landowners on potential locations within agricultural areas for the beneficial reuse of HDD drilling fluid. All Project drilling fluid would be disposed of in accordance with federal, state, and local regulations.

6.0 DRILLING OPERATIONAL CONDITIONS AND MONITORING AND RESPONSE ACTIONS

Table 6-1 provides an overview of the drilling operational conditions and corresponding monitoring and response actions. Subsequent sections of this HDD Plan provide details regarding each of the three conditions identified in table 6-1.

TABLE 6-1

North Bakken Expansion Project
Overview of Drilling Operational Conditions and Monitoring and Response Actions

Condition	Status	Actions
Condition 1: Normal Drilling Conditions	Normal drilling fluid circulation is maintained	• Perform routine collection of drilling fluid at endpoints. • Perform routine drilling data collection. • Conduct routine visual monitoring.
Condition 2: Loss of Circulation	Loss, or significant reduction, of drilling fluid circulation	• Discontinue drilling; continue pumping and rotating, and slowly swab the drill string, if appropriate. • Notify the EI. • Adjust drilling fluid and parameters in an effort to regain circulation. • Perform focused visual monitoring. • Continue drilling if no release to surface is detected.
Condition 3: Drilling Fluid Release and Remediation	Drilling fluid release to surface or waterbody is confirmed	• Notify EI and the WBI Energy Representative. • Notify regulatory agencies and authorities having jurisdiction. • Discontinue pumping; continue rotating and slowly swab the drill string, if appropriate. • Monitor and document the release area. • Contain and collect the release, if practical. • If the release is contained and collected, resume pumping and drilling. • If containment and collection is not practical, suspend HDD operations. • WBI Energy, in consultation with jurisdictional authorities, will issue a notice to proceed, notice to relocate, or notice to shut down.

6.1 CONDITION 1 – NORMAL DRILLING CONDITIONS

6.1.1 Drilling Operations

Documentation of the composition and properties of all drilling fluids to be used will be maintained at the job site and will be available for review by WBI Energy, its designated representative, and the EI, as well as by authorities having jurisdiction. Documentation shall include complete manufacturer's literature and Safety Data Sheets. No fluid will be used that does not comply with permit requirements and environmental regulations.

The HDD Contractor shall maximize reuse of drilling fluid surface returns by providing solids control and fluid cleaning equipment of a configuration and capacity that can process surface returns and produce drilling fluid suitable for reuse.

The HDD Contractor shall provide and maintain instrumentation that will accurately locate the pilot hole, measure drill string axial and torsional loads, and measure drilling fluid discharge rate and pressure. Drilling fluid pressure can only be monitored during drilling of the pilot hole. During reaming and swab passes, drilling fluid pressure is negligible due to the open ends of the

drill path. WBI Energy and its designated representatives will have access to these instruments and readings at all times. If requested, WBI Energy will provide this information to regulatory agencies having jurisdiction. A log of all recorded readings shall be maintained at the drill rig site and will become a part of the "As-Built" information to be supplied by the HDD Contractor.

6.1.2 Routine Monitoring

Routine monitoring under Condition 1 will consist of a visual examination by HDD Contractor personnel or the EI along the drilled alignment, including observing for turbidity plumes within waterbodies. These examinations will be made periodically on a time interval not to exceed 4 hours and may be curtailed during hours of darkness. If a sudden loss in drilling fluid pressure is detected, aerial or over-water equipment will be used to observe and monitor for turbidity plumes during the HDD/guided bore crossings, as needed. The HDD Contractor personnel or EI will have appropriate operational communication equipment (e.g., radio, cell phone) available at all times while observing the installation of the HDD/guided bore crossings. The name of the examiner, time of the examination, and observations shall be kept in a log at the rig site and will be available for inspection by WBI Energy and its designated representatives. Upon request, WBI Energy will also make the logs available to the regulatory agencies having jurisdiction.

If loss of circulation and possible release of drilling fluid to the surface is detected, Condition 2 will be implemented.

6.2 CONDITION 2 – LOSS OF CIRCULATION

6.2.1 Drilling Operations

The following procedures shall be implemented if a loss, or significant reduction, of drilling fluid circulation occurs:

- Discontinue drilling or reaming activities. Continue pumping and rotating, and slowly swab the drill string, if appropriate. Swabbing involves withdrawing the drill string to mechanically clean the drilled hole and reduces chances of the drill string getting stuck.
- The HDD Contractor shall immediately notify the EI. The EI will document that operations are continuing under Condition 2 in the daily report and notify the WBI Energy representative as necessary.
- The HDD Contractor shall immediately take steps to restore circulation. These steps shall include, but are not limited to, the following:
    - Adjust drilling fluid properties and parameters to encourage annular flow by specifically weighting up or down, increasing viscosity, or adding lost circulation material (walnut shells, mica, or other additives to promote circulation) to plug the seam where fluid is being lost. Flow shall be maintained such that annular velocities promote returns to the drilling pits.
    - At the HDD Contractor's option, employ lost circulation material as long as such materials have been approved by WBI Energy and comply with permit requirements and environmental regulations.

- Perform focused monitoring along the drill path for drilling fluid release to surface.
- If circulation is restored or drilling fluid is not observed at surface, drilling will continue under Condition 2 for a period of not less than 8 drilling hours. If a release is not identified and loss, or significant reduction, of drilling fluid circulation does not occur, the HDD Contractor shall notify the EI that drilling under Condition 1 has resumed. The EI will document that drilling under Condition 1 has resumed.
- If drilling fluid release is identified through focused monitoring, Condition 3 shall be implemented.
- If circulation cannot be restored, the HDD Contractor shall notify the EI and WBI Energy and continue drilling under Condition 2.

6.2.2 Focused Monitoring

Focused monitoring under Condition 2 will consist of continuous visual observation along the drilled alignment by HDD Contractor personnel and/or the EI with no other jobsite responsibilities. Focused monitoring will take place over the minimum 8-hour Condition 2 drilling timeline, as indicated above. The time and results of drilled alignment observations shall be kept in a log at the rig site and shall be available for inspection by WBI Energy and its designated representatives. Upon request, WBI Energy will also make the logs available to the regulatory agencies having jurisdiction. If a drilling fluid release to the surface is detected, Condition 3 shall be implemented.

6.3 CONDITION 3 – DRILLING FLUID RELEASE AND REMEDIATION

6.3.1 Drilling Operations

The following procedures will be implemented if a drilling fluid release to the surface is detected:

- The HDD Contractor will cease drilling immediately and notify the EI. The EI will document the location of the release as well as the containment and cleanup of the release in the daily report. WBI Energy will be notified immediately of any releases into waterbodies or other environmentally sensitive areas, or if a release threatens to enter these areas.
- In the event of a release into waterbodies or other environmentally sensitive areas, WBI Energy shall immediately notify the following*:*

TABLE 6.3.1-1

North Bakken Expansion Project
Inadvertent Release Notification Information

Agency	Name	Phone Number
FERC	Dawn Ramsey	202-502-6856
Department of Health, Division of Water Quality (for releases into waterbodies)	Division of Water Quality	701-328-5210
U.S. Fish and Wildlife Service (for release in sensitive habitat areas)	Jerry Reinisch	701-250-4481 Ext 8267
Game and Fish Department (for release in sensitive habitat areas)	Greg Link	701-328-6331
U.S. Army Corps of Engineers (for release on U.S. Army Corps of Engineers land or waters of the U.S)	Jeremy Thury	701-654-7751
State Historical Society of North Dakota	Andrew Clark	701-328-3574
State Water Commission (for release in Lake Sakakawea)	Gerald Heiser	701-328-2750
U.S. Forest Service (for releases on U.S. Forest Service Land)	Cale Bickerdyke	701-842-8502

- The HDD Contractor will discontinue pumping, and will rotate and slowly swab the drill string, if appropriate. Swabbing involves withdrawing the drill string to mechanically clean the drilled hole and reduces chances of the drill string getting stuck.

- If public health and safety are threatened by the inadvertent release, drilling operations will be shut down until the threat is eliminated.

- If the release occurs on land, it shall be contained with hand-placed barriers (e.g., hay bales, sand bags, silt fences) and collected for disposal or reuse. If the amount of the release exceeds that which can be contained with hand-placed barriers, small excavated collection sumps (less than 5 cubic yards) may be used. Pumping and drilling may continue under Condition 2 as long as the release is being contained and collected.

- If the amount of the release occurring on land exceeds that which can be contained and collected using small sumps, drilling operations shall be suspended until released volumes can be brought under control.

- If the release occurs near a potable water source or water well, the HDD Contractor will test the water quality and yield for the water well owner, and will provide an alternate supply of water to affected landowners until the water source or well is repaired. Water well repairs will occur at WBI Energy's expense.

- If the amount of any drilling fluid release on land exceeds that which can be practically contained and collected, or if a turbidity plume within surface waterbodies is observed to be excessively large, drilling operations shall be suspended and the HDD Contractor will notify WBI Energy that drilling cannot continue without a continuous release of drilling fluid. WBI Energy, in consultation with jurisdictional authorities, will then issue a notice to proceed or issue a notice to shut down until further notice.

- If impacts are noted to be occurring to fish or wildlife due to exposure to released drilling fluids, drilling operations shall be suspended and the HDD Contractor will notify WBI Energy immediately. WBI Energy, in consultation with jurisdictional authorities, will issue a notice to proceed or issue a notice to shut down until further notice.

6.3.2 Focused Monitoring

Focused monitoring under Condition 3 will consist of continuous visual observation along the drilled alignment and at any and all release areas. Focused monitoring shall be conducted by HDD Contractor personnel and/or the EI with no other jobsite responsibilities. The time and results of the focused monitoring observations shall be kept in a written log at the jobsite and shall be available for inspection by WBI Energy and its designated representatives. Upon request, WBI Energy will also make the logs available to the regulatory agencies having jurisdiction.

7.0 RESPONDING TO INADVERTENT RETURNS

7.1 MATERIALS AND EQUIPMENT

Materials that will be stored on site in the event of an inadvertent return include the following:

- wood stakes,
- sandbags;
- plastic sheeting;
- spill sorbent pads and booms;
- certified weed-free straw bales;
- silt fence;
- corrugated plastic pipe;
- shovels; and
- push brooms.

Mechanical equipment that will be either immediately available or staged on site in case of an inadvertent return include:

- vacuum truck;
- centrifugal, trash, and sump pumps;
- rubber-tired or wide-track backhoe;
- storage tanks;
- floating turbidity curtains; and
- skidsteer, as needed.

7.2 RETURNS WITHIN CERTIFICATED WORKSPACE

Containment and cleanup of returns within uplands and wetlands within the certificated workspace will occur immediately following the discovery. Contractor personnel will utilize the materials described above to contain and control the spread of any released drilling fluid. Drilling fluid will generally be cleaned by hand using hand shovels, buckets, and soft-bristled brooms where possible to avoid damage to existing vegetation. In heavily impacted areas, mechanized equipment may be utilized and restoration techniques will be implemented in accordance with FERC's *Upland Erosion Control, Revegetation, and Maintenance Plan* and *Wetland and Waterbody Construction and Mitigation Procedure*s. Fresh water washes will also be employed if deemed beneficial and feasible. Material will be collected in containers for temporary storage prior to removal from the site.

7.3 RETURNS OUTSIDE CERTIFICATED WORKSPACE

Should an inadvertent return be discovered outside of certificated workspace, WBI Energy will attempt to gather landowner permission, obtain all required environmental clearances, and seek a FERC variance in order to access the impacted area as soon as possible. WBI Energy plans to consult with adjacent landowners prior to construction in order to limit downtime during drilling operations and expedite the environmental response.

8.0 RESTORATION

If an inadvertent return were to occur, the HDD Plan will be implemented to contain and recover the drilling fluid. Areas that were affected by the inadvertent return will be restored to preconstruction conditions to the extent practicable in accordance with FERC's *Upland Erosion Control, Revegetation, and Maintenance Plan* and *Wetland and Waterbody Construction and Mitigation Procedures* and the proposed modifications described in table 1.3-1 of Resource Report 1, and the restoration plans prepared for the Project (appendix 1F of Resource Report 1).

9.0 CONTINGENCY PLANNING

If the actions described above do not address the issue, WBI Energy may opt to implement mitigation measures, select a new drill path, or abandon the drill and consider alternate crossing measures. Abandonment procedures and alternative crossing measures will be discussed with appropriate permitting and regulatory agencies, and required approvals will be obtained prior to implementing alternative crossing measures.

9.1 MITIGATION MEASURES

Before identifying alternative crossing locations or techniques, an attempt will be made to identify and assess the reason for the drill failure and implement measures to reduce additional inadvertent returns. Potential mitigation measures include:

- utilize surface (conductor) casing(s);
- use the intersect drill method;
- pre-grout permeable ground or fractured rock;

- install relief wells to provide a preferential pathway for drilling fluids to migrate to the surface; and/or

- plan for use of special drilling fluids, viscosity, pressure, and/or drill speed.

9.2 NEW DRILL PATH

Depending on the nature of the problem, WBI Energy may choose to select a new drill path that mitigates the cause of the problem. This would result in an altered alignment or depth of drill path, which may retain sections of the original drilled path that are not at risk to the problem. For any section of abandoned hole, the abandonment procedures identified in section 9.3 below would apply only to the abandoned section of the hole.

9.3 ABANDONMENT

In the event a drill hole is to be abandoned, the following procedures will be implemented:

- heavy drilling mud or cement mixture will be pumped into the hole as the drill assembly is extracted to seal the abandoned drill hole; and

- the drill end points will be cut and sealed within approximately 5 feet of the surface, filled with soil, and graded to the original contour.

9.4 ALTERNATIVE CROSSING METHODS

WBI Energy's preferred crossing method for certain surface waterbodies is via HDD or guided bore; however, in the event that the above options have been exhausted WBI Energy is committed to completing the Project in an effective and timely manner and will consider alternative crossing options. In developing an appropriate alternative consideration will be given to:

- stream bank type, flow width, depth, velocity, and flow volume;
- surrounding topography;
- lakebed substrate;
- condition of riparian areas;
- condition and extent of wetlands, if any, on each side of the crossing; and
- aquatic biota.

These and other factors will be considered and discussed with the appropriate regulatory agencies to minimize environmental impact and secure appropriate approvals.

NORTH BAKKEN EXPANSION PROJECT

Horizontal Directional Drill/Guided Bore Drilling Fluid Monitoring and Operations Plan

Attachment A

Horizontal Directional Drilling Installation Plan, WBI Energy Transmission Lake Sakakawea/Missouri River HDD Crossing, Prepared by Michels

HORIZONTAL DIRECTIONAL DRILLING INSTALLATION PLAN

WBI Energy Transmission
Lake Sakakawea/ Missouri River HDD Crossing

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HDD INSTALLATION PLAN
Michels Directional Crossings
WBI Energy Transmission
North Bakken Expansion Project
Lake Sakakawea / Missouri River Crossing
Installation of ~15,442' / 24" Steel Pipe

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Intro:
The proposed Lake Sakakawea/Missouri River HDD crossing consists of installation of ~15,442' of 24" steel pipe. HDD has been the selected installation method to minimize surface and water body disruption/impact. Environmental considerations were also a factor in choosing HDD as the construction method. HDD is a trenchless installation method that installs the pipeline far deeper under the waterbody with minimal surface and environmental impact when compared to traditional open-cut installations.

Drill Support and Manpower:
Michels proposes drilling and installing this crossing utilizing the pilot-hole intersect method, which requires cutting edge directional drilling technology & the use of two drill rigs drilling simultaneously toward each other in performance of the installation. Michels has been perfecting this unique cutting-edge method for the past 12-years, while successfully completing numerous complicated and long distance directional drill installations that otherwise would not have been attempted. Each drill rig site requires one shift of 8-12 men. The primary drill rig to be utilized will be a minimum DD-840 Drill Rig with the secondary rig being a minimum DD-840 Drill Rig. The crews will be scheduled to work approximately 12 to 14 hours per day and up to 7-days per week. 24-hour per day operations may be required at any given time on the crossing depending on conditions encountered in the bore-hole & specific requirements which must be met. Michels reserves the right to supply and substitute personnel as required but will provide WBI Energy notice prior to personnel changes being implemented.
(Attachment – Potential On-Site Specialized Manpower and Resumes)
(Attachment- Safety and JSA Information)
(Attachment- SPCC Plan)
(Attachment – Drill Rig Specifications)

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Drill Configuration/Geometry:
Directional drilling using the pilot-hole intersect method is proposed for this crossing. The planned borehole geometry is anticipated to follow the attached HDD plan and profile drawing. Adequate depth of cover should be maintained beneath contours and obstacles in accordance with industry standards at all crossings to minimize the risk for inadvertent drilling fluid returns. The HDD crossing will be installed within the tolerances listed in the construction contract so that the factor of safety ratings will be maintained. Conductor casing may also be installed at either or both the entry and exit locations in order to traverse unconsolidated formation if necessary, this is done in order to alleviate conditions associated with inadvertent drilling fluid returns and settlement or to allow a better transition into more consolidated formation.

(Attachment – HDD Plan and Profile Drawing)

Drill Work Sites Preparation:
The drill work sites required for staging equipment should be prepared by the prime contractor readied for Michels' mobilization to the job site. Cleared and level work pads at both sides of the crossing are necessary for the support and movement of semi-trucks and heavy equipment. The pad may require the installation of matting, gravel or other means for a stable workable surface. A work pad is required at both sides of the proposed crossing capable of supporting a drill rig with ancillary equipment. The two work areas are shown on the attached HDD design drawing and pipe laydown drawing. The two work areas should be connected by a straight centerline alignment. A drill rig dead-man is typically installed in front of the unit to support minimal movement of the rig during drilling operations. The dead-man consists of an 8' x 20' steel plate installed vertically down into the ground placed in front of the rig. It is used to distribute load bearing support across and to the surrounding ground formation during rigorous drilling operations.
(Attachment – Anticipated Entry/Exit Equipment)
(Attachment – HDD Equipment Noise Information)

Pilot Hole:
Michels uses two main pilot hole tracking systems for large scale HDDs such as the Lake Sakakawea / Missouri River crossing. The first being a wireline tracking system called the Para-track system. This system requires a surface cable or solenoid. The second pilot hole tracking system is the Gyroscope which requires no surface cable or solenoid. The typical hole intersect procedure for the two systems are described separately below.

Hole Intersect using the Para-Track System
A 12-1/4" drill bit is advanced from the entry points (Rig Side Entry and Pipe Side Entry) toward the pre-designated intersect point along the proposed bore-hole path alignment using a directional jetting bottom-hole assembly or mud motor with bit and bottom-hole assembly. The pilot hole drilling from Rig Side Entry can be prior to or concurrent with pilot hole drilling from the pipe side entry as intersect procedures do not have to occur at exactly half the distance. The intersect location ±500 feet is pre-determined prior to drilling however, conditions encountered during pilot hole drilling will dictate the approximate location of performing the intersect. The bottom-hole assembly will be advanced from the entry side toward the second pilot-hole projection which will be drilled or is being drilled from the other side. The bottom-hole assembly includes the bit (12-1/4" in diameter), drilling mud motor if required, orientation and pressure measurement sub, steering guidance tool (Vector Magnetics Para Track2 Survey and Guidance System) and non-magnetic drill collars. The drill stem

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added behind this bottom-hole assembly will be S-135 grade 7 5/8" FHDS (Full Hole Double Shoulder) series drill pipe or better and in random 30(±) foot lengths.

The location of the pilot-hole drill paths will be continuously monitored, surveyed then recorded from its respective drill rig location utilizing the data from the down-hole probe (Para Track2 Probe) as drilling proceeds. Critical tracking information to be processed includes elevation, alignment and distance away from each rig which is calculated then recorded in accordance with industry standard, once at the end of every drill stem length (approximately 30-feet).

Constant communication is maintained between the two drill crews as pilot-hole intersect operations progress. Prior to the pilot holes reaching the projected intersect location, the magnetic signal being monitored on the instrument tracking computer inside the control trailer will increase in strength. After the two pilot holes are overlapped by approximately 30', a PMR (Passive Magnetic Ranging) survey will be conducted. At this time, the Para Track2 Probe will be used to collect static magnetic field readings relative to the adjacent drill stem. To perform this operation, the 7 5/8" drill pipe positioned in the previously drilled borehole from the entry end will be retracted in predetermined distance increments, these distance retractions are sensed by the probe and recorded. The magnetic field readings collected by the Para Track2 probe will then be analyzed to verify that sufficient and accurate data has been collected and a position offset between the two boreholes can be calculated and determined. This PMR survey will be repeated once every 30' until the two boreholes are connected.

Hole Intersect using the Gyroscope System

A 12-1/4" drill bit is advanced from the entry points (Rig Side Entry and Pipe Side Entry) toward the pre-designated intersect point along the proposed bore-hole path alignment using a directional jetting bottom-hole assembly or mud motor with bit and bottom-hole assembly. The pilot hole drilling from Rig Side Entry can be prior to or concurrent with pilot hole drilling from the pipe side entry as intersect procedures do not have to occur at exactly half the distance. The intersect location (±500 feet) is pre-determined prior to drilling however, conditions encountered during pilot hole drilling will dictate the approximate location of performing the intersect. The bottom-hole assembly will be advanced from the entry side toward the second pilot-hole projection which will be drilled or is being drilled from the other side. The bottom-hole assembly includes the bit (12-1/4" in diameter), drilling mud motor if required, orientation and pressure measurement sub, steering guidance tool (Gyroscope Guidance System). The drill stem added behind this bottom-hole assembly will be S-135 grade minimum 7 5/8" FHDS (Full Hole Double Shoulder) series drill pipe or better and in random 30(±) foot lengths.

The location of the pilot-hole drill paths will be continuously monitored, surveyed then recorded from its respective drill rig location utilizing the data from the down-hole probe (Gyroscope) as drilling proceeds. Critical tracking information to be processed includes elevation, alignment and distance away from each rig which is calculated then recorded in accordance with industry standard, once at the end of every drill stem length (approximately 30-feet).

As the pilot holes approach the planned intersect area the following steps are typically followed to complete the intersect:

1. A pair of radars are placed, one behind each gyro on either side.
2. The drilling surveyors on both sides stay in contact sharing their survey data as the bore progresses.

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3. When they get within 30’ of the bits overlapping, one side will pull a joint of pipe to the top of the rig and wait for the opposite side to overlap their hole with the bit.
4. While the drilling side is progressing, the other side will monitor annular pressure (if annular pressure is being monitored) and watch for vibrations indicated on survey readouts.
5. If at this time the drilling side notices any changes to the push or rotation indicating they may be coming into the hole drilled from the opposite side, the side which is waiting will slowly push down and see if they bump into the other bit. If they do bump, the drilling superintendent and surveyors will then decide based on the angles at which the intersect occurred, the push and torque on the strings of pipe, and the distance from the intersect point to the ends of the hole, which side will push out of the ground. They will also decide, based on ground conditions how much space to keep between the bits as one side pulls back and the other pushes forward.
6. If the bits do no bump after the two holes are overlapped in a horizontal direction, the side which is not drilling forward will pull back drill stem and bit an appropriate distance so that the drilling side can drill far enough forward without the bits being overlapped until the side which is waiting can push down slowly while the other side monitors for vibrations until the radars are parallel to each other.
7. At this time the surveyors will take a radar survey. Based on the survey, the drilling superintendent and surveyors will determine the best option to drill from one side or the other until the holes are intersected. Usually, another radar survey will be taken in 1 to 3 drill pipes as the hole progresses to verify that the distance between the holes is matching what is expected based on the first set of data.
8. When the holes get close enough in a lateral and vertical direction that intersection is expected one side will pull back far enough that the drilling side can safely drill into the hole without causing damage to the tools. When the drilling superintendent and surveyor believe based on the pressures and survey data the holes are intersected, the other side will push down slowly until the bits are verified to have touched. Usually this is accomplished by pushing until either the push pressure rises above that in open hole, or the other side notices movement. Then one side will move a set distance and see if the other side can now push freely again.
9. When it is verified that the holes are intersected the drilling superintendent and surveyors will then decide based on the angles at which the intersect occurred, the push and torque on the strings of pipe, and the distance from the intersect point to the ends of the hole, which side will push out of the ground. They will also decide, based on ground conditions how much space to keep between the bits as one side pulls back and the other pushes forward. They will also decide, based on ground conditions how much space to keep between the bits as one side pulls back and the other pushes forward.
10. If the ground is soft, it can be necessary for both sides to bump the bits against each other and one side to push as the other side pulls back slowly maintaining contact with the bits to insure that the pushing side stays in the hole.

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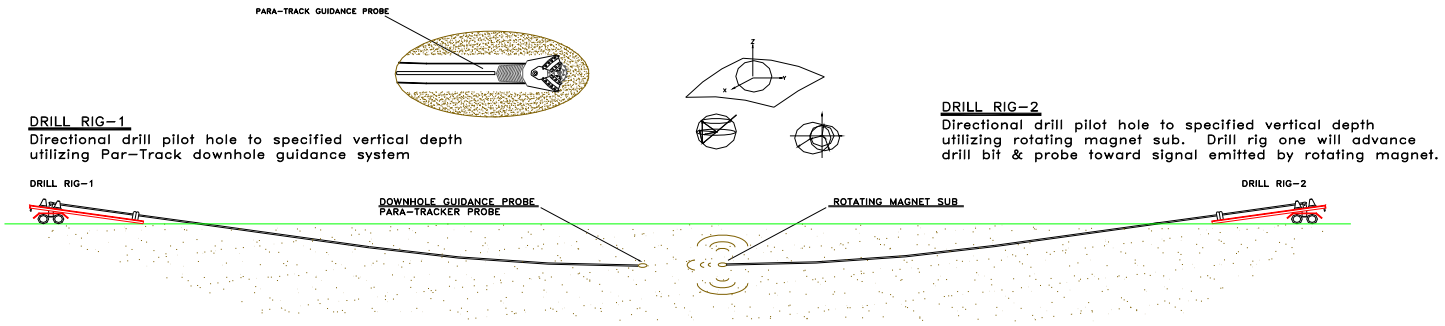
Pilot Hole Intersect Sketch



(Attachment – MGS Steer Tool System; Attachment – Gyroscope; Attachment - Para Tracker Gyro Module; Attachment - Para Tracker, Attachment Tensteer Tool, Attachment – Drill Rig Specification Hercules 1200, Atlas-840, Titan-440 and UNI 250X400, Attachment – Daily Tracking Forms)

Drilling Fluids:

Essential to any successful HDD process is the selection and proper utilization of drilling fluid, which is primarily made up of water and bentonite having pH values between 8 and 9. Bentonite is a naturally occurring, non-toxic, inert substance that meets NSF/ANSI-60 Drinking Water Additive Standards and is used for drilling potable water wells. Often soda ash is added to the drilling fluid to increase the pH to 8 and reduce the soluble calcium. This allows bentonite to perform at its maximum and reduces the amount of bentonite added to the drilling fluid. Soda ash is also NSF standard 60 certified and is used to drill potable water wells. Using these products minimizes the impact to any environmentally sensitive area in the unlikely event that an inadvertent return should occur.

Bentonite serves many notable purposes in the HDD process, which includes but is not limited to:

1) Cleans the drilled cuttings from the bore hole and cools the drilling tools,
2) Transports cuttings to the surface for recycling,
3) Aids in stabilizing formations by supplying a cohesive nature to the surrounding geological formation and preventing fluid loss from the bore hole,
4) Provides lubrication for the drill string and downhole assembly, which reduces frictional forces at the formation,
5) Drives a down-hole drill motor for rock drilling,
6) Provides hydrostatic fluid pressure in the bore hole to offset ground formation pressures.

Drilling fluid is composed of a carrier fluid and solids. The selected carrier fluid for this crossing consists of water (approximately 96%) and an inorganic, bentonite clay (approximately 4%). Michels has access to

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several different brands of bentonite. The selection of which brand to use is typically based on price, availability and proximity to the proposed drill site. The following brands all exhibit similar characteristics providing the same results as listed above.
(Attachment – Potential Bentonite Brands – Product Data Sheets/MSDS Sheets)

Potential Bentonite Brands

- Max Gel
- Super-Gel X
- Bara-Kade

The bentonite will be mixed in a mud mixing tank of up to 5,000 gallons, depending on mud rig size, in accordance with manufacturer's recommendation. Approximately 15 to 20 pounds of powder bentonite will be mixed with 100 gallons of fresh water *(Mud Composition),* and will be used throughout the entire drilling process to establish and maintain optimum drilling fluid properties. Estimated proportions listed above are based on past experience and do not take into account unexpected conditions encountered. Michels maintains fluid performance through the daily sampling, testing and recording of fluid properties throughout drilling operations. This provides Michels' Mud Technician the information required to make educated recommendations regarding maintenance of efficient drilling fluid rheology consistent with hole-stabilization with the intention of limiting inadvertent surface returns and optimizing drilling fluid performance. Following is one of the tables used as a guideline by the Mud Technician referencing recommended fluid consistencies targeted during typical testing. Consistencies of powder and water are varied to achieve these recommended viscosities.

Targeted Drilling Fluid Viscosities Recommended	
Sand	60-80 Viscosity
Silt	50-70 Viscosity
Clay	40-50 Viscosity
Rock	60-80 Viscosity
Gravel	70-90 Viscosity

Once the drilling fluid is thoroughly mixed to an acceptable consistency, it is pumped from the mud tank to the back end of the drill rig. From here it is injected under high pressure through the drill stem at a rate of between 300 to 800 gpm to the apex of the drill head. The spent drill fluid with mixed cuttings maintains a return flow back along the annular space created between the drill stem and the formation wall. Drill fluid returns to the entry pit where it is pumped by a 6hp submersible pump to the fluid recycle and processing system.

Additives may be deemed necessary based on evaluations and recommendations made by the Mud Technician during drilling and hole-opening operations. If the need for drill fluid additives does arise, it is anticipated that one of the attached additives may be required in order to maintain adequate fluid rheology down-hole. Michels formally submits the attached drilling fluid additives for approval and use on this project. (Attachment – Drilling Additives / LCMs for approval)

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Reaming Passes:
Michels anticipates performing one ream pass with a final hole dimeter of ~36" accommodate the 24" steel pipe. However, the final determination as to size and number of ream passes will be based on conditions encountered during pilot-hole drilling and the initial reaming operation.

The reamers proposed for the crossings will be various types of dirt and rock reamers custom fabricated by Michels specifically for this type of formation, which could include conventional fly-cutter type reamers and hole-openers. Michels also has additional resources for various rock-tooling which can be supplied at a moment's notice if needed. Equivalent or better tools may be substituted depending on availability of other supplier's products or if changes in anticipated drilling conditions are encountered.
(Attachment- Michels' Downhole Tools)

Cleaning Pass:
A swab pass will need to be conducted up to the same size as the final ream pass but no larger. The swab pass is typically pulled back from exit to entry.

Drill Mud Cleaning:
The first phase of the mud cleaning system is displacement of solid returns at the shaker. Heavy solids are sifted out by a shaker with screens and deposited into a pit. From here they will be transported by dump truck to a site for disposal.

Drill Mud Cleaning Equipment Specifications

Volume of Mixing/Scalper Tank	54.0-Bbls
Volume of Desander Tank	72.0-Bbls
Volume of Desilter Tank	72.0-Bbls
Quantity of Scalping Shakers	1.0-Shakers
Mesh Size of Scalping Shakers	10-20 Double Stacked
Desander Capability	2 @ 500-GPM (1,000 GPM Total)
Desander Cones	2.0-Cones
Desander Mesh Size	40 to 165
Quantity of Desilter Cones	10 Ea @ 100-GPM
Desilter Mesh Size	60 to 250
Steel Mud Circulating Tank Volume	160-Bbls
Returns Tank Volume (Mud Pit)	320-Bbls
Cuttings Tank Volume (20-yd Roll-off)	150-Bbls
Mud Screening, Max Pass Size	40-Mesh

(Attachment – Mud Cleaning Equipment Specifications)

Bentonite Pump Capabilities (ENTRY/EXIT) (Based on Availability)

Name Brand	Ellis Williams W-446 Triplex Piston Model
Liner Size	6-Inches
Maximum Pressure	1,027 PSI
Maximum Flow Rate	661 GPM
Gallons Per Stroke	2.20 Gallons Per Stroke

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Bentonite Pump Capabilities (ENTRY/EXIT) (Based on Availability)

Name Brand ..... Gardner Denver OPI-350
Liner Size 6-Inches
Maximum Pressure .....1,469 PSI
Maximum Flow Rate..... 529 GPM
Gallons Per Stroke ..... 2.94 Gallons Per Stroke

Pull Pipe:
The 24" pipe will be welded and placed on top of rollers in preparation for pullback. The pipe will be pulled into place utilizing an approved pull head, swivel and reamer from exit to entry. This is a continuous operation which takes place until the product pipe is pulled through the opened hole back to the entry point.
(Attachment - Michels' Support Rollers)

Contingency Planning:
Contingency planning is conducted in response to unforeseen events and conditions which could occur during normal operating sequences.

Included in the contingency plans, Michels has developed an environmentally responsive set of contingency plans including contingency planning for inadvertent returns to be invoked for expeditious attention and handling of various incidence as they arise.
(*Attachment – Contingency Plans for HDD crossing)*

Solids Control and Separation:
The first phase of the mud cleaning system is displacement of solid returns at the shaker. Solid control systems will vary for the various drill rigs however the end product is the same. Heavy solids are sifted out by a shaker with screens and deposited into a pit. From here they will be transported by dump truck to a site for disposal. Spent drill fluids are collected at the drill site and transferred to tanker trucks for disposal at an approved location. *(Attachment – Drill Fluid Recycle Flow Chart)*

Demobilization:
Excess drilling fluid is removed from the site and transported to the approved disposal site. Equipment and personnel will be moved off-site after successful completion of the hydrostatic test and clean-up operations will take place. Mud pits will be backfilled with the native soil that was excavated and temporarily stored. Topsoil will be segregated separately from the subsoil and backfilled appropriately to restore conditions as close to pre-construction as possible.

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ATTACHMENT

ON SITE
SPECIALIZED MANPOWER
AND RESUMES

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PERSONNEL STATEMENT

Personnel for each newly contracted job, from the Project Manager to the Mud Technician, are duly assigned to a project based on a number of circumstances. These may include but are not limited to the following; current projects under contract, geographic location of previous project, scope of work required for the directional drill. Our personnel and equipment have been assembled so that they are interchangeable from project to project.

The key to any directional drilling project is obviously having qualified personnel who are experienced in dealing with unforeseen circumstances as they arise. Michels' personnel are some of the most experienced and highly qualified drilling experts in the industry, as demonstrated on past projects accumulated on our reference list. With the appropriate resources at their disposal, Michels has overcome risks associated with some of the most difficult drilling projects ever attempted and has evolved into one of the foremost leaders in the directional drilling industry.

Each of the Drilling Superintendents employed by Michels is highly experienced in utilizing drill rigs of every size. Michels' Drilling Superintendents are well respected throughout the industry, as represented on the attached resumes. Each has completed countless difficult drills including installation of large diameter pipe and at great lengths. Our Drilling Superintendents have worked up through the ranks providing them a complete and comprehensive understanding of safety, hazards, environmental monitoring, manpower, equipment operations and repairs for each phase of the directional drilling operation. Michels' personnel maintain continuous schooling for all phases of the drilling operation.

As noted on the attached resumes, each Superintendent has drilled throughout North America as well as internationally, and has encountered various soil conditions, from sands, gravels, clay and cobble to solid rock formations.

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Directional Crossings

A Division of Michels Corporation

Jeff Mueller
Vice President of Michels Directional Crossings

Sean Nicholson
Vice President of HSE

Jason Pederson
Director of Safety for HDD

Ed Dye
Safety Coordinator

Michael Miller
Safety Coordinator

Spencer Rusk
Safety Coordinator

Mark Franz
Environmental Manager

Tim McGuire
Senior Advisor

Paul Krings
Sr. Equipment and Logistics Manager

Eric McBrair
HDD Tooling Manager

Dan Pucker
Directional Drill Shop Manager

Scott Nehls
HDD Logistics QA/ QC Manager

Matt Smith
General Manager Contracts and Business Administration

Greg Goral
Senior Design Engineer

Brad Eifert
Engineering Tech

Zach Osborn
Estimator

Diane Dalle Nogare
Executive Assistant

Toni Budahn
Administrative Assistant

Dustin Branscomb
Trenchless Engineer

Don Mueller
Eastern Operations Manager

Bob Spennati
Assistant Operations Manager

Randy Robinson
Midwest Operations Manager

Kurt Myhre
Western Operations Manager

Ray Viator
Marine Operations Manager

Ted Foltz
Special Projects Manager

Project Managers: to be assigned to Operations Managers on a per project basis.

Ken Coleman	Wendell Long	Eric Frawley	Larry Shilman
Jim McGovern	Karl Kornkven	Rick Zavitz	Jeremiah Yliniemi
Dale Schinderle	Michael Geelan	Doug Houska	Chad Johnson

Field Superintendents: to be assigned to Operations Managers on a per project basis.

Mike Brever	Marcus Carratt	Jack Edmunds	Brian Guelig	Nick Leblanc	Tim Monroe	Clifford McLain	Seth Strean	Matt Rohwer	Brady Hickey	Branden Cole
Dan Kriesel	Curt Rischmueller	Steve Sanders	Richard Wulff	Bobby Skipworth	Dave Williams	James Day	Josh Bush	Garrett Derrerr	Steve Case	Carl Bresser
Jamie Hollenbeck	Mark Matthews	Doug Stebbins	Seth Matheny	Ryan Jackson	Nate Mecklenburg	Jason Freund	Tim Bunkelman	Brian Morgan		

Survey Engineers: to be assigned to Operations Managers on a per project basis.

Jeff Nehmer	Cale Mullenix
Lorenzo Rivera	Eric Riha
Jeremiah Erickson	Dan Reynolds

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Jeffrey S. Mueller

Vice President

PROFESSIONAL EXPERIENCE

2020 – Present: **Vice President | Michels Directional Crossings | Brownsville, WI**

Responsible for horizontal directional drilling division construction operations. Duties include profit and loss responsibility for multiple and simultaneous directional drilling gas, product, water, sewer, civil, electric, telephone cable, and environmental projects. Day-to-day involvement with bid estimating, construction feasibility evaluation, specification and design criteria review, proposal preparation, contract and subcontract negotiations, project planning and oversight, cost scheduling, allocation of divisional resources, and interface with utility construction managers, engineers, and owners. Report directly to the Senior Vice President and President of the company.

2003 – Present: **Operations Manager | Michels Directional Crossings | Brownsville, WI**

Supervisor of field operation superintendents and directional drilling project managers. Oversee large inventory of drilling tools and materials during storage and field use. Monitors production by Fleet Department of directional drilling personnel and equipment. Duties include coordinating and scheduling the mobilization of equipment, personnel and materials to remote job sites throughout the United States and Internationally. Involved in estimating of various directional drilling projects. Specialize in the engineering design, build and maintenance of directional drilling fleet. Responsible for pilot hole drilling & survey for complicated bores which include implementing and integrating new technology necessary for successful completion of leading edge HDD crossings (i.e. hole-intersects). Complete project experience available upon request.

Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
42"	3980'	Susquehanna River MP 99.6, PA	2018
20"	7354'	Susquehanna River, PA	2018
36"	6238'	Ohio River, OH/WV	2017
30"	3483'	Ford Island to Landing C, HI	2017
42" Steel with 36" HDPE	3983'	St John's River, FL	2016
30"	6119'	Lake Whitney, TX	2016
12"	11,548'	Union Canal & Martin Barge Canal, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
12"	11,563'	Holland Bottoms Wetlands, AR	2015
18"	12,459'	Houston Ship Channel, TX	2015
6"	6999'	Navajo Reservoir/San Juan River, NM	2014

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
48"	2060'	Tres Palacios River, TX	2014
36"	9040'	Mississippi River & Levees, Il/MO	2014
42"	3008'	I-95 & Tidal Wetlands, NJ	2013
30"	6544'	1st Street, NJ	2013
42"	4441'	Goethals Bridge, NY	2013
30"	8101'	Kill Van Kull River, NY/NJ	2013
30"	5378'	Hudson River, NY/NJ	2012
30"	4850'	Red River, TX/OK	2012
42"	4519'	Freeman Road, LA	2011
42"	5117'	Nature Conservatory, LA	2011

1996 – 2003: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record-keeping of plots and production. Oversees drilling survey during crossing.

1991 – 1996: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, WI**

Responsible for surveying, staking and design of directional drill path and curve, monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software. Complete surveying skills and experience utilizing a Total Station for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points. Additional duties include on-site maintenance of technical equipment and necessary record-keeping of plots and drilling logs.

1989 – 1991: **Skilled Laborer | Michels Directional Crossings | Brownsville, WI**

Experience in working on and around directional drilling rigs as an integral member of a specialized team. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs; hydraulics; fluids; set-up and operation of drill motors; power generators; mud pumps; bentonite mixers; drill pipe; reamers; couplings; and overall equipment maintenance and operation.

EDUCATION

1989 **Lomira High School | Lomira , WI**

High School Diploma

Tim McGuire

Senior Advisor

PROFESSIONAL EXPERIENCE

2020 – Present: **Senior Advisor | Michels Directional Crossings | Brownsville, WI**

Provide advice in the management of domestic and international horizontal directional drilling operations. Responsibilities include business development, contract procurement and negotiation, project oversight and management, and client communication.

2002 – 2020: **Vice President | Michels Directional Crossings | Brownsville, WI**

Responsible for horizontal directional drilling division construction operations. Duties include profit and loss responsibility for multiple and simultaneous directional drilling gas, product, water, sewer, civil, electric, telephone cable, and environmental projects. Day-to-day involvement with bid estimating, construction feasibility evaluation, specification and design criteria review, proposal preparation, contract and subcontract negotiations, project planning and oversight, cost scheduling, allocation of divisional resources, and interface with utility construction managers, engineers, and owners. Report directly to the Senior Vice President and President of the company.

1998 – 2002: **General Manager | Michels Directional Crossings | Brownsville, WI**

1994 – 1998: **Project Engineer/Project Manager | Michels Corporation | Brownsville, WI**

1992 – 1994: **Division Manager | Michels Environmental Services | Brownsville, WI**

1991 – 1992: **Drilling Division Manager | Harrison Western Mining Corporation | Denver, CO**

1987 – 1992: **Project Manager/Geotechnical & Environmental Engineer | Ebasco Corporation | Denver, CO**

INDUSTRY INVOLVEMENT

- MCI Engineer Training Seminar “Horizontal Directional Drilling Design, Specification and Construction for Trenchless Placement of Underground Utilities”
- Midwest Gas Association “Horizontal Directional Drilling Large Diameter Pipeline Installations”
- National Groundwater Association Outdoor Action Conference “Horizontal Directional Drilling Demonstration for Installation of Horizontal Wells”

EDUCATION

Colorado School of Mines | Golden, CO

Bachelor of Science: Geological Engineering - Minor: Hydrogeology

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Matthew Smith

General Manager/Contracts & Business Administration

PROFESSIONAL EXPERIENCE

2019 – Present: **General Manager/Contracts & Business Administration | Michels Directional Crossings | Brownsville, WI**

Oversee day-to-day divisional business operations and management of operational costs.
Duties include profit and loss responsibility for multiple and simultaneous trenchless construction projects in the oil/gas, civil, power and communication business sectors.
Day to day involvement with bid estimating, construction feasibility evaluation, specification and design criteria review, contract and subcontract negotiations, project planning, cost scheduling and interface with utility construction managers, engineers and owners.

2013 – 2019: **Manager-Direct Pipe | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating Direct Pipe projects for various size gas, water, sewer, electrical and communication lines. Assists with project design and methods of operation. Oversees clarification and interpretation of construction drawings. Assumes accountability for the direction and performance of construction personnel. Oversees project schedule, safety, profitability and cost control. Direct pipe installations/pipe assists:

Diameter	Length	Crossing/Location	Year
48"	651'	Juniata River, PA - HK 750PT Installation	2018
42"	484'	Highway 50, West Virginia - HK 500PT Installation	2018
36"	856'	Qu`Appelle River, Canada - HK 750PT Installation	2017
36"	1,280'	Highway #1, Canada - HK 750PT Installation	2017
36"	1,027'	United Blvd & Mundy Creek, Canada - HK 750PT Installation	2017
36"	1,047'	Lougheed Hwy, Canada - HK 750PT Installation	2017
42"	7,200'	Athabasca River, Canada - HK 750PT Installation	2016
36"	827'	Leslie Street, Ontario, Canada - HK 300PT Installation	2015
42"	1,299'	Lisgar Meadowbrook, Ontario, Canada - HK750PT Installation	2015
42"	1,008'	Highway 63, Canada - HK750PT Installation	2015
48"	4,039'	Dow Barge Channel, Clute TX - HK750PT Installation	2015
36"	1,002'	Hwy 225, Deer Park, TX - HK300PT Installation	2015
36"	1,092'	Lubrizol Drainage, LaPorte, TX - HK300PT Installation	2015
48"	2,455'	Rio Grande River, El Refugio, TX - HK750PT Installation	2014
42"	1,200'	Railroad Crossing, Groves, TX - HK750PT Installation	2014
42"	1,050'	Beaver River, Alberta, Canada - HK750PT Installation	2013
42"	470'	I-84, Westfall, PA - HK750PT Installation	2013

PROFESSIONAL EXPERIENCE (continued)

2013: **Project Manager | Michels Tunneling | New Berlin, WI**

Responsible for overall site/field management and safety of microtunneling/tunneling projects. Monitor project budget including month end computations and projections. Coordinate project development between project engineer, superintendent and foreman. Prepare/submit all submittals, RFIs, extra work, contract change orders and pay requests.

2011 – 2013: **Project Engineer | Michels Tunneling | New Berlin, WI**

Planned, scheduled, conducted, and coordinated assigned engineering work; monitored work for compliance to appplicable codes, accepted engineering practices, and ensured effective communication and coordination on projects between all disciplines and project participants.

2010: **Engineer Internship | Michels Tunneling | New Berlin, WI**

2009: **Pipeline Laborer | Michels Pipeline Construction | New Berlin**

2003 – 2007: **Concrete/General Laborer | Forino Developers | Skinking, PA**

PROJECT PROFILES

OCI Project No. DB10-WASD-01 ESP - Miami, FL
Mico-tunnel installation of 1200 LF of 72" Permalok steel casing under the Government Cut Channel in Miami. The casing will be installed through the coral rock formation from a shaft constructed by others on Fisher Island to a shaft in the water off South Beach.

Intracoastal Waterway Pipeline Relocation, Galveston Causeway, Galveston, TX
700' of 48" Permalok tunnel drives through clay underneath the Galveston Bay for installation of new waterline for the City of Galveston. Michels Tunneling was the 4th contractor to attempt this project and completed it successfully and under budget.

Akron II - Akron, Ohio
The second phase of a sewer installation, including 2 microtunneling runs installed 1,086 LF 48" Hobas.

Massillon Road Sanitary Sewer Improvement - Akron, Ohio
Massillon Road 2,925 LF of 42" Cenrifugally Cast Fiberglass Reinforced Polymer Motar Pipe sanitary sewer gravity sewer, microtunnel installation; 1,328 LF of 48" CCFRPM pipe on micropile support, 29 LF of 36" OH CCFRPM pipe, gravity sewer, micropile support. 7 EA shaft excavations with steel sheeted ground and 7 EA manholes structures. 250 LF of open cut excavation with steel sheeted support.

SFPUC Bay Tunnel - San Francisco, CA
The project includes 26,208 LF of 12'-10" diameter concrete segmented tunnel under the San Francisco Bay from Menlo Park on the S.F. Peninsula Bay to Newark in the East Bay area, two slurry diaphragm wall shafts, and 108" cement motor lined steel pipe welded in the tunnel and shafts as a final liner carrier pipe.

TRAINING & CERTIFICATIONS

- Crane Signaler Certified
- Confined Space Certified

INDUSTRY INVOLVEMENT

- 2018 Trent Ralston Young Trenchless Achievement Award
- No-Dig Paper Presentation (2019): Crossing the Calumet

INDUSTRY INVOLVEMENT (continued)

- No-Dig Paper Presentation (2018): Lengthy crossings shortened by Direct Pipe Technology
- No-Dig Paper Presentation (2017): Direct Pipe method using water

EDUCATION

Gonzaga University | Spokane, WA

Bachelors of Science: International Business

Greg Goral

Senior Design Engineer

PROFESSIONAL EXPERIENCE

1988 – Present: **Senior Design Engineer | Michels Directional Crossings | Brownsville, WI**

Create forms for and compile various informational submittals for Directional Drilling and Line and Cable Divisions. Planning and design drawings on AutoCAD from preliminary designs to as-built drawings. Developed computer programs for simplifying preliminary and correction computations required for Directional Drilling. Composed dissertations for various projects proposed and awarded. Compiled engineering computations and studied stress and loading analysis for pipeline installation. Responsible for take-offs, material estimates, material purchasing and project coordination, and map route reproduction.

1986 – 1987: **Estimator/Purchasing | LaForce Hardware and Manufacturing | Green Bay, WI**

Involved in the bid process using skills in estimating and pricing. Scheduled materials for architect's review and approval. Responsible for the purchasing of materials and coordinating shipments to job sites.

1981 – 1984: **Machine Operator | Badger Wood Products, Inc. | De Pere, WI**

Machine operator responsible for setup operations for various machines in a production line process. Responsible for quality control at various machines.

TRAINING & CERTIFICATIONS

- Construction Materials & Techniques
- General Construction Estimating
- Route Laying and Photogramitry
- Engineering Mechanics-Statics
- Elements of Surveying

EDUCATION

1986 **University of Wisconsin–Platteville | Platteville, WI**

Bachelor of Science with Construction Management Major

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Dustin Branscomb

Trenchless Engineer

PROFESSIONAL EXPERIENCE

2018 – Present: **Trenchless Engineer | Michels Directional Crossings | Brownsville, WI**

Responsible for the design & engineering evaluation of trenchless pipeline installations, inclusive but not limited to design & build projects, constructability, feasibility, plan & procedure creation, pre-qualifications, calculations, specification review and/or insight, bid & proposal process, submittals, estimating, scheduling, pre-bid meeting attendance, pre-construction meeting attendance, as-built's, design changes, and ensuring project continuity from inception to execution.

2011 – 2018: **Drilling Survey Supervisor | Michels Directional Crossings | Brownsville, WI**

Responsible for surveying, staking and design of directional drill path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Performed the above operations for crossings which include, but not limited to:

Diameter	Length	Crossing/Location	Year
42"	3087'	Victoria Harbor, Canada	2018
36"	1511'	Hwy #1, Canada	2017
36"	1116'	United Blvd & Mundy Creek, Canada	2017
36"	1076'	Hwy 7 & CP Rail, Canada	2017
36"	827'	Leslie Street, Ontario, Canada - HK 300PT Installation	2015
42"	1,299'	Lisgar Meadowbrook, Ontario, Canada - HK750PT Installation	2015
42"	1,008'	Highway 63, Canada - HK750PT Installation	2015
48"	4,039'	Dow Barge Channel, Clute TX - HK750PT Installation	2015
36"	1,002'	Hwy 225, Deer Park, TX - HK300PT Installation	2015
36"	1,092'	Lubrizol Drainage, LaPorte, TX - HK300PT Installation	2015
48"	2,455'	Rio Grande River, El Refugio, TX - HK750PT Install.	2014
8"	7321'	MP 49.3 Landslide, MT	2014
36"	9040'	Mississippi River, IL/MO	2014
36"	2264'	Otter Creek,IL	2013

PROFESSIONAL EXPERIENCE (continued)

36"	1311'	Fraizer Creek, IL	2013
36"	1518'	Vermillion River, IL	2013
48"	1943'	West Neck Creek, VA	2013
48"	819'	Hunt Club Creek, VA	2013
8"	7177'	115 KV Power Duct, SC	2013
8"	7304'	115 KV Power Duct, SC	2013
36"	3571'	Angelina River, TX	2013
36"	2908'	Neches River & RR, TX	2013
8"	3503'	Hamlin Creek, Charleston, SC	2013
8"	4911'	115 KV Power Duct, SC	2013
36"	1444'	Hwy 155 & UPRR, TX	2012
36"	1740'	Sabine River, TX	2012
30"	2906'	Hickory Creek, Marietta, OK	2012
30"	4850'	Red River, Thackerville, TX/OK	2012
42"	1661'	Cordele, TX	2012
16"	1656'	Chicolete River, TX	2012
16"	1717'	Morales, TX	2012
42"	1670'	Morales, TX	2012
42"	1658'	Dewitt, TX	2012
8"	6675'	Wilmington, NC	2012
8"	6669'	Wilmington, NC	2012

2006 – 2011: **Project Engineer | GeoEngineers, Inc. | Springfield, MO**

Responsible for project management, HDD Design, construction observation, field program planning and conducting technical briefings of field staff, feasibility studies for various natural gas and product pipeline projects, geotechnical exploratin, geotechnical borehole logging and soil classificatino, completion of technical reports and proposals, budget management, client billings and collections, and client interaction.

2004 – 2006: **Assistant Civil Engineer | Coastland Civil Engineering, Inc, | Santa Rosa, CA**

Responsible for project management, land development projects, improvement plan and map review, flood and drainage review, city master plan development, specification and eingineer's estimate development, city engineering and all-embracing experience in struction inspection.

TRAINING & CERTIFICATIONS

- HDD profile design
- Analysis of operating and installation stresses
- Determination of minimum allowable radius of curvature
- Evaluation of pipe buoyancy and potential pull loads
- Slope stability analysis, Subsurface exploration, Laboratory Testing and Structual design

INDUSTRY INVOLVEMENT

- Registered Professional Engineering, Licence No. 20100000796. Missouri Board for Architects, Professional Engineers, Professional Land Surveyors and Landscape Architects
- Registered Professional Engineer, License No. 108030. Texas Board of Professional Engineers
- LEED Accredited Professional. Leadership in Energy and Environmental Design Green Building Accredited Professional (LEED AP)
- National Association of the Remodeling Industry Certified Green Building Professional

EDUCATION

2004 **California Polytechnic State University | San Luis Obispo, CA**

Bachelor of Science, Civil Engineering 2004

El Molino High School | Forestville, CA

High School Diploma

Bradley J. Eifert

Engineering Technician

PROFESSIONAL EXPERIENCE

2005 – Present: **Engineering Technician | Michels Directional Crossings | Brownsville, WI**

Create forms for and compile various informational submittals for Directional Drilling. Planning and design drawings on AutoCAD from preliminary designs to as-built drawings. Developed computer programs for simplifying preliminary and correction computations required for Directional Drilling. Composed dissertations for various projects proposed and awarded. Compiled engineering computations and studied stress and loading analysis for pipeline installation. Responsible for take-offs, material estimates, and map route reproduction.

2004 – 2005: **Assistant Project Coordinator | Michels Directional Crossings | Brownsville, WI**

Performed As-builts, scheduling, dispatch, and project tracking for communication cable burial. Designed and preformed anticipated loads and stress calculations for the following projects:

Diameter	Length	Location	Year
24"	2645'	Corning, NY	2011
36"	4992'	Melville, LA	2011
30"	5786'	Sussex, NJ	2010
16"	9931'	Goose Creek, SC	2010
42"	4512’	Vicksburg, MS	2009
30” Steel	34,000’ (19 Drills)	Atlanta, GA	2008-2009
30” HDPE	3076’	Albany, NY	2008
36” HDPE	2144’	Charleston, SC	2007
8” Steel	8400’	Okaloosa, FL	2006
20” HDPE	2300’	Honolulu, HA	2006
30” Steel	5700’	Trinidad	2006
36” Steel	2130’	Albuquerque, NM	2006
42” Steel	2078’	South Amboy, NJ	2006
24” Steel	24,000’ (6 Drills)	Sacramento, CA	2005-2006

EDUCATION

2005 **Moraine Park Technical College | Fond du Lac, WI**

Associate Degree- Civil Engineering Technician

1995 **Hartford Union High School | Hartford, WI**

High School Diploma

Zach Osborn

Estimator

PROFESSIONAL EXPERIENCE

2019 – Present: **Estimator | Michels Directional Crossings | Brownsville, WI**

Prepare estimates for Directional Drill projects across the United States. Review designs and feasibility of projects. Point of contact for customers during bid process. GIS mapping and tracking of current bids. Follow up on project status. Hand offs to operations when a project is awarded.

2017 – 2019: **Assistant Project Manager | Michels Pipeline Construction | Lakeville, MN**

Oversee projects and provide estimates. Manage projects through the full cycle. Profile HDD's for crews and create asbuilts on completed projects. /worked directly with customer with HDD feasibility and design. Pursue new business opportunities and customer relations. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
10"	1948'	Roads & Bluff, MN	2019
24"	2000'	Woods and Creek, MN	2019
8"	4650'	Little Falls, MN	2019
16"	1200'	Hwy & Railroad, MN	2018
10"	2450'	Missouri River, MT	2018
24"	1200'	I-494, MN	2018
24"	1800'	Crossing Bluff, WI	2017

2015 – 2017: **Foreman | Michels Pipeline Construction | Lakeville, MN**

Point of contact for non contract bores for the Distribution West Division. Managed and tracked units for billing. Time and equipment recording. Managed HDD worksite and constructed gas service work. Worked with distribution crews on miscellaneous projects around the Twin Cities Metropolitan area.

2009 – 2015: **Laborer/Operator | Michels Pipeline Construction | Lakeville, MN**

Labored and Operated equipment for the Distribution West Division. Worked with HDD Operations. Fused for outside projects outside of Centerpoint contract. Traveled and worked on out of state projects.

TRAINING & CERTIFICATIONS

- Class A CDL, HDD Academy, EWN Proctor Certification

EDUCATION

University of Wisconsin - La Crosse | La Crosse , WI

Triton High School | Dodge Center, MN

Diploma

Don Mueller

Eastern Operations Manager

PROFESSIONAL EXPERIENCE

2011 – Present: **Eastern Operations Manager | Michels Directional Crossings | Brownsville, WI**

Supervisor of field operation superintendents and directional drilling project managers. Oversee large inventory of drilling tools and materials during storage and field use. Monitors production by Fleet Department of directional drilling personnel and equipment. Duties include coordinating and scheduling the mobilization of equipment, personnel and materials to remote job sites throughout the United States and Internationally. Involved in estimating of various directional drilling projects. Specialize in the engineering design, build and maintenance of directional drilling fleet. Responsible for pilot hole drilling & survey for complicated bores which include implementing and integrating new technology necessary for successful completion of leading edge HDD crossings (i.e. hole-intersects). Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	4381'	Pennsylvania Drive, PA	2019
16"	6601'	Arch Bishop/S Chester Rd, PA	2019
16"	4399'	Valley Rd/Darlington Rd, PA	2019
16"	7402'	Susquehanna River, PA	2019
30"	3746'	Dix River, KY	2019
16"	3728'	Village Square Dr, PA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
16"	3981'	Glendale Rd & Concord Ave, PA	2019
20"	2236'	Lower Piney Creek, PA	2018
20"	2355'	Joanna Road, PA	2018
12"	1369'	Rocky Point Landing, Jamaica	2018
20"	2209'	Horse Valley Road, PA	2018
20"	7354'	Susquehanna River, PA	2018
16"	2346'	Frankstown Branch-Juniata River, PA	2018
20"	3874'	Waltonville Rd, PA	2018
20"	1337'	Berry Ridge & Old Mill Rd, PA	2018
16"	5869'	Conrail RR, Perth Amboy, NJ	2018
16"	2766'	Hall Street, NJ	2018
16"	1999'	Route-35, Perth Amboy, NJ	2018
20"	5841'	Ohio River MP 33.8, OH/WV	2017
20"	4771'	Raystown Lake, PA	2017
48"	3595'	Road 771 Canal, TX	2017
48"	2222'	Hwy 803, CA Rd & Supply Canal, TX	2017

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
20"	2005'	Hwy 20, PA	2017
36"	6238'	Ohio River, OH/WV	2017
36"	7194'	Ohio River MP 16.07, OH/WV	2017
42"	2431'	Maumee River & State Hwy 24, OH	2017
48"	2807'	Oliver Creek & SH 188, TX	2017
48"	3291'	Meter to LNG Facility, TX	2017
48"	2263'	US Hwy 181/Hwy 35, TX	2017
30"	2278'	Chattahoochee River, GA	2017
24"	2293'	Interstate 20, GA	2017
36"	1606'	Hannahatchee Creek, GA	2017
30"	2757'	Little Rock River, IA	2016
30"	6328'	Big Sioux River, SD/IA	2016
16"	11,397'	Lake Sacagawea South, ND	2016
30"	5714'	James River, SD	2016
30"	2291'	PCN3/Wetland, SD	2016
30"	3352'	Cliff Crossing, ND	2016
30"	1791'	200th St, SD	2016
16"	11,229'	Lake Sacagawea North, ND	2016
30"	1516'	408th & Wetland MP 360, SD	2016
16"	1112'	Palermo Railroad, ND	2016
30"	1407'	Lewis & Clark/274th St, SD	2016
30"	1519'	Turtle Creek, SD	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
36"	1862'	State Highway 50, IL	2015
36"	3461'	Kennedy Ave/Griffith Terminal, IN	2015
36"	2510'	Deep Creek, IL	2015
36"	3011'	Highway 41 & RR, IN	2015
36"	5128'	Lake Ave & RR, IL	2015
10"	4654'	Allegheny River, PA	2015
18"	12,459	Houston Ship Channel, TX	2015
24"	2003'	Highway 612, MS	2014
24"	2750'	Escatawpa River, MS	2014
36"	9040'	Mississippi River, IL/MO	2014
20"	2364'	Missouri River, IA/NE	2014

PROFESSIONAL EXPERIENCE (continued)

1998 – 2011: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States and Canada; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Oversees drilling survey during crossing.

1996 – 1998: **Pipe-Side Superintendent/Pullback Coordinator | Michels Directional Crossings | Brownsville , WI**

Lead person responsible for coordinating the pipe string-out and welding subcontractor located at the exit side of directional drill. Duties include overseeing of pipe string for pullback without delay, maintenance of equipment, material organization, and coordination of labor for specialized pipe coating and testing. Accountable for the critical path of having pipe prepared for pullback. Responsible for maintaining constant communication with Drilling Superintendent during pullback operation and coordinating efforts to pull the pipe in one well-balanced effort.

1995 – 1996: **Operator | Michels Directional Crossings | Brownsville, WI**

Crane operator responsible for safe operation and timely placement of drill stem and equipment. Integral link in the drilling operation, from drill rig set-up, pipe pull back and rig-down of equipment. Also conducted pipe support operations at the exit side during pipeline pullback. Responsible for permitting and mobilization/demobilization of heavy and non-dimensional equipment to drill sites.

1993 – 1995: **Skilled Laborer | Michels Directional Crossings | Brownsville, WI**

Specialized in mechanical repairs, land surveying, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

1987 – 1993: **United States Marine Corps | San Diego, CA**

EDUCATION

1987 **Winnebago Luthern Academy | Fond du Lac, WI**

High School Diploma

Randy Robinson

Midwest Operations Manager

PROFESSIONAL EXPERIENCE

2015 – Present: **Midwest Operations Manager | Michels Directional Crossings | Brownsville, WI**

Manage field crews on the installation of assigned pipeline projects. Specific duties include: material and supply coordinator, field liaison between engineering, estimating and subcontractors to ensure construction compliance, monitor work performance and craft productivity, enforce project quality, safety and environmental issues, regulation and resolution of field construction problems. Plan day-to-day operations onsite and line up the necessary resources to accomplish the plan. Work hand in hand with customers and third party inspection personnel to resolve issues.

2003 – 2015: **Superintendent | Michels Pipeline Construction | Lakeville, MN**

Supervises and assigns duties to directional drill rig crews installing plastic and steel pipelines. Generates daily work progress reports, trains new staff and orders materials and equipment necessary for overall success of the project. Prepares documents on cost, budget, contracts, estimates and other essential aspects of operations.

1993 – 2003: **Crew Foreman | Mueller Pipeline | New Berlin, WI**

Worked in the capacity of a foreman on pipeline related projects. Responsible for safety, schedule and budget of all assigned work. Directly managed crews performing distribution of gas, electric, telephone, and water directional drill instillation. Ensured conformance to specifications, drawings, procedures, and quality.

1987 – 1992: **Line Supervisor | McNeilus Truck & Manufacturing, Inc. | Dodge Center, MN**

1985 – 1987: **Laborer | Donaldson Construction | Dodge Center, MN**

1984 – 1985: **Forklift & Crane Operator | McNeilus Truck & Manufacturing, Inc. | Dodge Center, MN**

1982 – 1984: **Laborer | Steve Kutzler Family Farm | West Concord, MN**

EDUCATION

Marquette University | Milwaukee, WI

EUC Academy for Management

West Concord High School | West Concord, MN

High School Diploma

Kurt Myhre

Western Operations Manager

PROFESSIONAL EXPERIENCE

2020 – Present: **Western Operations Manager | Michels Directional Crossings | Brownsville, WI**

Supervisor of field operation superintendents and directional drilling project managers. Oversee large inventory of drilling tools and materials during storage and field use. Monitors production by Fleet Department of directional drilling personnel and equipment. Duties include coordinating and scheduling the mobilization of equipment, personnel and materials to remote job sites throughout the United States and Internationally. Involved in estimating of various directional drilling projects. Specialize in the engineering design, build and maintenance of directional drilling fleet. Responsible for pilot hole drilling & survey for complicated bores which include implementing and integrating new technology necessary for successful completion of leading edge HDD crossings (i.e. hole-intersects).

2017 – 2020: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production recordkeeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
20"	2236'	Lower Piney Creek, PA	2018
20"	2209'	Horse Valley Road, PA	2018
16"	1912'	Trough Creek Valley Pike/SR 829, PA	2018
20"	1720'	Everett RR-Juniata River, PA	2018
20"	1507'	Trough Creek Valley Pike/SR 829, PA	2018
16"	2346'	Frankstown Branch-Juniata River, PA	2018
20"	1337'	Berry Ridge & Old Mill Rd, PA	2018
20"	1260'	Hollow Road, PA	2017
20"	2307'	Frankstown Branch-Juniata River, PA	2017
20"	4771'	Raystown Lake, PA	2017
36"	7194'	Ohio River MP 16.07, OH/WV	2017

2015 – 2017: **Pipeline Major Maintenance Superintendent | Phillips 66 Pipeline, LLC | Billings, MT**

Supervisor for seven maintenance team members and lead on special projects. Managed the execution for all pipeline and field major maintenance work including the 6 year Division River Mitigation Program.

PROFESSIONAL EXPERIENCE (continued)

2014 – 2015: **Maintenance Craft Team Leader | Phillips 66 Refining | Borger, TX**

Supervisor for area maintenance team and lead on special projects.

2012 – 2014: **Pipeline Major Maintenance Coordinator | Phillips 66 Pipeline, LLC | Missoula, MT**

Provided coordination and oversight for all pipeline maintenance and construction projects for pipeline assets in Montana, Idaho and Washington.

1996 – 2011: **Construction Superintendent | Michels Pipeline (Formally Pilchuck Contractors, Inc.) | Kirkland, WA**

Held multiple positions ranging form laborer to superintendent. Expertise included construction of gas pipelines, phone, fiber optics and installations by directional drilling.

TRAINING & CERTIFICATIONS

- CPR/1st Aid and OSHA 10
- Operator Qualifications for Liquid & Gas Pipelines
- Competent Person Trench Safety Training
- Asbestos Inspector Level Certified
- CEPA Erosion Training
- FMCSA Supervisor Training
- FEMA ICS 100 through 400

EDUCATION

Central Washington University

MICHELS®

Ray J. Viator

Marine Operations Manager

PROFESSIONAL EXPERIENCE

2002 – Present: **Marine Operations Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects across the country. Duties include mobilization of all equipment and personnel to remote job sites: the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment: and necessary record-keeping of plots and production. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
12" Beach Offshore	1,500'	Old Harbour, Jamaica	2018
16" Beach Approach	1,508'	Beverly Harbor, MA	2015
16"	3,27'	Collins Cove, MA	2015
8" Water Approach	7,177'	Charleston, SC	2013
8" Land to Water	7,304'	Charleston, SC	2013
8" Land to Water	3,580'	Charleston, SC	2013
30" Water Exit	5,378'	Hudson River, NY	2012
12" Water to Water	1612'	WBC62, Cameron, LA	2011
36" Beach Approach	3492'	Trinidad/Tabago	2010
42” Land to Water	2208’	Guam	2008
32” Land to Water	1943’	Guam	2007
30” Land to Water	5668’	Trinidad	2006
24”	6183’	Corsicana, TX	2005
30”	2996’	Columbia, LA	2005
24” Beach Approach	3402’	Trinidad & Tobago	2005
12” Beach Approach	2714’	Hadera, Israel	2004
30” Beach Approach	2823’	Dor, Israel	2004
30” Beach Approach	2836’	North Redding, Israel	2004
30” Beach Approach	2728’	South Redding, Israel	2004
30” Water to Water	4300’	Georges Island, MA	2003
30” Water to Water	4631’	Beverly, MA	2003
30” Land to Water	4829’	Salem, MA	2003
30” Land to Water	3041’	Weymouth, MA	2003

1989 – 2001: **Operations Manager | Smit Land & Marine, Inc. | Houston, TX**

Provided pre-contract technical input and operational management of directionally drilled crossings. Contracts completed are briefly described below:

PROFESSIONAL EXPERIENCE (continued)

1985 – 1989: **Rig Superintendent | Smit Land & Marine, Inc. | Houston, TX**
Provided technical input and site supervision of all horizontal directional drilled crossings throughout the United States.

PROJECT PROFILES

Jacob Riis State Park; Construction of 5800’ of 12”steel water main pipe. (2001) – Rockaway, NY

City of Newport | Construction of a 24" HDPE x 2800' and a 20" HDPE with two 4” steel cable ducts x 2800’ crossing of Yaquinna Bay on the Pacific coast at Newport Oregon. The pipelines will be used for sewer/reclaimed water and fiber optic cables.; (2001) – Newport, OR

Georgetown County Water & Sewer District | Design and construction of a 10" HDPE x 4530' crossing of the Waccamaw River near Myrtle Beach South Carolina. The pipeline will be used for potable water supply to Sandy Island.; (2001)

AT&T (Concert Global Networks USA) | Construction of four 5” x 3000’ to 3600’ shore crossings drilled in rock and exiting in 35’ water depths on the Pacific coast of California at Manchester. The 5" dia. drill pipe will be used as a conduit for fiber optic cables linking the US with Japan.; (2000)

Daikin America | Design and construction of a 16" HDPE x 3000' shore crossing into the Tennessee River. The pipeline will be used as a NaCl/water outfall.; (2000) – Decatur, AL

City of Fort Lauderdale | Construction of a 24” x 1230’ steel water main and 7 No. 6” x 1220’ HDPE ducts crossing the Intracoastal Waterway.; (2000) – Fort Lauderdale, FL

City of Austin | Construction of two 24” steel water main crossings for the Davenport Ranch Water Supply Line Project in Austin, Texas: 1640’ Lake Austin (Colorado River) crossing and 1170’ FM 2222 crossing.; (2000)

Solutia | Construction of a 24" x 900' railroad and pipeline corridor crossing.; (1999) – Chocolate Bayou, TX

Exxon Pipeline Company | Construction of a 20" x 3830' shore crossing for the Hoover Offshore Oil Production System.; (1999) – Freeport, TX

Conoco, Inc. | Construction of a 10” x 4650’ crossing of the Old & Lost River Lake to replace an existing ethane line.; (1999) – Mont Belvieu, TX

Exxon Pipeline Company | Construction of the following crude and products pipelines for the “SOLA Project,” 24" x 2300' Mississippi River crossing, Dual 12” x 4300’ Mississippi River crossing, 24” x 4300’ Mississippi River crossing, Dual 12” + 24” x 1200’ Intracoastal Waterway cr; (1998) – Baton Rouge, LA

A.K. Steel | Design and construction of a 16" x 2350' crossing through rock, below Interstate 75 and a creek for gas distribution.; (1998) – Middletown, OH

Dauphin Island Gathering Partners | Design and construction of a 24" x 1800' shore crossing for gas distribution.; (1998) – Mobile Bay, AL

PROJECT PROFILES (continued)

Transco | Design and construction of a 30" x 4000' shore crossing for gas distribution and a 30” x 2800’ water-to-water crossing of Dauphin Island. Drilled from 7' of water to 22' of water.; (1998) – Mobile Bay, AL

Beaufort Jasper Water & Sewer Authority | Design and construction of a 28; (1998) – Hilton Head Island, SC

Amoco Trinidad Oil Company | Design and construction of a 12" x 4030' shore crossing for Trinidad LNG Project.; (1997) – Galeota Point, Trinidad

Dauphin Island Gathering Partners (OEDC) | Construction of a 24” x 4700’ water-to-water crossing. Drilled from 12' of water to 20' of water.; (1997) – Dauphin Island, AL

City of Charleston, CPW | Construction of a 30; (1997) – Charleston, SC

Mobil E & P | Design and construction of a 5" x 5200' and a dual 2" x 5200' water-to-water crossings of Little Dauphin Island and a bundled 6"+2-3"+2" x 900' shore approach in Aloe Bay.; (1996-1997) – Alabama

Texas Eastern Products Pipeline | Construction of an 8" x 5500' crossing of the Red River, an 8" x 570' crossing of the Old River and 2900' of 8" conventionally laid with two (2) valve sites and tie-ins.; (1996) – Louisiana

Shell Pipeline | Construction of a 20” x 4000’ crossing of the Mississippi River at Nairn from outside the flood protection levee.; (1996) – Louisiana

City of Savannah | Construction of a 30” x 5300’ crossing under Presidents Street, Savannah with a 28” HDPE pipeline within a 30” steel casing pipe.; (1996) – Savannah, GA

Dixie Pipeline | Construction of 10" x 2800' gas pipeline crossing the Atchafalaya River.; (1995) – Louisiana

Chevron Pipeline | Design and construction of a 12" x 3500' water-to-water crossing. Drilled from 21' of water to 12' of water.; (1995) – Dauphin Island, AL

City of Charleston, CPW | Construction of a 26” x 5280' crossing of the N. Cooper River with a 24” HDPE pipeline within a 26” steel casing pipe. Construction of a 26” x 5100' shore crossings into 30' of water from Fort Moultrie into Charleston Bay near Fort Sumter again with a 24; (1995) – Charleston, SC

AT&T | Construction of four (4) 5” x 4300’ shore crossings drilled in rock and exiting in 35’ water depths on the Pacific coast of Oregon at Bandon. The 5" dia. drill pipe will be used as a conduit for fiber optic cables linking the US with Japan (the TPC-5 pro; (1995)

Hampton Roads Sanitation District | Construction of five (5) river crossings: Pagan River 24” x 1300’; Bennetts Creek 36” x 1600’; Cypress Creek 30” x 1850’; Nansemond River 30” x 4750’; and Chuckatuck Creek 30” x 3100’.; (1994-1995) – Virginia

PROJECT PROFILES (continued)

Chevron Company USA | Construction of two shore approaches with bundled pipelines from Fourchon with exits in 13' of water: 10"+8" x 1560' and 2-8"+3" x 1350'.; (1994) – Louisiana

Exxon Company USA | Construction of a 12" x 3550' shore approach drilled from Grand Isle with an exit in 12' of water and pipe lay by the SubSea Constructor.; (1994) – Louisiana

Mobile Gas Service Corp. | Construction of a 12" x 2000' gas pipeline crossing of the Mobile River.; (1994) – Alabama

Dixie Pipeline | Construction of a 12" x 3500' gas pipeline crossing of the Amite River.; (1993) – Louisiana

Dixie Pipeline | Construction of a 12" x 2500' gas pipeline crossing of Baton Rouge Bayou in Baker.; (1993) – Louisiana

ARCO | Operational assistance to South East Asian office for the construction of a 26" x 3300' shore approach (drilled from land with pullback from the McDermott derrick / laybarge DB15) and a 26" x 4000' crossing in the open waters of the Java Sea. The 4000' c; (1993) – Jakarta, Indonesia

Chevron Pipeline | Construction of a 20" x 1600' crude oil pipeline replacement crossing of a ship channel in open waters in the approaches to Gulfport. Drilled from lift-boat barges and pullback from a laybarge in water depths of 20'.; (1992) – Mississippi

Corpoven | Construction of a 36" x 4450' pipeline crossing of the Rio Orinoco at Puerto Ordaz.; (1992) – Venezuela

BP Exploration | Construction of 3-12" pipeline bundle under Dauphin Island with a drilled length of 3900'. Drilled from self elevating platforms (lift-boats) and pullback from a laybarge in water depths of 14' and 20' respectively.; (1991) – Alabama

Lagoven | Installation of a 36" x 3300' pipeline crossing of the Rio Morichal Largo on the "orimulsion" trunkline project.; (1991) – Venezuela

Lagoven | Construction of a 36" x 1700' pipeline crossing of the Rio Tigre as part of the "orimulsion" project.; (1991) – Venezuela

Shell Pipeline | Construction of a 4" x 3500' crossing of the Saginaw River in Bay City.; (1991) – Michigan

Columbia Gas | Installation of two 20" diameter pipeline river crossings - Mantua Creek (1650') and Raccoon Creek (1550').; (1990) – New Jersey

Sun Pipeline | Replacement of an 8" x 2200' gas pipeline by drilling through rock on hillside.; (1990) – Ohio

Shell Pipeline | Construction of a 10" x 1500' crossing of the Kawkawlin River.; (1990) – Michigan

Amoco Gas | Construction of a 16" x 3900' crossing of Wolf Creek in Dollar Bay, Texas City.; (1990) – Texas

PROJECT PROFILES (continued)

City of Norfolk | Construction of a 20" x 1600' water pipeline crossing of the Elizabeth River in Norfolk.; (1990) – Norfolk, VA

Seagull | Installation of two beach crossings (drilled from land) and two water-to-water crossings (drilled from spud barges) for a 1-10" and 3-8" pipeline bundle across the Houston Ship Channel at Baytown. The pipelines were pulled from a shallow draft laybarge. ; (1990) – Texas

Dixie Pipe Line | Construction of a 12" x 3000' emergency replacement crossing of the Tangipahoa River at Zachary.; (1990) – Louisiana

City of Chesapeake | Construction of a 24" x 1600' water pipeline crossing of the Elizabeth River at Chesapeake.; (1990) – Chesapeake, VA

Dixie Pipe Line | Installation of a 12" x 2300' crossing of the Comite River at Baton Rouge.; (1990) – Louisiana

Phillips Petroleum | Construction of two 12" diameter crossings near Houston: a 700' crossing of the Brazos River and a similar length crossing of Clear Creek.; (1990) – Texas

ARKLA | Installation of two 12" crossings near Fort Coffee: 2000' at the Arkansas River and 950' at the Poteau River.; (1990) – Oklahoma

Texas Power | Construction of three 16" crossings at Freeport as part of Wacker Oil's offshore development: 1600' Ship Channel crossing, 2300' Intracoastal Waterway crossing and 2700' shore approach.; (1989) – Texas

Transco | Installation of two 20" diameter crossings at Corpus Christi: an 1800' highway crossing and a 2000' lagoon crossing.; (1989) – Texas

Dixie Pipeline | Installation of a 12" x 1800' crossing of the Pearl River near Columbia.; (1989) – Mississippi

Union Camp | Construction of two Savannah River crossings: 42" x 1850' and 10"+6" bundle x 1850'.; (1989) – Georgia

Contel | Construction of a 5" x 750' crossing of the Altamaha River crossing near Jessup.; (1989) – Georgia

Phillips Petroleum | Installation of a 20" x 1800' crossing of the Brazos River at Freeport.; (1989) – Texas

Phillips Petroleum | Construction of two 2300' crossings of the Osage River at Jefferson City for 12" and 6" pipelines.; (1989) – Missouri

AT&T | Installation of five crossings with 5" conduit between Little Rock and Tulsa: Little Maumelle River - 1100' and 650', Fourche La Fave River - 550', Arkansas River - 2000' and Petit Jean River - 550'.; (1989) – Arkansas & Oklahoma

MICHELS®

Robert Spennati

Assistant Operations Manager

PROFESSIONAL EXPERIENCE

2020 – Present: **Assistant Operations Manager | Michels Directional Crossings | Brownsville**

Assistant Supervisor of field operation superintendents and directional drilling project managers. Oversee large inventory of drilling tools and materials during storage and field use. Monitors production by Fleet Department of directional drilling personnel and equipment. Duties include coordinating and scheduling the mobilization of equipment, personnel and materials to remote job sites throughout the United States and Internationally. Involved in estimating of various directional drilling projects. Specialize in the engineering design, build and maintenance of directional drilling fleet. Responsible for pilot hole drilling & survey for complicated bores which include implementing and integrating new technology necessary for successful completion of leading edge HDD crossings (i.e. hole-intersects). Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
16"	6976'	Matlock/W Chester Rd, PA	2020

1993 – 2020: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production record-keeping, and overall on-site management.

Diameter	Length	Location	Year
16"	4381'	Pennsylvania Drive, PA	2019
16"	6601'	Arch Bishop/S Chester Rd, PA	2019
16"	4399'	Valley Rd/Darlington Rd, PA	2019
16"	3728'	Village Square Dr, PA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
16"	3981'	Glendale Rd & CConcord Ave, PA	2019
12"	1070'	Indiana Harbor Canal - 12" & 10" Bundle, IN	2018
20"	7354'	Susquehanna River, PA	2018
20"	3874'	Waltonville Rd, PA	2018
16"	1198'	Harrisburg Pike, PA	2017
20"	2205'	Hwy 15, PA	2017
48"	2807'	Oliver Creek & SH 188, TX	2017
48"	2349'	Chiltipan Creek, TX	2017
48"	2263'	US Hwy 181/Hwy 35, TX	2017

PROFESSIONAL EXPERIENCE (continued)

36"	3829'	Flint River, GA	2016
12"	3144'	Monkton Swamp, VT	2016
12"	2765'	Lewis Creek, VT	2016
12"	1491'	Drinkwater Road, VT	2016
12"	2856'	Wetland Replacement, OH	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
24"	3716'	Barbour's Cut, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
24"	5908'	Tabbs Bay, TX	2015
10"	4654'	Allegheny River, PA	2015
28"	1741'	Lafayette River, VA	2014
12"	2557'	Arkansas River, AR	2014
20"	1193'	SR-265/Leatherwood Rd, OH	2014
36"	1277'	Bear Creek, IL	2013
36"	2264'	Hwy 336 & 172, IL	2013
30"	4987'	Monksville Reservoir, NJ	2013
42"	3008'	I-95 & Tidal Wetlands, NJ	2013
42"	4441'	Goethals Bridge, NY	2013
30"	8101'	Kill Van Kull River, NY/NJ	2013

1988 – 1993: **Labor/Operator/ Foreman | Henkles & McCoy**

Fiber Work

1987 – 1988: **Drywall/Construction**

1985 – 1987: **Gas work/Service Lines | Circle M Construction**

1978 – 1988: **United States Army**

1978-80, Germany, 1980-82 Georiga, 1982-84 Germany, 1984-85 Georiga, 1985-88 US Army Reserves PA

EDUCATION

1978 **Mount Union High School**

High School Diploma

MICHELS®

Paul Krings

Senior Equipment and Logistics Manager

PROFESSIONAL EXPERIENCE

2019 – Present: **Senior Equipment and Logistics Manager | Michels Directional Crossings | Brownsville, WI**

Strategically manage operations in overseeing the coordinating of equipment and personnel to project jobsites. Plan, direct, coordinate purchasing, distribution and forecasting of daily operations. Oversee equipment repair and building of new, inventory control, material handling, customer service, coordinate transportation and hiring of employees. Ensures that project milestones/goals are met and adhering to approved budgets.

Provides direct supervision to supervisors and field personnel in daily operational activities, maintains regular on-site contact to assure services being performed are within Company guidelines and in accordance with consumer specifications.

Reviews daily reports and time tickets to determine hours worked, mechanical problems, etc. to effectively plan and schedule daily operational activities.

Ensures routine and preventative maintenance and repairs to keep all equipment in optimum operating condition, thus minimizing down time.

1996 – 2019: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation.

Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
36"	5841'	Ohio River MP 33.8, OH/WV	2017
25"	5788'	Hwy 41/45, WI	2017
30"	1614'	Mill Creek, IA	2016
20"	996'	O'Plaine Road, IL	2016
30"	6119'	Lake Whitney, TX	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
24"	3716'	Barbour's Cut, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
24"	5908'	Tabbs Bay, TX	2015
36"	3461'	Kennedy Ave/Griffith Terminal, IN	2015
36"	2510'	Deep Creek, IL	2015

PROFESSIONAL EXPERIENCE (continued)

18"	12,459	Houston Ship Channel, TX	2015
1x6" & 2x4" Bundle	1568'	Bore #3, Nageezi, NM	2014
2 x 4" Bundle	1809'	Hwy 550, Nageezi, NM	2014
6"	6999'	Lake Navajo/San Juan River, NM	2014
36"	9040'	Mississippi River, IL/MO	2014
24"	2020'	Unnamed Creek, AL	2014
24"	2884'	Hatchett Creek, AL	2014
36"	1277'	Bear Creek, IL	2013
30"	4987'	Monksville Reservoir, NJ	2013
42"	4441'	Goethals Bridge, NY	2013
30"	8101'	Kill Van Kull River, NY/NJ	2013
30"	3042'	Wyalusing, PA	2012
36"	4505'	Medicine Hat, Alberta Canada	2012
24"	2458'	Jonestown, PA	2012
36"	4992'	Melville, LA	2011
42"	5732'	Melrose, LA	2011
24"	6091'	Homestead, FL	2011
16"	2566'	Hitchcock Plaza, SC	2010
42"	2144'	Lafourche, LA	2010

1992 – 1996: **Fluid Dynamics Technician and Laborer | Michels Directional Crossings | Brownsville, WI**

Solely responsible for mixing bentonite solution to the right consistency with an emphasis in directional drilling. Proficient working in and around drilling rigs and in the overall operation as an integral member of the specialized team. Multi-capable to assist with all types of drilling tasks and familiar with repair, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, steer tool wireline connections, couplings, etc. Involved in various types of directional drilling projects, line and cable, water and setting manholes.

TRAINING & CERTIFICATIONS

- OSHA 510 - OSHA Standards for Construction
- 40-Hour Hazmat Training – Approved for PPE Level A
- Safety Trained – Competent Person
- Veriforce and Various DOT Pipeline Safety Training
- Forklift Training
- CDL with ABCDMNT Endorsements

EDUCATION

1989 **Moraine Park Technical College**

Mig and Tig Welding; Rod, Wire and Brazing Applications;Torch Use, Cutting and Welding

1984 **Waupun High School | Waupun, WI**

High School Diploma

MICHELS®

Eric McBrair

Direct Pipe Equipment Manager

PROFESSIONAL EXPERIENCE

2017 – Present: **Direct Pipe Equipment Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for equipment logistics, as well as assisting with the oversight and management of direct pipe field personnel. Support Direct Pipe field operations by developing, initiating and managing appropriate action plans to ensure quality and efficient performance of Direct Pipe resources. Duties include but not limited to: Collaborate with field operations to determine most suitable resources and means and methods of construction, troubleshoot equipment operation issues. Develop, create and maintain maintenance protocols to be utilized across the division. Coordinate equipment needs between project managers and prioritize work assignments. Manage and coordinate division equipment assets, ensuring proper allocation and efficient utilization.

2011 – Present: **Superintendent/DIRECT PIPE | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling Direct Pipe boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for direct pipe & directional micro-tunnel operations as well as directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
20"	826'	Qu'Appelle River, Canada - HK750PT Installation	2017
36"	1,535'	Calumet River, IL - HK300PT Installation	2017
36"	827'	Leslie Street, Ontario, Canada - HK 300PT Installation	2015
42"	1,299'	Lisgar Meadowbrook, Ontario, Canada - HK 750PT Installation	2015
48"	4,039'	Dow Barge Channel, Clute TX - HK750PT Installation	2015
36"	1,002'	Hwy 225, Deer Park, TX - HK300PT Installation	2015
36"	1,092'	Lubrizol Drainage, LaPorte, TX-HK300PT Installation	2015
48"	2,455	Rio Grande River, El Refugio, TX-HK750PT Installation	2014
42"	1,200'	Railroad Crossing, Groves, TX-HK750PT Installation	2014
42"	1,050'	Beaver River, Alberta, Canada-HK750PT Installation	2013
42"	470'	I-84, Westfall, PA - HK750PT Installation	2013
48"	333'	18th Street, Jersey City, NJ - HK750PT Installation	2012

PROFESSIONAL EXPERIENCE (continued)

30"	5,378'	Hudson River, Manhattan, NJ/NY - HK300PT Assist	2012
36"	6,500'	St. Johns River, Jacksonville, FL - HK300PT Assist	2012
42"	426'	Chemung River, Corning, NY - HK750PT Installation	2011

2011 – 2014: **Operator/Surveyor HDD | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation.

2003 – 2011: **General Laboror | Michels Directional Crossings | Brownsville, WI**

Experience in working on and around directional drilling rigs as an integral member of a specialized team. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs; hydraulics; fluids; set-up and operation of drill motors; power generators; mud pumps; bentonite mixers; drill pipe; reamers; couplings; and overall equipment maintenance and operation.

2001 – 2003: **House Builder**

EDUCATION

2001 **Fox Valley Technical College | Appleton, WI**

2000 **Berlin High School | Berlin, WI**

High School Diploma

Scott Nehls

HDD Logistics QA/QC Manager

PROFESSIONAL EXPERIENCE

2009 – Present: **HDD Logistics QA/QC Manager**

Michels Directional Crossings | Brownsville, WI

Responsible for truck load out and receiving, organization of HDD tooling and equipment, coordination of drill stem supply, tracking and calibration, new hire training, orientation, dispatch, manage divisional labor pool, tractor trailer inspection/maintenance program implementation, safety training/OQ program implementation, on-site review of HDD personnel & operations.

1989 – 2009: **Project Manager**

Michels Directional Crossings | Brownsville, WI

Responsible for coordinating and drilling directional boring projects across the country. Duties include mobilization of all equipment and personnel to remote job sites; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Provides safety training and performs evaluations. Assists with estimating and bid preparation. Some more noteable crossings include, but are not limited to:

Diameter	Length	Location	Year
20” & 42”	1544’ & 2127’	Wisconsin River, WI	2007
20” & 42”	2530’ & 2299’	Chippewa River, WI	2007
20” & 42”	2280’ & 2294’	Flambeau River, WI	2007
42” (2)	2294’ & 2775’	Lake Arrowhead, WI	2007
24”	2172’	Biscayne Bay, FL	2006
30”	2453’	Jackson Creek, WI	2006
30”	1301’	Jackson Creek, WI	2006
30” (2)	1400’ & 2661’	Rausonville & Willis Rd, MI	2005
24”	2429’	Kinnickinnic River, WI	2005
36” (3)	1276’ to 1531’	Clarkston, MI	2005
8”	1374’	Detroit, MI	2005
12” (10)	375’ to 750’	Lansing, MI	2004
16” (2)	2723’ & 2925’	Packard Rd & Washtenaw Ave, MI	2004
22”	2308’	St. Joseph River, MI	2004
30” (2)	1532’ & 1661’	Darien, WI	2004

PROFESSIONAL EXPERIENCE (continued)

6" (6)	1564' to 1880'	Lean, WI	2004
12" (3)	1668' to 3524'	New York/New Jersey	2003
30"	1673'	Huron River, MI	2002
36"	3395'	Huron River, MI	2002

1986 – 1989: **Superintendent**

Michels Mid-America Line & Cable | Brownsville, WI

Working foreman responsible for managing utility construction crews. Accountable for tie-ins behind our rail-mounted plow which consists of horizontal boring operations and dig downs. Implemented supervisory skills for material and labor coordination.

1980 – 1986: **Equipment Operator**

Michels Mid-America Line & Cable | Brownsville, WI

Rubber tire backhoe operator responsible for location of utility line obstructions and the timely placement of telephone pedestals to keep production oriented cable placing operations flowing smoothly.

1977 – 1983: **Marine Corp Sergeant/Section Leader**

Active Reserve Company-G, 24th Marines, 4th Division | Madison, WI

1977 – 1980: **General Laborer/Operator**

Michels Mid-America Line & Cable | Brownsville, WI

General laborer responsible for boring operations for telephone cable with various types of equipment.

1973 – 1977: **Project Set-Up Coordinator**

Michels Pipeline Construction | Brownsville, WI

Involved in coordinating materials and supplies for various job locations. Helped in attaining storage yards for equipment and supplies around the United States. Responsible for establishing accounts at various retailers and suppliers within the job working area.

INDUSTRY INVOLVEMENT

- Midwest Energy Association (MEA) Evaluator

EDUCATION

1977 **Lomira High School | Lomira, WI**

High School Diploma

Sean O. Nicholson

Vice President of HSE

PROFESSIONAL EXPERIENCE

2017 – Present: **Vice President of HSE | Michels Corporation | Brownsville, WI**

2007 – 2017: **Director of Health & Safety | Michels Corporation | Brownsville, WI**

Assigned the responsibility of developing, implementing and maintaining the health, safety and environmental program for Michels Pipeline Construction and Michels Directional Crossing divisions of Michels Corporation. Advise executive management pertaining to matters of safety and health, and monitor day-to-day operations to ensure compliance with applicable regulatory requirements and the company's health and safety policies and procedures.

2000 – 2007: **Corporate Director HSE/Risk Management | Mears Group, Inc.**

Responsible for all facets of HSE initiative compliance and training on an international level. Complied and reviewed incident/injury data to determine trends and develop corrective actions and/or programs to prevent recurrence and improve performance. Managed/directed all aspects of litigation issues and legal proceedings. Conducted investigations on suspected workers' compensation and property damage fraud cases. Developed and audited HSE programs and policies to ensure compliance with regulatory agencies governing the energy industry.

1999 – 2001: **Regional Manager of Safety Training & Environmental Compliance | 360networks Inc.**

Planned, implemented and coordinated programs to reduce and eliminate occupational injuries, illnesses, fatalities and financial losses. Developed accident prevention, loss control systems and programs for incorporation into operational policies of the organization. Duties also included, preparing and presenting various required training; performing routine environmental and safety inspections; leading investigations of accidents and injuries.

1999: **Clearing Foreman–Railway Services Division | 360networks Inc./Ledcor Industries**

Trained and managed 45 flagmen and achieved significant improvements in their productivity and safety. Conferred with department heads concerning problems such as near misses and accidents, and recommended measures and procedure to improve safety.

1998 – 1999: **Lead Hand | Ledcor Communications**

Assisted superiors in planning and coordinating activities of workers engaged in constructing, installing and inspecting long haul fiber optic infrastructures. Inspected work in progress to ensure the work conformed to company specifications.

TRAINING & CERTIFICATIONS

- Certified HSE Auditor with the Albert Construction Safety Association
- Completed "Auditor Certification Training Program" with NCCER
- OSHA 500 and 510
- OSHA Outreach Instructor
- Certified in HSE Law from the Institute of Applied Management and Law
- Certified Defensive Driving Instructor with National Safety Council
- Certified Instructor "Speed Shore" (Competent Person, Trenching and Excavation)

TRAINING & CERTIFICATIONS (continued)

- Certified Instructor–American Traffic Safety Services Association
- Traffic Control Supervisor and Technician
- “TaprooT” Investigations Course
- Certified Medic First Aid/CPR
- Master Trainer–NCCER

EDUCATION

1997 **Trent University | Ontario, Canada**

Bachelor of Arts (Honors)

MICHELS®

Jason Pedersen, CSM

Safety Director

PROFESSIONAL EXPERIENCE

2017 – Present: **Safety Director | Michels Corporation | Brownsville, WI**

The primary function of the HSE Director is to work within corporate strategies and policy frameworks to design, implement and direct safety programs, guidelines and procedures. This position provides personal leadership and sets an example of following all safe work practices and procedures. Regularly interfaces with Senior Management, peers, subordinates and client personnel, overseeing project site HSE plans and alliance with corporate values, requirements and initiatives.

The primary responsibility is to coordinate the company's safety activities including:

- Develop procedures and lead the implementation of processes which have been established to ensure compliance with applicable standards, requirements and identified practices. Ensure Michels Corporation has effective programs to protect the safety of employees and comply with or exceed regulations through personal observation, HSE Manager review and audits.
- Demonstrate leadership by giving clear, complete, and accurate information on HSE requirements, process standards, potential health and safety hazards, and potential process difficulties. Interface with operations providing leadership and coaching to facilitate continuous HSE performance improvement.
- Participate in incident/injury investigations, including on-site presence, preparation of reports, analysis and exhibits. Identify regulatory and civil parties needing involvement.
- Work with all employees to instill a safe and environmentally conscientious work environment, determining the awareness level, discussing policies and procedures, advising on the best means of following those policies and procedures and coaching to improve behavior as needed.
- Recommend, implement, and manage safety devices, equipment, and/or products that help protect employees and customers and mitigate losses.
- Work closely with Operations, Quality Assurance, HR, Risk, and various other departments to enhance HSE systems. Communicate HSE information to key management as directed.

2013 – 2017: **HSE – Senior Manager, Compliance Specialist | Michels Pipeline Construction | Brownsville, WI**

Manage the HSE Team. Carry out supervisory responsibilities in accordance with the organization's policies and applicable laws. Responsibilities include interviewing, hiring, and training employees; planning, assigning, and directing work; providing feedback; rewarding and disciplining employees; addressing complaints and resolving problems. Identify and leverage HSE best practices across divisions. Maintain open communication with divisional and department leads to ensure coordination of HSE needs. Advises HSE Director on Health, Safety, and Environmental-related matters throughout the corporation. Review project safety requirements prior to bid and advise division on site specific training or equipment that may be needed. Is present at or delegates to HSE Coordinators to be present during regulatory site visits. Assist with and participate in client sales presentations and formal client meetings. Represent Michels at conferences, committees, and customer meetings. Work with Information Systems and Technology to identify and implement tools to drive better communication, process-management, and reporting tools. Other duties as assigned.

PROFESSIONAL EXPERIENCE (continued)

2006 – 2013: **Senior Project HSE Manager | Michels Pipeline Construction | Brownsville, WI**

2006: **IL & IA North West Region Local 309 Steward | Minnesota Limited, Inc. | Big Lake, MN**

2005: **IL & IA North West Region Local 309 Steward | J & L Pipeline Services, Inc. | Tipton, IA**

1996 – 2004: **Safety Coordinator/Foreman | Murphy Brothers, Inc. | East Moline, IL**

1989 – 1995: **United States Navy**

1988 – 1989: **Laborer/Oiler | Southern Gas Pipeline Company | Corpus Christie, TX**

PROJECT PROFILES

Dominion | Atlantic Coast Pipeline (ACP), Spread 2-1 and 6; Approximately 71.9 miles of 42" OD mainline pipeline. - Buckhannon, WV and Farmville, VA

Enbridge Energy | NEXUS Gas Transmission, Spreads 4, 3 and 1; Approximately a total of 177.2 miles of 36" steel pipeline. - Belleville, MI, Northwood, OH and Canton, OH

Sunoco | Mariner East II - PPP3, Spread 4; Approximately62.9 miles of dual line 20" and 16" steel pipeline. – Hollidaysburg & Shirleysburg, PA

Williams | Atlantic Sunrise Pipeline (ASR) - Spread 1; 37 miles of 30" – Tunkhannock, PA

Enbridge Energy | Line 3 Replacement, Segment 18; 13 miles of 36" – Superior, WI

Energy Transfer Company | Dakota Access Pipeline Project; 380 Miles of 30" pipe along three mainline spreads, thirteen HDD and three pump stations in Il, IA, SD, and ND

Enbridge | Flanagan South Pipeline Project; 300 miles of 36” – Illinois & Missouri

TransCanada | Keystone XL Gulf Coast Project; 360 miles of 36” – Texas & Oklahoma

Shell Appalachia | 70 miles 20” & 10”; Pennsylvania

Energy Transfer | Tiger Expansion Project; 27 miles 42” – Louisiana

Enbridge | Hot Works Line 6B Replacement Project; 67 Miles 30” – Michigan

Energy Transfer | Tiger Pipeline Project; 100 miles 42 – Louisiana

Enbridge | Alberta Clipper Project; 110 miles 42” – North Dakota & Minnesota

Enbridge/Michels/GPP | Southern Lights; 310 miles 42” & 20” – Wisconsin & Illinois

El Paso/Michels | Two Launcher Stations; 10 miles 30” & 16” – Wisconsin

Kinder Morgan | Rockies Express Project; 53 miles 42” – Ohio

Lake Head | 120 miles 36”; Illinois & Wisconsin

Alliance Ltd | 150 miles 36”; Illinois & Iowa

El Paso | 10 miles 20”; Indiana

TRAINING & CERTIFICATIONS

- Certified Safety Manger/Trainer (CSM)
- Certified Occupational Safety Specialist (COSS)
- DNV Incident Investigation Certified
- Safety Auditor Certificate (SAC)
- OSHA 502 - Update for Construction Trainers
- OSHA 500 - Trainer Course for the Construction Industry
- OSHA 510 - OSHA Standards for Construction
- OSHA 10- and 30-Hour Certified Trainer
- Accident Investigation Technician (AIT)
- Hazard Analysis Techinician (HAT)
- Safety Inspections Technician (SIT)
- CMC Confined Space Rescue
- Reasonable Suspicion Trainer
- HAZWOPER Certification 4 Hour
- NCCER Instructor / Performance Evaluator
- Certified MES Q41 Evaluator
- AMSE Rigging Trainer (Crosby)
- Hazardous Material Trainer
- National Safety Council Defensive Driving Certified Instructor
- ATSSA Flagger Instructor
- ATSSA Certified Traffic Control Supervisor/Technician
- Medic First Aid/CPR/AED Trainer
- Respirator Fit Testing & Certification

Mark Franz

Environmental Manager

PROFESSIONAL EXPERIENCE

2009 – Present: **Environmental Manager | Michels Corporation | Brownsville, WI**

Responsible for environmental due diligence, oversight and compliance for mainline spreads. Function as environmental liaison between Michels and Client.

2009: **Environmental Coordinator | Michels Corporation | Brownsville, WI**

Environmental oversight of Michels-Spread 2 of the Alberta Clipper Pipeline Project for client Enbridge Energy. Project consists of installation of 64 miles of 36” mainline pipeline crossing through 41 permitted waterbodies and 136 wetlands in northwestern Minnesota. Responsible for environmental crew management, and support and oversight for field construction issues. Functioned as environmental liaison between Michels and Enbridge.

2006 – 2009: **Environmental Manager | Global Pipeline Partners, LLC | New Berlin, WI**

Environmental oversight of Phase 1 of the alliance agreement between Global Pipeline Partners LLC (Michels Pipeline, Welded Construction, Precision Pipeline and U.S. Pipeline) and client Enbridge Energy. Phase 1 consisted of installation of 321 miles of 20” and 42” mainline pipeline crossing through over 800 permitted wetlands and 230 permitted water bodies. Responsible for contractor environmental planning, support and oversight for field construction issues. Function as environmental liaison between Enbridge and each of the four contractors. Also responsible for preparation of necessary baseline information, environmental variance submittals and management of contractor compliance issues related to the projects Wisconsin Department of Natural Resources and US Army Corp of Engineers execution permits.

2005 – 2006: **Natural Resource Specialist | Michels Corporation | Brownsville, WI**

Responsible for environmental due diligence, wetland delineations and assessments, storm water management, habitat assessments, regulatory permitting, threatened and endangered species survey, and water resource management. Proficient in native vegetation identification in the midwestern and southeastern United States, and in the use of AutoCAD and ArcGIS.

2004 – 2005: **Environmental Specialist/Project Manager | Earth Tech**

1999 – 2004: **Reclamation Specialist/Project Manager | Michels Corporation | Brownsville, WI**

1996 – 1999: **Ecologist | Biological Research Associates, Ltd.**

1994 – 1996: **Biologist | Sarasota County Department of Natural Resources**

1992 – 1994: **Environmental Scientist | Reynolds Smith and Hill, Inc.**

1990 – 1992: **Assistant Biologist | Florida Department of Environmental Protection**

1984 – 1987: **Assistant Planner | Wiles, Dailey, Kane & Associates**

EDUCATION

New College of the University of South Florida | Sarasota, FL

Bachelor of Arts, Biology/Environmental Science

Edward J. Dye

HDD Safety Coordinator

PROFESSIONAL EXPERIENCE

2017 – Present: **HDD Safety Coordinator**

Michels Directional Crossings | Brownsville, Wisconsin

Develop and implementation of on-site procedure, emergency response plan, on-site safety inspections, equipment inspections and reporting to supervisors. Assigned the responsibility for coordinating and maintaining the company safety program. Advises management in matters of safety and health, and monitors day-to-day operations to ensure that the company's safety policies and procedures are followed.

2016 – 2017: **HSE Coordinator**

Michels Pipeline Construction | Brownsville, WI

Promotes Michels' Core Values, leads by example and is an ambassador for HSE Department and Michels Corporation. Assigned the responsibility for coordinating and maintaining the company safety and health program. Advises management in matters of safety and health, and monitors day-to-day operations to ensure that the company's safety policies and procedures are followed. The primary responsibility is to coordinate the company's safety activities are: daily job safety audits, ensure safety on all construction projects, edit and submit safety plan for projects, Ensure all personal protective equipment in on site when necessary, new hire orientation process, assist with organization of annual safety training, tailgate safety meeting coordination, and write up job hazard analysis. Represents Michels during regulatory inspections, client audits and meetings.

2013 – 2016: **Foreman**

Michels Pipeline Construction | Brownsville, WI

Direct activities of workers pertaining to the repair, maintenance, construction, installation, and reconditioning of pipelines. Determine tie-in locations and coordinate their installations with operating units on project sites while providing leadership and support in field production operations. Lead the crews in quality, safety and environmental compliance.

2006 – 2013: **Foreman**

River City Cutting | River City Cutting, IA

Led a multifunctional team of 6 employees on the demolition and precision cutting of concrete. Bid projects by evaluating blueprints, timelines, square footage, and customer operational needs. All projects under my supervision met their timeline, came in at or under bid, and turned a profit for the company. Performed work at numerous types of project sites such as military installations, nuclear power plants, hospitals, schools, bridges, roads, courthouses, jails, and multiple lock and dams. Taught formal classes to apprentices through the union hall on the use of core drills, concrete chainsaws, walk-behind saws, and remote control wall saws. Conducted interviews and background checks on new employees.

2002 – 2006: **Laborer**

Valley Construction | Rock Island, IL

TRAINING & CERTIFICATIONS

- OSHA 30-Hour
- OSHA 510 - OSHA Standards for Construction

TRAINING & CERTIFICATIONS (continued)

- OSHA 500 - Trainer Course for the Construction Industry
- OSHA 3015 - Excavation, Trenching and Soil Mechanics
- Construction Plan Reading Course
- Power Industrial Truck Operations
- Coating Maintenance Course
- Scaffold Builder
- Locating Pipelines
- First Aid/CPR Certified
- Damage Prevention During Excavation First Aid
- Traffic Control Certification
- Leak and Strength Test Course
- Cathodic Protection Systems
- Backfilling
- Underground Clearance
- Receiving Pigs for Lines In-Service
- Internal Devices for Lines In-Service
- Mechanical Joints

Michael Miller

HSE Safety Coordinator

PROFESSIONAL EXPERIENCE

2019 – Present: **HSE Safety Coordinator | Michels Corporation | Brownsville, WI**

Promotes Michels' Core Values, leads by example and is an ambassador for the HSE Department and Michels Corporation. Assigned the responsibility for coordinating and maintaining the company safety and health program. Advises management in matters of safety and health, and monitors day-to-day operations to ensure that the company's safety policies and procedures are followed. The primary responsibility is to coordinate the company's safety activities, which include but are not limited to: daily job safety audits, ensuring the safety on all construction projects, editing and submitting safety plans for projects, ensuring all personal protective equipment is on site when necessary, new hire orientation process, assisting with the organization of annual safety training, tailgate safety meeting coordination, and writing up job hazard analysis. Represents Michels during regulatory inspections, client audits and meetings.

2014 – 2018: **Safety Coordinator | LMC Industrial Contractors, Inc.**

Responsible for coordinating all safety efforts in both LMC's 550,000 square foot facility, as well as on all active sites. Evaluating all personnel to be Veriforce certified. Properly practice respiratory protection, SABC, confined space principals, hazardous abatement procedures, fall protection practices, trenching & excavation safety and compliance, fatigue management, critical lifts, rigging best practices, electrical safety/LOTO, and proper equipment use. Forklift operator certification and Forklift operation trainer. Conduct new hire orientations for all employees and subcontractors. Lead daily safety meetings for all shop and field work. Perform weekly jobsite safety assessments and reporting any deficiencies and near misses/violations. Perform accident investigations/Root Cause Analysis and enforcement of all environmental, safety, health and accident prevention procedures. Reporting of near hits, spills, releases, and safety or environmental non-compliance issues. Create and review task specific safety analysis/JSA/JHA.

2014: **Safety Coordinator Assistant | Holloman Corporation**

Ensure strict compliance with all federal, state and local safety requirements. Properly practice respiratory protection, SABC, confined space principals, hazardous abatement procedures, fall protection practices and proper equipment use.

2013: **Fleet Vehicle Maintenance Inventory/Tracking | Somerset Regional Water Resources**

Maintained inventory tracking for 70+ company vehicles. Ensure safety, inspection, and scheduled maintenance for all assets.

1993 – 2013: **Aircraft Electrical & Environmental Systems Craftsman/Quality & Safety Inspector | United States Air Force**

Performed and supervised aircraft electrical functions and activities. Compiled maintenance data and daily safe maintenance practice evaluations. Performed off equipment maintenance of system components and associated/special test equipment. Performed cryogenic maintenance on mobile servicing units.

TRAINING & CERTIFICATIONS

- Crosby Communication 4 Hour Fundamentals of Rigging
- Erosion and Sediment Control Lead Certified

TRAINING & CERTIFICATIONS (continued)

- Erosion & Sediment Control Training
- OSHA 10-Hour – Construction Safety & Health
- OSHA 30-Hour Construction
- OSHA 500 - Trainer Course for the Construction Industry
- OSHA 510 - OSHA Standards for Construction
- OSHA 511 - Occupational Safety & Health Standards for General Industry
- OSHA 5810 - Hazards Recognition and Standards for On-Shore Oil and Gas Exploration and Production
- Rigging Training

EDUCATION

USAF Non-Commissioned Officer Academy

1998 **Airforce Leadership School**

1996 **Community College of the Air Force**

Business Associates Degree

1993 **Aircraft Electrical & Environmental System Technical School**

Honors

Spencer Rusk

PROFESSIONAL EXPERIENCE

2018 – Present: **HSE Safety Coordinator | Michels Corporation | Brownsville, WI**

Promotes Michels' Core Values, leads by example and is an ambassador for the HSE Department and Michels Corporation. Assigned the responsibility for coordinating and maintaining the company safety and health program. Advises management in matters of safety and health, and monitors day-to-day operations to ensure that the company's safety policies and procedures are followed. The primary responsibility is to coordinate the company's safety activities, which include but are not limited to: daily job safety audits, ensuring the safety on all construction projects, editing and submitting safety plans for projects, ensuring all personal protective equipment is on site when necessary, new hire orientation process, assisting with the organization of annual safety training, tailgate safety meeting coordination, and writing up job hazard analysis. Represents Michels during regulatory inspections, client audits and meetings.

2017 – 2018: **Welder Helper | Michels Corporation | Cedar Rapids, IA**

- Local 25 Plumbers/Pipefitters Welder Helper. Extra duties include sandblasting & painting pipe, hot wraps and applying epoxy coatings in compliance with OSHA.
- Performed pipeline construction removal and installation e.g. digging, backfilling, final grading while being vocal with peers to make sure Michels safety standards and policies were followed.
- Involved in pigging operations to ensure pipe is clean and inspected ensuring it is up to standards.
- Wrote JSA's, step back for safety cards and actively participated in safety meetings.

2009 – 2018: **Firefighter & EMT | Geneseo Fire Protection District | Geneseo, IL**

- Serve as both firefighter and EMT supporting basic life support/trauma and medical patient care.
- Trained in fire suppression, structural fire classes, vehicle and confined space training as well as vehicle extrication.
- Conduct and teach fire safety education and first aid throughout the area schools.

2005 – 2018: **Automotive Collision Repair Technician | Pro/Tech Auto Body Inc. & Pinks' Paint & Body | Geneseo, IL**

- Analyzed requirements on fulfilling estimation paperwork, while maintaining a budget and completing the job within the time requirements; ensuring damage was repaired flawlessly.
- Created detailed damage assessment to optimize vehicle quality after repairs.
- Worked with customers to answer all questions to ensure customer service was paramount.
- Kept accurate logs of MSDS for the chemicals and paints used on site.

TRAINING & CERTIFICATIONS

- OSHA 10-Hour – Construction Safety & Health
- OSHA 30-Hour Construction
- First Aid/CPR Certified
- Hazardous Materials Awareness
- Basic Wildland Firefighter: I-200, L-180, S-130, S-190
- Firefighter II
- EMT – Basic

Scott Nehls

HDD Logistics QA/QC Manager

PROFESSIONAL EXPERIENCE

2009 – Present: **HDD Logistics QA/QC Manager**

Michels Directional Crossings | Brownsville, WI

Responsible for truck load out and receiving, organization of HDD tooling and equipment, coordination of drill stem supply, tracking and calibration, new hire training, orientation, dispatch, manage divisional labor pool, tractor trailer inspection/maintenance program implementation, safety training/OQ program implementation, on-site review of HDD personnel & operations.

1989 – 2009: **Project Manager**

Michels Directional Crossings | Brownsville, WI

Responsible for coordinating and drilling directional boring projects across the country. Duties include mobilization of all equipment and personnel to remote job sites; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Provides safety training and performs evaluations. Assists with estimating and bid preparation. Some more noteable crossings include, but are not limited to:

Diameter	Length	Location	Year
20” & 42”	1544’ & 2127’	Wisconsin River, WI	2007
20” & 42”	2530’ & 2299’	Chippewa River, WI	2007
20” & 42”	2280’ & 2294’	Flambeau River, WI	2007
42” (2)	2294’ & 2775’	Lake Arrowhead, WI	2007
24”	2172’	Biscayne Bay, FL	2006
30”	2453’	Jackson Creek, WI	2006
30”	1301’	Jackson Creek, WI	2006
30” (2)	1400’ & 2661’	Rausonville & Willis Rd, MI	2005
24”	2429’	Kinnickinnic River, WI	2005
36” (3)	1276’ to 1531’	Clarkston, MI	2005
8”	1374’	Detroit, MI	2005
12” (10)	375’ to 750’	Lansing, MI	2004
16” (2)	2723’ & 2925’	Packard Rd & Washtenaw Ave, MI	2004
22”	2308’	St. Joseph River, MI	2004
30” (2)	1532’ & 1661’	Darien, WI	2004

PROFESSIONAL EXPERIENCE (continued)

6" (6)	1564' to 1880'	Lean, WI	2004
12" (3)	1668' to 3524'	New York/New Jersey	2003
30"	1673'	Huron River, MI	2002
36"	3395'	Huron River, MI	2002

1986 – 1989: **Superintendent**

Michels Mid-America Line & Cable | Brownsville, WI

Working foreman responsible for managing utility construction crews. Accountable for tie-ins behind our rail-mounted plow which consists of horizontal boring operations and dig downs. Implemented supervisory skills for material and labor coordination.

1980 – 1986: **Equipment Operator**

Michels Mid-America Line & Cable | Brownsville, WI

Rubber tire backhoe operator responsible for location of utility line obstructions and the timely placement of telephone pedestals to keep production oriented cable placing operations flowing smoothly.

1977 – 1983: **Marine Corp Sergeant/Section Leader**

Active Reserve Company-G, 24th Marines, 4th Division | Madison, WI

1977 – 1980: **General Laborer/Operator**

Michels Mid-America Line & Cable | Brownsville, WI

General laborer responsible for boring operations for telephone cable with various types of equipment.

1973 – 1977: **Project Set-Up Coordinator**

Michels Pipeline Construction | Brownsville, WI

Involved in coordinating materials and supplies for various job locations. Helped in attaining storage yards for equipment and supplies around the United States. Responsible for establishing accounts at various retailers and suppliers within the job working area.

INDUSTRY INVOLVEMENT

- Midwest Energy Association (MEA) Evaluator

EDUCATION

1977 **Lomira High School | Lomira, WI**

High School Diploma

Ken Coleman

Project Manager

PROFESSIONAL EXPERIENCE

2008 – Present: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production recordkeeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
24"	3183'	Crow River, MN	2019
24"	2100'	Spanish Lake, MO	2019
22"	4986'	Atchafalaya River, LA	2019
42"	4687'	Lake Scranton Finished H2O Tunnel, PA	2018
42"	3980'	Susquehanna River MP 99.6, PA	2018
42"	1810'	Interstate 80, PA	2018
42"	2826'	San Joaquin River, CA	2017
10"	5697'	Mississippi River, LA	2017
6"	3309'	Hauser River, MT	2017
8"	1980'	CHS Yellowstone River, MT	2017
30"	7531'	Lake Oahe & Missouri River, ND	2017
12"	1178'	Howard Cove, ME	2016
12"	1023'	Cutler Site, ME	2016
12"	1114'	Sunflower Field, VT	2016
12"	1129'	Arch Site & Town Hill Rd, VT	2016
12"	686'	Laplatte River, VT	2016
12"	922'	Arch Site & Monkton Rd, VT	2016
12"	492'	Arch Site, VT	2016
42" Steel with 36" HDPE	3983'	St John's River, FL	2016
27" HDPE Bundle	3737'	Little Creek, VA	2016
16"	2249'	Ohio River, OH/KY	2015
24"	1405'	Platte River, MO	2015
36"	1755'	New York St, IL	2015

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
36"	2303'	Liberty Street,IL	2015
24"	3275'	Transfer Line 1, IN	2014
8"	2545'	MP266, Mountain Green, UT	2013
30"	1881'	Bennekill Stream, NJ	2013
30"	6544'	1st Street, NJ	2013
36"	1392'	Seacaucus, NJ	2012
30"	1186'	Bowman Cty., ND	2011
20"	1814'	Marion, OR	2011
20"	3075'	Marion, OR	2011
30"	5786'	Vernon, NJ	2011
42"	3008'	White River, AR	2010
42"	1010'	Albany Ave, NJ	2010

1993 – 2008: **Supervisor | Mears**

Supervised over HDD projects with pipe diameters of 6” to 60” with lengths of 600’ to 7,200’ in the United States, Canada, and Mexico.

1990 – 1993: **Operator | ARB**

Experience operating the following equipment: forklift, front end loader, dozer scraper, motor grader, back hoe, excavator, crane, hot mix plants, trenching machine, rock crusher, horizontal drilling rig and fusing machines from 4” to 32” HDPE.

1968 – 1990: **Operator | Reading & Bates**

Worked as Operator, low boy driver, horizontal drilling rig, and supervisor of equipment yard and warehouse.

EDUCATION

1962 **Harrison Central High School | Gulfport, MS**

High School Diploma

Jim McGovern

Project Manager

PROFESSIONAL EXPERIENCE

1995 – Present: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production recordkeeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
24"	3183'	Crow River, MN	2019
20"	2740'	West Branch Escanaba River, MI	2019
20"	2173'	Escanaba River 2, MI	2019
20"	1421'	Middle Branch Escanaba River, MI	2019
42"	2007'	Las Moras Creek, TX	2019
36"	2438'	Huron River MP 117.2, OH	2018
36"	3199'	Vermillion River MP 104.4, OH	2018
36"	1863'	E. Branch Black River MP 86.7, OH	2018
36"	1886'	Nimisila Rexervoir MP 40.9, OH	2018
16"	5869'	Conrail RR, NJ	2018
16"	2766'	Hall Street, NJ	2018
16"	1999'	Route-35, NJ	2018
12"	5170'	Larch Dr & Wetland, MN	2017
24"	5788'	Hwy 41/45, WI	2017
16"	3065'	Rock Creek & US HWY 67, IA	2016
16"	6693'	Wapsipinicon River, IA	2016
24"	1898'	Vermillion River, IL	2016
20"	1904'	North St Mary's River, IN	2016
20"	1076'	South St Mary's River, IN	2016
36"	1862'	State Highway 50, IL	2015
36"	3461'	Kennedy Ave/Griffith Terminal, IN	2015
36"	1813'	Calumet Ave, IN	2015
36"	2510'	Deep Creek, IL	2015
36"	1803'	Dyer Ditch, IN	2015
36"	3011'	Highway 41 & RR, IN	2015
36"	5128'	Lake Ave & RR, IL	2015

36"	1812'	Highway 394, IL	2015
36"	9040'	Mississippi River, IL/MO	2014
36"	2264'	Otter Creek, IL	2013
36"	3544'	Illinois River, IL	2013
36"	1611'	Mackinaw Rover, IL	2013
36"	3892'	Red River, OK	2013
36"	4213'	Menard Creek, TX	2013
36"	3571'	Angelina River, TX	2013
36"	2908'	Neches River & RR, TX	2013
36"	1867'	Flora, TX	2012
36"	1740'	Sabine River, TX	2012
36"	2567'	South Sulphur River, TX	2012
30"	2906'	Hickory Creek, Marietta, OK	2012
16"	1656'	Chicolete River, TX	2012
42"	1650'	Chicolete River, TX	2012
16"	1717'	Morales, TX	2012
42"	1670'	Morales, TX	2012
16"	1658'	Cordele, TX	2012
42"	1658'	Dewitt, TX	2012
16"	1717'	Morales, TX	2012
16"	1664'	Morales, TX	2012
42"	3205'	Dewitt, TX	2012
42"	1661'	Morales, TX	2012
24"	1386'	Jonestown, PA	2012
24"	2458'	Jonestown, PA	2012
8"	6675'	Wilmington, NC	2012
8"	6669'	Wilmington, NC	2012
8"	7019'	Missouri River, NE	2011
42"	3035'	Rambling Bayou, LA	2011
42"	5340'	Boise Cascade, LA	2011
42"	4932'	Bayou Jean De Jean, LA	2011
12"	2484'	Wetland #13, NC	2011
42"	2094'	Hwy 9, LA	2010
42"	5248'	Saline Bayou, LA	2010
42"	1838'	Steep Bayou, LA	2010

42"	2243'	Beouf River, LA	2010

1991 – 2005: **Pipe-Side Superintendent/Pullback Coordinator | Michels Directional Crossings | Brownsville, WI**

Responsible for coordination of pipe welding subcontractor located on exit side of directional drill. Duties include operation and maintenance of equipment, coordination of labor for specialized pipe coating and testing. Solely responsible for maintaining constant communication with the driller during control of ballasting, which is one of the most critical aspects of pipe pulling.

1987 – 1991: **Operator/Foreman | Michels Directional Crossings | Brownsville, WI**

Skilled in the operation of technical, lifting and heavy equipment for directional drilling operation. Working knowledge of hydraulic engineering and applied mechanical engineering. Experience in working on and around directional drilling rigs as an integral member of a specialized team. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

1972 – 1987: **Operator | Gas Division of Michels Pipeline Construction | Brownsville, WI**

Track-hoe and backhoe operator responsible for maintaining line and grade on civil and gas pipeline projects. Duties include trench maintenance and safety as well as equipment repairs and maintenance.

1968 – 1972: **Skilled Laborer | Michels Pipeline Construction | Brownsville, WI**

Laborer working with underground construction crew. Responsibilities include upholding safety consciousness while performing various duties to help maintain progressive pipe/cable laying production.

EDUCATION

1967 **Waupun High School | Waupun, WI**

High School Diploma

MICHELS®

Larry Shilman

Project Manager

PROFESSIONAL EXPERIENCE

1999 – Present: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production recordkeeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	7402'	Susquehanna River, PA	2019
20"	2355'	Joanna Road, PA	2018
4"	1495'	Des Moines River, IA	2018
16"	5869'	Conrail RR, NJ	2018
36"	5841'	Ohio River MP 33.8, OH/WV	2017
14"	9154'	Nansemond River, VA/ ND	2017
30"	7531'	Lake Oahe & Missouri River, ND	2017
16"	11,397'	Lake Sacagawea South, ND	2016
30"	3352'	Cliff Crossing, ND	2016
16"	11,229'	Lake Sacagawea North, ND	2016
8"	4022'	Lake Macatawa, MI	2016
8"	1957'	Grand River, MI	2016
30"	1418'	Highway 250, OH	2015
16"	1402'	Deer Lake, ND	2015
10"	1971'	Tank Farm/Central Ave, PA	2015
8"	3320'	Yellowstone River, MT	2015
24" HDPE	1061'	Lake Sakakawea, ND	2014
8"	7321'	MP 49.3 Landslide, MT	2014
8"	4159'	MP 54.8 Landslide, MT	2014
20"	2364'	Missouri River, IA/NE	2014
16"	2951'	Line 82, ND	2014
36"	5687'	Missouri River, MO	2013
36"	2355'	Salt Fork River, MO	2013
36"	2077'	Chariton River, MO	2013
48"	1943'	West Neck Creek, VA	2013

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
48"	819'	Hunt Club Creek, VA	2013
8"	7177'	115 KV Power Duct, SC	2013
8"	7304'	115 KV Power Duct, SC	2013
8"	4911'	115 KV Power Duct, SC	2013
36"	1366'	Big Sandy, Maple Springs, TX	2012
36"	1444'	Hwy 155 & UPRR, Big Sandy, TX	2012
36"	1761'	Private Lake, Maple Springs, TX	2012
30"	4850'	Red River, Thackerville, TX/OK	2012
30"	3042'	Wyalusing, PA	2012
24"	2458'	Jonestown, PA	2012

1998 – 1999: **Construction Supervisor | InterCon Construction, Inc. | Lakeville, MN**

Supervisor of 210 mile fiber optic installation, underground and aerial in Minneapolis and surrounding suburbs. Responsible for subcontractors, directional drilling, underground, aerial and InterCon crews.

1998: **Project Engineer | Brungardt, Honimichl & Company, P.A. | Overland Park, KS**

AT&T switched engineering firms from C&S Contract Services to Brungardt, Honimichl & Company. Responsibilities included project management for concurrent multiple projects including route selection, courthouse search, surveying, land acquisition, writing job specifications, bid meetings, inspection, as-built records and permitting. Total start up to completion construction.

1990 – 1997: **Project Manager | C & S Contract Services, Inc. | Martinville, IN**

Responsibilities include project management for concurrent multiple projects including route selection, courthouse search, surveying, land acquisition, writing job specifications, bid meetings, inspection, as-built records and permitting. Total start up to completion construction.

1988 – 1990: **Right-of-Way Supervisor | Bucher, Willis & Ratliff, Inc. | Aurora, IL**

Responsibilities include all start up activities, pre-construction, construction and post-construction damages for 126 miles of fiber optic projects across Northern Indiana as well as three diversity routes in South Bend, Indiana.

EDUCATION

1990 **State of Indiana**

Real Estate License

1973 **Warner High School | Warner, SD**

High School Diploma

MICHELS®

Eric Frawley

Project Manager

PROFESSIONAL EXPERIENCE

2015 – Present: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production recordkeeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
30"	3746'	Dix River, KY	2019
20"	2355'	Joanna Rd, PA	2018
12"	1369'	Rocky Point Landing, Jamaica	2018
20"	7354'	Susquehanna River, PA	2018
20"	3874'	Waltonville Rd, PA	2018
16"	1198'	Harrisburg Pike, PA	2017
24"	2026'	Highway 120, GA	2017
24"	2293'	Interstate 20, GA	2017
16"	11,397'	Lake Sacagawea South, ND	2016
30"	2069'	Floyd River/RR/HWY 60, IA	2016
16"	11,229'	Lake Sacagawea North, ND	2016
16"	1112'	Palermo Railroad, ND	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
16"	1508'	Beverly Harbor, MA	2015
16"	3827'	Collins Cove, MA	2015

2013 – 2015: **Project Manager | Oceaneering International Inc. | Houston, TX**

2010 – 2013: **Project Manager and Project Coordinator | Triton Diving Services | Houston, TX**

2006 – 2009: **Commercial Diver/Saturation Diver | Deep Marine Technology | Houston, TX**

2003 – 2005: **Commercial Diver/Supervisor | Epic Divers | Harley, LA**

2001 – 2003: **Dive Tender/Commercial Diver/EMT | Torch Offshore | LA**

TRAINING & CERTIFICATIONS

- American Petroleum Institute - Certified RIgger an Crane Operator Class A per API RP 2D 2002
- Offshore Water Survival (HUET) per API RP T-4 and T-7

TRAINING & CERTIFICATIONS (continued)

- "Association of Diving Contractors International - Surface-Supplied Air Diver, Surface -Supplied Mixed Gas Diver, Saturation Diver
- American Red Cross - First Aid, Adult, Infant and Child CPR, and CPR for the Professional Rescuer
- TWIC (Transportation Worker Identification Credential)
- EPIC Divers - Visual Weld Inspection, Flange Trained, Safety Incident Support Team 2003
- EMT (Emergency Medical Technician) Nationally Registered 2002
- LOLER (Lifting Operations Lifting Equipment and Regulations)
- BOSET (Basic Offshore Safety and Emergency Training)
- HAZWOPER First Responder
- Hydrogen sulfide safety awareness certified
- Captain 100 Ton License USA Coast Guard
- NORM (Naturally Occurring Radioactive Material Surveyor)
- Confined Space Supervisor/Rescuer 2003

EDUCATION

2010 **VTC, Virtual Training Company**

Major: Microsoft Excel, Word, Projects, Outlook, Adobe Acrobat X

2000 **United States Coast Guard**

One Hundred Ton Captain License

1999 **Santa Barba City College | Santa Barbara, CA**

Major: Marine Diving Technology

MICHELS®

Dale Schinderle

Project Manager

PROFESSIONAL EXPERIENCE

2018 – Present: **Project Manager | Michels Directional Crossings**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production record-keeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	4145'	Loyalhanna Lake, PA	2020
24"	795'	Great Passage Blvd, VA	2018
24"	426'	Amanda Dr, VA	2018
24"	300'	Riva Ridge Dr, VA	2018

1998 – 2018: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
20"	1665'	Aughwick Creek, PA	2018
20"	2209'	Horse Valley Rd, PA	2018
20"	1337'	Berry Ridge & Old Mill Rd, PA	2018
20"	4771'	Raystown Lake, PA	2017
20"	1260'	Hollow Rd, PA	2017
20"	845'	Patterson Rd/RR, IL	2016
20"	748'	Wetlands #1, IL	2016
24"	1029'	Drainage Ditch, IL	2015
36"	9040'	Mississippi River & Levees, IL/MO	2014
12"	2535'	Arkansas River, AR	2014
36"	2908'	Neches River & RR, TX	2013

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
16"	1110'	New Berlin, WI	2012
10"	3745'	Fort Lauderdale, FL	2012
12"	4300'	Marathon County, WI	2012
30"	7600'	Livingston & Oakland County, MI	2011
12"	6106'	Westmoreland County, PA	2010

1992 – 1998: **Foreman | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring rigs for various size gas, water, sewer, electrical and communication lines throughout the United States. Complete knowledge of directional drilling technology and procedures. Duties include rig set-up, operation and maintenance, employee management.

1987 – 1992: **Laborer/Operator | Michels Pipeline Construction | Brownsville, WI**

Experience in working on and around directional drilling rigs as an integral member of a specialized team. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs; hydraulics; fluids; set-up and operation of drill motors; power generators; mud pumps; bentonite mixers; drill pipe; reamers; couplings; and overall equipment maintenance and operation. Was a member or the IBEW out of Michigan.

INDUSTRY INVOLVEMENT

- Member of Operating Engineers-1995

EDUCATION

NWTI (Northeast Wisconsin Technical Institute)

Mechanical Drawing

Michael Geelan

Project Manager

PROFESSIONAL EXPERIENCE

2016 – Present: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production recordkeeping, and overall on-site management.

Diameter	Length	Crossing/Location	Year
16"	3728'	Village Square Dr, PA	2019
24"	3817'	Missouri River, MO	2019
24"	6336'	Mississippi River, IL/MO	2019
12"	1070'	Indiana Harbor Canal - 12" & 10" Bundle, IN	2018
36"	1805'	Portage River MP162.5 OH	2018
36"	2730'	Sanddusky River MP145.8, OH	2018
36"	1522'	Findlay Road MP 179.96, OH	2018
36"	4034'	Maumee River MP 181.7, OH	2018
42"	1501'	Platte River, NE	2018
42"	1861'	San Martin Lake Channel, TX	2018
42"	3717'	Bahia Grande Channel #2, TX	2018
42"	4869'	Bahia Grande Channel #1, TX	2018
48"	3235'	Arroyo Colorado Canal, TX	2017
48"	3085'	Rancho Viego Floodway, TX	2017
48"	3649'	IBWC North Floodway, TX	2017
48"	3595'	Road 771 Canal, TX	2017
48"	2222'	Hwy 803, CA Rd & Supply Canal, TX	2017
48"	2033'	Resaca De Los Cuates Canal, TX	2017
48"	2183'	Resaca De Los Fresnos Canal #2, TX	2017
48"	2555'	Resaca De Los Fresnos Canal #1, TX	2017
48"	2126'	Pinson Rd Canal, TX	2017
48"	2042'	County Rd 300 Canal, TX	2017

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
48"	2398'	CR2340 & Los Olmos Creek, TX	2017
36"	1594'	Dupage River #2, IL	2017
36"	1525'	Dupage River #1, IL	2017
36"	1545'	Van Dyke Road, IL	2017
30"	7282'	Mississippi River, IA/IL	2016

2014 – 2016: **Project Manager | Michels Corporation | New York, NY**

Responsible for contract management and project coordination, including personnel and material, cost and budget control, tracking progress and schedule, submission of proper submittals and support engineering, and review of daily field reports. Serving as the point of contact for the project and maintaining communication with clients, general/subcontractors, vendors, and suppliers.

2011 – 2016: **HSE-Safety Coordinator | Michels Corporation | New York, NY**

Development and implementation of on-site procedure, emergency response plan, on-site safety inspections, equipment inspections and reporting to supervisors. Assigned the responsibility for coordinating and maintaining the company safety program. Advises management in matters of safety and health, and monitors day-to-day operations to ensure that the company's safety policies and procedures are followed.

2007 – 2011: **Project/Field Engineer | Michels Tunneling | New Berlin, WI**

Holds responsibility for coordination of all technical activities on assigned projects. Plans, schedules, conducts, and coordinates assigned engineering work; monitors work for compliance to applicable codes, accepted engineering practices, and ensures effective communication and coordination on assigned projects between all disciplines and all other project participants.

PROJECT PROFILES

MED609 – 62nd St. Tunnel Project; 620 LF of 76" Hard Rock Tunnel using a Robbins TBM. Included pipe jacking operations of 72" Casing pipe for a new water main. Construction in Manhattan – New York City. – New York, NY

East Side Access Tunnel – Contract CM005; interior structures, interior structures, and fit-out for caverns and tunnels beneath the existing Grand Central Terminal in Manhattan. Work included installation of piping/drainage systems, embedded conduits & ground mesh, waterproofing membrane & contact grout pipes, >9 million pounds of rebar, and placement of >70,000 cubic yards of concrete & wet/dry mix shotcrete. – New York, NY

Novartis Institute | Campus Expansion Project at 181 Massachusetts Ave.; Construct a 72" dia. steel Utility Tunnel by Microtunneling one run by jacking a 72" dia. Permalok steel casing pipe for a total of 120'. Jacking from a new building foundation excavation to and existing parking garage basement. – Cambridge, MA

University of Massachusetts | Central Campus Infrastructure; Construct a Jacking Shaft 30' diameter by 40' deep. Microtunnel two runs by jacking 48" dia. Permalok steel casing pipe for a total of 950'. Install 24" dia. PVC carrier pipe inside the casing pipe and gill the annulus with grout. – Amherst, MA

PROJECT PROFILES (continued)

City of Milwaukee | 26th Street Combined Sewer Sliplining; 4,500 LF of slip lining a 126” diameter Hobas pipe inside an existing 144” combined sewer concrete pipe. Included excavation of 2 access shafts (approx. 80’ deep) using rib and lagging construction methods to lower the Hobas pipe into the existing tunnel. – Milwaukee, WI

San Francisco Public Utilities Commission | Bay Division Pipeline Reliability Upgrade, Bay Tunnel; 26,208 LF of 12’ – 10” diameter concrete segmented tunnel under the San Francisco Bay from Menlo Park on the S.F. Peninsula Bay to Newark in the East Bay area, two slurry diaphragm wall shafts, and 108” cement motor lined steel pipe welded in the tunnel and shafts as a final liner carrier pipe. – San Francisco, CA

Massillon Road Sanitary Sewer Improvement; 2,925 LF of 42” Centrifugally Cast Fiberglass Reinforced Polymer Mortar Pipe sanitary sewer gravity sewer, microtunnel installation; 1,328 LF of 48” CCFRPM pipe on micropile support, 29 LF of 36” OH CCFRPM pipe, gravity sewer, micropile support. 7 EA shaft excavations with steel sheeted ground and 7 EA manholes structures. 250 LF of open cut excavation with steel sheeted ground support. – Akron, OH

Brazos River Authority East Williamson County Regional Water System Contract A; Raw Water Intake Pump Station; Two 60-inch Raw Water Intake Pipelines by Microtunnel Construction; 303 LF – Austin, TX

Galveston Causeway; Two 700’ tunnel drives through clay underneath Galveston Bay. 48” Permalok. – Galveston, TX

OCI Project No. DB10-WASD-01 ESP; 1,200 LF of 72” Permalok steel casing under the Government Cut Channel – Miami, FL

Fairfax Department of Public Works & Environmental Services | Dogue Creek Force Main Replacement; Dogue Creek Force Main Replacement – Fairfax County, VA 4,200 LF of 74” dia. Microtunnel between 6 drop shafts and tied into the existing pump station and out fall structures in order to replace an existing sewer. The majority of work performed on and coordinated with the Army Military Base – Fort Belvoir. – Fairfax County, VA

Milwaukee Metropolitan Sewer District | South 43rd Street Relief Sewer; Installation of 4500 LF of RCP using both a Akkerman MTBM slurry machine and Iseki MTBM slurry machine and 2000 LF of RCP using a Decker TBM with Direct Pipe Jacking. Job alsoconsisted of sheet pile shafts and rib and lagging/liner plate shafts at 15 structure locations. – Milwaukee, WI

Milwaukee Metropolitan Sewer District | Canal St. Wet Weather Relief Sewer; Installation of 6,000 LF RCP of Direct Pipe Jack using a 105” Lovat EPB TBM with Direct Pipe Jacking. Job also consisted of sheet pile shafts and rib and lagging/liner plate shafts at 18 structure locations. – Milwaukee, WI

Sacramento Regional County Sanitation District | Upper Northwest Interceptor Sewer 3 & 4; Installation of 3,000 LF of RCP using an 84” Akkerman MTBM slurry machine, 8,000 LF RCP Two-Pass Tunnel using a 130” Lovat TBM, and 6,000 LF RCP of Direct Pipe Jack using a 105” Lovat EPB TBM. Job also consisted of 12 sheet pile shafts and 6 drilled manhole shafts. – Sacramento, CA

TRAINING & CERTIFICATIONS

- OSHA 30-Hour
- OSHA 10-Hour
- OSHA 500 – Trainer Course for Construction (Qualified To train 10 to 30 Hour Classes)

TRAINING & CERTIFICATIONS (continued)

- BioMarine BioPak Re-breather Training and Certification
- Cal/OSHA Certified Gas Tester
- Cal/OSHA Licensed Tunnel Safety Representative
- Certified Associate Constructor - American Institute of Constructors (AIC)
- American HealthCare Assoc. Healthcare Provider Certification
- American HealthCare Assoc. Heartsaver First Aid Certification
- Rigging and Fall Protection Inspection Training (Competent Person)
- Medic First Aid Certification Renewal (CPR, AED, & First Aid)
- Qualified Rigger and Signal Person
- Confined Space Entry Awareness Training (Competent Person)
- Open Trench Safety Awareness Training (Competent Person)
- Wisconsin Lift Truck Operator Training
- Commercial Driver's License (Class ABC)
- 32-Hour Supported Scaffold Certified (NYC-DOB)
- Louisiana State Licensing Board for Contractors -- Pipe Work: 7-43 (Sewer Lines) 7-44 (Storm Drains) 7-45 (Water Lines) #25444
- Louisiana State Licensing Board for Contractors -- Specialty: 7-590 Telecommunications #25444
- North Carolina Licensing Board for General Contractors -- S (Boring & Tunneling) #29269
- State of Rhode Island: Contractors' Registration and Licensing Board -- Commercial & Residential Contractor Registration #40432
- South Carolina Department of Labor, Licensing and Regulation -- Class WL5 (water lines) & BT5 (bore & tunnel) #G10861

INDUSTRY INVOLVEMENT

- 2009 National AGG/ASC Heavy Civil Construction Competition – 4th Place
- 2008 Great Lakes Region AGG/ASC Heavy Civil Construction Competition – 1st Place
- 2007 Great Lakes Region AGG/ASC Heavy Civil Construction Competition – 3rd Place
- 2006 Lynn E. Legault Undergraduate Scholarship (AGC Education Research Foundation)

EDUCATION

University of Wisconsin–Stout | Menomonie, WI

Bachelors of Science – Construction; Minor – Risk Control & Business

University of Wisconsin–Fond du Lac | Fond du Lac, WI

Associates of Arts & Science Degree

MICHELS®

Richard Zavitz

Drilling Fluids Specialist/Project Manager

PROFESSIONAL EXPERIENCE

2012 – Present: **Drilling Fluids Specialist/Project Manager | Michels Directional Crossings | Brownsville, WI**

Develop detailed drilling fluid plans and contingencies based upon geotechnical reports, equipment and scope of project. Measure and testing of drilling fluids and supervising the mixing and pumping operations. Perform technical analysis and interpret geotechnical reports. Control and maintain drilling fluids parameters and provide technical recommendations. More notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	7402'	Susquehanna River, PA	2019
20"	1720'	Everett Railroad & Juniata River, PA	2018
42"	3980'	Susquehanna River MP 99.6, PA	2018
36"	2792'	Middle Island Creek, WV	2017
36"	5841'	Ohio River MP 33.8, OH/WV	2017
10"	5697'	Mississippi River, LA	2017
8"	1530'	SPL Yellowstone River, MT	2017
8"	1542'	YPL Yellowstone River, MT	2017
12"	1285'	XOM Yellowstone River, MT	2017
30"	7531'	Lake Oahe & Missouri River, ND	2017
16"	11,397'	Lake Sacagawea South, ND	2016
30"	3352'	Cliff Crossing, ND	2016
16"	11,229'	Lake Sacagawea North, ND	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
24"	3716'	Barbour's Cut, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
24"	5908'	Tabbs Bay, TX	2015
12"	11,563	Holland Bottoms Wetlands, AK	2015
48"	4039'	Dow Barge Channel, TX (Direct Pipe)	2015
36"	3461'	Kennedy Ave/Griffith Terminal, IN	2015
36"	3011'	Highway 41 & RR, IN	2015
36"	5128'	Lake Ave & RR, IL	2015
36"	1002'	Highway 255, TX (Direct Pipe)	2015
36"	1092'	Lubrizol Drainage, TX (Direct Pipe)	2015
18"	12,459'	Rio Grande River, TX	2014
48"	2400'	Rio Grande River, TX (Direct Pipe)	2014

PROFESSIONAL EXPERIENCE (continued)

42"	1200'	RR Crossing, TX (Direct Pipe)	2014
36"	9040'	Mississippi River, IL/MO	2014
30" & 24"	2,850',1,991', 2,732',2,983'	SE Market Expansion Project MS & AL	2014
36"	3544'	Illinois River, IL	2013
36"	4304'	Bois D' Arc, TX	2013
36"	3892'	Red River, OK/TX	2013
36"	3077'	UP RR & Jefferson St, OK	2013
36"	4213'	Menard Creek, TX	2013
36"	3239'	Clear Boggy Creek, OK	2013

2011 – 2012: **Drilling Fluid Specialist | Mears Group, Inc. | Billings, MT**

Developed detailed drilling fluid plans and contingencies based upon geotechnical reports, available equipment and scope of project. Selected bentonite and polymers based on characteristics required by the project. Trained field personnel on mud testing concepts and drilling fluid theology. Liaised with environmental regulators to obtain approval for drilling fluid products for projects.

2010 – 2011: **Territory Manager | Akkerman, Inc. | Billings, MT**

Sold tunneling and pipe jacking equipment. Analyzed and interpreted geotechnical reports to provide equipment recommendations.

2000 – 2010: **Technical Sales Engineer | Wyo-Ben, Inc. | Billings, MT**

Engineered fluids on HDD, microtunneling, pipe ramming, pipe jacking and auger boring projects. Analyzed geotechnical reports and developed mud/lubrication programs.

1998 – 2000: **Sales Representative | Surface to Surface | London, Ontario, Canada**

Trained new HDD operators. Sold pipe and cable locating equipment.

Colorado School of Mines

Taught bentonite and polymer course at Microtunneling Short Course.

TRAINING & CERTIFICATIONS

- OSHA 510 - OSHA Standards for Construction
- Apprenticed under oil field qualified mud engineer working on HDD projects
- OSHA 10-Hour
- Multiple OQ courses for various energy companies
- Multiple safety courses required by various energy companies
- OFITE trained in repair and calibration of OFITE Model 900 viscometer

EDUCATION

1988 **University of Western Ontario**

Bachelor of Arts, Kinesiology

2000 **Wyo-Ben, Inc. Intensive Mud School**

Graduated

MICHELS®

Wendell Long

Project Manager

PROFESSIONAL EXPERIENCE

2002 – Present: **Project Manager**

Michels Directional Crossings | Brownsville, WI

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production record-keeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
36"	6238'	Ohio River, OH/WV	2017
30"	2278'	Chattahoochee River, GA	2017
30"	2757'	Little Rock River, IA	2016
30"	6328'	Big Sioux River, SD/IA	2016
30"	1614'	Mill Creek, IA	2016
30"	6119'	Lake Whitney, TX	2016
16"	11,563	Holland Bottoms Wetlands, AK	2015
22"	2538'	Barrington Rd, IL	2015
36"	1147'	E. 138th Street, IL	2015
36"	2697'	Barrington Rd, IL	2015
48"	2060'	Tres Palacios River, TX	2014
48"	1692'	Navidad River, TX	2014
24"	2750'	Escatawpa River, MS	2014
24"	3030'	Big Creek Lake, AL	2014
30"	2774'	South Canadian River, OK	2013
28"	4270'	Saline Creek, Alberta, Canada	2013
12"	4272'	Saline Creek, Alberta, Canada	2013
36"	3618'	Johnson Creek, TX	2013
36"	3314'	East Fork Angelina River, TX	2013
36"	3130'	Cypress, TX	2012
16"	1664'	Morales, TX	2012
42"	1657'	Morales, TX	2012
20"	2108'	Bayonne, NJ	2012
24"	6091'	Homestead, FL	2011
36"	2373'	Ravenswood, LA	2011

PROFESSIONAL EXPERIENCE (continued)

10'	778'	Ft. Lauderdale, FL	2011
10"	964'	Ft. Lauderdale, FL	2011
16"	9931'	Cooper River, SC	2010
42"	1998'	I-49, LA	2010
16"	2566'	Hitchcock Plaza, SC	2010
30"	2176'	I-285, Atlanta, GA	2010

1994 – 2002: **Project Manager**

Michels Mid-America Line and Cable | Brownsville, WI

Job estimating, profit and loss coordination of materials and equipment. Labor and production jobs varying in size up to $25 million. Projects include aerial, buried, underground, cooper and fiber routes.

1987 – 1991: **Project Manager**

U.S. Sprint | Midwest and Eastern U.S.A.

Responsible for construction management, permits, schedules and daily work operation to meet completion dates. Jobs varying in size to $20 million.

1985 – 1986: **Senior Engineer**

U.S. Sprint | Midwest and Eastern U.S.A.

In charge of engineering and fiber construction for several miles.

1981 – 1984: **Construction and Maintenance Supervisor**

United Telephone of Florida | Fort Meyers, FL

Responsibilities include new construction, maintenance, splicing and cutover of offices in eight exchanges. Responsible for daily operation of 35 splicers.

1964 – 1980: **Cable Splicer**

United Telephone of Florida | Fort Meyers, FL

Spliced paper and plastic cable, exchange cutover and maintenance of all types of cable.

1962 – 1963: **Lineman**

United Telephone of Florida | Fort Meyers, FL

Worked on open wire circuits including toll circuits and placements of cable.

EDUCATION

1956 **Hardee High School | Wauchula, FL**

High School Diploma

Jeremiah Yliniemi

Project Manager

PROFESSIONAL EXPERIENCE

2020 – Present: **Project Manager | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production record-keeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	4813'	Raystown Lake, PA	2020

2006 – 2020: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	7402'	Susquehanna River, PA	2019
20"	2236'	Lower Piney Creek, PA	2018
20"	1720'	Everett RR-Juniata River, PA	2018
16"	2346'	Frankstown Branch-Juniata River, PA	2018
16"	1275'	Hollow Road, PA	2017
20"	1260'	Hollow Road, PA	2017
20"	4771'	Raystown Lake, PA	2017
36"	7194'	Ohio River MP 16.07, OH/MV	2017
30"	7531'	Lake Oahe & Missouri River, ND	2017
16"	11,397'	Lake Sacagawea, ND	2016
30"	3352'	Cliff Crossing, ND	2016
16"	1112'	Palermo Railroad, ND	2016
12"	7228'	Athabasca River, Alberta, Canada	2016

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
42"	3885'	Dover River, Alberta, Canada	2016
24"	1230'	Christina River, Wood Buffalo, Canada	2015
42"	7205'	Athabasca River, Alberta, Canada	2015
42"	1008'	Highway 63, Canada - Direct Pipe Installation	2015
42"	2510'	Ruth Lake, Fort McMurray, Canada	2015
12" and 6"	3173'	Beaver Lake, Alberta, Canada	2015
42"	3114'	Beaver Lake, Fort Mc Murray, Canada	2015
42"	3776'	MacKay River, Fort McMurray, Canada	2015
30"	2667'	South Fork Ten Mile Creek, PA	2014
20"	1193'	SR-265/Leatherwood Rd, OH	2014
24"	3269'	Transfer Line 2, IN	2014
36"	1874'	Wetland S-517C, IN	2014
42"	4284'	Vermillion River, Canada	2013
42"	3392'	N. Saskatchewan River, Canada	2013
42"	4441'	Goethals Bridge, NY	2013
30"	8101'	Kill Van Kull River, NY/NJ	2013
36"	2133'	Little River, OK	2013
36"	4342'	Deep Fork river, OK	2013
36"	4505'	Medicine Hat Alberta Canada	2012
36"	4993'	Atchafalaya River, LA	2011
20"	3080'	Rock Creek, OR	2011
42"	4272'	St. John's River, BC	2011
14"	1633'	Ocean Sciences, Newfoundland	2011
42"	2204'	Bayou Comitte, LA	2010
36"	1873'	Petitcodic River, Canada	2009

2004 – 2006: **Nick's Conoco | Park Rapids, MN**

EDUCATION

2002 **Park Rapids Area High School**

High School Diploma

MICHELS®

Doug Houska

Project Manager

PROFESSIONAL EXPERIENCE

2019 – Present: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production record-keeping, and overall on-site management.

1991 – 2019: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, WI**

Responsible for surveying, staking and design of directional drill path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Performed the above operations for crossings which include, but not limited to:

Diameter	Length	Location	Year
20"	13,247'	Lake Sakakawea River, ND	2019
8"	3768'	MP 50.8 Landslide, MT	2018
36"	1805'	Portage River MP 162.5, OH	2018
36"	2974'	Wetland MP 8.1, OH	2018
42"	3980'	Susquehanna River MP 99.6, PA	2018
42"	1810'	Interstate 80, PA	2018
48"	3649'	IBWC North Floodway, TX	2017
48"	3595'	Road 771 Canal, TX	2017
48"	2222'	Hwy 803, CA Rd & Supply Canal, TX	2017
48"	2033'	Resaca De Los Cuates Canal, TX	2017
30"	2555'	Resaca De Los Fresnos Canal #1, TX	2017
48"	2126'	Pinson Rd Canal, TX	2017
30"	3483'	Ford Island to Landing C, HI	2017
48"	2042'	County Rd 300 Canal, TX	2017
48"	2349'	Chiltipan Creek, TX	2017

PROFESSIONAL EXPERIENCE (continued)

30"	7531'	Lake Oahe & Missouri River, ND	2017
16"	6693'	Wapsipinicon River, IA	2016
30"	2757'	Little Rock River, IA	2016
12"	1114'	Sunflower Field, VT	2016
30"	5714'	James River, SD	2016
30"	2069'	Floyd River/RR/HWY 60, IA	2016
30"	2991'	PCN3/Wetland, SD	2016
30"	1791'	200th St, SD	2016
30"	1372'	183rd St & Wetland MP 331, SD	2016
30"	5154'	House River, Alberta, Canada	2016
42"	3885'	Dover River, Alberta, Canada	2016
42"	3399'	McKay River, Alberta, Canada	2016
24"	1230'	Christina River, Wood Buffalo, Canada	2015
42"	7205'	Athabasca River, Alberta, Canada	2015
36"	5128'	Lake Ave & RR, IL	2015
12" and 6"	3173'	Beaver Lake, Alberta, Canada	2015
42"	3776'	MacKay River, Fort McMurray, Canada	2015

1988 – 1991: **Project Coordinator | Mid America Line and Cable, Division of Michels Pipeline | Brownsville, WI**

Assisted Project Manager with coordinating field personnel for large scale telephone cable installation projects. Recorded and prepared field reports for project, office and customer needs. Acting liaison between project managers, public, existing utility representatives and customer representatives. Coordinated project between existing utilities and placement of new installation. Maintain material inventory required for projects.

1980 – 1988: **Project Assistant/Bookkeeper | Michels Pipeline Construction | Brownsville, WI**

Purchasing agent responsible for coordinating all materials to various locations along project routes for water line and telephone installations . Inventory control of materials. Prepared field reports to keep record of labor and production. Liaison between existing utility representatives and Michels.

EDUCATION

1980 **Mitchell Area Vocational Technical College | Mitchell, SD**

Two year Associate Degree Accounting

1978 **Kimball High School | Kimball, SD**

High School Diploma

Chad R. Johnson

Project Manager

PROFESSIONAL EXPERIENCE

2019 – Present: **Project Manager | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production record-keeping, and overall on-site management. Some more notable crossings include, but are not limited to:

2019: **HDD Operator | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production.

2017 – 2019: **Skilled Laborer | Michels Directional Crossings | Brownsville, Wisconsin**

Integral member of a specialized team working on and around directional drilling rigs. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

2004 – 2017: **Bore Coordinator, Project Manager, Construction Inspection & Water Treatment Operator | Xenia Rural Water District | Bouton, IA**

Coordinated the projects from mapping the project to scheduling of utility locations and equipment. Worked with the state, county and local officials for the projects and acquired DOT permits. Attended landowners meetings/conflict management, completed daily project reports and reported to the executive director. Installation of water lines 1" to 24" PVC, fusible PVC and HDPE and 8" to 36" steel. Operation of multiple pieces of equipment (bore machines, ditch witch, backhoes, track hoes and dozers).

TRAINING & CERTIFICATIONS

- Water Treatment and Distribution Grade II Certification
- Vocational Auto Mechanics

EDUCATION

Boone High School | Boone, IA

High School Graduate

MICHELS®

Karl Kornkven

Project Manager

PROFESSIONAL EXPERIENCE

2020 – Present: **Project Manager | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production record-keeping, and overall on-site management.

2002 – 2020: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	7595'	Houston Ship Channel, TX	2019
16"	6053'	Tabbs Bay, TX	2019
16"	3846'	Barbour's Cut, TX	2019
30"	3746'	Dix River, KY	2019
20"	2355'	Joanna Rd, PA	2018
36"	1886'	Nimisila Reservoir MP 40.9, OH	2018
20"	7354'	Susquehanna River, PA	2018
30"	7531'	Lake Oahe & Missouri river, ND	2017
30"	2991'	PCN3/Wetland, SD	2016
12"	7228'	Athabasca River, Alberta, Canada	2016
30"	5154'	House River, Alberta, Canada	2016
42"	3399'	McKay River, Fort McMurray, Cananda	2016
24"	1230'	Christina River, Wood Buffalo, Canada	2015

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
42"	7205'	Athabasca River, Alberta, Canada	2015
42"	2510'	Ruth Lake, Fort McMurray, Canada	2015
42"	3114'	Beaver Lake, Fort McMurray, Canada	2015
42"	3776'	MacKay River, Fort McMurray, Canada	2015
36"	1613'	Fish Pond, Alberta, Canada	2014
36"	1359'	Wetland Crossing #2, Alberta, Canada	2014
36"	9040'	Mississippi River, IL/MO	2014
42"	4284'	Vermillion River, Canada	2013
30"	4905'	Merseles, NJ	2013
30"	5378'	Hudson River, NJ/NY	2012
30"	4850'	Red River, TX/OK	2012
16"	1649'	Cordele, TX	2012
42"	1661'	Cordele, TX	2012
16"	3214'	Dewitt, TX	2012
42"	3205'	Dewitt, TX	2012
36"	4505'	Medicine Hat, Alberta, Canada	2012
36"	4993'	Atchafalaya River, LA	2011
42"	4272'	St. John's River, BC	2011
36"	4495'	Saskatchewan River, AB	2011
14"	1554'	St. John's Newfoundland	2010
42"	4322'	Cache River, AR	2010
42"	5084'	Mississippi River, AR	2010

2000 – 2002: **Drill Rig Operator | Michels Directional Crossings | Brownsville, WI**

Experience in working on and around directional drilling rigs as an integral member of a specialized team. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs; hydraulics; fluids; set-up and operation of drill motors; power generators; mud pumps; bentonite mixers; drill pipe; reamers; couplings; and overall equipment maintenance and operation.

1998 – 2000: **Drilling Fluid Technician | Michels Directional Crossings | Brownsville, WI**

Solely responsible for mixing bentonite to the right consistency with an emphasis in directional drilling. Proficient working in and around drilling rigs and overall operation as an integral member of the specialized team. Multi-capable to assist with all types of drilling tasks and familiar with repair, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, steer tool wireline connections, couplings, etc. Involved in various types of directional drilling projects, line and cable, water and setting manholes.

PROFESSIONAL EXPERIENCE (continued)

1991 – 1997: **Machinist | Nissen Manufacturing | Larimore, ND**

Machinist performing welding, drilling and assembly

1988 – 1991: **Air Traffic Controller | United States Air Force | Grand Forks, ND**

EDUCATION

University of North Dakota

Bottineau High School | Bottineau, ND

High School Diploma

MICHELS®

Dan Kriesel

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2006 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	3653'	Ship Road/King Road, PA	2019
16"	4358'	Phoenixville Pike Road, PA	2019
22"	4986'	Atchafalaya River, LA	2019
8"	3768'	MP 50.8 Landslide, MT	2018
42"	3980'	Susquehanna River MP 99.6, PA	2018
36"	5841'	Ohio River MP 33.8, OH/WV	2017
14"	9154'	Nansemond River, VA	2017
10"	5697'	Mississippi River, LA	2017
30"	3483'	Ford Island to Landing C, HI	2017
30"	7531'	Lake Oahe & Missouri River, ND	2017
16"	6693'	Wapsipinicon River, IA	2016
30"	6328'	Big Sioux River, SD/IA	2016
24"	4531'	Athabasca River, Alberta, Canada	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
24"	3716'	Barbour's Cut, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
30"	1418'	Highway 250, OH	2015
16"	1402'	Deer Lake, ND	2015
36"	3461'	Kennedy Ave/Griffith Terminal, IN	2015
36"	3011'	Highway 41 & RR, IN	2015
10"	4654'	Allegheny River, PA	2015
8"	3320'	Yellowstone River, MT	2015

24" HDPE	1061'	Lake Sakakawea, ND	2014
8"	7321'	MP 49.3 Landslide, MT	2014
8"	4159'	MP 54.8 Landslide, MT	2014
20"	2364'	Missouri River, NE/IA	2014
16"	2951'	Line 82, ND	2014
36"	2264'	Otter Creek, IL	2013
36"	1611'	Mackinaw River, IL	2013
48"	1943'	West Neck Creek, VA	2013
48"	819'	Hunt Club Creek, VA	2013
8"	7177'	115 KV Power Duct, SC	2013
8"	7304'	115 KV Power Duct, SC	2013
8"	3503'	Hamlin Creek, Charelston, SC	2013
8"	4911'	115 KV Power Duct, SC	2013
8"	12,902'	MP66, Wyola, MT	2012
8"	4475'	MP57, Lodge Grass, MT	2012
8"	2645'	Tioga Junction, PA	2012
16"	3894'	Roaring Branch, PA	2012
10"	1819'	Texas Creek, Tioga, PA	2011
16"	1818'	Texas Creek, Tioga, PA	2011
30"	5786'	Lake Conway, Vernon, NJ	2011
42"	992'	Bayou Rapids, Bunkie, LA	2011
42"	1223'	Bayou Robert, Bunkie, LA	2011
36"	3030'	Black Bear Forest, Bunkie, LA	2011
3"	1879'	Coquille River, Bandon, OR	2010
3"	1895'	Coquille River, Bandon, OR	2010
30"	1275'	Little Powder River, WY	2010

2006: **Operator | InterCon Construction | Madison, WI**

Duties include rig set-up, operation, maintenance, and mud technician for water lines.

2004 – 2006: **Foreman/Operator | Blue Badger, Inc. | Rosebush, MI**

Duties include walk over locating and operating of 80x100 rig for water, gas, fiber optic and sewer line installation.

2002 – 2004: **Operator/Laborer | Mears/HDD, LLC | Rosebush, MI**

Duties include wire line splice technician, mud technician, operate track hoe/back hoe and laborer for water, gas and sewer line installation.

EDUCATION

1994 **Mason County Central High School | Scottville, MI**

High School Diploma

MICHELS®

Marcus Carratt

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2000 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
16"	12,769'	Houston Ship Channel, TX	2019
16"	6053'	Tabbs Bay, TX	2019
8"	12,769'	Montezeuma Slough, CA	2019
24"	3341'	Hwy 367/Coldwater Creek, MO	2019
24"	3817'	Missouri River, MO	2019
36"	2611'	Tuscarawas River MP 47.8, OH	2018
16"	5869'	Conrail RR, NJ	2018
36"	5841'	Ohio River MP 33.8, OH/WV	2017
20"	4771'	Raystown Lake, PA	2017
48"	2349'	Chiltipan Creek, TX	2017
48"	3291'	Meter to LNG Facility, TX	2017
30"	5714'	James River, SD	2016
30"	1516'	408th & Wetland MP 360, SD	2016
30"	1519'	Turtle Creek, SD	2016
42"	3885'	Dover River, Alberta, Canada	2016
4-4" HDPE	764'	Fox River, WI	2015
48"	4039'	Dow Barge Channel, Clute TX - Direct Pipe	2015
36"	9040'	Mississippi River, IL/MO	2014
42"	1153'	Railroad Crossing, TX - Direct Pipe	2014
42"	3392'	N. Saskatchewan River, Canada	2013
42"	4441'	Goethals Bridge, NY	2013

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
42"	3186'	Arthur Kill, Staten Island, NJ/NY	2013
16"	1656'	Chicolete River, TX	2012
42"	1650'	Chicolete River, TX	2012
16"	1717'	Morales, TX	2012
42"	1670'	Morales, TX	2012
36"	4505'	Medicine Hat, Alberta, Canada	2012
24"	2458'	Jonestown, PA	2012
36"	4519'	Freeman Road, LA	2011
42"	5117'	Nature Conservatory, LA	2011
36"	4992'	Atchafalaya River, LA	2011
16"	9931'	Cooper River, SC	2010
42"	3485'	Quachita River, LA	2010
42"	4067'	LA State Hey 34, LA	2010

1999 – 2000: **Foreman | Schatz Underground Cable | Villa Ridge, MO**

Working foreman responsibilities included locating, operating Ditch Witch, directional boring rig, trencher, plow, back hoe, and small back hoe.

1997 – 1999: **Laborer | Michels Pipe Line Construction | Brownsville, WI**

Experience in working on and around directional drilling rigs as an integral member of a specialized team. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs; hydraulics; fluids; set-up and operation of drill motors; power generators; mud pumps; bentonite mixers; drill pipe; reamers; couplings; and overall equipment maintenance and operation.

1993 – 1997: **Beginning Manager | Driver, United States Marine Corps | Camp LeJeune, NC**

sgssg

TRAINING & CERTIFICATIONS

- PCST Certificate Renewal Course (2014)

EDUCATION

1986 **Waupun High School | Waupun, WI**

High School Diploma

Steve Sanders

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2003 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	2518'	Herman O.W. Drive, PA	2019
16"	6601'	Arch Bishp/S Chester Rd, PA	2019
42"	4687'	Lake Scranton Finished H2O Tunnel, PA	2018
36"	2974'	Wetland MP 8.1, OH	2018
30"	2273'	Susquehanna River @ MP 35, PA	2018
42"	2826'	San Joaquin River, CA	2017
12"	5741'	Rum River & Wetland, MN	2017
12"	5170'	Larch Dr & Wetland, MN	2017
6"	3309'	Hauser Lake, MT	2017
8"	1980'	CHS Yellowstone River, MT	2017
8"	1530'	SPL Yellowstone River, MT	2017
8"	1542'	YPL Yellowstone River, MT	2017
12"	1285'	XOM Yellowstone River, MT	2017
24"	1898'	Vermillion River, IL	2016
12"	3144'	Monkton Swamp, VT	2016
12"	1491'	Drinkwater Rd, VT	2016
20"	1904'	North St Mary's River, IN	2016
20"	1076'	South St Mary's River, IN	2016
30"	6119'	Lake Whitney, TX	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
24"	3716'	Barbour's Cut, TX	2015
24"	7432'	Houston Ship Channel, TX	2015

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
24"	5908'	Tabbs Bay, TX	2015
36"	1862'	State Highway 50, IL	2015
36"	1813'	Calumet Ave, IN	2015
36"	1803'	Dyer Ditch, IN	2015
36"	1812'	Highway 394, IL	2015
30"	1376'	Tom's Creek, MS	2014
24"	2750'	Escatawpa River, MS	2014
24"	3030'	Big Creek Lake, AL	2014
24"	2020'	Unnamed Creek, AL	2014
30"	2774'	South Canadian River, OK	2013
30"	4987'	Monksville Reservoir, NJ	2013
30"	1707'	Bayonne Inlet, NJ	2013
30"	8101'	Kill Van Kull River, NY/NJ	2013
20"	869'	Centerview, MO	2012
20"	2458'	Centerview, MO	2012
16"	3894'	Roaring Branch, PA	2012
20"	2513'	Tioga Junction, PA	2012
30"	5786'	Lake Conway, NJ	2011
42"	3008'	White River, AR	2010
42"	1851'	Siphon Creek, LA	2010
20"	5222'	Pokegama Carnegie, WI	2009
36"	2096'	Prairie River, MN	2009
20"	1130'	Wilson Bay, NC	2009

1995 – 2002: **HDD Rig Operator | Michels Directional Crossings | Brownsville, WI**

Experience in working on and around directional drilling rigs as an integral member of a specialized team. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs; hydraulics; fluids; set-up and operation of drill motors; power generators; mud pumps; bentonite mixers; drill pipe; reamers; couplings; and overall equipment maintenance and operation.

EDUCATION

1994 **University of Wisconsin–Stout | Menomonie, WI**

1990 **Berlin High School | Berlin , WI**

High School Diploma

MICHELS®

Jack Edmunds

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

1998 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record-keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down-hole survey along with surveying and surveying instrumentation.

Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
16"	4145'	Loyalhanna Lake, PA	2020
20"	13,247'	Lake Sakakawea, ND	2019
20"	6429'	Badlands Canyon, MT	2019
8"	12,769'	Montezeuma Slough, CA	2019
16"	2734'	Yellowstone River, MT	2019
22"	4986'	Atchafalaya River, LA	2019
42"	4687'	Lake Scranton Finished H2O tunnel, PA	2018
42"	1861'	San Martin Lake Channel, TX	2018
42"	3717'	Bahia Grande Channel #2, TX	2018
42"	4869'	Bahia Grande Channel #1, TX	2018
48"	3235'	Arroyo Colorado Canal, TX	2017
48"	3649'	IBWC North Floodway, TX	2017
48"	2222'	Hwy 803, CA Rd & Supply Canal, TX	2017
48"	2183'	Resaca De Los Fresnos Canal #2, TX	2017
48"	2555'	Resaca De Los Fresnos Canal #1, TX	2017
48"	2398'	CR2340 & Los Olmos Creek, TX	2017
48"	2807'	Oliver Creek & SH 188, TX	2017
48"	2263'	US Hwy 181/Hwy 35, TX	2017
30"	2782'	Mississippi River, IA/IL	2016
42" Steel with 36" HDPE	3983'	St John's River, FL	2016
27" HDPE Bundle	3737'	Little Creek, VA	2016
8"	1957'	Grand River, MI	2016

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
16"	1508'	Beverly Harbor, MA	2015
16"	3827'	Collins Cove, MA	2015
36"	2303'	Liberty Street, IL	2015
18"	12,459	Houston Ship Channel, TX	2015
36"	9040'	Mississippi River, IL/MO	2014
24"	3269'	Transfer Line 2, IN	2014
24"	3275'	Transfer Line 1, IN	2014
30"	2344'	Delaware River, PA/NJ	2013
42"	3008'	I-95 & Tidal Wetlands, NJ	2013
30"	4831'	18th Street, NJ	2013
16"	1664'	Morales, TX	2012
42"	1657'	Morales, TX	2012
10"	1495'	Missoula, MT	2012
24"	1546'	Colorado River, CO	2011
12"	1612'	WBC62 (Offshore), LA	2011

1981 – 1998: **Trenchless Technology Operator/Supervisor & Journeyman Welder | Michels Pipeline Construction | Brownsville, WI**

As Operator/Supervisor he completed profit and loss responsibility for performing trenchless casing installations for civil, pipeline, communications and power at roads, railroads and rivers. Coordinated and executed entire boring operation from mobilization to demobilization.

1977 – 1981: **Skilled Laborer/Operator | Beloit Pipe and Dredge Company | Beloit , WI**

Performed various duties in the construction of natural gas and petroleum product pipeline. Multi-capable to assist with all facets of product pipeline installation including conventional and trenchless methods of construction.

TRAINING & CERTIFICATIONS

- Certified for fusion of plastic natural gas pipe and fittings.
- Certified for butt, sidewall and/or socket fusion of Driscopipe polyethylene pipe and fittings.

INDUSTRY INVOLVEMENT

- Member of Local 601 of United Association of Journeyman and Apprentices for the Plumbing and Pipe Fitting Industry of the United States and Canada (Steamfitters).

EDUCATION

1995 **Moraine Park Technical College**

Welding Courses

1976 **Waupun High School | Waupun , WI**

High School Diploma

MICHELS®

Brian Guelig

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2006 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
20"	2740'	West Branch Escanaba River, MI	2019
20"	13,247'	Lake Sakakawea River, ND	2019
24"	6336'	Mississippi River, IL/MO	2019
42"	4687'	Lake Scranton Finished H2O Tunnel, PA	2018
20"	2355'	Joanna Rd, PA	2018
42"	1501'	Platte River, NE	2018
42"	1861'	San Martin Lake Channel, TX	2018
42"	3717'	Bahia Grande Channel #2, TX	2018
42"	4869'	Bahia Grande Channel #1, TX	2018
48"	3085'	Rancho Viejo Floodway, TX	2017
48"	3649'	IBWC North Floodway, TX	2017
48"	3595'	Road 771 Canal, TX	2017
48"	2033'	Resaca De Los Cuates Canal, TX	2017
48"	2555'	Resaca De Los Fresnos Canal #1, TX	2017
36"	7194'	Ohio River MP 16.07, OH/WV	2017
24"	2026'	Highway 20, GA	2017
36"	1606'	Hannahatchee Creek, GA	2017
36"	1907'	Earthen Dam, GA	2016
36"	3829'	Flint River, GA	2016
36"	4311'	Major Mackenzie Rd, Ontario, Canada	2016
36"	3901'	Rutherford Rd, Ontario, Canada	2016

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
36"	3160'	Christina River, Alberta, Canada	2016
42"	1411'	Torbram Rd, Ontario, Canada	2015
36"	3133'	Pamona Creek, Ontario, Canada	2015
36"	1559'	West Don River, Ontario, Canada	2015
36"	1352'	Bayview Road, Ontario, Canada	2015
36"	2992'	Alden Road, Ontario, Canada	2015
36"	3363'	Steeles Ave, Ontario, Canada	2015
36"	1588'	Hwy 404, Ontario, Canada	2015
36"	1355'	Beaver Creek, Ontario, Canada	2015
36"	3805'	Williamette River, OR	2014
16"	2951'	Line 82, ND	2014
36"	1874'	Wetland S-517C, IN	2014
8"	2545'	MP266, Mountain Green, UT	2013
30"	1881'	Bennekill Stream, NJ	2013
30"	6544'	1st Street, NJ	2013

2002 – 2006: **Operator | Michels Directional Crossings | Brownsville, WI**

Experience in working on and around directional drilling rigs as an integral member of a specialized team. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs; hydraulics; fluids; set-up and operation of drill motors; power generators; mud pumps; bentonite mixers; drill pipe; reamers; couplings; and overall equipment maintenance and operation.

1999 – 2002: **Laborer | Northeast Asphalt | Fond du Lac, WI**

EDUCATION

1999 **New Holstein High School | New Holstein, WI**

High School Diploma

MICHELS®

Nick LeBlanc

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2004 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, wi**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	6601'	Arch Bishop/S Chester Rd, PA	2019
42"	2007'	Las Moras Creek, TX	2019
20"	2355'	Joanna Rd, PA	2018
36"	4034'	Maumee River MP 181.7, OH	2018
16"	5869'	Conrail RR, NJ	2018
16"	2766'	Hall Street, NJ	2018
16"	1999'	Route-35, NJ	2018
30"	2278'	Chattahoochee River, GA	2017
16"	11,397'	Lake Sacagawea South, ND	2016
30"	3352'	Cliff Crossing, ND	2016
16"	11,229'	Lake Sacagawea North, ND	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
4-4" HDPE	764'	Fox River, WI	2015
12"	11,563	Holland Bottoms Wetlands, AK	2015
36"	2510'	Deep Creek, IL	2015
36"	5128'	Lake Ave & RR, IL	2015
18"	12,459	Houston Ship Channel, TX	2015
28"	1741'	Lafayette River, VA	2014
48"	2060'	Tres Palacios River, TX	2014
48"	1692'	Navidad River, TX	2014
36"	1311'	Fraizer Creek, IL	2013

36"	3544'	Illinois River, IL	2013
36"	3077'	UP RR & Jefferson St, Tushka, OK	2013
36"	1499'	60" Water Main, OK	2013
36"	2133'	Little River, OK	2013
36"	2610'	Stroud, OK	2013
30"	4850'	Red River, Thackerville, TX/OK	2012
24"	1386'	Jonestown, PA	2012
8"	6669'	Wilmington, NC	2012
24"	1701'	Howard, MD	2011
36"	2496'	Taterville, LA	2011
36"	5325'	Kingston, LA	2011
16"	9931'	Cooper River, SC	2010
42"	3485'	Quachita River, LA	2010
42"	4067'	LA State Hey 34, LA	2010
36"	5240'	Pokegama Carnegie, WI	2009
42"	3800'	Mississippi River, MO	2009

EDUCATION

1999 **Carencro High**

High School Diploma

MICHELS®

Dave Williams

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2015 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
16"	6976'	Matlock/W Chester Rd, PA	2020
36"	1321'	Saline River MP 237.4, MI	2018
36"	1863'	E. Branch Black River MP 86.7, OH	2018
20"	2355'	Joanna Rd, PA	2018
36"	1430'	Interstate 80 MP 110.3, OH	2018
36"	1810'	Interstate 80, PA	2018
36"	2836'	Nemadji Golf Course, WI	2017
42"	2826'	San Joaquin River, CA	2017
36"	1725'	Tower Ave/Hwy 35, WI	2017
42"	2431'	Maumee River & State Hwy 24, OH	2017
16"	3065'	Rock Creek & US HWY 67, IA	2016
30"	2757'	Little Rock River, IA	2016
30"	2069'	Floyd River/RR/HWY 60, IA	2016
30"	1791'	200th St, SD	2016
30"	1372'	183rd St & Wetland MP 331, SD	2016
30"	1278'	Wetland MP 311, SD	2016
30"	5154'	House River, Alberta, Canada	2016
36"	3160'	Christina River, Alberta, Canada	2016
36"	2215'	Bathurst Rd, Ontario, Canada	2015
36"	3363'	Steeles Ave, Ontario, Canada	2015
36"	1588'	Hwy 404, Ontario, Canada	2015

PROFESSIONAL EXPERIENCE (continued)

2008 – 2015: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
36"	3805'	Williamette River, OR	2014
24"	1961'	County Road 2, AL	2014
24"	2884'	Hatchett Creek, AL	2014
36"	1874'	Wetland S-517C, IN	2014
8"	2545'	MP266, UT	2013
30"	1881'	Bennekill Stream, NJ	2013
42"	3392'	N. Saskatchewan River, Canada	2013
30"	6544'	1st Street, NJ	2013
30"	1633'	Brooklyn, NY	2012
30"	5786'	Vernon, NJ	2011
42"	1851'	Siphin Creek,LA	2010
36"	2096'	Prairie River, MN	2009
36"	5237'	Pokegema Carnegie, WI	2009

1994 – 2008: **Operator | PTS Contractors | Green Bay, WI**

Sewer and water utility contractor.

EDUCATION

1986 **Amber Pocasset High School | Amber, OK**

High School Diploma

Ryan Jackson

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2012 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	2734'	Yellowstone River, MT	2019
22"	4986'	Atchafalaya River, LA	2019
42"	3717'	Bahia Grande Channel #2, TX	2018
42"	4869'	Bahia Grande Channel #1, TX	2018
48"	3235'	Arroyo Colorado Canal, TX	2017
48"	3649'	IBWC North Floodway, TX	2017
42"	3983'	42" Steel with 36" HDPE, St John's River, FL	2016
27"	3737'	27" HDPE Bundle, Little Creek, VA	2016
8"	1957'	Grand River, MI	2016
8"	4022'	Lake Macatawa, MI	2016
16"	1508'	Beverly Harbor, MA	2015
16"	3827'	Collins Cove, MA	2015
18"	12,459'	Houston Ship Channel, TX	2015
36"	3805'	Williamette River, OR	2014
30"	1701'	Red River, OK	2013
30"	2344'	Delaware River, PA/NJ	2013
30"	1246'	OK City Water Main, OK	2013
30"	4987'	Monksville Reservoir, NJ	2013
42"	4441'	Goethels Bridge, NY	2013
30"	4801'	18th Street, NJ	2013
30"	5378'	Hudson River, NY/NJ	2012

PROFESSIONAL EXPERIENCE (continued)

2007 – 2012: **HDD Operator | Michels Directional Crossings | Brownsville, Wisconsin**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation.

TRAINING & CERTIFICATIONS

- Safety Trained with Forklift & Excavator - Competent Person
- OSHA 30 Hour

EDUCATION

2004 **Winnebago Lutheran Academy | Fond du Lac, Wisconsin**

High School Graduate

Mark Matthews

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2017 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. More notable crossings include, but are not limited to:

Diameter	Length	Location	Year
42"	34551'	Bow River, Canada	2019
42"	2264'	Springbank Reservoir, Canada	2019
36"	6135'	Kakwa River 36" Bundle, Canada	2019
42"	3773'	Permanent Creek 42" Bundle, Canada	2019
42"	1640'	Pouce Coupe River, Canada	2019
36"	1749'	Deadhorse Creek, Canada	2018
12"	6986'	Mackenzie River, Canada	2018
42"	3087'	Victoria Harbor, Canada	2018
36"	1511'	Hwy #1, Canada	2017
48"	1112'	134 Street & 92nd Avenue, Canada	2017
36"	1116'	United Blvd & Mundy Creek, Canada	2017
36"	1076'	Hwy 7 & CP Rail, Canada	2017
48"	2349'	Chiltipan Creek, TX	2017

2011 – 2017: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
48"	2263'	US Hwy 181/Hwy 35, TX	2017
48"	2807'	Oliver Creek & SH 188, TX	2017
12"	7228'	Athabasca River, Alberta, Canada	2016
42"	3885'	Dover River, Alberta, Canada	2016

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
24"	1230'	Christina River, Wood Buffalo, Canada	2015
42"	7205'	Athabasca River, Alberta, Canada	2015
12"	3472'	Gilmore Lane, OR	2014
36"	1640'	LaMoine River, IL	2013
36"	5313'	Kansas City RR, LA	2011
42"	4952'	Rambling Bayou, LA	2011
36"	4993'	Atchafalaya Rivre, LA	2011
36"	1518'	Vermillion River, IL	2013
36"	4304'	Bois D' Arc, TX	2013
36"	3239'	Clear Boggy Creek, OK	2013
36"	1792'	North Canadian River, OK	2013
36"	1444'	Hwy 155 & UP RR, Big Sandy, TX	2012
36"	1761'	Private Lake, Maple Springs, TX	2012
36"	4505'	Medicine Hat Alberta, Canada	2012

2009 – 2011: **Operator | Michels Pipeline | Brownsville, WI**

Responsibilities included locating, operating Ditch Witch, directional boring rig, trencher, plow, back hoe, and small back hoe.

2006 – 2009: **Operator/Driller | Laney Directional Drilling | Humble, TX**

Operated Drill Rig, Trackhoe and Crane. Currently hold world record for drilling 6700' of 42" in Sulphur, LA (7/2008).

EDUCATION

1987 **Linville High School | Linville , LA**

High School Diploma

MICHELS®

Richard Wulff

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2015 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Some more notable crossings, but not limited to:

Diameter	Length	Location	Year
16"	2997'	Paoli Pike/E Boot Road, PA	2019
16"	3419'	Greenhill Road, PA	2019
12"	1070'	Indiana Harbor Canal - 12" & 10" Bundle, IN	2018
20"	1665'	Aughwick Creek, PA	2018
20"	2209'	Horse Valley Road, PA	2018
20"	1507'	Trough Creek Valley Pike/SR 829, PA	2018
16"	1999'	Route-35, NJ	2018
16"	1198'	Harrisburg Pike, PA	2017
20"	2005'	Hwy 15, PA	2017
36"	1545'	Van Dyke Road, IL	2017
24"	3166'	N Saskatchewan River, Alberta, Canada	2016
24"	4531'	Athabasca River, Alberta, Canada	2016
30"	2461'	Highway 63, Alberta, Canada	2015
24"	1956'	Clearwater River, Alberta, Canada	2015

1998 – 2015: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
36"	1613'	Fish Pond, Alberta, Canada	2014
36"	2274'	Highway 13, Alberta, Canada	2014
36"	2133'	Wetland Crossing, Alberta, Canada	2014
12"	4272'	Saline Creek, Alberta, Canada	2013
36"	3618'	Johnson Creek, TX	2013

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
36"	3314'	East Fork Angelina River, TX	2013
36"	1867'	Flora, TX	2012
20"	869'	Centerview, MO	2012
20"	2458'	Centerview, MO	2012
16"	3894'	Roaring Branch, PA	2012
30"	3455'	Marysville, MI-Searnia, Ontario	2011
16"	1413'	Mill Ln, NJ	2010
30"	1422'	Mill Ln/Hedding Ave, NJ	2010
36"	3999'	Mississippi River, MN	2009
42"	2429'	Scioto River, OH	2009
42"	3800'	Mississippi River, MO	2009
42"	3043'	Little Miami River, OH	2009
36"	2190'	Souris River, Manitoba	2009

1996 – 1998: **Operator | Haug Roofing | West Bend, WI**

Operate crane and skid loader. Knowledgeable on every aspect of the roofing business; design techniques, blueprints, drawings and structure.

EDUCATION

2003 **Fond du Lac High School | Fond du Lac, WI**

High School Diploma

MICHELS®

Seth Matheny

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2017 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	1933'	W Baltimore/Glenwood Rd, PA	2020
16"	4399'	Valley Rd/Darlington Rd, PA	2019
20"	1720'	Everett Railroad-Juniata River, PA	2018
20"	2209'	Horse Valley Road, PA	2018
20"	1416'	Blacklog Creek, PA	2018
16"	2766'	Hall Street, NJ	2018
36"	6238'	Ohio River, OH/WV	2017
16"	1260'	Hollow Road, PA	2017

2014 – 2016: **Foreman | Kirk Excavating | Columbus, OH**

Oversee day to day operations. Met with contractors. Operated various horizontal directional drills. Set-up and created bore profiles. Steered and/or located pilot bore. Mandated OSHA Regulations.

2011 – 2014: **Operator | Precise Boring of Ohio | Lancaster, OH**

Operated various horizontal directional drills. Operated and maintained mud cleaning systems. Set-up and created bore profiles. Steered and/or located pilot bore. Completed all necessary paperwork pertaing to the job. Mandated OSHA Regulations.

2007 – 2011: **Foreman | Sureshot Directional Drilling | Lancaster, OH**

Maintained inventory for all drilling needs. Fostered communication and relations with contractors and utility companies. Prepared job estimates and bids and trained new employees. Operated various horizontal directional drills. Set-up and created bore profiles. Steered and/or located pilot bore. Mandated OSHA Regulations.

2002 – 2007: **Operator | Tob Gobel Excavating and Well Drilling | Amanda, OH**

Operated backhoe, trackhoe, bulldozer and skid steer. Well driller assistant, grade checker and other duties as needed.

TRAINING & CERTIFICATIONS

- Class A CDL with Tanker Endorsement
- OSHA 10 Training
- Safeland and Safegulf Training
- HDPE Columbia Gas Fusion Certification

EDUCATION

2005 **Amanda-Clearcreek High School | Amanda, OH**

High School Graduate

Jamie Hollenbeck

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2018 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Some more notable crossings, but not limited to:

Diameter	Length	Crossing/Location	Year
20"	13,247'	Lake Sakakawea, ND	2019
20"	6429'	Badlands Canyon, MT	2019
8"	12,769'	Montezeuma Slough, CA	2019
24"	2100'	Spanish Lake, MO	2019
22"	4986'	Atchafalaya River, LA	2019
20"	1068'	Rahway River, NJ	2018
42"	3980'	Susquehanna River MP 99.6, PA	2018

2008 – 2018: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
36"	5841'	Ohio River MP 33.8, OH/WV	2017
10"	5697'	Mississippi River, LA	2017
30"	3483'	Ford Island to Landing C, HI	2017
30"	7531'	Lake Oahe & Missouri River, ND	2017
16"	6693'	Wapsipinicon River, IA	2016
30"	6328'	Big Sioux River, SD/IA	2016
24"	4531'	Athabasca River, Alberta, Canada	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
24"	3716'	Barbour's Cut, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
36"	3461'	Kennedy Ave/Griffith Terminal, IN	2015
36"	3011'	Highway 41 & RR, IN	2015

PROFESSIONAL EXPERIENCE (continued)

10"	4654'	Allegheny River, PA	2015
8"	3320'	Yellowstone River, MT	2015
24" HDPE	1061'	Lake Sakakawea, ND	2014
8"	7321'	MP 49.3 Landslide, MT	2014
8"	4159'	MP 54.8 Landslide, MT	2014
20"	2364'	Missouri River, NE/IA	2014
16"	2951'	Line 82, ND	2014
36"	2264'	Otter Creek, IL	2013
48"	1943'	West Neck Creek, VA	2013
8"	7177'	115 KV Power Duct, SC	2013
8"	7304'	115 KV Power Duct, SC	2013
8"	4911'	115 KV Power Duct, SC	2013
8"	12,902'	MP66, Wyola, MT	2012
8"	4475'	MP57, Lodge Grass, MT	2012
16"	3894'	Roaring Branch, PA	2012
16"	1818'	Texas Creek, Tioga, PA	2011
30"	5786'	Lake Conway, Vernon, NJ	2011
42"	992'	Bayou Rapids, Bunkie, LA	2011
42"	1223'	Bayou Robert, Bunkie, LA	2011
36"	3030'	Black Bear Forest, Bunkie, LA	2011

2005 – 2008: **Laborer | Ballard Utility**

Run Directional Drills

2001 – 2005: **Laborer | NPL**

Installed gas services and mains by Directional Drilling

1994 – 2000: **Operator | Mears Directional Drilling**

Worked as a laborer, became an operator for an excavator and final advancement operating a 24-40 drill rig.

MICHELS®

Doug Stebbins

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2018 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. More notable crossings include, but are not limited to:

Diameter	Length	Location	Year
42"	3451'	Bow River, Cananda	2019
24"	3183'	Crow River, MN	2019
20"	1010'	East Branch Escanaba River, MI	2019
20"	6429'	Badlands Canyon, MT	2019
20"	1421'	Middle Branch Escanaba River, MI	2019
24"	6336'	Mississippi River, IL/MO	2019
20"	2355'	Joanna Rd, PA	2018
36"	2611'	Tuscarawas River MP 47.8, OH	2018
42"	3980'	Susquehanna River MP 99.6, PA	2018
42"	1810'	Interstate 80, PA	2018

2007 – 2017: **HDD Operator | Michels Corporation | Brownsville, wi**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation. Responsible for surveying, staking and design of directional drill path and curve, drilling the pilot hole, monitoring the drill path and calculating and interpreting the ground elevations and contours. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). On-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
36"	1511'	Hwy #1, Canada	2017
36"	1116'	United Blvd & Mundy Creek, Canada	2017
36"	1076'	Hwy 7 & CP Rail, Canada	2017
16"	11,397'	Lake Sacagawea South, ND	2016
16"	11,229'	Lake Sacagawea North, ND	2016

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
12"	7228'	Athabasca River, Alberta, Canada	2016
42"	3399'	McKay River, Alberta, Canada	2016
42"	7205'	Athabasca River, Alberta, Canada	2015
8"	7321'	MP 49.3 Landslide, MT	2014
36"	4005'	Canadian River, OK	2013
36"	1792'	North Canadian River, OK	2013
36"	1366'	Big Sandy, Maple Springs, TX	2012
30"	3042'	Wyalusing, PA	2012
20"	2513'	Tioga Junction, PA	2012

2002 – 2007: **Operator/Foreman | InterCon Construction | Madison, WI**

Skilled in the operation of technical, lifting and heavy equipment for directional drilling operation. Working knowledge of hydraulic engineering and applied mechanical engineering. Experience in working on and around directional drilling rigs as an integral member of a specialized team. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill morors, power generators mud pmps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

EDUCATION

1995 **Wakefield High School | Michigan**

High School Diploma

MICHELS®

Curt Rischmueller

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2006 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville , WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	1933'	W Baltimore Pike/Glenwood Rd, PA	2020
20"	2236'	Lower Piney Creek, PA	2018
36"	2730'	Sanddusky River MP 145.8, OH	2018
20"	3874'	Waltonville Rd, PA	2018
36"	1525'	Dupage River #1, IL	2017
12"	1178'	Howard Cove, ME	2016
12"	1023'	Cutler Site, ME	2016
12"	2765'	Lewis Creek, VT	2016
12"	2856'	Wetland Replacement, OH	2016
20"	845'	Patterson Rd/RR, IL	2016
20"	1335'	Laraway Rd, IL	2016
12"	11,563	Holland Bottoms Wetlands, AK	2015
24"	1405'	Platte River, MO	2015
16"	2249'	Ohio River, OH/KY	2015
22"	2538'	Barrington Rd, IL	2015
36"	1147'	E. 138th Street, IL	2015
36"	2697'	Barrington Rd, IL	2015
36"	3031'	BNSF RR & Aurora Rd, IL	2015
12"	2557'	Arkansas River, AR	2014
36"	2355'	Salt Fork River, MO	2013
36"	2077'	Chariton River, MO	2013

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
36"	3892'	Red River, OK	2013
36"	4213'	Menard Creek, TX	2013
36"	3571'	Angelina River, TX	2013
36"	2908'	Neches River & RR, TX	2013
36"	4505'	S. Saskatchewan River, Alberta	2012
36"	2567'	S. Sulpher, Sandhill, TX	2012
36"	1640'	Sabine River, Pine Hurst Farm, TX	2012
30"	2133'	Alberta, Canada	2012
42"	3443'	Wetland R2, Bienville Parish, LA	2011
30"	5786'	Lake Conway, Vernon, NJ	2011
42"	1223'	Bunkie, LA	2011
20"	2855'	Suwannee River, FL	2010
42"	1786'	Big Creek, LA	2010

2000 – 2006: **HDD Foreman | InterCon Construction | Madison, WI**

Set up drill site location. Maintain daily operations of Directional Drill. Direct correspondence with contractors, landowners and other personnel dealing with drill operations.

1995 – 2000: **Fuser/Welder | InterCon Construction | Madison, WI**

Ran house service and mainline extension for MG&E and Wisconsin Power and Light.

EDUCATION

1980 **Sauk Prairie High School | Sauk City, WI**

High School Diploma

MICHELS®

Bobby Skipworth

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2017 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Some more notable crossings, but not limited to:

Diameter	Length	Location	Year
16"	2997'	Paoli Pike/E boot Road, PA	2019
16"	707'	Eagle View Blvd, PA	2019
16"	1152'	Meadow Ln & Shepard Ln, PA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
4"	1495'	Des Moines River, IA	2018
12"	1070'	Indiana Harbor Canal - 12" & 10" Bundle, IN	2018
12"	1369'	Rocky Point Landing, Jamaica	2018
16"	1999'	Route-35, NJ	2018
16"	1198'	Harrisburg Pike, PA	2017
10"	5697'	Mississippi River, LA	2017
30"	2278'	Chattahoochee River, GA	2017

2014 – 2016: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation.

Diameter	Length	Location	Year
12"	1178'	Howard Cove, ME	2016
12"	1023'	Cutler Site, ME	2016
12"	2765'	Lewis Creek, VT	2016
12"	2856'	Wetland Replacement, OH	2016
20"	845'	Patterson Rd/RR, IL	2016
20"	1335'	Laraway Rd, IL	2016
12"	11,563	Holland Bottoms Wetlands, AK	2015
24"	1405'	Platte River, MO	2015

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
16"	2249'	Ohio River, OH/KY	2015
22"	2538'	Barrington Rd, IL	2015
36"	1147'	E. 138th Street, IL	2015
36"	2697'	Barrington Rd, IL	2015
36"	3031'	BNSF RR & Aurora Rd, IL	2015
12"	2557'	Arkansas River, AR	2014
24"	3030'	Big Creek Lake, AL	2014

MICHELS®

Tim Monroe

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2016 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Some more notable crossings, but not limited to:

Diameter	Length	Location	Year
16"	3628'	Eagleview Blvd, PA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
16"	3981'	Glendale Rd & Concord Ave, PA	2019
36"	3199'	Vermillion River MP 104.4, OH	2018
36"	1522'	Findlay Road MP 179.9, OH	2018
16"	5869'	Conrail RR, NJ	2018
36"	2377'	Hydro Park MP 250.7, MI	2018
36"	6238'	Ohio River, OH/WV	2017
24"	983'	Mystic River, MA	2017
24"	2293'	Interstate 20, GA	2017
36"	3829'	Flint River, GA	2016
30"	5714'	James River, SD	2016
42" Steel w/ 36" HDPE	3983'	St John's River, FL	2016

2008 – 2016: **Drilling Fluids Technician/Laborer | Michels Directional Crossings | Brownsville, WI**

Integral member of a specialized team working on and around directional drilling rigs. Provide onsite services by measuring and testing of fluid mixing and pumping, including technical analysis and practical recommendations for controlling fluid properties. Maintain fluid properties on rig sites by testing fluid properties accurately. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
16"	1508'	Beverly Harbor, MA	2015
16"	3827'	Collins Cove, MA	2015
36"	2303'	Liberty Street, IL	2015
18"	12,459	Houston Ship Channel, TX	2015

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
36"	9040'	Mississippi River, IL/MO	2014
24"	3269'	Transfer Line 2, IN	2014
24"	3275'	Transfer Line 1, IN	2014
20"	1193'	SR-265/Leatherwood Rd, OH	2014
30"	2344'	Delaware River, PA/NJ	2013
42"	3008'	I-95 & Tidal Wetlands, NJ	2013
16"	1664'	Morales, TX	2012
42"	1657'	Morales, TX	2012
10"	1495'	Missoula, MT	2012
24"	1546'	Colorado River, CO	2011
12"	1612'	WBC62 (Offshore), LA	2011
10"	3447'	Grand Lake, OK	2011

EDUCATION

2003 **Fond du Lac High School | Fond du Lac, WI**

High School Diploma

MICHELS®

James Day

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2017 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
36"	2717'	N Saskatchewan River, Canada	2019
16"	7402'	Susquehanna River, PA	2019
20"	2236'	Lower Piney Creek, PA	2018
20"	1720'	Everett RR-Juniata River, PA	2018
20"	2209'	Horse Valley Road, PA	2018
20"	7354'	Susquehanna River, PA	2018
36"	5841'	Ohio River MP 33.8, OH/WV	2017
42"	2431'	Maumee River/State Hwy 24, OH	2017

2008 – 2017: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation. Some notable crossings include, but are not limited to:

Diameter	Length	Location	Year
30"	7531'	Lake Oahe & Missouri River, ND	2017
16"	6693'	Wapsipinicon River, IA	2016
30"	6328'	Big Sioux River, SD/IA	2016
12"	7228'	Athabasca River, Alberta, Canada	2016
42"	7205'	Athabasca River, Alberta, Canada	2015
36"	2510'	Deer Creek, IL	2015
42"	3776	Mackay River, Alberta, Canada	2015

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
6"	6999'	Navajo Reservoir/San Juan river, NM	2014
36"	9040'	Mississippi River & Levees, IL/MO	2014
24"	2020'	Unnamed Creek, AL	2014
42"	1252'	Battle River, Alberta, Canada	2013
30"	6544'	East 1st Street, NJ	2013
30"	4905'	Merseles Streer, NJ	2013
12"	4272'	Saline Creek, Alberta, Canada	2013
30"	5378'	Hudson River, NJ/NY	2012
30"	4850'	Red River, TX/OK	2012
42"	3205'	Dewitt, TX	2012
36"	4505'	Medicine Hat, Alberta, Canada	2012
36"	4993'	Atchafalaya River, LA	2011
42"	4272'	St. John's River, BC	2011
42"	2204'	Bayou Comitte, LA	2010
36"	1873'	Petitcodic River, Canada	2009
24"	3009'	Middle Salinas River, CA	2008
30"	1657'	St. Lucie Canal, FL	2008
30"	2739'	Couse Midden, FL	2008

2007 – 2008: **Laborer | Intercom Construction | Madison, WI**

Directional Drilling, Fusing and hand digging for services

EDUCATION

2002 **Boone High School | Boone, IA**

High School Graduate

MICHELS®

Cliff Mclain

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2006 – Present: **Field Operations Superintendent | Michels Corporation | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
20"	6429'	Badlands Canyon, MT	2019
30"	3746'	Dix River, KY	2019
36"	2974'	Wetland MP 8.1, OH	2018
36"	1886'	Nimisila Reservoir MP 40.9, OH	2018
36"	2611'	Tuscarawas River MP 47.8, OH	2018
30"	2273'	Susquehanna River @ MP 35, PA	2018
12"	5741'	Rum River & Wetland, MN	2017
12"	5170'	Larch Dr & Wetland, MN	2017
36"	1594'	Dupage River #2, IL	2017
30"	7282'	Mississippi River, IA/IL	2016
42"	3885'	Dover River, Alberta, Canada	2016
42"	7205'	Athabasca River, Alberta, Canada	2015
42"	2510'	Ruth Lake, Fort McMurray, Canada	2015
12"	3472'	Gilmore Lane, OR	2014
36"	1640'	LaMoine River, IL	2013
36"	4304'	Bois D' Arc, TX	2013
36"	4005'	Canadian River, OK	2013
36"	1792'	North Canadian River, OK	2013
30"	3042'	Wyalusing, PA	2012
16"	3894'	Roaring Branch, PA	2012
20"	2513'	Tioga Junction, PA	2012

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
12"	2530'	Cornwall, ONT, Canada	2011
10"	964'	US Route 1, Fort Lauderdale, FL	2011
30"	3455'	Marysville, MI-Searnia, Ontario	2011
42"	3008'	White River, Russell, AR	2010
42"	5084'	Mississippi River, Helena, AR	2010
42"	3497'	Little Red River, AR	2010
20"	5022'	Pokegama Carnegie, WI	2009
20"	5087'	Mississippi River, Empire, LA	2009

1995 – 2006: **Drill Operator | InterCon Construction | Madison, WI**

Crane operator responsible for safe operation and timely placement of drill stem and equipment. Integral link in the drilling operation, from drill rig set-up, pipe pull back and rig-down of equipment. Also conducted pipe support operations at the exit side during pipeline pullback. Responsible for permitting and mobilization/demobilization of heavy and non-dimensional equipment to drill sites.

EDUCATION

Florence High School | Florence, WI

High School Diploma

Josh Bush

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2017 – Present: **Field Operations Superintendent | Michels Directional Crossings**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	6976'	Matlock/W Chester Rd, PA	2020
16"	3728'	Village Square Dr, PA	2019
36"	1487'	River Raisin, MI	2018
36"	1805'	Portage River, OH	2018
16"	2346'	Frankstown Branch-Juniata River, PA	2018
20"	2307'	Frankstown Branch-Juniata River, PA	2017

2016 – 2017: **HDD Operator | Michels Directional Crossings**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation.

2013 – 2016: **Skilled Laborer | Michels Directional Crossings**

Integral member of a specialized team working on and around directional drilling rigs. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

2009 – 2013: **Diesel Mechanic | McCartney Produce | Paris, TN**

TRAINING & CERTIFICATIONS

- Respiratory Protection
- Respirable Crystalline Silica
- First Aid/CPR/AED Certification
- Confined Space Rescue Certification

EDUCATION

2011 **Gateway School | Paris, TN**

High School Graduate

MICHELS®

Jason Freund

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2020 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

2009 – 2020: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings, but not limited to:

Diameter	Length	Crossing/Location	Year
12"	1369'	Rocky Point Landing, Jamaica	2018
36"	2974'	Wetland MP 8.1, OH	2018
30"	2273'	Susquehanna River @ MP 35, PA	2018
42"	2826'	San Joaquin River, CA	2017
12"	5741'	Rum River & Wetland, MN	2017
12"	5170'	Larch Dr & Wetland, MN	2017
6"	3309'	Hauser Lake, MT	2017
8"	1980'	CHS Yellowstone River, MT	2017
8"	1530'	SPL Yellowstone River, MT	2017
8"	1542'	YPL Yellowstone River, MT	2017
12"	1285'	XOM Yellowstone River, MT	2017
24"	1898'	Vermillion River, IL	2016
12"	3144'	Monkton Swamp, VT	2016
12"	1491'	Drinkwater Rd, VT	2016
20"	1904'	North St Mary's River, IN	2016
20"	1076'	South St Mary's River, IN	2016
30"	6119'	Lake Whitney, TX	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
24"	3716'	Barbour's Cut, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
24"	5908'	Tabbs Bay, TX	2015
36"	1862'	State Highway 50, IL	2015
36"	1813'	Calumet Ave, IN	2015
36"	1803'	Dyer Ditch, IN	2015
36"	1812'	Highway 394, IL	2015

2000 – 2008: **Skilled Laborer | Michels Directional Crossings | Brownsville, WI**

Integral member of a specialized team working on and around directional drilling rigs. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

MICHELS®

Mike Brever

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2018 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Some more notable crossings, but not limited to:

Diameter	Length	Crossing/Location	Year
36"	3199'	Vermillion River MP 104.4, OH	2018
36"	2974'	Wetland MP 8.1, OH	2018

2009 – 2018: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
30"	3483'	Ford Island to Landing C, HI	2017
20"	2005'	Highway 15, PA	2017
36"	1535'	Calumet River, IL Direct Pipe	2017
36"	3901'	Rutherford Rd, Ontario, Canada	2016
42"	3885'	Dover River, Alberta, Canada	2016
36"	3160'	Christina River, Alberta, Canada	2016
30"	5154'	House River, Alberta, Canada	2015
12'	11,563'	Holland Bottoms Wetland, AR	2015
48"	4039'	Dow Barge Channel, TX Direct Pipe	2015
10"	4654'	Allegheny River, PA	2015
36"	3805'	Williamette River, OR	2014
24"	2884'	Hatchett Creek, AL	2014
16"	2951'	Line 82, ND	2014
8"	2545'	MP266, Mountain Green, UT	2013
30"	1881'	Bennekill Stream, NJ	2013
30"	6544'	1st Street, NJ	2013
42"	1670'	Lavaca River, TX	2012

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
42"	1650'	Chicolete River, TX	2017
30"	1633'	Paerdegat Basin, NY	2017
36"	1392'	Hackensack River, NJ	2017
24"	2645'	Chemung River, NY	2016
30"	5786'	Lake Coneay, NJ	2016

2005 – 2009: **Heavy Truck/Diesel Mechanic | Mike's Truck and Trailer Repair | New Brighton, MN**

EDUCATION

2006 **Henippen Technician College | Brooklyn Center, MN**

Heavy Truck Degree

2003 **Columbia Heights High School | Columbia Heights, MN**

High School Diploma

MICHELS®

Tim Bunkelman

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2018 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production.

Diameter	Length	Location	Year
16"	983'	N Chester Rd/Bancroft, PA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
20"	1665'	Aughwick Creek, PA	2018
20"	2209'	Horse Valley Road, PA	2018

1992 – 2018: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
20"	1507'	Trough Creek Valley Pike/SR 829, PA	2018
16"	1999'	Route-35, NJ	2018
16"	1198'	Harrisburg Pike, PA	2017
20"	2005'	Hwy 15, PA	2017
36"	1545'	Van Dyke Road, IL	2017
24"	3166'	N Saskatchewan River, Alberta, Canada	2016
24"	4531'	Athabasca River, Alberta, Canada	2016
30"	2461'	Highway 63, Alberta, Canada	2015
24"	1956'	Clearwater River, Alberta, Canada	2015
36"	1613'	Fish Pond, Alberta, Canada	2014
36"	1359'	Wetland Crossing #2, Alberta, Canada	2014
36"	9040'	Mississippi River, IL/MO	2014
42"	4284'	Vermillion River, Canada	2013
30"	4905'	Merseles, NJ	2013
30"	5378'	Hudson River, NJ/NY	2012

PROFESSIONAL EXPERIENCE (continued)

1989 – 1992: **Skilled Laborer | Michels Directional Crossings | Brownsville, WI**

Integral member of a specialized team working on and around directional drilling rigs. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

1987 – 1989: **Construction of Pole Buildings | Pro Builders | Lomira , WI**

1979 – 1986: **Heavy Equipment Diesel Mechanic | US Army**

EDUCATION

1979 **Campbellsport High School | Campbellsport, WI**

MICHELS®

Seth Strean

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2020 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

2012 – 2019: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings, but not limited to:

Diameter	Length	Crossing/Location	Year
20"	2236'	Lower Piney Creek, PA	2018
36"	2730'	Sanddusky River MP 145.8, OH	2018
20"	3874'	Waltonville Rd, PA	2018
36"	1525'	Dupage River #1, IL	2017
12"	1178'	Howard Cove, ME	2016
12"	1023'	Cutler Site, ME	2016
12"	2765'	Lewis Creek, VT	2016
12"	2856'	Wetland Replacement, OH	2016
20"	845'	Patterson Rd/RR, IL	2016
20"	1335'	Laraway Rd, IL	2016
12"	11,563	Holland Bottoms Wetlands, AK	2015
24"	1405'	Platte River, MO	2015
16"	2249'	Ohio River, OH/KY	2015
22"	2538'	Barrington Rd, IL	2015
36"	1147'	E. 138th Street, IL	2015
36"	2697'	Barrington Rd, IL	2015
36"	3031'	BNSF RR & Aurora Rd, IL	2015
12"	2557'	Arkansas River, AR	2014
36"	2355'	Salt Fork River, MO	2013
36"	2077'	Chariton River, MO	2013

PROFESSIONAL EXPERIENCE (continued)

2000 – 2012: **Skilled Laborer | Michels Directional Crossings | Brownsville , WI**

Integral member of a specialized team working on and around directional drilling rigs. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

EDUCATION

1999 **Goodrich High School | Fond du Lac, WI**

Matt Rohwer

Field Superintendent

PROFESSIONAL EXPERIENCE

2007 – Present: **Field Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical, and communication lines. Complete knowledge of directional drilling technology and procedures. Duties include mobilization of all equipment and personnel to job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; necessary record keeping of production and overall on-site management.

2005 – 2007: **Laborer | NPL | Lakeville, MN**

General labor installing utilities.

PROJECT PROFILES

2018 | CHS | Wastewater Force Main Project; HDD 24" pipe under BSF Railroad Tracks – Laurel, MT

2018 | MERC | Rochester Lateral; HDD 16" pipe under CP Railroad Tracks – Rocxhester, MN

2007-2017 | CPE | Multiple Pipe Sizes | Miscellaneus Railroad Tracks around Twin Cities; MN

TRAINING & CERTIFICATIONS

- ERail Safe

EQUIPMENT EXPERIENCE

- Drill Rig
- Excavator
- Mud Rig

EDUCATION

Triton High School | Dodge Center, MN

Brady Hickey

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2010 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites, set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Oversees drilling survey during crossing.

Diameter	Length	Location	Year
16"	4,100'	Hummelstown, PA	2020
10"	1,200'	Linn, MO	2019
24"	2,000'	Cologne, MN	2019
24"	1,000'	Cologne, MN	2019
8"	4,800'	Little Falls, MN	2019
8"	600'	Spokane, WA	2019

TRAINING & CERTIFICATIONS

- Safety training
- Veriforce training
- TWIC Card

EQUIPMENT EXPERIENCE

- Excavator
- Mud Rig
- Drill Rig

EDUCATION

Triton High School | Dodge Center, MN

Branden Cole

Field Superintendent

PROFESSIONAL EXPERIENCE

2019 – Present: **Field Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites, set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Oversees drilling survey during crossing.

2015 – 2019: **Foreman | Precision Pipeline | Eau Claire, WI**

Horizontal Directional Drilling of steel natural gas and petroleum pipelines. Ordered tooling for drills, supervised crew, interpreted blueprints and profiles, performed daily progress reports and time sheets, and tracking of expenditures on the job.

2009 – 2015: **Laborer | Roese Contracting/Pipeline LLC | Kawkawlin, MI**

Responsibilities included location utilities, installing fiber optic cable, plastic pipeline for gas distribution, gas service and meter sets to customer homes.

1994 – 2009: **Crew Member | Ironworkers Local 25 | Novi, MI**

Erected steel buildings, tied reinforcing steel for concrete placement, made connections on structural steel, steel welding, bolting up steel, setting beams on bridges, steel roofing, sheeting on buildings, and ornamental work.

PROJECT PROFILES

NPL | HDD; Rochester, MN

Sunoco | Manor East II HDD; Harrisburg, PA

DTE | HDD and Open Trench; Detroit, MI

Michigan DOT | Erected Bridges; Detroit, MI

DOW | Erected Buildings; Midland, MI

Michigan DOT | Welding on Bridges; Pontiac, MI

TRAINING & CERTIFICATIONS

- Class A Commercial Driver's License
- ASE Certified Mechanic
- Certified Welder
- First Aid/CPR/AED Certification
- Trenching/Excavation Safety Training
- OSHA 20-Hour

INDUSTRY INVOLVEMENT

- Operating Engineers Local 49
- Laborer's Union 1098
- Ironworkers Local 25

EQUIPMENT EXPERIENCE

- Track/Excavator

EQUIPMENT EXPERIENCE (continued)

- Front end loader
- Skytrac
- Roller
- Skid Steer
- Reclaimer
- Drill Rig

EDUCATION

1998 **Mott Community College | Flint, MI**

Construction Management

Steve Case

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2008 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
10"	2100'	Blue Line Replacvement, MO	2019
8"	3100'	Elkhorn River, NE	2019
20"	1800'	County Road B, MN	2019
16"	1400'	Rochester Greenfield Lateral, MN	2019
16"	2300'	Teton River, MT	2019

2006 – 2008: **Forman | Telecom Construction | Clearwater, MN**

Conduct daily tasks, install fiber optic cables, install phone and power cables using HDD methods. Read prints/alignment sheets, locate utility lines using electronic locating devices, set vaults for utilities

2004 – 2006: **Automotive Technician | Nokomis Auto Service | Alexandria, MN**

Perform inspections on automobiles and diagnose problem. Use of electronic scan tools to perform repairs on automobiles. Repair faulty part(s), replace, test vehicle.

INDUSTRY INVOLVEMENT

- Member of Operating Engineers Local 49

EQUIPMENT EXPERIENCE

- Drill Rig, Trackhoe, Dozer and Backhoe

EDUCATION

Park High School | Livingston , MT

High School Diploma

Garrett Derrer

Assistant Superintendent

PROFESSIONAL EXPERIENCE

2020 – Present: **Assistant Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

2016 – 2020: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation. Some more notable crossings, but not limited to:

Diameter	Length	Location	Year
16"	2518'	Herman O.W. Drive, PA	2019
16"	4381'	Pennsylvania Drive, PA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
16"	3981'	Glendale Rd & Concord Ave, PA	2019
36"	3199'	Vermillion River MP 104.4, OH	2018
16"	5869'	Conrail RR, NJ	2018
36"	2377'	Hydro Park MP 250.7, MI	2018
36"	6238'	Ohio River, OH/WV	2017
24"	983'	Mystic River, MA	2017
24"	2293'	Interstate 20, GA	2017
36"	3829'	Flint River, GA	2016
30"	5714'	James River, SD	2016

2016: **Welder | Whitehead Construction | Elizabethton, TN**

Welding and repairing electrostatic precipitator cleaning systems in power plants and coal burners

2015: **Pipe Fitter | Fagen Inc | Granite Falls, MN**

Installing piping systems and hydro testing product pipe for an ethanol plant

TRAINING & CERTIFICATIONS

- OSHA 30
- NCCER Level 4 Certifiation
- Pipe Fitting Diploma
- Professional Welding Diploma

EDUCATION

Tulsa Welding School | Tulsa , OK

Professional Welding and Pipe Fitting Diploma

TBAISD CTC | Traverse City, MI

Pre Trade Welding

Mancelona High School | Mancelona , MI

High School Diploma

MICHELS®

Jeff Nehmer

Drilling Survey Technician

PROFESSIONAL EXPERIENCE

1997 – Present: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, WI**

Responsible for surveying, staking and design of directional drill path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Performed the above operations to crossings which include, but not limited to:

Diameter	Length	Crossing/Location	Year
20"	2740'	West Branch Escanaba River, MI	2019
20"	6429'	Badlands Canyon, MT	2019
24"	3341'	Hwy 367/Coldwater Creek, MO	2019
24"	2100'	Spanish Lake, MO	2019
22"	4986'	Atchafalaya River, LA	2019
24"	3817'	Missouri River, MO	2019
24"	6336'	Mississippi River, IL/MO	2019
42"	4687'	Lake Scranton Finished H2O Tunnel, PA	2018
20"	2355'	Joanna Rd, PA	2018
20"	1720'	Everett RR-Juniata River, PA	2018
20"	1068'	Rahway River, NJ	2018
30"	2273'	Susquehanna River @ MP 35, PA	2018
36"	2836'	Nemadji Golf Course, WI	2017
20"	2005'	Hwy 15, PA	2017
12"	5741'	Rum River & Wetland, WI	2017
12"	5171'	Larch Dr & Wetland, MN	2017
36"	7194'	Ohio River MP 16.07, OH/WV	2017
24"	5788'	Hwy 41/45, WI	2017
36"	1545'	Van Dyke Road, IL	2017
24"	2293'	Interstate 20, GA	2017
12"	1285'	XOM Yellowstone River, MT	2017

12"	1178'	Howard Cove, ME	2016
12"	1023'	Cutler Site, ME	2016
12"	3144'	Monkton Swamp, VT	2016
12"	2765'	Lewis Creek, VT	2016
12"	1491'	Drinkwater Rd, VT	2016
12"	922'	Arch Site & Monkton Rd, VT	2016
42" Steel with 36" HDPE	3983'	St John's River, FL	2016
20"	983'	Schweitzer Rd, IL	2016
8"	1957'	Grand River, MI	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
16"	3827'	Collins Cove, MA	2015
36"	1147'	E. 138th Street, IL	2015
16"	2249'	Ohio River, OH/KY	2015
10"	4654'	Allegheny River, PA	2015
36"	3805'	Williamette River, OR	2014
24"	1935'	Coosa River, AL	2014
24"	2884'	Hatchett Creek, AL	2014
24"	3269'	Transfer Line 2, IN	2014
24"	3275'	Transfer Line 1, IN	2014
36"	1874'	Wetland S-517C, IN	2014
36"	3544'	Illinois River, IL	2013
8"	2545'	MP266, Mountain Green, UT	2013
30"	4987'	Monksville Reservoir, NJ	2013
30"	4905'	Merseles St, NJ	2013
30"	6544'	1st Street, NJ	2013
42"	4441'	Goethals Bridge, NY	2013
30"	8101'	Kill Van Kull River NY/NJ	2013

1995 – 1996: **Subsurface Exploration | Wisconsin Dept. of Transportation | Madison, WI**

Took core samples vertically from the ground and ran tests on soil conditions for roadways.

EDUCATION

1997 **MATC**

Degree as Civil Engineering Technician

1994 **Columbus High School | Columbus , WI**

High School Diploma

MICHELS®

Cale Mullenix

Drilling Survey Technician

PROFESSIONAL EXPERIENCE

1997 – Present: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, WI**

Responsible for surveying, staking and design of directional drill path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Performed the above operations for crossings which include, but not limited to:

Diameter	Length	Crossing/Location	Year
20"	13,247'	Lake Sakakawea, ND	2019
20"	6429'	Badlands Canyon, MT	2019
8"	12,769'	Montezeuma Slough, CA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
16"	3981'	Glendale Rd & Concord Ave, PA	2019
4"	1495'	Des Moines River, IA	2018
12"	1369'	Rocky Point Landing, Jamaica	2018
36"	2974'	Wetland MP 8.1, OH	2018
36"	2611'	Tuscarawas River, OH	2018
20"	7354'	Susquehanna River, PA	2018
42"	1501'	Platte River, NE	2018
36"	1370'	Interstate-80 MP 251.5, MI	2018
36"	2377'	Hydro Park MP 250.17, MI	2018
42"	4869'	Bahia Grande Channel #1, TX	2018
42"	2826'	San Joaquin River, CA	2017
14"	9154'	Nansemond River, VA	2017
10"	5697'	Mississippi River, LA	2017
12"	5171'	Larch Dr & Wetland, MN	2017
36"	7194'	Ohio River MP 16.07, OH/WV	2017
30"	3483'	Ford Island to Landing C, HI	2017
6"	3309'	Hauser Lake, MT	2017

36"	1545'	Van Dyke Road, IL	2017
30"	7531'	Lake Oahe & Missouri River, ND	2017
30"	2278'	Chattahoochee River, GA	2017
24"	2026'	Highway 120, GA	2017
30"	7282'	Mississippi River, IA/IL	2016
16"	11,397'	Lake Sacagawea South, ND	2016
30"	3352'	Cliff Crossing, ND	2016
16"	11,229'	Lake Sacagawea North, ND	2016
16"	1112'	Palermo Railroad, ND	2016
20"	1904'	North St Mary's River, IN	2016
20"	845'	Patterson Rd/RR, IL	2016
20"	871'	Wetlands #2, IL	2016
8"	1957'	Grand River, MI	2016
24"	7432'	Houston Ship Channel, TX	2015
16"	1508'	Beverly Harbor, MA	2015
16"	3827'	Collins Cove, MA	2015
36"	2510'	Deep Creek, IL	2015
36"	3011'	Highway 41 & RR, IN	2015
36"	2697'	Barrington Rd, IL	2015
36"	1755'	New York St, IL	2015
36"	2303'	Liberty Street, IL	2015
36"	3805'	Williamette River, OR	2014
2 x 4" Bundle	1809'	Hwy 550, Nageezi, NM	2014
6"	6999'	Lake Navajo/San Juan River, NM	2014
8"	7321'	MP 49.3 Landslide, MT	2014
8"	4159'	MP 54.8 Landslide, MT	2014
24"	1935'	Coosa River, AL	2014
16"	2951'	Line 82, ND	2014
36"	5687'	Missouri River, MO	2013
30"	1246'	OK City Water Main, OK	2013
30"	4987'	Monksville Reservoir, NJ	2013
12"	6209'	Jamacian Bay, NY	2013
42"	3008'	I-95 & Tidal Wetlands, NJ	2013
30"	4905'	Merseles St, NJ	2013
30"	6544'	1st Street, NJ	2013

PROFESSIONAL EXPERIENCE (continued)

1996 – 1997: **Fluid Dynamics Technician | Michels Directional Crossings | Brownsville, WI**

Accountable for mixing bentonite solution used throughout directional drilling and reaming operations. Trained to monitor viscosity of mixture and manipulate ratios of solids and fluid to maintain specific viscosities which continually change based on the environment and which vary by operation phases and subterrain. Experience in operation, maintenance and repair of bentonite mixing equipment.

EDUCATION

1996 **University of Wisconsin-Madison | Madison, WI**

1995 **Goodrich High School | Fond du Lac, WI**

High School Diploma

MICHELS®

Lorenzo Rivera Jr

Drilling Survey Technician

PROFESSIONAL EXPERIENCE

2017 – Present: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for surveying, staking and design of directional drill/Direct Pipe path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Performed the above operations for crossings which include, but not limited to:

Diameter	Length	Crossing/Location	Year
16"	7595'	Houston Ship Channel, TX	2019
24"	3183'	Crow River, MN	2019
20"	1421'	Middle Branch Escanaba River, MI	2019
16"	3628'	Eagleview Blvd, PA	2019
42"	2007'	Las Moras Creek, TX	2019
20"	2236'	Lower Piney Creek, PA	2018
42"	4687'	Lake Scranton Finished H2O Tunnel, PA	2018
36"	1863'	E Branch Black River MP 86.7, OH	2018
48"	651'	Juniata River, PA - HK750PT Installation	2018
36"	1682'	W Branch Black River MP 92.3, OH	2018
42"	1861'	San Martin Lake Channel, TX	2018
42"	899'	Highway 50, West Virginia - HK500PT Installation	2018
36"	1535'	Calumet River, IL - HK300PT Installation	2017
48"	2183'	Resaca De Los Fresnos Canal #2, TX	2017
48"	2555'	Resaca De Los Fresnos Canal #1, TX	2017
48"	2126'	Pinson Rd Canal, TX	2017
48"	2042'	County Rd 300 Canal, TX	2017
48"	2398'	CR2340 & Los Olmos Creek, TX	2017
48"	2349'	Chiltipan Creek, TX	2017

PROFESSIONAL EXPERIENCE (continued)

2013 – 2017: Operaor/Direct Pipe | Michels Directional Crossings | Brownsville, WI

Skilled equipment operator with the operation of technical, lifting and heavy equipment for direct pipe & directional micro-tunnel operations as well as directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

DIRECT PIPE INSTALLATIONS/PIPE ASSISTS

Diameter	Length	Crossing/Location	Year
36"	827'	Leslie Street, Ontario, Canada - HK 300PT Installation	2015
48"	4,039'	Dow Barge Channel, Clute TX - HK750PT Installation	2015
36"	1,002'	Hwy 225, Deer Park, TX - HK300PT Installation	2015
36"	1,092'	Lubrizol Drainage, LaPorte, TX-HK300PT Installation	2015
48"	2,455	Rio Grande River, El Refugio, TX-HK750PT Installation	2014
42"	1,200'	Railroad Crossing, Groves, TX-HK750PT Installation	2014

HDD PROJECTS

Diameter	Length	Crossing/Location	Year
30"	11,229'	Lake Sacagawea North, SD	2016
30"	6119'	Lake Whitney, TX	2016
12"	11,563	Holland Bottoms Wetlands, AK	2015
36"	2510'	Deep Creek, IL	2015
36"	5128'	Lake Ave & RR, IL	2015
18"	12,459	Houston Ship Channel, TX	2015
28"	1741'	Lafayette River, VA	2014
48"	2060'	Tres Palacios River, TX	2014
48"	1692'	Navidad River, TX	2014

2013: Truck Driver | Billy Cummings | TX

2012 – 2013: Bank Teller | City National Bank | TX

EDUCATION

2013 Texas Technical College | TX

Engineering Prerequisite Classes

2010 PJC Junior College | TX

Eric Riha

Drilling Survey Technician

PROFESSIONAL EXPERIENCE

2019 – Present: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for surveying, staking and design of directional drill path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs.

Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	2518'	Herman O.W. Drive, PA, PA	2019

2018 – 2019: **HDD Operator | Michels Directional Crossings | Brownsville, Wisconsin**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation.

2017 – 2018: **Skilled Laborer | Michels Directional Crossings | Brownsville, Wisconsin**

Integral member of a specialized team working on and around directional drilling rigs. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

2013 – 2015: **CNC Lathe Operator | D&S Machine Service Inc. | Luxemburg**

Operated a CNC lathe machine to precise dimensions per interpretation of blue prints, prioritize the tasks at hand for the day & operated a forklift.

EDUCATION

2015 **Northeast Wisconsin Technical College | Green Bay, WI**

Natural Gas Utility Construction

2012 **Kewaunee High School | Kewaunee , WI**

High School Graduate

MICHELS®

Jeremiah Erickson

Drilling Survey Technician

PROFESSIONAL EXPERIENCE

2008 – Present: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, WI**

Responsible for surveying, staking and design of directional drill/Direct Pipe path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Performed the above operations for crossings which include, but not limited to:

Diameter	Length	Location	Year
16"	3628'	Eagleview Blvd, PA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
16"	3981'	Glendale Rd & Concord Ave, PA	2019
36"	856'	Qu'Appelle River, Canada - HK750PT Installation	2017
42"	1861'	San Martin Lake Channel, TX	2017
36"	1535'	Calumet River, IL - HK300PT Installation	2017
20"	2005'	Highway 15, PA	2017
36"	1606'	Hannahatchee Creek, GA	2017
36"	3829'	Flint River, GA	2016
42"	7200'	Athabasca River, Canada - HK750PT Installation	2016
48"	4039'	Dow Barge Channel, Clute TX - HK750PT Installation	2015
36"	1002'	Hwy 225, Deer Park, TX - HK300PT Installation	2015
36"	1092'	Lubrizol Drainage, LaPorte, TX-HK300PT Installation	2015
48"	2455	Rio Grande River, El Refugio, TX-HK750PT Installation	2014
42"	1200'	Railroad Crossing, Groves, TX-HK750PT Installation	2014
8"	7321'	MP 9.3 Landslide, MT	2014
42"	1050'	Beaver River, Alberta, Canada-HK750PT Installation	2013
42"	470'	I-84, Westfall, PA - HK750PT Installation	2013
42"	4441'	Goethals Bridge, NY	2013
36"	5687'	Missouri River, MO	2013

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
36"	2958'	North Sulpher, Mount Joy, TX	2012
30"	4850'	Red River, Thackerville, TX/OK	2012
42"	1670'	Morales, TX	2012
42"	1658'	Dewitt, TX	2012
16"	5754'	New Berlin, WI	2012
20"	3075'	Rock Creek, OR	2011
42"	1826'	Interstate 49 and RR, LA	2011
42"	3443'	Wetland R2, LA	2011
42"	1704'	Willow Creek, LA	2010
42"	2015'	Flat Creek, LA	2010
42"	2129'	Ceasars Creek, OH	2009
36"	3031'	Four Legged Lake, MN	2009
42"	4068'	Illinois River, IL	2009
42"	2691'	200th Ave, IL	2009
42"	3627'	Salt River, MO	2009
42"	1992'	Hwy 67, TX	2008
42"	3705'	Neches River, TX	2008
42"	6004'	Old River, TX	2008

EDUCATION

2003 High School Graduate

MICHELS®

Dan Reynolds

Drilling Survey Technician

PROFESSIONAL EXPERIENCE

2006 – Present: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, WI**

Responsible for surveying, staking and design of directional drill path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Performed the above operations for crossings which include, but not limited to:

Diameter	Length	Crossing/Location	Year
30"	3746'	Dix River, KY	2019
22"	4986'	Atchafalaya River, LA	2019
20"	2236'	Lower Piney Creek, PA	2018
20"	2209'	Horse Valley Road, PA	2018
20"	1416'	Blacklog Creek, PA	2018
16"	2346'	Frankstown Branch-Juniata River, PA	2018
20"	1337'	Berry Ridge & Old Mill Rd, PA	2018
16"	5869'	Conrail RR, NJ	2018
20"	2307'	Frankstown Branch-Juniata River, PA	2017
36"	6238'	Ohio River, OH/WV	2017
12"	5741'	Rum River & Wetland, MN	2017
42"	2431'	Maumee River & State Hwy 24, OH	2017
48"	2807'	Oliver Creek & SH 188, TX	2017
48"	2263'	US Hwy 181/Hwy 35, TX	2017
36"	3829'	Flint River, GA	2016
30"	7282'	Mississippi River, IA/IL	2016
12"	2765'	Lewis Creek, VT	2016
12"	2856'	Wetland Replacement, OH	2016
42"	3885'	Dover River, Alberta, Canada	2016

"27" HDPE

Bundle"	3737'	Little Creek, VA	2016

12"	11,563	Holland Bottoms Wetlands, AK	2015
30"	1418'	Highway 250, OH	2015
24"	1405'	Platte River, MO	2015
22"	2538'	Barrington Road, IL	2015
12" and 6"	3173'	Beaver Lake, Alberta, Canada	2015
10"	1971'	Tank Farm/Central Ave, PA	2015
42"	3776'	MacKay River, Fort McMurray, Canada	2015
36"	1613'	Fish Pond, Alberta, Canada	2014
36"	1359'	Wetland Crossing #2, Alberta, Canada	2014
36"	2274'	Highway 13, Alberta, Canada	2014
36"	2133'	Wetland Crossing, Aberta, Canada	2014
30"	2667'	South Fork Ten Mile Creek, PA	2014
24"	2750'	Escatawpa River, MS	2014
20"	1193'	SR-265/Leatherwood Rd, OH	2014
36"	2355'	Salt Fork River, MO	2013
30"	2774'	South Canadian River, OK	2013
30"	4400'	Saline Creek, Alberta, Canada	2013
42"	4284'	Vermillion River, Alberta, Canada	2013
28"	4270'	Saline Creek, Alberta, Canada	2013
36"	4304'	Bois D' Arc, TX	2013
30"	1707'	Bayonne Inlet, NJ	2013
36"	2908'	Neches River & RR, TX	2013
8"	10,053'	Potomac River, VA/MD	2012
20"	3048'	St. Clair, Marysville, MI	2012
8"	12,885'	MP66, Big Horn County, MT	2012
8"	4400'	MP57, Big Horn County, MT	2012
30"	2906'	Hickory Creek, Marietta, OK	2012
36"	4505'	Medicine Hat, Alberta, Canada	2012
30"	2133'	Alberta, Canada	2012
8"	6669'	Wilmington, NC	2012

PROFESSIONAL EXPERIENCE (continued)

2003 – 2006: **Drilling Survey Technician | Southeast Pipeline Construction | Casa Grande, AZ**

All aspects of drilling and design utilizing Tru-Tracker software for contractor. Larger projects include:

Diameter	Length	Location/Customer
56" (3)	2100'-2520'	Bechtel/API
16" (9)	800'-3400'	Williston Basin
36"	1185'	Snelson Hoen Rd
24"	3385'	Carbon Mountain

2003: **Drilling Survey Technician | H.M.S. Construction | Rio Vista, CA**

All aspects of drilling and design utilizing Tru-Tracker software for contractor. Larger projects include:

Diameter	Length	Location/Customer
8" & 12"	450'	City of Waikiki, HI
HDPE	615'-1005' (6)	U.S. Navey Aloha-Aina Park
32"	2900'	AP & T Tidal Inlet

2002 – 2003: **Drilling Survey Technician | Thunderbird Exploration | Gilbert, AZ**

Steering hand working on communication projects. Larger projects include:

Diameter	Length	Location/Customer
8"	Various	Telecommunications
8" & 10"	600'-2400'	U.W. I.
24"	800'-1200'	Questar

1998 – 2002: **Drilling Survey Technician | Ozzie's Directional Drilling | Scottsdale, AZ**

EDUCATION

1980 **Soper High School | Soper, OK**

High School Diploma

ATTACHMENT

SAFETY AND JSA INFORMATION

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MICHELS®

Performance Indicators

Performance Measure	Target/Achievements
Lagging Indicators:	
Total # of Incidents	Should demonstrate that employees understand what is considered an incident and are appropriately reporting with an emphasis on **Near-Hit reporting**
Incident Severity Totals (near hit, minor, serious, major, critical)	1 Near Hit/Learning Event : 2,500 hours worked
Recordable Injury Related Incidents	No medical aid incidents
Total Exposure Hours	Contractor and Subcontractor total hours.
Total Spills/Releases	Demonstrates employee's knowledge of spill/release definition and the proper methods to use clean-up kits that are provided to all employees/jobs
Recordable Vehicle Incidents	No reportable vehicle incidents
Total Exposure Miles	For contractor and subcontractor
Leading Indicators	
Total # of Tailgate Meetings	Held Daily
Total # of Weekly Safety Meetings	Held Weekly
Total # Monthly Safety Meetings (Project Team)	Held Monthly
Total # of JSAs reviewed for quality assurance	# of JSAs developed and # reviewed
Total # of Safety Stand downs	List and Why they were held
Total # of Formal Inspections	When and Conducted by Whom
Total # Safety Meetings (Michels)	(as per Michels Site Specific Safety Plan (SSSP) • Monthly Safety meeting • Weekly / Shift Safety Meeting • Daily Tailgate Meeting • Total # of Safety Meetings per month
Work Site Inspection – formalized / documented (as per Contractor)	**(**Daily – Safety Inspector) (1 with Project Manager / construction manager) (2 with HSE Representative)
Michels Response to audit/inspection findings or any HSE related issues	Demonstration that Michels takes safety related issues seriously and implements effective controls in a timely manner to ensure a safe work site

STEP BACK FOR SAFETY

CREW TYPE:	JOB#:
DATE:	TIME:

Top Three Hazards?

Controls in Place (PPE, Spotter, etc.)?

PRINT NAME	SIGNATURE	PRINT NAME	SIGNATURE
1.		7.	
2.		8.	
3.		9.	
4.		10.	
5.		11.	
6.		12.	

SUBMIT COMPLETED CARDS WITH YOUR DAILY JSA

JOB SAFETY ANALYSIS

PURPOSE:

A Job Safety Analysis (JSA) is a tool used to iden fy/recognize poten al hazards at your work loc on, and to help implement solu ons or correct ns to reduce or eliminate the hazard prior to the start of work to allow for a safe working environment.

ASSESS ***IDENTIFY*** ***CONTROL***

HAZARDS IDENTIFIED MAY INCLUDE BUT ARE NOT LIMITED TO:

1. Trip Hazards—Timber mats, rough terrain, etc.
2. Exis U es—Overhead/Underground
3. Pinch Points—Moving equipment/material
4. Slips & Trips—Slippery /obstructed work surfaces
5. Falls—Working at heights r greater)
6. Excav ns—Soil failure
7. Environmental—Excessive mud, water, dust, etc.
8. Chemicals—Hazardous substances
9. Wildlife—Venomous snakes & spiders
10. Plants—Poisonous plants

IF YOU HAVE A QUESTIONS…..ASK!!!

MICHELS CORPORATION

Project Name: _____ Project Location: _____
Inspected by: _____ Date of Inspection: _____
Equipment Name: _____ Number: _____
Hours/Mileage _____

CONSTRUCTION EQUIPMENT INSPECTION
*** Verbally report to supervisor and turn sheets in daily

CONSTRUCTION EQUIPMENT INSPECTION

		N/A	Remarks			N/A	Remarks
Tracks, tires, wheels				Motor (wiring)			
Brakes				Radiator			
Horn				Belts			
Lights				Hoses			
Clutch				Lubrication Points			
Windshield Wiper				Loose Bearings			
Glass				Guards			
Rear View Mirror				Belt Tension			
Body				Loose Gears			
Cover				Brakes			
Frame				Vibration			
Dump Mechanism				Pneu. Interlocks			
Steering				Exhaust System			
Fire Extinguisher				Proper RPM			
Signal System				Overload Protect			
Fuel & Gas Lines				Mech. Switch			
Fuel Tank				Ground Continuity			
Exhaust System				Limit Switches			
Boom				Cords			
Boom Hoist				Plugs/Receptacles			
Sheaves				Fan Shroud			
Hooks,				Back Up Alarm			
Grab Bars, Steps				Pins-Bushings			
Warning Lights				Pins-Keepers			
Cables							

Operator/Print Name _____ Operator/Signature _____

Foreman/Print Name _____ Foreman/Signature _____

Comments: _____

MICHELS®

DIRECTIONAL CROSSINGS
TAILGATE SAFETY MEETING MINUTES

Date: _____ **Job #** _____ **Location:** _____

Company: _____ **Foreman/Supervisor:** _____

First Aid Personnel: _____

	Name	Address	Phone #
NEAREST CLINIC:			
CLOSEST MAJOR INTERSECTION:			

FOR LIFE THREATENING INJURIES OR EMERGENCIES – DIAL 911 or:

 # In Crew: _____ **# Attending:** _____ **Current Weather:** _____

Competent Person(s) (if applicable): _____

Who Will Transport Injured Personnel? _____

Work To Be Performed: _____

Topics Discussed: _____

Potential Site Hazards: _____

Safety Recommendations: _____

Attendance (use additional paper if necessary)

Print	Sign	Print	Sign

JOB SAFETY ANALYSIS WORK SHEET

Tasks to be performed/critical steps to be taken (Check all that apply to job)	Potential Hazard (Check all that apply to tasks/steps from column 1)	Recommended Safe Job Procedures (Check all protective measures that apply to what was identified in column 2)	
☐ Driving	☐ Traffic hazards (vehicular & pedestrian)	☐ Designate a person for a specific task such as confined space attendant, fire watch, etc.	☐ Keep guards in place at all times – no modifications to tools or equipment
☐ Walking	☐ Working on rough/challenging/uneven terrain	☐ Hold a pre job meeting with all involved	☐ Use hearing protection
☐ Manual Digging	☐ Exposure to loud noise	☐ Utilize one call and pothole/daylight existing utilities BEFORE excavating	☐ Know the depth of water and stay out of it
☐ Mechanical Digging	☐ Overhead Utilities / Underground Utilities	☐ Inspect excavations & complete report	☐ Yield for pedestrians & equipment
☐ Manual Lifting	☐ Suspended Loads / Swinging Loads	☐ Barricade or mark areas of excavation	☐ Reduce speed and drive defensively
☐ Mechanical Lifting (Crane)	☐ Heavy Objects/ Back Injuries	☐ Utilize protective systems (shoring/sloping)	☐ Use of additional PPE (face shield, goggles, chaps etc.)
☐ Welding /Cutting/Grinding	☐ Heavy Lifting Equipment	☐ Nobody permitted to enter unsafe excavations (ensure access/egress is provided)	☐ Inspection and color coding of electrical tools
☐ Hauling Equipment/Materials	☐ Heavy Earthmoving Equipment	☐ Walk with small steps, take time & watch footing	☐ Inspect tools for signs of excessive wear/damage & replace if necessary
☐ Setting/Moving Timbers/Mats	☐ Trenches/Excavations (Engulfment/collapse)	☐ Never park a vehicle next to heavy equipment	☐ Stay clear of x-ray operations
☐ Coating	☐ Asphyxiation / confined space hazards	☐ Wear appropriate PPE at all times	☐ Install portable lighting in dark areas
☐ Sandblasting	☐ Slips, trips & falls – rough/slippery working surfaces	☐ Use taglines where appropriate	☐ Use bug spray or other means of pest control
☐ Rigging	☐ Possible hit/struck/crushed by moving trucks or equipment	☐ Stay a minimum of 25 ft. from loads and equipment	☐ Store cylinders upright, secured with the caps on and transport properly
☐ Line-ups	☐ Slings, Cables, Chains could break/fail	☐ Use proper lifting techniques (lift with legs)	☐ Identify and avoid poisonous plants
☐ End-facing/Beveling	☐ Exposure to gamma emitting sources & x-ray	☐ Stay clear of equipment when in operation	☐ Use spotter with warning device (air horn)
☐ Climbing to Lower Levels	☐ Abrasive materials (eye injuries/skin abrasions)	☐ Never stand/walk between two pieces of working equipment	☐ Drink plenty of water, take cool down/warm-up breaks
☐ Climbing to Higher Levels	☐ Multiple pinch/crush points	☐ Stay a minimum of 10 ft. from all power lines	☐ Install pressure relief valve (PRV)
☐ X-Raying	☐ Compressed Gases	☐ Utilize goal post system and spotters	☐ Test the atmospheres for hazards
☐ Cell Phone use	☐ Heat Stress/Hypothermia (Hot/Cold weather)	☐ Flashback arrestors must be in place	☐ Ensure proper ventilation
☐ Run cords, hydraulic lines and Kelley hose	☐ Inclement Weather (Lightning/Rain/Snow/Fog/Icy conditions)	☐ Ensure certifications are in place on all lifting equipment, devices and rigging	☐ Wear sunscreen and appropriate clothing
☐ Road Crossing	☐ Falls from an upper level	☐ Inspect pins and cables daily for problems	☐ Never lift with the teeth of buckets
☐ Loading/Offloading equipment/Materials	☐ Without proper communication drill string can turn inadvertently causing pinched by/ struck by	☐ Establish eye contact and intent with the operator of the equipment before approaching	☐ Visually inspect the leads as they are being run out
☐ Installing shoring/trench box	☐ Poisonous plants (Contact Dermatitis)	☐ Stay on designated ROW	☐ Ensure spill kit is readily available
☐ Break connections apart to install or remove rods or tooling	☐ Worn or damaged leads could cause shock or property damage	☐ Establish good communication between workers and drill operator before any operations start	☐ Ensure hoses are properly connected and whip-checks are in place
☐ Pumping	☐ Uneven/unsecured or bulky loads	☐ Only one person directing operator/driller	☐ Inspect wear points on hoses/HDPE and replace damaged/worn sections
☐ Lowering-in product	☐ Components/drill stem potentially remaining under pressure even after "ALL STOP"	☐ Stop work and take cover in inclement weather	
☐ Backfilling	☐ Overloading equipment – equipment failure	☐ Secure ladders, & ensure they are not damaged	☐ Ensure fall protection (tied-off/guard rails/hand rails) are in place
☐ Boring/Directional Drilling	☐ Welding, cutting, burning tools (Fire Hazard)	☐ Road/traffic signs must be up while working.	
☐ Pipe Entry	☐ Pipe falling off rollers or out of calipers	☐ Use flaggers to control vehicle/pedestrian traffic	☐ Inspect calipers for correct size before use
☐ Ballast operations/buoyancy	☐ Rotating tooling, pinched by, struck by	☐ Ensure adequate number of fire extinguishers on site and in vehicles	☐ Do not place hands in the box or on the ends of the drill stem/pipe
☐ Pre-heating	☐ Grinding tools - Flying Sparks and Debris	☐ Close observation of pipe rollers and cradles	☐ Use GFCI's and proper grounding
☐ Refueling	☐ Water Exposure/Drowning	☐ Install back-up alarms/ensure alarms are working	☐ Communicate with the railroad and ensure flagger protection is provided if necessary – don't work within 25 feet without flagger protection!
☐ Making wire connections	☐ Electrical Shock Hazards	☐ Never step or reach over rotating stems/pipe	
☐ Changing out hydraulic components	☐ Safety Latch on rigging inoperable/missing	☐ Position trailer on level terrain if possible	☐ Erect barricades and ensure personnel are kept clear of test area
☐ Break connections apart – EXIT SIDE	☐ Working near live railroad tracks (train traffic)	☐ Set parking brake on vehicles & equipment when not in use	
☐ Hydrotest product line	☐ Environmental release/spill		☐

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ATTACHMENT

SPCC PLAN

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SPILL PREVENTION/CONTROL/ COUNTERMEASURE PLAN (SPCC)

For HDD - Crossings

A DIVISION OF MICHELS CORPORATION

DIRECTIONAL DRILLED CROSSINGS

Revision 0
March 18, 2020

MICHELS DIRECTIONAL CROSSINGS
A DIVISION OF MICHELS CORPORATION

SPILL PREVENTION CONTROL AND COUNTERMEASURE PLAN (SPCC)

HORIZONTAL DIRECTIONAL DRILLING

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I. Introduction

This Spill Prevention Control and Countermeasure Plans (SPCC) have been developed by Michels Corporation (Michels) to serve as a guideline for horizontal directional drilling (HDD) operations. This plan is intended to ensure that the equipment utilized to perform the work and the fuel, oil, and lubricant products used in the day to day operation of the equipment will have no long-term adverse environmental impact on the staging areas required for construction. The guidelines contained in this plan will be implemented by field personnel to prevent accidental releases of hazardous material to the environment and to outline measures taken should an accidental release occur. The drilling project manager for the project is experienced in these matters and is typically the designated Spill Coordinator for Michels.

This SPCC plan was developed using Federal Energy Regulatory Commission (FERC) guidelines for construction activities along a pipeline right-of-way. This plan is intended to comply with all applicable requirements of FERC and local State and County authorities. Since HDD operations are generally confined to two distinct locations, the rig (entry) side and pipe (exit) side, this SPCC plan addresses construction operations at these specific locations only for hazardous materials. This SPCC plan consists of three sections:

- Preventative measures to be taken prior to initiating construction with hazardous materials;
- Preventative procedures to be followed while using hazardous materials during construction;
- Procedures to be implemented should an accidental spill of hazardous material occur;

II. Pre-Construction Hazardous Material Spill Prevention

Prior to construction, all Michels' personnel who will be performing work on site will have attended a FERC-approved environmental training program within the last year. This training program will serve to indoctrinate the personnel and make them aware of the pollution control laws, rules, and regulations applicable to the pipeline right-of-ways. Michels' personnel are highly experienced with the equipment to be used in HDD operations and have worked on numerous FERC governed projects in the past. However all personnel will be refreshed by the project manager and drill superintendent in the operation and maintenance of construction equipment to prevent the accidental discharge or spill of fuel, oil, or lubricants.

Through the environmental training program and the project manager's guidance along with knowledge obtained from past experience, all Michels' personnel will be thoroughly educated on the following topics:

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- Precautionary measures to prevent spills;
- Potential sources of spills, such as equipment failure or malfunction and re-fueling procedures;
- Standard operating procedures in case of a spill, including applicable notification requirements;
- Equipment, Materials, and Supplies available for clean-up of a spill;
- Review of known spill events, if any.

Prior to mobilizing equipment to the proposed alignment R.O.W., Michels will thoroughly inspect and if necessary repair or replace equipment components that could potentially leak hazardous material. The equipment will be cleaned of any debris or material observed to be hazardous. All hazardous material storage containers and secondary containment devices will be inspected and if necessary repaired or replaced.

The spill containment and clean-up materials used by Michels will be inventoried and if necessary re-stocked prior to initiating construction operations. At a minimum, the following spill containment and clean-up materials will be located in a central location at each side of the HDD crossings where equipment is in use or hazardous materials are stored in sufficient quantities to contain and clean-up a spill or release should one occur:

- Spill containment kits typically consisting of the following items
  - 1 x 55 gal poly drum
  - 50 x 18” x 18” absorbent pads
  - 8 x 3” x 4’ absorbent socks
  - 6 x 18” x 18” absorbent pillows
  - 3 x 5” x 10’ absorbent booms
  - 4 Disposable plastic bags with ties
  - 4 pair nitrile gloves
- Plastic sheeting
- Floor Dry absorbent material (50 pound bag-typical)
- Personal protective equipment (i.e. gloves and safety glasses)
- Replacement parts and equipment for repair of tanks, hoses, nozzles, etc.
- Equipment and tools to divert spilled fluids and create earthen barriers

III. HDD Construction Operations Hazardous Material Spill Prevention

Once construction activities for the HDD are underway, hazardous material spill prevention will be a continuous element of the operations. During equipment set up, potential sources of hazardous material releases, i.e. fuel tanks, hydraulic oil tanks and hoses, antifreeze tanks, and lubricant storage bins will be located as far away as practicably possible from streams, wetlands, and drainage ways. If necessary, and if practicable, temporary barriers may be constructed or placed between the potential sources of spills and areas identified as extremely sensitive to accidental

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spills. Spill containment and clean-up materials/kits will be located in a central location at each side of the drill site location where equipment is in operation or hazardous materials are stored and all personnel will be made aware of the location.

Secondary containment devices will be placed to enclose major sources of potential hazardous spill locations (i.e. fuel storage tanks and hazardous materials storage areas). A site layout drawing for entry locations and exit locations showing the placement of significant sources of hazardous material releases and secondary containment measures are attached in **Appendix A** of this plan. The exact location of the equipment will vary to address specific site conditions after the temporary work space has been prepared for equipment set-up. Access to the sites will be limited by the Project Manager to only authorized personnel and visitors.

During construction, spill refresher briefings will be scheduled quarterly and conducted by Michels. The briefings will refresh Michels' personnel on the topics covered during the pre-construction environmental training as well as review operations to date, including any accidental spills that may have occurred and measures taken for prevention of future spills.

Michels will store, handle and transfer hazardous materials used during HDD operations in a manner to prevent accidental releases or spills of these materials. **Table-1** attached in **Appendix-A** to this plan summarizes the hazardous materials, combined expected volumes, and storage methods for both the entry and exit locations. The Material Safety Data Sheets (MSDS) for every product used by Michels are maintained on file in the drilling survey trailer on site should they be required to assess the hazard potential of a spill. The list of primary hazardous materials (petroleum-based products) to be used by Michels over the course of each HDD crossing is as follows:

- Gasoline
- Diesel Fuel
- Hydraulic Oil
- Lubricants
- Penetrating Oils
- Antifreeze

Michels' personnel will follow specific guidelines set forth in this plan during operation and maintenance of equipment and vehicles used in support of the HDD operations. All waste oil or fuel collected during routine maintenance of the equipment will be contained and disposed of in accordance with state and federal requirements.

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IV. Potential Sources of Hazardous Spill-Preventative Measures to be Implemented

For day to day operations, Michels' personnel will follow these guidelines to prevent the accidental release or spill of hazardous materials:

Potential Source of Hazardous Spill	Preventative Measures To be Implemented
Fuel stored in a storage tank	• Except as specified in **Attachment-A** of Appendix-B, locate storage tank at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. • Install secondary containment devices around tank in excess of 150% of the maximum volume to be stored. • Inspect tank and secondary containment daily and before filling, implement corrective action upon discovery of deterioration that could cause a spill or result in a leak. Record inspection results weekly on log attached in the appendix to this plan. • Remove any precipitation found within the secondary containment. Prior to removing the precipitation, inspect for film, sheen, discoloration, sludge, emulsion or tarry residue, if present then collect the liquid for disposal. Do not discharge to land or surface waters. • Plug or close all tank openings when not in use. • Maintain sufficient quantities of spill control and clean-up materials in a central location near the storage tank, inspect supply daily. • Provide security measures to protect against vandalism of stored materials
Liquid material stored in a container	• Except as specified in **Attachment-A** of Appendix-B, store container at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. • If practicable and if room allows, store containers in a central location within a common secondary containment device. All significant container storage (i.e. greater than 5 gallon) will have secondary containment in excess of 150% of the maximum volume proposed to be stored. • Use small containers which are in good condition (maximum 55 gallon drum). • Take measures to protect the containers from the elements or physical damage. • Inspect containers daily, replace immediately if damaged or leaking. Record inspection results weekly on log attached in **Attachment-B** of Appendix-B to this plan • Close containers when not in use. • Maintain sufficient quantities of spill control and clean-up materials in a central location where the containers are regularly used, inspect supply daily. • Provide security measures to protect against vandalism of stored materials

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Liquid material transferred from a storage tank or container to vehicles or equipment	• Except as specified in **Attachment-A** of Appendix-B**,** transfer materials at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. Exercise extreme caution for transfers in areas where set-back distances from sensitive areas cannot be met such as placement of absorbent pads or drip pans beneath transfer points, creating temporary earthen berms, or other similar precautionary spill measures. • Transfer during daylight hours or where lighting is adequate to illuminate the area. • Monitor transfer operations at all times. • Maintain sufficient quantities of spill control and clean-up materials in a central location where transfers regularly occur, inspect supply daily. • Provide security measures to protect against vandalism of stored materials

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Liquid material used in vehicles and equipment	• Except as specified in **Attachment-A** of Appendix-B, park at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. • Inspect daily for leaks or signs of deterioration that could result in a leak. • Repair or replace defective tanks, hoses, fittings, etc. • Maintain sufficient quantities of spill control and clean-up materials in a central location where equipment or vehicles are in use, inspect supply daily. • Provide security measures to protect against vandalism of stored materials

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Liquid material transferred from tank vehicle to vehicles & equipment	• Except as specified in **Attachment A** of Appendix-B, tank vehicle used during re-fueling operations shall be specifically designed for supplying fuel to vehicle or equipment tanks and will comply with the requirements of NFPA 385 and other applicable state and federal requirements. • Tank vehicle and its equipment shall be maintained in good repair. • Drivers to be thoroughly trained in the proper method and operation of tank vehicles and in acceptable unloading procedures. • The driver or operator will not leave vehicle unattended during re-fueling operations • All engines to be shut off and operators not on the equipment during refueling operations. • Smoking is to be forbidden on or near any vehicle involved in re-fueling operations. Extreme precaution shall be exercised to prevent people in the vicinity from smoking, lighting matches, or carrying any flame or lighted device. Signs prohibiting smoking or open flames to be prominently displayed in open view on the tank vehicle. • Re-fueling procedures will not be initiated until precautions have been taken to prevent the motion of vehicles involved. Parking brakes to be utilized if available. • Length of refueling hose is typically limited to 50-feet from the hose reel. Tank vehicle to be positioned with respect to vehicles being fueled in order to prevent unwanted traffic between the tank vehicle and vehicle/equipment being fueled. • Each vehicle must contain one portable fire extinguisher that has a minimum rating of 4A, or 4-B,C. Ratings to be in accordance with NFPA-10. Signage on vehicles shall clearly indicate location of fire extinguisher. • Fueling/Re-fueling operations should typically take place during daylight hours. Nighttime fueling operations conducted in adequately lighted areas. • Documentation of training to be made available upon request. • Provide security measures to protect against vandalism of stored materials

Should these guidelines prove to be inadequate to prevent the accidental release or spill of hazardous material, they will be revised and implemented as required to ensure that every possible preventative effort is being taken. All personnel will be made aware of any such revisions at the time of the revision and at the environmental refresher meetings.

V. HDD Construction Operations Hazardous Material Spill Procedures

A spill is an unintentional release of hazardous material to the environment. In the unlikely event that an inadvertent spill of a hazardous material occurs the following steps will be followed at a minimum:

- Step 1 - Containment: Assess the situation prior to attempting to control the spill. Secure the spill scene and attempt to identify and stop the source of spill and

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contain at source. Limit access to the site in order to prevent/limit personal and/or property damage. Responders must have knowledge of the spilled material and immediately utilize all available resources (i.e. equipment, personnel, and materials), to contain spill. If adequate resources are not available, expedite mobilization of additional resources from other construction activities as required to fully contain the spill. If the spill cannot be adequately handled by additional resources, Michels will arrange for an approved spill response contractor to mobilize to the site and contain, clean up, and perform required sampling and disposal of spilled materials and residual contaminated debris.

- Step 2 - Remediation: Properly trained personnel shall clean up hazardous material immediately after spill is contained to prevent further migration of hazardous materials into the environment. Responders should consult with proper governmental resource agencies as required. In no case shall containment equipment be used to permanently store contaminated material. Containerize in DOT-approved containers, label, and remove all contaminated material from the construction area and dispose of material in accordance with applicable regulatory guidelines (i.e. transport to hazardous waste disposal facility by licensed waste hauler). The Owner will be provided with proper documentation showing that material was disposed of in a proper manner.

- Step 3 - Notification: Reporting requirements will depend on the quantity of spill. A spill constituting less than a significant spill event will be reported to Owner and/or Owner's representative Chief Inspector **(CI)-_____: ( ) - (office), or ( ) - (cell).**

  Significant spills are defined as: any amount of petroleum, oils, or lubricants discharged to a receiving stream that causes a film, sheen, or discoloration of surface water or adjoining shoreline; or any reportable quantity of hazardous material as defined by 40CFR320. If a significant spill should take place, Michels' Project Manager (PM), will notify the Prime Contractors' Project Manager and Owner's representative Chief Inspector **(CI)-_____( ) - (office), or ( ) - (cell)** of the spill as soon as he has confirmed that the spill has been completely contained. Michels' PM will assist the Owner's representative in submitting the regulatory-required information for hazardous spill notification in accordance with Governing Agency procedures. At the very minimum the project superintendent will provide the CI with the information required on the "Spill Report" included as **Attachment C** in Appendix C.

- Step 4 – Michels' Project Manager will be responsible for any applicable agency reporting requirements. The notification requirements for petroleum and hazardous materials spills are as follows:

  - Federal Contacts:
    National Spill Response Center 1-800-424-8802

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- State Contacts:
  State Department of Environmental
  Quality - Spill Notification ( ) - (Business Hours)
  ( ) - (After Hours)

- Local Contacts:
  Local Fire Department _____

- A completed Petroleum and Hazardous Materials Spill Report must be submitted to OWNER & Governmental Agencies within 48 hours.
- Prior to continuing work, Michels will determine the cause of the spill and implement measures to ensure that further spills will not occur.

A More detailed list of Local Emergency Response Personnel and Hospital Location will be attached and filled out as **Attachment D** in Appendix C.

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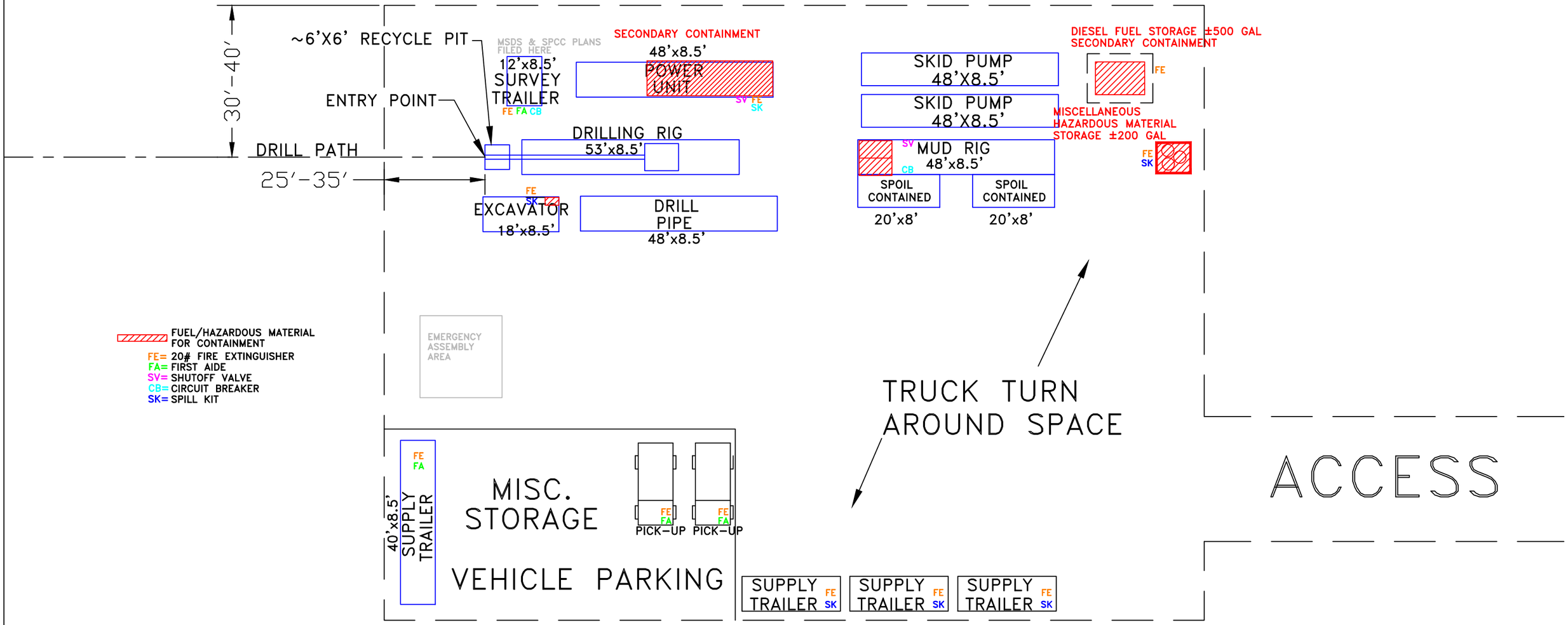
APPENDIX-A

EROSION CONTROL PLACED AROUND PERIMETER OF SITE

200'X150' TEMP WORKSPACE



PLAN VIEW

NOTE: THIS IS A TYPICAL SITE SET-UP. THERE ARE VARIOUS CONFIGURATIONS USED DEPENDING UPON SITE RESTRICTIONS. FIELD MODIFICATIONS TO SUIT SITE.

NOTE: BENTONITE SLURRY PUMPED FROM PIT, COLLECTED & RECYCLED OR DISPOSED OF AT AN APPROVED LOCATION

REVISIONS

NO.	DATE	REVISION DESCRIPTION	SOURCE DRAWING
0			

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DIRECTIONAL BORE FOR: OWNER | PROJECT: PROJECT NAME

DRAWING: ANTICIPATED ENTRY SITE LAYOUT

SCALE: NTS | LOCATION: CROSSING NAME

DRAWN BY: B.J.E. | MDC JOB #: xxx | DATE: 3 / 18 / 20

TABLE I

HAZARDOUS SUBSTANCE INVENTORY

Material	Quantity (gallons)	Storage Location	Reportable Quantity (include reference)
Oil/Fuel:			
Unleaded Gasoline	**10 Gallons**	**5 Gallon DOT-Approved Re-fill able Cans - Storage Trailer**	
	80 Gallons	**Fuel Tank in Bed of Pick-Up Truck**	
Diesel Fuel	**120 Gallons**	**Fuel Tank in Bed of Pick-Up Truck**	
	500 Gallons	**Fuel Tank w/Secondary Containment on Site in excess of 150% of maximum volume**	
Motor Oil	**1 or 5 Gallons**	**Reinforced Plastic Container - Storage Trailer**	
Hydraulic Oil	**110-Gallons**	**Two 55-gallon drums w/Secondary Containment on Site in excess of 150% of maximum volume**	
Commercial Chemicals:			
Ethylene Glycol	**40-Gallons**	**1 or 5 Gallon Reinforced Plastic Containers - Storage Trailer**	
Hazardous Wastes:			

APPENDIX-B

Attachment A

The setbacks specified for refueling, fuel storage, and parking of equipment may not be practicable for certain construction activities, including horizontal directional drilling. Exceptions to the setback requirements may be allowed for:

- Areas where removing equipment from a wetland for servicing or overnight parking would increase adverse impacts to the wetland and/or result in significant construction delays;
- Construction sites where moving equipment to refueling stations from pre-fabricated equipment pads is impracticable or where there is a natural barrier from the water-body or wetland (i.e., dike, road or railroad);
- Locations where the water-body or wetland is located adjacent to a road crossing (from which the equipment can be serviced);
- Refueling and fuel storage for immobile equipment including, but not limited to, bending and boring machines, air compressors, padding machines, and hydro-test fill pumps.

ATTACHMENT B
WEEKLY HAZARDOUS MATERIALS/WASTE INSPECTION LOG

For each item listed below, Contractor will indicate whether existing conditions are acceptable (A) or unacceptable (U). Resolution of all unacceptable conditions must be documented. Contractor will inspect all storage facilities on a regular basis, but not less than weekly. Contractor will keep records of all inspections on file. Contractor will provide a coy of the completed form to the Chief Inspector and Environmental Inspector on a weekly basis.

I. STORAGE AREAS FOR FUELS, LUBRICANTS AND CHEMICALS

General

A/U

_____ Construction yard or storage areas secured

_____ National Fire Protection Association symbol posted in storage area or at yard entrance

_____ Storage areas properly prepared and signed

_____ Material Safety Data Sheets available

_____ Hazardous Materials Management Plan/Spill Prevention and Countermeasure Plan available

Hazardous Materials Management

A/U

_____ No evidence of spilled or leaking materials

_____ Incompatible materials separated

_____ All containers labeled properly

_____ All containers securely closed

_____ All containers upright

_____ No evidence of container bulging, damage, rust or corrosion

Secondary Containment Areas

A/U

_____ Containment berm intact and capable of holding 110% of material stored plus precipitation

_____ Lining intact

_____ No materials overhanging berms

_____ No materials stored on berms

_____ No flammable materials used for berms

Compressed Gases

A/U

_____ Cylinders labeled with contents

_____ Cylinders secured from falling

_____ Oxygen stored at least 25 feet away from fuel

_____ Cylinders in bulk storage are separated from incompatible materials by fire barriers or by appropriate distance

II. HAZARDOUS WASTE MANAGEMENT

Waste Container Storage

A/U

_____ No evidence of spilled or leaking wastes

_____ Adequate secondary containment for all wastes

_____ Separate containers for each waste stream—no piles

_____ Waste area not adjacent to combustibles or compressed gases

_____ All containers securely closed

_____ Bungs secured tightly

_____ Open-top drum hoops secured

_____ All containers upright

_____ No evidence of container bulging, corrosion

_____ No severe container damage or rust

_____ Containers are compatible with waste (e.g. plastic liner for corrosives, metal liner for solvents)

_____ No smoking and general danger/warning signs posted

Waste Container Labeling

A/U

_____ Containers properly labeled

_____ Name, address and EPA ID number or ID Number of generator listed (Not required if Contractor is an exempt small quantity generator.)

_____ Accumulation start date listed

_____ Storage start date listed

_____ Chemical and physical composition of waste listed

_____ Hazardous property listed

Nonhazardous Waste Areas

A/U

_____ No litter in yard

_____ No hazardous wastes or used oil mixed with trash (e.g., contaminated soil, oily rags, diapers, or other oily materials)

_____ Empty oil and aerosol containers for disposal are completely emptied

III. EMERGENCY RESPONSE EQUIPMENT

A/U

_____ Shovels

_____ Absorbent materials (booms, pads, pillows, socks, “Speedy Dry”

_____ Personal protective equipment (goggles, gloves)

_____ Fire-fighting equipment

_____ First aid supplies (e.g. medical supplies, squeeze bottle eye wash)

_____ DOT-approved containers

_____ Plastic sheeting, bags and ties

_____ Communication equipment

_____ Bung wrench (non-sparking)

IV. CORRECTIVE ACTIONS TAKEN (Required for all unacceptable conditions)

_____

_____

_____

_____

_____

_____

_____

_____

_____

Date: _____ **Contractor Name :** _____

Inspected by (Contractor’s Inspector): _____

Signature: _____

APPENDIX-C

ATTACHMENT C

Petroleum and Hazardous Material Spill Report

Date of spill: _____ Incident No: _____ Date of spill discovery: _____

Time of spill: _____ Time of spill recovery: _____

Location Name: _____ Spread: _____ County: _____

Section: _____ Township: _____ Range: _____

Name and Title of Discoverer: _____

Type of material spilled and product name: _____

Manufacturer's Name: _____

Legal description of spill location: _____

Directions from nearest community: _____

_____

_____

Estimated volume of spill: _____ Estimated material recovered: _____

Weather Conditions: _____

Topography and surface conditions of spill site: _____

Spill medium (pavement, sandy soil, water, etc.): _____

Proximity of spill to surface waters or wetland: _____

Did the spill reach a water body? _____ Yes _____ No

If so, was a sheen present? _____ Yes _____ No

Direction and time of travel (if in stream): _____

Responsible party (name, phone number): _____

Describe the causes and circumstances resulting in the spill: _____

_____

_____

Describe the extent of observed contamination, both horizontal and vertical (i.e., spill-stained soil in a 5'' radius to a depth of 1"):

_____

_____

Resources and installations that may be affected: _____

_____

_____

Potential impact on human health: _____

Describe immediate spill control and/or cleanup methods used and implementation schedule: _____

Current status of cleanup actions: _____

Name/Company/Address/Phone Number for the following:

Construction Superintendent: _____

OWNER
Representative: _____

Environmental Director: _____

Person Who Reported the Spill: _____

Environmental Inspector: _____

On-Scene Agency Coordinator (where applicable): _____

Form completed by: _____ Date: _____

The Contractor must complete this for any petroleum or hazardous material spill regardless of size, and submit the form to OWNER or OWNER's designated representative for construction observation within 48 hours of the occurrence.

ATTACHMENT D
LOCAL Emergency RESPONSE PERSONNEL-HOSPITAL LOCATION

The contractor should provide a listing by municipality of the local emergency response organizations near the HDD project site, and the name and phone number of a contact person for each. For example, list fire and police departments, emergency management organizations, etc. The contractor should update and complete this information as required for his/her work locations. Additions will be made by the Project Manager once they become available prior to drilling operations.

Local Emergency Contacts

- Federal Contacts:
  National Spill Response Center 1-800-424-8802

- State Contacts:
-
-
- Local Contacts:
  Emergency Response -
  Emergency Response -
  Local Fire Department 911
  Local Police Department 911

- Nearest Hospital:

Other Phone Numbers to be added to this form if necessary.

MICHELS®

ATTACHMENT

DRILL RIG SPECIFICATIONS

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MICHELS®

817 W. Main Street, P.O. Box 128
Brownsville, WI 53006
Telephone: (920) 583-3132
Fax: (920) 583-3429
www.michels.us

HERCULES
(11) RIGS OWNED & OPERATED

DRILL RIG SPECIFICATIONS

Weight:	100,000 – 103,000 Pounds
Height:	13’ 6”
Length:	53’
Width:	8’ 6”
Horsepower:	1500+ HP (750 HP ea)

DRILL RIG CAPACITY

Torque Capacity:	164,500 Ft/Lbs
Max Spindle Speed:	90 RPM
Thrust/Pull:	1,260,000 Lbs

DRILLING SPECIFICATIONS (DIRT)

MAXIMUM RECOMMENDED

Back Ream:	96”
Drilling Distance:	8,000’

DRILLING SPECIFICATIONS (ROCK)

MAXIMUM RECOMMENDED

Back Ream:	60”
Drilling Distance:	8,000’

SURVEY SYSTEM SPECIFICATIONS

Type:	**Downhole probe** transmits tool face, 3 dimensional coordinate data	
Accuracy:	+/-0.1º All Angles	
Max Locating Depth:	Unlimited	
	Tool face	±0.5º
Type:	**Gyro-Steering Tool**	
Accuracy:	Inclination	±0.01˚
	Azimuth	±0.04˚
	Tool face	±0.02˚

SECONDARY SURVEY SYSTEM SPECIFICATIONS

Type:	**ParaTrack**	
Accuracy:	Inclination	±0.1º
	Azimuth	±0.4º
	Tool face	±0.5º

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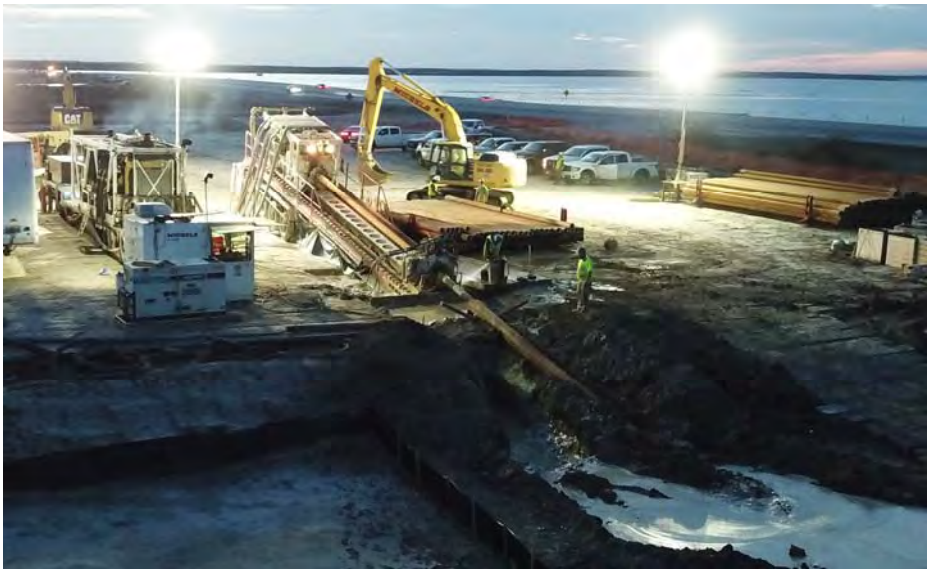
Brownsville, WI 53006
Telephone: (920) 583-3132
Fax: (920) 583-3429
www.michels.us



ATLAS 840
(7) RIGS OWNED & OPERATED

DRILL RIG SPECIFICATIONS

Weight:	88,000 – 93,000Lbs Varies
Height:	13’ 6”
Length:	54’
Width:	8’ 6”
Engine:	Dsl Cat Model 3456 or 3412
Horsepower:	660 HP or 750 HP

DRILL RIG CAPACITY

Torque Capacity:	164,500 Ft/Lbs
Max Spindle Speed:	100 RPM
Thrust/Pull:	840,000 Lbs

DRILLING SPECIFICATIONS (DIRT)

MAXIMUM RECOMMENDED

Back Ream:	60”
Drilling Distance:	6,500’

DRILLING SPECIFICATIONS (ROCK)

MAXIMUM RECOMMENDED

Back Ream:	52”
Drilling Distance:	6,500’

SURVEY SYSTEM SPECIFICATIONS

Type:	**Downhole probe** transmits tool face, 3 dimensional coordinate data	
Accuracy:	+/-0.1º All Angles	
Max Locating Depth:	Unlimited	
	Tool face	±0.5º
Type:	**Gyro-Steering Tool**	
Accuracy:	Inclination	±0.01˚
	Azimuth	±0.04˚
	Tool face	±0.02˚

SECONDARY SURVEY SYSTEM SPECIFICATIONS

Type:	**ParaTrack**	
Accuracy:	Inclination	±0.1º
	Azimuth	±0.4º
	Tool face	±0.5º

MICHELS®

ATTACHMENT

HDD PLAN AND PROFILE DRAWING

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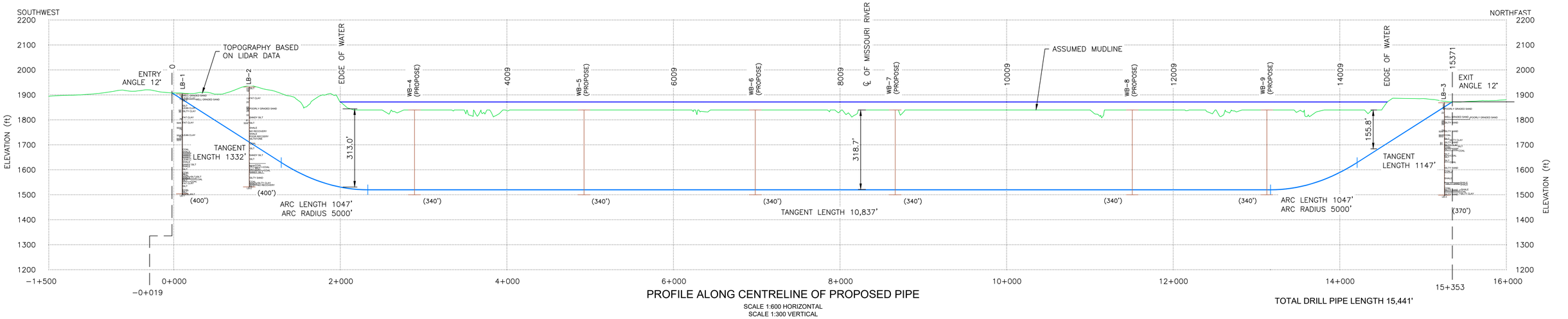
PLAN VIEW
SCALE 1-in:600-ft



PROFILE ALONG CENTRELINE OF PROPOSED PIPE
SCALE 1:600 HORIZONTAL
SCALE 1:300 VERTICAL

BORING LEGEND

SPT (N)
SOIL DESCRIPTION
ROD/REC
ROCK DESCRIPTION
BORING NAME

HORIZONTAL DIRECTIONAL DRILL DATA MISSOURI RIVER		
DESCRIPTION	STATION (ft)	ELEVATION (ft)
ENTRY @ 12°	−0+019	1908.07
PC1 = 5000' RADIUS	1+293.20	1629.26
PT1 =	2+332.76	1520.00
PC2 = 5000' RADIUS	13+170.24	1520.00
PT2 =	14+210.00	1629.26
EXIT @ 12°	15+353.00	1872.17
HORIZONTAL DISTANCE (ft) = 15371		
DIRECTIONAL DRILL PIPE LENGTH (ft) = 15441.16		

REFERENCE DOCUMENT NO.	DATE
1.	

CCI & Associates Inc.
20333 State Highway 249, Suite 480
Houston, TX 77070
COR F-18518

ENGINEER AND PERMIT STAMPS

ISSUED FOR REVIEW NOT FOR CONSTRUCTION

PIPELINE SPECIFICATIONS

OUTSIDE DIAMETER (OD)(in)	24
WALL THICKNESS (WT)(in)	1.219
GRADE (psi)	52,000
PRODUCT	NATURAL GAS
MATERIAL	STEEL
SPECIFICATIONS	API 5L
INTERNAL COATING	N/A
OUTER COATING	DUAL FBE
MAX. OPER. PRESSURE (psi)	1,480
MIN. TEST PRESSURE (psi)	1,850
MAX. OPER. TEMP (°F)	100
MIN. INSTALLATION TEMP (°F)	23

STEERING TOLERANCES

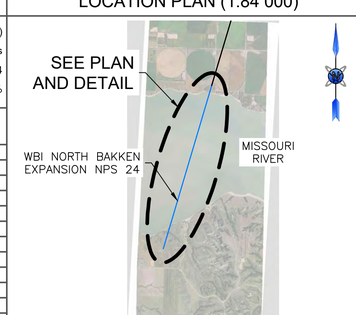
	30ft	100ft	330ft
MINIMUM RADIUS (ft)	1000	1450	4500

PULL FORCE / RIG SIZE / STRESS

PULL FORCE (w/ BUOYANCY CONTROL):	863,000 lbs (w/sf)
MINIMUM RECOMMENDED RIG SIZE:	1,000,000 lbs
COMBINED STRESS UNITY CHECK:	0.44
OPERATING STRESS	65.7%

DRAWING STATUS	DATE	DRN	CHK	DES	GEO	APR	CR
ISSUED FOR REVIEW	2019-12-19	MS		KP		KP	
PRELIMINARY	2019-10-23	MS		KP		KP	
PRELIMINARY	2019-07-25	TL	MAL	KP		KP	
PRELIMINARY	2019-06-14	RL		KP		KP	
PRELIMINARY	2019-06-11	RL		KP		KP	
PRELIMINARY	2019-03-11	AN		CG		KP	

LOCATION PLAN (1:84 000)



ND83-NF

WBI NORTH BAKKEN EXPANSION PROJECT

MISSOURI RIVER HDD CROSSING
PLAN AND PROFILE

WATFORD CITY / TIOGA, NORTH DAKOTA

SCALE	DWG. #	REVISION	SHEET
AS SHOWN	2386-EG-0101	A	1 OF 2

File Name: S:\Current Jobs\2386-WBI-N.Bakken Expansion\Eng\Drawings\01-Lake Sakakawea\Missouri River\Preliminary\2386-EG-0101-F.dwg Date/Time: 11-Dec-19 / 3:48:23 PM Last Saved By: Matthew.Smith

ATTACHMENT

ANTICIPATED ENTRY/EXIT EQUIPMENT

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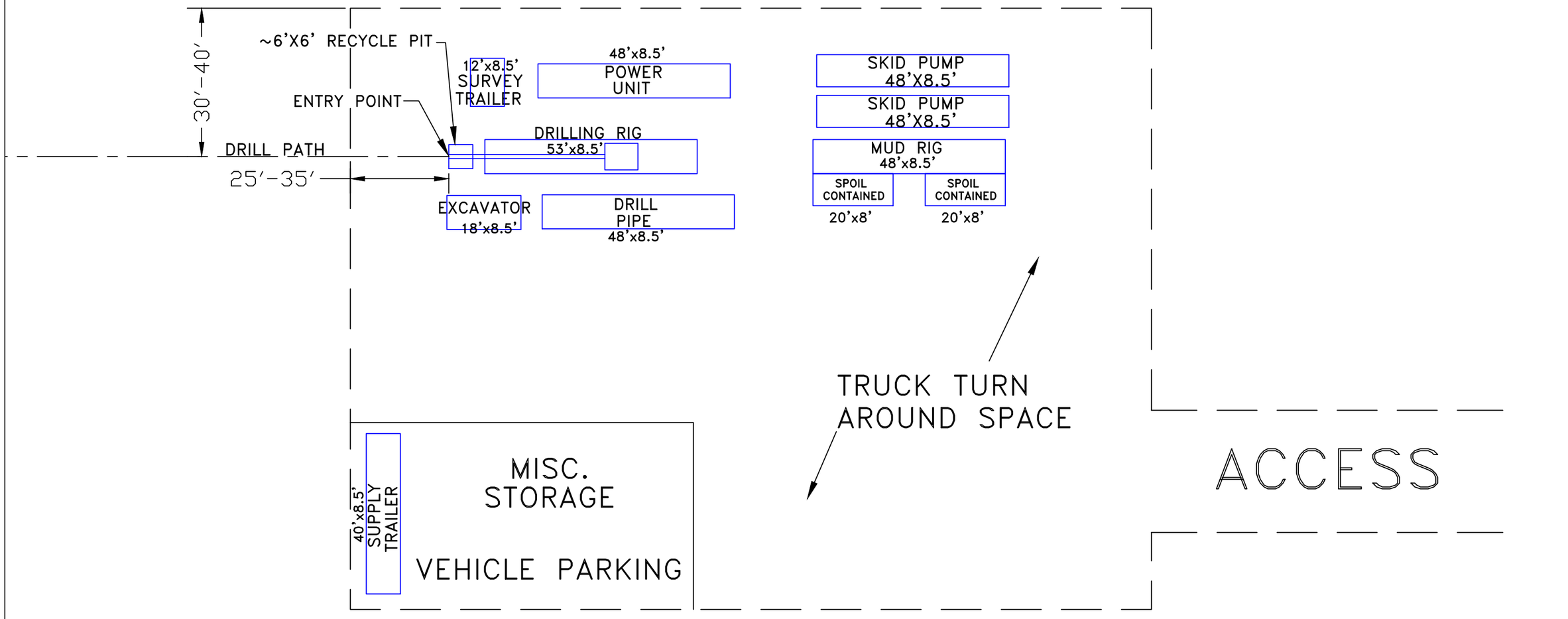
200'X150' TEMP WORKSPACE



PLAN VIEW

NOTE: THIS IS A TYPICAL SITE SET-UP. THERE ARE VARIOUS CONFIGURATIONS USED DEPENDING UPON SITE RESTRICTIONS. FIELD MODIFICATIONS TO SUIT SITE.

NOTE: BENTONITE SLURRY PUMPED FROM PIT, COLLECTED & RECYCLED OR DISPOSED OF AT AN APPROVED LOCATION

REVISIONS

NO.	DATE	REVISION DESCRIPTION	SOURCE DRAWING
0			

MICHELS®
817 W. MAIN ST. P.O. BOX 128 BROWNSVILLE, WISCONSIN 53006
PHONE: (920) 583-3132 FAX: (920) 924-4323

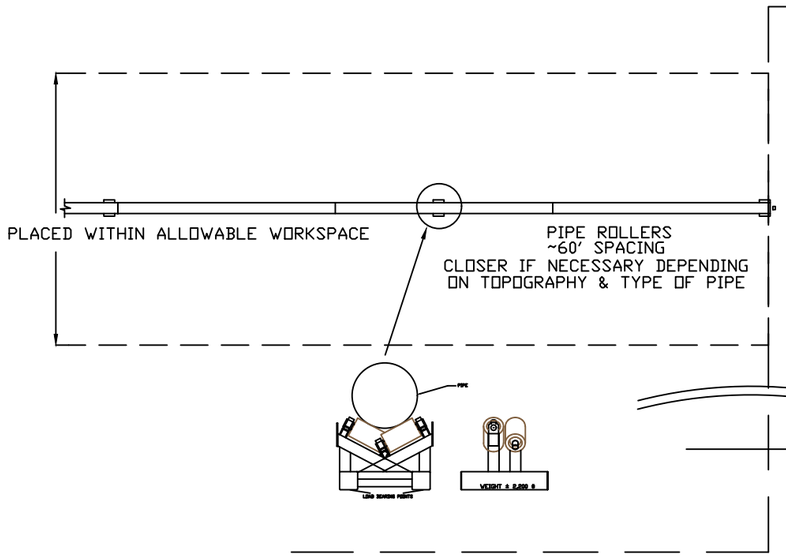
DIRECTIONAL BORE FOR: OWNER | PROJECT: PROJECT NAME

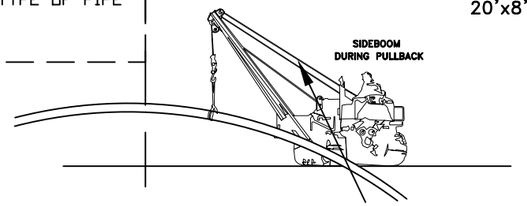
DRAWING: ANTICIPATED ENTRY SITE LAYOUT

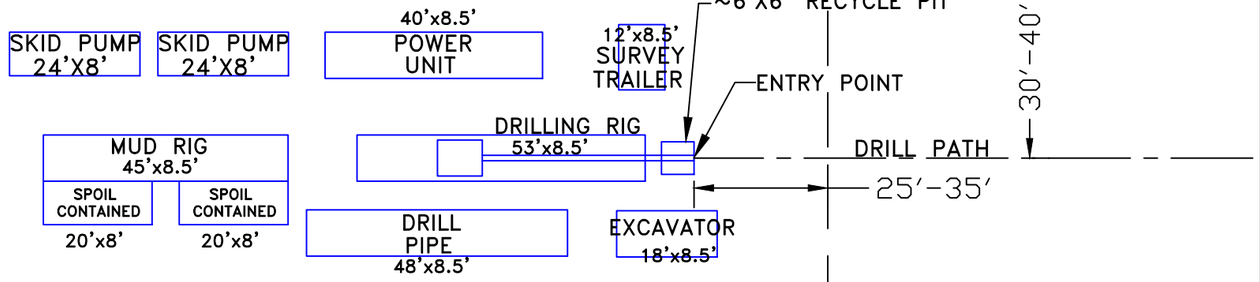
SCALE: NTS | LOCATION: CROSSING NAME

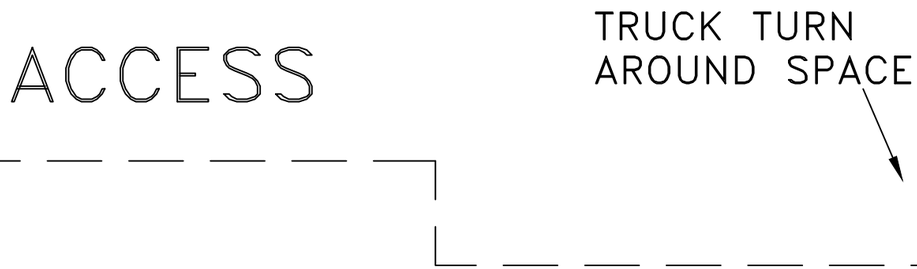
DRAWN BY: B.J.E. | MDC JOB #: xxx | DATE: 1/6/18

200'X150' TEMP WORKSPACE









PLAN VIEW

NOTE: RIG AND SUPPORT EQUIPMENT SHOWN MAY OR MAY NOT BE REQUIRED BUT SHALL BE PLANNED FOR IN CASE A HOLE INTERSECT IS REQUIRED AND/OR AS A HDD CONTINGENCY MEASURE

NOTE: THIS IS A TYPICAL SITE SET-UP. THERE ARE VARIOUS CONFIGURATIONS USED DEPENDING UPON SITE RESTRICTIONS. FIELD MODIFICATIONS TO SUIT SITE.

NOTE: BENTONITE SLURRY PUMPED FROM PIT, COLLECTED & RECYCLED OR DISPOSED OF AT AN APPROVED LOCATION

REVISIONS

NO.	DATE	REVISION DESCRIPTION	SOURCE DRAWING
0			

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817 W. MAIN ST. P.O. BOX 128 BROWNSVILLE, WISCONSIN 53006
PHONE: (920) 583-3132 FAX: (920) 924-4323

DIRECTIONAL BORE FOR: OWNER	PROJECT: PROJECT NAME
DRAWING: ANTICIPATED EXIT SITE LAYOUT	
SCALE: NTS	LOCATION: CROSSING NAME
DRAWN BY: B.J.E.	MDC JOB #: xxx
DATE: 1/6/18	

ATTACHMENT

MGS STEER TOOL SYSTEM

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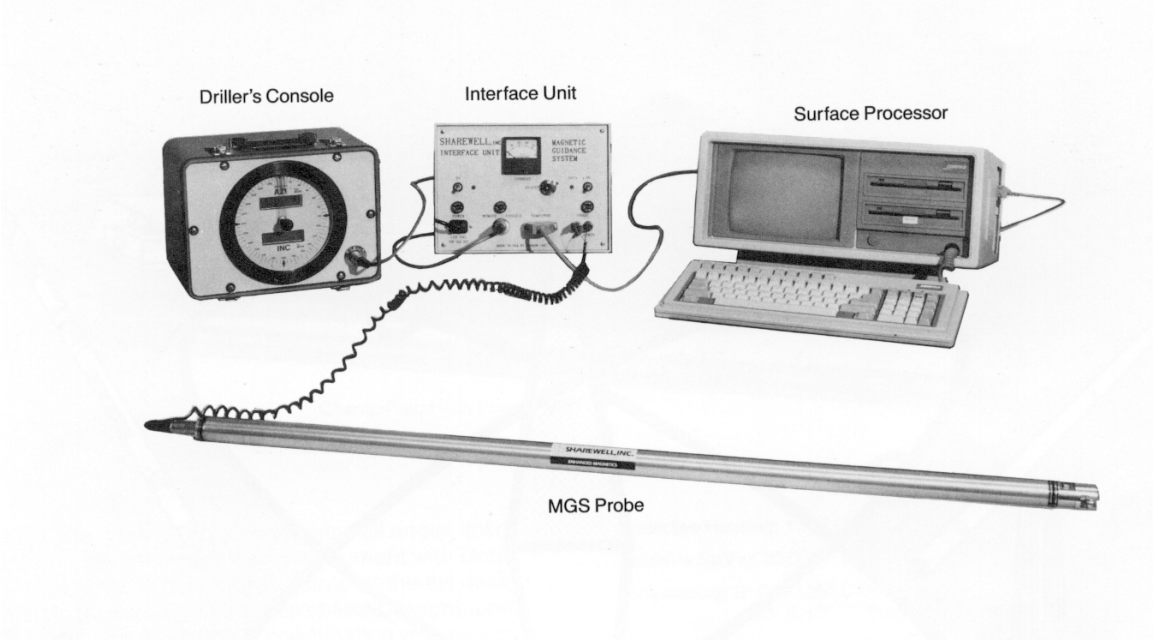
MAGNETIC GUIDANCE SYSTEM



The Magnetic Guidance System (M.G.S.) is designed to address a wide range of applications from normal oil and gas drilling to drainhole and pipeline river crossing drilling.

While directional drilling with either a downhole motor or jetting operation, the system permits you to guide the bit with utmost accuracy. Data is transmitted to surface via a single-conductor wireline.

The system comprises three main sub-sections: the downhole probe, the surface processing unit, and the driller's remote display.

Useful features include the ability to monitor the magnetic moments during drilling operations and to perform probe operational diagnostics while downhole as well as to verify probe calibration at the drilling location.

The directional engineer has the option to drill using either magnetic tool face or gravity tool face, along with having the magnetic hole direction and hole inclination displayed on a continuous basis from the remote readout. The surface processing unit provides duplicate output as the remote display, as well as the magnetic parameters including voltage temperature. A printed record of the data is available at selected intervals by the operator. The M.G.S. downhole probe incorporates the latest technology in accelerometers, magnetometers, calibration and modeling techniques to provide a rugged and reliable tool.

PROBE SPECIFICATIONS

SENSORS:

3 Axis Accelerometers → All Angle Capability
3 Axis Magnetometers → All Angle Capability

DIMENSION & RATING:

Probe Length	47.25"
Probe Diameter	1.38"
Protective Housing	1.75" x 6'
Protective Housing Pressure Rating	20,000 P.S.I.
Maximum Operating Temperature	125°C
Repeatability	0.2° at Horizontal 0.5° at 4° or Less
Accuracy	± 1%

DRILLER'S CONSOLE:

Two 4-character L.C.D. displays for Inclination, Azimuth and Tool Face Mode
360° Rotating Pointer for Tool Face Position
Hermetically Sealed Unit
12 Vac Operation
Electronics Isolated From Case
Easily Positioned Near Driller

SOFTWARE:

Displays Individual Sensor Values
Display of All Magnetic Parameters
Tool Face Offset Option
Complete Diagnostic Check
Automatic Tool Face Switching Mode Option
Data Printout on Request
Menu Driven
Borehole Survey Calculations

SURFACE PROCESSOR:

COMPAQ Portable or IBM Compatible with Printer

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ATTACHMENT

GYROSCOPIC
STEER TOOL SYSTEM

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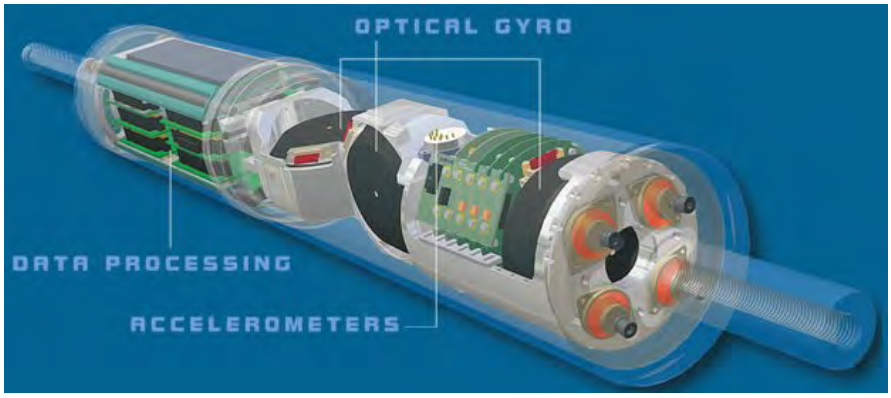
DRILLGUIDE GYRO STEERING TOOL



Technical Specifications –

Electric Power (Input on surface)	110-Volts AC / 50 Hz
Electric Power (Output to Downhole Tool)	48-Volts AC
Tool OD	6-5/8-inches
Tool Length	9-ft
Tool Joint Connection (Box Up x Pin Down)	4-1/2 IF
Maximum Allowed Torque (on Tool Housing)	18,000-foot pounds
Maximum Allowed Push/Pull (on Tool Housing)	75,000-pounds
Maximum Allowed Temperature (on Tool)	120-f
Maximum Allowed Shock (on Tool)	50-g (half sine wave)
Maximum Allowed Vibration (on Tool)	20-g up to 200-Hz
Maximum Allowed Mud Pressure (on Tool)	650-psi
Maximum Allowed Side Load (on Tool Housing)	33,000-pounds

Accuracy –

Azimuth	0.04°
Inclination	0.01°
Tool Face	0.02°

For additional information - http://www.drillguide.com

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ATTACHMENT

PARA TRACKER SYSTEM

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Vector Magnetics LLC
236 Cherry Street
Ithaca, New York 14850
607-273-8351 Fax: 607-273-6137

ParaTrack2 Survey and Guidance System Specifications

Downhole Survey Probe

Shock mounted triaxial accelerometers and magnetometers, temperature sensor and digitizing circuitry contained in 1.750 in. dia. x 55.3 in. long beryllium copper pressure barrel. Telemetry and power via wireline.

Temperature Rating:	85°C
Pressure Rating:	1200 bar
Survey Accuracy:	
Inclination:	±0.1°
Azimuth:	±0.4°
Toolface:	±0.5°
Maximum wireline length:	5000 meters

Interface Unit

Input:	85-265 VAC 50-60 HZ
Output:	48VDC, 50 mA

Guidance System

A single signal wire earthed at each end or with a return wire to close the loop.

Guidance Unit Input:	85-265 VAC 50-60 HZ
Guidance Unit Output:	34 VRMS, 6 Amps p-p max.
Position Accuracy:	±2% of separation from signal wire

Drillpipe and Borehole Pressure Module

(requires compatible survey probe)

Borehole gauge, 0-500 psi Full Scale, 1200 psi survival, 2400 psi burst
Drillpipe gauge, 0-2000 psi Full Scale, 6000 psi survival, 10000 psi burst
Non-linearity +/-0.1 %FS
Hysteresis +/-0.015 %FS
Repeatability +/-0.01 %FS

ATTACHMENT

PARA TRACK GYRO MODULE

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PGM

PARATRACK GYRO MODULE

IMMUNE TO MAGNETIC INTERFERENCE

The ParaTrack Gyro Module (PGM) is the latest in a long line of Vector Magnetics innovations for the HDD market. With no concern of magnetic interference from nearby active utility lines, shorepiles, ship traffic or other transportation activity, drilling may be carried out confidently, regardless of surrounding conditions.

The PGM runs in conjunction with the ParaTrack Steering Tool, providing the ability to tie in with the entire ParaTrack System of tools and software. The PGM is especially effective for initial surface entry, while absolute position may then be verified via the ParaTrack2 Guide Wire or Beacon Tracker, providing confidence that the bore is placed properly relative to the planned exit location prior to punch out.

Features

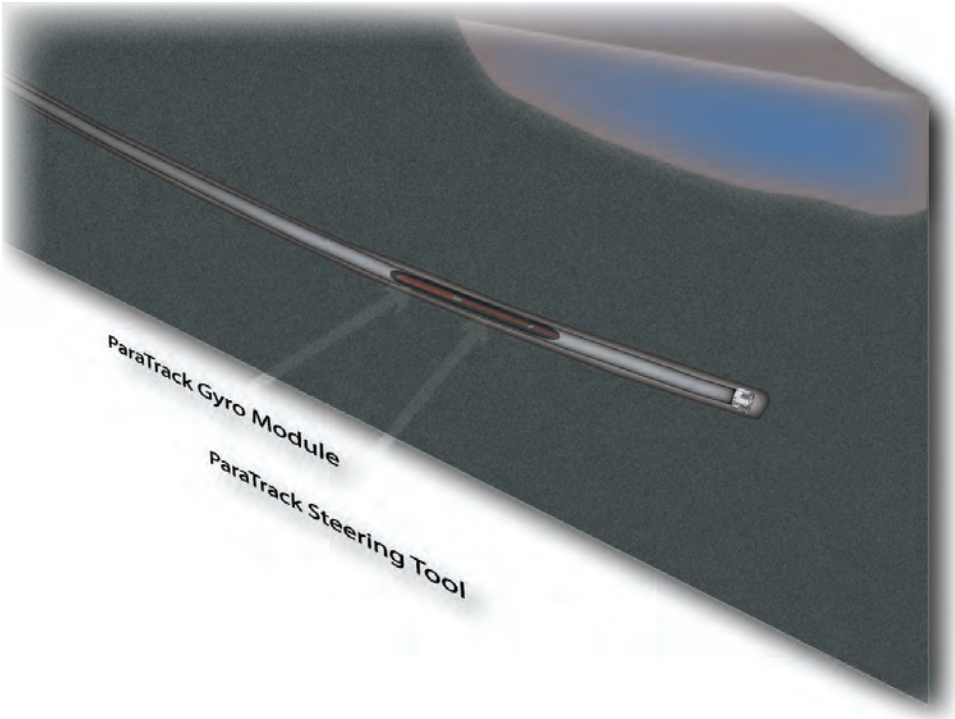
- Fiber optic north seeking gyro system
- Compatible with the entire ParaTrack line of Steering, Tracking and Surveying tools

Benefits

- Accurate surveying in cases of severe magnetic interference
- No specialized handling or personnel required
- Surveys immune from drillstring vibration

Applications

- Surveying in densely developed urban areas
- Verification and correction of magnetic azimuth in long unguided sections



Specifications

Outside Diameter: 2.75" (requires 3.5" collar)

Length: Head to foot - 48"

Internal Operating Temperature: 0-70C

Electrical Connection: 1-3/16", 12 tpi (standard wet connect)

Copyright © 2017 Vector Magnetics LLC

ATTACHMENT

TENSTEER TOOL

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TENSTEER DRILLER'S CONSOLE

- Features a 10.4" TFT color LCD with backlight that is sunlight readable
- Physical dimensions are 12.3" X 10.3" X 4.0"
- Weight is less than 12 lbs
- Operating temperature is –10° C to 70° C
- Internally protected against shock and vibration
- Sealed, metal construction that is resistant to dust, dirt and liquids
- 24V DC input power provided by Tensteer Steering Tool Receiver (STR)
- Inclination: Digital Display, ±90° range with 0.1° resolution
- Azimuth: Digital Display, 360° range with 0.1° resolution
- Tool Face: Digital Display, 360° range with 2.0° resolution
- Tool Face has magnetic and high side indicators
- Values for HTOT and GTOT are displayed
- Pipe and Annulus Pressure are capable of being displayed

For more information, contact Tensteer LLC at the following:

4245 Gattis School Rd Round Rock, TX 78664
Phone: 512-670-0447
Fax: 512-670-1070
Email: fred@tensteer.com
Website: www.tensteer.com

TENSTEER HIGH RESOLUTION STEERING TOOL PROBE

- Probe size: 1.75” diameter x 49” long
- Operating temperature: -20°C to 75°C
- Pressure rating: 12,000 psi
- Shock: 1000g, 0.5 msec, half sine
- Vibration: 30g peak, 30 to 500 Hz
- Maximum lateral displacement error: 2.6 ft. per 1000 ft. or a conical uncertainty of ±0.15°
- Survey resolution: 0.02°
- Magnetic resolution: <0.5 nT
- Power: 36 - 42 VDC, 70 mA
- Can track with DC power supply or welder
- Pressure and gamma upgradable
- Compatible with TrueGyde Software
- Can upgrade Tensor Probes

For more information, contact Tensteer LLC at the following:

4245 Gattis School Rd Round Rock, TX 78664
Phone: 512-670-0447
Fax: 512-670-1070
Email: fred@tensteer.com
Website: www.tensteer.com

TENSTEER STEERING TOOL RECEIVER (STR)

- Physical dimensions: 8.2″ X 8.3″ X 11″
- Weight: under 10 lbs
- Operating temperature: -20°C to 70°C
- Internal shock and vibration protection
- Powered by 110 VAC, 60Hz or 220 VAC 50 Hz, 60W max
- Three communication ports – USB, 9 Pin RS232, 25 Pin RS232
- Compatible with Tensor STDC and future Tensteer Driller's Consoles
- Wireline current shown on analog meter
- Power and data status shown on LED lamps

For more information, contact Tensteer LLC at the following:

4245 Gattis School Rd Round Rock, TX 78664
Phone: 512-670-0447
Fax: 512-670-1070
Email: fred@tensteer.com
Website: www.tensteer.com

ATTACHMENT

DAILY TRACKING FORMS

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Date:
Location:
Superintendent:

MICHELS®

FIELD REPORT

Tester Name
Michels Directional Crossings
817 W. Main Street, Brownsville, WI 53006
E-mail address

TIME	DENSITY "MUD WEIGHT" (lbs/gal)	FUNNEL VISCOSITY use Marsh funnel (sec/qt)	Solids/Sand Content (% by Vol)	pH	Comments

DRILL FLUID PRODUCT USED		DRILL FLUID HAULED OFF
Bentonite Type:	**Additives:**	
Drill-Terge:		

MICHELS DIRECTIONAL CROSSINGS
DAILY PROGRESS REPORT

DATE:
WEATHER:
PREPARED BY:
LOCATION: *ENTRY:* *EXIT:*

MICHELS JOB #

MICHELS®

	EMPLOYEE	CLASS	HOURS	
ENTRY SIDE				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.

	EMPLOYEE	CLASS	HOURS	
EXIT SIDE				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.

OPERATIONAL INFORMATION

CONDUCTOR CASING:	*Entry:*				
	Exit:				
HOLE SIZE / OPERATION:	*Entry Side*				
TOOL USED:					
TODAY's FOOTAGE:					
TOTAL FOOTAGE:					
% COMPLETED:					
COMPLETED PILOT HOLE:					

DRILLING FLUIDS INFORMATION

	ENTRY			EXIT	
BENTONITE TODAY:					Pallets
BENTONITE TO DATE:		Pallets			Pallets
WATER USED TODAY:					Gal.
WATER USED TOTAL:		Gal.			Gal.
LOSE CIRCULATION TODAY:					
VAC TRUCKS HAULED TODAY:		Ea.			Ea.
DISPOSAL VOLUME TODAY:		Gal.			
DISPOSAL VOLUME TOTAL:		Gal.			Gal.
DUMP TRUCKS TODAY:		Ea.			Ea.
SOLIDS DISPOSED TODAY:		Yds.			Yds.
SOLIDS DISPOSED TOTAL:		Yds.			Yds.

SUMMARY OF DAILY ACTIVITIES AND PROGRESS:

MICHELS®

PROJECT:
LOCATION:
JOB #:
SHEET #:

DATE	SURVEY #	MD	INC	FINAL AZI	HTOTAL	DIP	P2 ELEV	P2 RT	CALC STATION	CALC ELEV	CALC RIGHT	3 JOINT INC RADIUS	3 JOINT AZI RADIUS

MICHELS®

ATTACHMENT

BENTONITE BRANDS
PRODUCT DATA SHEETS

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MAX GEL ™

Certified to ANSI/NSF 60

MAX GEL viscosifier is a premium Wyoming bentonite blended with special extenders producing a viscosifier that will yield more than twice as much viscosity as regular Wyoming bentonite. MAX GEL is a high-yielding, easily mixed, superior mud making bentonite in fresh water.

APPLICATIONS

MAX GEL is used in the following applications to rapidly build mud viscosity and provide superior hole cleaning, as well as to help control lost circulation, formation sloughing and promote hole stability in unconsolidated formations.

- Potable water wells
- Mineral exploration (coring and rotary drilling)
- Horizontal directional drilling
- Blast holes
- Shaft drilling
- Monitor / observation wells
- Gel-foam air drilling applications

ADVANTAGES

- Yields more quickly than API-standard bentonite
- Non-toxic and proven suitable for use in drilling potable water wells
- Increased penetration rates are exhibited due to lower solids content than regular bentonite systems
- Transportation and storage costs are reduced due to lower treatment requirements as compared to bentonite

TYPICAL AMOUNTS OF MAX GEL ADDITIONS ADDED TO FRESH WATER

Drilling Application/Desired Results	lb/100gal	lb/bbl	kg/m3
Normal drilling	15 - 25	6 - 11	15 - 30
In gravel or other poorly consolidated formation	25 - 40	12 - 18	35 - 50
Lost circulation control	35 - 45	15 - 20	40 - 45
Added to freshwater mud to improve hole cleaning properties, increase hole stability and develop filter cakes	5 - 10	2 - 5	6 - 14

LIMITATIONS

- Loses effectiveness in water containing >7500 mg/l sodium chloride / 240 mg/l calcium
- If dispersants or thinners are to be used, they should be added sparingly, using 50% or less of the normal treatment

TYPICAL PHYSICAL PROPERTIES

Physical appearance..... Light tan / gray – green powder
Specific gravity ..... 2.3 - 2.5
Approximate yield..... 220 bbl/ton

TOXICITY AND HANDLING

Bioassay information available upon request. No special requirements are necessary for handling and storage. Avoid inhalation of dust. A dust respirator and goggles are recommended if mixing in an enclosed area.

PACKAGING AND STORAGE

MAX GEL is packaged in 50 lb. (22.7-kg), multi-wall, paper sacks and is available in bulk. Store in a dry location (slip hazard when wet) and minimize dust (use dust-less systems for handling, storage and cleanup).

This material is supplied solely for informational purposes and M-I L.L.C. makes no guarantees or warranties, either expressed or implied, with respect to the accuracy or use of this data. All product warranties and guarantees shall be governed by the Standard Terms of Sale.

MATERIAL SAFETY DATA SHEET
MAX GEL

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

TRADE NAME: MAX GEL

OTHER NAME: Bentonite

CHEMICAL CLASS: Naturally occuring mineral.

APPLICATIONS: Oil well drilling fluid additive. Viscosifier.

EMERGENCY TELEPHONE: 281-561-1600

SUPPLIER: Supplied by a Business Unit of
M-I L.L.C.
P.O. Box 42842, Houston, Texas 77242-2842
See cover sheet for local supplier.

TELEPHONE: 281-561-1509
FAX: 281-561-7240

CONTACT PERSON: Sam Hoskin - Manager, Occupational Health

2. COMPOSITION, INFORMATION ON INGREDIENTS

INGREDIENT NAME:	CAS No.:	CONTENTS :	EPA RQ:	TPQ:
Silica, crystalline, quartz	14808-60-7	2-15 %		
Bentonite	1302-78-9	70-95 %		
Silica, crystalline, Cristobalite	14464-46-1	2-12 %		
Silica, crystalline, Tridymite	15468-32-3	1-5 %		
Gypsum	13397-24-5	0-1 %		

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW:

CAUTION! MAY CAUSE EYE, SKIN AND RESPIRATORY TRACT IRRITATION. Avoid contact with eyes, skin and clothing. Avoid breathing airborne product. Keep container closed. Use with adequate ventilation. Wash thoroughly after handling.

This product is a/an gray to tan powder. Slippery when wet. No significant immediate hazards for emergency response personnel are known.

ACUTE EFFECTS:

HEALTH HAZARDS, GENERAL:

Particulates may cause mechanical irritation to the eyes, nose, throat and lungs. Particulate inhalation may lead to pulmonary fibrosis, chronic bronchitis, emphysema and bronchial asthma. Dermatitis and asthma may result from short contact periods.

INHALATION: May be irritating to the respiratory tract if inhaled.

INGESTION: May cause gastric distress, nausea and vomiting if ingested.

SKIN: May be irritating to the skin.

EYES: May be irritating to the eyes.

CHRONIC EFFECTS:
CARCINOGENICITY:

IARC: Not listed. NTP: Not listed. OSHA: Not regulated.

ATTENTION! CANCER HAZARD. CONTAINS CRYSTALLINE SILICA WHICH CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.

IARC Monographs, Vol. 68, 1997, concludes that there is sufficient evidence that inhaled crystalline silica in the form of quartz or cristobalite from occupational sources causes cancer in humans. IARC classification Group 1.

ROUTE OF ENTRY:

Inhalation. Skin and/or eye contact.

TARGET ORGANS:

Respiratory system, lungs. Skin. Eyes.

4. FIRST AID MEASURES

GENERAL: Persons seeking medical attention should carry a copy of this SDS with them.

INHALATION: Move the exposed person to fresh air at once. Perform artificial respiration if breathing has stopped. Get medical attention.

INGESTION: Drink a couple of glasses water or milk. Do not give victim anything to drink of he is unconscious. Get medical attention.

SKIN: Wash skin thoroughly with soap and water. Remove contaminated clothing. Get medical attention if any discomfort continues.

EYES: Promptly wash eyes with lots of water while lifting the eye lids. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

5. FIRE FIGHTING MEASURES

AUTO IGNITION TEMP. (?F): N/D
FLAMMABILITY LIMIT - LOWER(%): N/D
FLAMMABILITY LIMIT - UPPER(%): N/D

EXTINGUISHING MEDIA:

This material is not combustible. Use extinguishing media appropriate for surrounding fire.

SPECIAL FIRE FIGHTING PROCEDURES:

No specific fire fighting procedure given.

UNUSUAL FIRE & EXPLOSION HAZARDS:

No unusual fire or explosion hazards noted.

HAZARDOUS COMBUSTION PRODUCTS:

Not relevant.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS:

Wear proper personal protective equipment (see SDS Section 8).

SPILL CLEAN-UP PROCEDURES:

Avoid generating and spreading of dust. Shovel into dry containers. Cover and move the containers. Flush the area with water. Do not contaminate drainage or waterways. Repackage or recycle if possible.

7. HANDLING AND STORAGE

HANDLING PRECAUTIONS:

Avoid handling causing generation of dust. Wear full protective clothing for prolonged exposure and/or high concentrations. Eye wash and emergency shower must be available at the work place. Wash hands often and change clothing when needed. Provide good ventilation. Mechanical ventilation or local exhaust ventilation is required.

STORAGE PRECAUTIONS:

Store at moderate temperatures in dry, well ventilated area. Keep in original container.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

		OSHA PEL:		ACGIH TLV:		OTHER:		
INGREDIENT NAME:	**CAS No.:**	**TWA:**	**STEL:**	**TWA:**	**STEL:**	**TWA:**	**STEL:**	**UNITS:**
Silica, crystalline, quartz	14808-60-7	*		0.1				mg/m3 resp.dust
Bentonite	1302-78-9	5		3				mg/m3 resp.dust
Silica, crystalline, Cristobalite	14464-46-1	*		0.05				mg/m3 resp.dust
Silica, crystalline, Tridymite	15468-32-3	*		0.05				mg/m3 resp.dust
Gypsum	13397-24-5	15						mg/m3 total dust

INGREDIENT COMMENTS:

* OSHA PELs for Mineral Dusts containing crystalline silica are 10 mg/m3 / (%SiO2+2) for quartz and 1/2 the calculated quartz value for cristobalite and tridymite.

PROTECTIVE EQUIPMENT:

ENGINEERING CONTROLS:

Use appropriate engineering controls such as, exhaust ventilation and process enclosure, to reduce air contamination and keep worker exposure below the applicable limits.

VENTILATION: Supply natural or mechanical ventilation adequate to exhaust airborne product and keep exposures below the applicable limits.

RESPIRATORS: Use at least a NIOSH-approved N95 half-mask disposable or reuseable particulate respirator. In work environments containing oil mist/aerosol use at least a NIOSH-approved P95 half-mask disposable or reuseable particulate respirator. For exposures exceeding 10 x PEL use a NIOSH-approved N100 Particulate Respirator.

PROTECTIVE GLOVES:

Use suitable protective gloves if risk of skin contact.

EYE PROTECTION:

Wear dust resistant safety goggles where there is danger of eye contact.

PROTECTIVE CLOTHING:

Wear appropriate clothing to prevent repeated or prolonged skin contact.

HYGIENIC WORK PRACTICES:
Wash promptly with soap and water if skin becomes contaminated. Change work clothing daily if there is any possibility of contamination.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE/PHYSICAL STATE:	Powder, dust.
COLOR:	Grey. to Tan.
ODOR:	Odorless or no characteristic odor.
SOLUBILITY DESCRIPTION:	Insoluble in water.
DENSITY/SPECIFIC GRAVITY (g/ml):	2.3-2.6 TEMPERATURE (?F): 68
BULK DENSITY:	67 lb/ft3; 1068 kg/m3
VAPOR DENSITY (air=1):	N/A
VAPOR PRESSURE:	N/A TEMPERATURE (?F):

10. STABILITY AND REACTIVITY

STABILITY: Normally stable.

CONDITIONS TO AVOID:
N/A.

HAZARDOUS POLYMERIZATION:
Will not polymerize.

POLYMERIZATION DESCRIPTION:
Not relevant.

MATERIALS TO AVOID:
N/A

HAZARDOUS DECOMPOSITION PRODUCTS:
No specific hazardous decomposition products noted.

11. TOXICOLOGICAL INFORMATION

TOXICOLOGICAL INFORMATION:
No toxicological data is available for this product.

12. ECOLOGICAL INFORMATION

ECOLOGICAL INFORMATION:
Contact M-I Environmental Affairs for ecological information.

13. DISPOSAL CONSIDERATIONS

WASTE MANAGEMENT:
This product does not meet the criteria of a hazardous waste if discarded in its purchased form. Under RCRA, it is the responsibility of the user of the product to determine at the time of disposal, whether the product meets RCRA criteria for hazardous waste. This is because product uses, transformations, mixtures, processes, etc, may render the resulting materials hazardous. Empty containers retain residues. All labeled precautions must be observed.

DISPOSAL METHODS:

Recover and reclaim or recycle, if practical. Should this product become a waste, dispose of in a permitted industrial landfill. Ensure that containers are empty by RCRA criteria prior to disposal in a permitted industrial landfill.

14. TRANSPORT INFORMATION

PRODUCT RQ: N/A

U.S. DOT:
U.S. DOT CLASS: Not regulated.

CANADIAN TRANSPORT:
TDGR CLASS: Not regulated.

SEA TRANSPORT:
IMDG CLASS: Not regulated.

AIR TRANSPORT:
ICAO CLASS: Not regulated.

15. REGULATORY INFORMATION

REGULATORY STATUS OF INGREDIENTS:

NAME:	CAS No:	TSCA:	CERCLA:	SARA 302:	SARA 313:	DSL(CAN):
Silica, crystalline, quartz	14808-60-7	Yes	No	No	No	Yes
Bentonite	1302-78-9	Yes	No	No	No	Yes
Silica, crystalline, Cristobalite	14464-46-1	Yes	No	No	No	Yes
Silica, crystalline, Tridymite	15468-32-3	Yes	No	No	No	Yes
Gypsum	13397-24-5	Yes	No	No	No	Yes

US FEDERAL REGULATIONS:
WASTE CLASSIFICATION: Not a hazardous waste by U.S. RCRA criteria. See Section 13.

REGULATORY STATUS: This Product or its components, if a mixture, is subject to following regulations (Not meant to be all inclusive - selected regulations represented):

SECTION 313: This product does not contain toxic chemical subject to the reporting requirements of Section 313 of Title III of the Superfund Amendment and Reauthorization Act of 1986 and 40 CFR Part 372.

SARA 311 Categories:
1: Immediate (Acute) Health Effects.
2. Delayed (Chronic) Health Effects.

The components of this product are listed on or are exempt from the following international chemical registries:
TSCA (U.S.)
DSL (Canada)
EINECS (Europe)

STATE REGULATIONS:

STATE REGULATORY STATUS:

This product or its components, if a mixture, is subject to following regulations (Not meant to be all inclusive - selected regulations represented):.

None.

PROPOSITION 65: This product contains the following chemical(s) considered by the State of California's Safe Drinking Water and Toxic Enforcement Act of 1986 as causing cancer or reproductive toxicity, and for which warnings are now required: Silica, crystalline

CANADIAN REGULATIONS:
LABELS FOR SUPPLY:

REGULATORY STATUS:

This Material Safety Data Sheet has been prepared in compilance with the Controled Product Regulations.

Canadian WHMIS Classification: D2A - Other Toxic Effects: Very Toxic Material

16. OTHER INFORMATION

NPCA HMIS HAZARD INDEX: * 1 Slight Hazard
FLAMMABILITY: 0 Minimal Hazard
REACTIVITY: 0 Minimal Hazard
NPCA HMIS PERS. PROTECT. INDEX: E - Safety Glasses, Gloves, Dust Respirator

USER NOTES:

N/A = Not applicable N/D = Not determined

INFORMATION SOURCES:

OSHA Permissible Exposure Limits, 29 CFR 1910, Subpart Z, Section 1910.1000, Air Contaminants.

ACGIH Threshold Limit Values and Biological Exposure Indices for Chemical Substances and Physical Agents (latest edition).

Sax's Dangerous Properties of Industrial Materials, 9th ed., Lewis, R.J. Sr., (ed.), VNR, New York, New York, (1997).

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans, Silica, Some Silicates, Coal Dust, and para-Aramid Fibrils, Vol. 68, World Health Organization, Lyon, France, 1997.
Product information provided by the commercial vendor(s).

PREPARED BY: Sam Hoskin/bb

REVISION No.: 0

SDS STATUS: Approved.

DATE: June 1, 1999

DISCLAIMER:

SDS furnished independent of product sale. While every effort has been made to accurately describe this product, some of the data are obtained from sources beyond our direct supervision. We cannot make any assertions as to its reliability or completeness; therefore, user may rely on it only at user's risk. We have made no effort to censor or conceal deleterious aspects of this product. Since we cannot anticipate or control the conditiions under which this information and product may be used, we make no guarantee that the precautions we have suggested will be adequate for all individuals and/or situations. It is the obligation of each user of this product to comply with the requirements of all applicable laws regarding use and disposal of this product. Additional information will be furnished upon request to assist the user; however, no warranty, either expressed or implied, nor liability of any nature with respect to this product or to the data herein is made or incurred hereunder.

Water Well Drilling &
Mineral Exploration Products

AMERICAN Colloid Company
Water/Mineral Division

Super Gel-X
High Yield Bentonite

DESCRIPTION:

- Super Gel-X is a 200 mesh, high viscosity 200-bbl yield, sodium bentonite for use in all freshwater drilling conditions.

RECOMMENDED USE:

- May be used for all types of freshwater mud rotary drilling.

CHARACTERISTICS:

- Highly concentrated for maximum yield.
- Fast and easy mixing.
- Reduces solids and increases lifting power.
- Removes cuttings.
- Cools and lubricates bit.
- Stabilizes bore holes.

MIXING AND APPLICATION:

- Mixing ratios are based on 200-bbl yield material using freshwater. Level of water purity will affect bentonite performance.

- Super Gel-X mixing ratio in lbs. per 100 gallons of water:

  Normal conditions ..... 15 to 25 lbs.
  Sand and gravel ..... 25 to 35 lbs.
  Fluid loss controls ..... 35 to 40 lbs.

PACKAGING:

- 50 pound, multi-wall, non-tear, waterproof bags, 48 bags per pallet, and all pallets are stretch-wrapped.

1500 W. Shure Drive **Arlington Heights, IL 60004** **1434-(3112) 392-4600**

The information and data contained herein are believed to be accurate and reliable. American Colloid Company makes no warranty of any kind and accepts no responsibility for the results obtained through this application of this information.

MATERIAL SAFETY DATA SHEET

May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

PRODUCT NAME: SUPER GEL-X™

Section I MANUFACTURER'S INFORMATION

MANUFACTURER'S NAME & ADDRESS:

CETCO – *Drilling Products Group*
1500 West Shure Drive
Arlington Heights, IL 60004

Date Prepared: June 1, 2002

Telephone Number: 847-392-5800 Fax 847-506.6150
EMERGENCY CONTACT: CHEMTREC 800-424-9300
E-mail: www.cetco.com

Section II HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

HAZARDOUS COMPONENTS: (Specific Chemical Identity: Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Crystalline Quartz: CAS# 14808-60-7			*	< 6%
Respirable Crystalline Quartz:			NIOSH	< 2%
Present (TWA)	0.1 mg/m^3	0.1 mg/m^3	50 ug/m^3	
Proposed (TWA)		50.0 ug/m^3		
Nuisance Dust:				
Respirable	5 mg/m^3	5 mg/m^3		
Total Dust	15 mg/m^3	10 mg/m^3		

*** WARNING:** This product contains a small amount of crystalline silica, which may cause delayed respiratory disease if inhaled over a prolonged period of time. Avoid breathing dust. Use NIOSH/MSHA approved respirator where TLV for crystalline silica (Quartz) may be exceeded. IARC Monographs on the evaluation of the Carcinogenic Risk of Chemicals to Humans (volume 68, 1997) concludes that crystalline silica is carcinogenic to humans in the form of quartz. IARC classification 1.

The small quantities of crystalline silica (quartz) found in this product are, under normal conditions, naturally coated with an unremovable layer of amorphous silica and/or bentonite clay. IARC (vol. 68, 1997, pg. 191-192) has stated that crystalline silica (quartz) can differ in toxicity depending on the minerals with which it is combined, citing studies in IARC (vol. 42, 1987, p. 86) which stated that the toxic effect of crystalline silica (quartz) is reduced by the "protective effect...due mainly to clay minerals..."

National Institute for Occupational Safety and Health (NIOSH) has recommended that the permissible exposure limit be changed to 50 micrograms respirable free silica per cubic meter of air (0.05 mg/ m^3) as determined by a full shift sample up to a 10 hour working day, 40 hours per week. *See*: 1974 NIOSH criteria for a recommended Standard for Occupational Exposure to Crystalline Silica should be consulted for more detailed information.

PEL - OSHA Permissible Exposure Limit.

TLV - American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value.

TWA - 8 hour time weighted average

Note: The Permissible Exposure Limits (PEL) reported above are the pre - 1989 limits that were reinstated by OSHA June 30, 1993 following a decision by the United States Circuit Court of Appeals for the 11th Circuit. Federal OSHA is now enforcing these PELs. More restrictive exposure limits may be enforced by some other jurisdictions.

PRODUCT IDENTIFICATION:

Chemical Name: Dry Mixture of Inorganic Mineral Compounds.
NFPA/HMIS: Health - 2, Fire - 0, Reactivity - 0, Specific Hazard - *See Section VI.*
Shipping Class: Not Regulated (DOT / 49CFR, IMDG, ICAO / IATA).

Section III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point: Not Applicable.
Vapor Pressure (mm Hg.)**:** Not Applicable.
Vapor Density (AIR = 1)**:** Not Applicable.
Solubility in Water: Negligible.
Specific Gravity (H_2O = 1)**:** 2.5
Melting Point: 1400°F
Evaporation Rate (Butyl Acetate = 1)**:** Not Applicable.
Appearance and Odor: Tan or beige to light gray colored powder to fine granules, odorless.

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PRODUCT NAME: SUPER GEL-X™

Section IV FIRE AND EXPLOSION HAZARD DATA

Flash Point (*Method Used*)**:** Not Available. **Flammable Limits:** Not Available. **LEL** - NA. **UEL** - NA.
Extinguishing Media: Not Applicable. **Special Fire Fighting Procedure:** Not Applicable.
Unusual Fire/Explosion Hazards: Product may pose possible dust explosion under *extremely rare* circumstances or conditions.

Section V REACTIVITY DATA

Stability: Stable **Conditions to Avoid** - None Known.
Incompatibility (*Materials to Avoid*)**:** Powerful oxidizing agents such as fluorine, chlorine trifluoride, manganese trioxide, etc.
Hazardous Decomposition or By-products: Silica will dissolve in hydrofluoric acid producing a corrosive gas, silicon tetrafluoride.
Hazardous Polymerization: Will Not Occur **Conditions to Avoid** - None Known.

Section VI HEALTH HAZARD DATA

Route(s) of Entry: Inhalation? Yes Skin? No Ingestion? No
Health Hazards (Acute and Chronic):

Inhalation: Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may have the following serious chronic health effects:
Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness and reduced pulmonary function. Smoking exacerbates this disease. Individuals with silicosis are predisposed to develop tuberculosis.
Cancer Status: The International Agency for Research on Cancer has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1 - carcinogenic to humans). Refer to *IARC Monograph 68, Silica, Some Silicates and Organic Fibers* (published in June 1997) in conjunction with the use of these
materials. The National Toxicology Program classifies respirable crystalline silica as "reasonably anticipated to be a carcinogen". For further information *See*: "Adverse effects of Crystalline Silica Exposure" published by the American Thoracic Society Medical Section of the American Lung Association, American Journal of Respiratory and Critical Care Medicine, Volume 155, page 761-765, 1997.

Other Data with Possible Relevance to Human Health: The small quantities of crystalline silica (quartz) found in this product are, under normal conditions, naturally coated with an unremovable layer of amorphous silica and/or bentonite clay. IARC (Vol. 68, 1997, pg. 191-192) has stated that crystalline silica (quartz) can differ in toxicity depending on the minerals with which it is combined, citing studies in IARC (Vol. 42, 1987 pg. 86) which stated that the toxic effect of crystalline silica (quartz) is reduced by the "protective effect....due mainly to clay minerals..."

Carcinogenicity: NTP? No IARC Monographs? Yes OSHA Regulated? No

Signs and Symptoms of Exposure: Excessive inhalation of generated dust may result in shortness of breath and reduced pulmonary function.

Medical Conditions Generally Aggravated by Exposure: Individuals with respiratory disease, including but not limited to, asthma and bronchitis, or subject to eye irritation should not be exposed to respirable crystalline silica (quartz) dust.

Emergency and First Aid Procedures:
Eyes & Skin: Flush with water.
Gross Inhalation of Dust: Remove to fresh air; give oxygen or artificial respiration if necessary; seek medical attention.
Ingestion: If large amounts are swallowed, get immediate medical attention.

Section VII PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken in Case Material is Released or Spilled: Vacuum if possible to avoid generating airborne dust. Avoid breathing dust. Wear an approved respirator. Avoid adding water; product will become slippery when wet.
Waste Disposal Method: Bury in an approved sanitary landfill, in accordance with federal, state and local regulations.
Precautions to Be Taken in Handling and Storing: Avoid breathing dust, use NIOSH/MSHA approved respirator where TLV limits for Crystalline Silica may be exceeded.
Other Precautions: Slippery when wet.

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PRODUCT NAME: SUPER GEL-X™

Section VIII CONTROL MEASURES

Respiratory Protection: Use appropriate respiratory protection for respirable particulate based on consideration of airborne workplace concentration and duration of exposure arising from intended end use. Refer to the most recent standards of ANSI (z88.2) OSHA (29 CFR 1910.134), MSHA (30 CFR Parts 56 and 57) and NIOSH Respirator Decision Logic.

Ventilation: Use local exhaust as required to maintain exposures below applicable occupational exposure limits (*See Section II*). See also ACGIH "Industrial Ventilation – A Manual for Recommend Practice", (*current edition*).

Protective Gloves: Not Required. **Eye Protection:** Recommended.

Other Protective Clothing or Equipment: None. **Work/Hygienic Practices:** Use good housekeeping practices.

Section IX REGULATORY INFORMATION

SARA 311/312: Hazard Categories for SARA Section 311/312 Reporting: Chronic Health
SARA 313: This product contains the following chemicals subject to annual release reporting requirements under the SARA section 313 (40 CFR 372): None

CERCLA section 103 Reportable Quantity: None

California Proposition 65: *This product contains the following substances known to the state of California to cause cancer and/or reproductive harm: This product contains crystalline silica (respirable); however, the user should note that the small quantities of crystalline silica (quartz) found in this product are, under normal conditions, naturally coated with an unremovable layer of amorphous silica and/or bentonite clay. IARC (Vol. 68, 1997, pg. 191-192) has stated that crystalline silica (quartz) can differ in toxicity depending on the minerals with which it is combined. Citing studies in IARC (Vol. 42, 1987, p. 86) which stated that the toxic effect of crystalline silica (quartz) is reduced by the "protective effect....due mainly to clay minerals...".*

Toxic Substances Control Act: All of the components of this product are listed on the EPA TSCA Inventory or are exempt from notification requirements.

Canadian Environmental Protection Act: All the components of this product are listed on the Canadian Domestic Substances List or exempt from notification requirements.

European Inventory of Commercial Chemical Substances: All the components of this product are listed on the EINECS Inventory or exempt from notification requirements. (The EINECS number for Quartz: 231-545-5)
European Community Labeling Classification: Harmful (Xn)
European Community Risk and Safety Phrases: R40, R48, S22

Japan MITI: All the components of this product are existing chemical substances as defined in the Chemical Substance Control Law.

Australian Inventory of Chemical Substances: All the components of this product are listed on the AICS Inventory or exempt from notification requirements.

Canadian WHMIS Classification: Class D, Division 2, Subdivision A (Very Toxic Material causing other Toxic Effects)

NF-+PA Hazard Rating: Health: 2 Fire: 0 Reactivity: 0
HMIS Hazard Rating: Health: * Fire: 0 Reactivity: 0

***Warning** - Chronic health effect possible - inhalation of silica dust may cause lung injury/disease (silicosis). Take appropriate measures to avoid breathing dust. *See Section II*.

REFERENCES:

Registry for Toxic Effects of Chemical Substances (RTECS), 1995.

Patty's Industrial Hygiene and Toxicology.

NTP Seventh Annual Report on Carcinogens, 1994.

IARC Monograph Volume 68, Silica, Some Silicates and Organic Fibers, 1997.

The information herein has been compiled from sources believed to be reliable and is accurate to the best of our knowledge. However, CETCO cannot give any guarantees regarding information from other sources, and expressly does not make any warranties, nor assumes any liability, for its use.

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MATERIAL SAFETY DATA SHEET

Product Trade Name: **BARA-KADE® BENTONITE**

Revision Date: 31-Mar-2005

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Trade Name: BARA-KADE® BENTONITE
Synonyms: None
Chemical Family: Mineral
Application: Additive

Manufacturer/Supplier

BPM Minerals LLC
3000 N Sam Houston Parkway East
Houston, TX 77032

Telephone: (281) 871-7900
Fax: (281) 871-7940
Emergency Telephone: (800) 666-9260 or (713) 753-3000

Prepared By

Chemical Compliance
Telephone: 1-580-251-4335

2. COMPOSITION/INFORMATION ON INGREDIENTS

SUBSTANCE	CAS Number	PERCENT	ACGIH TLV-TWA	OSHA PEL-TWA
Crystalline silica, cristobalite	14464-46-1	0 - 1%	0.05 mg/m^3	1/2 x $\frac{10 \text{ mg/m}^3}{\%SiO2 + 2}$
Crystalline silica, tridymite	15468-32-3	0 - 1%	0.05 mg/m^3	1/2 x $\frac{10 \text{ mg/m}^3}{\%SiO2 + 2}$
Crystalline silica, quartz	14808-60-7	1 - 5%	0.05 mg/m^3	$\frac{10 \text{ mg/m}^3}{\%SiO2 + 2}$
Bentonite	1302-78-9	60 - 100%	Not applicable	Not applicable

More restrictive exposure limits may be enforced by some states, agencies, or other authorities.

3. HAZARDS IDENTIFICATION

Hazard Overview

CAUTION! - ACUTE HEALTH HAZARD
May cause eye and respiratory irritation.

DANGER! - CHRONIC HEALTH HAZARD
Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposures below recommended exposure limits. Wear a NIOSH certified, European Standard EN 149, or equivalent respirator when using this product. Review the Material Safety Data Sheet (SDS) for this product, which has been provided to your employer.

4. FIRST AID MEASURES

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Skin Wash with soap and water. Get medical attention if irritation persists.

Eyes In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Ingestion Under normal conditions, first aid procedures are not required.

Notes to Physician Treat symptomatically.

5. FIRE FIGHTING MEASURES

Flash Point/Range (F):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (F):	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined

Fire Extinguishing Media All standard firefighting media.

Special Exposure Hazards Not applicable.

Special Protective Equipment for Fire-Fighters Not applicable.

NFPA Ratings: Health 0, Flammability 0, Reactivity 0
HMIS Ratings: Flammability 0, Reactivity 0, Health 0*

6. ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures Use appropriate protective equipment. Avoid creating and breathing dust.

Environmental Precautionary Measures None known.

Procedure for Cleaning / Absorption Collect using dustless method and hold for appropriate disposal. Consider possible toxic or fire hazards associated with contaminating substances and use appropriate methods for collection, storage and disposal.

7. HANDLING AND STORAGE

Handling Precautions This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposure below recommended exposure limits. Wear a NIOSH certified, European Standard En 149, or equivalent respirator when using this product. Material is slippery when wet.

Storage Information Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits listed in Section 2.

Respiratory Protection Wear a NIOSH certified, European Standard EN 149, or equivalent respirator when using this product.

Hand Protection Normal work gloves.

Skin Protection Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.

Eye Protection Wear safety glasses or goggles to protect against exposure.

Other Precautions None known.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid
Color:	Various
Odor:	Odorless
pH:	8-10
Specific Gravity @ 20 C (Water=1):	2.65
Density @ 20 C (lbs./gallon):	Not Determined
Bulk Density @ 20 C (lbs/ft3):	50-70
Boiling Point/Range (F):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (F):	Not Determined
Freezing Point/Range (C):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Insoluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (lbs./gallon):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistrokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data: Stable

Hazardous Polymerization: Will Not Occur

Conditions to Avoid	None anticipated
Incompatibility (Materials to Avoid)	Hydrofluoric acid.
Hazardous Decomposition Products	Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	Eye or skin contact, inhalation.
Inhalation	Inhaled crystalline silica in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (IARC, Group 1). There is sufficient evidence in experimental animals for the carcinogenicity of tridymite (IARC, Group 2A). Breathing silica dust may cause irritation of the nose, throat, and respiratory passages. Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may also have serious chronic health effects (See "Chronic Effects/Carcinogenicity" subsection below).
Skin Contact	May cause mechanical skin irritation.
Eye Contact	May cause eye irritation.
Ingestion	None known
Aggravated Medical Conditions	Individuals with respiratory disease, including but not limited to asthma and bronchitis, or subject to eye irritation, should not be exposed to quartz dust.
Chronic Effects/Carcinogenicity	Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis. Cancer Status: The International Agency for Research on Cancer (IARC) has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources can cause lung cancer in humans (Group 1 - carcinogenic to humans) and has determined that there is sufficient evidence in experimental animals for the carcinogenicity of tridymite (Group 2A - possible carcinogen to humans). Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997) in conjunction with the use of these minerals. The National Toxicology Program classifies respirable crystalline silica as "Known to be a human carcinogen". Refer to the 9th Report on Carcinogens (2000). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies crystalline silica, quartz, as a suspected human carcinogen (A2). There is some evidence that breathing respirable crystalline silica or the disease silicosis is associated with an increased incidence of significant disease endpoints such as scleroderma (an immune system disorder manifested by scarring of the lungs, skin, and other internal organs) and kidney disease.

Other Information For further information consult "Adverse Effects of Crystalline Silica Exposure" published by the American Thoracic Society Medical Section of the American Lung Association, American Journal of Respiratory and Critical Care Medicine, Volume 155, pages 761-768 (1997).

Toxicity Tests

Oral Toxicity: Not determined

Dermal Toxicity: Not determined

Inhalation Toxicity: Not determined

Primary Irritation Effect: Not determined

Carcinogenicity Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997).

Genotoxicity: Not determined

Reproductive / Developmental Toxicity: Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air) Not determined

Persistence/Degradability Not determined

Bio-accumulation Not Determined

Ecotoxicological Information

Acute Fish Toxicity: TLM96: 10000 ppm (Oncorhynchus mykiss)
Acute Crustaceans Toxicity: Not determined
Acute Algae Toxicity: Not determined

Chemical Fate Information Not determined

Other Information Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method Bury in a licensed landfill according to federal, state, and local regulations.

Contaminated Packaging Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Land Transportation

DOT
Not restricted

Canadian TDG
Not restricted

ADR Not restricted

Air Transportation

ICAO/IATA Not restricted

Sea Transportation

IMDG
Not restricted

Other Shipping Information

Labels: None

15. REGULATORY INFORMATION

US Regulations

US TSCA Inventory	All components listed on inventory.
EPA SARA Title III Extremely Hazardous Substances	Not applicable
EPA SARA (311,312) Hazard Class	Acute Health Hazard Chronic Health Hazard
EPA SARA (313) Chemicals	This product does not contain a toxic chemical for routine annual "Toxic Chemical Release Reporting" under Section 313 (40 CFR 372).
EPA CERCLA/Superfund Reportable Spill Quantity For This Product	Not applicable.
EPA RCRA Hazardous Waste Classification	If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.
California Proposition 65	The California Proposition 65 regulations apply to this product.
MA Right-to-Know Law	One or more components listed.
NJ Right-to-Know Law	One or more components listed.
PA Right-to-Know Law	One or more components listed.

Canadian Regulations

Canadian DSL Inventory	All components listed on inventory.
WHMIS Hazard Class	D2A Very Toxic Materials (Crystalline silica)

16. OTHER INFORMATION

The following sections have been revised since the last issue of this SDS
Not applicable

Additional Information

For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Material Safety Data Sheet for this or other Halliburton products, contact Chemical Compliance at 1-580-251-4335.

Disclaimer Statement

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

*****END OF SDS*****

MATERIAL SAFETY DATA SHEET

Product Trade Name: **BARA-KADE® BENTONITE**

Revision Date: 31-Mar-2005

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Trade Name: BARA-KADE® BENTONITE
Synonyms: None
Chemical Family: Mineral
Application: Additive

Manufacturer/Supplier

BPM Minerals LLC
3000 N Sam Houston Parkway East
Houston, TX 77032

Telephone: (281) 871-7900
Fax: (281) 871-7940
Emergency Telephone: (800) 666-9260 or (713) 753-3000

Prepared By

Chemical Compliance
Telephone: 1-580-251-4335

2. COMPOSITION/INFORMATION ON INGREDIENTS

SUBSTANCE	CAS Number	PERCENT	ACGIH TLV-TWA	OSHA PEL-TWA
Crystalline silica, cristobalite	14464-46-1	0 - 1%	0.05 mg/m^3	1/2 x $\frac{10 \text{ mg/m}^3}{\%SiO2 + 2}$
Crystalline silica, tridymite	15468-32-3	0 - 1%	0.05 mg/m^3	1/2 x $\frac{10 \text{ mg/m}^3}{\%SiO2 + 2}$
Crystalline silica, quartz	14808-60-7	1 - 5%	0.05 mg/m^3	$\frac{10 \text{ mg/m}^3}{\%SiO2 + 2}$
Bentonite	1302-78-9	60 - 100%	Not applicable	Not applicable

More restrictive exposure limits may be enforced by some states, agencies, or other authorities.

3. HAZARDS IDENTIFICATION

Hazard Overview

CAUTION! - ACUTE HEALTH HAZARD
May cause eye and respiratory irritation.

DANGER! - CHRONIC HEALTH HAZARD
Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposures below recommended exposure limits. Wear a NIOSH certified, European Standard EN 149, or equivalent respirator when using this product. Review the Material Safety Data Sheet (SDS) for this product, which has been provided to your employer.

4. FIRST AID MEASURES

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Skin Wash with soap and water. Get medical attention if irritation persists.

Eyes In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Ingestion Under normal conditions, first aid procedures are not required.

Notes to Physician Treat symptomatically.

5. FIRE FIGHTING MEASURES

Flash Point/Range (F):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (F):	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined

Fire Extinguishing Media All standard firefighting media.

Special Exposure Hazards Not applicable.

Special Protective Equipment for Fire-Fighters Not applicable.

NFPA Ratings: Health 0, Flammability 0, Reactivity 0
HMIS Ratings: Flammability 0, Reactivity 0, Health 0*

6. ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures Use appropriate protective equipment. Avoid creating and breathing dust.

Environmental Precautionary Measures None known.

Procedure for Cleaning / Absorption Collect using dustless method and hold for appropriate disposal. Consider possible toxic or fire hazards associated with contaminating substances and use appropriate methods for collection, storage and disposal.

7. HANDLING AND STORAGE

Handling Precautions This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposure below recommended exposure limits. Wear a NIOSH certified, European Standard En 149, or equivalent respirator when using this product. Material is slippery when wet.

Storage Information Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits listed in Section 2.

Respiratory Protection Wear a NIOSH certified, European Standard EN 149, or equivalent respirator when using this product.

Hand Protection Normal work gloves.

Skin Protection Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.

Eye Protection Wear safety glasses or goggles to protect against exposure.

Other Precautions None known.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid
Color:	Various
Odor:	Odorless
pH:	8-10
Specific Gravity @ 20 C (Water=1):	2.65
Density @ 20 C (lbs./gallon):	Not Determined
Bulk Density @ 20 C (lbs/ft3):	50-70
Boiling Point/Range (F):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (F):	Not Determined
Freezing Point/Range (C):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Insoluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (lbs./gallon):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistrokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data: Stable

Hazardous Polymerization: Will Not Occur

Conditions to Avoid	None anticipated
Incompatibility (Materials to Avoid)	Hydrofluoric acid.
Hazardous Decomposition Products	Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	Eye or skin contact, inhalation.
Inhalation	Inhaled crystalline silica in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (IARC, Group 1). There is sufficient evidence in experimental animals for the carcinogenicity of tridymite (IARC, Group 2A). Breathing silica dust may cause irritation of the nose, throat, and respiratory passages. Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may also have serious chronic health effects (See "Chronic Effects/Carcinogenicity" subsection below).
Skin Contact	May cause mechanical skin irritation.
Eye Contact	May cause eye irritation.
Ingestion	None known
Aggravated Medical Conditions	Individuals with respiratory disease, including but not limited to asthma and bronchitis, or subject to eye irritation, should not be exposed to quartz dust.
Chronic Effects/Carcinogenicity	Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis. Cancer Status: The International Agency for Research on Cancer (IARC) has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources can cause lung cancer in humans (Group 1 - carcinogenic to humans) and has determined that there is sufficient evidence in experimental animals for the carcinogenicity of tridymite (Group 2A - possible carcinogen to humans). Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997) in conjunction with the use of these minerals. The National Toxicology Program classifies respirable crystalline silica as "Known to be a human carcinogen". Refer to the 9th Report on Carcinogens (2000). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies crystalline silica, quartz, as a suspected human carcinogen (A2). There is some evidence that breathing respirable crystalline silica or the disease silicosis is associated with an increased incidence of significant disease endpoints such as scleroderma (an immune system disorder manifested by scarring of the lungs, skin, and other internal organs) and kidney disease.

Other Information For further information consult "Adverse Effects of Crystalline Silica Exposure" published by the American Thoracic Society Medical Section of the American Lung Association, American Journal of Respiratory and Critical Care Medicine, Volume 155, pages 761-768 (1997).

Toxicity Tests

Oral Toxicity: Not determined

Dermal Toxicity: Not determined

Inhalation Toxicity: Not determined

Primary Irritation Effect: Not determined

Carcinogenicity Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997).

Genotoxicity: Not determined

Reproductive / Developmental Toxicity: Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air) Not determined

Persistence/Degradability Not determined

Bio-accumulation Not Determined

Ecotoxicological Information

Acute Fish Toxicity: TLM96: 10000 ppm (Oncorhynchus mykiss)
Acute Crustaceans Toxicity: Not determined
Acute Algae Toxicity: Not determined

Chemical Fate Information Not determined

Other Information Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method Bury in a licensed landfill according to federal, state, and local regulations.

Contaminated Packaging Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Land Transportation

DOT
Not restricted

Canadian TDG
Not restricted

ADR Not restricted

Air Transportation

ICAO/IATA Not restricted

Sea Transportation

IMDG
Not restricted

Other Shipping Information

Labels: None

15. REGULATORY INFORMATION

US Regulations

US TSCA Inventory	All components listed on inventory.
EPA SARA Title III Extremely Hazardous Substances	Not applicable
EPA SARA (311,312) Hazard Class	Acute Health Hazard Chronic Health Hazard
EPA SARA (313) Chemicals	This product does not contain a toxic chemical for routine annual "Toxic Chemical Release Reporting" under Section 313 (40 CFR 372).
EPA CERCLA/Superfund Reportable Spill Quantity For This Product	Not applicable.
EPA RCRA Hazardous Waste Classification	If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.
California Proposition 65	The California Proposition 65 regulations apply to this product.
MA Right-to-Know Law	One or more components listed.
NJ Right-to-Know Law	One or more components listed.
PA Right-to-Know Law	One or more components listed.

Canadian Regulations

Canadian DSL Inventory	All components listed on inventory.
WHMIS Hazard Class	D2A Very Toxic Materials (Crystalline silica)

16. OTHER INFORMATION

The following sections have been revised since the last issue of this SDS
Not applicable

Additional Information

For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Material Safety Data Sheet for this or other Halliburton products, contact Chemical Compliance at 1-580-251-4335.

Disclaimer Statement

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

*****END OF SDS*****

MICHELS®

ATTACHMENT

DRILLING ADDITIVES / LCMs FOR APPROVAL

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MICHELS®

Product Name	Manufacturer	Generic Name	Intended Use	NSF 60 APPROVED?
Platinum PAC	M I Swaco	PAC	Fluid Loss Inhibitor	YES
Platinum PAC UL	M I Swaco	PAC	Fluid Loss Inhibitor	YES
Ringfree	M I Swaco	Thinner	Drill Mud Thinner	YES
Torqmaster	WyoBen, Inc.	Surfactant	Torque reduction / reduce bit balling	NO
Plugz It	WyoBen, Inc.	Proprietary bentonite blend	Lost Circulation Material	YES
Clay Cutter	Cetco	Clay Inhibitor	Inhibit swelling of clay formations	NO
Clay Breaker	DCS Fluids	Clay Inhibitor	Inhibit swelling of clay formations	NO
Torque Breaker	DCS Fluids	Surfactant	Torque reduction / reduce bit balling	NO
Ball Buster	DCS Fluids	SAPP	Reduce bit / reamer balling	YES
Soda Ash	Various	pH Enhancement	Increase pH and reduce hardness of make up water	YES
Sodium Bicarbonate	Various	Calcium Control	Reduce calcium contamination of mud from drilling grout	YES
Citric Acid	Various	pH Reducer	Reduce pH when drilling grout	YES

MICHELS®

POTENTIAL ADDITIVIVE

PLATINUM PAC

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SDS no. 12391
Version 7
Revision date 21/Jul/2014
Supersedes date 20/Dec/2013

Safety Data Sheet
PLATINUM PAC†

1. Identification of the substance/preparation and of the Company/undertaking

1.1 Product identifier

Product name PLATINUM PAC†
Product code 12391

1.2 Relevant identified uses of the substance or mixture and uses advised against

Recommended Use Drilling fluid additive Fluid loss reducer.

Uses advised against Consumer use

1.3 Details of the supplier of the safety data sheet

Supplier
M-I L.L.C.
P.O.Box 42842
Houston, TX 77242
www.miswaco.slb.com

Prepared by
Global Chemical Regulatory Compliance (GCRC) , Bethicia Prasek

1.4 Emergency Telephone Number

Emergency telephone - (24 Hour) Australia +61 2801 44558, Asia Pacific +65 3158 1074, China +86 10 5100 3039, Europe +44 (0) 1235 239 670, Middle East and Africa +44 (0) 1235 239 671, New Zealand +64 9929 1483, USA 001 281 561 1600
Telephone Number - 281-561-1512

2. Hazards identification

2.1 Classification of the substance or mixture

GHS - Classification

Health hazards Not classified

Environmental hazards Not classified

Physical Hazards

Combustible dust	-

2.2 Label elements

Signal word
WARNING

May form combustible dust concentrations in air

Precautionary statements
P240 - Ground/bond container and receiving equipment
P243 - Take precautionary measures against static discharge

P241 - Use explosion-proof electrical/ ventilating/ lighting/ equipment

3. Composition/information on Ingredients

3.1 Substances

Component	CAS-No	Weight % - range
Carboxymethylcellulose sodium salt	9004-32-4	99

3.2 Mixtures

Not Applicable

4. First aid measures

4.1 Description of first-aid measures

Inhalation — If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Ingestion — Rinse mouth. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Seek medical attention if irritation occurs.

Skin contact — Wash off immediately with soap and plenty of water removing all contaminated clothes and shoes. Get medical attention immediately if symptoms occur.

Eye contact — Promptly wash eyes with lots of water while lifting eye lids. Remove contact lenses. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

4.2 Most important symptoms and effects, both acute and delayed

General advice — The severity of the symptoms described will vary dependant of the concentration and the length of exposure. If adverse symptoms develop, the casualty should be transferred to hospital as soon as possible.

Main symptoms

Inhalation	Please see Section 11. Toxicological Information for further information.
Ingestion	Please see Section 11. Toxicological Information for further information.
Skin contact	Please see Section 11. Toxicological Information for further information.
Eye contact	Please see Section 11. Toxicological Information for further information.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician Treat symptomatically.

5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Fog, Alcohol Foam, CO_2, Dry Chemical.

Extinguishing media which shall not be used for safety reasons
None known.

5.2 Special hazards arising from the substance or mixture

Unusual fire and explosion hazards
Suspended dust may present a dust explosion hazard.

Hazardous combustion products
Carbon oxides (COx).

5.3 Advice for firefighters

Special protective equipment for fire-fighters
As in any fire, wear self-contained breathing apparatus and full protective gear.

Special Fire-Fighting Procedures
Containers close to fire should be removed immediately or cooled with water.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Extinguish all ignition sources. Avoid sparks, flames, heat and smoking. Evacuate personnel to safe areas. Use personal protective equipment. See also section 8. If spilled, take caution, as material can cause surfaces to become very slippery.

6.2 Environmental precautions

The product should not be allowed to enter drains, water courses or the soil.

Environmental exposure controls
Avoid release to the environment.

6.3 Methods and materials for containment and cleaning up

Methods for containment
Prevent further leakage or spillage if safe to do so.

Methods for cleaning up
Sweep up and shovel into suitable containers for disposal. After cleaning, flush away traces with water. Material becomes slippery when wet. Use caution if wet.

6.4 Reference to other sections

See section 13 for more information.

7. Handling and storage

7.1 Precautions for safe handling

Handling
Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin and eyes. Avoid dust formation.

Hygiene measures
Use good work and personal hygiene practices to avoid exposure. Do not eat, drink or smoke when using this product.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/precautions Ensure adequate ventilation. Provide appropriate exhaust ventilation at places where dust is formed. Keep airborne concentrations below exposure limits.

Storage precautions Keep away from open flames, hot surfaces and sources of ignition. Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure controls/personal protection

8.1 Control parameters

Exposure limits Control as an ACGIH particulate not otherwise specified (PNOS): 10 mg/m^3 (Inhalable); 3 mg/m^3 (Respirable) and an OSHA particulate not otherwise regulated (PNOR): 15 mg/m^3 (Total); 5 mg/m^3 (Respirable).

Component	ACGIH TLV	OSHA PEL
Carboxymethylcellulose sodium salt 9004-32-4 (99)	Not Determined	Not Determined

8.2 Exposure controls

All chemical Personal Protective Equipment (PPE) should be selected based on an assessment of both the chemical hazard present and the risk of exposure to those hazards. The PPE recommendations below are based on an assessment of the chemical hazards associated with this product. Where this product is used in a mixture with other products or fluids, additional hazards may be created and as such further assessment of risk may be required. The risk of exposure and need of respiratory protection will vary from workplace to workplace and should be assessed by the user in each situation.

Engineering measures to reduce exposure
Ensure adequate ventilation.

Personal protective equipment

Eye protection It is good practice to wear goggles when handling any chemical. Tightly fitting safety goggles.

Hand protection Wear chemical resistant gloves such as nitrile or neoprene.

Respiratory protection	All respiratory protection equipment should be used within a comprehensive respiratory protection program that meets the requirements of 29 CFR 1910.134 (U.S. OSHA Respiratory Protection Standard) or local equivalent. If exposed to airborne mist/aerosol of this product, use at least a NIOSH-approved N95 half-mask disposable or re-usable particulate respirator. In work environments containing oil mist/aerosol, use at least a NIOSH-approved P95 half-mask disposable or reuseable particulate respirator. If exposed to vapors from this product use a NIOSH/MSHA-approved respirator with an Organic Vapor cartridge.
Skin and body protection	Wear suitable protective clothing.
Hygiene measures	Wash hands before eating, drinking or smoking, Remove and wash contaminated clothing before re-use.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

Physical state	Solid powder
Appearance	Opaque
Odor	Mild Odorless
Color	Off-white - Tan
Odor threshold	Not applicable

Property	**Values**	**Remarks**
pH	No information available	
pH @ dilution	6.5-8.0 @ 1% in H2O	
Melting/freezing point		
Boiling point/range	No information available	
Flash point	Does not flash	
Evaporation rate (BuAc =1)		
Flammability (solid, gas)	Not Applicable	
Flammability Limits in Air		
Upper flammability limit	Not applicable	
Lower flammability limit	Not applicable	
Vapor pressure	0 mmHg	
Vapor density	Not applicable	
Specific gravity	1.5 - 1.6	
Bulk density	No information available	
Relative density	No information available	
Water solubility	Gels on contact with water	
Solubility in other solvents	No information available	
Autoignition temperature	No information available	
Decomposition temperature	No information available	
Kinematic viscosity	No information available	
Dynamic viscosity	No information available	
Log Pow	Not determined	
Explosive properties	Not Applicable	
Oxidizing properties	None known.	

9.2 Other information

Pour point	No information available
Molecular weight	No information available
VOC content(%)	None
Density	No information available

10. Stability and reactivity

10.1 Reactivity

No specific reactivity hazards associated with this product.

10.2 Chemical stability

Stable under normal temperature conditions and recommended use.

10.3 Possibility of Hazardous Reactions

Hazardous polymerization
Hazardous polymerization does not occur.

Hazardous Reactions
None known.

10.4 Conditions to avoid

Heat, flames and sparks.

10.5 Incompatible materials

Strong oxidizing agents.

10.6 Hazardous decomposition products

Carbon oxides (COx).

11. Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Inhalation — Inhalation of dust may cause shortness of breath, tightness of the chest, a sore throat and cough.

Eye contact — Dust may cause mechanical irritation.

Skin contact — Repeated exposure may cause skin dryness or cracking.

Ingestion — Irritant; may cause pain or discomfort to mouth, throat and stomach.

Acute toxicity — 0% of the mixture consists of ingredient(s) of unknown toxicity.

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Carboxymethylcellulose sodium salt	= 27000 mg/kg (Rat)	> 2 g/kg (Rabbit)	> 5800 mg/m³ (Rat) 4 h

Sensitization — This product does not contain any components suspected to be sensitizing.

Mutagenic effects — This substance has no evidence of mutagenic properties.

Carcinogenicity — This substance has no evidence of carcinogenic properties.

Reproductive toxicity	None known.
Developmental toxicity	Not known to cause birth defects or have a deleterious effect on a developing fetus.
Routes of exposure	Inhalation. Skin contact. Eye contact.
Routes of entry	None known.
Specific target organ toxicity (single exposure)	Not classified
Specific target organ toxicity (repeated exposure)	Not classified.
Aspiration hazard	Not Applicable.

12. Ecological information

12.1 Toxicity

Toxicity to algae
See component information below.

Toxicity to fish
See component information below.

Toxicity to daphnia and other aquatic invertebrates
See component information below.

Component	Toxicity to fish	Toxicity to algae	Toxicity to daphnia and other aquatic invertebrates
Carboxymethylcellulose sodium salt	No information available	No information available	No information available

12.2 Persistence and degradability

No product level data available.

12.3 Bioaccumulative potential

No data available.

12.4 Mobility in soil

No information available.

12.5 Results of PBT and vPvB assessment

This substance is not considered to be persistent, bioaccumulating or toxic (PBT)
This substance is not considered to be very persistent nor very bioaccumulating (vPvB)

12.6 Other adverse effects.

None known. Check for additional information in sect. 7.

13. Disposal considerations

13.1 Waste treatment methods

Waste from residues / unused products	Dispose of in accordance with local regulations.
Contaminated packaging	Empty containers should be taken for local recycling, recovery or waste disposal.

14. Transport information

14.1 UN Number

UN/ID No. (ADR/RID/ADN/ADG)	Not regulated
UN No. (IMDG)	Not regulated
UN No. (ICAO)	Not regulated
UN No. (DOT)	Not regulated

14.2 Proper shipping name

Not regulated for transportation by DOT, TDG, IMDG and ICAO/IATA.

14.3 Hazard class(es)

ADR/RID/ADN Hazard class	Not regulated
IMDG Hazard class	Not regulated
ICAO Hazard class/division	Not regulated
DOT Hazard class	Not regulated

14.4 Packing group

ADR/RID/ADN Packing Group	Not regulated
IMDG Packing group	Not regulated
ICAO Packing group	Not regulated
DOT Packing group	Not regulated

14.5 Environmental hazard

No

14.6 Special precautions

Not Applicable

15. Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

International inventories

USA (TSCA)	Complies
European Union (EINECS and ELINCS)	Complies
Canada (DSL)	Complies
Philippines (PICCS)	Complies
Japan (ENCS)	Complies
China (IECSC)	Complies
Australia (AICS)	Complies
Korean (KECL)	Complies
New Zealand (NZIoC)	Complies

U.S. Federal and State Regulations

SARA 311/312 Hazard Catagories Not a SARA 311/312 hazard.

SARA 302/304, 313, CERCLA RQ, California Proposition 65
Note: If no components are listed below, this product is not subject to the referenced SARA and CERCLA regulations and is not known to contain a Proposition 65 listed chemical at a level that is expected to pose a significant risk under anticipated use conditions.

This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class Not a controlled product.

16. Other information

Supersedes date 20/Dec/2013

Revision date 21/Jul/2014

Version 7

The following sections have been revised All sections.

HMIS classification

Health	0
Flammability	1
Physical hazard	0
PPE	E

N/A - Not Applicable, N/D - Not Determined.

†A mark of M-I L.L.C.

Disclaimer
The information provided in this Material Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

MICHELS®

POTENTIAL ADDITIVIVE

PLATINUM PAC UL

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SDS no. 12481
Version 4
Revision date 08/Jan/2015
Supersedes date 14/Feb/2012

Safety Data Sheet
PLATINUM PAC† UL

1. Identification

1.1 Product identifier

Product name PLATINUM PAC† UL

Product code 12481

1.2 Relevant identified uses of the substance or mixture and uses advised against

Recommended Use Drilling fluid additive.

Uses advised against Consumer use

1.3 Details of the supplier of the safety data sheet

Supplier
M-I L.L.C.
P.O.Box 42842
Houston, TX 77242
www.miswaco.slb.com

Prepared by
Global Chemical Regulatory Compliance (GCRC) , Bethicia Prasek

1.4 Emergency Telephone Number

Emergency telephone (24 Hour) Australia +61 2801 44558, Asia Pacific +65 3158 1074, China +86 10 5100 3039, Europe +44 (0) 1235 239 670, Middle East and Africa +44 (0) 1235 239 671, New Zealand +64 9929 1483, USA 001 281 561 1600
Telephone Number - 281-561-1511

2. Hazards identification

2.1 Classification of the substance or mixture

GHS - Classification

Health hazards Not classified

Environmental hazards Not classified

Physical Hazards

Combustible dust	-

2.2 Label elements

Signal word
WARNING

May form combustible dust concentrations in air

Precautionary statements
P240 - Ground/bond container and receiving equipment
P243 - Take precautionary measures against static discharge

P241 - Use explosion-proof electrical/ ventilating/ lighting/ equipment

Unknown acute toxicity 0% of the mixture consists of ingredient(s) of unknown toxicity.

3. Composition/information on Ingredients

3.1 Substances

Not Applicable

3.2 Mixtures

Component	CAS-No	Weight % - range
Carbohydrate	Proprietary	60 - 100

Comments
The exact percentage (concentration) of composition has been withheld as a trade secret

4. First aid measures

4.1 First-Aid Measures

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Ingestion Rinse mouth. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Seek medical attention if irritation occurs.

Skin contact Wash off immediately with soap and plenty of water removing all contaminated clothes and shoes. Get medical attention immediately if symptoms occur.

Eye contact Promptly wash eyes with lots of water while lifting eye lids. Remove contact lenses. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

4.2 Most important symptoms and effects, both acute and delayed

General advice	The severity of the symptoms described will vary dependant of the concentration and the length of exposure. If adverse symptoms develop, the casualty should be transferred to hospital as soon as possible.
Main symptoms	
Inhalation	Please see Section 11. Toxicological Information for further information.
Ingestion	Please see Section 11. Toxicological Information for further information.
Skin contact	Please see Section 11. Toxicological Information for further information.
Eye contact	Please see Section 11. Toxicological Information for further information.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician Treat symptomatically

5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Fog, Alcohol Foam, CO_2, Dry Chemical.

Extinguishing media which shall not be used for safety reasons
None known.

5.2 Special hazards arising from the substance or mixture

Unusual fire and explosion hazards
Suspended dust may present a dust explosion hazard.

Hazardous combustion products
Carbon oxides (COx).

5.3 Advice for firefighters

Special protective equipment for fire-fighters
As in any fire, wear self-contained breathing apparatus and full protective gear.

Special Fire-Fighting Procedures
Containers close to fire should be removed immediately or cooled with water.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Extinguish all ignition sources. Avoid sparks, flames, heat and smoking. Evacuate personnel to safe areas. Use personal protective equipment. See also section 8. If spilled, take caution, as material can cause surfaces to become very slippery.

6.2 Environmental precautions

As local regulations may vary; all waste must be disposed/recycled/reclaimed in accordance with federal, state, and local environmental control regulations.

Environmental exposure controls
Avoid dust formation.

6.3 Methods and materials for containment and cleaning up

Methods for containment
Prevent further leakage or spillage if safe to do so.

Methods for cleaning up
Sweep up and shovel into suitable containers for disposal. After cleaning, flush away traces with water. Material becomes slippery when wet. Use caution if wet.

6.4 Reference to other sections

See section 13 for more information.

7. Handling and storage

7.1 Precautions for safe handling

Handling
Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin and eyes. Avoid dust formation.

Hygiene measures
Use good work and personal hygiene practices to avoid exposure. Do not eat, drink or smoke when using this product.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/precautions Ensure adequate ventilation. Provide appropriate exhaust ventilation at places where dust is formed. Keep airborne concentrations below exposure limits.

Storage precautions Keep away from open flames, hot surfaces and sources of ignition. Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure controls/personal protection

8.1 Control parameters

Exposure limits **Control as an ACGIH particulate not otherwise specified (PNOS): 10 mg/m³ (Inhalable); 3 mg/m³ (Respirable) and an OSHA particulate not otherwise regulated (PNOR): 15 mg/m³ (Total); 5 mg/m³ (Respirable).**

Component	ACGIH TLV	OSHA PEL
Carbohydrate	Not Determined	Not Determined

8.2 Exposure controls

All chemical Personal Protective Equipment (PPE) should be selected based on an assessment of both the chemical hazard present and the risk of exposure to those hazards. The PPE recommendations below are based on an assessment of the chemical hazards associated with this product. Where this product is used in a mixture with other products or fluids, additional hazards may be created and as such further assessment of risk may be required. The risk of exposure and need of respiratory protection will vary from workplace to workplace and should be assessed by the user in each situation.

Engineering measures to reduce exposure
Ensure adequate ventilation.

Personal protective equipment

Eye protection	Tightly fitting safety goggles.
Hand protection	Wear chemical resistant gloves such as nitrile or neoprene.
Respiratory protection	All respiratory protection equipment should be used within a comprehensive respiratory protection program that meets the requirements of 29 CFR 1910.134 (U.S. OSHA Respiratory Protection Standard) or local equivalent. If exposed to airborne mist/aerosol of this product, use at least a NIOSH-approved N95 half-mask disposable or re-usable particulate respirator. In work environments containing oil mist/aerosol, use at least a NIOSH-approved P95 half-mask disposable or reuseable particulate respirator. If exposed to vapors from this product use a NIOSH/MSHA-approved respirator with an Organic Vapor cartridge.
Skin and body protection	Wear suitable protective clothing.
Hygiene measures	Wash hands before eating, drinking or smoking, Remove and wash contaminated clothing before re-use.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

Physical state	Solid powder
Appearance	Opaque
Odor	Mild Odorless
Color	White - Yellow
Odor threshold	Not applicable

Property	**Values**	**Remarks**
pH		
pH @ dilution	6.5-8.5 @ 1% in H2O	
Melting/freezing point		
Boiling point/range	No information available	
Flash point	Does not flash	
Evaporation rate (BuAc =1)	No information available	
Flammability (solid, gas)	Not Applicable	
Flammability Limits in Air		
Upper flammability limit	No information available	
Lower flammability limit	No information available	
Vapor pressure	0 mmHg	
Vapor density	Not applicable	
Specific gravity	0.3 - 0.5	
Bulk density	No information available	
Water solubility	Soluble in water	
Solubility in other solvents	No information available	
Autoignition temperature	No information available	
Decomposition temperature	No information available	
Kinematic viscosity	No information available	
Dynamic viscosity	No information available	
Log Pow	Not determined	
Explosive properties	Not Applicable	
Oxidizing properties	None known.	

9.2 Other information

Pour point	No information available
Molecular weight	No information available

VOC content(%) None
Density No information available

10. Stability and reactivity

10.1 Reactivity

No specific reactivity hazards associated with this product.

10.2 Chemical stability

Stable under normal temperature conditions and recommended use.

10.3 Possibility of Hazardous Reactions

Hazardous polymerization
Hazardous polymerization does not occur.

Hazardous Reactions
None known.

10.4 Conditions to avoid

Heat, flames and sparks.

10.5 Incompatible materials

Strong oxidizing agents.

10.6 Hazardous decomposition products

Carbon oxides (COx).

11. Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Inhalation Inhalation of dust may cause shortness of breath, tightness of the chest, a sore throat and cough.

Eye contact Dust may cause mechanical irritation.

Skin contact Repeated exposure may cause skin dryness or cracking.

Ingestion Irritant; may cause pain or discomfort to mouth, throat and stomach.

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Carbohydrate	= 27000 mg/kg (Rat)	> 2 g/kg (Rabbit)	> 5800 mg/m³ (Rat) 4 h

Component	IARC Group 1 or 2	ACGIH - Carcinogens	OSHA listed carcinogens	NTP
Carbohydrate	No data available	No data available	No data available	No data available

Sensitization This product does not contain any components suspected to be sensitizing.

Mutagenic effects This substance has no evidence of mutagenic properties.

Carcinogenicity	This substance has no evidence of carcinogenic properties.
Reproductive toxicity	None known.
Developmental toxicity	Not known to cause birth defects or have a deleterious effect on a developing fetus.
Routes of exposure	Inhalation. Skin contact. Eye contact.
Routes of entry	None known.
Specific target organ toxicity (single exposure)	Not classified
Specific target organ toxicity (repeated exposure)	Not classified.
Aspiration hazard	Not Applicable.

12. Ecological information

12.1 Toxicity

Toxicity to algae
See component information below.

Toxicity to fish
See component information below.

Toxicity to daphnia and other aquatic invertebrates
See component information below.

Component	Toxicity to fish	Toxicity to algae	Toxicity to daphnia and other aquatic invertebrates
Carbohydrate (60 - 100)	No information available	No information available	No information available

12.2 Persistence and degradability

No product level data available.

12.3 Bioaccumulative potential

No data available.

12.4 Mobility in soil

No information available.

12.5 Results of PBT and vPvB assessment

This substance is not considered to be persistent, bioaccumulating or toxic (PBT)
This substance is not considered to be very persistent nor very bioaccumulating (vPvB)

12.6 Other adverse effects.

None known.

13. Disposal considerations

13.1 Waste treatment methods

Disposal Method Disposal should be made in accordance with federal, state and local regulations.

Contaminated packaging Empty containers should be taken for local recycling, recovery or waste disposal.

14. Transport information

14.1 UN Number

UN/ID No. (ADR/RID/ADN/ADG)	Not regulated
UN No. (IMDG)	Not regulated
UN No. (ICAO)	Not regulated
UN No. (DOT)	Not regulated

14.2 Proper shipping name

Not regulated for transportation by DOT, TDG, IMDG and ICAO/IATA.

14.3 Hazard class(es)

ADR/RID/ADN Hazard class	Not regulated
IMDG Hazard class	Not regulated
ICAO Hazard class/division	Not regulated
DOT Hazard class	Not regulated

14.4 Packing group

ADR/RID/ADN Packing Group	Not regulated
IMDG Packing group	Not regulated
ICAO Packing group	Not regulated
DOT Packing group	Not regulated

Marine pollutant
No

14.6 Special precautions
Not Applicable

15. Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

International inventories

USA (TSCA)	Complies
European Union (EINECS and ELINCS)	Complies
Canada (DSL)	Complies
Philippines (PICCS)	Complies
Japan (ENCS)	Complies

China (IECSC)	Complies
Australia (AICS)	Complies
Korean (KECL)	Complies
New Zealand (NZIoC)	Complies

U.S. Federal and State Regulations

SARA 311/312 Hazard Categories
Not a SARA 311/312 hazard.

SARA 302/304, 313, CERCLA RQ, California Proposition 65
Note: If no components are listed below, this product is not subject to the referenced SARA and CERCLA regulations and is not known to contain a Proposition 65 listed chemical at a level that is expected to pose a significant risk under anticipated use conditions.

Component	SARA 302 / TPQs	SARA 313	CERCLA RQ
Carbohydrate	N/A	N/A	N/A

State Comments
Proposition 65: This product is not known to contain chemicals considered by the State of California's Safe Drinking Water and Toxic Enforcement Act of 1986 as causing cancer and/or reproductive toxicity at levels that are expected to pose a significant risk under anticipated use conditions.

Canadian Classification

This product has been classified in accordance with the hazard criteria of the CPR and the SDS contains all the information required by the CPR.

WHMIS Hazard Class Not a controlled product.

16. Other information

Supersedes date 14/Feb/2012

Revision date 08/Jan/2015

Version 4

The following sections have been revised All sections. Updated according to GHS/CLP.

HMIS classification

Health	0
Flammability	1
Physical hazard	0
PPE	E

N/A - Not Applicable, N/D - Not Determined.

†A mark of M-I L.L.C.

Disclaimer
The information contained herein is considered in good faith as reliable of the date issued and is based upon on measurements, tests or data derived from supplier's own study or furnished by others. In providing this SDS information, Supplier makes no express or implied warranties as to the information or product; merchantability or fitness of purpose; any express or implied warranty; or non-infringement of intellectual property rights; and supplier assumes no responsibility for any direct, special or consequential damages, results obtained, or the activities of others. To the maximum extent permitted by law, supplier's warranty obligations and buyer's sole remedies are as stated in separate agreement between the parties.

MICHELS®

POTENTIAL ADDITIVIVE

RING FREE

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SDS no. 12003
Version 3
Revision date 24/Jul/2014
Supersedes date 27/Dec/2013

Safety Data Sheet
RINGFREE†

1. Identification of the substance/preparation and of the Company/undertaking

1.1 Product identifier

Product name RINGFREE†
Product code 12003

1.2 Relevant identified uses of the substance or mixture and uses advised against

Recommended Use Drilling fluid additive

Uses advised against Consumer use

1.3 Details of the supplier of the safety data sheet

Supplier
M-I L.L.C.
P.O.Box 42842
Houston, TX 77242
www.miswaco.slb.com

Prepared by
Global Chemical Regulatory Compliance (GCRC) , Mike McDowell

1.4 Emergency Telephone Number

Emergency telephone - (24 Hour) Australia +61 2801 44558, Asia Pacific +65 3158 1074, China +86 10 5100 3039, Europe +44 (0) 1235 239 670, Middle East and Africa +44 (0) 1235 239 671, New Zealand +64 9929 1483, USA 001 281 561 1600
Telephone Number - 281-561-1512

2. Hazards identification

2.1 Classification of the substance or mixture

GHS - Classification

Not a dangerous substance or mixture according to the Globally Harmonized System (GHS)

Health hazards Not classified

Environmental hazards Not classified

Physical Hazards Not classified

2.2 Label elements

Not a dangerous substance or mixture according to the Globally Harmonized System (GHS)
Hazard statements
None

Precautionary statements
None

-

3. Composition/information on Ingredients

3.1 Substances

Not Applicable

3.2 Mixtures

Not Applicable

Comments
No classified ingredients, or those having occupational exposure limits, present above the level of disclosure.

4. First aid measures

4.1 Description of first-aid measures

Inhalation — If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Ingestion — Rinse mouth. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Get medical attention if symptoms occur.

Skin contact — Wash off immediately with soap and plenty of water removing all contaminated clothes and shoes. Get medical attention immediately if symptoms occur.

Eye contact — Remove contact lenses. Promptly wash eyes with lots of water while lifting eye lids. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

4.2 Most important symptoms and effects, both acute and delayed

General advice — The severity of the symptoms described will vary dependant of the concentration and the length of exposure. If adverse symptoms develop, the casualty should be transferred to hospital as soon as possible.

Main symptoms

Inhalation — Please see Section 11. Toxicological Information for further information.

Ingestion — Please see Section 11. Toxicological Information for further information.

Skin contact — Please see Section 11. Toxicological Information for further information.

Eye contact — Please see Section 11. Toxicological Information for further information.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician Treat symptomatically.

5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media
Use extinguishing media appropriate for surrounding material.

Extinguishing media which shall not be used for safety reasons
None known.

5.2 Special hazards arising from the substance or mixture

Unusual fire and explosion hazards
None known.

Hazardous combustion products
Carbon oxides (COx).

5.3 Advice for firefighters

Special protective equipment for fire-fighters
As in any fire, wear self-contained breathing apparatus and full protective gear.

Special Fire-Fighting Procedures
Containers close to fire should be removed immediately or cooled with water.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. See also section 8.

6.2 Environmental precautions

The product should not be allowed to enter drains, water courses or the soil.

Environmental exposure controls
Avoid release to the environment.

6.3 Methods and materials for containment and cleaning up

Methods for containment
Prevent further leakage or spillage if safe to do so. Dike far ahead of liquid spill for later disposal.

Methods for cleaning up
Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. After cleaning, flush away traces with water.

6.4 Reference to other sections

See section 13 for more information.

7. Handling and storage

7.1 Precautions for safe handling

Handling
Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin and eyes. Do not breathe vapors or spray mist. Avoid spills and splashing during use.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/precautions	Ensure adequate ventilation. Keep airborne concentrations below exposure limits.
Storage precautions	Keep containers tightly closed in a dry, cool and well-ventilated place.
Packaging material	Use specially constructed containers only

8. Exposure controls/personal protection

8.1 Control parameters

Exposure limits The product does not contain any hazardous materials with occupational exposure limits established.

8.2 Exposure controls

All chemical Personal Protective Equipment (PPE) should be selected based on an assessment of both the chemical hazard present and the risk of exposure to those hazards. The PPE recommendations below are based on an assessment of the chemical hazards associated with this product. Where this product is used in a mixture with other products or fluids, additional hazards may be created and as such further assessment of risk may be required. The risk of exposure and need of respiratory protection will vary from workplace to workplace and should be assessed by the user in each situation.

Engineering measures to reduce exposure
Ensure adequate ventilation.

Personal protective equipment

Eye protection	It is good practice to wear goggles when handling any chemical. Tightly fitting safety goggles.
Hand protection	Wear chemical resistant gloves such as nitrile or neoprene.
Respiratory protection	No personal respiratory protective equipment normally required, In case of insufficient ventilation wear suitable respiratory equipment.
Skin and body protection	Wear suitable protective clothing, Provide eyewash station.

Hygiene measures Wash hands before eating, drinking or smoking, Remove and wash contaminated clothing before re-use.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

Physical state	Liquid
Appearance	Transparent
Odor	Mild
Color	Light yellow
Odor threshold	Not applicable

Property	Values	Remarks
pH	6 - 8	

pH @ dilution	
Melting/freezing point	
Boiling point/range	90 °C / 194 °F
Flash point	No information available
Evaporation rate (BuAc =1)	
Flammability (solid, gas)	Not Applicable
Flammability Limits in Air	
Upper flammability limit	Not applicable
Lower flammability limit	Not applicable
Vapor pressure	No information available
Vapor density	No information available
Specific gravity	1.27
Bulk density	No information available
Relative density	No information available
Water solubility	Slightly soluble in water.
Solubility in other solvents	No information available
Autoignition temperature	No information available
Decomposition temperature	No information available
Kinematic viscosity	No information available
Dynamic viscosity	No information available
Log Pow	Does not bioaccumulate
Explosive properties	No information available
Oxidizing properties	No information available

9.2 Other information

Pour point	No information available
Molecular weight	No information available
VOC content(%)	No information available
Density	No information available

10. Stability and reactivity

10.1 Reactivity

No specific reactivity hazards associated with this product.

10.2 Chemical stability

Stable under normal temperature conditions and recommended use.

10.3 Possibility of Hazardous Reactions

Hazardous polymerization
Hazardous polymerization does not occur.

10.4 Conditions to avoid

None known.

10.5 Incompatible materials

Strong oxidizing agents.

10.6 Hazardous decomposition products

Carbon oxides (COx).

11. Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Inhalation	Inhalation of vapors in high concentration may cause irritation of respiratory system.
Eye contact	May cause slight irritation.
Skin contact	Prolonged contact may cause redness and irritation.
Ingestion	Ingestion may cause stomach discomfort.
Acute toxicity	0% of the mixture consists of ingredient(s) of unknown toxicity.

Sensitization	This product does not contain any components suspected to be sensitizing.
Mutagenic effects	No evidence of mutagenic properties.
Carcinogenicity	No evidence of carcinogenic properties.
Reproductive toxicity	No evidence of toxicity to reproduction.
Developmental toxicity	Not known to cause birth defects or have a deleterious effect on a developing fetus.
Routes of exposure	Eye contact. Skin contact. Inhalation.
Routes of entry	No route of entry noted.
Specific target organ toxicity (single exposure)	Not classified
Specific target organ toxicity (repeated exposure)	Not classified.
Aspiration hazard	Not Applicable.

12. Ecological information

12.1 Toxicity

Toxicity to algae
See component information below.

Toxicity to fish
See component information below.

Toxicity to daphnia and other aquatic invertebrates
See component information below.

12.2 Persistence and degradability

No product level data available.

12.3 Bioaccumulative potential

No data available.

12.4 Mobility in soil

No information available.

12.5 Results of PBT and vPvB assessment

This preparation contains no substance considered to be persistent, bioaccumulating nor toxic (PBT)
This preparation contains no substance considered to be very persistent nor very bioaccumulating (vPvB)

12.6 Other adverse effects.

None known.

13. Disposal considerations

13.1 Waste treatment methods

Waste from residues / unused products	Dispose of in accordance with local regulations.
Contaminated packaging	Empty containers should be taken for local recycling, recovery or waste disposal.

14. Transport information

14.1 UN Number

UN/ID No. (ADR/RID/ADN/ADG)	Not regulated
UN No. (IMDG)	Not regulated
UN No. (ICAO)	Not regulated
UN No. (DOT)	Not regulated

14.2 Proper shipping name

Not regulated for transportation by DOT, TDG, IMDG and ICAO/IATA.

14.3 Hazard class(es)

ADR/RID/ADN Hazard class	Not regulated
IMDG Hazard class	Not regulated
ICAO Hazard class/division	Not regulated
DOT Hazard class	Not regulated

14.4 Packing group

ADR/RID/ADN Packing Group	Not regulated
IMDG Packing group	Not regulated
ICAO Packing group	Not regulated
DOT Packing group	Not regulated

14.5 Environmental hazard

No

14.6 Special precautions
Not Applicable

15. Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

International inventories

USA (TSCA)	Complies
European Union (EINECS and ELINCS)	Does not Comply
Canada (DSL)	Complies
Philippines (PICCS)	Complies
Japan (ENCS)	Complies
China (IECSC)	Complies
Australia (AICS)	Complies
Korean (KECL)	Complies
New Zealand (NZIoC)	Complies

IMPORTS, Canada
No import volume restrictions.

U.S. Federal and State Regulations

SARA 311/312 Hazard Catagories Not a SARA 311/312 hazard.

State Comments
Proposition 65: This product is not known to contain chemicals considered by the State of California's Safe Drinking Water and Toxic Enforcement Act of 1986 as causing cancer and/or reproductive toxicity at levels that are expected to pose a significant risk under anticipated use conditions.

This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class Not a controlled product.

16. Other information

Supersedes date	27/Dec/2013
Revision date	24/Jul/2014
Version	3
The following sections have been revised	All sections. Updated according to GHS.

Health	0
Flammability	1
Physical hazard	0
PPE	E

Disclaimer
The information provided in this Material Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

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TORQMASTER

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WYO-BEN, INC.

SAFETY DATA SHEET

1. PRODUCT AND COMPANY IDENTIFICATION

Product identifier
Product Code 25392
Product Name **TORQMASTER®**

Other means of identification

Recommended use of the chemical and restrictions on use
Use only for the purpose on the product label.

Details of the supplier of the safety data sheet

Manufacturer / Manufactured For
WYO-BEN
1345 Discovery Dr
Billings, Montana 59102
Phone: 406-652-6351
Emergency telephone number
24 Hour Emergency Phone Number: 1-800-535-5053

2. HAZARDS IDENTIFICATION

This product is not classified according to paragraph (d) of 29 CFR 1910.1200 and does not require a hazard warning label.

Hazard Classification

Acute aquatic toxicity	Category 3
Chronic aquatic toxicity	Category 3

Signal Word
None

Hazard Statements
Harmful to aquatic life with long lasting effects

Hazard Symbol
None

Precautionary Statements - Prevention
Avoid release to the environment.

Precautionary Statements - Response
Specific Treatment (See Section 4 on the SDS).
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
IF ON SKIN: Wash with plenty of soap and water. Wash contaminated clothing before reuse.
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
IF SWALLOWED: Rinse mouth. DO NOT induce vomiting. Drink plenty of water.

Precautionary Statements – Storage
Keep out of reach of children.

Precautionary Statements - Disposal
Dispose of contents/container to an approved waste disposal plant.

Hazards not otherwise classified (HNOC)

Other Information

Unknown Acute Toxicity 0.06% of the mixture consists of ingredient(s) of unknown toxicity.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS No.	Weight-%	Trade Secret
PROPRIETARY	Proprietary	1-5	*
Sodium Carbonate	497-19-8	1-5	*

*The exact percentage (concentration) of composition has been withheld as a trade secret.

4. FIRST AID MEASURES

First aid measures

Skin Contact Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Wash contaminated clothing before reuse. If skin irritation persists, call a physician.

Eye contact Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. If irritation persists, call a physician.

Inhalation If mists/vapors are formed or irritation occurs, leave area and do not return until mists/vapors have dissipated. If irritation persists, see a physician.

Ingestion Rinse mouth. Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Drink plenty of water. If irritation persists, see a physician.

Most important symptoms and effects, both acute and delayed

Symptoms No Information available.

Indication of any immediate medical attention and special treatment needed

Note to physicians Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media

Caution: Use of water spray when fighting fire may be inefficient.

Specific hazards arising from the chemical

No Information available.

Explosion data

Sensitivity to Mechanical Impact None
Sensitivity to Static Discharge None

Protective equipment and precautions for firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA **Health Hazard 0** **Fire Hazard 0** **Reactivity 0**

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions Ensure adequate ventilation, especially in confined areas.

Environmental precautions

Environmental precautions See Section 12 for additional ecological information.

Methods and material for containment and cleaning up

Methods for containment Prevent further leakage or spillage if safe to do so.

Methods for cleaning up Soak up with inert absorbent material. Pick up and transfer to properly labeled containers.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage, including any incompatibilities

Storage Conditions Keep containers tightly closed in a dry, cool and well-ventilated place.

Incompatible materials None known based on information supplied.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Appropriate engineering controls

Engineering Controls Showers, Eyewash stations & Ventilation systems.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin and body protection Wear chemical resistant gloves.

Respiratory protection If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators or air purifying respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.

General Hygiene Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Viscous Liquid
Appearance	Pink, Dark
Odor	Mild
Odor threshold	No Information available

Property	Values
pH	9.5 - 11.5
Specific Gravity	1.01
Viscosity	No Information available
Melting point/freezing point	No Information available
Boiling point / boiling range	> 212 / ° F Degrees
Flash point	> 212 / ° F Degrees
Evaporation rate	No Information available
Flammability (solid, gas)	No Information available
Upper flammability limit:	No Information available
Lower flammability limit:	No Information available
Vapor pressure	No Information available
Vapor density	No Information available
Bulk Density Lbs/Gal	No Information available
Water solubility	Complete
Partition Coefficient (n-octanol/water)	No Information available
Autoignition temperature	No Information available
Decomposition temperature	No Information available
VOC Content (%)	No Information available

10. STABILITY AND REACTIVITY

Reactivity
No data available

Chemical stability
Stable under recommended storage conditions.

Possibility of Hazardous Reactions
None under normal processing.

Conditions to avoid
Extremes of temperature and direct sunlight.

Incompatible materials
None known based on information supplied.

Hazardous Decomposition Products
None known based on information supplied.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information No data available

Inhalation No data available.

Eye contact No data available.

Skin Contact No data available.

Ingestion No data available.

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50
Sodium Carbonate 497-19-8	= 4090 mg/kg (Rat)	-	= 2300 mg/m³ (Rat) 2 h

Information on toxicological effects

Symptoms No Information available.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Sensitization	No Information available.
Germ cell mutagenicity	No Information available.
Carcinogenicity	No Information available.
Reproductive toxicity	No Information available.
STOT - single exposure	No Information available.
STOT - repeated exposure	No Information available.
Aspiration hazard	No Information available.

Numerical measures of toxicity - Product Information

Unknown Acute Toxicity 0.05% of the mixture consists of ingredient(s) of unknown toxicity.
This is based upon values calculated per chapter 3.1 of the GHS document.

12. ECOLOGICAL INFORMATION

Ecotoxicity

0.05% of the mixture consists of components(s) of unknown hazards to the aquatic environment

Chemical Name	Algae/aquatic plants	Fish	Crustacea
PROPRIETARY	-	LC50 Oncorhynchus mykiss, 96 hr.,1.2 mg/L:	LC50 Daphnia sp., 48 hr., 5.3 mg/L
Sodium Carbonate 497-19-8	EC 50 Nitzschia sp.,120 hr.,242 mg/L	LC 50 Lepomis macrochirus, 96 hr., 300 mg/L static LC50 Pimephales promelas, 96 hr., 310 - 1220 mg/L., static	EC50 Daphnia magna, 48 hr., 265 mg/L

Persistence and degradability
No Information available.

Bioaccumulation
No Information available.

Other adverse effects No Information available.

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Disposal of wastes Disposal should be in accordance with applicable regional, national and local laws and regulations.

Contaminated packaging Do not reuse container.

This product contains one or more substances that are listed with the State of California as a hazardous waste.

Chemical Name	California Hazardous Waste Status
Sodium Carbonate 497-19-8	Corrosive

14. TRANSPORT INFORMATION

The shipping classification information in this section (Section 14) is meant as a guide to the overall classification of the product. However, transportation classifications may be subject to change with changes in package size. Consult shipper requirements under 49 CFR, IATA and IMDG to assure regulatory compliance.

DOT Not regulated

15. REGULATORY INFORMATION

International Inventories

TSCA	Complies
DSL/NDSL	Complies
EINECS/ELINCS	Does not comply
ENCS	Does not comply
IECSC	Does not comply
KECL	Does not comply
PICCS	Does not comply
AICS	Does not comply

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory.
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List.
EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances.
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
AICS - Australian Inventory of Chemical Substances

US Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311/312 Hazard Categories

Acute health hazard	No
Chronic Health Hazard	No
Fire hazard	No
Sudden release of pressure hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

US State Regulations

California Proposition 65

This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

This product does not contain chemicals subject to Right-To-Know regulations in other states.

U.S. EPA Label Information

EPA Pesticide Registration Number Not Applicable

16. OTHER INFORMATION

Prepared	12/17/2019
Last Revision	01/17/2020

DISCLAMER

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text. No warranty or guarantee, expressed or implied is made by WYO-BEN, INC. as to this information, or as to the safety, toxicity or effect of the use of this product.

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PLUGZ IT

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WYO-BEN, INC.

SAFETY DATA SHEET

SECTION 1 — CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Trade Name: **PLUGZ-IT™ MAX**
Chemical Family: Mineral
Application: Sealing

Manufacturer/Supplier: Wyo-Ben, Inc.
1345 Discovery Drive
Billings, MT 59102 USA
Telephone: 800.548.7055
Facsimile: 406.656.0748

Emergency Phone Number CHEMTREC® 800.424.9300

SECTION 2 — HAZARD IDENTIFICATION

Hazard Symbol: Health Hazard

Signal Word: Warning

Hazard Overview: ACUTE HEALTH HAZARD
May cause eye and respiratory irritation.

CHRONIC HEALTH HAZARD
Breathing crystalline silica can cause lung disease, including silicosis and lung cancer.

SECTION 3 — COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	Percent	ACGIH TLV-TWA	OSHA PEL-TWA*
Crystalline Silica, quartz	14808-60-7	1 – 6%	0.025 mg/m^3	$\frac{10\ mg/m^3}{\%SiO2 + 2}$

*More restrictive exposure limits may be enforced by some states, agencies, or other authorities.
Non-hazardous components > 94%

SECTION 4 — FIRST AID MEASURES

Inhalation: If inhaled, remove to a dust free area. Get medical attention if respiratory irritation develops or if breathing becomes difficult. Inhalation may aggravate existing respiratory illness.

Skin: Wash with soap and water until clear. Seek medical attention if irritation persists.

Eyes: In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Ingestion: No adverse effects.

Notes to Physician: Treat Symptomatically.

SECTION 5 — FIRE FIGHTING MEASURES

Flash Point/Range (F):	Not applicable
Flash Point/Range (C):	Not applicable
Flash Point Method:	Not applicable
Autoignition Temperature (F):	Not applicable
Autoignition Temperature (C):	Not applicable
Flammability Limits in Air – Lower (%):	Not applicable
Flammability Limits in Air – Upper (%):	Not applicable
Fire Extinguishing Media:	All standard firefighting media. (Caution slippery when wet.)
Special Exposure Hazards:	Not applicable
Special Protective Equipment for Firefighters:	Not applicable
NFPA Ratings:	Health 0, Flammability 0, Reactivity 0

SECTION 6 — ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures:	Use appropriate protective equipment. Avoid creating and breathing dust.
Environmental Precautionary Measures:	None known.
Procedure for Cleaning/Absorption:	Collect using appropriate dustless method and hold for appropriate disposal.

SECTION 7 — HANDLING AND STORAGE

Handling Precautions:	This product contains quartz which may become airborne. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposure below recommended exposure limits. Wear a NIOSH/MSHA European Standard En 149, or equivalent certified for silica bearing dust, respirator when using this product. Material is slippery when wet. Promptly clean up spills to avoid breathing airborne dust.
Storage Information:	Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container.

SECTION 8 — EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls:	Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits.
Personal Protective Equipment:	If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.
Respiratory Protection:	Not normally needed. If significant exposures are possible use NIOSH/MSH respirator approved for silica bearing dust.
Hand Protection:	Normal work gloves.
Skin Protection:	Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.
Eye Protection:	Wear safety glasses or goggles to protect against exposure.
Other Precautions:	None known.

SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid
Color:	Light tan to gray as dry powder
Odor:	Odorless
pH:	8 – 10 (5% aqueous solution)
Specific Gravity @ 20 C (Water=1):	2.45 – 2.55
Density @ 20 C (lbs/gallon):	Not determined
Bulk Density @ 20 C (lbs/ft^3):	60 – 66
Boiling Point/Range (F):	Not applicable
Boiling Point/Range (C):	Not applicable
Freezing Point/Range (F):	Not applicable
Freezing Point/Range (C):	Not applicable
Vapor Pressure @ 20 C (mmHg):	Not applicable
Vapor Density (Air=1):	Not applicable
Percent Volatiles:	Not applicable
Evaporation Rate (Butyl Acetate=1):	Not applicable
Solubility in Water (g/100ml):	Insoluble, forms colloidal suspension
Solubility in Solvents (g/100ml):	Not applicable
VOCs (lbs/gallon):	Not applicable
Viscosity, Dynamic @ 20 C (centipoise):	240
Viscosity, Kinematic @ 20 C (centistrokes):	Not applicable
Partition Coefficient/n-Octanol/Water:	Not applicable
Molecular Weight (g/mole):	Not applicable

SECTION 10 — STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid:	None anticipated
Incompatibility (Materials to Avoid):	Hydrofluoric Acid
Hazardous Decomposition Products:	None
Additional Guidelines:	Not applicable

SECTION 11 — TOXICOLOGICAL INFORMATION

Principle Route of Exposure:	Eye or skin contact, inhalation.
Inhalation:	Inhaled crystalline silica in the form or quartz from occupational sources is carcinogenic to humans (IARC, Group 1).
Skin Contact:	May cause mechanical skin irritation.
Eye Contact:	May cause eye irritation.
Ingestion:	None known
Aggravated Medical Conditions:	Individuals with respiratory disease, including but not limited to asthma and bronchitis, or subject to eye irritation, should not be exposed to respirable quartz-bearing dust.
Chronic Effects/Carcinogenicity:	Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis. Cancer Status: The International Agency for Research on Cancer (IARC, 1997) concludes that there is sufficient evidence in humans for carcinogenicity of inhaled crystalline silica from occupational sources (IARC Group 1), that carcinogenicity was not detected in all industrial circumstances studied and that carcinogenicity may depend on characteristics of the crystalline silica or on external factors affecting its biological activity. See IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997). The National Toxicology Program (NTP) classifies respirable crystalline silica as "Known to be a human carcinogen" (NTP 9th Report on Carcinogens, 2000). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies crystalline silica, quartz, as a suspected human carcinogen (A2).
Other Information:	See "Adverse Effects of Crystalline Silica Exposure" published by the American Thoracic Society Medical Section of the American Lung Association, American Journal of Respiratory and Critical Care Medicine, Volume 155, pages 761-768 (1997).
Toxicity Tests	
Oral Toxicity:	Not determined (on FDA GRAS list; used as a food additive)
Dermal Toxicity:	Not determined (on FDA GRAS list; used in cosmetic preparations)
Inhalation Toxicity:	Not determined
Primary Irritation Effect:	Not determined
Carcinogenicity:	Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997).
Genotoxicity:	Not determined
Reproductive/Developmental Toxicity:	Not determined

SECTION 12 — ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air):	Not determined
Persistence/Degradability:	Not determined
Bio-accumulation:	Not determined

Ecotoxicological Information

Acute Fish Toxicity:	Not determined
Acute Crustaceans Toxicity:	Not determined
Acute Algae Toxicity:	Not determined

Chemical Fate Information:	Not determined
Other Information:	Not applicable

SECTION 13 — DISPOSAL CONSIDERATIONS

Disposal Method:	Bury in a licensed landfill according to federal, state and local regulations.
Contaminated Packaging:	Follow all applicable national or local regulations.

SECTION 14 — TRANSPORT INFORMATION

Land Transportation

DOT – Not Restricted
Canadian TDG – Not Restricted
ADR – Not Restricted

Air Transportation

ICAO/IATA – Not Restricted

Sea Transportation

IMDG – Not Restricted

Other Transportation Information

Labels: None

SECTION 15 — REGULATORY INFORMATION

US Regulations

US TSCA Inventory	All components listed on inventory or are exempt.
EPA SARA Title III Extremely Hazardous Substances	Not applicable
EPA SARA (311, 312) Hazard Class	Acute Health Hazard Chronic Health Hazard
EPA SARA (313) Chemicals	This product does not contain a toxic chemical for routine annual “Toxic Chemical Release Reporting” under Section 313 (40 CFR 372).

EPA CERCLA/Superfund Reportable Spill Quantity	Not applicable
EPA RCRA Hazardous Waste Classification	If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.
California Proposition 65	This product contains crystalline silica (respirable) which is a substance known to the State of California to cause cancer.

Canadian Regulations

Canadian DSL Inventory	All components listed on inventory are exempt.
WHMIS Hazard Class	This product contains crystalline silica (respirable) and is classified as a Class D, Division 2, Subdivision A substance.

SECTION 16 — OTHER INFORMATION

Prepared	03/18/2015
Last Revision	07/23/2015

DISCLAIMER

All information presented herein is believed to be accurate; however, it is the user's responsibility to determine in advance of need that the information is current and suitable for their circumstances. No warranty or guarantee, expressed or implied is made by WYO-BEN, INC. as to this information, or as to the safety, toxicity or effect of the use of this product.

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CLAY CUTTER

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MATERIAL SAFETY DATA SHEET

1. Product and Company Identification

Material name CLAY CUTTER™

Version # 05

Revision date 19-December-2008

Chemical name Formation Inhibitor

Chemical description Liquid

CAS # Mixture

Manufacturer

CETCO
Drilling Products Group
2870 Forbs Avenue
Hoffman Estates, IL 60192 US
safetydata@amcol.com
http://www.cetco.com/
General Information (800) 527-9948
CHEMTREC® (800) 424-9300

2. Hazards Identification

Emergency overview No hazards resulting from the material as supplied. Health injuries are not known or expected under normal use.

OSHA regulatory status While this material is not considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200), this MSDS contains valuable information critical to the safe handling and proper use of the product. This MSDS should be retained and available for employees and other users of this product.

Potential health effects

Eyes Contact with eyes may cause irritation.

Skin May cause skin irritation in susceptible persons.

Inhalation Health injuries are not known or expected under normal use.

Ingestion Ingestion of this product may cause nausea, vomiting and diarrhea.

3. Composition / Information on Ingredients

The manufacturer lists no ingredients as hazardous according to OSHA 29 CFR 1910.1200.

Composition comments This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

4. First Aid Measures

First aid procedures

Eye contact Immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation develops or persists.

Skin contact Wash off with soap and water. Remove contaminated clothing. Get medical attention if irritation develops or persists.

Inhalation Remove to fresh air. If the affected person is not breathing, apply artificial respiration. If breathing is difficult, give oxygen. Get medical attention, if needed.

Ingestion Give victim water or milk. If swallowed, do NOT induce vomiting. Never give anything by mouth to an unconscious person. Obtain medical attention.

General advice If you feel unwell, seek medical advice (show the label where possible).

5. Fire Fighting Measures

Flammable properties Not a fire hazard.

Extinguishing media

Suitable extinguishing media Use any media suitable for the surrounding fires.

Protection of firefighters

Protective equipment and precautions for firefighters	Move containers from fire area if you can do it without risk. Cool containers with flooding quantities of water until well after fire is out.
Hazardous combustion products	None known.

6. Accidental Release Measures

Environmental precautions	Prevent spreading over a wide area (e.g. by containment or oil barriers). Prevent further leakage or spillage if safe to do so. Do not flush into surface water or sanitary sewer system.
Methods for containment	Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible.
Methods for cleaning up	Absorb spill with inert material (e.g., dry sand or earth), then place in a chemical waste container. Do not allow the spilled product to enter public drainage system or open water courses. Wear appropriate protective equipment and clothing during clean-up.

7. Handling and Storage

Handling	Use only in well-ventilated areas. Provide sufficient air exchange and/or exhaust in work rooms. In case of insufficient ventilation, wear suitable respiratory equipment.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Store in original container.

8. Exposure Controls / Personal Protection

Engineering controls	Good general ventilation should be sufficient to control airborne levels. Local exhaust is suggested for use, where possible, in enclosed or confined spaces. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower.

Personal protective equipment

Eye / face protection	Wear safety glasses; chemical goggles (if splashing is possible).
Skin protection	Wear appropriate chemical resistant gloves. Use of an impervious apron is recommended.
Respiratory protection	None required where adequate ventilation conditions exist.
General hygeine considerations	Use good industrial hygiene practices in handling this material. Wash hands before breaks and immediately after handling the product.

9. Physical & Chemical Properties

Appearance	Not available.
Color	Not available.
Odor	Not available.
Odor threshold	Not available.
Physical state	Liquid.
Form	Liquid.
pH	Not available.
Melting point	Not available.
Freezing point	Not available.
Boiling point	Not available.
Flash point	Not available.
Evaporation rate	Not available.
Flammability	Not available.
Flammability limits in air, upper, % by volume	Not available.
Flammability limits in air, lower, % by volume	Not available.
Vapor pressure	Not available.
Vapor density	Not Determined
Specific gravity	Not available.
Relative density	Not available.
Solubility (water)	Not available.

Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Percent volatile	50 % v/v

10. Chemical Stability & Reactivity Information

Chemical stability	No hazards to be especially mentioned. Stable at normal conditions.
Conditions to avoid	None known.
Incompatible materials	None known.
Hazardous decomposition products	Upon decomposition, this product may yield gaseous nitrogen oxides, carbon monoxide, carbon dioxide and/or low molecular weight hydrocarbons.
Possibility of hazardous reactions	Will not occur.

11. Toxicological Information

Component analysis - LD50	This product is judged to have an acute oral LD50 (rat) greater than 5 g/kg of body weight, and ar acute dermal LD50 (rabbit) greater than 3.16 g/kg of body weight.
Further information	This product has no known adverse effect on human health.

12. Ecological Information

Ecotoxicity	This material is not expected to be harmful to aquatic life. This material has a biodegradatior percentage of 85.2% and is considered to have ready biodegradability. This material exceeds the OECD Guideline 301B for environmental friendliness
Environmental effects	Ecological injuries are not known or expected under normal use.
Persistence and degradability	Not available.

13. Disposal Considerations

Disposal instructions	Dispose in accordance with all applicable regulations.

14. Transport Information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory Information

US federal regulations	OSHA Process Safety Standard: This material is not known to be hazardous by the OSHA Highly Hazardous Process Safety Standard, 29 CFR 1910.119.

CERCLA (Superfund) reportable quantity

None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - No Delayed Hazard - No Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No
Section 302 extremely hazardous substance	No
Section 311 hazardous chemical	No

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	No

Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	No
Europe	European Inventory of New and Existing Chemicals (EINECS)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	No
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	No

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

State regulations This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

16. Other Information

Further information This safety datasheet only contains information relating to safety and does not replace any product information or product specification.

HMIS ratings

NFPA ratings Health: 0
Flammability: 0
Instability: 0

Disclaimer The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The manufacturer expressly does not make any representations, warranties, or guarantees as to its accuracy, reliability or completeness nor assumes any liability, for its use. It is the user's responsibility to verify the suitability and completeness of such information for each particular use.

Third party materials: Insofar as materials not manufactured or supplied by this manufacturer are used in conjunction with, or instead of this product, it is the responsibility of the customer to obtain, from the manufacturer or supplier, all technical data and other properties relating to these and other materials and to obtain all necessary information relating to them. No liability can be accepted in respect of the use of this product in conjunction with materials from another supplier.

Issue date 19-December-2008

This data sheet contains changes from the previous version in section(s): Composition / Information on Ingredients: Component information

MICHELS®

POTENTIAL ADDITIVIVE

CLAY BREAKER

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1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

TRADE NAME: ClayBreaker

24-HOUR EMERGENCY TELEPHONE: 1-800-535-5053 (Infotrac)

SUPPLIER: DCS Fluids Solutions LP
P.O. Box 1027
Graham, TX 76450
(940) 521-0400

Product Use: Well Stimulation Additive, Clay Stabilizer
CAS #: Mixture

2. COMPOSITION, INFORMATION ON INGREDIENTS

No hazardous ingredients as defined by OSHA 29 CFR 1910.1200

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Colorless to amber liquid with a strong odor. May be irritating to eyes, skin and respiratory tract. May be harmful if swallowed. Avoid contact with skin, eyes and clothing.

POTENTIAL HEALTH HAZARDS:

- **INHALATION:** May cause irritation of respiratory tract.
- **INGESTION:** May cause irritation of the gastrointestinal tract including nausea, vomiting and diarrhea.
- **SKIN:** May cause skin irritation.
- **EYES:** May cause eye irritation.

CHRONIC EFFECTS: None known

Ingredients found on one of the OSHA designated carcinogen lists are listed below.

No ingredients listed in this section.

4. FIRST AID MEASURES

INHALATION: If breathing is difficult, remove to fresh air and keep at rest in a comfortable position for breathing. Obtain immediate medical attention.

INGESTION: If swallowed, seek immediate medical attention and show this container or label. Do not induce vomiting without medical advice.

SKIN: Wash skin thoroughly with soap and water. Remove contaminated clothing. Get medical attention if any irritation continues.

EYES: Immediately flush eyes with large quantities of water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of all eye and lid tissue. Get medical attention if irritation develops.

ADVICE TO PHYSICIANS: No specific treatment. Treat according to symptoms present.

5. FIRE FIGHTING MEASURES

FLASH POINT: >200° F (>93.3° C)
FLAMMABLE LIMITS: LEL: N/A
UEL: N/A

EXTINGUISHING AGENTS:

Water, dry chemical, CO2, water spray or regular foam.
Do not use a solid water stream as it may scatter and spread fire.

SPECIAL FIRE FIGHTING PROCEDURES:

Wear positive-pressure, self-contained breathing apparatus (SCBA) and protective fire fighting clothing (including fire fighting helmet, coat, pants, boots, and gloves). If protective equipment is not available or not used, fight fire from a protected location or safe distance.

UNUSUAL FIRE & EXPLOSION HAZARDS:

Always stay away from tanks engulfed in flame. Withdraw immediately in case of rising sound from venting safety devices of any discoloration of tanks due to fire. Move containers from fire area if you can do it without risk. Do not scatter spilled material with high pressure water streams. Use water spray to cool unopened containers. Cool containers with flooding quantities of water until well after fire is out.

6. ACCIDENTAL RELEASE MEASURE

PERSONAL PROTECTION:

Don appropriate personal protective equipment prior to entering spill/leak area.
(See Section 8)

SPILL CLEAN-UP PROCEDURES:

Limit access to area, as necessary. Shut off leak if it can be done safely. Contain spill with dike. Prevent run-off into sewers or waterways. Pump large spills into salvage containers. Soak up residue and small spills with vermiculite, paper, clay or other absorbent material. Remove affected soils. Place in salvage containers. Continue to observe handling precautions.

WASTE DISPOSAL METHOD:

Follow approved local beneficial reuse guidelines for uncontaminated spent drilling fluids. If contaminated, dispose of in a licensed industrial landfill according to local, state and federal regulations. If released to the environment for other than its intended purpose, this product, in its current state, does not meet the definition of a hazardous waste under 40 CFR 261.

7. HANDLING AND STORAGE

HANDLING PRECAUTIONS:

Always wear recommended personal protection equipment. Do not get in eyes, on skin or clothing. Avoid breathing mist or vapor. Use only with adequate ventilation or wear respiratory protection.

STORAGE PRECAUTIONS:

Keep containers tightly closed and properly labeled. Store at moderate temperatures in dry, well-ventilated area. Keep container closed when not in use. Keep in original container. Store containers in upright position. Since emptied containers retain product residue, follow hazard precautions even when empty.

HYGIENIC WORK PRACTICES:

Use good personal hygiene practices. Wash hands and skin thoroughly after handling. Promptly remove contaminated clothing and wash before reuse. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

ENGINEERING CONTROLS:

There are no occupational exposure limits established at this time. Since this material may be irritating to skin and mucous membranes, general room ventilation plus local exhaust at points of emission should be used to maintain levels of airborne contaminants as low as feasibly possible.

PERSONAL PROTECTION EQUIPMENT

RESPIRATORY:

Respiratory protection is not required under normal use. Wear a NIOSH/MSHA approved respirator following manufacturer's recommendations where airborne contaminants may occur.

EYE / FACE PROTECTION:

Wear chemical safety goggles or face shield to protect against splashing.

SKIN PROTECTION:

Chemical resistant gloves and splash aprons made of impermeable material should be worn.

9. PHYSICAL AND CHEMICAL PROPERTIES

- **Appearance and Odor:** Colorless to amber liquid with strong odor.
- **Physical State:** Liquid
- **pH:** 6.5 – 9
- **Vapor Pressure:** Not determined
- **Vapor Density:** Not determined
- **Boiling Point:** Not determined
- **Melting Point:** 469.4° F estimated
- **Solubility in Water:** Complete
- **Specific Gravity:** 1.01 – 1.03

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable at normal conditions**.**

CONDITIONS TO AVOID: Heat, flames and sparks.

MATERIALS TO AVOID: Strong acids.

HAZARDOUS DECOMPOSITION PRODUCTS: None expected.

HAZARDOUS POLYMERIZATION: Does not occur.

11. TOXICOLOGICAL INFORMATION

ACUTE EFFECTS:

Acute LD50: 400 – 4000 mg/kg, Rat, Oral
Acute LC50: > 4000 mg/kg, Rat, Dermal

Not expected to be hazardous by OSHA criteria.

CHRONIC EFFECTS:

None known. Not expected to be hazardous by OSHA criteria.
This product has no known adverse effect on human health.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL INFORMATION:

ClayBreaker has a biodegradation percentage of 85.2% and is considered to have ready biodegradability. Test of ready biodegradability are stringent tests that provide limited opportunity for acclimation and biodegradation to occur. A positive result in a test of ready biodegradability is an indication that the test substance will undergo rapid and ultimate biodegradation in the environment. OECD Guideline 301B has set the standard for ready biodegradability at 60%. ClayBreaker exceeds this standard for environmental friendliness.

13. DISPOSAL CONSIDERATIONS

Follow approved local beneficial reuse guidelines for uncontaminated spent drilling fluids. If contaminated, dispose of in a licensed industrial landfill according to local, state and federal regulations. If released to the environment for other than its intended purpose, this product does not meet, in its present state, the definition of a hazardous waste under 40 CFR 261. Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for a hazardous waste. Dispose in accordance with all applicable regulations.

14. TRANSPORTATION INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION (DOT):

Not regulated as dangerous goods.

CANADIAN TRANSPORTATION OF DANGEROUS GOODS (TDG):

Not regulated as dangerous goods.

IMDG:

Not regulated as dangerous goods.

IATA:

Not regulated as dangerous goods.

15. REGULATORY INFORMATION

OSHA: This product is not a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200. We request that you make all information in the Material Safety Data Sheet available to your employees.

TSCA: Not on inventory.

SARA TITLE III/CERCLA:

To aid our customers in complying with regulatory requirements, SARA Title III Hazard Categories for this product are indicated below. If the word "YES" appears next to any category, this product may be reportable by you under the requirements of 40 CFR Part 370. Please consult those regulations for details.

Immediate (Acute) Health:	YES
Delayed (Chronic) Health:	NO
Fire Hazard:	NO
Reactive Hazard:	NO
Sudden Release of Pressure:	NO

Reportable Quantity: Not reportable

Spills/release resulting in the loss of any ingredient at or above its RQ requires immediate notification to the National Response Center (1-800-424-8802) and to your Local Emergency Planning Committee.

16. OTHER INFORMATION

HMIS RATINGS: HEALTH (1) FLAMMABILITY (0) PHYSICAL HAZARD (0)
Based on the NPCA HMIS III rating system.

CURRENT ISSUE DATE: August 1, 2014
Updated information on LD50 and LC50.

DCS Fluid Solutions LP believes the information contained in this material safety data sheet is accurate based on the information supplied by reputable suppliers of our raw materials. We cannot make any assertions as to its reliability or completeness; therefore, the user may rely on it only at user's risk. We have made no effort to censor or conceal deleterious aspects of this product. Since we cannot anticipate or control the conditions under which this information and product may be used, we make no guarantee that the precautions we have suggested will be adequate for all individuals and/or situations. It is the obligation of each user of this product to comply with the requirements of all applicable laws regarding use and disposal of this product. Neither warranty, either expressed or implied, nor liability of any nature with respect to this product or to the data herein is made or incurred hereunder.

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POTENTIAL ADDITIVIVE

TORQUE BREAKER

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MATERIAL SAFETY DATA SHEET

5/04/04

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: TorqBreaker™
Chemical Family: Surfactant
Supplier: DCS Fluid Solutions.
PO Box1027
Graham TX 76450
940-521-0500

2. COMPOSITION/INFORMATION ON INGREDIENTS

OSHA Regulated Components: None

3. HAZARDS IDENTIFICATION

Acute Health Effects: None
Chronic Health Effects: None
Carcinogen: No

PRIMARY ENTRY ROUTES:

1) Skin and Eyes: Repeated contact with the skin may be irritating. Eye contact may be irritating.
2) Ingestion: May be harmful.
3) Inhalation: Not considered a hazard.

4. FIRST AID MEASURES

SKIN CONTACT: Remove contaminated clothing without delay. Wash skin thoroughly with water. If irritation persists, get medical attention.
EYE CONTACT: Rinse thoroughly with plenty of water for 15 minutes. In case of persistent eye irritation, consult a physician.
INGESTION: Give large volumes of water. Do not induce vomiting. Get medical attention.
INHALATION: N/A

5. FIRE FIGHTING MEASURES

FLASH POINT: None (will not burn)
EXTINGUISHING MEDIA: N/A
FIRE FIGHTING PROCEDURES: N/A

UNUSUAL FIRE AND EXPLOSION HAZARD: Fire fighters should observe all precautions that apply to any fire where chemicals are stored.

6. ACCIDENTAL RELEASE MEASURES

If product leaks or spills, flood area with water. Mop up and dispose to sanitary sewer. Adhere to all Federal, State and Local Regulations.

7. HANDLING AND STORAGE

Store containers tightly closed and in an upright position.
Do not destroy or deface the label.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Food, beverages and tobacco products should not be carried, stored or consumed where this material is in use. Before eating, drinking or smoking, wash face and hands with soap and water. Avoid skin contact. Protective clothing such as impervious gloves are recommended to prevent skin contact. For operations where eye or face contact can occur, wear eye protection such as chemical splash proof goggles or face shield.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Viscous Liquid
Color:	Red
Odor:	Slight Citrus
Solubility:	Completely soluble in water
Specific Gravity:	1.035
pH	10.0
Freezing Point:	N/A
Flash Point:	None (will not burn)
Vapor Pressure	N/A

10. STABILITY AND REACTIVITY

STABILITY: Stable Conditions to Avoid: None known
POLYMERIZATION: Will not occur. Conditions to Avoid: None known

11. TOXICOLOGICAL INFORMATION

None Available

12. ECOLOGICAL INFORMATION

None Available

13. DISPOSAL INFORMATION

If released into the environment for other than its intended purpose, this product does not meet the definition of a hazardous waste under 40 CFR 261. Follow approved local beneficial reuse guidelines for uncontaminated spent drilling fluids. If contaminated, dispose of in a licensed industrial landfill according to local, state and federal regulations..Recover and reuse if possible.

14. TRANSPORT INFORMATION

SHIPPING NAME: Not applicable/Not Regulated
HAZARD CLASS: Not applicable
UN NUMBER: Not applicable
DOT HAZARDOUS SUBSTANCES: Not applicable
TRANSPORT LABEL: None Required

15. REGULATORY INFORMATION

US TSCA: All components of this product are included on the TSCA Inventory in compliance with the Toxic Substances Control Act, 15 U.S.C. 2601

SECTION 313 SUPPLIER NOTIFICATION (SARA): This product contains the following toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right to Know Act of 1986 and of 40 CFR 372: None.

16. OTHER INFORMATION – NFPA Hazard Rating

Fire
0
Health 0 0 Reactivity
2
PPE

Health: 0=minimal
1=slightly hazardous
2=hazardous
3=serious hazard
4=severe hazard

Fire: 0=will not burn
1=FP>141F
2=FP>73=<141F
3=FP<73F
4=BP<95F FP by Pensky Marten closed cup

Reactivity: 0=None

PPE 0=not necessary

1=mild	1=goggles
2=strong	2=goggles, gloves
	3=goggles, gloves, protective clothes
	4=goggles, gloves, respirator

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BALL BUSTER

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BHS Marketing

Western Briquette

BALLBUSTER

MATERIAL SAFETY DATA SHEET

Sodium Acid Pyrophosphate

Date: June 20, 2001

I Company Identification

Company Name:	BHS Marketing / Western Briquette
Mailing Address:	P.O. Box 27955 SLC, UT 84127-0955
Physical Address:	2320 West Indiana Ave. SLC, UT 84104
Telephone:	(801) 973-8232
Fax:	(801) 973-8838
Emergency Number:	Chemtrec (800) 424-9300

II Product Identification

Product Name:	Sodium Acid Pyrophosphate, SAPP, Disodium pyrophosphate
Chemical Formula:	$Na_2H_2P_2O_7$
Molecular Weight:	221.96
CAS Number:	7758-16-9

III Typical Physical Properties

Physical Appearance:	White powder
Odor:	Odorless
Bulk Density:	0.9 kg/l approx.
pH (1% aqueous solution):	3.7-4.4
Melting Point:	Decomposes at 220°C
Solubility in Water:	approx. 13g in 100g water, room temperature
Vapor Pressure:	Negligible

IV Reactivity Data

Chemical Stability:	Stable
Materials to Avoid:	Avoid contact with strong bases

V Toxicological Information

Toxicity:	Oral-rat LD-50: > 1000 mg/kg

VI Hazard Data

Acute	
Eye Contact:	Causes irritation
Skin Contact:	Causes irritation
Ingestion:	Causes irritation
Inhalation:	Causes irritation
Symptoms of Overexposure:	Irritant to eyes, skin and respiratory systems. Ingestion can cause vomiting and diarrhea

VII Recommended First Aid Measures

General First Aid:	Remove the person from source of exposure. Wash with plenty of water. Upon ingestion, if the person is conscious, cause him/her to vomit. Get medical attention

VIII Fire Fighting Measures

Flash Point:	Not flammable
Extinguishing Media:	Not combustible
Special Firefighting Procedures:	Protective clothing and self contained breathing apparatus

IX Accidental Release Measures

Clean up & Disposal of Spills:	Spillage or leakages are cleaned up by mechanical removal, if possible. Flushing with plenty of water

X Handling & Storage

Handling:	Avoid inhalation, contact with eyes, skin or clothing. Do not ingest
Storage:	Store in a cool, well ventilated, dry place, in tightly closed containers

XI Exposure Controls/ Personal Protection

Appropriate Hygienic Practices:	As part of good industrial, personal hygiene and safety procedure, avoid all unnecessary exposure to the product and ensure prompt removal from eyes, skin and clothing. Maintain good housekeeping to control dust accumulations.

Personal Protection Equipment

Eye Protection:	Use safety glasses
Skin Protection:	Wear protective clothing, gloves and dust respirator if necessary
Ventilation Protection:	Adequate ventilation

XII Additional Information

The information in this MSDS was obtained from sources, which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness.

The conditions or methods of handling, storage, use and disposal are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use or disposal of the product.

*n/a= Not Applicable

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POTENTIAL ADDITIVIVE

SODA ASH

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Soda Ash / Sodium Carbonate

Revision Date: 1/18/2016

SAFETY DATA SHEET

1 PRODUCT AND COMPANY IDENTIFICATION

1.1 PRODUCT IDENTIFIERS

Product Name:	Soda Ash or Sodium Carbonate
Chemical Name:	Sodium Carbonate
Synonyms / Common Names:	Carbonic Acid Sodium Salt
Registration Number REACH:	01-2119485498-19-0011
Product Type REACH:	Substance/mono-constituent
CAS Number:	497-19-8
EC Index Number:	011-005-00-2
EC Number:	207-838-8
RTECS Number:	VZ4050000

1.2 RELEVANT IDENTIFIED USES

Glass production	Paper production	Manufacture of substances
Detergent component	Laboratory chemicals	Acidity regulator

1.3 MANUFACTURER

Ciner Wyoming LLC
254 County Road 4-6
Green River, Wyoming 82935
United States
Telephone Number: (307) 875-2600
www.ciner.us.com

1.4 EMERGENCY TELEPHONE NUMBER

Emergency Response Information Provider: CHEMTREC

Within the United States Emergency Telephone Number: 1-800-424-9300

Outside the United States / International Emergency Telephone Number: +1-703-527-3887

2 HAZARD(S) IDENTIFICATION

2.1 CLASSIFICATION OF THE SUBSTANCE OR MIXTURE

GHS Classification in accordance with 29 CFR 1910 (OSHA HazCom Standard):

Eye Irritation (Category 2A), H319

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS LABEL ELEMENTS, INCLUDING PRECAUTIONARY STATEMENTS

Pictograms:

Irritant

Signal Word: Warning

Hazard Statement(s):

H319 Causes serious eye irritation.

Precautionary Statement(s):

P264 Wash skin thoroughly after handling.

P280 Wear eye protection / face protection.

P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P337 + P313 If eye irritation persists: Get medical advice / attention.

2.3 HAZARDS NOT OTHERWISE CLASSIFIED OR NOT COVERED BY GHS

None

3 COMPOSITION / INFORMATION ON INGREDIENTS

3.1 SUBSTANCES

Synonyms:	Soda Ash, Sodium Carbonate, Carbonic Acid Sodium Salt
Formula:	Na_2CO_3

Molecular Weight: 105.99 g/mol

Component (REACH Registration)	CAS # / EC #	Concentration	Classifications	Remark
Sodium carbonate (01-2119485498-19-0011)	CAS #: 497-19-8 EC #: 207-838-8	≥ 99%	Eye Irrit. 2A, H319	Mono-constituent

* For the full text of the H-Statements mentioned in this Section, see Section 16.

4 First-Aid Measures

4.1 Description of First-Aid Measures

General - Check the vital functions. Unconscious: maintain adequate airway and respiration. Respiratory arrest: artificial respiration or oxygen. Cardiac arrest: perform resuscitation. Victim conscious with labored breathing: half-seated. Victim in shock: on his back with legs slightly raised. Vomiting: prevent asphyxia/aspiration pneumonia. Prevent cooling by covering the victim (no warming up). Keep watching the victim. Give psychological aid. Keep the victim calm, avoid physical strain. Depending on the victim's condition: doctor/hospital.

After inhalation - Remove the victim into fresh air. Respiratory problems: consult a doctor/medical service.

After skin contact - Rinse with water. Soap may be used. Do not apply (chemical) neutralizing agents. Take victim to a doctor if irritation persists.

After eye contact - Rinse immediately with plenty of water for at least 15 minutes. Do not apply neutralizing agents. Take victim to an ophthalmologist if irritation persists.

After ingestion - Rinse mouth with water. Immediately after ingestion: give lots of water to drink. Do not induce vomiting. Consult a doctor/medical service if victim is unwell.

4.2 Most important symptoms and effects, both acute and delayed

4.2.1 Acute Symptoms

If inhaled - Dry/sore throat. Coughing. Slight irritation. Exposure to high concentrations: Irritation of the respiratory tract. Irritation of the nasal mucous membranes. Respiratory difficulties.

In case of skin contact - Not irritating

In case of eye contact - Inflammation/damage of the eye tissue. Corrosion of the eye tissue. Lacrimation.

If swallowed – After absorption of high quantities: Nausea. Vomiting. Abdominal pain. Irritation of the gastric/intestinal mucosa.

4.2.2 Delayed Symptoms

No effects known.

4.3 Indication of any immediate medical attention and special treatment needed

No data available.

5 Fire-Fighting Measures

5.1 Extinguishing Media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

Upon combustion CO and CO2 are formed. Reacts on exposure to water with some metals. CO2 generation occurs when mixed with acidic materials.

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Special protective equipment for firefighters

Gloves. Safety glasses. Protective clothing. Dust cloud protection and heat/fire exposure: Compressed air respirator.

6 Accidental Release Measures

6.1 Personal Precautions, Protective Equipment and Emergency Procedures

Use personal protective equipment. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions

Contain released substance, pump into suitable containers. Plug the leak, cut off the supply. Knock down/dilute dust cloud with water spray. Violent exothermic reaction with some acids; release of harmful gases/vapors (carbon dioxide). Carbon dioxide is heavier than air and will collect in ducts, drains and low lying areas. Prevent spreading in sewers.

6.3 Methods and material for containment and cleaning up

Prevent dust cloud formation. Scoop solid spill material into closed containers. Carefully collect the spill. Clean contaminated surfaces with an excess of water. Wash clothing and equipment after handling.

6.4 Reference to other sections

For disposal see section 13.

7 HANDLING AND STORAGE

7.1 PRECAUTIONS FOR SAFE HANDLING

Avoid contact with skin and eyes. Use air conveying/mechanical systems for bulk transfer to storage. Provide appropriate exhaust ventilation at places where dust is formed. In case of insufficient ventilation, wear suitable respiratory equipment if release of airborne dust is expected.

7.2 CONDITIONS FOR SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES

Store in original container. Keep in properly labeled containers. Keep container tightly closed.

7.3 SUITABLE PACKAGING MATERIAL

No data available

7.4 INCOMPATIBLE PRODUCTS

Aluminum, powdered aluminum, and acids.

8 EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 COMPONENTS WITH WORKPLACE CONTROL PARAMETERS

Contains no substances with occupational exposure limit values.

8.2 EXPOSURE CONTROLS

Appropriate engineering controls – Avoid formation of dust. Keep away from ignition sources. Keep container tightly closed. Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

8.3 PERSONAL PROTECTIVE EQUIPMENT

Eye / Face Protection - Safety glasses with side shields or protective goggles. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection - Handle with gloves, butyl rubber or PVC, which have good resistance. Gloves must be inspected prior to use. Use proper glove removal technique to avoid skin contact with product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection – Protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection – For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator. For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

8.4 CONTROL OF ENVIRONMENTAL EXPOSURE

Prevent leakage or spillage if safe to do so. Do not let product enter drains. See section 6.2, 6.3, and 13.

9 PHYSICAL AND CHEMICAL PROPERTIES

9.1 INFORMATION ON BASIC PHYSICAL AND CHEMICAL PROPERTIES

Appearance Form:	Crystalline Solid / Crystalline Powder / Grains / Lumps
Color:	Colorless
Odor:	Odorless
Odor Threshold:	No data available
Particle Size:	694 µm
pH:	11.6; 5.0%
Melting Point / Freezing Point:	851 °C / 1,564 °F
Boiling Point	1,600 °C / 2,912 °F
Flash Point:	No data available
Explosion Limits:	No data available
Evaporation Rate:	No data available
Flammability:	Non Combustible
Log Kow:	-6.19 Estimated value
Viscosity:	No data available
Vapor Pressure:	No data available
Vapor Density:	No data available
Solubility water:	212.5 g/l; 20 °C / 68 °F
Relative Density:	2.52 -253; 20 °C / 68 °F
Absolute Density:	2,530 kg/m^3
Decomposition temperature:	>1600 °C / >2912 °F
Auto-ignition temperature:	>400 °C / >752 °F
Explosive Properties:	No data available
Oxidizing Properties:	No data available

9.2 PHYSICAL HAZARDS

No data available

10 STABILITY AND REACTIVITY

10.1 REACTIVITY

None under normal use conditions.

10.2 CHEMICAL STABILITY

Stable. Decomposes by reaction with strong acid.

10.3 POSSIBILITY OF HAZARDOUS REACTIONS

None under normal processing.

10.4 CONDITIONS TO AVOID

Exposure to air or moisture over prolonged periods.

10.5 INCOMPATIBLE MATERIALS

Aluminum, powdered aluminum, and acids.

10.6 HAZARDOUS POLYMERIZATION

Hazardous polymerization does not occur.

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11 TOXICOLOGICAL INFORMATION

11.1 INFORMATION ON TOXICOLOGICAL EFFECTS

11.1.1 Acute toxicity

LD50 Oral - rat – 2,800 mg/kg
LD50 Dermal – rabbit >2,000 mg/kg
LD50 Inhalation - rat – 2.30 mg/l, 2 hour exposure time

11.1.2 Corrosion / irritation

Skin - rabbit
Result: Mild skin irritation – 24 hours

11.1.3 Serious eye damage / eye irritation

Eyes - rabbit
Result: Severe eye irritation – 24 hours

11.1.4 Respiratory or skin sensitization

Inhalation - no data available
Skin Sensitization: no data available

11.1.5 Germ cell mutagenicity

No data available

11.1.6 Carcinogenicity

No data available

11.1.7 Reproductive toxicity

No data available

11.1.8 Specific target organ toxicity - single exposure

No data available

11.1.9 Specific target organ toxicity - repeated exposure

No data available

11.1.10 Chronic effects from short and long-term exposure

On continuous / repeated exposure / contact: Red skin. Dry skin. Tingling / irritation of the skin. Affection of the nasal septum.

12 ECOLOGICAL INFORMATION

12.1 TOXICITY

	Parameter	Method	Value	Duration	Species	Test design	Fresh / salt water	Value determination
Acute toxicity fishes	LC50	Other	300 mg/l	96 h	Lepomis macrohirus	Static system	Fresh water	Experimental value
Acute toxicity invertebrates	EC50	Other	200 - 227 mg/l	48 h	Ceriodaphnia sp.	Semi-static	Fresh water	Experimental value
Toxicity algae and other aquatic plants	EC50		242 mg/l	5 days	Algae			Experimental value

12.2 PERSISTENCE AND DEGRADABILITY:

Biodegradability: not applicable

12.3 BIOACCUMULATIVE POTENTIAL:

Low potential for bioaccumulation (Log Know <4)

12.4 MOBILITY IN SOIL:

Low potential for absorption in soil.

12.5 RESULTS OF PBT AND VPVB ASSESSMENT:

PBT/vPvB assessment not available as chemical safety assessment is not required/not conducted.

12.6 OTHER ADVERSE EFFECTS:

No data available

13 DISPOSAL CONSIDERATIONS

13.1 WASTE DISPOSAL

Remove waste in accordance with local and/or national regulations. Contact a licensed professional waste disposal service to dispose of this material. Different types of hazardous waste should not be mixed together if it will entail a risk of pollution or create problems for the further management of the waste. Hazardous waste shall be managed responsibly. Do not discharge into drains.

14 TRANSPORT INFORMATION

14.1 UNITED STATES DEPARTMENT OF TRANSPORTATION (DOT)
Non-regulated

14.2 INTERNATIONAL MARITIME DANGEROUS GOODS (IMDG)
Non-regulated

14.3 INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA)
Non-regulated

14.4 TDG / ADN / RID / ADR
Non-regulated

15 REGULATORY INFORMATION

15.1 SARA 302 COMPONENTS
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

15.2 SARA 313 COMPONENTS
SARA 313: This material does not contain any chemical with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

15.3 SARA 311/312 HAZARDS
Acute Health Hazard

15.4 PENNSYLVANIA RIGHT TO KNOW COMPONENTS
Sodium carbonate, CAS-No: 497-19-8

15.5 NEW JERSEY RIGHT TO KNOW COMPONENTS
Sodium carbonate, CAS-No: 497-19-8

15.6 WHMIS CLASSIFICATION: C, D2
Note: The product listed on this SDS has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations.

16 OTHER INFORMATION

16.1 FULL TEXT OF H-STATEMENTS REFERRED TO UNDER SECTION 2 AND 3.

Eye Irrit.	Eye Irritation
H319	Causes serious eye irritation

16.2 HMIS RATING

Health Hazard:	2
Flammability:	0
Physical Hazard:	0

16.3 NFPA RATING

Health Hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

16.4 NOTICE

The above information is believed to be correct but is not intended to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Ciner and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product.

MICHELS®

POTENTIAL ADDITIVIVE

SODIUM BICARBONATE

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Soda Ash / Sodium Carbonate

Revision Date: 7/27/2018

SAFETY DATA SHEET

1 PRODUCT AND COMPANY IDENTIFICATION

1.1 PRODUCT IDENTIFIERS

Product Name:	Soda Ash or Sodium Carbonate
Chemical Name:	Sodium Carbonate
Synonyms / Common Names:	Carbonic Acid Sodium Salt
Product Type REACH:	Substance/mono-constituent
CAS Number:	497-19-8
EC Index Number:	011-005-00-2
EC Number:	207-838-8
RTECS Number:	VZ4050000

1.2 RELEVANT IDENTIFIED USES

Glass Production	Paper Production	Manufacture of Substances
Detergent Component	Laboratory Chemicals	Acidity Regulator

1.3 MANUFACTURER

Ciner Wyoming LLC
254 County Road 4-6
Green River, Wyoming 82935
United States
Telephone Number: (307) 875-2600
www.ciner.us.com

1.4 EMERGENCY TELEPHONE NUMBER

Emergency Response Information Provider: CHEMTREC
Within the United States Emergency Telephone Number: 1-800-424-9300
Outside the United States / International Emergency Telephone Number: +1-703-527-3887

2 HAZARD(S) IDENTIIFICATION

2.1 CLASSIFICATION OF THE SUBSTANCE OR MIXTURE

GHS Classification in accordance with 29 CFR 1910 (OSHA HazCom Standard):
Eye Irritation (Category 2A), H319
For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS LABEL ELEMENTS, INCLUDING PRECAUTIONARY STATEMENTS

Pictograms:

Irritant

Signal Word: Warning

Hazard Statement(s):
H319 Causes serious eye irritation.

Precautionary Statement(s):
P264 Wash skin thoroughly after handling.

P280 Wear eye protection / face protection.

P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P337 + P313 If eye irritation persists: Get medical advice / attention.

2.3 HAZARDS NOT OTHERWISE CLASSIFIED OR NOT COVERED BY GHS

None

---

3 COMPOSITION / INFORMATION ON INGREDIENTS

3.1 SUBSTANCES

Synonyms: Soda Ash, Sodium Carbonate, Carbonic Acid Sodium Salt
Formula: Na_2CO_3
Molecular Weight: 105.99 g/mol

Component (REACH Registration)	CAS #	Concentration	Classifications	Remark
Sodium Carbonate (01-2119485498-19-0011)	CAS #: 497-19-8	≥ 99%	Eye Irrit. 2A, H319	Monoconstituent

* For the full text of the H-Statements mentioned in this Section, see Section 16.

4 FIRST-AID MEASURES

4.1 DESCRIPTION OF FIRST-AID MEASURES

General - Check the vital functions. Unconscious: maintain adequate airway and respiration. Respiratory arrest: artificial respiration or oxygen. Cardiac arrest: perform resuscitation. Victim conscious with labored breathing: half-seated. Victim in shock: on his back with legs slightly raised. Vomiting: prevent asphyxia/aspiration pneumonia. Prevent cooling by covering the victim (no warming up). Keep watching the victim. Give psychological aid. Keep the victim calm, avoid physical strain. Depending on the victim's condition: doctor/hospital.

After inhalation - Remove the victim into fresh air. Respiratory problems: consult a doctor/medical service.

After skin contact - Rinse with water. Soap may be used. Do not apply (chemical) neutralizing agents. Take victim to a doctor if irritation persists.

After eye contact - Rinse immediately with plenty of water for at least 15 minutes. Do not apply neutralizing agents. Take victim to an ophthalmologist if irritation persists.

After ingestion - Rinse mouth with water. Immediately after ingestion: give lots of water to drink. Do not induce vomiting. Consult a doctor/medical service if victim is unwell.

4.2 MOST IMPORTANT SYMPTOMS AND EFFECTS, BOTH ACUTE AND DELAYED

4.2.1 Acute Symptoms

If inhaled - Dry/sore throat. Coughing. Slight irritation. Exposure to high concentrations: Irritation of the respiratory tract. Irritation of the nasal mucous membranes. Respiratory difficulties.

In case of skin contact - Not irritating

In case of eye contact - Inflammation/damage of the eye tissue. Corrosion of the eye tissue. Lacrimation.
If swallowed – After absorption of high quantities: Nausea. Vomiting. Abdominal pain. Irritation of the gastric/intestinal mucosa.

4.2.2 Delayed Symptoms

No effects known.

4.3 INDICATION OF ANY IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED

No data available.

5 FIRE-FIGHTING MEASURES

5.1 EXTINGUISHING MEDIA

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 SPECIAL HAZARDS ARISING FROM THE SUBSTANCE OR MIXTURE

Upon combustion CO and CO2 are formed. Reacts on exposure to water with some metals. CO2 generation occurs when mixed with acidic materials.

5.3 ADVICE FOR FIREFIGHTERS

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 SPECIAL PROTECTIVE EQUIPMENT FOR FIREFIGHTERS

Gloves. Safety glasses. Protective clothing. Dust cloud protection and heat/fire exposure: Compressed air respirator.

6 ACCIDENTAL RELEASE MEASURES

6.1 PERSONAL PRECAUTIONS, PROTECTIVE EQUIPMENT AND EMERGENCY PROCEDURES

Use personal protective equipment. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 ENVIRONMENTAL PRECAUTIONS

Contain released substance, pump into suitable containers. Plug the leak, cut off the supply. Knock down/dilute dust cloud with water spray. Violent exothermic reaction with some acids; release of harmful gases/vapors (carbon dioxide). Carbon dioxide is heavier than air and will collect in ducts, drains and low-lying areas. Prevent spreading in sewers.

6.3 METHODS AND MATERIAL FOR CONTAINMENT AND CLEANING UP

Prevent dust cloud formation. Scoop solid spill material into closed containers. Carefully collect the spill. Clean contaminated surfaces with an excess of water. Wash clothing and equipment after handling.

6.4 REFERENCE TO OTHER SECTIONS

For disposal see section 13.

7 HANDLING AND STORAGE

7.1 PRECAUTIONS FOR SAFE HANDLING

Avoid contact with skin and eyes. Use air conveying/mechanical systems for bulk transfer to storage. Provide appropriate exhaust ventilation at places where dust is formed. In case of insufficient ventilation, wear suitable respiratory equipment if release of airborne dust is expected.

7.2 CONDITIONS FOR SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES

Store in original container. Keep in properly labeled containers. Keep container tightly closed.

7.3. SUITABLE PACKAGING MATERIAL

No data available.

7.4 INCOMPATIBLE PRODUCTS

Aluminum, powdered aluminum, and acids.

8 EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 COMPONENTS WITH WORKPLACE CONTROL PARAMETERS

Contains no substances with occupational exposure limit values.

8.2 EXPOSURE CONTROLS

Appropriate engineering controls – Avoid formation of dust. Keep away from ignition sources. Keep container tightly closed. Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

8.3 PERSONAL PROTECTIVE EQUIPMENT

Eye / Face Protection - Safety glasses with side shields or protective goggles. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin Protection - Handle with gloves, butyl rubber or PVC, which have good resistance. Gloves must be inspected prior to use. Use proper glove removal technique to avoid skin contact with product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection – Protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory Protection – For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator. For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

8.4 CONTROL OF ENVIRONMENTAL EXPOSURE

Prevent leakage or spillage if safe to do so. Do not let product enter drains. See section 6.2, 6.3, and 13.

9 PHYSICAL AND CHEMICAL PROPERTIES

9.1 INFORMATION ON BASIC PHYSICAL AND CHEMICAL PROPERTIES

Appearance Form:	Crystalline Solid / Crystalline Powder / Grains / Lumps
Color:	Colorless
Odor:	Odorless
Odor Threshold:	No data available
Particle Size:	694 µm
pH:	11.6; 5.0%
Melting Point / Freezing Point:	851°C / 1,564°F
Boiling Point:	1,600°C / 2,912°F
Flash Point:	No data available
Explosion Limits:	No data available
Evaporation Rate:	No data available
Flammability:	Non-Combustible
Log Kow:	-6.19 Estimated Value
Viscosity:	No data available
Vapor Pressure:	No data available
Vapor Density:	No data available
Solubility Water:	212.5 g/l; 20°C / 68°F
Relative Density:	2.52 – 2.53; 20°C / 68°F
Absolute Density:	2,530 kg/m^3
Decomposition Temperature:	>1600°C / >2912°F
Auto-Ignition Temperature:	>400°C / >752°F
Explosive Properties:	No data available
Oxidizing Properties:	No data available

9.2 PHYSICAL HAZARDS
No data available.

10 STABILITY AND REACTIVITY

10.1 REACTIVITY
None under normal use conditions.

10.2 CHEMICAL STABILITY
Stable. Decomposes by reaction with strong acid.

10.3 POSSIBILITY OF HAZARDOUS REACTIONS
None under normal processing.

10.4 CONDITIONS TO AVOID
Exposure to air or moisture over prolonged periods.

10.5 INCOMPATIBLE MATERIALS
Aluminum, powdered aluminum, and acids.

10.6 HAZARDOUS POLYMERIZATION
Hazardous polymerization does not occur.

11 TOXICOLOGICAL INFORMATION

11.1 INFORMATION ON TOXICOLOGICAL EFFECTS

11.1.1 Acute toxicity
LD50 Oral - rat – 2,800 mg/kg
LD50 Dermal - rabbit >2,000 mg/kg
LD50 Inhalation - rat – 2.30 mg/l, 2-hour exposure time

11.1.2 Corrosion/irritation
Skin - rabbit
Result: Mild skin irritation – 24 hours

11.1.3 Serious eye damage/eye irritation
Eyes - rabbit
Result: Severe eye irritation – 24 hours

11.1.4 Respiratory or skin sensitization
Inhalation - no data available
Skin Sensitization: no data available

11.1.5 Germ cell mutagenicity
No data available

11.1.6 Carcinogenicity
No data available

11.1.7 Reproductive toxicity
No data available

11.1.8 Specific target organ toxicity - single exposure
No data available

11.1.9 Specific target organ toxicity - repeated exposure
No data available

11.1.10 Chronic effects from short and long-term exposure
On continuous / repeated exposure / contact: Red skin. Dry skin. Tingling / irritation of the skin. Affection of the nasal septum.

12 ECOLOGOCAL INFORMATION

12.1 TOXICITY

	Parameter	Method	Value	Duration	Species	Test Design	Fresh/Salt Water	Value Determination
Acute toxicity fishes	LC50 Other	Other	300 mg/l	96 h	Lepomis macronhirus	Static system	Fresh water	Experimental value
Acute toxicity invertebrates	EC50	Other	200-227 mg/l	48 h	Ceriodaphnia sp.	Semi-static	Fresh water	Experimental value
Toxicity algae and other aquatic plants	EC50		242 mg/l	5 days	Algae			Experimental value

12.2 PERSISTENCE AND DEGRADABILITY:
Biodegradability: not applicable

12.3 BIOACCUMULATIVE POTENTIAL:
Low potential for bioaccumulation (Log Kow <4)

12.4 MOBILITY IN SOIL:
Low potential for absorption in soil.

12.5 RESULTS OF PBT AND VPVB ASSESSMENT:
PBT/vPvB assessment not available as chemical safety assessment is not required/not conducted.

12.6 OTHER ADVERSE EFFECTS:
No data available.

13 DISPOSAL CONSIDERATIONS

13.1 WASTE DISPOSAL
Remove waste in accordance with local and/or national regulations. Contact a licensed professional waste disposal service to dispose of this material. Different types of hazardous waste should not be mixed together if it will entail a risk of pollution or create problems for the further management of the waste. Hazardous waste shall be managed responsibly. Do not discharge into drains.

14 TRANSPORT INFORMATION

14.1 UNITED STATES DEPARTMENT OF TRANSPORTATION (DOT)
Non-regulated

14.2 INTERNATIONAL MARITIME DANGEROUS GOODS (IMDG)
Non-regulated

14.3 INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA)
Non-regulated

14.4 TDG/ADN/RID/ADR
Non-regulated

15 REGULATORY INFORMATION

15.1 SARA 302 COMPONENTS
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

15.2 SARA 313 COMPONENTS
SARA 313: This material does not contain any chemical with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

15.3 SARA 311/312 HAZARDS
Acute Health Hazard

15.4 PENNSYLVANIA RIGHT TO KNOW COMPONENTS
Sodium carbonate, CAS-No: 497-19-8

15.5 NEW JERSEY RIGHT TO KNOW COMPONENTS
Sodium carbonate, CAS-No: 497-19-8

15.6 WHMIS CLASSIFICATION: C, D2
Note: The product listed on this SDS has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations.

15.7 US CALIFORNIA SAFE DRINKING WATER & TOXIC ENFORCEMENT ACT (PROPOSITION 65)
This product does not contain any chemicals known to the State of California to cause cancer, birth, or any other reproductive defects.

16 OTHER INFORMATION

16.1 FULL TEXT OF H-STATEMENTS REFERRED TO UNDER SECTION 2 AND 3.

Eye Irrit.	Eye Irritation
H319	Causes serious eye irritation

16.2 HMIS RATING

Health Hazard:	2
Flammability:	0
Physical Hazard:	0

16.3 NFPA RATING

Health Hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

16.4 NOTICE

The above information is believed to be correct but is not intended to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Ciner and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product.

16.5 PRODUCT CERTIFICATIONS

This product is certified to NSF/ANSI Standard 60 for use in drinking water treatment at the specified maximum use limit. The MUL (maximum use level) for sodium carbonate anhydrous is 100 mg/L under NSF/ANSI Standard 60.

OU Kosher Certification

CERTIFIED HALAL حلال ISLAMIC FOOD AND NUTRITION COUNCIL OF AMERICA

NSF Certified to NSF/ANSI 60

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POTENTIAL ADDITIVIVE

CITRIC ACID

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Univar USA Inc Safety Data Sheet

SDS No:	
Version No:	003 2015-06-02
Order No:	

3075 Highland Pkwy, Ste 200, Downers Grove, IL 60515
(425) 889 3400

Emergency Assistance

For emergency assistance involving chemicals call
Chemtrec - (800) 424-9300

Safety Data Sheet

CITRIC ACID FCC/USP PWD

SECTION 1:IDENTIFICATION OF THE SUBSTANCE/ MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1 PRODUCT IDENTIFIER

- Chemical name	Citric acid - Food grade
- REACH Registration Number	01-2119457026-42-0031

1.2 RELEVANT IDENTIFIED USES OF THE SUBSTANCE AND USES ADVISED AGAINST

Citric acid can be used in food as food additives and also in technical application as clarifying agent, water softener, buffer, foam booster and stabilizer, complexing agent and as an intermediate in production of organic chemicals.

1.3 DETAILS OF THE SUPPLIER

- Company identification

US:
Tate & Lyle Ingredients Americas, LLC.
2200 E.Eldorado Street
Decatur, IL 62521

Europe:
Tate & Lyle Slovakia s.r.o.
Boleraz 114
919 08 boleraz
Slovakia

1.4 EMERGENCY PHONE NR.

CHEMTREC
Toll-Free: 1-800-424-9300 (USA and Canada)
Non Toll-Free +1-703-527-3887 (Global)

SECTION 2:HAZARDS IDENTIFICATION

2.1. CLASSIFICATION OF THE SUBSTANCE OR MIXTURE

According with the version of the Globally Harmonized system of Classification and labeling adopted in the United states and Regulation 1272/2008/EC [CLP]: Eyes irritant category 2(H319)

Safety Data Sheet

CITRIC ACID FCC/USP PWD

2.2 LABEL ELEMENTS

GHS07

Signal word:
Warning

Hazard Statement:
Causes serious eye irritation. H319

Precautionary Statement:
Wash hands thoroughly after handling. P264
Wear eye protection. P280

Precautionary Statement. IF IN EYES: P305
Response :
Rinse cautiously with water for several minutes. P351
Remove contact lenses, if present and easy to do Continue rinsing. P338
If eye irritation persists: P337
Get medical advice/attention. P313

2.3. OTHER HAZARDS
FIRE AND EXPLOSION HAZARD:
May form combustible dust concentrations in air. Possibility of dust explosion. it is recommended that all dust control equipment and material transport systems involved are engineered to prevent conditions contributing to dust explosions. Do not allow dust to accumulate on flat surfaces, on rafters or building structural components. Keep away from all ignition sources including heat, sparks and flame.

SECTION 3:COMPOSITION/INFORMATION OF INGREDIENTS

- Chemical name Citric acid - Food grade

Safety Data Sheet

CITRIC ACID FCC/USP PWD

- CAS number	77-92-9
- EINECS number	201-069-1
- Synonyms	2 - Hydroxy -1,2,3 propanetricarboxylic acid Acidulant - Citric acid - food additive E330.

SECTION 4:FIRST AID MEASURES

4.1 DESCRIPTION OF FIRST AID MEASURES

- General advise	Seek medical attention if irritation develops after first aid application
- Inhalation	Move people from the exposure to fresh air.
- Skin contact	Wash skin with soap and water.
- Eye contact	Remove particulates by irrigating with eye wash solution or clean water, holding eyelids apart.
- Ingestion	Wash mouth and flush throat upto the stomach.

4.2 MOST IMPORTANT SYMPTOMS AND EFFECTS, BOTH ACUTE AND DELAYED
ROUTE(S) OF ENTRY: Skin Contact; Eye Contact
HUMAN EFFECTS AND SYMPTOMS OF OVEREXPOSURE:
ACUTE SKIN CONTACT: This product is irritating to the skin resulting in reddening, stinging, and swelling.
ACUTE EYE CONTACT: This product is irritating to the eyes resulting in stinging, reddening, tearing, and swelling.
CHRONIC EFFECTS OF EXPOSURE: No applicable information was found concerning any adverse chronic health effects from overexposure to this product.
CARCINOGENICITY: The components of this product are not listed by NTP, IARC or regulated as a carcinogen by OSHA.
MEDICAL CONDITIONS
AGGRAVATED BY EXPOSURE: Persons with pre-existing eye or skin disorders may be more susceptible to the effects of this product.

4.3 INDICATION OF ANY IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED.
None Anticipated

SECTION 5: FIRE-FIGHTING MEASURES

5.1 EXTINGUISHING MEDIA
Water spray, dry powder, carbon dioxide or media appropriate for surrounding fire. Use of water jet may cause explosive dust conditions.

Safety Data Sheet

CITRIC ACID FCC/USP PWD

5.2 SPECIFIC HAZARDS
FIRE AND EXPLOSION HAZARD: Possibility of dust explosion. It is recommended that all dust control equipment and material transport systems involved are engineered to prevent conditions contributing to dust explosions. Do not allow dust to accumulate on flat surfaces, on rafters or building structural components. Use of water jet may cause explosive dust conditions.
SEE NFPA 61, Standard for the prevention of Fire and Dust Explosions in Agricultural and Food Processing Facilities, 2008 or later Edition, and other related standards.

5.3 SPECIFIC PROTECTIVE EQUIPMENT AND PRECAUTIONS FOR FIRE-FIGHTERS
Wear self-contained breathing apparatus and full protective gear. Use water spray to cool fire exposed containers.

FLAMMABILITY CLASS (OSHA)
Not applicable

HAZARDOUS COMBUSTION PRODUCTS
Carbon dioxide and carbon monoxide

SECTION 6:ACCIDENTAL RELEASE MEASURES

6.1 PERSONAL PRECAUTIONS
Use personal protective equipment. Wear eye protection. Avoid contact with skin and eyes.

6.2 ENVIRONMENTAL PRECAUTIONS
Prevent further leakage or spillage if safe to do so. No special environmental precautions required

6.3 METHODS FOR CLEANING UP
Vacuum or sweep spills. Minimize dust generation.
If washing down spilled area is necessary, use copious amounts of water and control runoff.
Follow local, state and federal regulations for product disposal

6.4 REFERENCE TO OTHER SECTIONS
See Section 7 for information on safe handling
See Section 8 for information on personal protection equipment
See Section 13 for disposal information

SECTION 7: HANDLING AND STORAGE

Safety Data Sheet

CITRIC ACID FCC/USP PWD

7.1 PRECAUTIONS FOR SAFE HANDLING
See NFPA 61, Standard for the Prevention of Fire and Dust Explosions in Agricultural and Food Processing Facilities, 2008 Edition, and other related standards. Use with adequate ventilation. Minimize dust generation and accumulation; dust deposits should not be allowed to accumulate on surfaces, as these may form an explosive mixture if they are disturbed.

All dust control equipment and material transport systems involved are engineered to prevent conditions contributing to dust explosions and may require explosion relief vents or an explosion suppression system or an oxygen-deficient environment. Bonding and grounding systems may be required.

Dust-handling systems (such as exhaust ducts, dust collectors, vessels, and processing equipment) should be designed to limit or prevent leakage of dust into the work area.

Do not allow dust to accumulate on flat surfaces, on rafters or building structural components. Routine housekeeping should be instituted to reduce dust accumulation. Use Avoid dispersal of dust in the air; use vacuum or wet sweeping methods. Do not use compressed air to clean surfaces.

Keep away from all ignition sources including heat, sparks, and flame. Where dust accumulations occur use non-sparking tools.

7.2 CONDITIONS OF SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES
Store in a cool dry place. Store in a tightly closed container/bag.
The packaging material should have reasonable moisture and air barriers and comply with food regulations.
7.3 SPECIFIC END USE(S)
See overview of the exposure scenario and summary of risk management measures in Appendix 1

SECTION 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 CONTROL PARAMETERS
Exposure limits: Nuisance dust (also called particulate not otherwise regulated (PNOR)).
OSHA PEL: 15 mg/ mg/m3 Total dust
5 mg/m3 Respirable dust
ACGIH TLV: 10 mg/m3 Inhalable dust
5 mg/m3 Respirable dust
15 mg/m3 Total dust

Safety Data Sheet

CITRIC ACID FCC/USP PWD

8.2 EXPOSURE CONTROLS
APPROPRIATE ENGINEERING CONTROLS:
Ventilation: See NFPA 61, Standard for the Prevention of Fire and Dust Explosions in Agricultural and Food Processing Facilities, 2008 Edition, and National Fire Protection Association 650, Standard for Pneumatic Conveying Systems for Handling Combustible Materials, 1997 Edition and other related standards. Normal industrial hygiene measures should be sufficient for protection of employees from exposure to dusts. Local and mechanical exhaust is desirable when dumping bags.

APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT:
Eye protection: Safety glasses are recommended. Safety goggles are desirable when dumping bags.
Emergency wash facilities: Eye wash is recommended for conditions where dust generation is likely.
Special protective clothing: Not normally required.
Gloves: Not normally required. Use ordinary work gloves if dust dries skin.
Respirator: NIOSH approved N-95 dust respirator if working in situations that could generate large amounts of airborne dust.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:
See section 5.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1 INFORMATION ON BASIC PHYSICAL AND CHEMICAL PROPERTIES

- Physical form	Solid
- Color	White to off-white
- Odor	Essentially odorless to very slight sugar odor
- pH (concentration)	NA
- Boiling point	104°C (219 °F)
- Flash point	345°C
- Melting/freezing point	approx. 153°C at 1,013 hPa
- Decomposition temperature	NA
- Auto-ignition temperature	NA
- Explosion properties	NA
- Oxidising properties	NA
- Vapour pressure	2.21*10-6 Pa at 25°C
- Vapor density	0.62 (Air = 1)
- Relative density	1.665at 20°C

Safety Data Sheet

CITRIC ACID FCC/USP PWD

- Bulk density	Not Established
- Specific gravity	15 °C (1.24 at 59 °F)
- Viscosity	Not Established
- Water solubility	590 g/L at 20°C
- Solubility (non aqueous)	Methyl alcohol: completely miscible
- Partition coefficient	In OCTANOL/ WATER (log value): Log Kow: -0.2 to -1.8
- Dissociation constant	pKa: 3.13, 4.76 and 6.4 at 25°
- Evaporation rate	Less than 1 (Butyl acetate =1)

9.2 OTHER INFORMATION

SECTION 10: STABILITY AND REACTIVITY

10.1 REACTIVITY
Stable

10.2 CHEMICAL STABILITY
Stable under normal conditions.
Polymerization will not occur.

10.3 POSSIBILITY OF HAZARDOUS REACTIONS
Not applicable

10.4 CONDITIONS TO AVOID
Practices which produce dust or disperse finely divided dust in air.
See NFPA 61. Standard for the Prevention of Fire and Dust Explosions in Agricultural and Food Processing Facilities, 2008 Edition, and other related standards.

10.5 INCOMPATIBLE MATERIALS
Oxidizing agents, strong acids

10.6 Hazardous decomposition products:
Nothing unusual

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 INFORMATION ON TOXICOLOGICAL EFFECTS

- Inhalation	ORAL: LD50: 5400 – 5790 mg/kg bw (mouse) / LD50: 11700 mg/kg bw (rat) DERMAL: LD50 >2000 mg/kg bw rat
- Ingestion	No effects known or anticipated.

Safety Data Sheet

CITRIC ACID FCC/USP PWD

- Skin irritation / corrosion	Sustained exposure in a dusty manufacturing environment may result in mechanical irritation in the creases of the skin, particularly at the fingers, or other drying effects. no health effects known or anticipated.
- Eye irritation	Irritating to eyes.
- Skin sensitisation	Not sensitizing
- Chronic toxicity	Not known or anticipated
- Genetic toxicity	Not known or anticipated
- Carcinogenicity	Not classifiable as Carcinogen.
- Reprotoxicity	Not known or anticipated
- Specific effects	Not applicable

SECTION 12: ECOLOGICAL INFORMATION

12.1 TOXICITY
LC50 for freshwater fish: 440 mg/l
EC50/LC50 for freshwater invertebrates: 1535 mg/l.

12.2 PERSISTENCE/DEGRADABILITY
Ready biodegradable

12.3 BIOACCUMULATIVE POTENTIAL
Log Kow <3, not bioaccumulative

12.4 MOBILITY IN SOIL
Not applicable

12.5 BPT, vPvB
The substance does not meet the criteria for PBT or vPvB.

12.6 OTHER ADVERSE EFFECTS
None known

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 WASTE TREATMENT METHODS
Follow local, state and federal regulations for product disposal. Not a hazardous waste unless contaminated with hazardous products.

SECTION 14: TRANSPORTATION INFORMATION

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International regulations (RID/ADR; RTMDR; IMDG; IATA/OACI): Not classified as dangerous for transport.
DOT shipping label: Non-hazardous

SECTION 15: REGULATORY INFORMATION

15.1 SAFETY, HEALTH AND ENVIRONMENTAL REGULATIONS
According with the version of the Globally Harmonized System of Classification and labeling adopted in the United States and Regulation 1272/2008/EC(CLP): Classified

15.2 CHEMICAL SAFETY ASSESSMENT
US FEDERAL REGULATIONS:
Clean Air Act:
ODS: Not applicable.
SARA (EPCRA) Section 313 (40 C.F.R. § 372.65): Not applicable.
TSCA Status: On TSCA inventory.

STATE REPORTING REQUIREMENTS:
California Proposition 65: Not applicable.

SECTION 16: OTHER INFORMATION

See Hazard Communication Guidance for Combustible Dusts, OSHA 3371-08 2009, U.S. Occupational Safety and Health Administration, https://www.osha.gov/Publications/3371combustible-dust.html (accessed 10/8/14)
And
NFPA 654, Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids, for general safe handling and design guidance.

Other classifications of the substance:
TSCA STATUS: On TSCA Inventory.
FDA STATUS: Citrus acid, Anhydrous complies with FDA Regulation 21 C.F.R. § 184.1033;
CALIFORNIA PROPOSITION 65: Not applicable.
HMIS rating:
Health: 1
Flammable: 0

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Reactivity: 0
(0 = minimal ; 1 = slight ; 2 = moderate ; 3 = serious ; 4 = severe)

Safety Data Sheet according to Commission Regulation (EU) No 453/2010 of 20 May 2010 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)

DISCLAIMER OF LIABILITY

The information in this SDS is collected from reliable sources. However, the information is provided without any warranty, expressed or implied. The conditions or methods of handling, storage, use or disposal of the product might be beyond our control and knowledge. For the avoidance of doubt, we shall in no such circumstances be under any liability in respect of loss, damage or expenses arising from handling, storage, use or disposal of the product by your company and/or your subcontractors. This SDS is only applicable for the product mentioned in the identification chapter and title. If the product is used as a component in another product, this SDS may not be applicable on the composite material.

Annex I

SUMMARY OF RISK MANAGEMENT MEASURES
Safe use has been demonstrated by calculation of risk characterisation ratios where appropriate, while qualitative considerations were stipulated where quantification was not possible. The risk characterisation is based on the following risk management measures:
Exposure scenario ,,Description ,,General measures ,,Specific Human Health risk management measures ,,Specific Environment risk management measures ,,
ES1 ,,Production and intermediate use on production sites ,,Good working practices, containment and safe handling in line with industry best practice. ,,(i) Local Exhaust ventilation (LEV)
(ii) Personal Protective Equipment (PPE): Working clothing, protective gloves and safety glasses. Dust masks in areas where dust may be present. In case of open handling of larger quantities or accidental release, a particle mask or respirator with independent air supply is recommended. ,,(i) Treatment of effluent in waste water treatment plant. ,,
ES2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17 ,,Industrial use ,,
Good working practices, containment and safe handling in line with industry best practice. ,,(i) Local Exhaust ventilation (LEV) if
aerosol mists or dusts are present.
(ii) Personal Protective Equipment (PPE): Working clothing, protective gloves and safety glasses. Dust masks in areas where dust may be present. In case of open handling of larger quantities or accidental release, a particle mask or respirator with independent air supply is

Safety Data Sheet

CITRIC ACID FCC/USP PWD

recommended. ,,(i) Treatment of effluent in waste water treatment plant. ,,
ES10 ,,Textile industry ,,Good working practices, containment and safe handling in line with industry best practice. ,,(i) Local Exhaust ventilation (LEV) if aerosol mists or dusts are present.
(ii) Personal Protective Equipment (PPE): Working clothing, ,,(i) Treatment of effluent in waste water treatment plant.
(ii) No direct discharge into the marine environment ,,

Univar USA Inc Safety Data Sheet

For Additional Information contact SDS Coordinator during business hours, Pacific time: (425) 889-3400

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ATTACHMENT

DOWNHOLE TOOLS/REAMERS

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Reaming Tools/Equipment

The reamers utilized for hole-opening operations are custom fabricated by Michels Corporation, however equivalent or better tools may be substituted depending on availability of other suppliers' products, or, if changes in anticipated drilling conditions are encountered. Michels R&D program for downhole tools includes monitoring of performance & longevity of reaming equipment in differing soil conditions throughout North America as well as foreign destinations. Utilizing the latest technology, tooling and materials available to the industry is a continuing goal of Michels.

There is essentially no limit to the length of time these tools can be run since simple repairs can be made in the field to keep the reamers in good working condition. The condition of the reamers will depend on the type of ground encountered; typically these reamers are discarded when they are observed to be beyond field repair. Initial maximum run time for specific reamers recommended by Michels is 50-100 hours.

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DRILL FLUID RECYCLING
MUD CLEANING EQUIPMENT

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Drill Mud Cleaning and Disposal

The first phase of the mud cleaning system is displacement of solid returns at the shakers. Heavy solids are sifted out by a shaker with screens and deposited into a pit. From here they will be transported by dump truck to a site for disposal.

Drill Mud Cleaning Equipment Specifications

Volume of Mixing/Scalper Tank	54.0-Bbls
Volume of Desander Tank	72.0-Bbls
Volume of Desilter Tank	72.0-Bbls
Quantity of Scalping Shakers	1.0-Shakers
Mesh Size of Scalping Shakers	10-20 Double Stacked
Desander Capability	2 @ 500-GPM (1,000 GPM Total)
Desander Cones	2.0-Cones
Desander Mesh Size	40 to 165
Quantity of Desilter Cones	10 Ea @ 100-GPM
Desilter Mesh Size	60 to 250
Steel Mud Circulating Tank Volume	160-Bbls
Returns Tank Volume (Mud Pit)	320-Bbls
Cuttings Tank Volume (20-yd Roll-off)	150-Bbls
Mud Screening, Max Pass Size	40 Mesh

Due to the quantity and types of mud pumps owned by Michels and located on multiple drill sites Michels utilizes one of the following pumps based on availability and geographic location:

Bentonite Pump Capabilities (ENTRY/EXIT)

Name Brand	Gardner Denver OPI-350
Liner Size	6-Inches
Maximum Pressure	1,469 PSI
Maximum Flow Rate	529 GPM
Gallons Per Stroke	2.94 Gallons Per Stroke

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Bentonite Pump Capabilities (ENTRY/EXIT SIDE)

Name Brand..... Ellis Williams W-446 Super Force Triplex Piston Model

Liner Size..... 6-Inches

Maximum Pressure..... 1,027 PSI

Maximum Flow Rate..... 661 GPM

Gallons Per Stroke..... 2.20 Gallons Per Stroke

Bentonite Pump Capabilities (ENTRY/EXIT SIDE)

Name Brand..... Gardner Denver OPI-700

Liner Size..... 7-Inches

Maximum Pressure..... 1,690 PSI

Maximum Flow Rate..... 599 GPM

Gallons Per Stroke..... 3.99 Gallons Per Stroke

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MICHELS ROLLERS

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Michels Directional Crossings Pipeline Rollers

General Description: Steel tubing welded frame supporting two urethane coated rollers. Pillow block bearings are used to mount the rollers. The rollers are opposed to each other and set @ 125° to accommodate various pipe sizes.

Size: Footprint of 50”x48” with overall height of 40”

Load Capacity: 167,000 Lbs per assembly

Shafts: Material is steel 4140, 2-15/16 Diameter.

Frame: Frame weldment made of steel ASTM A-500 Grade square tubing

Rollers: 11” O.D., 20” face width, 8-5/8” core size. Coating is urethane approximately 1” thick (95 Shore-A)

Bearings: 4-required per assembly, 2 on each coated roller. Manufacturer is Linkbelt, Part Number PB22447E w/ 2-15/16” spherical roller, self aligning, contact seal.

Load Capacity for Bearings;

Basic = 41,800 Lbs
Static = 71,500 Lbs,
L-10 Life = 9,410 Hours @ 300 RPM

ATTACHMENT

MICHELS CONTINGENCY PLANS

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DIRECTIONAL DRILL CONTINGENCY PLANS

WBI

Lake Sakakawea Crossing

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Horizontal Directional Drilling

CONTINGENCY PLANS

Michels believes contingency planning begins with the appointment of competent field personnel having the greatest amount of experience to complete a project. Michels' personnel are some of the most qualified drilling experts in the industry, as demonstrated by resumes and experience lists highlighting past projects completed. With the abundant resources at their disposal, Michels has overcome risks associated with some of the most difficult drilling projects ever attempted and has evolved into an industry leader. Michels Project Managers are some of the best in the industry utilizing the many resources available while coordinating the various facets of a productive drill site.

Michels' Drill Superintendents are highly experienced at utilizing drill rigs and ancillary equipment of every size. They have worked up though the ranks providing them a complete and comprehensive understanding of safety, environmental monitoring, manpower, equipment operations and repairs for each phase of the drilling operation. As noted on the attached resumes, each Superintendent has drilled throughout North America and has encountered varying soil conditions, from sands, gravels, clay and cobble to solid rock formation. They are well respected throughout the industry and have worked with a majority of the major Pipeline Construction Companies in North America. Michels' personnel maintain continuous certification through accredited schooling for all phases of the drilling operation.

Contingency planning is conducted in response to unforeseen events and conditions, which could occur during normal operating sequences. The following contingency plans are in place to ensure completion of the project in accordance with governing authorities. The Field Operations Superintendent oversees preventative measures before product line installation. This alleviates the probability for adverse conditions such as stuck pipe. The following are some of the more common variables, which we have developed contingency plans for. They include but are not limited to:

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Possible Condition: *Inadvertent Drill Fluid Release Response and Control*

Contingency:

A large reduction or sudden loss in drill fluid returns is a signal to the driller and monitoring personnel that monitoring for inadvertent returns should be intensified for possible surface release. Therefore, the proposed drill R.O.W. will be inspected for inadvertent returns at a minimum of twice per shift and becoming more frequent if there is a large reduction or sudden loss. The frequency and results of R.O.W. inspections will be documented and recorded on the daily reports. Early detection and quick response is the key to controlling and/or limiting surface release. Additional information regarding access to USACE-Owned Land is addressed later in this document.

The absence of an open bore-hole conduit or the presence of a major formation fracture can lead to partial and/or potentially total loss of drilling fluid circulation. While it is impossible to determine the precise nature of this type of fluid loss, it is possible to accurately monitor for it by watching for a significant difference between the rate fluid is being pumped down-hole and the rate it returns to the surface. The drilling fluid pumping rate and the rate of drilling fluid return to the surface is constantly monitored by the mud technician and relayed to the driller while the HDD operation is progressing. The driller will know immediately if an unusually high volume of drilling fluid is being lost down-hole, depending on the ground conditions encountered in the crossing and taking into account the volume used to fill the bore-hole. Should the driller believe that circulation is being completely lost he will implement the following procedures:

1) Temporarily cease drilling operations, including pump shut down;
2) Dispatch experienced observers as required to monitor the area in the vicinity of the crossing, for inadvertent returns of drilling fluid at the surface or in the river;
3) Identify the position of the drill head in relation to the point of entry
4) Re-start the pump and stroke the bore-hole up and down in stroke lengths up to 30 feet up to 6 times but no fewer than 2 in an effort to size the bore-hole annulus and re-open the circulation pathway.

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In addition, the thixotropic properties of the drilling fluid may be thickened within the guidelines set forth by the manufacturer to aid in re-establishing circulation as required depending on bore-hole conditions. Observers will regularly monitor for inadvertent fluid returns as long as the pump remains on. Occasionally, based on the driller's discretion, it may be useful to increase the stroke length up to 90 feet or past the point at which he believes circulation was lost.

If circulation is re-established, drilling will proceed as usual and monitoring for inadvertent fluid will take place once again if the rate of drilling returns progressively decreases at the fluid entry pit. If circulation is not re-established, monitoring for inadvertent fluid returns to the ground surface and river will continue and drilling will proceed.

If the amount of inadvertent returns is not great enough to allow practical collection, the affected area will be diluted with fresh water and allowed to dry and dissipate naturally back into the earth. If the amount of returns exceeds that which can be suitably contained with hand placed containment barriers, small collection sumps (less than 3.8 cubic meters) will be used to pump fluid back to the solids control system.

When drilling fluid returns are observed to be continuously surfacing above ground at an accessible location the following procedure will be followed:

1) Immediately cease pumping of drilling fluid;
2) Contain the location such that the drilling fluid cannot migrate across the ground surface;

On-Site Materials and equipment used for containment:

- Straw Bales, if available;
- Silt Fence;
- Check Dams;
- Backhoe for Accessible Areas;
- Shovels;

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- Portable Pumps;
- 100 feet of Hose.

3) Excavate a small sump pit at the location and provide a means for the fluid to be returned to either the drilling operations or a disposal site (i.e. pump through hose or into tanker);
4) Notify on-site contractor supervisor and Owner's representative as required by the communication plan;
5) Continue drilling operations, maintain the integrity of the containment measures, and monitor the fluid returns as required to ensure that no surface migration occurs;
6) Clean-up is carried out once inadvertent returns are contained/controlled;
7) Fluid pumped to a secure containment vessel;
8) Area is diluted with water;
9) Area is restored to original condition.

If inadvertent drilling fluid returns are observed to be surfacing above-ground at a location that is inaccessible, i.e. along the bed of a water body, or, into the water, the following procedures will be followed:

Ensure that all reasonable measures within the limitations of the technology have been taken to re-establish circulation;

Continue drilling with the minimum amount of drilling fluid required to penetrate the formation and successfully install the product line.

Typically lost circulation has the highest probability of occurring while the pilot hole is being drilled due to the smaller bore-hole annulus and the relatively large volume of solids being displaced and carried out in the drilling fluid. In the course of drilling the pilot hole, circulation will often be temporarily lost as the pilot bit is advanced through more permeable or less

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competent sections of the ground formation when fluid pressures are at a maximum. As the pilot bit advances beyond these sections of the bore-hole fluid pressure will fall and circulation within the bore-hole will naturally be re-established. Much of the fluid lost to the formation under the greater pressures will return back to the bore-hole as the pressures fall, in which case the drilling fluid is not likely to migrate to the surface or the river. It is also possible for the drilling fluid to leave the bore-hole and migrate in a direction other than the ground surface or the wetland, in which case it may never be observed even if circulation is lost for long periods of time.

It should be noted that frequently drill cuttings generated as a result of the drilling process will naturally bridge and subsequently seal fractures or voids as drilling progresses, thus providing another means of re-establishing circulation. This is especially likely during the reaming process as higher volumes of larger cuttings are typically generated. Therefore it is usually beneficial to proceed with the pilot hole even if circulation has not been re-established since it will likely be re-established at some point during the reaming process.

The use of an environmentally safe drilling fluid ensures that even in the unlikely event of fluid loss at sensitive areas, there will be no adverse environmental impact other than a temporary minor increase in turbidity until the drilling fluid dissipates. It is important to note that any temporary increase in turbidity as a result of inadvertent drilling fluid loss while directional drilling the crossing will be several orders of magnitude less than that of an open-cut crossing.

Contingency Access Plan for USACE-Owned Lands in Event of Unanticipated Return

In event of an unanticipated return of drilling fluid on U.S. Army Corps of Engineer (USACE) owned lands, WBI Energy, Inc. (WBI) and its contractors would mobilize clean-up crews as soon as practicable. Crews would utilize access points and routes identified on Figures 1 and 2 (North Side and South Side of the Lake Sakakawea horizontal directional drill). To the extent practicable WBI Energy will use publically available access roads to reach inadvertent return cleanup areas. WBI and its contractors will notify landowners prior to the commencement of HDD drilling activities and will work expediently to contact landowners in event of an inadvertent return.

If necessary, equipment used to access and clean-up inadvertent returns of drilling fluid on the ground surface of USACE owned property would include rubber tired vehicles, such as pick-ups

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and vacuum trucks (vac-trucks). It is anticipated that for an inadvertent return of drilling fluid to the ground surface, access to USACE owned property would follow the paths illustrated on Figures 1 and 2, the primary route on both sides of the Lake Sakakawea HDD would be along the permanent right-of-way leading from the drill box to the banks above the shoreline. From the permanent right-of-way, a direct perpendicular route would be taken to reach the site of the inadvertent return with the shortest path. To the maximum extent practicable, woody vegetation (trees and shrubs) will not be cleared; access paths would avoid trees and general vegetation disturbance to the maximum extent practicable. Where necessary crews will travel around persistent, live, woody vegetation.

If access is necessary along the beach on either the north side of Lake Sakakawea, as shown in Figure 1, or the south side of Lake Sakakawea, as shown in Figure 2, crews will either access the clean-up location by walking in, or utilizing small, low ground pressure equipment, such as UTVs or ATVs. A secondary option for beach access would be to mobilize a small boat from a public dock to bring personnel and cleanup equipment to the beach. Every effort will be made to access clean-up sites, if necessary, from the higher ground along the permanent right-of-way. After clean-up of drilling fluid is complete, crews will follow the same path out that was taken in to the inadvertent return, to minimize additional disturbance. Calls will be made to the appropriate USACE point of contact as soon as feasible, but not greater than 24 hours from the time crews are mobilized to clean-up the inadvertent return.

Attachment – Figure 1

Attachment – Figure 2

Possible Condition: *EQUIPMENT MALFUNCTION/FAILURE-SPARE PARTS*

Contingency: Based on past experience, Michels can reasonably estimate the average life expectancy of all major components of the drilling operation under normal operating conditions. The operating hours of the equipment are recorded prior to start of drilling operations and maintained throughout completion of the crossing. Documentation and maintenance records are maintained by the drilling superintendent so that replacement of key components can be routinely performed in a timely manner to prevent failure. Occasionally, a component of the drilling operation will fail unexpectedly even with the most stringent maintenance and replacement schedule. These types of failures have occurred in the past and

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Michels has established a spare parts inventory with each drill rig based on the most common failures of this type. Spare parts kept on site include hydraulic pumps, flendor motors, and drive gears. In addition, odd sized or extremely high pressure hydraulic hoses that are not readily available "off the shelf" are kept on site.

Major Spare Parts kept on-site

- 1,800-Mission pump
- 2,500-Halco pump
- Mud Rig – Clutch and Transmission
- 11 – Vise Blocks
- 4 - Vise Hydraulic Rams
- 2 - Rotary Motors
- 2 – Drive Motors
- 1 – Hydraulic Pump
- 2 – Vise Travel Motors
- 1 – Circulation Pump
- 2 – Mud Swivels
- 2 – Complete Rebuilds for OPI-350
- Rebuild Parts for EW-446
- Electric Motor for Halco
- Electric Motor for Cooling Fans
- 2 – Shaker Motors

It is not feasible to maintain a complete spare parts inventory with each drilling rig on site so Michels immediately identifies local sources for commonly available spare parts and equipment upon job start up. Spare parts not readily available locally are kept in one of four Michels' permanent warehouse locations in Bothell, Washington; Adrie, Alberta Canada; Harrisburg, Pennsylvania; or Brownsville, Wisconsin, where the parts can be shipped overnight to the job site to prevent extensive down time caused as a result of equipment failure if necessary.

Possible Condition: *STUCK PIPE*

Contingency: The following are some of the preventative measures invoked by the Drilling Foreman in order to reduce the chances for complications while pulling back product pipe.

1. Utilize drilling equipment capable of supplying enough power to remove seized pipe from either entry or exit location.

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2. Performing an extra reaming pass with the purpose of cleaning out the reamed hole (not a cutting pass) and adding proper lubrication with precise weight bentonite mixture.
3. Reduce torsional and axial loads through the use of properly spaced rollers, well maintained swivels and creating a smooth transition between downhole exit angle and pipe strung out on top of ground readied for pullback.
4. Utilize Ballasting to control the weight of the pipe by achieving negative or neutral buoyancy.

Contingencies for stuck pipe

If above preventative methods fail and the pipe become seized in the borehole we invoke Best Available Control Technology (BACT). One of the methods involves specific techniques in conjunction with ballasting, which is controlled loading with water. Past experience has shown us that if the leading end of the pipe remains too heavy during ballasting, air can be supplied to this area of pipe, displacing water back toward the middle, and in some circumstances freeing up the point of greatest friction.

If the drilling rig is unable to supply the initial thrust to release the seized pipe, side booms and or track-hoes can supply thrusting pressure from the exit side in order to start momentum. Michels drilling rigs have the potential to supply up to 1,200,000 pounds of thrust and pulling-force, add additional equipment and there is not much that cannot be dislodged.

Not only can force be applied from the drill-rig side but additional force can be applied from the pipe installation side for large diameter installations through the use of a Herrenknect pipe thruster for land to land crossings. This alternative source of power supplied from the opposite end can dramatically assist large diameter pipe pullback during significant changes in the effective weight of the pipe during pullback (buoyancy) caused by either losing circulation or re-establishing circulation unexpectedly therefore causing drastic changes in the buoyancy of the pipe. This method also reduces the risk for damage to pipe coating during pullback by reducing the tensile force needed to pull back the pipe. If the large diameter pipe becomes stuck additional control can be established to move pipe back and forth in the event gravel, cobble and/or boulder sized

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materials fall in the hole after swabbing. This can be used as an alternative to the percussion hammer which has been used as a contingency measure on previous past projects.

(See Attachment Herrenknect Pipe Thruster)

If percussion assistance is determined to be necessary to supply the energy required to complete the pullback operation, Michels is capable of performing this operation utilizing a GrundoRam percussion hammer supplied by TT-Technologies. The work area needed for invoking hammer assist procedures is located on the pipe pullback side of the crossing. This will encompass an area of 40-feet long x 20-feet wide for staging of the "Taurus" GrundoRam percussion hammer and assist equipment. This pipe-ramming machine has a thrust of up to 2,000 tones and a ramming speed of 180-strokes/minute. A GrundoRam and 1600 CFM air compressor will be made available by Michels on-site. Additional sources for spare parts and accessories should also be identified.

(See Attachment Grundo-Ram Percussion)

A specially manufactured reinforced push ring is positioned at the back end of the product line so that equal transmission of percussion energy can be transmitted down the product pipe, and to protect the steel pipe end while in contact with the GrundoRam "Taurus". The persistent exertion of energy along the descending steel pipeline aids in aggressively sliding the pipe through suspect areas of unconsolidated formation or through areas of cave-in. Although this is not a regular occurrence due to mitigative measures taken prior to installation, Michels has successfully completed this unique form of pipeline pullback assist periodically over the past 10-years and has built a solid reputation as an innovator in this field.

Possible Condition: *INCLEMENT WEATHER*

Contingency: Key personnel monitor long range forecasts for the project areas to be affected. Various weather services (i.e. NOAA, Weather Channel etc) are monitored by computer for bad weather and potential hurricanes. Regular updates are given to Michels' personnel to make them aware of approaching weather conditions. Evacuation routes will be identified and reviewed with all personnel for potential hurricanes prior to beginning work and responsibilities will

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be assigned. If electrical storms are projected to affect a drill site, approaching storms will be monitored by radar and radio and communication will be maintained between Project Manager and personnel. Electrical storms can potentially cause serious problems for a drilling operation. The Drill Superintendent must use his discretion as to the appropriate safe action to be taken for the safety of the crew and entire drilling operation. Proper grounding must be maintained throughout a drilling operation.

A safe area on the site will also be designated for response to an approaching tornado. Stream gages will also be identified and monitor for potential flooding conditions.

Possible Condition: *NOISE*

Contingency: Noise reduction can be accomplished using several methods. To begin with, a site reconnaissance or noise modeling must be completed by the Owner to determine what decibel (dB) level will be allowable at the affected locations. Some of the Noise Control Considerations include: Redirection of sound waves or deadening just by the simple positioning of drilling equipment and strategic location of frac-tanks. This option generally has little affect upon cost and may cause minor inconveniences for the drilling operation.

Another option is to utilize hospital/industrial grade mufflers to deaden sound as it leaves engines of motorized equipment. This could impede maximum operating output from equipment and also slow down the drilling operation.

More costly forms of Sound Control include; Building walls made of hay bales, sound curtain matting or plywood, or, building sound deadening enclosures constructed of wood.

Possible Condition: *DAMAGE TO EXISTING UTILITIES*

Contingency: Preventative measures include proper notification of local utilities through area one-call programs or site investigation and recording of area markers, manholes and valves. Pot-holing existing utilities is the most reliable method of exact utility location

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Damage to existing utilities or structures may occur during drilling or reaming operations. Occasionally unknown or unmarked utilities may be hit during drilling or reaming operations. If this circumstance does occur the type of utility is first identified so that severity of response can be identified. Emergency personnel for the identified utility are then notified. Pertinent personnel for the Owner and/or Owner Representatives are then notified, following the chain of command. Decisions are then made as to appropriate action to be taken.

Possible Condition: *ENCOUNTERING SUBSURFACE OBSTRUCTION*

Contingency: Occasionally an unknown subsurface obstruction is encountered during drilling operations such as; 1) buried tanks, 2) Building foundations/piers/pilings, 3) buried junk/cars. If this situation occurs, the location of the object is first identified in relation to the drill path. If the current R.O.W. is ample and soils provide adequate steering capabilities, the drill head is pulled back to a pre-calculated point along the previously drilled path and the drill bit is rotated and steered around the obstruction.

The chance of encountering an obstruction during reaming operations is highly unlikely. But, if this should occur, the magnitude of the obstruction must first be evaluated. If the obstruction is determined to be impassible, operations will be halted until an agreeable solution can be determined.

Possible Condition: *RUNNING SANDS*

Contingency: It is possible that loose cohesionless soils, such as running sands, may not support the drilled annular space over a long directional drill length. Although this circumstance sounds serious, it may not prevent the installation of a pipeline. Mechanical agitation of the formation by the downhole tool and trailing drill string, combined with the injection of bentonite drilling fluid causes the soils to experience a decrease in shear strength. When the resulting shear strength is low enough, the soil will react in a fluid-like manner thus, allowing the pipeline to be pulled through it.

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It would be highly unusual for soil strata to be of the same consistency from drill entry to drill exit, especially at the various depths encountered during pilot hole drilling. Prior to drilling, only general soil information is known for estimating and hypothesizing. The type of drilling fluid providing the best performance capabilities for the conditions is chosen based upon this information. Adjustments are then made in the field correlating to specific soil properties in order to improve performance.

Possible Condition: *PIPELINE MISALIGNMENT*

Contingency: Today's technology in the directional drilling industry provides state of the art instrumentation and tracking capabilities. The directional drill alignment is accurately known to within ± 0.01° or, ± 1.4 feet per 1,000 feet in both profile and plan view. The addition of Para Tracker as a secondary form of verification and validation for plan view orientation, left and right of center line, provides precise information which is updated regularly during drilling operations. The most frequent cause of misalignment is the inability to steer in transitional zones near the exit location. These soils may include varying degrees of overburden or formations allowing unpredictable degrees of penetration. The orientation or angle of these zones from horizontal may deflect the drill bit having a direct affect upon steering capabilities.

In any case, the steering probe maintains its tracking capabilities and allows the Survey Technician continuous feedback for locating the drill string in a three dimensional plane. Any deviation from the targeted exit is known and can be compensated for. If the target area is not large enough to accommodate the deviation, the drill string can be pulled back to a calculated point and be redirected toward the proposed exit location.

Possible Condition: *PRESSURE CONTROL*

Contingency: An important function of the drilling fluid is to prevent the uncontrolled entry into the hole of fluids from the formation penetrated by the bit. The pressure exerted by the column of drilling fluid (hydrostatic head) must be somewhat greater than the pressure exerted by the formation fluids to allow raising the drill string without any problems. Following are some mitigative measures taken to counteract pressures.

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1. Avoid swabbing drill string (plunging the drill string back and forth with great force)
2. Keep the hole full of drill mud while pulling the drill pipe, especially when hydrostatic head is not much greater than formation pressure.

At any given depth, the hydrostatic pressure (in psi) of the mud column is equal to mud density (in lb/gal) times depth (in feet) times 0.052

Psi (hydrostatic pressure)	=	lb/gal (density)	x	feet (depth)	x	0.052

Possible Condition: *HOLE COLLAPSE*

Contingency: Most drillable formations, whether consolidated or unconsolidated, have some form of cohesive properties allowing drilling fluid to interact and add to its bonding properties, thus avoiding hole collapse. Some soils, such as large gravel zones or cobble areas may not be capable of holding a hole. If this type of formation exists in the overburden soil (upper strata), a steel casing pipe may be washed over the drill stem into competent soil and left in place during operations. Drilling and reaming operations will then resume utilizing this conduit as a means of carrying drill cuttings back up-hole without obstruction. This reduces the chance for lost circulation. Under this circumstance, the integrity of the pipe coating **cannot** be guaranteed.

If this type of formation exists throughout the borehole, it should be known and researched prior to drilling so that an alternate route may be researched. The route that provides the best chance for success should be the route chosen. If a competent drilling contractor properly investigates a route, the chance for a hole collapse is greatly reduced.

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Possible Condition: *PIPELINE COLLAPSE*

Contingency: Pipeline collapse during pulling operations is a rare occurrence caused by certain factors, which must be considered before pullback begins. Some of the main factors, which must be considered during pre-planning stages or prior to pipeline pullback operations, include:

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1. Pre-engineered profile must reflect the minimum radius of curvature calculated for the given pipe (wall thickness, pipe size, tensile strength, X-rating)
2. Drilled profile should not exceed pipe tolerance throughout the drilled borehole.
3. Experienced directional drilling Survey Technician verifies three joint radii calculations for maximum degree of bend per 30-foot joint.
4. Industry standard safety factor should be included in the profile and calculations taking into account unknowns.
5. Exit and entry angles must be within specified tolerances so that support equipment capabilities are not exceeded in order to provide the pipeline a smooth, uninhibited transition into the opened hole.
6. Calculations performed for anticipated stresses the pipe will be subjected to during pullback (i.e. Pull loads, tensile, unconstrained buckle, hoop stress.) This way upper stress limits will be known.
7. Proper ballasting of product line through controlled loading of water to the leading end of pipeline. This procedure also provides internal pressure to the product line as a counter balance to external pressures. If water is added to the opened end of the product line and allowed to flow down toward the leading end during pullback, a vacuum may occur creating undue stress on the product line which would increase the possibility of implosion or collapse. Therefore, a conduit is positioned to carry water through the interior of the product pipe dispersing water at the leading end of the pipe filling it from the lowest portion (elevation) toward the highest elevation. Volume calculations are maintained to ensure only the lowest portion of the pipe is maintained full of water.

The appointment of highly competent personnel experienced in pipeline pullback procedures is a must. There is no substitute for experience. Experienced personnel should be placed at critical positions at both the drill entry and exit locations.

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FIGURE 1

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Milepost
Workspace
Access Route
Low Impact Access Route
Surveyed Wetland
Surveyed Waterbody

N

125 62.5 0 125
Feet

Figure 1
North Bakken Expansion Project
Preliminary Access Plan in Event of Inadvertent Returns for Access to USACE Lands

WBI ENERGY TRANSMISSION

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Drawn By: RJC

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FIGURE 2

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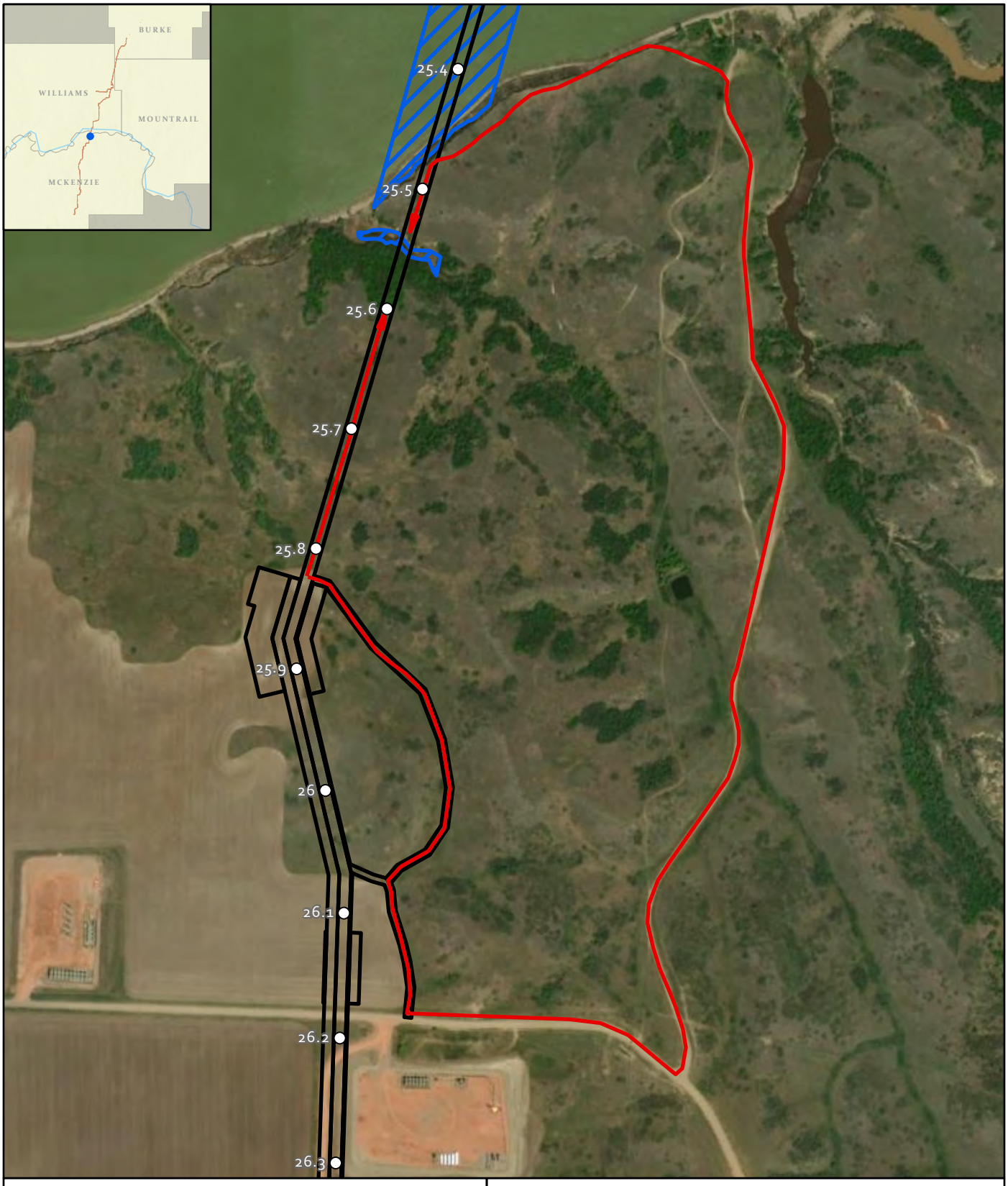

Figure 2
North Bakken Expansion Project
Preliminary Access Plan in Event of Inadvertent Returns for Access to USACE Lands

WBI ENERGY TRANSMISSION

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ATTACHMENT

GRUNDO RAM
PNEUMATIC PIPE RAMMER

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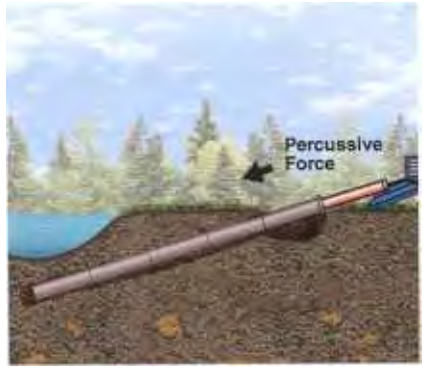
Percussive Power

for directional drilling assist

Conductor Barrel™

A sure start for your bore even in the worst soil.

- Ram casings through difficult soil conditions to more desirable drill starting points.
- Guide down-hole or mud motors to rocky soils through the conductor barrel.
- Provides friction-free section for product pullback.



Pullback Assist

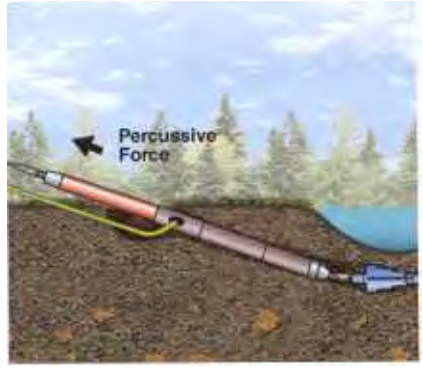
Overcome hydrolock with a pipe rammer.

- Rammer attached to product pipe during pullback.
- Percussive action keeps pipe moving and helps prevent high levels of pullback stress.
- Percussive power frees immobilized product pipes.

Pipe Removal

Remove stuck product pipe and bore again.

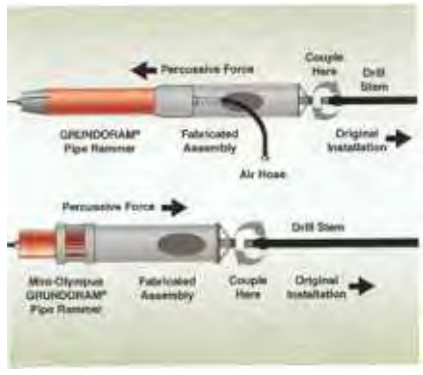
- Rammer attached to product pipe after pullback fails.
- Percussive action pulls product pipe, removing it from the bore.
- Salvage the job and bore again.



Drill Stem Recovery

Retrieve stuck drill stems.

- Pipe Rammer fitted with a special sleeve.
- Stuck drill stem welded to the back of the rammer sleeve.
- Percussive power frees drill stem, saving time and money.



"Power without limits!"

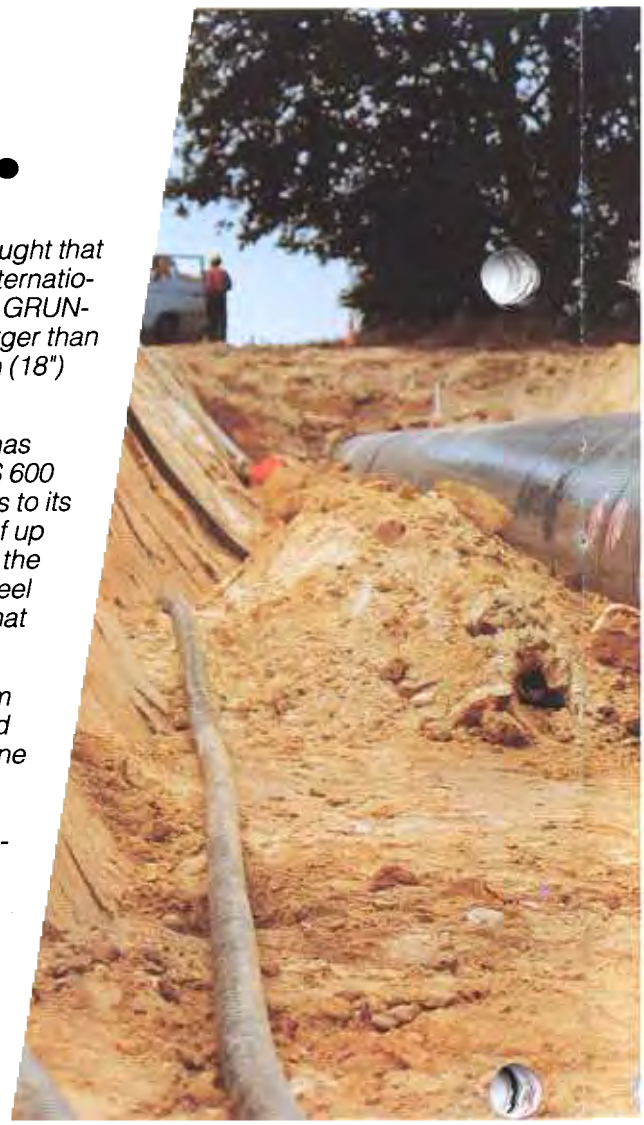
The strongest in existance ...

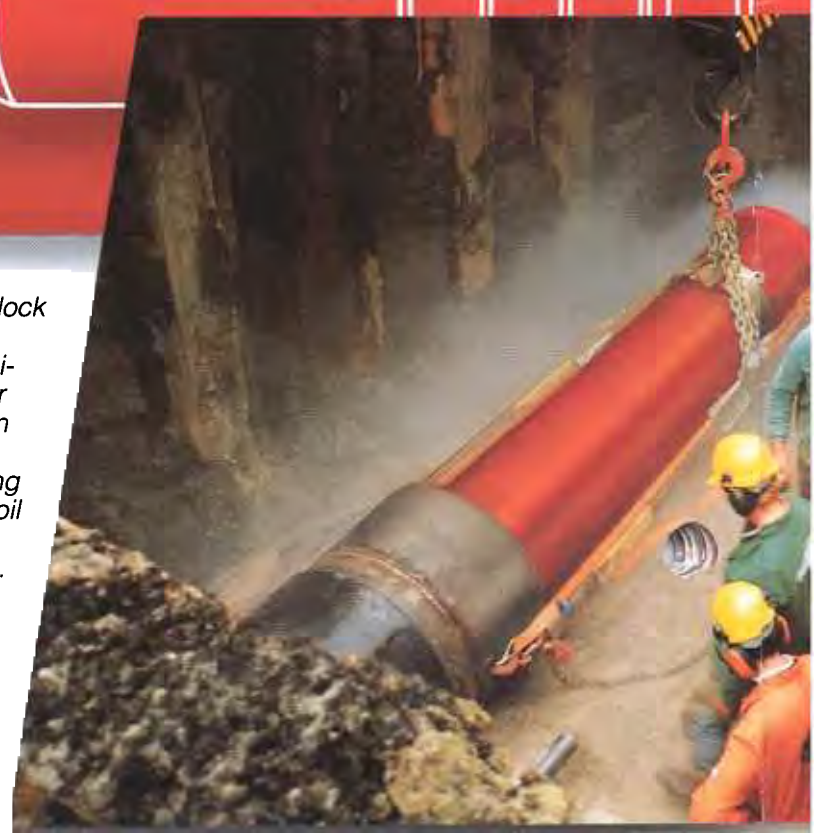
Who would have thought that there would be an international requirement for a GRUNDORAM hammer - larger than the GOLIATH 450 mm (18") machine?

International demand has made the new TAURUS 600 mm (24") a must. Thanks to its dimensions and thrust of up to 2,000 tons (4,480 lbs) the TAURUS is the largest steel pipe ramming machine that exists.

Steel pipes up to 2,000 mm (80") can now be installed with this powerful machine when installing casing or product pipes for the water, sewage, telephone, electricity and gas industries or railway authorities.

When other ramming equipment has reached its power limit the TAURUS offers that extra power to get that pipe into the ground.





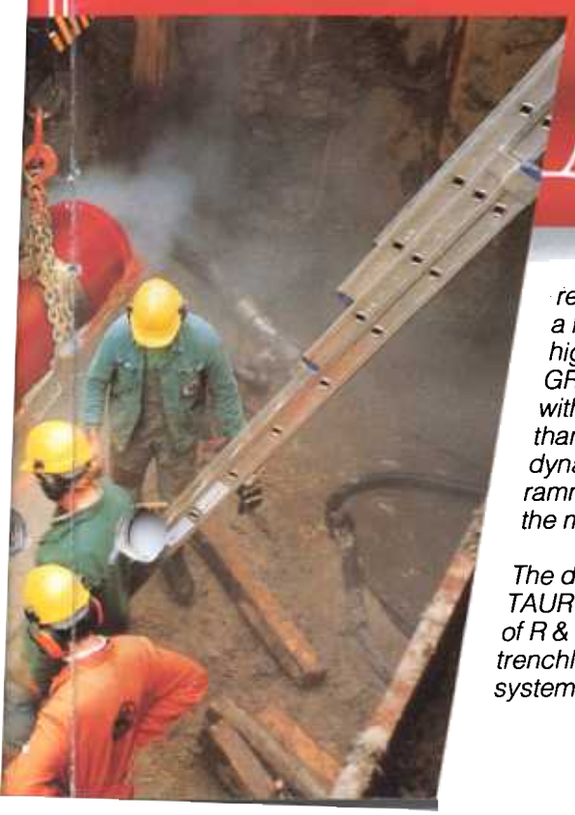
It is designed of a monoblock main casing made from a high quality alloy with a unique flexible control stud for perfect impact transmission onto the steel pipe. This makes it a reliable and lasting boring unit even in difficult soil conditions or over long stretches of steel pipe installation.

A GRUNDORAM's number of strokes has a direct influence on the forward ramming speed. However, high ground

TAURUS

Ø of rammer.....	.....24"
Length.....	.....12 ft
Weight.....	....10,580 lbs
Air consumption.	1.766 ft³/min
Strokes per min..	180
Thrust.....	....4,400 lbs
Suitable for pipes.	.....>380

A TAURUS used on a gas pipeline installation.



resistance and friction require a low stroke frequency with a higher single impact. The GRUNDORAM model TAURUS with 180 strokes/min and more than 2,000 tons (4,480 lbs) of dynamic thrust ensures high ramming speeds even under the most difficult conditions.

The development of the new TAURUS is the result of years of R & D in the field of trenchless pipe laying systems.

The GRUNDORAM is suitable to resist the highest stress in difficult soils thanks to its monoblock casing and flexible control stud.

GRUNDORAM

Good examples back up our claims

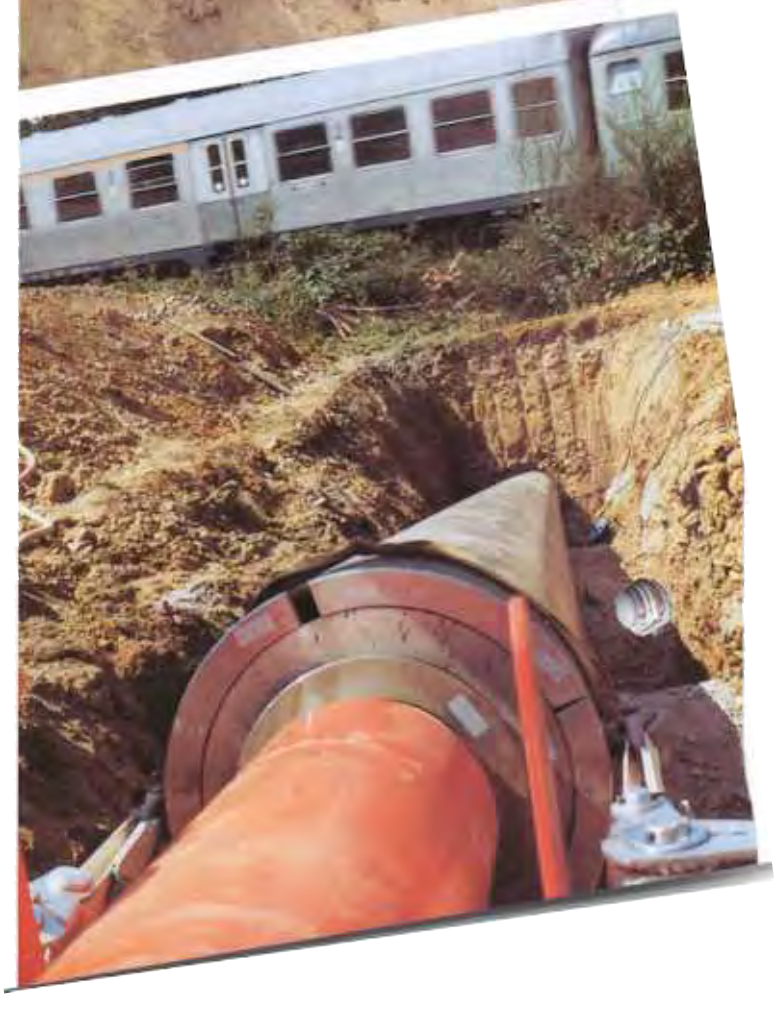
Global usage is quickly leading to the general acceptance of the robust GRUNDORAM system. Contractors value the ● simple operation and ● reliability the ● enormous impact power, the ● wide range of applications, the ● quick and easy preparation and the ● sturdy accessories.

● 220 ft of steel pipe, 14" diameter was rammed under a canal to accommodate 8 fibre-optic cables.

● 125 ft of 59" diameter pipe was laid under an embankment in Manchester, England, as a drainage system.

● 65 steel pipes of 28" diameter were installed parallel to each other under the main Seoul-Pusan railway line in South Korea.

● A 24" steel pipe was easily rammed along a 131 ft stretch under a railway embankment south of Cairo/Egypt.



"Typical" but also not everyday jobsite projects are excellent references, for example

● 115 ft of steel drainage pipe of 55" diameter was perfectly installed under the river Pader in the heart of the city of Paderborn/ Germany

● 200 ft of 30" steel casing for gas/telecom/mains supply was installed under the A 1 motorway without traffic disruption or diversions

● *90 steel pipes of 20" diameter were driven in vertically to provide solid foundations for a noise-protection barrier in Germany.*

There are many other typically good examples that could be listed. If you are interested in specific cases, contact us - we will supply you with detailed information.

GRUNDORAM

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HERRENKNECT
PIPE THRUSTER

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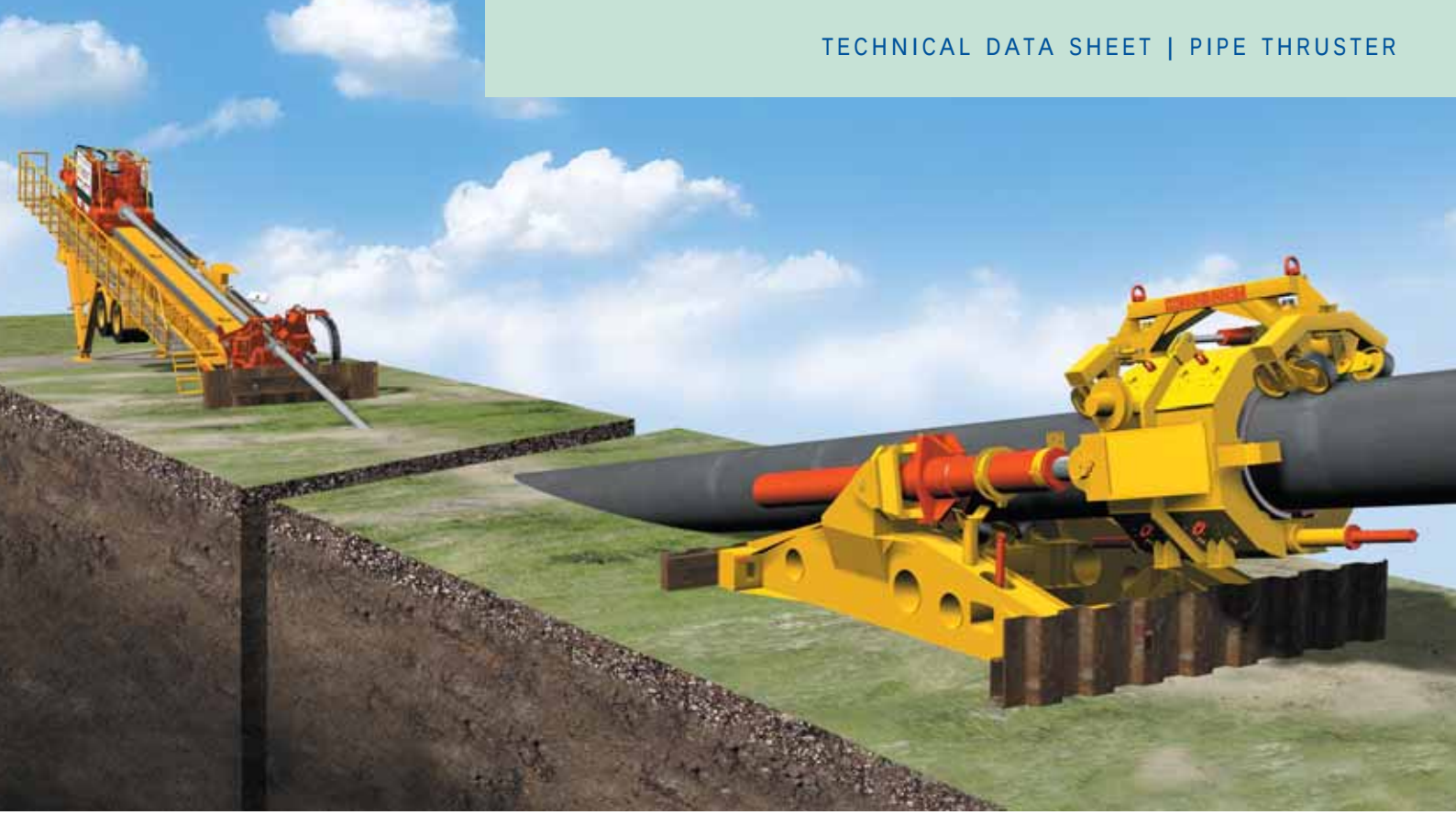

Additional Power for Pipe Pullback.

The newly developed Herrenknecht Pipe Thruster is an auxiliary device for Horizontal Directional Drilling Technology and extends its field of application. The Thruster is mounted at the exit point and helps to push the entire pipeline into the ground. It is particularly suited for extremely long pipelines, very large diameters or difficult geological conditions. Depending on the project the Pipe Thruster can be used as a support tool, a rescue tool or as a pipe installation tool.

After finishing the pilot hole and the reaming procedures using a HDD Rig the Pipe Thruster assists during the pipe pull. The Pipe Thruster is mounted at the exit point and pushs the product pipe into the enlarged hole while the Rig is pulling the pipe. This simultaneuos process will reduce the stresses on the drillpipe and the product pipe.

Beside improved safety the Pipe Thruster allows drill lengths of more than 3,000m and makes the use of big pipe diameters more common.

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www.herrenknecht.com

HERRENKNECHT
Tunnelling Systems

Innovative Solution: The Pipe Thruster

Range of Application

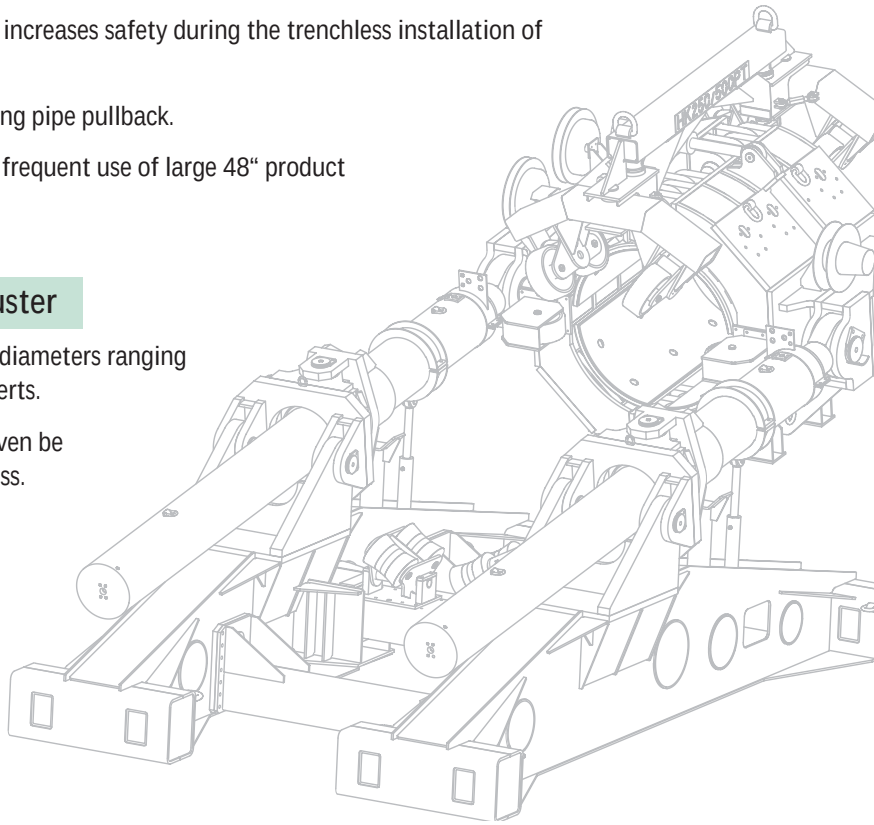
- Support of the HDD process during pipe pullback.
- Sea Outfall projects: ashore thrusting of the product pipeline.
- Rescue Tool for the recovery of stucked pipelines, e.g. in difficult geological conditions.

Advantages of the Method

- The deployment of the Pipe Thruster allows to add a push force from the exit point to the pull force of the HDD Rig.
- The flexible load distribution at the entry and exit point increases safety during the trenchless installation of pipelines considerably.
- Reduced stress for drill pipes and rigsite equipment during pipe pullback.
- Increase of drill lengths to more than 3,000m and more frequent use of large 48“ product pipe diameters.

Advantages of the Herrenknecht Pipe Thruster

- The Herrenknecht Pipe Thruster can be used for all pipe diameters ranging between 20“ and 48“ by just changing the clamping inserts.
- Due to a tilting clamping device the Pipe Thruster can even be installed when the pipeline pullback is already in progress.
- The clamping device is suitable for all types of pipelines and coatings.
- The modular design does not require special cargo transports.



Technical Data

Pipe Thruster

- Operating angle: 5° - 15°
- Push and pull force (normal): 250t (2,500kN)
- Push and pull force (maximum): 500t (5,000kN)
- Min. clamp diameter: 20“ (508mm)
- Max. clamp diameter: 48“ (1,219mm)
- Max. speed: 5m/min.
- Stroke of push/pull cylinder: 5,000mm
- Dimensions: 9 x 4.1 x 4.4m
- Weight: 45t

Power Unit

- Dimensions: 20ft container
- Installed power: 400kW
- Weight: 10t
- Remote control and hydraulic hoses to the Pipe Thruster are included.

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DRILL FLUID RECYCLING FLOW CHART

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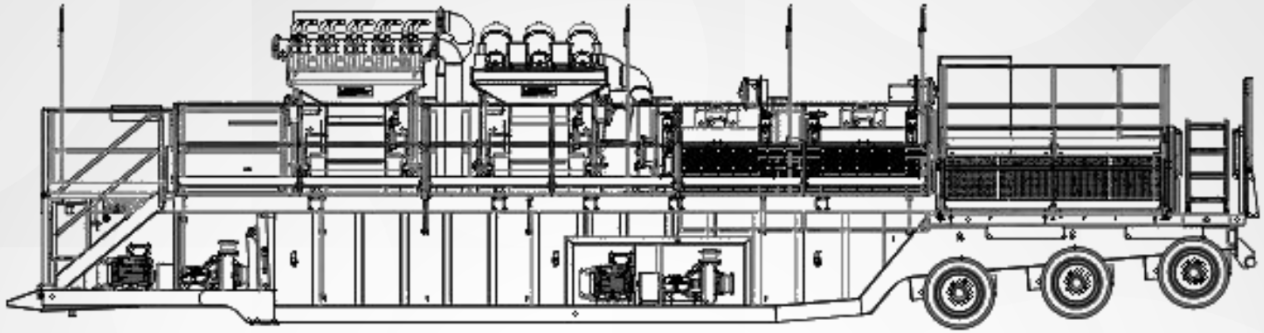
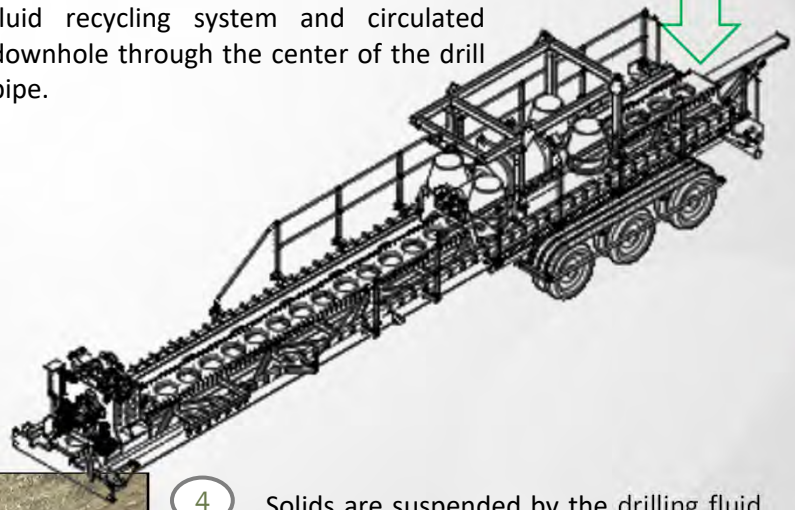
1 Drilling fluid volume is initially prepared consisting primarily of bentonite (NSF/ANSI-60 Drinking Water Additive Standard Certified) & water. Pumps are used to circulate the fluid downhole.



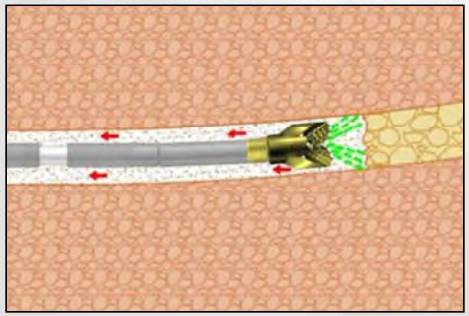
CLEAN FLUID

2 Drilling fluid is pumped from the drilling fluid recycling system and circulated downhole through the center of the drill pipe.



3 Once downhole, drilling fluid serves the following purposes;

- In alluvial formations, assists with jetting the hole
- Transports cuttings to the surface
- Aids in stabilizing formations
- Provides lubrication & tool cooling
- Provides hydrostatic fluid pressure to balance formation pressure.



SOLIDS LADEN FLUID

4 Solids are suspended by the drilling fluid downhole and transported throughout the annular space to the entry pit at surface.

5 Solid laden drilling fluid returns to the recycling system where it is processed by large particle shakers, de-sanders & de-silters. It is during this stage that the suspended cuttings are removed and the desired drilling fluid rheology is restored.

MICHELS®

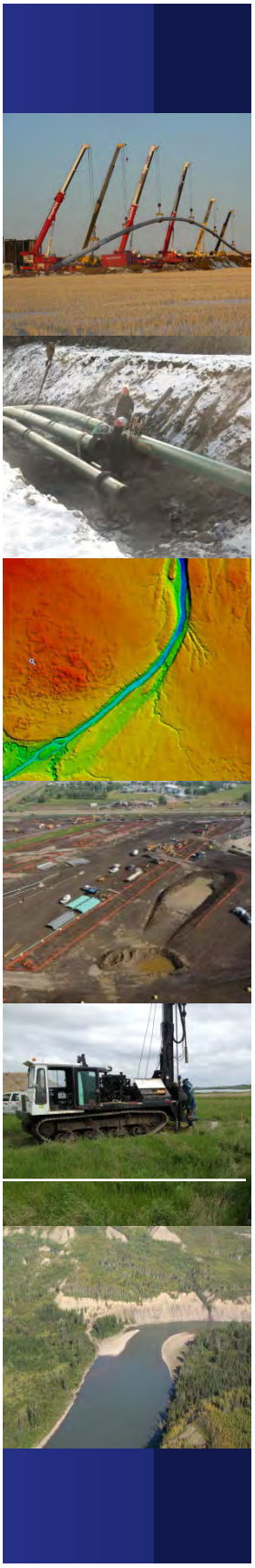
NORTH BAKKEN EXPANSION PROJECT

Horizontal Directional Drill/Guided Bore Drilling Fluid Monitoring and Operations Plan

Attachment B

North Bakken Expansion HDD Design Report Missouri River NPS 24 HDD Crossing, Prepared by CCI & Associates Inc

CCI & Associates Inc.



North Bakken Expansion

HDD Design Report

Missouri River NPS 24 HDD Crossing

Prepared for:

WBI Energy Transmission

Project No.: 2386

Document No.: 2386-01-DESIGN REPORT-00

Date: 07/31/2020

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Revision	Prepared by	Checked by	Approved by	Date Approved
00	CG	BKP	JT	07/31/2020

North Bakken Expansion

HDD Design Report - Missouri River NPS 24 HDD Crossing

CCI & Associates Inc. – North Dakota CoCP # 27692PE

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1 INTRODUCTION

WBI Energy Transmission, Inc. (WBI) is planning to construct a pipeline crossing of the Missouri River (Lake Sakakawea) within North Dakota, between the cities of Tioga and Watford City as part of the North Bakken Expansion Project. The project involves approximately 60 miles of new NPS 24 (24" O.D.) natural gas pipeline that will connect WBI Energy's Tioga Compressor Station near Tioga, North Dakota, with Northern Border Pipeline Company's mainline at a new interconnection point south of Watford City, North Dakota. The pipeline is for natural gas takeaway to help reduce natural gas flaring in the area. The pipeline alignment crosses the Missouri River approximately 24 miles north of Watford City and 23 miles east of Williston, ND. At the crossing location, the Missouri River forms Lake Sakakawea, which contains a historic channel traversing the lake, and is a United States Army Corps of Engineers (USACE) monitored navigable waterway. This report will focus on the feasibility of the North Bakken Missouri River crossing utilizing the Horizontal Directional Drill (HDD) trenchless construction method. The proposed HDD crossing will cross beneath the entire width of the lake, measuring 15,393 ft in length from entry to exit.

This report is provided as a feasibility assessment of site conditions, incorporating the available geotechnical information and a geometric review of the proposed HDD alignment and design along with annular pressure analysis and pipe stress analysis. Also included are some challenges the contractor may face and some mitigation strategies that may be implemented to minimize the project risks. This assessment is also intended to provide verification that the HDD design meets USACE requirements.

2 DESIGN PARAMETERS

The parameters utilized in the design of the crossing are as follows:

a) The Pipeline Research Council International (PRCI) design guidelines (PR-277-144507-R01) and ASME B31.8 requirements, as applicable, were utilized to model the bending, external hoop, tensile, and combined stress cases for the installation and operating conditions imposed on the pipe.
b) The calculations consider the pipe material, diameter, wall thickness, grade, depth, and the geometric design of the crossing.
c) The geotechnical conditions at the site were analyzed to design the drill for progression through formations that are favorable for horizontal directional drills, where possible, with consideration given to potential borehole instability and surficial casing installation.
d) The HDD crossing was designed by completing an assessment of the annular pressure to minimize the risk of hydraulic fracture to the surface or water body during drilling of the pilot hole. The HDD crossing was designed to have a factor of safety against hydraulic fracture beneath the Missouri River (Lake Sakakawea) of greater than 2.0, as per USACE calculations. The annular pressure calculation models the potential fracture pressure of the overburden formation versus the downhole pressures created during the pilot hole phase of the construction.
e) Space limitations associated with points of inflection (PI), topographical features, and achievable temporary workspace (TWS) were considered. Temporary workspace has been selected to ensure that the required equipment can be set up on site to complete the work and to minimize grading requirements and disturbance.
f) The entry and exit positions have been identified based on the location of the pipe section lay out for installation, generally at the exit location. The drill is designed as an intersect and will have a drill rig set up at both the entry and exit locations.
g) The crossing has been designed with consideration of the pullback section and available layout. These plans will be updated (if required) to allow for multiple sections and/or contractor input.

h) All elevations and topographic survey data utilized are based off North American Vertical Datum 88 (NAVD 88) and State Plane North Dakota North coordinate system.

3 MISSOURI RIVER CROSSING LOCATION

3.1 SITE DESCRIPTION

The proposed HDD crosses the Missouri River (Lake Sakakawea) within McKenzie and Williams County, North Dakota. The proposed pipeline alignment is located approximately 24 miles north of Watford City and 23 miles east of Williston, ND, and is shown in Figure 1, below. The length of the proposed HDD measures approximately 15,393 ft.

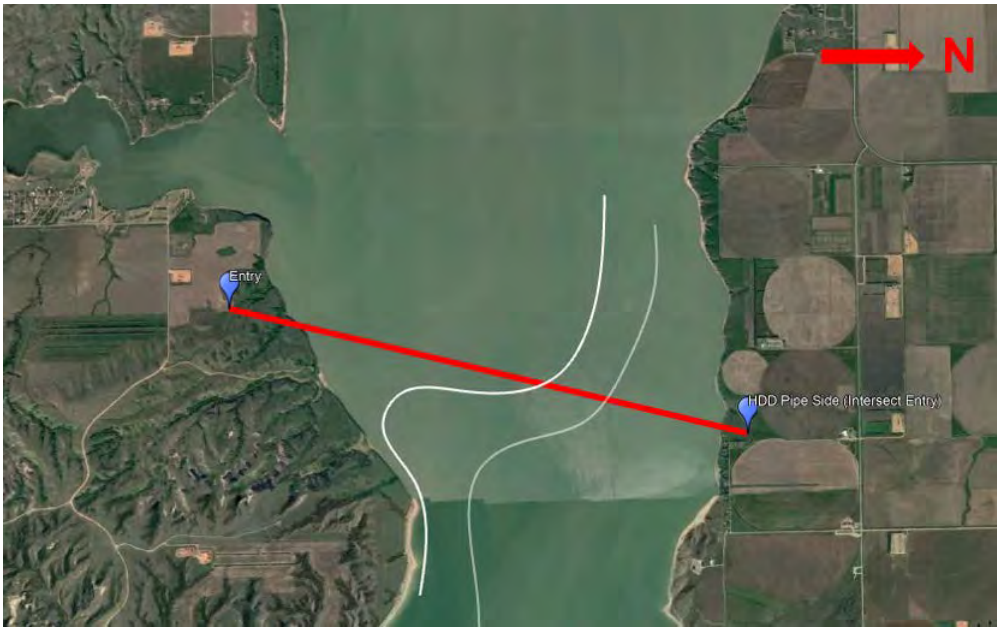


Figure 1. Proposed HDD Alignment Location

The proposed HDD entry location is situated in a relatively level, cultivated grass field, southwest of rugged terrain along the edge of the Missouri River and east of Tobacco Garden Bay. From entry, the HDD alignment follows the proposed pipeline right-of-way down rolling, sloped terrain towards the south bank, crosses the Missouri River (Lake Sakakawea) and climbs the north bank to the location of the HDD exit. The exit location is situated within a maintained grass field, west of several houses along the lake. The pipe string staging and preparation area, shown in Figure 2, is located to the north of the exit point (pipe side) within a proposed temporary workspace area. The planned pipe string and pullback alignment continues to the north, crossing 52nd Street NW and a cultivated field before roping to parallel Highway 17A, ending at Highway 1804 (54th Street NW).

The land near the proposed HDD consists of primarily agricultural fields and grassed areas with several residential buildings in proximity of the northern work site.

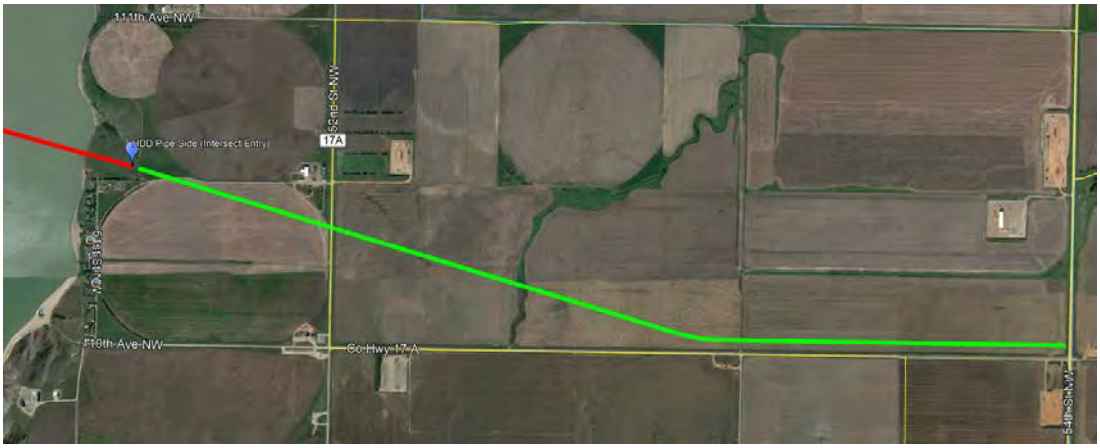


Figure 2. Proposed HDD Pipe Stringing Location

3.2 GEOLOGICAL SETTING

The geology in the area consists of glacial deposits overlying the Sentinel Butte Formation followed by the Bullion Creek Formation, both of the Paleocene Age. The Sentinel Butte Formation consists of layers of silt, clay, sand, lignite, carbonaceous shale, and mudstone. The Bullion Creek Formation comprises primarily silt, clay, sand with interbedded sandstone, lignite, baked clay, and limestone. Both formations are poorly lithified and form rolling topography over areas of Western North Dakota. It is expected that the proposed HDD bore path will be encompassed within the Sentinel Butte Formation and not encounter the Bullion Creek Formation.

3.3 GEOTECHNICAL REVIEW

To form a basis on evaluating the site specific subsurface conditions, CCI sub-contracted Groundwater & Environmental Services, Inc. (GES) to perform a subsurface exploration and laboratory testing program at the proposed HDD site to support the feasibility evaluation and design of the Lake Sakakawea crossing. As part of the geotechnical program, two investigations were completed: one (1) land-based investigation and one (1) water-based investigation. Associated subsequent geotechnical reports entitled "Geotechnical Investigation Report – WBI North Bakken Expansion Project", dated June 14, 2019 and "Geotechnical Investigation Report, Water-Based Borings – WBI North Bakken Expansion Project", dated July 9, 2020 were completed. As part of the land-based investigation, three (3) exploratory land borings, LB-1 to LB-3, were drilled/sampled to depths between 372 and 403 ft below ground surface. As part of the water-based investigation, six (6) additional water-based borings, WB-1 to WB-6, were drilled/sampled to depths between 300 and 315 ft below the Lake Sakakawea thalweg.

The locations of the nine (9) geotechnical borings relative to the HDD alignment are shown in Figure 2, below, and depicted in the design drawing attached in Appendix A.

Figure 3. Borings Location Plan

The borehole coordinates were obtained during the geotechnical investigation by GES using a handheld GPS. The borehole depths and coordinates are shown below in Table 1.

Table 1. Geotechnical Boring Locations and Depths

Borehole	Depth (ft)	Latitude	Longitude
LB -1	403	48.115647°	-103.092842°
LB-2	400	48.117656°	-103.092611°
LB-3	372	48.156139°	-103.077672°
WB-4	300	48.123139°	-103.090536°
WB-5	300	48.128400°	-103.087644°
WB-6	300	48.133994°	-103.086317°
WB-7	315	48.138314°	-103.083792°
WB-8	300	48.146003°	-103.081647°
WB-9	310	48.150150°	-103.079189°

A summary of the encountered subsurface conditions encountered during the geotechnical program, as well as some concerns regarding the geotechnical conditions as they relate to HDD construction operations is listed below in Table 2 and 3. A copy of the detailed geotechnical boring logs from GES' geotechnical investigation is located within the Geotechnical Reports provided in Appendix E.

Table 1. Generalized Summary of the Boring Logs for Missouri River

Borehole	Location	Geologic Description[1, 2]	Primary Geotechnical Concerns
LB -1	Approx. 130 ft NE of entry point, near NE corner of entry pad TWS	0 – 25 ft: Med. Dense Sand 25 – 110 ft: V. Stiff to Hard Lean/Fat Clay and Silt 110 – 211 ft: Hard Fat/Lean Clay 211 – 233 ft: Coal 233 – 288 ft: Highly Weathered, Hard Shale 288 – 403 ft: Hard Silt	Thick coal layer encountered from 211 to 233 ft. Intermittent coal layers/lenses frequently encountered below 233 ft. Fat clays/shale could contain high swell potential.
LB-2	Approx. 930 ft NE of entry point, west side of HDD CL	0 –35 ft: Loose to Med. Dense Silt/Silty Sand. 35-55 ft: V. Stiff Fat Clay 55 – 120 ft: Loose to Dense Sand 120 – 153 ft: Hard Silt and Lean Clay 153 – 215 ft: Highly Weathered Shale and Siltstone	Loose granular materials encountered poses slough risk. Thick coal layer encountered from 215 to 238 ft. Intermittent coal layers/lenses frequently

Borehole	Location	Geologic Description[1, 2]	Primary Geotechnical Concerns
		215 – 238: Coal 238 – 350 ft: Hard Silt 350 – 380 ft: Dense Sand 380 – 400 ft: Highly Weathered Shale	encountered below 238 ft. Fat clays/shale could contain high swell potential.
LB-3	Approx. 100 ft from exit point, along southern edge of exit pad TWS	0 – 115 ft: V. Loose to V. Dense Sand and Silty Sand 115 – 140 ft: Coal 140 – 202 ft: V Dense/Hard Sand, Silt and Lean Clay 202 – 252 ft: Hard Silt with coal lenses 252 – 290 ft: V. Dense Sand 290 – 336 ft: Highly Weathered, Hard Shale 347 – 372 ft: V. Dense Silty Sand	Loose granular materials encountered poses slough risk. Thick coal layer encountered from 115 to 140 ft. Intermittent coal layers/lenses frequently encountered below 140 ft. Shale contains swell potential.
WB-4	Approx. 2,900 ft from entry point, west side of HDD CL	0 – 45 ft: Soft/Loose Lean Clay and Sand 45 – 53 ft: Loose Gravelly Sand 53 – 81 ft: Hard Lean Clay 81 – 102 ft: Highly Weathered, Hard Shale 102 – 127 ft: Coal 127 – 277 ft: Highly Weathered, Hard Shale and Weakly Cemented, V. Dense Sandstone 287 – 300 ft: Highly Weathere, Hard Shale	Granular (alluvial) materials encountered poses slough risk. Thick coal layer encountered from 102 to 127 ft. Intermittent coal layers/lenses frequently encountered below 127 ft. Shale could contain high swell potential.
WB-5	Approx. 4,950 ft from entry point, east side of HDD CL	0 – 35 ft: Med. Stiff/Loose Silt and Sand 35 – 85 ft: Med. to V. Dense Sand and Gravel 85 – 140 ft: Hard/Dense Lean Clay and Sand 140 – 245 ft: Highly Weathered, Hard Shale 245 – 267 ft: Weakly Cemented, V. Dense Sand 267 – 280 ft: Coal 280 – 300 ft: Hard Lean Clay	Thick coal layer encountered from 267 to 280 ft. Intermittent coal layers/lenses frequently encountered below 140 ft. Shale could contain high swell potential.
WB-6	Approx. 7,000 ft from entry point, west side of HDD CL	0 – 70 ft: V. Loose to Med. Dense Sand 70 – 115 ft: V. Stiff Lean/Fat Clay and Silt 115 – 220 ft: Dense to V. Dense Sand 220 – 300 ft: Highly Weathered, Hard Shale	Frequent coal layers/lenses encountered below 220 ft. Fat clays/shale could contain high swell potential.
WB-7	Approx. 8,690 ft from entry point, east side of HDD CL	0 – 56 ft: V. Loose to Med. Dense Sand 56 – 120 ft: Med. Dense/V. Stiff Sand and Lean Clay 120 – 210 ft: Dense to V. Dense Sand 210 – 235 ft: Highly Weathered, Hard Shale 235 – 253 ft: Coal 253 – 315 ft: Highly Weathered, Hard Shale	Thick coal layer encountered from 235 to 253 ft. Intermittent coal layers/lenses frequently encountered below 253 ft. Shale could contain high swell potential.
WB-8	Approx. 3,840 ft from exit point, west side of HDD CL	0 – 35 ft: V. Soft to Med. Stff Lean Clay and Silt 35 – 150 ft: V. Loose to V. Dense Sand 150 – 230 ft: Highly Weathered, Hard Shale 230 – 240 ft: Coal 240 – 290 ft: Highly Weathered, Hard Shale 290 – 300 ft: Coal	Thick coal layers encountered in the bedrock. As well, thinner intermittent coal layers/lenses frequently encountered. Shale could contain high swell potential.
WB-9	Approx. 2,230 ft from exit point, west side of HDD CL	0 – 140 ft: V. Loose to V. Dense Sand and Gravelly Sand 140 – 225 ft: Highly Weathered, Hard, Shale 225 – 235 ft: Coal 235 – 290 ft: Highly Weathered, Hard, Shale 290 – 305 ft: Coal 305 – 310 : Highly Weathered, Hard, Shale	Thick coal layers encountered in the bedrock. As well, thinner intermittent coal layers/lenses frequently encountered. Shale could contain high swell potential.

Note 1: Soil descriptions as per United Soil Classification System (USCS)
Note 2: Soil Consistency and Relative Density determined as per in-situ SPT N-Value

Although variations exist, the subsurface conditions were similar in the nine (9) borings. In general, the subsurface conditions comprised overburden glacial and alluvial deposits to depths between 127 and 290 ft below the surface/thalweg overlying the Sentinel Butte Formation to the depth of the investgation. The glacial and alluvial deposits predominantly consisted of variable deposits of fat/lean clay, sand and silt with thin, frequent interbedded layers of gravel and coal. The consistency of the overburden material increased with depth, starting as soft/loose and becoming hard/very dense. As noted, the bedrock of the Sentinel Butte Formation consisted of primarily poorly lithified shale and sand. Within the formation, two

(2) relatively continuous coal layers were identified along the length of the drill. The coal layers varied in thickness from approximately 5 to 30 ft, with frequently encountered thinner layers/lenses.

Although not encountered in the geotechnical investigation, there is potential to encounter cobbles and/or boulders along the drill path. By definition, glacial deposits consists of a variations of all soil types, including a random distribution of cobble and boulder sized materials, and granular layers/lenses.

No standpipes were installed. Rather, groundwater conditions were inferred from seepages noted and measurements taken during drilling. For the land-based borings, water was observed at 24 ft in LB-3 whereas LB-1 and LB-2 remained dry; however, in each of these borings mud-rotary drilling commenced at a depth of 25 ft, precluding deeper measurements. No groundwater measurements were obtainable in the water-based borings since a perfect seal was not feasible on the casing through the lake. It is expected that the groundwater is situated at an elevation equivalent to the elevation of Lake Sakakawea.

The proposed HDD is anticipated to be within shale of the Sentinel Butte Formation for most of its length, passing through overburden/alluvial deposits as it nears surface at the entry and exit locations. As noted, the overburden/alluvial deposits consist of variations of fat/lean clay, sand and silt. Two relatively continuous coal layers, approximately 5 to 30 ft thick, are proximate to the bottom tangent of the bore path.

4 HDD CROSSING CONSIDERATIONS

4.1 PIPE SPECIFICATIONS

The pipeline specifications provided by WBI are summarized in Table 3. These parameters were used in the engineering design of the Missouri River HDD crossing.

Table 3. Pipe Specifications for the Missouri River HDD Crossing

Parameter	NPS 24 HDD
Outside Diameter (inch)	24
Wall Thickness (inch)	0.99
Pipe Material	Steel
Carried Product	Natural Gas
Specification	API 5L
Grade	X60
Specified Minimum Yield Strength (SMYS) (psi)	60,000
Chosen Design Radius (ft)	5,000
Minimum Allowable Design Radius (MADR) (ft)	1,500
Entry Angle	15°
Exit Angle	14°
Borehole Diameter (inch)	36
Maximum Operating Temperature (°F)	100
Minimum Installation Temperature (°F)	60
Maximum Operating Pressure (psi)	1,480

4.2 HDD ALIGNMENT

The proposed crossing follows a southwest to northeast alignment with the proposed entry and exit (pipe layout) points located approximately 2,100 ft south and 850 ft north of the Missouri River edge of water, respectively. The crossing passes beneath the lake for approximately 12,300 ft. Temporary workspace (TWS) is required at both ends of the crossing to facilitate entry and exit-side construction spreads, which are planned to have workspace dimensions of 300 ft x 300 ft (on the south) and 270 ft x 300 ft (on the north).

The proposed crossing is planned to be completed by intersect methodology, approximately 6000-9000 ft will be competed from either direction, the drill paths will intersect within a 3200 ft "intersect zone". The details of the design are shown on the Issued for Permit (IFP) HDD design drawing [2386-EG-0101, Rev G, dated July 31, 2020] provided in Appendix A.

4.3 BOREHOLE SIZE

The final borehole diameter must be larger than pipe outer diameter to facilitate pipeline installation and reduce the drag forces acting on the pipe while allowing for proper drilling fluid circulation within the annulus. The general industry standard for pipes with diameter more than 20 inches is a final borehole diameter 12 inches larger than the pipe outer diameter. For the proposed NPS 24 HDD crossing, the minimum final borehole diameter is expected to be 36 inches.

4.4 ENTRY AND EXIT ANGLES

The entry and exit angles have been selected based on expected geologic formations and casing requirements, bending restrictions, topography and the support of the pullback section. The entry angle (south) has both been selected to be 15° for this crossing to minimize casing requirements while adhering to geometric constraints and depth. The exit angle was selected to minimize casing requirements on exit while considering the overbend support height and support equipment requirements. The exit angle has been designed to be 14° for the proposed crossing. Due to the pipe size and specification, significant equipment is still required to lift and safely support the pipe above ground during installation. The risks associated with above-ground pipe support equipment requirements on site will be discussed further in the construction risk assessment.

4.5 HDD DEPTH OF COVER

Selection of an HDD depth is based on several parameters including geological formation, casing requirements, required overburden pressure to overcome the drilling fluid annular pressure (while maintaining an adequate factor of safety), and watercourse geometric parameters. The proposed installation depth considered should maximize the length of drill advancing through favorable materials for directional drilling to maximizing borehole stability during hole opening and pipe installation. The drill path is designed to avoid the coal layers identified in the geotechnical investigation for as much of the drill path as possible.

The bottom tangent depth for the proposed NPS 24 HDD is around 250 ft below the bottom of the lake. It is expected that the majority of the drill path will be within shale of the Sentinel Butte Formation based on the 9 geotechnical borings described above. The design depth for the proposed crossing is expected to provide adequate overburden pressure to counteract the expected drilling fluid pressures while utilizing the HDD pilot hole intersect method. Further details about annular pressure modeling are discussed in Section 5.1.

4.6 DESIGN RADIUS

The standard practice in the HDD industry is to utilize 1,200 times the nominal pipe diameter (in ft) as the design radius of curvature (ROC). For example, an NPS 24 (2 ft O.D.) pipe would utilize a 2,400 ft ROC. This is a general "Rule of Thumb" for quick calculations which has been developed over the years based on constructability as opposed to pipe stress limitations. The minimum vertical curve chosen for the proposed HDD is 5,000 ft, which is much larger than the minimum based on the above criteria. This increased design radius has been chosen to assist in ease of steering for the contractor during construction. Applying the design radius, the bending stress and operational shear stress have been calculated to be 13.1% and 48.1%, of allowable, respectively.

An essential part of the design of HDD crossings is providing the contractor with minimum steering tolerances during pilot-hole based on an acceptable level of stress on the pipe. These tolerances are designed to allow the contractor to follow the designated drill path as closely as possible while avoiding any variation that may result in overstressing the product pipe. CCI has calculated the minimum allowable design radius (MADR) for the pipe based on limiting the bending stress to less than 45% of allowable (as per PRCI). For this crossing, an additional design factor has been added to this typical MADR calculation, in order to ensure major variations from the design radius which may negatively affect installation pull-forces are avoided. In addition to the calculated 3-joint minimum allowable design radius (MADR), CCI recommends the additional minimum 1-joint radius specification as shown in Table 4.

Table 4. Minimum Radius Allowances

	Radius Specification
30ft (single-joint)	Minimum ROC – 1,100 ft
100ft Average (3-joint) / MADR	Minimum ROC – 2,000 ft
Design Radius	5,000 ft

If the contractor adheres to these minimum radius specifications, the product pipe will be within allowable stress limits during installation and operation. It should be noted that a recommended single-joint minimum radius has been included, which is sometimes not specified within HDD designs. Without a single-joint radius specification, it is possible that the contractor may be able to include an excessive steer within a single joint, yet still adhere to the provided 3-joint minimum radius average. In order to avoid overstressing of the pipe that may occur in such an instance, adherence to the single-joint radius specification is recommended.

4.7 LAYDOWN AREA

The design proposes that the product pipe be laid out in one (1) continuous section. The proposed pullback workspace is 100 ft wide and crosses an unnamed road and 52nd Street NW (Highway 17A). The proposed pullback alignment also crosses an un-named creek which would likely require two (2) additional side booms to support the pipe from either side of the creek bed. The creek may need to be diverted, bridged, or infilled within the temporary workspace to support machinery traffic and equipment. From an initial desktop study, most of the designated workspace that is planned to be used during pullback will travel through cleared land, so minimal clearing will be required. Near the end of the pullback section, the workspace turns and parallels Co Highway 17A. To accommodate this curve, the pullback includes a 4000 ft radius horizontal curve.

Due to the usage of 52nd Street, it is expected that it will not be possible to close for pullback and it is expected the pipe will be lifted and supported over the road during pullback operations after final welds.

Due to the pipe size, a significant excavation length would be required if the pipe were to be strung under the road in a culvert. The culvert option could be investigated if permission to support the pipe over the road are not granted.

Based on CCI's stress analysis, the minimum allowable overbend radius of the pullback section is roughly 1,600 ft for the NPS 24 pipe. The stress analysis also yielded a maximum crane/side boom support spacing of 80 ft (based on typical roller-cradle capacities) and roller spacing of 40 ft, assuming adequately sized supports will be used. It is also recommended the maximum unsupported overhang not exceed 60 ft. The overbend radius and maximum support spacing was selected to maintain the imposed stress on the product pipe below 80% of allowable stress as per PRCI and with consideration of roller-cradle capacities.

The pullback alignment described above encounters a relatively level topography, with one geographically noticeable hill approximately 2,800 ft north along the pipe stringing alignment. The hill is gradual and should not affect pullback operations. Given the 14° exit angle, the height of the pullback overbend will reach approximately 35 ft above ground surface. This overbend results in approximately 6 cranes and 3 side booms to support the pipe within the overbend.

At the end of the existing 100 ft wide workspace, CCI has proposed an additional 40' of workspace, ending at the road surface of 54th Street NW. This additional workspace is to allow the pipe to be laid out in one section. Due to the topographical elevation changes within the layout, it is expected the pipe will not be as close to the road as is conservatively shown on the Issued for Permit (IFP) HDD design drawing [2386-EG-0102, Rev D, dated July 31, 2020] provided in Appendix A.

5 HDD ENGINEERING ANALYSES

The proposed HDD design has incorporated supplied topographical information, geotechnical information, and ROW alignment. In addition to these considerations, detailed annular pressure analysis and pipe stress analysis calculations have been completed as outlined below.

5.1 ANNULAR PRESSURE MODELING

The annular pressure (AP) was modeled to simulate the downhole pressure during the pilot hole phase of construction and compare it with the limiting pressure of the substrata above the drill path. The AP simulation was conducted with CCI's analysis tools, which have been developed with industry standard calculation models (Bingham Plastic, General Overburden, and USACE/Delft model) and additional modified safety factors based on our experience from over 15,000 completed HDD crossings. CCI developed geotechnical parameters for the crossing that are closely representative of the soil formations observed in the land boring logs and water boring logs completed by GES at the crossing.

Drilling fluid properties, used to model the downhole pressure during drilling, are dependent on construction practices of the HDD contractor, field conditions, and interpretations of the drilling fluid technician. Annular drilling fluid pressures can significantly change with changes in drilling fluid properties. Therefore, it is important to re-evaluate drilling fluid pressures based on fluid properties during HDD operations and compare them with estimated limiting pressures of the formation. Additionally, annular pressure measurement tools should be used to monitor annular pressure during the HDD installation.

The drilling parameters utilized by CCI for this analysis are based on tooling specifications provided by the drilling contractor and are as follows:

- 13 1/2" drill bit (pilot)
- 7 5/8" drill pipe

- 650 gpm (2.5 m^3/min) fluid pump rate
- 9.6 lb/gal fluid density
- 25 lb/100ft^2 yield point of fluid
- 20 cP plastic viscosity of fluid

Calculated expected annular pressure graphs for each drill direction were produced with the above drilling parameters and are modeled in Figure 3 and Figure 4. These annular pressure graphs form the basis for establishing whether a proposed HDD crossing is at risk for hydraulic fracture during the pilot hole phase. This graph shows a calculated expected downhole pressure, as well as an *Operating Zone* above the expected downhole pressure, shown as 125% of the calculated pressure. According to this model, drilling pressures that exceed the overburden fracture pressure do not necessarily indicate a fracture will occur, but rather a higher risk that hydraulic fracture may occur in those areas.

CCI has reviewed and incorporated the geotechnical program laboratory testing results from the geotechnical investigation and developed three geotechnical parameter sets for this crossing. These geotechnical parameter sets represent a “Firm CL-CI Clay” layer at surface, a variable thickness “Compact Sand” layer, and a “Shale Bedrock” layer in which the drill progresses for the majority of the crossing. The Parameters utilized by CCI are listed below.

Firm CL-CI:

- 26° Internal Angle of Friction
- 200 psf Cohesion Coefficient
- 120 pcf Unit weight of Soil
- 0.4 ksi Shear Modulus of the Soil
- Variable Radius of Plastic Zone based on soil parameters

Compact Sand:

- 32° Internal Angle of Friction
- 0 psf Cohesion Coefficient
- 125 pcf Unit weight of Soil
- 2.2 ksi Shear Modulus of the Soil
- Variable Radius of Plastic Zone based on soil parameters

Shale Bedrock:

- 26° Internal Angle of Friction
- 902 psf Cohesion Coefficient
- 131 pcf Unit weight of Bedrock
- 6.7 ksi Shear Modulus of the Bedrock
- Variable Radius of Plastic Zone based on soil parameters

Due to the length of the Missouri River HDD crossing, the crossing will be completed by intersect methodology. Figure 3 and 4 represent the annular pressure curves for the north and south portions of the HDD pilot hole. The Intersect Zone is shown on both drills, and represents the maximum length drilled from either side. The graphs shown are based on a modified CCI Delft equation. The modified Delft equation used here utilizes a smaller Radius of Plastic Zone than the standard Delft equation which results in much lower limiting pressure outputs, equating to more conservative allowable pressures in the curves shown below than would be shown in typical Delft model outputs.

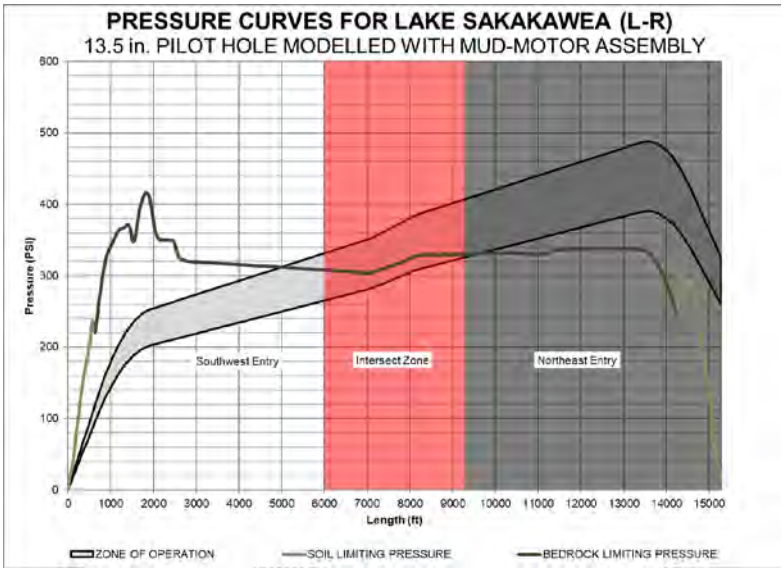


Figure 3. Modeled Annular Pressure During South Pilot Hole

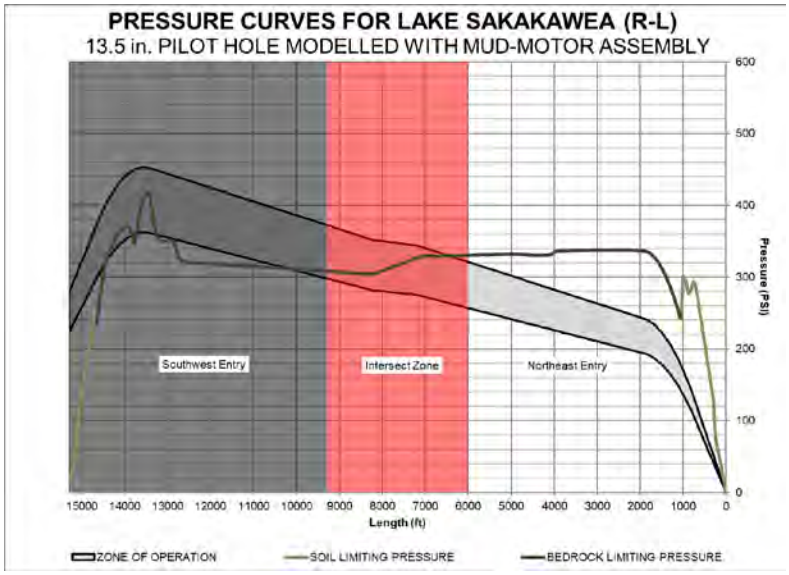


Figure 4. Modeled Annular Pressure During North Pilot Hole

The modified CCI annular pressure graphs above suggest that the drilling pressures remain below the limiting pressures of the overburden along the first 5000-6000 ft of the drill from either side. Within the 5000-8000 ft measured depth range, the lower operating pressures are below or slightly over the limiting over burden pressures. Once past the planned intersect zones, the drilling pressures greatly exceed the overburden pressure, illustrating the need for an intersect based on annular pressure considerations. Within the middle section of the drill, near the intersect zone, the risk of hydraulic fracture for the HDD is moderate.

The annular pressure graphs in Figures 5 and 6, below, have been run using the standard USACE Delft equation. These annular pressure graphs correspond to the factor of safety graphs seen in Figures 7 and 8.

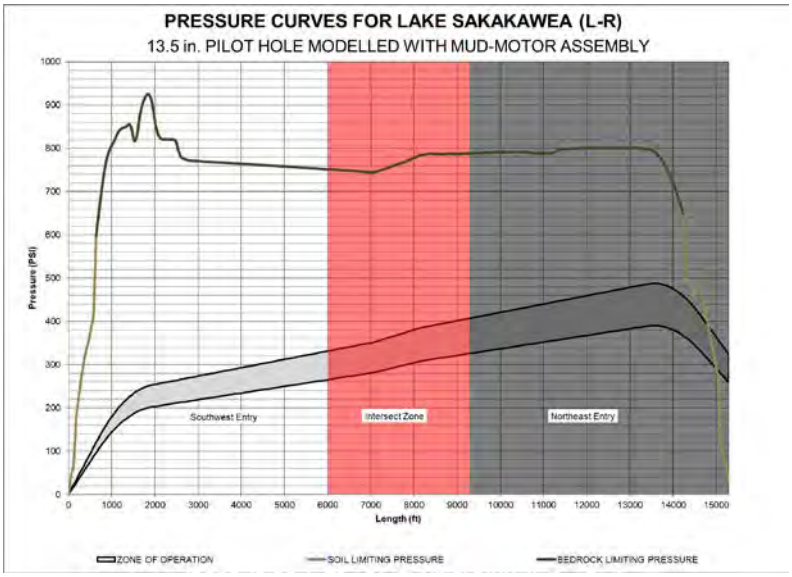


Figure 5. USACE Modeled Annular Pressure During South Pilot Hole

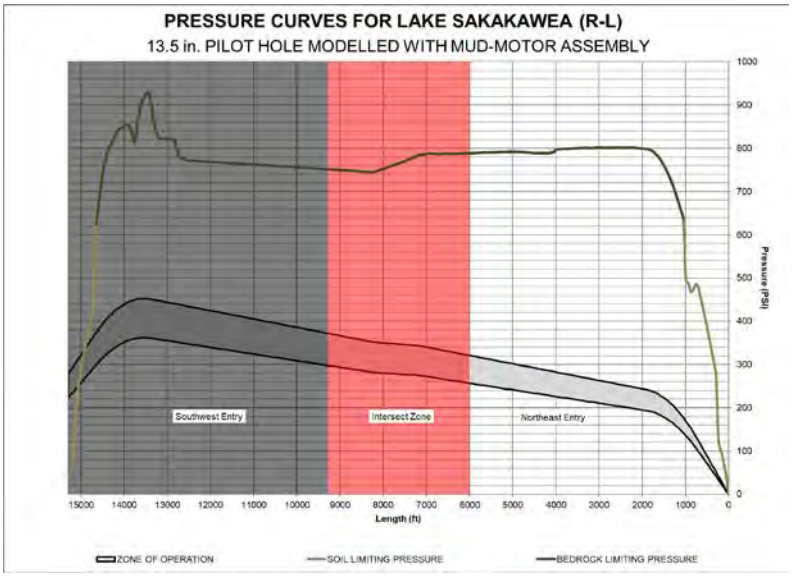


Figure 6. USACE Modeled Annular Pressure During North Pilot Hole

USACE requires a factor of safety against hydraulic fracturing, generally in the 2.0 range, for the portion of the drill passing beneath a regulated waterbody. The factor of safety is calculated by dividing the calculated limiting pressure of the formation by the expected annular pressure along the length of the drill path. Figure 7 and 8 shows the factor of safety against hydraulically fracturing the formation during pilot hole installations utilizing the standard USACE calculation models without any additional factor of safety applied to the equations at the design depth.

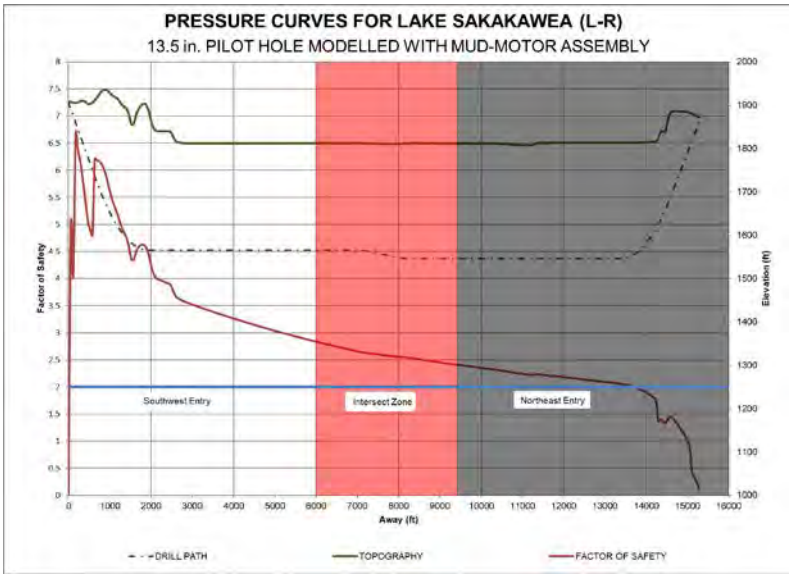


Figure 7. Factor of Safety Against Hydraulic Fracture South Pilot Hole

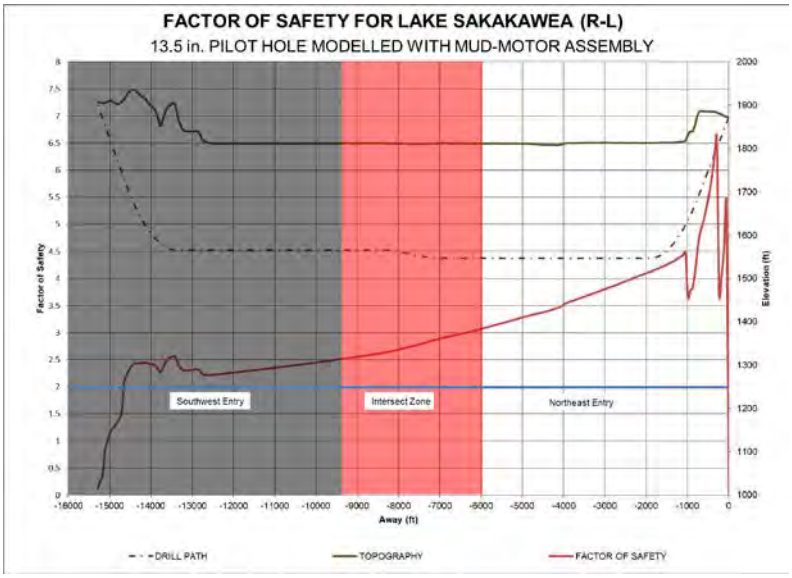


Figure 8. Factor of Safety Against Hydraulic Fracture North Pilot Hole

Figure 7 and 8 indicate that the Factor of Safety (FOS) against hydraulic fracture is above 2.0 for the entire planned pilot hole from the south and north sides. Utilizing USACE calculations, the FOS is roughly 2.5-4 below the Missouri River. Based on the results of the analysis, the HDD design meets the USACE minimum requirements for factor of safety against hydraulic fracture.

During construction, the risk and impact of hydraulic fracture and inadvertent returns (IR) to surface can be reduced by implementing preventative measures during pilot hole. It is recommended that the contractor reduce pump rates as the drills approach the intersect location. It is also recommended that contractor maintain drilling fluid densities at the low end of what is industry standard. An annular pressure

tool should be used during construction to monitor pressures as the drill progresses, avoiding exceeding containment pressures under any critical locations, as required by the USACE. The contractor should review the drilling fluid parameters and tooling and ensure the proposed equipment is in alignment. It may be preferential to utilize a larger drill bit to increase the annular space and decrease the expected pressures.

5.2 HDD STRESS ANALYSIS

The installation and operating conditions imposed on the product pipe during and after installation have been modelled against the respective code requirements as laid out in Section 2. The HDD stress modeling determines if given pipe specifications are adequate for the design.

5.2.1 Pulling Load

To pull the product line inside the borehole, the pull force must overcome several resisting forces including effective weight of the pipe, fluidic drag, frictional drag between the pipe and the borehole walls and between the pipe and the rollers, drag due to length of drill string in the hole, and the reamer assembly in front of the pull section.

The pull force has been calculated with the assumption that the pipe will be installed in one continuous section with no mid-welds as it is suspected there will be sufficient, or nearly sufficient, workspace. It is expected a small section of pipe may need to be pulled into the borehole prior to a single, final weld. This portion of the pipe would be expected to be in the surface casing, and it is not anticipated increased pull forces will be experienced due to this stop near the beginning of pull. If the pipeline installation requires multiple sections beyond this short initial section, the pull forces should be reevaluated to account for the effects of downtime due to intermittent welds during pullback. The soil around the borehole could slough or swell while the pipe remains stationary downhole during the welding process which would result in increased friction on the pipe during pulling.

The calculated expected installation pull force is dependent on the geometry of the HDD, geologic formations present along the drill path, drilling mud properties, and pipe size and weight. CCI has calculated the expected range of pull forces for the product pipe installation, accounting for typical ranges of downhole mud densities. In this analysis, 9.5 ppg (pounds per gallon) drilling fluid is applicable for relatively clean drilling fluid with minimal suspended cuttings, while 12 ppg fluid would be applicable for relatively “dirty” drilling fluid containing significant suspended solids and cuttings. CCI utilizes a safety factor of 1.5 when calculating pull force to account for variations in drilling practices, geology, etc. and addition of the reamer and swivel in the pullback bottom hole assembly. CCI has calculated pull forces for the proposed HDD crossings with and without the additional factor of safety. The calculated pull forces are shown in Table 5. Due to the wall thickness of the product pipe and its associated weight, the pipe is relatively close to neutrally buoyant and therefore buoyancy control is not required for this installation.

Table 5. Pullforce Calculation Analysis

	Drilling Fluid (9.5 ppg)	Drilling Fluid (12 ppg)
Pull force	502,000 lbs	640,000 lbs
Pull force incl. 1.5 x S.F.	752,000 lbs	960,000 lbs

5.2.2 Installation & Operating Stresses

As the pipeline is installed through the final borehole, it is subjected to three primary loading conditions: tension, bending, and external (hoop) pressure. As part of the design process, the individual stresses and their combined effect on the pipe were evaluated to check the pipeline potential for failure.

During operation, the stress imposed on a pipeline installed by HDD is similar to a conventionally installed pipe with the exception of the elastic bending resulting from a continually welded pipeline pulled through a curved borehole. The operating loads including bending, net hoop stress (difference between external and internal pressures), thermal expansion, and combined stresses were checked to evaluate the risk of failure for the NPS 24 product pipe.

The stress analysis completed by CCI based on the design geometry, pipe specifications, and operating conditions for the proposed HDD installation is summarized in Table 6.

A summary of the maximum expected installation and operating stresses and their allowable limits are presented in Appendix B.

Table 6. Installation & Operating Stresses

	Missouri River HDD Crossing	
	Installation Stresses	**% of Allowable (PRCI)**
Maximum Tensile Stress (PRCI 5.1.1, 5.5)	8,935 psi	16.5%
Maximum Bending Stress (PRCI 5.2.2)	5,900 psi	13.1%
Maximum Hoop Stress (PRCI 5.2.3)	2,642 psi	11.3%
Maximum Operating Stress (PRCI 5.4.4.2)	13,000 psi	48.1%
Maximum Combined Installation Stress (tensile and bending) (PRCI 5.2.4)	0.29	29%
Maximum Combined Installation Stress (tensile, bending, and hoop) (PRCI 5.2.4)	0.10	10%

5.2.3 Pipe Lifting Stress Modeling

An analysis was completed to evaluate stresses and imposed loading on the product pipe and supporting equipment during lifting and pullback operations. Minimum support spacing was determined based on pipe specifications and capacity of expected equipment. Summaries of the maximum expected support loading and stresses on the pipe and supports are presented in Appendix B.

The lifting plan requirements including minimum allowable overbend radii, maximum support spacing and maximum allowable overhang to not overstress the pipe or supporting equipment are shown in Table 7. The stresses imposed on the pipeline and loadings on supporting equipment during pullback are also shown. The stress analysis assumes that the pipe is installed empty without buoyancy control.

Table 7. Pullback Support Stresses & Loading

Parameter	
Tensile Stress / % SMYS	10,412 psi / 20%
Bending Stress / % SMYS	18,718 psi / 36%
Combined Tensile & Bending Stress / % SMYS	28,400 psi / 55%
Vertical Load at Support	55,400 lbs
Longitudinal Load At Support	5,540 lbs

Parameter	
Vertical Load at Roller Support	9,700 lbs
Support Spacing	80 ft
Roller Spacing	40 ft
Maximum Unsupported Overhang	60 ft
Overbend Radius	1,600 ft

CCI recommends that designed stresses imposed on the product pipe during pullback are limited to 80% SMYS to account for mishandling in the field during maneuvering and installation. The results from the stress analysis completed for the pullback show that the pipe will be subjected to stresses that are below the recommended limit and are therefore considered acceptable.

CCI recommends that the contractor selects adequately sized lifting equipment and rollers that can handle the expected loadings while providing an adequate factor of safety as per OSHA requirements. CCI recommends that the selected contractor independently evaluate the pullback and pipe lifting plan and account for weather conditions such as snow, rain, and winds to ensure that the equipment and product pipe do not become overloaded or overstressed during pipe handling and pullback.

5.2.4 Design Summary

For this crossing, the operating stresses govern the design of the pipe, and not the installation stresses. Calculations carried out by CCI indicate that the provided pipe specifications are suitable for the HDD installation, based upon the installation and operating conditions supplied.

5.3 HDD CONSTRUCTION RISK ASSESSMENT

The main construction risks and challenges for the Missouri River HDD crossing were identified in the risk assessment conducted by CCI, based on available data and previous experience. The risk items are ranked into the risk categories ranging from low risk to very high risk based on the probability and the consequence of each risk factor.

The descriptions of risk items and a summary of the risk assessment for the crossing detailing the risks prior to any mitigation and after mitigation is presented in Appendix C. The following are major risks and the main mitigation strategies developed.

Casing Installation / Removal:

Casing not Being Installed to Depth

Risk: Geotechnical conditions near surface can pose a problem when driving casing to a designed depth. It is expected both the entry and exit locations will require casing. The entry (south) is expected to be cased to the shale/siltstone bedrock, and the exit location will be cased past the coal layer. The proposed lengths of casing install, although expected to be achievable, are quite considerable.

Mitigation: Achievable casing installation lengths should be investigated prior to construction. The casing should be installed in 160-200ft lengths of telescoped casing. The final casing size shall be 48" and the initial casing should be sized to ensure the final casing will reach the required depth for seating.

Casing Not Being Fully Removed Upon Completion

Risk: Due to the proposed lengths of casing install, the makeup of the subsurface material traversed by the casing, and the expected length of time the casing will remain stationary, there is a risk that the full lengths of casing on either end may not be easily or successfully removed after completion of the product pipe installation.

Mitigation: Contractor shall submit casing plan that includes proper welding specifications to ensure integrity of the casing. Contractor shall also have a mitigation plan for grouting off any portions of casing left below-ground. Owner's integrity management personnel shall evaluate impact of casing left downhole and have a suitable cathodic protection mitigation plan prepared to address any possible related concerns.

Pilot Hole Operations:

Fracture to Water Body

Risk: Fractured formations (including coal seams as identified within the bedrock formation) or high annular pressures could result in release of fluid to surface. The length of the Missouri River crossing results in high pressures due to the building friction forces. The bedrock layer is inconsistent and dips significantly in the middle of the Missouri River, reducing the expected strength of the overburden formation.

Mitigation: The crossing is designed to be completed as an intersect which will limit the expected drilling pressures. The crossing has been designed with significant depth to limit the potential for fracture. Casing will also help with circulation back to entry/exit locations, which should reduce the potential for climbing annular pressures. Contractor shall utilize an Annular Pressure Tool to measure actual downhole pressures during drilling of the pilot hole to ensure any significant increases in pressure beyond planned ranges can be addressed and reduced to within expected ranges with mechanical tripping or additional circulation as applicable.

Large Fluid Loss to the Formation

Risk: Drilling fluid has the potential to migrate outside of the designed drill path in fractures. The crossing location is characterized by several coal seams, including two thick coal seams above and below the bottom tangent of the drill path, which may act as preferential path for drilling fluid.

Mitigation: The drill depth has been chosen to limit the risk of fracture to surface. Casing is included in the design to minimize the amount of coal seams the drill path will encounter. The contractor shall develop a mitigation plan for reducing significant losses where possible, including the use of Loss Circulation Material (LCM) pills to try to plug off any encountered zones of significant fluid loss.

Steering Control Issues

Risk: The crossing is 15,393ft long and each rig will need to drill approximately 7,000 – 8,000 ft. Maintaining weight on bit in order to be able to steer at this length is expected to be difficult, complicating the intersect operations.

Mitigation: The crossing is designed with a large radius which will reduce the steering requirements. The Contractor is utilizing 7 5/8" drill string and gyro steering systems to ensure accuracy and a successful intersect. The bottom tangent is very long and will allow the drills

sufficient time to align for intersect operations. Casing at the entry and exit locations may help to maintain weight on bit.

Annular Pressure Issues

Risk: Drilling operations require soil cuttings to be cleaned out of the bore and hydro-transported back to the rig by the drilling fluid. This process requires large volumes of pressurized drilling fluid to be pumped downhole. The length of the crossing will increase the risk of annular pressure issues.

Mitigation: The Contractor shall maintain returns to both entry pits and monitor annular pressures. A mud engineer shall be on site to monitor adherence to the crossing specific Engineered Drilling Fluid Plan (EDFP). A bottoms up procedure (circulating the calculated amount of fluid that it takes to flow from the bit downhole back up to the entry pit) should be in place and followed when necessary to clean the hole.

Over Schedule Risk

Risk: Geotechnical conditions, permitting, and environmental issues can all contribute to delays in the schedule. The crossing is long with a large borehole size. Over schedule could significantly increase costs. Significant delays could have a large financial impact due to delay to in-service date.

Mitigation: All requirements of the permits should be strictly followed. The Contractor shall ensure proper drilling procedures are in place. Encountered geotechnical conditions should be monitored and reported during drilling so modifications can be made to execution strategy, as required, to ensure no negative impacts. It is recommended construction proceed 24/7 with 2 12hr rotational shifts per day.

Disposal of Drilling Fluid

Risk: Drilling fluid needs to be stored and disposed of. Running out of temporary storage can lead to schedule delays and environmental concerns. The length and large borehole size will result in significant volumes of drilling fluid. Drilling fluid may be contaminated due to coal seams.

Mitigation: Adequate storage should be on site. An EDFP should be followed and an adequate recycling system will be on site. An approved disposal plan should be developed prior to construction. Facility disposal should be expected.

Reaming Operations:

Over Schedule Risk

Risk: Geotechnical conditions, permitting, and environmental issues can all contribute to delays in the schedule. The crossing is long with a large borehole size. Over schedule could significantly increase costs. Significant delays could have a large financial impact due to delay to in-service date.

Mitigation: All requirements of the permits should be strictly followed. The Contractor shall ensure proper drilling procedures are in place. Encountered geotechnical conditions should be monitored and reported during drilling so modifications can be made to execution strategy, as required, to ensure no negative impacts. Using two rigs will split the workload which would be normally be placed upon a single rig.

Loss of Equipment in the Borehole

Risk: Reaming or enlarging the bore to the desired diameter may cause instability areas. These areas may cause downhole tooling to get stuck or lost. Loss of equipment within the borehole is a larger risk than with a shorter crossing.

Mitigation: The utilization of intersect methodology will mitigate the risk of losing equipment within the borehole. Using two rigs will split the workload which would be normally be placed upon a single rig. If problems arise on one side of the reamer, the opposite rig will maintain contact with the downhole tooling and be able to trip to surface. Drill string management plan should be provided by the contractor, which should include regularly switching out drill stem on either side of the reamers.

Poor Removal of Cuttings

Risk: Due to the large ream pass and length a large volume of cuttings will be created and therefore will have to be removed from the borehole.

Mitigation: Drilling fluid parameters will be optimized for maximum cutting transportation, through adherence to the EDFP. High pump rates throughout the ream passes of the HDD will increase the annular velocity and therefore carrying capacity. Additional trips will be necessary to mechanically remove cuttings from the borehole. The number of trips required will be based on the borehole conditions. The cut size should ensure that cuttings can be removed.

Drilling Fluid Control

Risk: As the volume of drilling fluid within the borehole increases, it becomes more difficult to change its properties with drilling fluid additives. The large diameter borehole combined with the length will impact the quality and makeup of the drilling fluid. Coal seams may contaminate drilling fluid. Contractor will be hauling in water.

Mitigation: The Contractor should prepare and adhere to an approved EDFP which will outline the steps required to ensure the highest quality of drilling fluid is used for the crossing. A premix tank should be made available in addition to the mud tank. Contractor should continue to adhere to the EDFP throughout reaming operations even if they are experiencing fluid losses.

Pullback Operations:

Stuck Pipe

Risk: There is a risk that the pipe section becomes stuck in the borehole due to borehole length, instability, blockages, or irregularities. The pullforce for this length is between approximately 502,000 and 960,000lbs.

Mitigation: One or more wiper trips shall be completed to ensure a clean hole. Required force should be monitored during the wiper passes. It is recommended that a Pipe Thruster (with custom inserts for NPS 24) be available on exit side to assist the rig with pullback in the event pullforces start to become exceedingly high.

Pull Forces Exceeding Theoretical Model

Risk: There is a risk that pull forces exceed the theoretical model, especially with the length of the drill. Contributing factors can include cuttings in the borehole, having to temporarily halt line pull, borehole instability, and heavy drilling fluid.

Mitigation: A swab pass should be completed and downtime during installation should be minimized. It is expected pipe pull will continue overnight as required. This should be planned for with crews in advance, lighting shall be sufficient to allow overnight operations for pull. Pipe thruster should be available on exit side to assist the rig will pullback.

Coating Damage

Risk: Gravel, cobbles, boulders, and bedrock interfaces within the bore path pose a risk that the pipe coating is damaged during line pull.

Mitigation: Wiper passes shall be completed to gauge any possible areas of issue, and additional passes may be used to ensure minimized risk prior to pullback. FBE and ARO coated pipe shall be used.

Pipe Handling

Risk: The exit angle, wall thickness, and size of the pipe result in a large radius overbend that reaches a height of 35 ft. The pipe section requires significant support equipment.

Mitigation: A pullback lift plan should be created prior to construction for review and approval. The equipment capacities should be sufficient for the anticipated loads. Spreader bars may reduce crane requirements. A traffic plan should be created for Highway 17A (52nd Street NW) and 54th Street NW (if required).

Pipe Preparation:

Over Schedule Risk

Risk: There is significant support equipment required for pullback. If pullback is delayed this could be a large cost to keep the equipment on site. If the pipe section is not ready for pull the hole could tighten.

Mitigation: A pullback lift plan should be created prior to construction for review and approval. The equipment capacities should be sufficient for the anticipated loads. Spreader bars may reduce crane requirements. A traffic plan should be created for Highway 17A (52nd Street NW) and 54th Street NW (if required). Progress of the HDD should be tracked closely.

Other Risks:

Crossing Length

Risk: The crossing is 15,393ft long, approaching record lengths for an HDD crossing. There is a risk that the crossing could encounter compounding issues that lead to the crossing not being completed successfully.

Mitigation: A competent contractor with adequate tooling and relevant experience with similarly large installations has been selected. The risks should be highlighted to all stakeholders.

Access to Water

Risk: Water sources should be investigated/confirmed. Water transport should be a major consideration.

Mitigation: Additional transport and water sources should be investigated prior to construction. Transport should include contingency to ensure a lack of water does not lead to any delays with progress of the drill, particularly in the event of significant fluid losses during drilling, where large volumes of make-up water may be required.

Public Attention

Risk: Scrutiny is possible in the area. There is a risk of negative public perception issues. The summer season will see high levels of lake use.

Mitigation: The contractor shall ensure all procedures are being followed and their impact is minimized. The contractor shall ensure all correspondence with the public is completed by WBI representation.

6 RECOMMENDATIONS

The following recommendations outline the main action items that should be completed in order to ensure smooth progression of the project into the construction phase:

a) Review of information by all stakeholders and issuance of the Issued for Construction (IFC) drawings incorporating any changes from the Owner, environment, or other consultants.

b) Ensure that all the requirements of the USACE Omaha district are met, and an open line of communication is maintained throughout design and construction.

c) Ensure all required ROW and TWS, environmental notifications and permits, and water withdrawal and disposal sites are acquired.

d) Review the Construction Execution Plan, including but not limited to Pullback Plan, Water Management and Drilling Fluid Disposal Plan, Drilling Rig Anchoring Plan, Casing Plan, and Site-Specific Environmental Plan.

e) Scope of construction inspection, turbidity monitoring and fluid disposal management services should be identified.

f) Review any new environmental concerns with respect to the crossings and develop contingency plans if required.

g) Select an appropriate level of qualified supervision on site for all stages of the drill to ensure that the drill profile is adhered to within the radius limits set forth on the IFC drawing, the proper drilling techniques and equipment are utilized, and schedule and costs are controlled.

h) Select a qualified drilling contractor with experience completing HDD installations of similar size and scope in the area who is familiar with the local geologic formations and associated risks.

7 CONCLUSIONS

This assessment shows the risks identified on the Missouri River NPS 24 HDD crossing and if adequately mitigated, reduces the overall impact on the project. Based on the available data, it is deemed feasible to construct the Missouri River HDD crossing along the proposed North Bakken Expansion Pipeline project

successfully. The crossing is one of the longest HDD crossings completed, and there is potential for an unsuccessful HDD installation, however, this risk will be minimized if the recommendations included within this report are followed.

8 LIMITATIONS

This report has been prepared based on the available site-specific information for the exclusive use of WBI in the construction of the proposed Missouri River HDD crossing. No other warranty is expressed or implied and the information presented within this report shall not be applied to other projects.

Although subsurface conditions are not expected to vary significantly from those shown on the drawings, it should be appreciated that extrapolation of subsurface conditions between boreholes and to depths below the depth of exploration is subject to interpretation and could be at variance with actual field conditions.

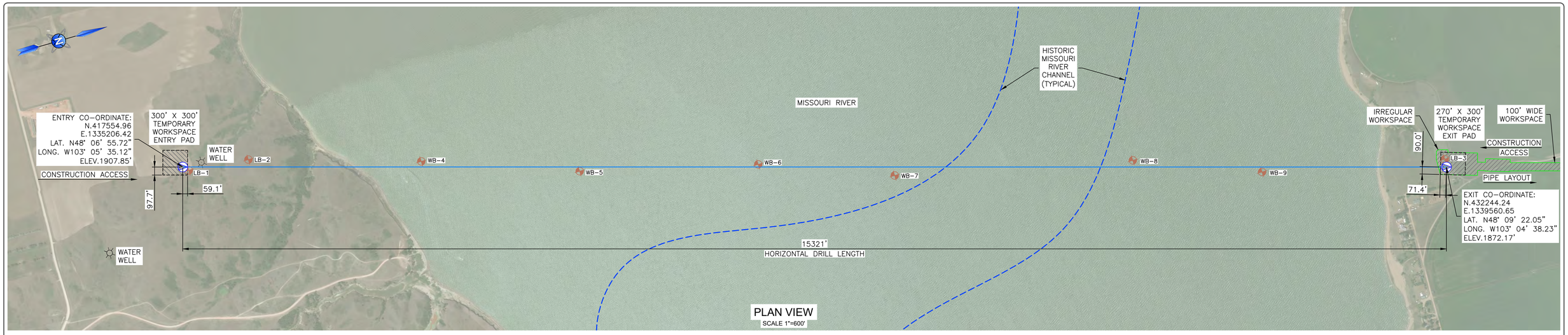
9 REFERENCE DOCUMENTS – HDD DESIGN DRAWINGS

Drawing Name	Drawing Number	Revision	Sheet
Missouri River HDD Crossing Plan and Profile	2386-EG-0101	G	1 of 3
Missouri River HDD Pullback Plan and Detail	2386-EG-0102	D	2 of 3
Missouri River HDD Construction Notes	2386-EG-0103	A	3 of 3

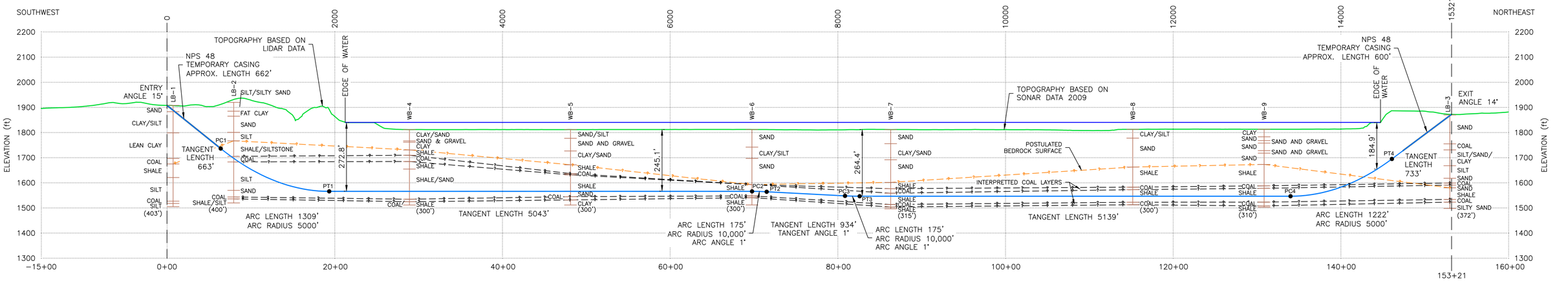
Geotechnical Report: WBI North Bakken Land-based Geotech Report

Geotechnical Report: WBI North Bakken Water-based Geotech Report

APPENDIX A – HDD DESIGN DRAWINGS



PLAN VIEW
SCALE 1"=600'



PROFILE ALONG PROPOSED PIPELINE
SCALE 1"=600' HORIZONTAL
SCALE 1"=200' VERTICAL

TOTAL DRILL LENGTH 15393'

HORIZONTAL DIRECTIONAL DRILL DATA MISSOURI RIVER HDD		
DESCRIPTION	STATION (ft)	ELEVATION (ft)
ENTRY @ 15°	0+00.00	1907.85
PC1 = 5000' RADIUS	6+40.51	1736.23
PT1	19+34.61	1565.86
PC2 = 10,000' RADIUS	69+78.43	1565.86
PT2	71+52.95	1564.33
PC3 = 10,000' RADIUS	80+87.31	1548.02
PT3	82+61.83	1546.50
PC4 = 5000' RADIUS	134+00.95	1546.50
PT4	146+10.56	1695.02
EXIT @ 14°	153+21.04	1872.17
HORIZONTAL DISTANCE (ft) = 15321.04		
DIRECTIONAL DRILL PIPE LENGTH (ft) = 15392.57		

Pilot Hole Tolerances	
Item	Tolerance
Pilot Entry Angle	Increase in angle up to 1° (deeper), but no decrease in angle allowed as long as minimum 3-joint bending radius is not compromised.
Pilot Entry Location	As staked by COMPANY. No change without COMPANY approval.
Pilot Exit Angle	Change in angle up to +/-1° allowed as long as minimum 3-joint bending radius is not compromised.
Pilot Exit Location	Up to 40 feet longer or 10 feet shorter than exit stake. Between 10 feet left and 10 feet right of COMPANY survey centerline.
Pilot Depth	Up to 5 feet decrease in design depth (shallower) allowed except under critical areas such as roads, utilities, levees etc. near the entry and exit points. Up to 10 feet increase in depth (deeper) allowed. Best efforts shall be made to stay at or below pipe design profile depth.
Pilot Alignment	Shall remain within 10 feet left or right of COMPANY centerline survey.

GEOTECHNICAL BORE HOLE INFORMATION			
BOREHOLE	LATITUDE	LONGITUDE	DEPTH (ft)
LB-1	48° 6' 56.33"	-103° 5' 34.23"	403
LB-2	48° 7' 3.56"	-103° 5' 33.40"	400
LB-3	48° 9' 22.10"	-103° 4'39.62"	372
WB-4	48° 7' 23.30"	-103° 5'25.93"	300
WB-5	48° 7' 42.24"	-103° 5' 15.52"	300
WB-6	48° 8' 2.38"	-103° 5' 10.74"	300
WB-7	48° 8' 17.93"	-103° 5' 1.65"	315
WB-8	48° 8' 45.61"	-103° 4' 53.93"	300
WB-9	48° 9' 0.54"	-103° 4' 45.08"	310

REFERENCE DOCUMENT NO.	DATE
1. NBE_PL-PROPOSED_ROUTES 190824	2019-08-24
2. 2386-01-IMP STEEL STRESS-24-inch-02	2020-07-30

ENGINEER AND PERMIT STAMPS

PIPELINE SPECIFICATIONS	NPS 24
OUTSIDE DIAMETER (OD)(in)	24
WALL THICKNESS (WT)(in)	0.99
GRADE (psi)	60,000
PRODUCT	NATURAL GAS
MATERIAL	STEEL
SPECIFICATIONS	API 5L
INTERNAL COATING	N/A
OUTER COATING	DUAL FBE
MAX. OPER. PRESSURE (psi)	1,480
MIN. TEST PRESSURE (psi)	1,850
MAX. OPER. TEMP (°F)	100
MIN. INSTALLATION TEMP (°F)	60

STEERING TOLERANCES	30ft	100ft	DESIGN
MINIMUM RADIUS (ft)	1100	2000	5000

PULL FORCE / RIG SIZE / STRESS	
PULL FORCE (w/o BUOYANCY CONTROL):	752,000 lbs (w/sf)
MINIMUM RECOMMENDED RIG SIZE:	1,000,000 lbs
COMBINED STRESS UNITY CHECK:	0.29
OPERATING STRESS	48.1%

DRAWING STATUS	DATE	DRN	CHK	DES	GEO	APR	CR
ISSUED FOR PERMIT	2020-07-31	MS	EY	CG	LC	KP	NM

LOCATION PLAN (1"=7000')

NAD83.ND-Nft

WBI ENERGY TRANSMISSION
An MDU Resources Group company

WBI NORTH BAKKEN EXPANSION PROJECT
MISSOURI RIVER HDD CROSSING
PLAN AND PROFILE
WATFORD CITY / TIOGA, MCKENZIE COUNTY, NORTH DAKOTA

SCALE	DWG. #	REVISION	SHEET
AS SHOWN	2386-EG-0101	G	1 OF 3

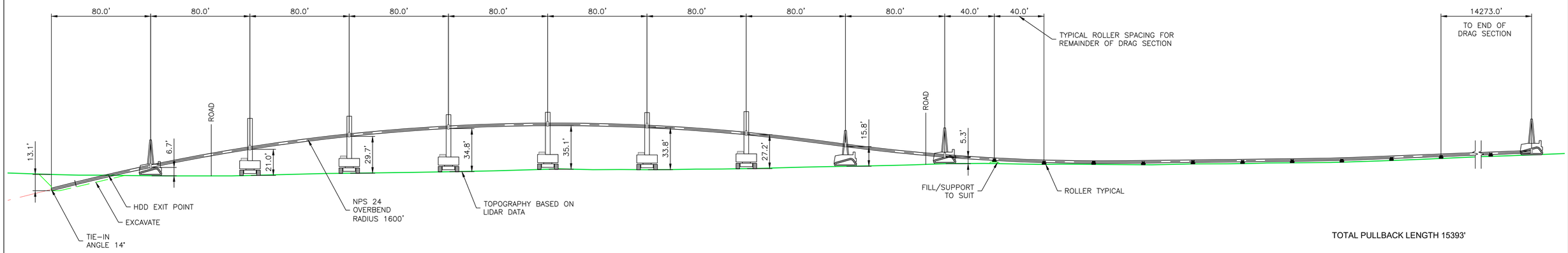
CCI & Associates Inc.
20445 State Highway 249, Suite 250
Houston, TX 77070
COCP 27692PE

1"=600'
FT 0 600 1200 2400

1"=200'
FT 0 200 400 800

PULLBACK PLAN VIEW

SCALE 1"=600'



TOTAL PULLBACK LENGTH 15393'

PULLBACK DETAIL

SCALE 1"=40' HORIZONTAL
SCALE 1"=40' VERTICAL

REFERENCE DOCUMENT NO.	DATE
1. NBE_PL-PROPOSED_ROUTES 190824	2019-08-24
2. 2386-01-IMP STEEL STRESS-24-inch-02	2020-07-30

CCI & Associates Inc.
20445 State Highway 249, Suite 250
Houston, TX 77070
COCP 27692PE

ENGINEER AND PERMIT STAMPS

1"=600'
FT 0 600 1200 2400

1"=40'
FT 0 40 80 160

PIPELINE SPECIFICATIONS

	NPS 24
OUTSIDE DIAMETER (OD)(in)	24
WALL THICKNESS (WT)(in)	0.99
GRADE (psi)	60,000
PRODUCT	NATURAL GAS
MATERIAL	STEEL
SPECIFICATIONS	API 5L
INTERNAL COATING	N/A
OUTER COATING	DUAL FBE
MAX. OPER. PRESSURE (psi)	1,480
MIN. TEST PRESSURE (psi)	1,850
MAX. OPER. TEMP (°F)	100
MIN. INSTALLATION TEMP (°F)	60

PULL FORCE / RIG SIZE / STRESS

PULL FORCE (w/o BUOYANCY CONTROL):	752,000 lbs (w/sf)
MINIMUM RECOMMENDED RIG SIZE:	1,000,000 lbs

DRAWING STATUS	DATE	DRN	CHK	DES	GEO	APR	CR
ISSUED FOR PERMIT	2020-07-31	MH	EY	CG	N/A	KP	NM

LOCATION PLAN (1"=7000')

NAD83.ND-Nft

WBI ENERGY TRANSMISSION
An MDU Resources Group company

WBI NORTH BAKKEN EXPANSION PROJECT

MISSOURI RIVER HDD CROSSING
PULLBACK PLAN AND DETAIL

TIOGA, MCKENZIE COUNTY, NORTH DAKOTA

SCALE	DWG. #	REVISION	SHEET
AS SHOWN	2386-EG-0102	D	2 OF 3

NOTES

1. All dimensions are in feet unless otherwise specified. All dimensions are to the centerline of borehole unless otherwise specified.
2. All drill path lengths are rounded to the nearest foot and angles are rounded to the nearest degree, unless otherwise specified.
3. This drawing is based on information provided from various sources. Consulting company does not take responsibility for the accuracy of information provided by others.
4. The crossing shall be constructed in accordance with ASME B31.8 2018.

CONSTRUCTION

5. The estimated theoretical pull force (including safety factor) for this HDD crossing has been calculated to be 752,000 lbs without the consideration of pipeline buoyancy control.
6. Assumed final borehole size is 36".
7. The Contractor shall submit a Drilling Execution Plan for Company approval (prior to start of drilling operations) meeting the minimum requirements of the Contract Documents. Any deviation from the Execution Plan shall only be allowed with Company approval.
8. The Contractor shall verify topographical survey information represented on this drawing in the field prior to construction. Contractor shall inform the Owner of any topographical discrepancies identified.
9. The design drill path and existing utilities being crossed shall have a minimum separation of 10ft.
10. Contractor shall supply and use an approved annular pressure tool capable of operating within the expected pressure range. Annular pressure information provided is based on a mud motor assembly for a 13 1/2" pilot hole.
11. The locations of existing utilities, pipelines and structures shown on the drawing are approximate and shall be verified in the field by the Contractor prior to start of any excavation or pilot hole operations. Verification shall be in accordance with Company specifications and procedures. The Contractor shall ensure any utilities, pipelines and structures in the area are protected and not damaged by the construction.
12. The Contractor shall take specific precautions in protecting existing utilities, pipelines and structures at the entry and exit sites. Such precautions may include: entry/exit pits excavated below existing utilities, casing or sheet piling used to protect pipelines, ramping/matting and special drilling precautions employed during drilling. These precautions shall be used to ensure the drilling tools, pipe and product pipe maintain a safe distance from the existing pipelines, utilities and structures.
13. The Contractor shall assess the need for temporary casing, including both small diameter "wash-over" type casing during pilot hole, and large diameter hammered-in place casing. If large diameter casing is utilized, casing shall be sized to accommodate the final ream pass and shall utilize centralizer casing within the temporary conductor casing. Casing diameter, wall thickness, grade, and drive shoe design shall be determined by the Contractor. A Contractor's Casing Plan shall be submitted and approved by Company prior to casing installation. All temporary casings shall be removed at completion unless otherwise noted.
14. The pilot hole shall be drilled along the design drill path with the designated design radius of curvature shown in the drawing. The pilot hole shall be within the pilot hole tolerances noted on the drawing.
15. The design radius for this crossing is 5000 ft. The pilot hole drilling shall adhere to the following tolerances:
    30ft (single joint) radius shall not be less than 1100 ft
    100ft (3-joint) average radius shall not be less than 2000 ft
16. Crossing to be completed using an intersect methodology utilizing an HDD rig on either side of the crossing. Intersect shall be planned for near the mid-point of the drill geometry in order to ensure minimized risk of drilling fluid release throughout the drill.
17. This engineered design is based on the following minimum equipment requirements that the Contractor shall have onsite:
    a. Drilling Equipment:
    - Drilling Rig with a minimum pull force of 1,000,000 lbs;
    - Drill Pipe 7 5/8" (inspected as per the HDD specification);
    - Drill Bit – 13 1/2" in diameter or larger (provide details, condition, and supplier);
    - 8" Mud Motor or larger capable of running within its specified maximum load range (provide details, condition, and supplier);
    - Annular Pressure Tool (0 to 510 psi range);
    - Reamers designed for the formation (provide manufacturer's operating specifications, condition, and supplier);
    - Gyroscopic steering system;
    - Casing (specifications and details to be provided for approval).

    b. Drilling Fluid Recycling Equipment:
    - Pump Capacity (Operable Rate – 1050 gpm);
    - Shakers (Operable Rate – 1050 gpm);
    - Centrifuge/Desander/Desilter (Minimum Capacity of 1050 gpm);
    - Engineered Drilling Fluid Plan must be able to be implemented in the field with the proposed equipment.

    c. This is a minimum list of equipment and should not be considered a directive on how to complete the work. The Contractor is responsible for the execution of the work under its Approved Execution Plan and shall supply all necessary equipment to complete its plan at its own cost. All equipment shall be supplied in good working order, maintained, fueled and serviced.
18. Drilling Fluid is assumed to have a maximum density of 10 lbs/gallon and 1.0% sand content.

ENVIRONMENTAL

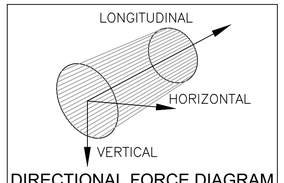
19. Emergency response spill kits must be on-site and available for use for the duration of the project.
20. Terrestrial "inadvertent return walks" shall be initiated every 4hrs. (at a minimum), or immediately following a loss of fluid event.
21. Contractor's proposed drilling fluid composition, including all expected additives, shall be reviewed and approved by the Owner's representative prior to construction.
22. The watercourse must be monitored for a potential release of drilling fluid and to assess the immediate effects of the works on the aquatic environment in accordance with applicable Federal and State regulations.
23. The Contractor shall ensure that the following documentation is on-site and readily available at all times (at a minimum):
    a. Emergency Response Procedure (ERP);
    b. Environmental Protection Plan (EPP);
    c. MSDS for all on-site material;
    d. Copies of Land Use Agreements.

GEOTECHNICAL

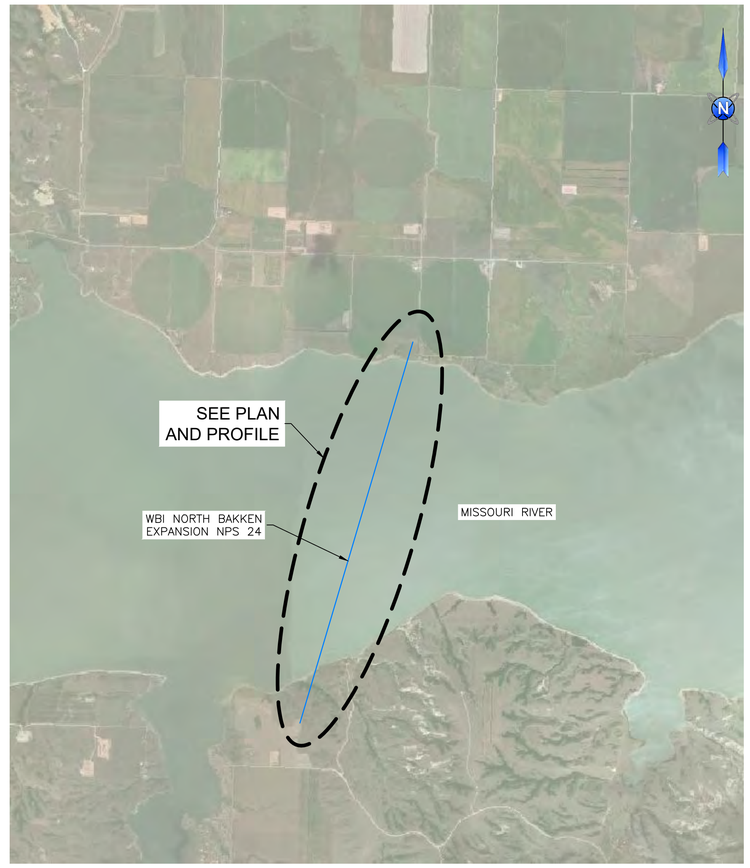
24. A land-based geotechnical investigation was completed at this site by Groundwater and Environmental Services, Inc (GES), and can be referenced from the report titled "Geotechnical Investigation Report WBI North Bakken Expansion Project", dated June 14, 2019. A supplemental water-based geotechnical investigation was also completed and can be referenced from the report titled "Geotechnical Investigation Report Water Based Borings", dated July 9, 2020.
25. The soil and bedrock stratigraphy shown is based on interpretation of data from three (3) land-based boreholes, and six (6) water-based boreholes, drilled at the locations shown and the designer's understanding of the local geology. Due to natural variations in subsurface conditions and inherent uncertainties associated with the interpretation of subsurface data, some variation in stratigraphy between boreholes and along the length of the bore should be expected.
26. The Contractor should independently evaluate the crossing with due consideration given to the suitability of its proposed equipment and construction procedures. Proposed construction means and methods shall be submitted to Company for approval but remain the sole responsibility of the Contractor.

PULLBACK NOTES

1. This drawing is engineered and designed to ensure the pipe section is not overstressed during the installation process.
2. This drawing is developed to inform the Contractor of the maximum spacing, anticipated lifting heights, minimum loading requirements and the minimum amount of support equipment to be provided by the Contractor. It is expected that the Pipeline Contractor will choose the type and size of equipment to manage the minimum loads provided.
3. The shown spacing and heights of supports represent a modeled maximum total stress on the pipe (including tension, bending and shear stress at the supports) of 80% of SMYS.
4. The support placement and spacing shown is based on provided topographical survey data. The Contractor shall field fit equipment according to the terrain or other on-site requirements adhering to a maximum spacing provided of 80ft between any two supports.
5. This drawing is based on information provided from various sources. Contractor shall confirm the accuracy of information prior to construction.
6. All loads shown assume that no buoyancy control will be utilized for this pullback.
7. All dimensions are to the bottom of pipe.
8. It is anticipated that all support equipment will utilize roller cradles during the pullback operation. Load capacity of each roller cradle is 56,500lbs (24"-36" roller cradle model). The load capacity shall be confirmed prior to use.
9. Equipment shall be sized with an adequate safety factor (2.0x or greater) to safely handle expected loads and to suit the heights recommended to facilitate the proper radius of curvature. It is expected that extended boom lengths or ramping under the side-booms may be necessary.
10. Shown pipe roller spacing based on roller load capacity of 12,000lbs. Roller spacing shall be adjusted to suit model of roller used.
11. It is the Contractor's responsibility to ensure they have crossing agreements from all utility and pipeline companies in the area where work will be performed overtop or in the vicinity of high pressure pipelines or utilities.
12. Proper padding/ramping above existing lines is required for all areas in which heavy equipment is moved or placed where the equipment may impact these lines.
13. Contractor shall ensure that there is minimal public disturbance and disruption during all parts of the work.
14. Contractor shall be prepared to work with other Contractors in the area.
15. Care shall be taken in manipulating the first and last section of pipe throughout the pullback. The maximum unsupported length at the leading and trailing ends of the pull section shall not exceed 60ft in order to prevent overstressing of the pipe.
16. Contractor shall implement an adequately sized catch off tractor as an anchor when the pipe section involves a slope, horizontal curve and/or a high to low installation. The tractor must be secured to the pipe section in an acceptable manner such as a pull head.
17. Contractor shall consider other factors such as weather conditions (wind, rain, snow, etc.) and site conditions on the pullback operations to ensure a safe lift and installation.
18. Contractor shall secure the load lines on cranes (if required) to the ground to minimize movement of the cradles along the pipe.
19. Contractor to take all precautions to minimize damage to pipe coating during pullback. Any damage to coating shall be repaired as specified in contract documents.
20. Contractor shall modify this plan (as required) to ensure the pipe pull section is sufficiently supported at all times during pullback. Contractor must provide a Pullback Plan for approval by the owner's representative two weeks in advance of commencing the work.
21. For the support design shown, the largest expected forces are:
    Single Cradle Support
    a. Vertical 55,400lbs
    b. Horizontal 95lbs
    c. Longitudinal 5,540lbs
22. The loads on the supports during pullback resolve to three directions; vertical, horizontal and longitudinal. The vertical direction is the weight of the pipe, the horizontal direction results from horizontal curves and the longitudinal direction results from the pipe being pulled through the cradles. A diagram can be seen in the detail to the right.

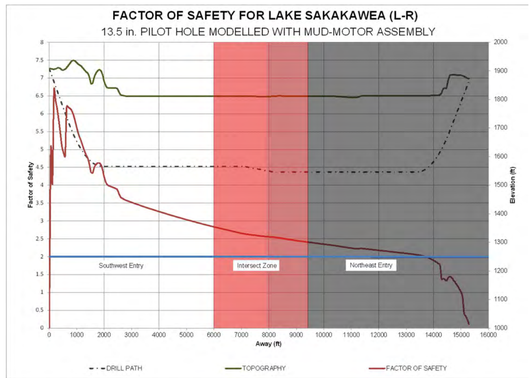


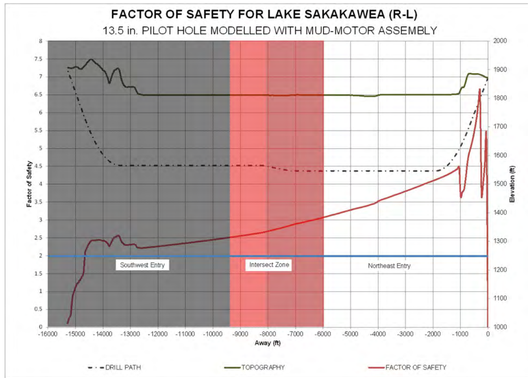
DIRECTIONAL FORCE DIAGRAM
N.T.S.



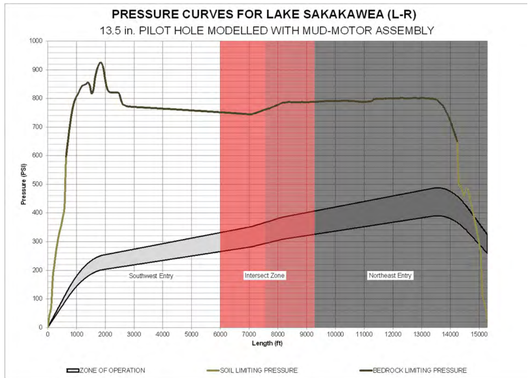
LOCATION PLAN
SCALE 1"=3000'

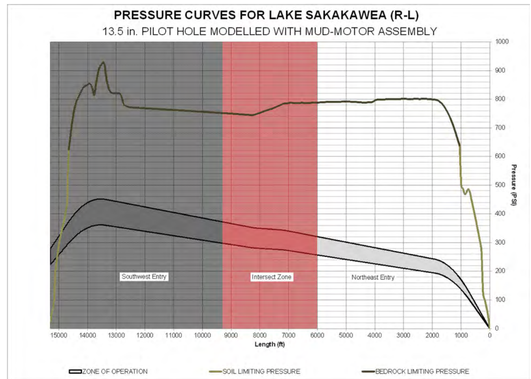
FACTOR OF SAFETY GRAPHS





ANNULAR PRESSURE CHART





REFERENCE DOCUMENT NO.	DATE
1. NBE_PL-PROPOSED_ROUTES 190824	2019-08-24
2. 2386-01-IMP STEEL STRESS-24-inch-02	2020-07-30
3. 2386-01-L2R-AP-02	2020-07-23
4. 2386-01-R2L-AP-02	2020-07-23
5. 2386-01-L2R-AP-02 (USACE FS)	2020-07-23
6. 2386-01-R2L-AP-02 (USACE FS)	2020-07-23

CCI & Associates Inc.
20445 State Highway 249, Suite 250
Houston, TX 77070
COCP 27692PE

ENGINEER AND PERMIT STAMPS

PIPELINE SPECIFICATIONS

	NPS 24
OUTSIDE DIAMETER (OD)(in)	24
WALL THICKNESS (WT)(in)	0.99
GRADE (psi)	60,000
PRODUCT	NATURAL GAS
MATERIAL	STEEL
SPECIFICATIONS	API 5L
INTERNAL COATING	N/A
OUTER COATING	DUAL FBE
MAX. OPER. PRESSURE (psi)	1,480
MIN. TEST PRESSURE (psi)	1,850
MAX. OPER. TEMP (°F)	100
MIN. INSTALLATION TEMP (°F)	60

STEERING TOLERANCES

	30ft	100ft	DESIGN
MINIMUM RADIUS (ft)	1100	2000	5000

PULL FORCE / RIG SIZE / STRESS

PULL FORCE (w/o BUOYANCY CONTROL):	752,000 lbs (w/sf)
MINIMUM RECOMMENDED RIG SIZE:	1,000,000 lbs
COMBINED STRESS UNITY CHECK:	0.29
OPERATING STRESS	48.1

DRAWING STATUS	DATE	DRN	CHK	DES	GEO	APR	CR
ISSUED FOR PERMIT	2020-07-31	MH	EY	CG	LC	KP	NM

NAD83.ND-Nft

WBI ENERGY TRANSMISSION
An MDU Resources Group company

WBI NORTH BAKKEN EXPANSION PROJECT

MISSOURI RIVER HDD CROSSING
CONSTRUCTION NOTES AND PIPELINE INFORMATION

WATFORD CITY / TIOGA, MCKENZIE COUNTY, NORTH DAKOTA

SCALE	DWG. #	REVISION	SHEET
AS SHOWN	2386-EG-0103	A	3 OF 3

APPENDIX B – HDD STRESS SUMMARY

Owner:	WBI Energy Transmission
Project:	North Bakken Expansion
Date:	2020-07-29
Calculation Description:	Stress Assessment NPS 24 HDD
Applicable Crossings:	Lake Sakakawea - 9.5 lb/gal Fluid

CCI & Associates Inc.

Completed By:	KP	Reviewed By:	JT	Sheet Revision:	R19.1

Pipe Information			Design Criteria				Crossing Characteristics	
Pipe Diameter (in)	Pipe W.T. (in)	Pipe Grade (psi)	MOP (psi)	Max. Operating Temperature (°F)	Installation Temperature (°F)	Design Radius (ft)	Maximum Depth From Entry Location (ft)	HDD Length (ft)
24	0.990	60000	1,480	100	60	5000	361	15393

The pipe section installated stresses are modelled in 5 sections (exit tangent (5), exit arc (4), bottom tangent (3), entry arc (2), entry tangent (1)) incorporating effects of buoyancy, soil friction, curvature, fluidic drag and pipe weight. The calculated stresses are evaluated using the AGA method (PRCI). Operating stresses incorporate hoop, bending, tensile, and thermal expansion.

Variable Definitions:

F_y - Specified Minimum Yield Strength
D - Outer Diameter of Product Pipe
E - Young's Modulus (Steel)
t - Wall Thickness of Product Pipe

Tensile Stress:

			% of Allowable
5	6761.2 psi	**PRCI 5.1.1, 5.5**	12.5%
4	7007.0 psi		**13.0%**
3	6434.7 psi	**Allowable Tensile Stress**	11.9%
2	6758.5 psi	$F_t = (0.9) * F_y$	12.5%
1	6961.7 psi	= 54000 psi	12.9%

Bending Stress:

			% of Allowable
5	295.0 psi	**PRCI 5.2.2**	0.7%
4	5900.0 psi	$f_b = (E/D)/(2R)$	**13.1%**
3	295.0 psi	**Allowable Bending Stress**	0.7%
2	5900.0 psi	$F_b = \{0.72 - (0.58\ F_y\ D / (E\ t)\}\ F_y$	**13.1%**
1	295.0 psi	= 45000 psi	0.7%

Hoop Stress:

			% of Allowable
5	1242.0 psi	**PRCI 5.2.3**	5.3%
4	2130.2 psi	$f_h = P_{ext}D/2t$	**9.1%**
3	2130.2 psi	**Allowable Hoop Stress**	**9.1%**
2	2130.2 psi	$F_{hc} = [0.88 \times E \times (t/D)^2] / 1.5$	**9.1%**
1	1111.3 psi	= 23300.7 psi	4.8%

Operating Stresses:

			% of Allowable
5	10197.0 psi	**PRCI 5.4.4.2:**	37.8%
4	12999.5 psi	**Allowable Shear Stress**	**48.1%**
3	10197.0 psi	$F(v) = 45\%$ of F_y	37.8%
2	12999.5 psi	$F(v) = 27000$ psi	**48.1%**
1	10197.0 psi		37.8%

Combined Stress (Tensile and Bending)

			% of Allowable
5	0.13	**PRCI 5.2.4**	13%
4	0.26	$f_t/0.9F_y+f_b/F_b \le 1$	**26%**
3	0.13		13%
2	0.26		26%
1	0.14		14%

Combined Stress (Tensile, Bending, and Hoop)

			% of Allowable
5	0.02	**PRCI 5.2.4**	2%
4	0.08	$A^2+B^2+2v\lvert A\rvert B \le 1$	**8%**
3	0.02	$A = ((f_t+f_b-0.5f_h)1.25)/F_y$	2%
2	0.07	$B = 1.5f_h/F_{hc}$	7%
1	0.02		2%

Estimated PullForce (without Buoyancy Control)

501,204 lbs 751,805 lbs (including 1.5x Safety Factor)

Owner:	WBI Energy Transmission
Project:	North Bakken Expansion
Date:	2020-07-29
Calculation Description:	Stress Assessment NPS 24 HDD
Applicable Crossings:	Lake Sakakawea - 10.5 lb/gal Fluid

CCI & Associates Inc.

Completed By:	KP	Reviewed By:	JT	Sheet Revision:	R19.1

Pipe Information			Design Criteria				Crossing Characteristics	
Pipe Diameter (in)	Pipe W.T. (in)	Pipe Grade (psi)	MOP (psi)	Max. Operating Temperature (°F)	Installation Temperature (°F)	Design Radius (ft)	Maximum Depth From Entry Location (ft)	HDD Length (ft)
24	0.990	60000	1,480	100	60	5000	361	15393

The pipe section installated stresses are modelled in 5 sections (exit tangent (5), exit arc (4), bottom tangent (3), entry arc (2), entry tangent (1)) incorporating effects of buoyancy, soil friction, curvature, fluidic drag and pipe weight. The calculated stresses are evaluated using the AGA method (PRCI). Operating stresses incorporate hoop, bending, tensile, and thermal expansion.

Variable Definitions:

F_y - Specified Minimum Yield Strength
D - Outer Diameter of Product Pipe
E - Young's Modulus (Steel)
t - Wall Thickness of Product Pipe

Tensile Stress:

			% of Allowable
5	6777.8 psi	**PRCI 5.1.1, 5.5**	12.6%
4	7208.1 psi		**13.3%**
3	5968.7 psi	**Allowable Tensile Stress**	11.1%
2	6336.4 psi	$F_t = (0.9) * F_y$	11.7%
1	6454.9 psi	= 54000 psi	12.0%

Bending Stress:

			% of Allowable
5	295.0 psi	**PRCI 5.2.2**	0.7%
4	5900.0 psi	$f_b = (E/D)/(2R)$	**13.1%**
3	295.0 psi	**Allowable Bending Stress**	0.7%
2	5900.0 psi	$F_b = \{0.72 - (0.58\ F_y\ D / (E\ t)\}\ F_y$	**13.1%**
1	295.0 psi	= 45000 psi	0.7%

Hoop Stress:

			% of Allowable
5	1353.3 psi	**PRCI 5.2.3**	5.8%
4	2335.1 psi	$f_h = P_{ext}D/2t$	**10.0%**
3	2335.1 psi	**Allowable Hoop Stress**	**10.0%**
2	2335.1 psi	$F_{hc} = [0.88 \times E \times (t/D)^2] / 1.5$	**10.0%**
1	1208.9 psi	= 23300.7 psi	5.2%

Operating Stresses:

			% of Allowable
5	10197.0 psi	**PRCI 5.4.4.2:**	37.8%
4	12999.5 psi	**Allowable Shear Stress**	**48.1%**
3	10197.0 psi	F(v) = 45% of F_y	37.8%
2	12999.5 psi	F(v) = 27000 psi	**48.1%**
1	10197.0 psi		37.8%

Combined Stress (Tensile and Bending)

			% of Allowable
5	0.13	**PRCI 5.2.4**	13%
4	0.26	$f_t/0.9F_y+f_b/F_b \le 1$	**26%**
3	0.12		12%
2	0.25		25%
1	0.13		13%

Combined Stress (Tensile, Bending, and Hoop)

			% of Allowable
5	0.02	**PRCI 5.2.4**	2%
4	0.08	$A^2+B^2+2v\lvert A\rvert B \le 1$	**8%**
3	0.02	$A = ((f_t+f_b-0.5f_h)1.25)/F_y$	2%
2	0.07	$B = 1.5f_h/F_{hc}$	7%
1	0.02		2%

Estimated PullForce (without Buoyancy Control)

515,588 lbs 773,382 lbs (including 1.5x Safety Factor)

Owner:	WBI Energy Transmission
Project:	North Bakken Expansion
Date:	2020-07-29
Calculation Description:	Stress Assessment NPS 24 HDD
Applicable Crossings:	Lake Sakakawea - 12 lb/gal Fluid

CCI & Associates Inc.

Completed By: KP | Reviewed By: JT | Sheet Revision: R19.1

Pipe Information			Design Criteria				Crossing Characteristics	
Pipe Diameter (in)	Pipe W.T. (in)	Pipe Grade (psi)	MOP (psi)	Max. Operating Temperature (°F)	Installation Temperature (°F)	Design Radius (ft)	Maximum Depth From Entry Location (ft)	HDD Length (ft)
24	0.990	60000	1,480	100	60	5000	361	15393

The pipe section installated stresses are modelled in 5 sections (exit tangent (5), exit arc (4), bottom tangent (3), entry arc (2), entry tangent (1)) incorporating effects of buoyancy, soil friction, curvature, fluidic drag and pipe weight. The calculated stresses are evaluated using the AGA method (PRCI). Operating stresses incorporate hoop, bending, tensile, and thermal expansion.

Variable Definitions:

F_y - Specified Minimum Yield Strength
D - Outer Diameter of Product Pipe
E - Young's Modulus (Steel)
t - Wall Thickness of Product Pipe

Tensile Stress:

			% of Allowable
5	6969.8 psi	**PRCI 5.1.1, 5.5**	12.9%
4	7689.7 psi		14.2%
3	8133.7 psi	**Allowable Tensile Stress**	15.1%
2	8807.5 psi	$F_t = (0.9) * F_y$	16.3%
1	8935.1 psi	= 54000 psi	**16.5%**

Bending Stress:

			% of Allowable
5	295.0 psi	**PRCI 5.2.2**	0.7%
4	5900.0 psi	$f_b = (E/D)/(2R)$	**13.1%**
3	295.0 psi	**Allowable Bending Stress**	0.7%
2	5900.0 psi	$F_b = \{0.72 - (0.58\ F_y\ D / (E\ t)\}\ F_y$	**13.1%**
1	295.0 psi	= 45000 psi	0.7%

Hoop Stress:

			% of Allowable
5	1520.4 psi	**PRCI 5.2.3**	6.5%
4	2642.4 psi	$f_h = P_{ext}D/2t$	**11.3%**
3	2642.4 psi	**Allowable Hoop Stress**	**11.3%**
2	2642.4 psi	$F_{hc} = [0.88 \times E \times (t/D)^2] / 1.5$	**11.3%**
1	1355.4 psi	= 23300.7 psi	5.8%

Operating Stresses:

			% of Allowable
5	10197.0 psi	**PRCI 5.4.4.2:**	37.8%
4	12999.5 psi	**Allowable Shear Stress**	**48.1%**
3	10197.0 psi	F(v) = 45% of F_y	37.8%
2	12999.5 psi	F(v) = 27000 psi	**48.1%**
1	10197.0 psi		37.8%

Combined Stress (Tensile and Bending)

			% of Allowable
5	0.14	**PRCI 5.2.4**	14%
4	0.27	$f_t/0.9F_y+f_b/F_b \le 1$	27%
3	0.16		16%
2	0.29		**29%**
1	0.17		17%

Combined Stress (Tensile, Bending, and Hoop)

			% of Allowable
5	0.03	**PRCI 5.2.4**	3%
4	0.09	$A^2+B^2+2\nu\lvert A\rvert B \le 1$	9%
3	0.04	$A = ((f_t+f_b-0.5f_h)1.25)/F_y$	4%
2	0.10	$B = 1.5f_h/F_{hc}$	**10%**
1	0.04		4%

Estimated PullForce (without Buoyancy Control)

639,119 lbs 958,679 lbs (including 1.5x Safety Factor)

Owner:	WBI Energy Transmission
Project:	North Bakken Expansion
Date:	08/01/2019
Calculation Description:	HDD Pipe Pullback Analysis NPS 24
Applicable Crossings:	Lake Sakakawea - 12 lb/gal Fluid

CCI & Associates Inc.

Completed By:	KP	Reviewed By:	JT	Sheet Revision: R19.1

Pipe Information			Design Criteria					
Pipe Diameter (in)	**Pipe W.T. (in)**	**Pipe Grade (psi)**	**Overbend Radius (ft)**	**Total Supported Weight (lbs/ft)**	**Maximum Support Spacing (ft)**	**Roller Spacing (ft)**	**Maximum Unsupported Overhang (ft)**	**Estimated Pullforce (lbs)**
24.00	0.990	60000	1,600	242.0	80	40	60	958,679

The pipe pullback is modelled such that the pipe is not over-stressed due to the combination of bending, tensile, and shear stresses throughout the pullback section, both in the spans between supports and at the support locations.
The pullback is also modelled such that the supports are not overloaded with the weight of the pipe at any point during the pipe installation, including as the tailing end passes from support to support.

Definitions:

SMYS - Specified Minimum Yield Strength
Overhang - Where Unsupported Tail End of Pipe Extends Beyond Support
Full Span - Where Pipe Is Supported Between 2 Supports at Maximum Support Spacing Shown Above

SUPPORT LOADING

Vertical Load at Each Boom/Crane Support — **% of Support Capacity ***

At Support With Full Span:
25,100 kg 55,400 lbs — **97.9%**
At Support With Overhang:
15,400 kg 33,900 lbs — 60.1%

Longitudinal Load at Each Boom/Crane Support
2510.0 kg 5,540 lbs

* based on load capacity of Darby 24"-36" Rolli-Cradle

Horizontal Load at Each Boom/Crane Support
43 kg 95 lbs

Horizontal Load at Each Roller Support
43 kg 95 lbs

PIPE STRESS

Bending Stress	**% SMYS**	**% of Allowable (PRCI)**
At Support With Full Span:		
22355.6 psi	37.3%	53.9%
At Support with Overhanging Pipe:		
26363.1 psi	43.9%	**63.5%**

Tensile Stress

10411.5 psi	17.4%	**19.3%**

Combined Stress (Tensile and Bending)

32767.1 psi	54.6%	**73%**

APPENDIX C – RISK ASSESSMENT SUMMARY

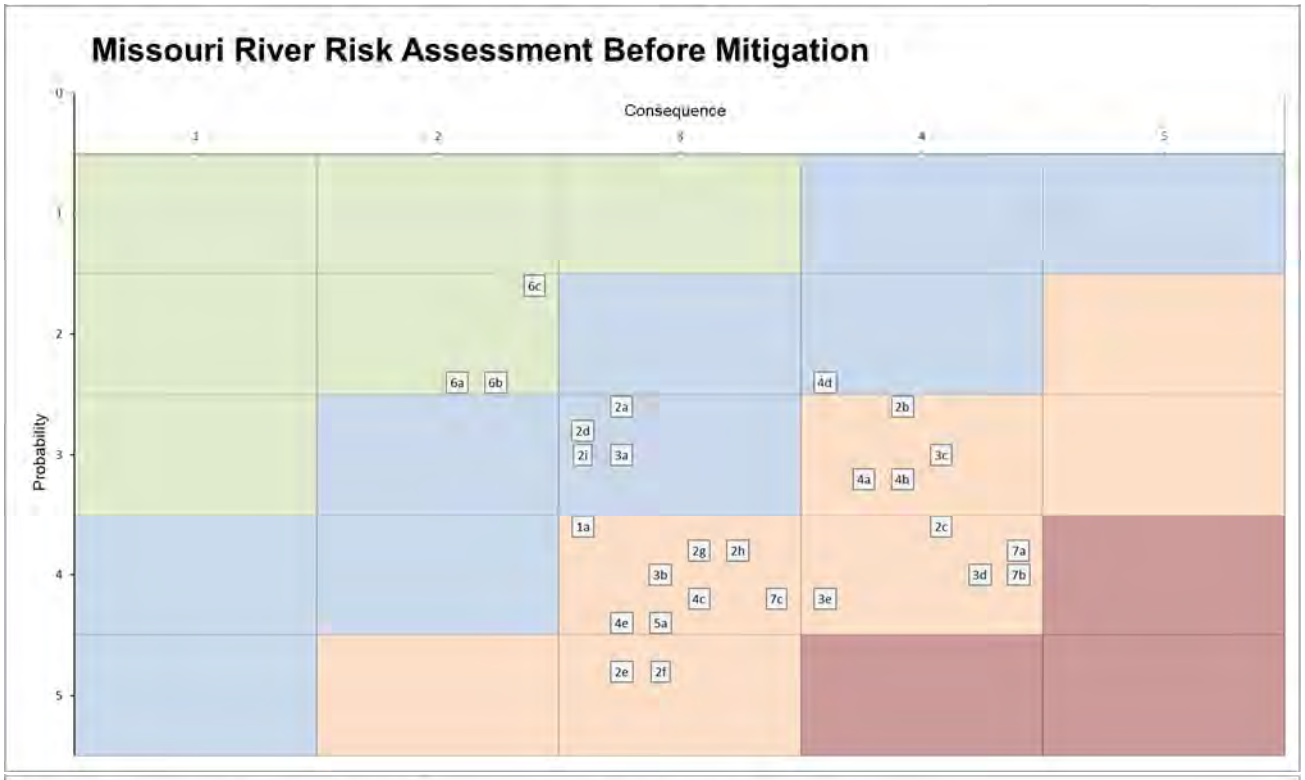
Missouri River Risk Assessment Summary

Phase	#	Description	Safety and Health Risk	Environmental Risk	Financial Risk	Production/Schedule Risk	Reputation Risk	Business Impact Risk	Risk Before Mitigation	Risk After Mitigation
Installation of Casing (Entry and Exit Points)	1a	Casing not Being Installed to Depth							High Risk	Medium Risk
Pilot Hole	2a	Fracture to Surface (Entry or exit, whichever poses as the greatest risk)		✓	✓	✓			Medium Risk	Medium Risk
	2b	Fracture to Water Body		✓	✓	✓	✓	✓	High Risk	Medium Risk
	2c	Large Fluid Loss to the Formation (>25% of total volume)		✓	✓	✓			High Risk	Medium Risk
	2d	Unstable Borehole (swelling, broken up, etc.)			✓	✓			Medium Risk	Medium Risk
	2e	Steering Control Issues			✓	✓			High Risk	High Risk
	2f	Annular Pressure Issues		✓	✓	✓			High Risk	High Risk
	2g	Over-Schedule Risk			✓	✓			High Risk	Medium Risk
	2h	Disposal of Drilling Fluid		✓	✓	✓			High Risk	Medium Risk
	2i	Water Ingress to Borehole			✓	✓			Medium Risk	Low Risk
Reaming Operations	3a	Unstable Borehole			✓	✓			Medium Risk	Medium Risk
	3b	Over-Schedule Risk			✓	✓			High Risk	Medium Risk
	3c	Loss of Equipment in Borehole			✓	✓	✓		High Risk	Medium Risk
	3d	Poor Removal of Cuttings			✓	✓			High Risk	High Risk
	3e	Drilling Fluid Control			✓	✓			High Risk	Medium Risk
Pullback Operations	4a	Pipe Section Gets Stuck in Borehole			✓	✓			High Risk	Medium Risk
	4b	Pull Forces Exceed Theoretical Model							High Risk	Medium Risk
	4c	Coating Damaged during Installation			✓	✓			High Risk	Medium Risk
	4d	Product Pipe is Damaged during Installation			✓	✓	✓		Medium Risk	Medium Risk
	4e	Pipe Handling on Exit	✓		✓	✓			High Risk	Medium Risk
Pipeline Contractor - Pipe Preparation and Support	5a	HDD Takes Longer than Scheduled to Complete			✓	✓			High Risk	Medium Risk
Construction Access and Pad Preparation	6a	Construction Access			✓	✓			Low Risk	Low Risk
	6b	Pad Layout & Construction			✓	✓			Low Risk	Low Risk
	6c	Travel Safety	✓				✓		Low Risk	Low Risk
Other Risks	7a	Crossing Length			✓	✓	✓	✓	High Risk	High Risk
	7b	Access to Water			✓	✓			High Risk	Medium Risk
	7c	Public Attention			✓		✓	✓	High Risk	Medium Risk
	7d				✓	✓	✓	✓		

Probability		
Value	Description	Chance
1	Rare	≤ 5%
2	Unlikely	~ 25%
3	Possible	~ 50%
4	Likely	~ 75%
5	Almost Certain	≥ 95%

Consequence	
Value	Description
1	Insignificant
2	Minor
3	Moderate
4	Major
5	Catastrophic

L	Low Risk - Managed by routine procedures
M	Medium Risk - Planned Mitigation Strategy Required
H	High Risk - Prioritized Mitigation Strategy Required
VH	Very High Risk - Immediate Mitigation Strategy Required


Missouri River Risk Assessment Before Mitigation
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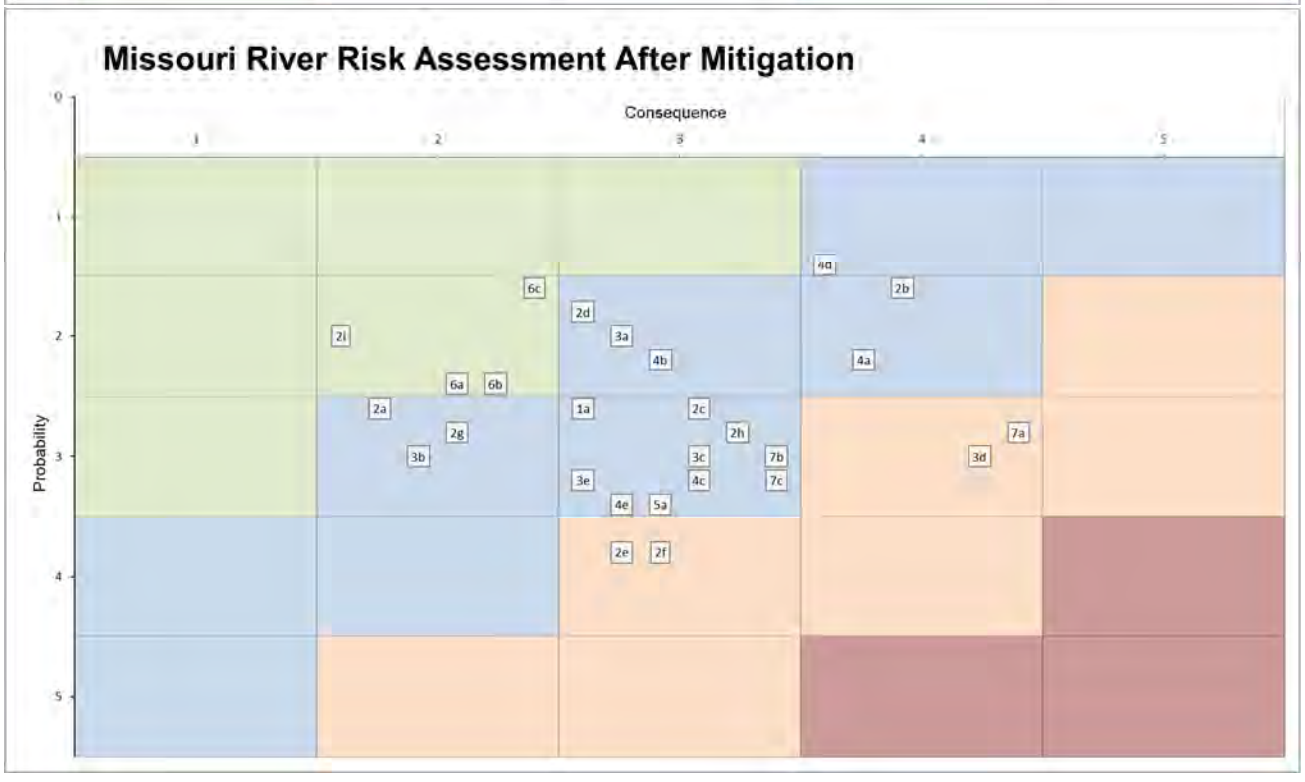
Missouri River Risk Assessment After Mitigation
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Attendance: Kerby, Chelsea, Justin, Landon, Stefan, Steve, Neil

Missouri River

Date: July 31, 2020
Rev: 0

Mud Motor HDD Risk Assessment

No.	Risk/Issue	Type of Risk/Issue		Pre-Mitigation Probability	Pre-Mitigation Consequence	Post-Mitigation Probability	Post-Mitigation Consequence	Review Cost Needed?
Installation of Casing (Entry and Exit Points)								
1a	Casing not Being Installed to Depth	Safety and Health	-	4	3	3	3	Select
		Environment	-	High Risk		Medium Risk		
		Financial	-	**Description**		**Mitigation Strategy**		
		Production/Schedule	-	Geotechnical conditions near surface can pose a problem when driving casing to a designed depth. It is expected both the entry and exit locations will require casing. The entry (south) is expected to be cased to the shale/siltstone bedrock, and the exit location will be cased past the coal layer. The proposed lengths of casing install, although expected to be achievable, are quite considerable.		Achievable casing installation lengths should be investigated prior to construction. The casing should be installed in 160-200ft lengths of telescoped casing. The final casing size shall be 48" and the initial casing should be sized to ensure the final casing will reach the required depth for seating.		
		Reputation	-					
		Business Impact	-					
Pilot Hole								
2a	Fracture to Surface (Entry or exit, whichever poses as the greatest risk)	Safety and Health	-	3	3	3	2	Select
		Environment	Yes	Medium Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Granular material near surface can pose a potential risk for drilling fluid to fracture to surface. The crossing is characterized by well graded to poorly graded sand to depths of 20-120ft.		The sand is expected to be stable enough to maintain an open borehole, or cased. The topography near entry and exit is relatively flat and allows the drill to obtain sufficient depth to effectively mitigate the risk of fracture.		
		Reputation	-					
		Business Impact	-					
2b	Fracture to Water Body	Safety and Health	-	3	4	2	4	Select
		Environment	Yes	High Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Fractured formations (including coal seams as identified within the bedrock formation) or high annular pressures could result in release of fluid to surface. The length of the Missouri River crossing results in high pressures due to the building friction forces. The bedrock layer is inconsistent and dips fairly significantly in the middle of the Missouri River, reducing the expected strength of the overburden formation.		The crossing is designed to be completed as an intersect which will limit the expected drilling pressures. The crossing has been designed with significant depth to limit the potential for fracture. Casing will also help with circulation back to entry/exit locations, which should reduce the potential for climbing annular pressures. Contractor shall utilize an Annular Pressure Tool to measure actual downhole pressures during drilling of the pilot hole to ensure any significant increases in pressure beyond planned ranges can be addressed and reduced to within expected ranges with mechanical tripping or additional circulation as applicable.		
		Reputation	Yes					
		Business Impact	Yes					
2c	Large Fluid Loss to the Formation (>25% of total volume)	Safety and Health	-	4	3	3	3	Select
		Environment	Yes	High Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Drilling fluid has the potential to migrate outside of the designed drill path in fractures. The crossing location is characterized by several coal seams, including two thick coal seams above and below the bottom tangent of the drill path, which may act as preferential path for drilling fluid.		The drill depth has been chosen to limit the risk of fracture to surface. Casing is included in the design to minimize the amount of coal seams the drill path will encounter. The contractor shall develop a mitigation plan for reducing significant losses where possible, including the use of Loss Circulation Material (LCM) pills to try to plug off any encountered zones of significant fluid loss.		
		Reputation	-					
		Business Impact	-					
2d	Unstable Borehole (swelling, broken up, etc.)	Safety and Health	-	3	3	2	3	Select
		Environment	-	Medium Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Site conditions have identified granular materials at both entry and exit locations. During drilling operations this material can become unstable and collapse, which may cause reduced returns. Casing has been specified on entry and exit.		The Contractor should monitoring annular pressure and returns to ensure the borehole remains clear of obstructions, if returns slow the Contractor should mechanically clean the hole.		
		Reputation	-					
		Business Impact	-					
2e	Steering Control Issues	Safety and Health	-	5	3	4	3	Select
		Environment	-	High Risk		High Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	The crossing is 15,393ft long and each rig will need to drill 7000ft-8000ft. Maintaining weight on bit in order to be able to steer at this length is expected to be difficult, complicating the intersect.		The crossing is designed with a large radius which will reduce the steering requirements. The Contractor is utilizing 7 5/8" drill string and gyro steering systems to ensure accuracy and a successful intersect. The bottom tangent is very long and will allow the drills sufficient time to align for intersect operations. Casing may help to maintain weight on bit.		
		Reputation	-					
		Business Impact	-					
2f	Annular Pressure Issues	Safety and Health	-	5	3	4	3	Select
		Environment	Yes	High Risk		High Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Drilling operations require soil cuttings to be cleaned out of the bore and hydro-transported back to the rig by the drilling fluid. This process requires large volumes of pressurized drilling fluid to be pumped downhole. The length of the crossing will increase the risk of annular pressure issues.		The Contractor shall maintain returns to both entry pits and monitor annular pressures. A mud engineer shall be on site to monitor adherence to the crossing specific Engineered Drilling Fluid Plan (EDFP). A bottoms up procedure (circulating the calculated amount of fluid that it takes to flow from the bit downhole back up to the entry pit) should be in place and followed when necessary to clean the hole.		
		Reputation	-					
		Business Impact	-					
2g	Over-Schedule Risk	Safety and Health	-	4	3	3	2	Select
		Environment	-	High Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Geotechnical conditions, permitting, and environmental issues can all contribute to delays in the schedule. The crossing is long with a large borehole size. Over schedule could significantly increase costs. Significant delays could have a large financial impact due to delay to in-service date.		All requirements of the permits should be strictly followed. The Contractor shall ensure proper drilling procedures are in place. Encountered geotechnical conditions should be monitored and reported during drilling so modifications can be made to execution strategy, as required, to ensure no negative impacts. It is recommended construction proceed 24/7 with 2 12hr rotational shifts per day.		
		Reputation	-					
		Business Impact	-					
2h	Disposal of Drilling Fluid	Safety and Health	-	4	3	3	3	Select
		Environment	Yes	High Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Drilling fluid needs to be stored and disposed of. Running out of temporary storage can lead to schedule delays and environmental concerns. The length and large borehole size will result in significant volumes of drilling fluid. Drilling fluid may be contaminated due to coal seams.		Adequate storage should be on site. An EDFP should be followed and an adequate recycling system will be on site. An approved disposal plan should be developed prior to construction. Facility disposal should be expected.		
		Reputation	-					
		Business Impact	-					
2i	Water Ingress to Borehole	Safety and Health	-	3	3	2	2	Select
		Environment	-	Medium Risk		Low Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Ground water tends to migrate to where soil has been cut/ displaced. Coal seams may provide preferential paths for water ingress into the borehole. The ingress of water may dilute the bentonite drilling fluid and reduce the carrying capacity.		The crossing is level and the hole will be full of drilling fluid. Since the identified seams are below rig elevation, it is anticipated that the hydrostatic pressure of the drilling fluid will minimize water ingress to a manageable range.		
		Reputation	-					
		Business Impact	-					
Reaming Operations								
3a	Unstable Borehole	Safety and Health	-	3	3	2	3	Select
		Environment	-	Medium Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Site conditions have identified granular materials at both entry and exit locations. During drilling operations this material can become unstable and collapse, which may cause reduced returns.		The Contractor should monitoring annular pressure and returns to ensure the borehole remains clear of obstructions, if returns slow the Contractor should mechanically clean the hole. Adequate pumps for the ream size and length should be on site.		
		Reputation	-					
		Business Impact	-					
3b	Over-Schedule Risk	Safety and Health	-	4	3	3	2	Select
		Environment	-	High Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Geotechnical conditions, permitting, and environmental issues can all contribute to delays in the schedule. The crossing is long with a large borehole size.		All requirements of the permits should be strictly followed. The Contractor shall ensure proper drilling procedures are in place. Geotechnical conditions should be monitored and reported during drilling so modifications can be made to execution strategy, as required, to ensure no negative impacts. Using two rigs will split the workload which would be normally be placed upon a single rig.		
		Reputation	-					
		Business Impact	-					
		Safety and Health	-	3	4	3	3	Select
		Environment	-	High Risk		Medium Risk		

3c	Loss of Equipment in Borehole	Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	Reaming or enlarging the bore to the desired diameter may cause instability areas. These areas may cause downhole tooling to get stuck or lost. Loss of equipment within the borehole is a larger risk than with a shorter crossing.			The utilization of intersect methodology will mitigate the risk of losing equipment within the borehole. Using two rigs will split the workload which would be normally be placed upon a single rig. If problems arise on one side of the reamer, the opposite rig will maintain contact with the downhole tooling and be able to trip to surface. Drill string management plan should be provided by the contractor, which should include regularly switching out drill stem on either side of the reamers.		
		Reputation	Yes						
		Business Impact	-						
3d	Poor Removal of Cuttings	Safety and Health	-	4	4		3	4	Select
		Environment	-	High Risk			High Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	Due to the large ream pass and length a large amount of cuttings will be created and therefore will have to be removed from the borehole.			Drilling fluid parameters will be optimized for maximum cutting transportation, through adherence to the EDFP. High pump rates throughout the ream passes of the HDD will increase the annular velocity and therefore carrying capacity. Additional trips will be necessary to mechanically remove cuttings from the borehole. The number of trips required will be based on the borehole conditions. The cut size should ensure that cuttings can be removed.		
		Reputation	-						
		Business Impact	-						
3e	Drilling Fluid Control	Safety and Health	-	4	4		3	3	Select
		Environment	-	High Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	As the volume of drilling fluid within the borehole increases, it becomes more difficult to change its properties with drilling fluid additives. The large diameter borehole combined with the length will impact the quality and makeup of the drilling fluid. Coal seams may contaminate drilling fluid. Contractor will be hauling in water.			The Contractor should prepare and adhere to an approved EDFP which will outline the steps required to ensure the highest quality of drilling fluid is used for the crossing. A premix tank should be made available in addition to the mud tank. Contractor should continue to adhere to the EDFP throughout reaming operations even if they are experiencing fluid losses.		
		Reputation	-						
		Business Impact	-						
Pullback Operations									
4a	Pipe Section Gets Stuck in Borehole	Safety and Health	-	3	4		2	4	Select
		Environment	-	High Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	There is a risk that the pipe section becomes stuck in the borehole due to borehole length, instability, blockages, or irregularities. The pullforce for this length is between approximately 502,000 and 960,000lbs.			One or more wiper trips shall be completed to ensure a clean hole. Required force should be monitored during the wiper passes. It is recommended that a Pipe Thruster (with custom inserts for NPS 24) be available on exit side to assist the rig with pullback in the event pullforces start to become exceedingly high.		
		Reputation	-						
		Business Impact	-						
4b	Pull Forces Exceed Theoretical Model	Safety and Health	-	3	4		2	3	Select
		Environment	-	High Risk			Medium Risk		
		Financial	-	Description			Mitigation Strategy		
		Production/Schedule	-	There is a risk that pull forces exceed the theoretical model, especially with the length of the drill. Contributing factors can include cuttings in the borehole, having to temporarily halt line pull, borehole instability, and heavy drilling fluid.			A swab pass should be completed and downtime during installation should be minimized. It is expected pipe pull will continue overnight as required. This should be planned for with crews in advance, lighting shall be sufficient to allow overnight operations for pull. Pipe thruster should be available on exit side to assist the rig will pullback.		
		Reputation	-						
		Business Impact	-						
4c	Coating Damaged during Installation	Safety and Health	-	4	3		3	3	Select
		Environment	-	High Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	Gravel, cobbles, boulders, and bedrock interfaces within the bore path pose a risk that the pipe coating is damaged during line pull.			Wiper passes shall be completed to gauge any possible areas of issue, and additional passes may be used to ensure minimized risk prior to pullback. FBE and ARO coated pipe shall be used.		
		Reputation	-						
		Business Impact	-						
4d	Product Pipe is Damaged during Installation	Safety and Health	-	2	4		1	4	Select
		Environment	-	Medium Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	If the borehole has any ledges (intersect location or bedrock interface), the pipe could get hung up or scratched on these ledges resulting in pipe damage.			Ledges shall be reamed/smoothed out prior to product pipe installation. The intersect should be completed as straight as possible to reduce the potential for a ledges where the bits meet.		
		Reputation	Yes						
		Business Impact	-						
4e	Pipe Handling on Exit	Safety and Health	Yes	4	3		3	3	Select
		Environment	-	High Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	The exit angle, wall thickness, and size of the pipe result in a large radius overbend that reaches a height of 35 ft. The pipe section requires significant support equipment.			A pullback lift plan should be created prior to construction for review and approval. The equipment capacities should be sufficient for the anticipated loads. Spreader bars may reduce crane requirements. A traffic plan should be created for Highway 17A (52nd Street NW) and 54th Street NW (if required).		
		Reputation	-						
		Business Impact	-						
Pipeline Contractor - Pipe Preparation and Support									
5a	HDD Takes Longer than Scheduled to Complete	Safety and Health	-	4	3		3	3	Select
		Environment	-	High Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	There is significant support equipment required for pullback. If pullback is delayed this could be a large cost to keep the equipment on site. If the pipe section is not ready for pull the hole could tighten.			The pullback section should be completed significantly before pull is expected to ensure no unneccesary delays. Coordination of all contractors. Traffic plan for Highway 17A.		
		Reputation	-						
		Business Impact	-						
Construction Access and Pad Preparation									
6a	Construction Access	Safety and Health	-	2	2		2	2	Select
		Environment	-	Low Risk			Low Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	Access is assumed to be along ROW, through agricutural fields.			All agreements should be in place prior to mobilization. All workspace should be cleared as required. Access should be prepared.		
		Reputation	-						
		Business Impact	-						
6b	Pad Layout & Construction	Safety and Health	-	2	2		2	2	Select
		Environment	-	Low Risk			Low Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	The workspace are within grassy fields, clearing and grading are expected to be minimal.			All agreements should be in place prior to mobilization. All workspace should be cleared as required.		
		Reputation	-						
		Business Impact	-						
6c	Travel Safety	Safety and Health	Yes	2	2		2	2	Select
		Environment	-	Low Risk			Low Risk		
		Financial	-	Description			Mitigation Strategy		
		Production/Schedule	-	Contractor will have to travel to site from a off project location. Could continue into winter.			A travel plan should be in place.		
		Reputation	Yes						
Other Risks									
7a	Crossing Length	Safety and Health	-	4	4		3	4	Select
		Environment	-	High Risk			High Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	The crossing is 15,393ft long, approaching record lengths for an HDD crossing. There is a risk that the crossing could encounter compounding issues that lead to the crossing not being completed successfully.			A competent contractor with adequate tooling and relevant experience with similarly large installations has been selected. The risks should be highlighted to all stakeholders.		
		Reputation	Yes						
		Business Impact	Yes						
7b	Access to Water	Safety and Health	-	4	4		3	3	Select
		Environment	-	High Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	Water sources should be investigated/confirmed. Water transport should be a major consideration.			Additional transport and water sources should be investigated prior to construction. Transport should include contingency to ensure a lack of water does not lead to any delays with progress of the drill, particularly in the event of significant fluid losses during drilling, where large volumes of make-up water may be required.		
		Reputation	-						
		Business Impact	-						
7c	Public Attention	Safety and Health	-	4	3		3	3	Select
		Environment	-	High Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	-	Scrutiny is possible in the area. There is a risk of negative public perception issues. The summer season will see high levels of lake use.			The contractor shall ensure all procedures are being followed and their impact is minimized. The contractor shall ensure all correspondence with the public is completed by WBI representation.		
		Reputation	Yes						
		Business Impact	Yes						

APPENDIX D – GEOTECHNICAL REPORTS

CCI and Associates, Inc.

Geotechnical Investigation Report

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Date:
June 14, 2019

Geotechnical Investigation Report

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

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ANTHONY P. FRANCIS REGISTERED PROFESSIONAL 8204 ENGINEER NORTH DAKOTA

6/14/2019

Anthony Frances, PE
Geotechnical Engineering
Material Testing Services, LLC.

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Figure 1 – Soil Boring Location Map

Tables

Table 1 – Soil Boring Locations
Table 2 – Laboratory Soil Test Data

Appendices

Appendix A - Boring Logs
Appendix B - Photographic Documentation
Appendix C - Laboratory Reports

Acronyms

ASTM	American Society for Testing and Materials
CCI	CCI and Associates, Inc.
GES	Groundwater & Environmental Services, Inc.
HDD	horizontal directional drilling
HSA	Hollow-stem auger
IDS	Interstate Drilling Services, LLP
MTS	Material Testing Services, LLC
TGCBA	Tobacco Garden Creek Bay Area
USACE	US Army Corp of Engineers

1 Introduction

This report presents the results of the geotechnical investigation that was performed by Groundwater and Environmental Services, Inc. (GES) for the project known as the WBI North Bakken Expansion Project in western North Dakota. Specifically, this report covers the geotechnical exploration at 3 land-based soil borings located along the proposed horizontal directional drilling (HDD) pipeline project under Lake Sakakawea/Missouri River (**Figure 1**). The proposed pipeline alignment under Lake Sakakawea is located approximately 1 mile northeast of the Tobacco Garden Creek Bay Area (TGCBA). The TGCBA is located approximately 23 miles northeast of Watford City, North Dakota.

Services for this investigation were performed in general accordance with the April 1, 2019 Services Contract by and between CCI and Associates, Inc. (CCI) and GES.

1.1 Project Location and Scope

The objective of this phase of the geotechnical investigation is to assist CCI with evaluating the subsurface conditions at 3 land-based boring locations (LB-1 through LB-3) located along the proposed HDD pipeline alignment on the north and south sides of Lake Sakakawea.

The scope of work included the following:

- Prepare a site-specific health and safety plan for GES employees and subcontractors for the proposed geotechnical investigation activities.
- Coordinate field activities and communication with project team and CCI.
- Arrange for utility clearance through North Dakota One Call.
- Mobilize our drilling project team to the project including Interstate Drilling Services, LLP (IDS) and GES personnel.
- Advance 3 land-based soil borings and collect samples at designated locations surveyed by a CCI subcontractor.
- Contract laboratory tests on soil samples obtained from the 3 land-based soil borings to evaluate physical properties.
- Provide a written geotechnical report.

2 Methods

2.1 Soil Borings

As part of the geotechnical investigation, GES contracted with IDS of Grand Forks, North Dakota, to advance the 3 land-based soil borings (**Figure 1**). IDS used a Diedrich D-50 track-mounted drill rig to advance the borings and collect soil samples.

The drilling rig, equipment and supplies mobilized to the project location on April 23, 2019. Advancement of soil boring LB-1 began on April 24 and the last soil boring LB-3 was completed on May 5, 2019. The drilling operation consisted of one crew working 12-hour shifts. Borehole locations for LB-1 through LB-3 were provided by CCI and are provided in **Table 1**.

Soil borings LB-1, LB-2, and LB-3 were completed to depths of 403 feet, 400 feet, and 370 feet below grade, respectively. Hollow-stem auger (HSA) boring methodology was used to collect soil samples while boring through unconsolidated sediment in the upper portion of each soil boring. Once competent sediment was encountered, a closed loop, fluid rotary drilling methodology was used to advance the borings. Rock coring drilling methodology was used at each boring for the last, approximately 200+ feet (to boring terminus). Upon completion, each boring was sealed from the boring terminus to ground surface with a concrete/bentonite slurry through a tremie rod. Drilling cuttings and sediment were thin spread at each boring location.

During HSA and fluid rotary drilling methodology, 1.5-foot samples were collected at 5 foot intervals using a split-spoon sampler in accordance with American Society for Testing and Materials (ASTM) D1586 (*Standard Test Method for Standard Penetration Test [SPT] and Split-Barrel Sampling of Soils*) using a 2-inch diameter split-spoon sampler. During rock coring drilling methodology, samples were generally collected at 5-foot sample intervals continuously in accordance with ASTM D2113 (*Standard Practice for Rock Core Drilling and Sampling of Rock for Site Exploration*) using a using a NQ3 size, triple-tube core barrel with a diamond bit.

Soils were classified in the field by a GES field geologist using ASTM Visual-Manual procedures (ASTM D2488, *Standard Practice for Description and Identification of Soils [Visual-Manual Procedure]*). The field geologist also collected samples from the split-spoon sampler and rock core sampler for geotechnical laboratory testing.

The boring logs and standard boring classification guidelines are contained in **Appendix A**. Photographic documentation of the project is provided in **Appendix B.**

2.2 Laboratory Testing

GES contracted with Material Testing Services, LLC (MTS) of Minot, North Dakota to provide geotechnical laboratory testing and evaluation services to aid in classifying and evaluating the physical properties of the soil/rock samples. Soil/rock sample selection and laboratory test parameters were determined by CCI.

The laboratory testing included the following:

- Moisture Content (ASTM D4959 - Standard Test Method for Determination of Water Content of Soil by Direct Heating and D4643 - Standard Test Method for Determination of Water Content of Soil and Rock by Microwave Oven Heating).
- Sieve Analysis (ASTM D422 – Test Method for Particle-size Analysis of Soils).
- Atterberg Limits (ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils).
- Unconfined Compression Testing (ASTM D2166 – Standard Test Method for Unconfined Compressive Strength of Cohesive Soils).

Test results are summarized in **Table 2** with the exception of the unconfined compression test results, which are provided with the laboratory reports in **Appendix C.**

3 Site Conditions

The proposed HDD pipeline crossing traverses southwest to northeast across Lake Sakakawea approximately 1 mile northeast of the TGCBA. The physiographic regions where the proposed HDD pipeline crossing is located consist of the McKenzie Upland Unit, located southwest of the Missouri River and the Coteau Slope Unit, located northeast of the Missouri River. These units are part of the Great Plains and are characterized by rolling to hilly plains with both erosional and glacial landforms. The proposed HDD crossing is located within the historic Missouri River floodplain that was flooded with the construction of the Garrison Dam in 1956 to form Lake Sakakawea. This area is located in the central portion of the Williston Basin.

The surface geology in the area consists of thin layers of glacial deposits underlain by the Tertiary-Aged Sentinel Butte Formation and Bullion Creek Formation. The Sentinel Butte Formation consists of layers of silt, clay, sand, lignite, carbonaceous shale, and mudstone (Carlson, 1985). The Bullion Creek Formation underlies the Sentinel Butte Formation and consists of yellowish layers of silt, clay, and sand with interbedded sandstone, lignite, baked clay, and limestone (Bluemle, 1977). Both formations form rolling topography over broad areas and has been eroded to badlands near rivers.

Soil borings LB-1 through LB-3 generally consisted of well graded to poorly graded sand in the upper portion of the borings. The well graded to poorly graded sand was logged from the ground surface to a depth of approximately 25 feet below grade at LB-1 and from the ground surface to approximately 120 feet below grade at LB-2 and LB-3. Underlying the sand, silt, clay (lean and fat), weathered shale, and silty sand were logged. Underlying the sand, lignite (laminations to layers >20 feet thick) were logged throughout each boring to boring terminus. Saturated conditions were only encountered at boring LB-3, at 24.5 feet below grade.

4 Limitations

The data generated and conclusions and opinions provided are based on the scope of work performed. All work was conducted in a manner consistent with currently accepted geotechnical

engineering practices exercised by members of the profession practicing under similar conditions. No other warranty, expressed or implied, is made.

The samples collected and described in this report are representative of the subsurface conditions at the sampled locations and intervals, and therefore, do not necessarily reflect strata variations that may exist between sampled intervals and locations. If variations from the subsurface conditions described in this study are noted during additional investigations and/or construction, recommendations in this report must be re-evaluated.

GES is not responsible for the independent conclusions, opinions, or recommendations made by others based on the data presented in this report. Nor can GES warrant that this report will satisfy the dictates of or provide a legal defense in connection with an environmental law or regulation.

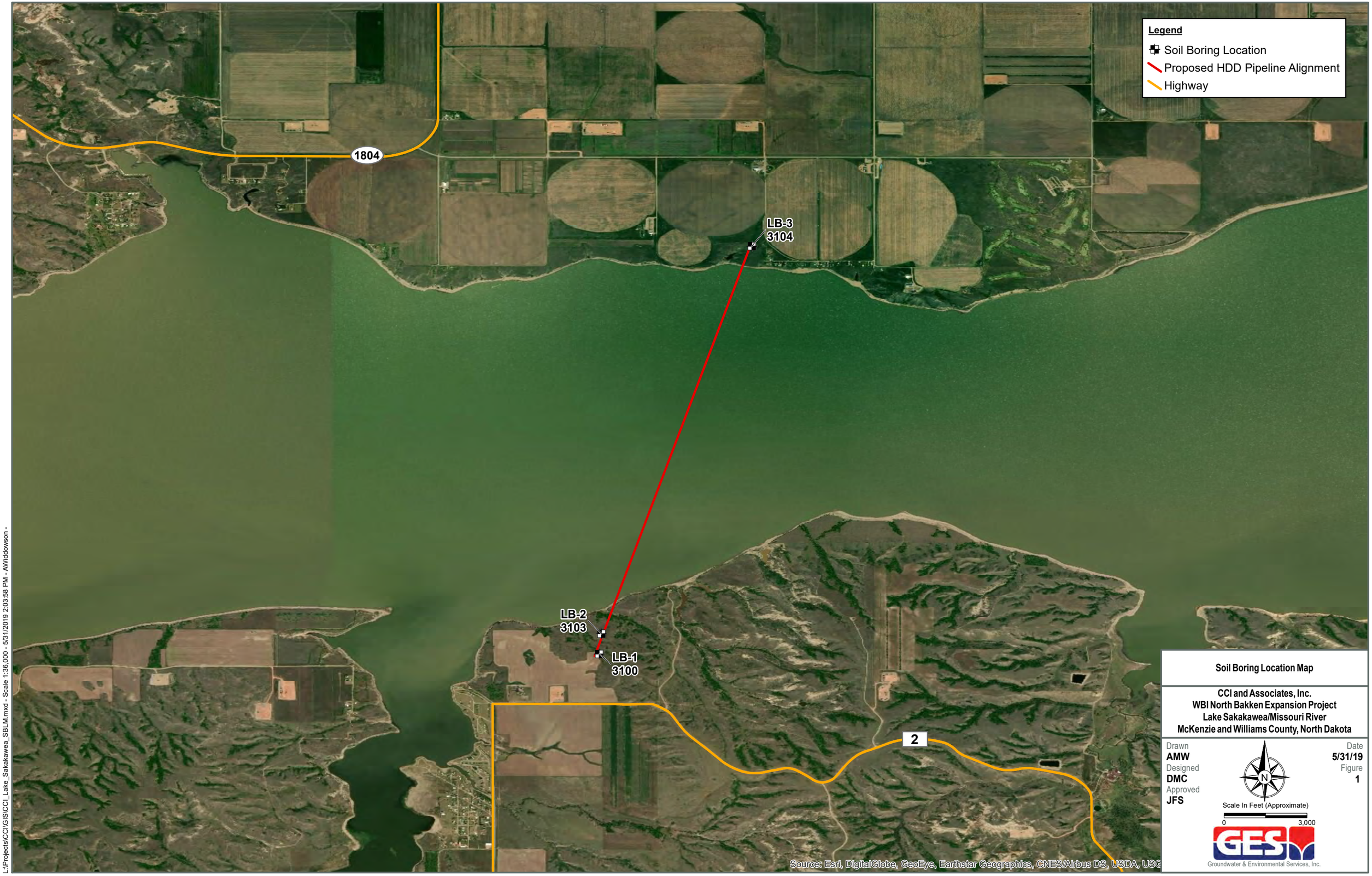
The results reported and any opinions reached by GES are for the benefit of the CCI & Associates and their client and unless agreed to by GES in writing, are not to be disclosed to or relied upon by any third party. The results and opinions set forth by GES in this report will be valid as of the date of the report.

References

Bluemle, J.P. 1977. *Geologic Highway Map of North Dakota*. North Dakota Geological Survey Educational Series 11, Miscellaneous Map 19.

Carlson, Clarence G. 1985. *Geology of McKenzie County, North Dakota.* North Dakota Geological Survey, Bulletin 80 – Part 1 and North Dakota State Water Commission, County Groundwater Studies 37 – Part 1.

Figure



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Soil Boring Location Map

CCI and Associates, Inc.
WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Drawn **AMW**
Designed **DMC**
Approved **JFS**

Date **5/31/19**
Figure **1**

Scale In Feet (Approximate)
0 3,000

Groundwater & Environmental Services, Inc.

Tables

Table 1

Soil Boring Locations

HDD Crossing	Boring ID	Boring Depth (ft)	Sample Interval (ft)	Boring Coordinates	
				Northing	Easting
Lake Sakakawea/Missouri River	LB-1	403	5	417613.836	1335268.645
	LB-2	400	5	418344.342	1335349.645
	LB-3	372	5	432251.954	1339466.302

Table 2

Laboratory Soil Test Data

Boring No.	Sample Depth (ft)	Sample Type	Moisture Content	Grain Size Distribution				Atterberg Limits		
				% Gravel	% Sand	% Silt	% Clay	LL	PL	PI
LB-1	4.5 - 6	SS	9.5							
LB-1	9.5 - 11	SS	13.2							
LB-1	14.5 - 16	SS	32.4							
LB-1	19.5 - 21	SS	4.4							
LB-1	24.5 - 26	SS	19.2							
LB-1	29.5 - 31	SS	24.3							
LB-1	34.5 -36	SS	25.8					50	19	30
LB-1	39.5 - 41	SS	23.8							
LB-1	44.5 - 46	SS	22							
LB-1	49.5 - 51	SS								
LB-1	54.5 - 56	SS	20.7							
LB-1	59.5 - 61	SS	22.2							
LB-1	64.5 - 66	SS	25.8							
LB-1	69.5 - 70	SS								
LB-1	74.5 - 76	SS	26.3							
LB-1	79.5 - 81	SS	24.8							
LB-1	84.5 - 86	SS	22.9							
LB-1	89.5 - 91	SS						57	21	36
LB-1	94.5 - 95	SS								
LB-1	99.5 - 101	SS	23.2							
LB-1	104.5 - 106	SS	24.6							
LB-1	109.5 - 111	SS	23.9							
LB-1	114.5 - 116	SS	22							
LB-1	119.5 - 121	SS	24.4							
LB-1	124.5 - 126	SS	19.1							
LB-1	129.5 - 131	SS						36	20	16
LB-1	134.5 - 136	SS	21.2							
LB-1	139.5 - 141	SS	21.1							
LB-1	144.5 - 146	SS	21.9							
LB-1	149.5 - 151	SS	28.5							
LB-1	154.5 - 156	SS	19.4							
LB-1	159.5 - 161	SS	21							
LB-1	164.5 - 165.5	SS	24.9							
LB-1	169.5 - 171	SS						48	19	28
LB-1	174.5 - 175.5	SS	19.9							
LB-1	179.5 - 180.5	SS	22.6							

Table 2

Laboratory Soil Test Data

Boring No.	Sample Depth (ft)	Sample Type	Moisture Content	Grain Size Distribution				Atterberg Limits		
				% Gravel	% Sand	% Silt	% Clay	LL	PL	PI
LB-1	185 - 189	RC	8.5							
LB-1	189 - 193	RC	13.8							
LB-1	193 - 198	RC	15.4							
LB-1	198 - 203	RC	16							
LB-1	203 - 208	RC								
LB-1	208 -213	RC	16							
LB-1	213 - 218	RC								
LB-1	218 - 223	RC								
LB-1	223 - 228	RC	54.1							
LB-1	228 - 233	RC	60.4							
LB-1	233 - 238	RC	15.4							
LB-1	238 -243	RC								
LB-1	243 - 248	RC	11.6							
LB-1	248 - 253	RC	11							
LB-1	253 - 258	RC	17.9							
LB-1	258 - 263	RC						41	18	23
LB-1	263 - 268	RC	21.2							
LB-1	268 - 273	RC	12.2							
LB-1	273 - 278	RC	11.8							
LB-1	278 - 283	RC	13.8							
LB-1	283 - 288	RC	15.5							
LB-1	288 - 293	RC	15.3							
LB-1	293 -298	RC	14.1							
LB-1	298 - 203	RC	14.2							
LB-1	303 - 308	RC								
LB-1	308 - 313	RC	15.3							
LB-1	313 - 318	RC	21.3							
LB-1	318 - 323	RC	16.9							
LB-1	323 - 328	RC	16.3							
LB-1	328 - 333	RC	13.1							
LB-1	333 - 338	RC	14.3							
LB-1	338 - 343	RC	15.5							
LB-1	343 - 348	RC	15.5							
LB-1	348 - 353	RC	17.6							
LB-1	353 - 358	RC	16.9							
LB-1	358 - 363	RC	16							
LB-1	363 - 368	RC	18.9							
LB-1	368 - 373	RC	16.2							
LB-1	373 - 378	RC	20.2							

Table 2

Laboratory Soil Test Data

Boring No.	Sample Depth (ft)	Sample Type	Moisture Content	Grain Size Distribution				Atterberg Limits		
				% Gravel	% Sand	% Silt	% Clay	LL	PL	PI
LB-1	378 -383	RC	19.8							
LB-1	383 - 388	RC								
LB-1	388 - 393	RC	18.9							
LB-1	393 - 398	RC								
LB-1	398 - 403	RC	19.9							
LB-2	4.5 - 6	SS	20.5							
LB-2	9.5 - 11	SS	17.3							
LB-2	14.5 - 16	SS	25.5							
LB-2	19.5 - 21	SS	22.6							
LB-2	24.5 - 26	SS	10.4							
LB-2	29.5 - 31	SS	27.5							
LB-2	34.5 - 36	SS								
LB-2	39.5 - 41	SS	32.9							
LB-2	44.5 - 46	SS						73	26	46
LB-2	49.5 - 51	SS	33							
LB-2	54.5 - 56	SS	19.9							
LB-2	59.5 - 61	SS	12.5							
LB-2	64.5 - 66	SS	14.1							
LB-2	69.5 - 71	SS	18.8							
LB-2	74.5 - 76	SS	14.3							
LB-2	79.5 - 81	SS	22	0.0	82.0	11.5	6.5			
LB-2	84.5 - 86	SS	17.3							
LB-2	89.5 - 91	SS	16							
LB-2	94.5 - 96	SS	18.2							
LB-2	99.5 - 101	SS	17.5							
LB-2	104.5 - 106	SS	14.8							
LB-2	109.5 - 111	SS	18.6							
LB-2	114.5 - 116	SS	21.7							
LB-2	119.5 - 121	SS	19							
LB-2	124.5 - 126	SS	21.9							
LB-2	129.5 - 131	SS	23.4							
LB-2	134.5 - 136	SS						NP	NP	NP
LB-2	139.5 - 140.5	SS	20.6							
LB-2	144.5 - 145.5	SS	25.8							
LB-2	149.5 - 150.5	SS	23.6							
LB-2	153 - 158	RC						33	17	16
LB-2	158 - 160	RC	15.6							
LB-2	160 - 165	RC								
LB-2	165 - 170	RC	16.1							
LB-2	170 - 175	RC	17.4							
LB-2	175 - 180	RC	19.1							
LB-2	180 - 185	RC	57.2							
LB-2	185 - 190	RC	12.3							
LB-2	190 - 195	RC	11.8							

Table 2

Laboratory Soil Test Data

Boring No.	Sample Depth (ft)	Sample Type	Moisture Content	Grain Size Distribution				Atterberg Limits		
				% Gravel	% Sand	% Silt	% Clay	LL	PL	PI
LB-2	195 - 200	RC	15.5							
LB-2	200 - 205	RC	16.3							
LB-2	205 - 210	RC								
LB-2	210 - 215	RC	15.5							
LB-2	215 - 220	RC								
LB-2	220 - 225	RC	61.2							
LB-2	225 - 230	RC	53.5							
LB-2	230 - 235	RC	65.6							
LB-2	235 - 240	RC	17.4							
LB-2	240 - 245	RC	15.5							
LB-2	245 - 250	RC	11.7							
LB-2	250 - 255	RC	15.6							
LB-2	255 - 260	RC	21.5							
LB-2	260 - 265	RC						26	23	3
LB-2	265 - 270	RC	14.1							
LB-2	270 - 275	RC	16.3							
LB-2	275 - 280	RC	16							
LB-2	280 - 285	RC	15.4							
LB-2	285 - 290	RC								
LB-2	290 - 295	RC	14.9							
LB-2	295 - 300	RC	16							
LB-2	300 - 305	RC	17.8							
LB-2	305 - 310	RC	23.1							
LB-2	310 - 315	RC	20.7							
LB-2	315 - 320	RC	13.6							
LB-2	320 - 325	RC	11.2							
LB-2	325 - 330	RC	17.9							
LB-2	330 - 335	RC						53	24	29
LB-2	335 - 340	RC	16.9							
LB-2	340 - 345	RC	16.3							
LB-2	345 - 350	RC	17.5							
LB-2	350 - 355	RC	16.3							
LB-2	355 - 360	RC	18	0.0	57.7	24.7	17.6			
LB-2	360 - 365	RC								
LB-2	365 - 370	RC	14.2							
LB-2	370 - 375	RC	15.3							
LB-2	375 - 380	RC	17.2							
LB-2	380 - 385	RC	15.3							
LB-2	385 - 390	RC	17.2							
LB-2	390 - 395	RC	16.2							
LB-2	395 - 400	RC								
LB-3	4.5 - 6	SS	4.3							
LB-3	9.5 - 11	SS	3.7							
LB-3	14.5 - 16	SS	2.4							

Table 2

Laboratory Soil Test Data

Boring No.	Sample Depth (ft)	Sample Type	Moisture Content	Grain Size Distribution				Atterberg Limits		
				% Gravel	% Sand	% Silt	% Clay	LL	PL	PI
LB-3	19.5 - 21	SS	3							
LB-3	24.5 - 26	SS	24.3							
LB-3	29.5 - 31	SS	25							
LB-3	34.5 - 36	SS	22	0.0	96.0	0.0	0.0			
LB-3	39.5 - 41	SS	22.2							
LB-3	44.5 - 46	SS	18.5							
LB-3	49.5 - 51	SS	14.1							
LB-3	54.5 - 56	SS	21							
LB-3	59.5 - 61	SS	20.9							
LB-3	64.5 - 66	SS	11	19.5	72.6	5.9	1.9			
LB-3	69.5 - 71	SS	23.8							
LB-3	74.5 - 76	SS	21							
LB-3	79.5 - 81	SS	18.2							
LB-3	84.5 - 86	SS	17.7							
LB-3	89.5 - 91	SS	12							
LB-3	94.5 - 96	SS	20.8							
LB-3	99.5 - 101.5	SS	12.5							
LB-3	104.5 - 105.5	SS	21.9							
LB-3	109.5 - 111	SS	16	0.0	59.1	29.2	11.2			
LB-3	114.5 - 115.5	SS								
LB-3	119.5 - 120	SS								
LB-3	124.5 - 125	SS								
LB-3	129.5 - 130	SS								
LB-3	134.5 - 135	SS								
LB-3	139.5 - 141	SS	17.1							
LB-3	144.5 - 146	SS	22.3							
LB-3	149.5 - 151	SS	20.2							
LB-3	154.5 - 156	SS	21.4							
LB-3	159.5 - 161	SS	20.4							
LB-3	164.5 - 166	SS						24	18	6
LB-3	169.5 - 171	SS	19.2							
LB-3	175 - 180	RC	32.5							
LB-3	180 - 185	RC	28.4							
LB-3	185 - 187	RC	51							
LB-3	187 - 192	RC	60.3							
LB-3	192 - 197	RC								
LB-3	197 - 202	RC	20.3							
LB-3	202 - 207	RC	18.9							
LB-3	207 - 212	RC	15.1							
LB-3	212 - 217	RC	15.4							
LB-3	217 - 222	RC	13.3							
LB-3	222 - 227	RC	15.9							
LB-3	227 - 232	RC						24	23	1
LB-3	232 - 237	RC	11.1							

Table 2

Laboratory Soil Test Data

Boring No.	Sample Depth (ft)	Sample Type	Moisture Content	Grain Size Distribution				Atterberg Limits		
				% Gravel	% Sand	% Silt	% Clay	LL	PL	PI
LB-3	237 - 242	RC	18.5							
LB-3	242 - 247	RC	15.6							
LB-3	247 - 252	RC	17							
LB-3	252 - 257	RC	20.2							
LB-3	257 - 262	RC								
LB-3	262 - 267	RC	19.4							
LB-3	267 - 272	RC	16.9							
LB-3	272 - 277	RC								
LB-3	277 - 282	RC	18							
LB-3	282 - 287	RC	23.8							
LB-3	287 - 292	RC	17.1							
LB-3	292 - 297	RC	19.2							
LB-3	297 - 302	RC								
LB-3	302 - 307	RC	14.8							
LB-3	307 - 312	RC	15.9							
LB-3	312 - 317	RC	17.4							
LB-3	317 - 322	RC	16.3							
LB-3	322 - 327	RC	15.8							
LB-3	327 - 332	RC								
LB-3	332 - 337	RC	19.2							
LB-3	337 - 342	RC	17.9							
LB-3	342 - 347	RC								
LB-3	347 - 352	RC	15.8							
LB-3	352 - 357	RC								
LB-3	357 - 362	RC	16.2							
LB-3	362 - 367	RC	22.3							
LB-3	367 - 372	RC	18.7							

Notes:
SS = Split Spoon
RC = Rock Core
Per MTS, some moisture content tests were not conducted because of lignite or moisture was done with the Atterberg Limit Testing.

Appendix A – Boring Logs

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-1**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
0				SW: WELL GRADED SAND, fine to medium grained, with trace silt, pale brown (10YR 6/3), moist, medium dense.							
5	1	11 in.	7-7-6		-						
10	2	12 in.	8-5-4	Color changes to light yellowish brown (10YR 6/4) and loose at 9.5 ft.	-						
15	3	18 in.	5-3-4	CL: LEAN CLAY, with trace silt, brownish yellow (10YR 6/6), moist, medium stiff.	0.5						
20	4	13 in.	7-5-8	SW: WELL GRADED SAND, fine to medium grained, pale brown (10YR 6/3), moist, medium dense.	-						
25	5	17 in.	5-10-13	ML: SILT, light yellowish brown (2.5Y 6/3), moist, medium dense.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 6' 56.33"

Lon: 103° 5' 34.23"

SOIL BORING LOG

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Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	6		18 in.	9-10-13	CL: LEAN CLAY, with trace silt, light olive brown (2.5Y 5/3) with gray (2.5Y 5/1) mottling, moist, very stiff to hard.	4.25						
35	7		18 in.	9-13-20		4.5	19	50	30			
40	8		14 in.	10-16-27	CL: LEAN CLAY, light brownish gray (2.5Y 6/2), moist, hard.	1.0						
45	9		17 in.	8-10-18	ML: SILT, light olive brown (2.5Y 5/3), moist, medium dense.	4.5						
50	10		18 in.	13-33-50/6"	CL: LEAN CLAY, gray (2.5Y 5/1), moist, hard. Lignite seam at least 12 in. thick at 50 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

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Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
55	11	18 in.	9-16-26		4.5						
60	12	13 in.	18-20-33	CL: LEAN CLAY, with trace silt, dark gray (2.5Y 4/1), moist, hard.	4.5						
65	13	18 in.	9-13-16	CL-ML: SILTY CLAY, gray (2.5Y 5/1), moist, very stiff.	3.25						
70	14	4 in.	50/4"	Lignite seam at least 4 in. thick at 69.5 ft.	-						
75	15	18 in.	15-21-32	ML: SILT, with trace clay, gray (2.5Y 5/1), moist, very dense. Lignite seam 1 in. thick at 75 ft.	4.5						
80	16	18 in.	10-14-16	CL: LEAN CLAY, with trace silt, gray (2.5Y 5/1), moist, hard.	4.5						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

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Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
85	17		18 in.	10-13-15	With trace lignite and very stiff at 84.5 ft.	3.75						
90	18		18 in.	23-30-41	CH: FAT CLAY, consolidated, possibly highly weathered shale, gray (2.5Y 5/1) moist, hard.	4.5	21	57	36			
95	19		5 in.	50/5"	Lignite seam at least 5 in. thick at 94.5 ft.	-						
100	20		18 in.	17-27-40	ML: SILT, with trace clay, gray (2.5Y 6/1), moist, very dense.	4.5						
105	21		18 in.	19-28-45		4.5						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 6' 56.33"

Lon: 103° 5' 34.23"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-1**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
110	22		18 in.	11-28-48	CH: FAT CLAY, with trace silt and trace coal, consolidated, possibly highly weathered shale, gray (2.5Y 5/1) moist, hard.	4.5						
115	23		18 in.	17-33-50/6"	Lignite seam at least 1 in. thick at 116 ft.	4.5						
120	24		18 in.	21-28-41	CL: LEAN CALY, with some silt, gray (2.5Y 5/1), moist, very dense.	4.5						
125	25		18 in.	21-36-50/6"	With trace lignite at 124.5 ft.	4.5						
130	26		18 in.	16-25-36		4.5	20	36	16			

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-1**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	27		15 in.	21-36-50/3"		4.5						
140	28		18 in.	22-35-43	Lignite seam at least 2 in. thick at 139.5 ft.	4.5						
145	29		17 in.	24-36-50/5"		4.5						
150	30		18 in.	24-36-50/6"	Consolidated, weakly cemented, with lignite seam at least 1 in. thick at 151 ft.	4.5						
155	31		17 in.	27-43-50/5"	CL: LEAN CLAY, with some silt, consolidated, highly weathered shale, gray (2.5Y 5/1), moist, hard.	4.5						
160	32		12 in.	27-33-50/6"		4.5						

Notes:

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Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

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SOIL BORING LOG

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Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

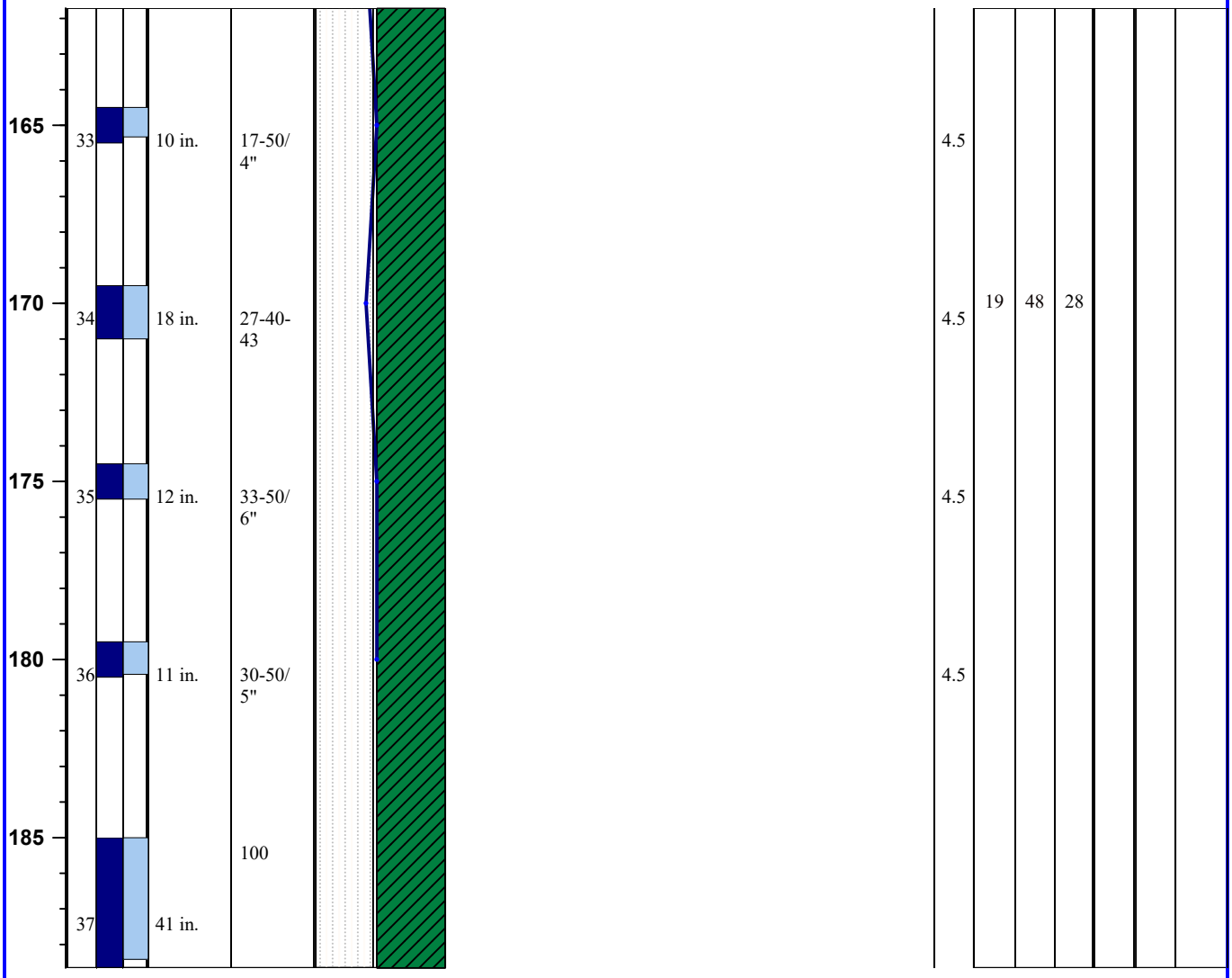
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**



Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-1**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
190			100								
	38	36 in.	83								
195											
	39	54 in.	63								
200				Silt seam 4 in. thick at 200 ft.							
	40	60 in.	95								
205											
	41	60 in.	81								
210				Lignite seam 1 in. thick at 210 ft.							
	42	60 in.		Coal: Lignite coal, black (2.5Y 2.5/1).							
			83								
215	43										

Notes:

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Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-1**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
220	44	60 in.	87								
			68								
225	45	60 in.									
			53								
230	46	60 in.									
			100	Shale: SHALE, highly weathered, gray (2.5Y 5/1), moist, hard.							
235	47	48 in.		ML: SILT, gray (2.5Y 5/1), moist, very dense.							
				Shale: SHALE, highly weathered, gray (2.5Y 5/1), moist, hard.							
			97	Trace Lignite less than 1 in. thick at 238 ft.							
240	48	60 in.		Lignite seam 6 in. thick at 242 ft.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

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Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
245	49	50 in.	81	ML: SANDY SILT, fine grained, gray (2.5Y 5/1), moist, very dense.							
				Shale: SHALE, highly weathered, gray (2.5Y 5/1), moist, hard.							
			85	Trace Lignite 1 in. thick at 248 ft.							
				ML: SANDY SILT, fine grained, gray (2.5Y 5/1), moist, very dense.							
250	50	60 in.		Shale: SHALE, highly weathered, gray (2.5Y 5/1), moist, hard.							
				Calcified layer, light gray (2.5Y 7/1), harder than surrounding shale, 6 in. thick at 251.5 ft.							
			43	CL: LEAN CLAY with fine grained sand and silt, gray (2.5Y 5/1), moist, very dense.							
255	51	42 in.									
			100			18	41	23			
260	52	60 in.									
			100	Shale: SHALE, highly weathered, gray (2.5Y 5/1), moist, hard.							
265	53	55 in.									
			95	Lignite seam 2 in. thick at 269 ft.							

Notes:

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M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-1**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
270	54	60 in.		Color turns greenish gray (GLEY1 6/1) at 272 ft.							
			97	Shale: SHALE, highly weathered, with trace lignite, dark gray (2.5Y 4/1), moist, hard.							
275	55	60 in.		Lignite seam 5 in. thick at 276 ft.							
			93	Color turns to gray (2.5Y 5/1) and lignite seam 4 in. thick at 278 ft.							
280	56	60 in.		ML: SANDY SILT, fine grained, gray (2.5Y 5/1), moist, very dense.							
			100	Shale: SHALE, highly weathered, with trace lignite, greenish gray (GLEY1 6/1), moist, hard.							
285	57	60 in.		Color turns to gray (2.5Y 5/1) and lignite seam 1 in. thick at 285.5 ft.							
			97	ML: SILT, with trace clay, consolidated, weakly cemented, greenish gray (GLEY1 6/1) moist, very dense.							
290	58	60 in.		Lignite seam 1 in. thick at 288.5 ft.							
			100	Color turns to gray (2.5Y 5/1) at 293 ft.							
295	59	54 in.									

Notes:

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Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

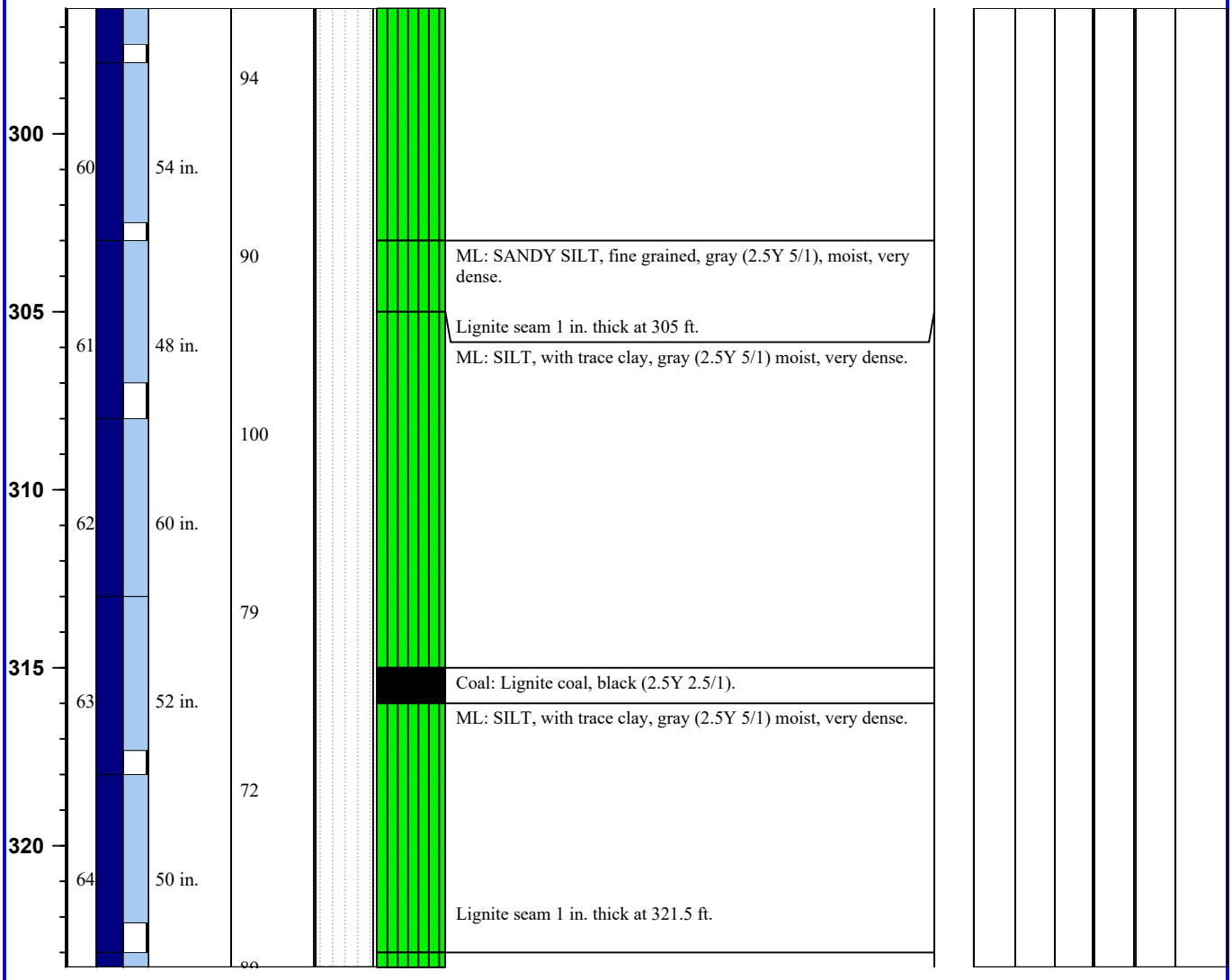
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**



Notes:

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

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Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

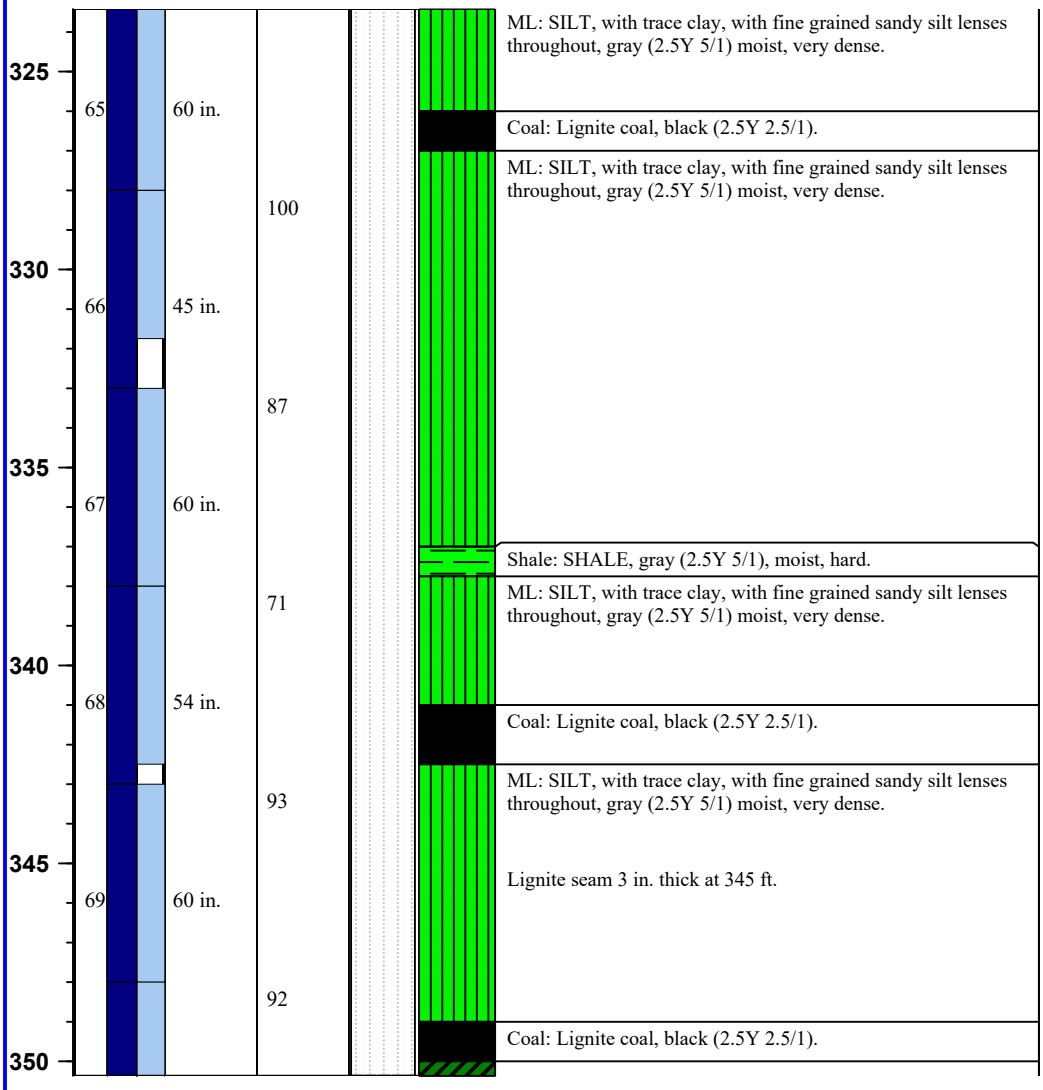
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**



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Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
355	70	32 in.	100	CH: FAT CLAY, with silt, with fine grained sandy silt lenses throughout, gray (2.5Y 5/1) moist, very dense.		23	196	173			
	71	60 in.									
360			92	ML: SILT, with trace fine grained sand, weakly cemented, gray (2.5Y 6/1) moist, very dense.							
	72	60 in.									
365			100								
	73	50 in.									
370			98								
	74	60 in.									
375			100								
	75	60 in.									

Notes:

Soil Lithologies based on field observations and laboratory analysis.

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SOIL BORING LOG

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ID NO. **LB-1**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
380	76	60 in.	83	Coal: Lignite coal, black (2.5Y 2.5/1).							
385	77	58 in.	74								
390	78	60 in.	94	ML: SILT, with trace clay, weakly cemented, gray (2.5Y 6/1) moist, very dense.							
395	79	60 in.	100								
400	80	58 in.	74	Coal: Lignite coal, black (2.5Y 2.5/1).							
				ML: SILT, with trace clay, weakly cemented, gray (2.5Y 6/1) moist, very dense.							
				EOB at 403 ft. Target depth reached.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 6' 56.33"

Lon: 103° 5' 34.23"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
0				ML: SILT, with trace clay, light brownish gray (2.5Y 6/2), moist, medium dense.							
5	1	6 in.	7-8-9		-						
10	2	11 in.	6-6-11	SM: SILTY SAND, fine grained, light olive brown (2.5Y 5/3), moist, medium dense.	-						
15	3	13 in.	7-9-9	ML: SILT, with trace clay, light olive brown (2.5Y 5/3), moist, medium dense.	-						
20	4	16 in.	6-7-10	Color turns to dark grayish brown (2.5Y 4/2) at 19.5 ft.	-						
25	5	16 in.	4-4-4	SM: SILTY SAND, fine grained, light olive brown (2.5Y 5/3), moist, loose.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

Lon: 103° 5' 33.40"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	6		15 in.	5-5-6	ML: SANDY SILT, fine grained, grayish brown (2.5Y 5/2), moist, medium dense.	-						
35	7		18 in.	4-4-8	CH: FAT CLAY, with trace silt, gray (2.5Y 5/1), moist, very stiff.	2.25						
40	8		18 in.	4-5-8		2.75						
45	9		18 in.	4-6-7		2.75	26	73	46			
50	10		18 in.	5-7-8		3.0						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

Lon: 103° 5' 33.40"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
55	11		12 in.	10-13-13	SP: POORLY GRADED SAND, fine grained, with trace silt, grayish brown (2.5Y 5/2) moist, medium dense.	-						
60	12		16 in.	8-10-10	SP: POORLY GRADED SAND, fine grained, grayish brown (2.5Y 5/2) moist, medium dense.	-						
65	13		18 in.	7-8-12		-						
70	14		12 in.	7-4-6	SP: POORLY GRADED SAND, fine grained with trace medium grained, with trace silt, grayish brown (2.5Y 5/2) moist, loose.	-						
75	15		14 in.	11-14-16	SP: POORLY GRADED SAND, fine to medium grained, grayish brown (2.5Y 5/2) moist, medium dense.	-						
80	16		12 in.	13-11-12	With some silt and clay at 79.5 ft.	-					82.0	18.0

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
85	17	12 in.	13-17-19	Fine grained and dense at 84.5 ft.	-						
90	18	14 in.	6-7-9	With trace silt and medium dense at 89.5 ft.	-						
95	19	13 in.	10-14-14	Mostly fine grained with some medium grained at 94.5 ft.	-						
100	20	12 in.	9-17-17	Fine grained and dense at 99.5 ft.	-						
105	21	13 in.	8-9-9	Medium dense at 104.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
110	22	13 in.	10-8-8	Trace lignite at 110 ft.	-						
115	23	16 in.	7-10-11	With trace silt and trace clay at 114.5 ft.	-						
120	24	15 in.	10-15-18	ML: SANDY SILT, fine grained, with trace clay, gray (2.5Y 5/1), moist, dense.	0.5						
125	25	18 in.	8-11-21	CL-ML: SILTY CLAY, gray (2.5Y 5/1), moist, hard.	3.0						
130	26	18 in.	15-25-36		4.5						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	27		18 in.	17-24-34	ML: SILT, with trace fine grained sand, gray (2.5Y 5/1), moist, very dense.	-						
140	28		12 in.	20-50/6"	ML: SILT, with trace clay, weakly cemented, gray (2.5Y 5/1), moist, very dense. Lignite seam at least 1 in. thick at 140.5 ft.	4.5						
145	29		12 in.	20-50/6"	With trace lignite at 144.5 ft.	4.5						
150	30		12 in.	18-50/6"		4.5						
				100	Shale: SHALE, highly weathered, consolidated lean clay, gray (2.5Y 5/1), moist, hard.		17	33	16			
155	31		48 in.									
				97								
160	32		24 in.	83	Lignite seam at least 4 in. thick at 160 ft.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
165	33	60 in.	83	Poor recovery, suspect non-cohesive sand was washed out and not collected in the core barrel from 165 to 170 ft.							
	34	15 in.									
170			81	Poor recovery, suspect non-cohesive sand was washed out and not collected in the core barrel from 170 to 175 ft.							
	35	11 in.									
175			0	No Recovery 175 to 180 ft.							
	36	0 in.									
180			35	Shale: SHALE, highly weathered, consolidated silty clay, gray (2.5Y 5/1), moist, hard. Poor recovery, suspect non-cohesive sand was washed out and not collected in the core barrel from 180 to 185 ft.							
	37	20 in.		Fine grained silty sand seam 3 in. thick at 183 ft.							
185			100								
	38	41 in.									

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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GPS Coordinates

Lat: 48° 7' 3.56"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

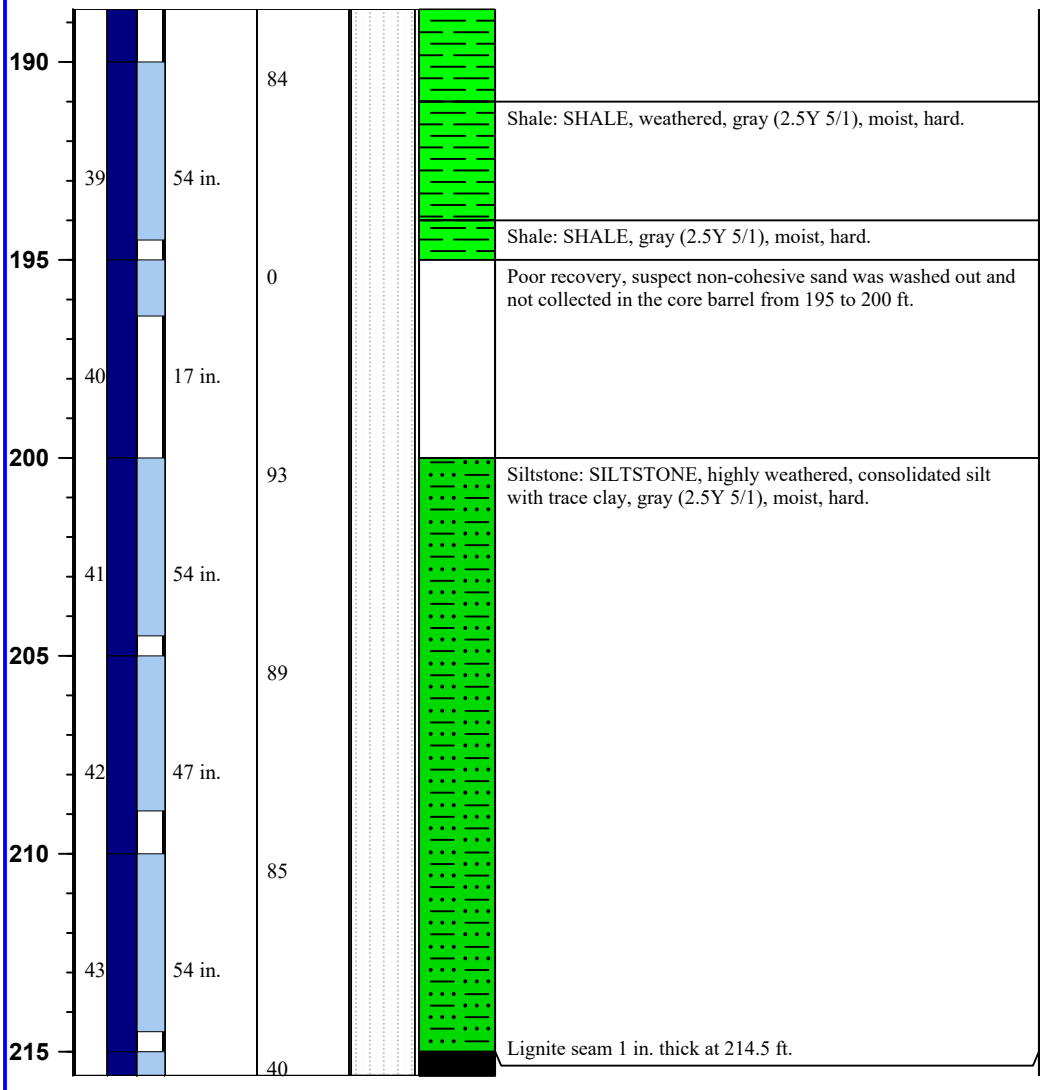
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**



Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
220	44	48 in.	33	Coal: Lignite coal, black (2.5Y 2.5/1).							
225	45	60 in.	9								
	46	58 in.									
230			33								
	47	60 in.									
235			50								
	48	48 in.		ML: SILT, with trace lignite, gray (2.5Y 5/1), moist, very dense.							
240			100	With trace fine grained sand at 240 ft. Lignite seam less than 1 in. thick at 240.5 ft.							
	49										

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
245	49		100	Lignite seam less than 1 in. thick at 243.5 and 244 ft.							
				Poor recovery, suspect non-cohesive sand was washed out and not collected in the core barrel from 245 to 250 ft.							
	50	33 in.									
250			0	Poor recovery, suspect non-cohesive sand was washed out and not collected in the core barrel from 250 to 255 ft.							
	51	0 in.									
255			56	ML: SANDY SILT, fine grained, with trace clay, gray (2.5Y 5/1), moist, dense.							
				ML: SILT, gray (2.5Y 5/1), moist, very dense.							
	52	48 in.									
260			95	With trace clay at 260 ft.		23	26	3			
	53	60 in.									
265			95	Weakly cemented at 265 ft.							
	54	60 in.									

Notes:

Soil Lithologies based on field observations and laboratory analysis.

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Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
270			75	ML: SANDY SILT, fine grained, weakly cemented, gray (2.5Y 5/1), moist, dense.							
	55	57 in.									
275			69	ML: SILT, with trace clay, weakly cemented, gray (2.5Y 5/1), moist, very dense.							
	56	48 in.		Lignite seam 3 in. thick at 276 ft. Lignite seam 6 in. thick at 277.5 ft.							
280			100	With trace lignite seams throughout at 280 ft.							
	57	60 in.									
285			85								
	58	45 in.		Lignite seam 4 in. thick at 286 ft.							
				Lignite seam 4 in. thick at 288.5 ft.							
290			100	ML: SILT, with trace clay, weakly cemented, with trace lignite throughout, gray (2.5Y 5/1), moist, very dense.							
	59	54 in.									
295			95								

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

Lon: 103° 5' 33.40"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
	60	60 in.		Lignite seam 1 in. thick at 297.5 ft.							
300			97	Sandy silt seam 4 in. thick at 299 ft.							
	61	48 in.		SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.							
305			30	Silt seam with trace clay 6 in. thick at 304 ft.							
				SP-SM: SAND WITH SILT, fine grained, gray (2.5Y 5/1), moist, very dense.							
	62	43 in.		ML: SILT, gray (2.5Y 5/1), moist, very dense.							
				Fine grained sand with silt seam 4 in. thick at 309 ft.							
310			80	Lignite seam 2 in. thick at 310 ft.							
				ML: SILT, with trace clay, gray (2.5Y 5/1) moist, very dense.							
	63	60 in.		Coal: Lignite coal, black (2.5Y 2.5/1).							
315			95	ML: SILT, with trace fine grained sand, with trace lignite throughout, gray (2.5Y 5/1) moist, very dense.							
	64	57 in.									
320			93	Coal: Lignite coal, black (2.5Y 2.5/1).							
				ML: SILT, with trace clay, gray (2.5Y 5/1) moist, very dense.							
	65	60 in.									

Notes:

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Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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Lon: 103° 5' 33.40"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

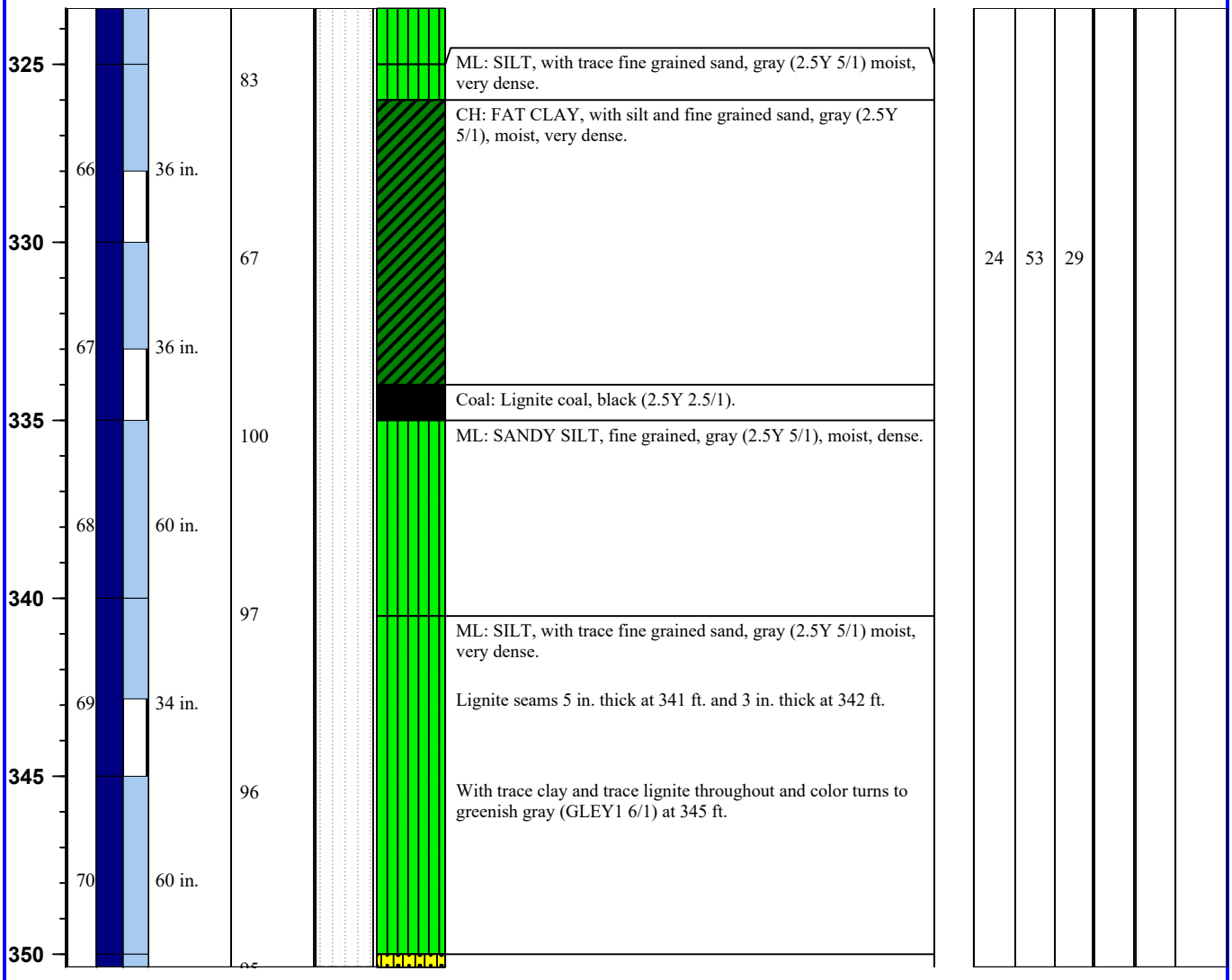
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**



Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

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PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
355	71	42 in.	100	SM: SILTY SAND, fine grained, with little clay, weakly cemented, greenish gray (GLEY1 6/1), moist, very dense.						57.7	42.3
360	72	59 in.	95								
	73	60 in.									
365			100								
	74	55 in.									
370			88								
	75	60 in.									
375			78	Coal: Lignite coal, black (2.5Y 2.5/1).							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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Lon: 103° 5' 33.40"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

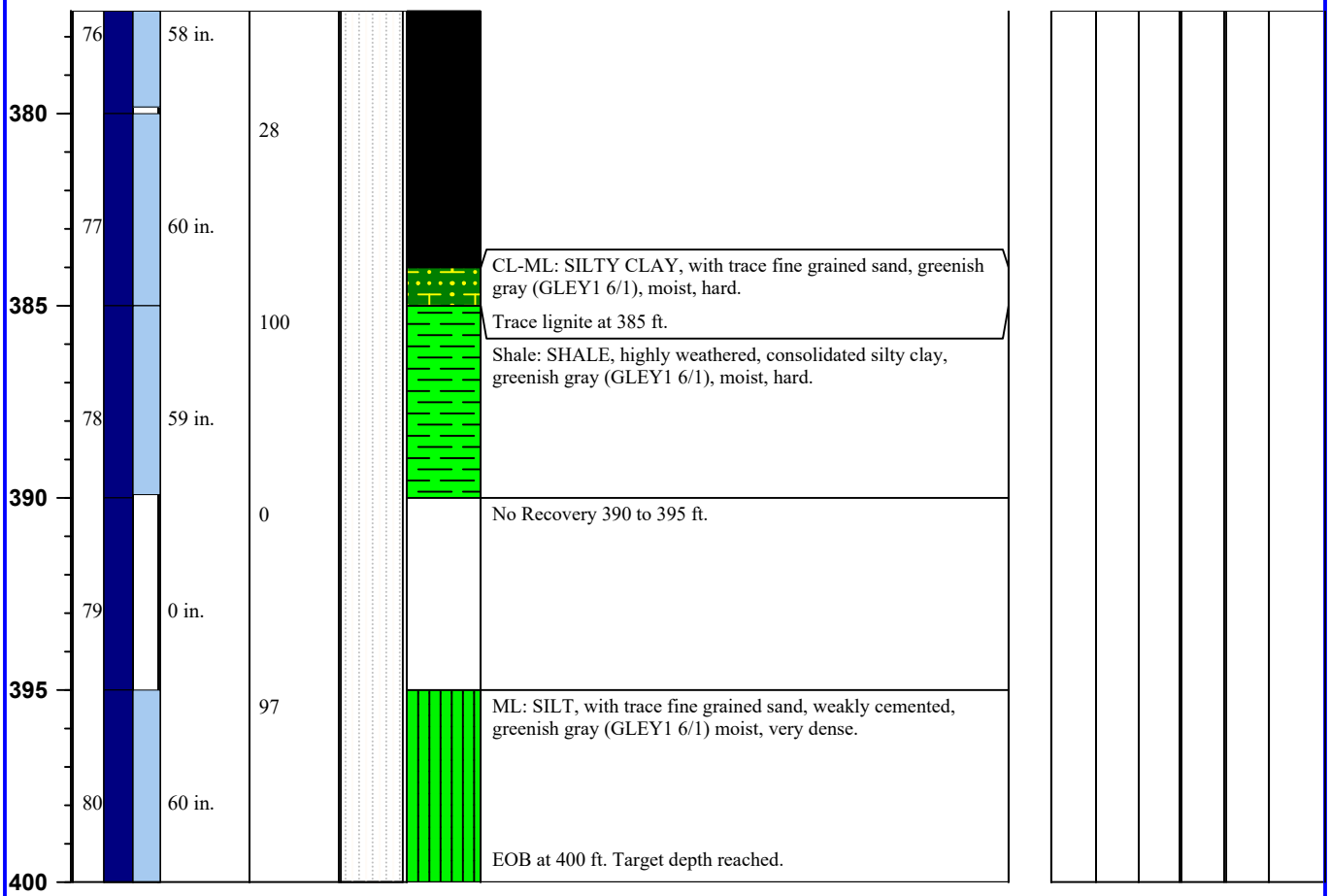
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**



Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

Lon: 103° 5' 33.40"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
0				SP: POORLY GRADED SAND, fine to medium grained, brown (7.5YR 4/3) moist, loose.							
5	1	15 in.	3-3-2		-						
10	2	13 in.	4-3-3		-						
15	3	13 in.	3-2-2	Color turns to brown (7.5YR 5/4) and trace coarse grained sand, very loose at 14.5 ft. Trace lignite at 16 ft.	-						
20	4	16 in.	5-3-3	Trace lignite at 21 ft.	-						
25	5	18 in.	2-4-5	Color turns to brown (7.5YR 4/3) and wet at 24.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 22.10"

Lon: 103° 4' 39.62"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	6		18 in.	2-3-3	Color turns to brown (7.5YR 5/3) at 29.5 ft.	-						
35	7		18 in.	4-7-8	Color turns to brown (7.5YR 4/3) at 34.5 ft.	-					96.0	
40	8		18 in.	4-6-11		-						
45	9		18 in.	6-10-12	Lignite seam less than 1 in. thick at 46 ft.	-						
50	10		18 in.	3-3-5	SW: WELL GRADED SAND, fine to medium grained, dark brown (7.5YR 3/3) wet, loose. Gravel and sand seam, coarse grained, 4 in. thick at 50.5 ft. Trace lignite at 51 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

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GPS Coordinates

Lat: 48° 9' 22.10"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
55	11		18 in.	3-4-7	SW: WELL GRADED SAND, fine to medium grained, brown (7.5YR 4/3) wet, medium dense.	-						
60	12		18 in.	7-5-6	Gravel and sand seam, coarse grained, 6 in. thick at 60.5 ft.	-						
65	13		12 in.	6-10-10	SPG: POORLY GRADED SAND WITH GRAVEL, coarse grained, dark brown (7.5YR 3/2), wet, medium dense.	-				19.5	72.6	7.8
70	14		18 in.	5-8-9	CL: LEAN CLAY WITH SAND, fine grained, with silt, dark grayish brown (10YR 4/2), wet, very stiff.	2.0						
75	15		18 in.	17-24-25	SM: SILTY SAND, fine grained, grayish brown (2.5Y 5/2), wet, dense.	-						
80	16		18 in.	15-21-21		-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

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Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
85	17	8 in.	12-10-16	SW: WELL GRADED SAND, fine to medium grained, gray (2.5Y 5/1) wet, medium dense.	-						
90	18	14 in.	24-33-25	SW: WELL GRADED SAND, fine to coarse grained, gray (2.5Y 5/1) wet, very dense.	-						
95	19	18 in.	33-36-50/6"	SP: POORLY GRADED SAND, fine grained, with trace silt, dark gray (2.5Y 4/1) wet, very dense.	-						
100	20	12 in.	23-50/6"	With trace lignite at 99.5 ft. Trace silty clay at 101.5 ft.	-						
105	21	11 in.	34-50/6"	SP: POORLY GRADED SAND, fine grained, dark gray (2.5Y 4/1) moist, very dense.	-						

Notes:

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

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Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

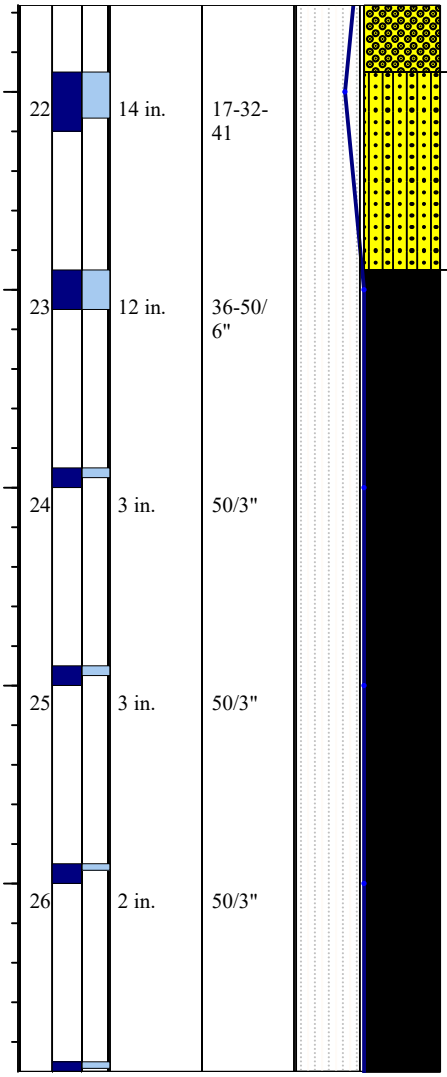
Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
110	22	14 in.	17-32-41	SM: SILTY SAND, fine grained, with trace clay, dark gray (2.5Y 4/1) moist, very dense.	-					59.1	40.4
115	23	12 in.	36-50/6"	Coal: Lignite coal, black (2.5Y 2.5/1), moist, very dense.	-						
120	24	3 in.	50/3"		-						
125	25	3 in.	50/3"		-						
130	26	2 in.	50/3"		-						



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ID NO. **LB-3**

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Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	27	2 in.	50/2"		-						
140	28	18 in.	17-33-43	ML: SILT, with trace clay, gray (2.5Y 5/1), moist, very dense.	-						
145	29	18 in.	18-26-36	CL-ML: SILTY CLAY, dark gray (2.5Y 4/1), moist, hard.	4.5						
150	30	18 in.	15-20-30	SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.	4.5						
155	31	18 in.	17-33-50/6"		-						
160	32	18 in.	16-23-28		-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 22.10"

Lon: 103° 4' 39.62"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
165	33	18 in.	17-24-27	CL-ML: SILTY CLAY, gray (2.5Y 5/1), moist, hard.	4.5	18	24	6			
170	34	18 in.	24-25-48	ML: SILT, with trace fine grained sand and trace clay, gray (2.5Y 5/1), moist, very dense.	3.5						
175	35	8.5 in.	59	Coal: Lignite coal, black (2.5Y 2.5/1).							
180	36	24 in.	75	CL: LEAN CLAY, with trace silt, gray (2.5Y 5/1). Lignite seam 2 in. thick at 182 ft. Lignite seam 2 in. thick at 184 ft.							
185	37	18 in.	89 40	SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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SOIL BORING LOG

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Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

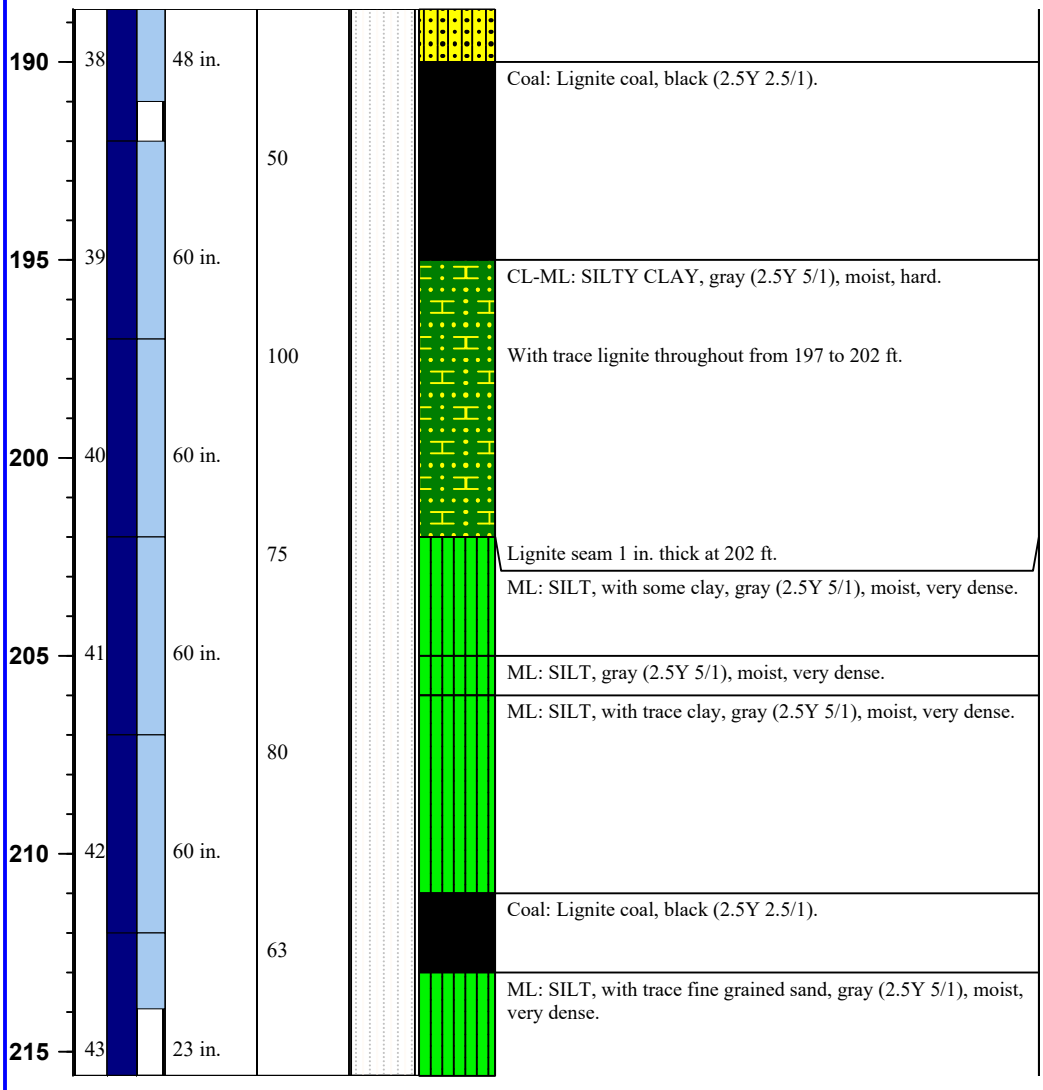
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**



Notes:

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NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 22.10"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
220	44	54 in.	98	Lignite seam 1 in. thick at 219.5 ft. ML: SILT, gray (2.5Y 5/1), moist, very dense.							
			90	CL-ML: SILTY CLAY, gray (2.5Y 5/1), moist, hard.							
225	45	60 in.									
			100	ML: SILT, with trace fine grained sand, gray (2.5Y 5/1), moist, very dense.		23	24	1			
230	46	57 in.									
			84	ML: SILT, with trace clay, gray (2.5Y 5/1), moist, very dense. Shale layer 6 in. thick at 234 ft.							
235	47	56 in.									
			85	Coal: Lignite coal, black (2.5Y 2.5/1).							
240	48	54 in.		ML: SILT, with trace clay and with trace lignite, gray (2.5Y 5/1), moist, very dense.							
			100								

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

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Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

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Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
245	49	60 in.	100	ML: SANDY SILT, fine grained, weakly cemented, greenish gray (GLEY1 6/1), moist, very dense.							
250	50	60 in.	100								
255	51	60 in.	100	SM: SILTY SAND, fine grained, weakly cemented, greenish gray (GLEY1 6/1), moist, very dense.							
260	52	60 in.	100								
265	53	60 in.	70	Shale seam 1 in. thick at 267 ft.							
	54	60 in.									

Notes:

Soil Lithologies based on field observations and laboratory analysis.

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Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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Lon: 103° 4' 39.62"

SOIL BORING LOG

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ID NO. **LB-3**

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Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
270											
			10	Coal: Lignite coal, black (2.5Y 2.5/1).							
	55	60 in.									
275				Silty clay layer 6 in. thick at 275 ft.							
			58								
				ML: SILT, with trace fine grained sand, gray (2.5Y 5/1), moist, very dense.							
280	56	48 in.									
			100	SM: SILTY SAND, fine grained, weakly cemented, greenish gray (GLEY1 6/1), moist, very dense.							
285	57	60 in.									
			95	Trace lignite less than 1 in. thick at 287 ft.							
				Trace lignite less than 1 in. thick at 289 ft.							
290	58	60 in.		Shale: SHALE, highly weathered, with trace coal, greenish gray (GLEY1 6/1), moist, hard.							
			91	Shale: SHALE, highly weathered, gray (2.5Y 5/1), moist, hard.							
295	59	60 in.									

Notes:

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Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

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Address: **NA** GES Job #: **3502056**

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Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
300	60	60 in.	97	Shale layer, not weathered, 2 in. thick and color turns to dark gray (2.5Y 4/1) at 297 ft.							
				Sandstone layer 8 in. thick at 301 ft.							
			83	Color turns to gray (2.5Y 5/1) at 302 ft.							
305	61	60 in.									
			100	Silty sand layer, fine grained, 6 in. thick at 307 ft.							
				Shale layer, not weathered, less than1 in. thick at 307.5 ft.							
310	62	60 in.									
			80								
315	63	60 in.									
				Lignite seam 3 in. thick at 316 ft.							
			100	SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.							
				Shale: SHALE, highly weathered, gray (2.5Y 5/1), moist, hard.							
320	64	60 in.									
				SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.							
			100	Shale: SHALE, highly weathered, with trace lignite throughout, gray (2.5Y 5/1), moist, hard.							

Notes:

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Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
325	65	60 in.	100			25	105	81			
330	66	60 in.	95								
335	67	60 in.	70	SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.							
340	68	60 in.	10	Coal: Lignite coal, black (2.5Y 2.5/1). Silty clay layer 6 in. thick at 339 ft.							
345	69	60 in.	100	Silty clay layer 6 in. thick at 344 ft.							
350	70	46 in.		SM: SILTY SAND, fine grained, weakly cemented, gray (2.5Y 5/1), moist, very dense.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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SOIL BORING LOG

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Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

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Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
355	71	58 in.	57	Shale: SHALE, highly weathered, with trace lignite, gray (2.5Y 5/1), moist, hard.							
				Coal: Lignite coal, black (2.5Y 2.5/1).							
			62	SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.							
360	72	50 in.		CL-ML: SILTY CLAY, gray (2.5Y 5/1), moist, hard.							
			94	SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.							
365	73	54 in.									
			67								
370	74	58 in.		EOB at 372 ft. Target depth reached.							

Notes:

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NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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GPS Coordinates

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Appendix B – Photographic Documentation

Site Photographs

Geotechnical Investigation Report
CCI and Associates, Inc.
WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River, North Dakota

Description:
Soil Boring LB-1

Direction of View:
Looking North-northwest

Date Taken:
4/28/2019

Site Photographs

Geotechnical Investigation Report
CCI and Associates, Inc.
WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River, North Dakota

Description:
Soil Boring LB-2

Direction of View:
Looking North-northwest

Date Taken:
4/29/2019

Site Photographs

Geotechnical Investigation Report
CCI and Associates, Inc.
WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River, North Dakota

Description:
Soil Boring LB-3

Direction of View:
Looking South

Date Taken:
5/2/2019

Appendix C - Laboratory Reports

Project: **WBI N Bakken Expansion** Job Number: **G19-025** Sheet **1** of **10**

Manager: _____ Client: _____ Project Description: _____

Location: **Missouri River HDD Crossing**

Elevation Datum: _____

Borehole / Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-1 4.5							9.5						
LB-1 9.5							13.2						
LB-1 14.5							32.4						
LB-1 19.5							4.4						
LB-1 24.5							19.2						
LB-1 29.5							24.3						
LB-1 34.5	49.6	19.2	31.0				21.0						
LB-1 39.5							23.8						
LB-1 44.5							22.0						
LB-1 54.5							20.7						
LB-1 59.5							22.2						
LB-1 64.5							25.8						
LB-1 74.5							26.3						
LB-1 79.5							24.8						
LB-1 84.5							22.9						
LB-1 89.5	56.7	20.8	36.0				22.4						
LB-1 99.5							23.2						
LB-1 104.5							24.6						
LB-1 109.5							23.9						

Material Testing Services, LLC	**Summary of Material Properties**	June 6, 2019

Project: **WBI N Bakken Expansion** Job Number: **G19-025** Sheet **2** of **10**

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-1 114.5							22.0						
LB-1 119.5							24.4						
LB-1 124.5							19.1						
LB-1 129.5	36.4	20.3	16.0				20.4						
LB-1 134.5							21.2						
LB-1 139.5							21.1						
LB-1 144.5							21.9						
LB-1 149.5							28.5						
LB-1 154.5							19.4						
LB-1 159.5							21.0						
LB-1 164.5							24.9						
LB-1 169.5	47.7	19.4	29.0				19.3						
LB-1 174.5							19.5						
LB-1 179.5							22.6						
LB-1 185.0							8.5						
LB-1 189.0							13.8						
LB-1 193.0							15.4						
LB-1 198.0							16.0						
LB-1 203.0					137.7	118.7	16.0						
LB-1 208.0							16.0						
LB-1 223.0							54.1						
LB-1 228.0							60.4						

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-1 233.0							15.4						
LB-1 238.0					129.4	110.4	17.2						
LB-1 243.0							11.6						
LB-1 248.0							11.0						
LB-1 253.0							17.9						
LB-1 258.0	40.8	18.1	23.0				15.5						
LB-1 263.0							21.2						
LB-1 268.0							12.2						
LB-1 273.0							11.8						
LB-1 278.0							13.8						
LB-1 283.0							15.5						
LB-1 288.0							15.3						
LB-1 293.0							14.1						
LB-1 298.0							14.2						
LB-1 303.0					142.5	122.0	16.8						
LB-1 308.0							15.3						
LB-1 313.0							21.3						
LB-1 318.0							16.9						
LB-1 323.0							16.3						
LB-1 328.0							13.1						
LB-1 333.0							14.3						
LB-1 338.0							15.5						

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-1 343.0							15.5						
LB-1 348.0							17.6						
LB-1 353.0	196.0	23.0	173.0				18.4						
LB-1 358.0							16.0						
LB-1 363.0							18.9						
LB-1 368.0							16.2						
LB-1 373.0							20.2						
LB-1 378.0							19.8						
LB-1 388.0							18.9						
LB-1 393.0					131.4	112.1	17.2						
LB-1 398.0							19.9						
LB-2 4.5							20.5						
LB-2 9.5							17.3						
LB-2 14.5							25.5						
LB-2 19.5							22.6						
LB-2 24.5							10.4						
LB-2 29.5							27.5						
LB-2 34.5							25.8						
LB-2 39.5							32.9						
LB-2 44.5	72.9	26.4	47.0				31.4						
LB-2 49.5							33.0						
LB-2 54.5							19.5						

Project: **WBI N Bakken Expansion** Job Number: **G19-025** Sheet **5** of **10**

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-2 59.5							12.5						
LB-2 64.5							14.1						
LB-2 69.5							18.8						
LB-2 74.5							14.3						
LB-2 79.5				18.0			21.9						
LB-2 84.5							17.3						
LB-2 89.5							16.0						
LB-2 94.5							18.2						
LB-2 99.5							17.5						
LB-2 104.5							14.8						
LB-2 109.5							18.6						
LB-2 114.5							21.7						
LB-2 119.5							19.0						
LB-2 124.5							21.9						
LB-2 129.5							23.4						
LB-2 134.5	NP	NP	NP				23.9						
LB-2 139.5							20.6						
LB-2 144.5							25.8						
LB-2 149.5							23.6						
LB-2 153.0	33.5	17.1	16.0				15.4						
LB-2 158.0							15.6						
LB-2 165.0							16.1						

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-2 170.0							17.4						
LB-2 175.0							19.1						
LB-2 180.0							57.2						
LB-2 185.0							12.3						
LB-2 190.0							11.8						
LB-2 195.0							15.5						
LB-2 200.0							16.3						
LB-2 205.0					130.0	111.2	16.9						
LB-2 210.0							15.5						
LB-2 220.0							61.2						
LB-2 225.0							53.5						
LB-2 230.0							65.6						
LB-2 235.0							17.4						
LB-2 240.0							15.5						
LB-2 245.0							11.7						
LB-2 255.0							21.5						
LB-2 260.0	26.3	23.3	3.0				19.5						
LB-2 265.0					137.1	119.6	14.6						
LB-2 270.0							16.3						
LB-2 275.0							16.0						
LB-2 280.0							15.4						
LB-2 290.0							14.9						

Project: **WBI N Bakken Expansion** Job Number: **G19-025** Sheet **7** of **10**

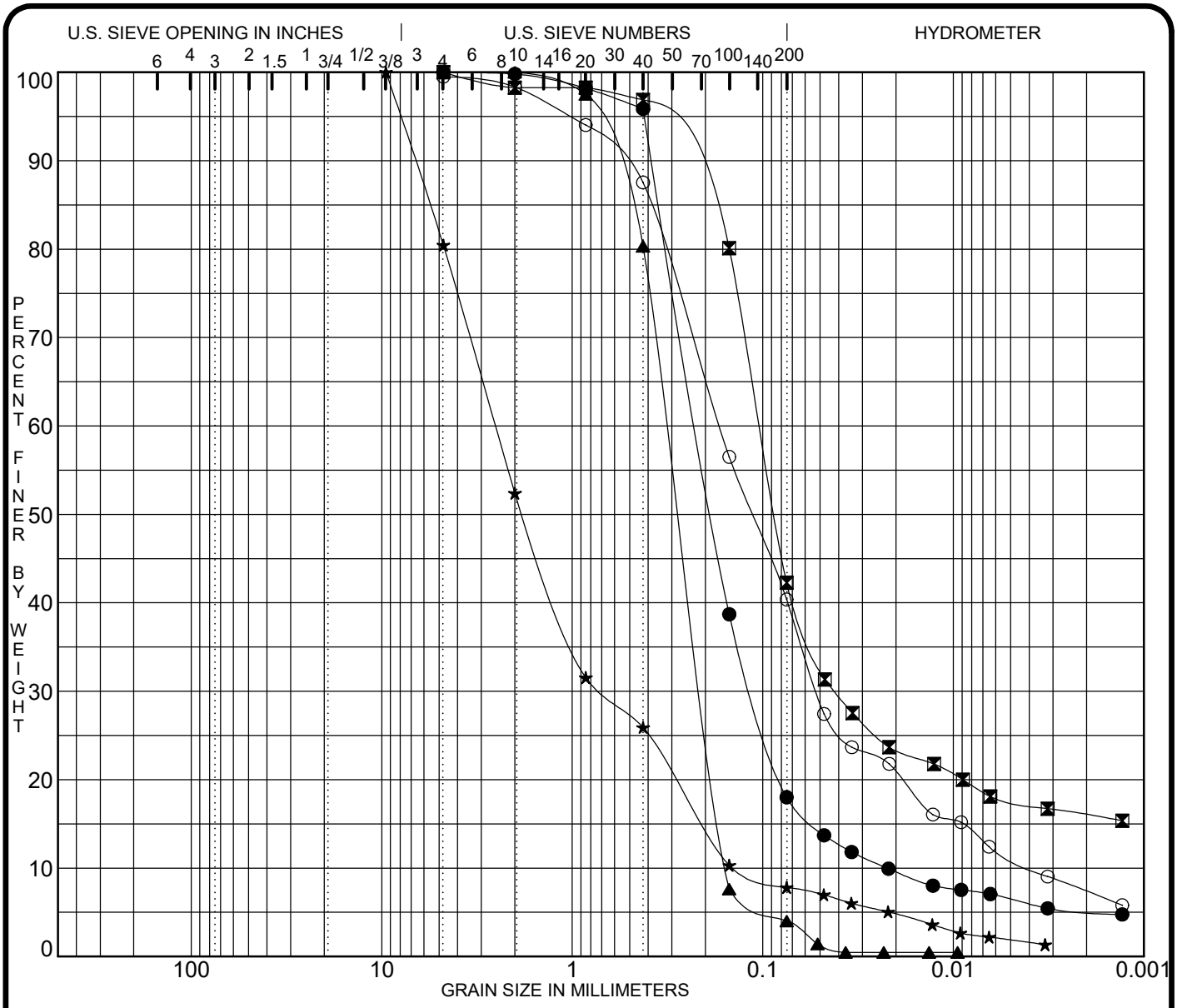
Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-2 295.0							16.0						
LB-2 300.0							17.8						
LB-2 305.0							23.1						
LB-2 310.0							20.7						
LB-2 315.0							13.6						
LB-2 320.0							11.2						
LB-2 325.0							17.9						
LB-2 330.0	52.8	23.9	29.0				18.2						
LB-2 335.0							16.9						
LB-2 340.0							16.3						
LB-2 345.0							17.5						
LB-2 350.0							16.3						
LB-2 355.0				42.3			17.9						
LB-2 360.0					135.7	114.6	18.4						
LB-2 365.0							14.2						
LB-2 370.0							15.3						
LB-2 375.0							17.2						
LB-2 380.0							15.3						
LB-2 385.0							17.2						
LB-2 390.0							16.2						
LB-2 395.0					129.3	109.5	18.1						
LB-3 4.5							4.3						

Borehole Depth / Elev.	Specimen Description	LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data: Top	Bottom	Type	Rec	'N'
LB-3 9.5								3.7						
LB-3 14.5								2.4						
LB-3 19.5								3.0						
LB-3 24.5								24.3						
LB-3 29.5								25.0						
LB-3 34.5	POORLY GRADED SAND				4.0			22.4						
LB-3 39.5								22.2						
LB-3 44.5								18.5						
LB-3 49.5								14.1						
LB-3 54.5								21.0						
LB-3 59.5								20.9						
LB-3 64.5					7.8			10.8						
LB-3 69.5								23.8						
LB-3 74.5								21.0						
LB-3 79.5								18.2						
LB-3 84.5								17.7						
LB-3 89.5								12.0						
LB-3 94.5								20.8						
LB-3 99.5								12.5						
LB-3 104.5								21.9						
LB-3 109.5					40.4			15.8						
LB-3 139.5								17.1						

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-3 144.5							22.3						
LB-3 149.5							20.2						
LB-3 154.5							21.4						
LB-3 159.5							20.4						
LB-3 164.5	23.9	18.1	6.0				20.3						
LB-3 169.5							19.5						
LB-3 175.0							32.5						
LB-3 180.0							28.4						
LB-3 185.0							51.0						
LB-3 187.0							60.3						
LB-3 197.0							20.3						
LB-3 202.0							18.9						
LB-3 207.0							15.1						
LB-3 212.0							15.4						
LB-3 217.0							13.3						
LB-3 222.0							15.9						
LB-3 227.0	24.3	23.1	1.0				13.5						
LB-3 232.0							11.1						
LB-3 237.0							18.5						
LB-3 242.0							15.6						
LB-3 247.0							17.0						
LB-3 252.0							20.2						

Project: **WBI N Bakken Expansion** Job Number: **G19-025** Sheet **10** of **10**

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-3 257.0					128.2	108.8	17.8						
LB-3 262.0							19.4						
LB-3 267.0							16.9						
LB-3 277.0							18.0						
LB-3 282.0							23.8						
LB-3 287.0							17.1						
LB-3 292.0							19.2						
LB-3 297.0					134.6	113.8	18.3						
LB-3 302.0							14.8						
LB-3 307.0							15.9						
LB-3 312.0							17.4						
LB-3 317.0							16.3						
LB-3 322.0							15.8						
LB-3 327.0	105.3	24.7	80.0				23.2						
LB-3 332.0							19.5						
LB-3 337.0							17.9						
LB-3 347.0							15.8						
LB-3 357.0							16.2						
LB-3 362.0					136.1	116.1	17.2						
LB-3 367.0							18.7						



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Classification	MC%	LL	PL	PI	Cc	Cu
●	**LB-2**	**79.5**		**22**				**2.55**	**9.9**
⊠	**LB-2**	**355.0**		**18**					
▲	**LB-3**	**34.5**	**POORLY GRADED SAND SP**	**22**				**0.87**	**2.0**
★	**LB-3**	**64.5**		**11**				**1.42**	**18.4**
⊙	**LB-3**	**109.5**		**16**				**4.12**	**43.1**

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**LB-2**	**79.5**	**4.75**	**0.22**	**0.112**	**0.0223**	**0.0**	**82.0**	**11.5**	**6.5**
⊠	**LB-2**	**355.0**	**4.75**	**0.10**	**0.042**		**0.0**	**57.7**	**24.7**	**17.6**
▲	**LB-3**	**34.5**	**2.00**	**0.32**	**0.207**	**0.1552**	**0.0**	**96.0**		
★	**LB-3**	**64.5**	**9.50**	**2.53**	**0.703**	**0.1375**	**19.5**	**72.6**	**5.9**	**1.9**
⊙	**LB-3**	**109.5**	**4.75**	**0.17**	**0.052**	**0.0039**	**0.0**	**59.1**	**29.2**	**11.2**

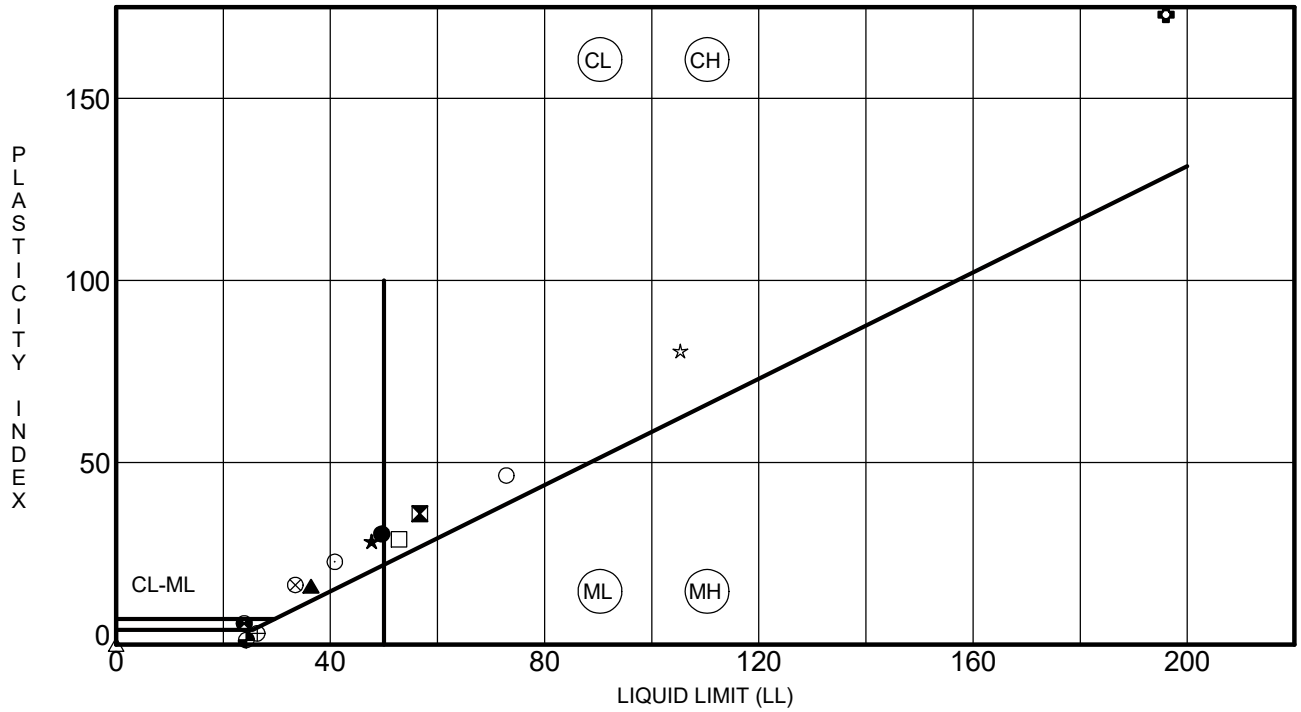
PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G19-025**

DATE **6/6/19**

PARTICLE SIZE ANALYSIS

Material Testing Services, LLC



Specimen Identification			LL	PL	PI	Fines	Classification
●	LB-1	34.5	50	19	30		
⊠	LB-1	89.5	57	21	36		
▲	LB-1	129.5	36	20	16		
★	LB-1	169.5	48	19	28		
⊙	LB-1	258.0	41	18	23		
✿	LB-1	353.0	196	23	173		
○	LB-2	44.5	73	26	46		
△	LB-2	134.5	NP	NP	NP		
⊗	LB-2	153.0	33	17	16		
⊕	LB-2	260.0	26	23	3		
□	LB-2	330.0	53	24	29		
⊛	LB-3	164.5	24	18	6		
◕	LB-3	227.0	24	23	1		
☆	LB-3	327.0	105	25	81		

PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G19-025**

DATE **6/6/19**

ATTERBERG LIMITS' RESULTS

Material Testing Services, LLC

MATERIAL TESTING SERVICES, LLC

P.O. Box 634
Minot, ND 58702
(701) 852-5553

P.O. Box 1093
Williston, ND 58802
(701) 572-4226

UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING
ZGE 15-102

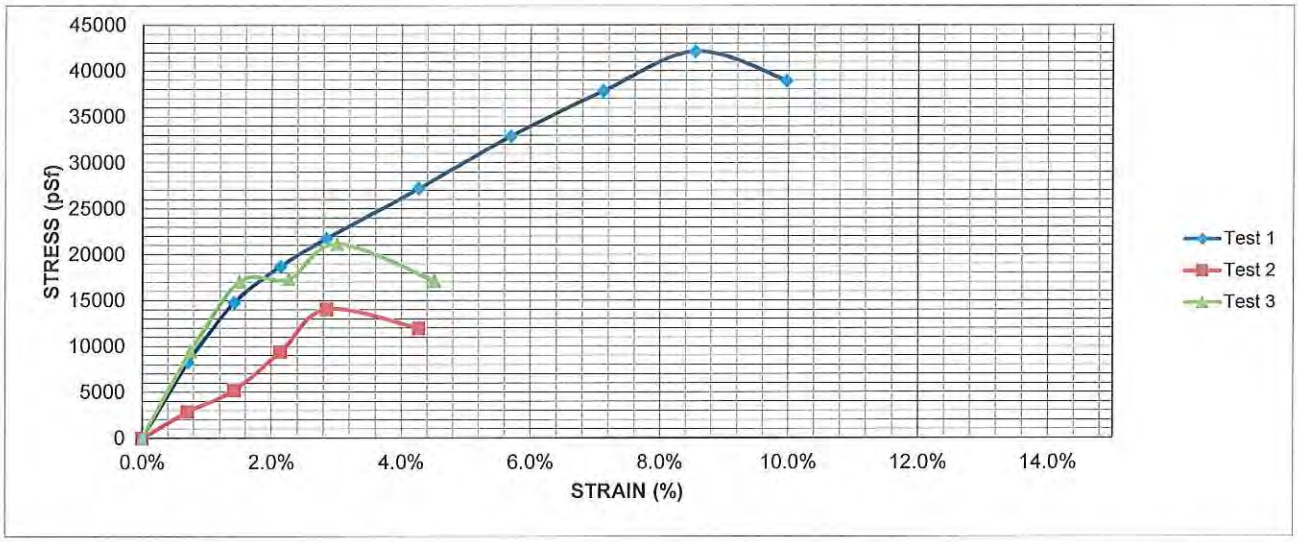
DATE: 6-Jun-19

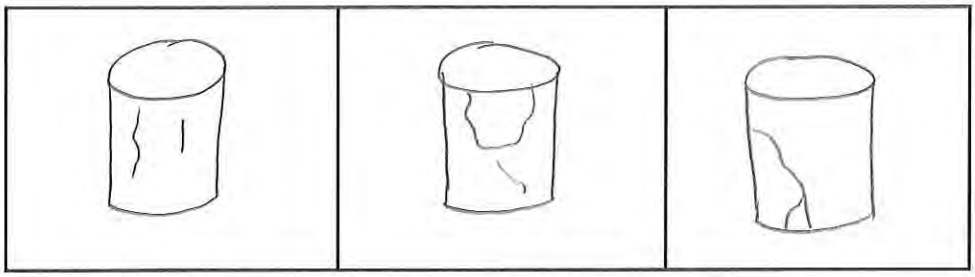
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G19-025

Specimen ID:	Test 1	Test 2	Test 3
	LB-1	LB-1	LB-1
	RC - 203-208 feet	RC - 238-243 feet	RC - 303-308 feet
Soil Class:			
Dry Density (pcf):	118.7	110.4	122.0
Water Content:	16.0%	17.2%	16.8%
Sample Dia. (mm):	42.3	45.3	42.9
Sample Ht (mm):	89.2	89.0	84.3
Height/Diameter:	2.11	1.97	1.97
Unc. Strength (psf):	**42174**	**14087**	**21196**
Strain at Failure (%):	8.5	2.9	3.0





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Material Testing Services, LLC

by

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P.O. Box 634
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UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

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MISSOURI RIVER HDD CROSSING
ZGE 15-102

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COPIES TO:

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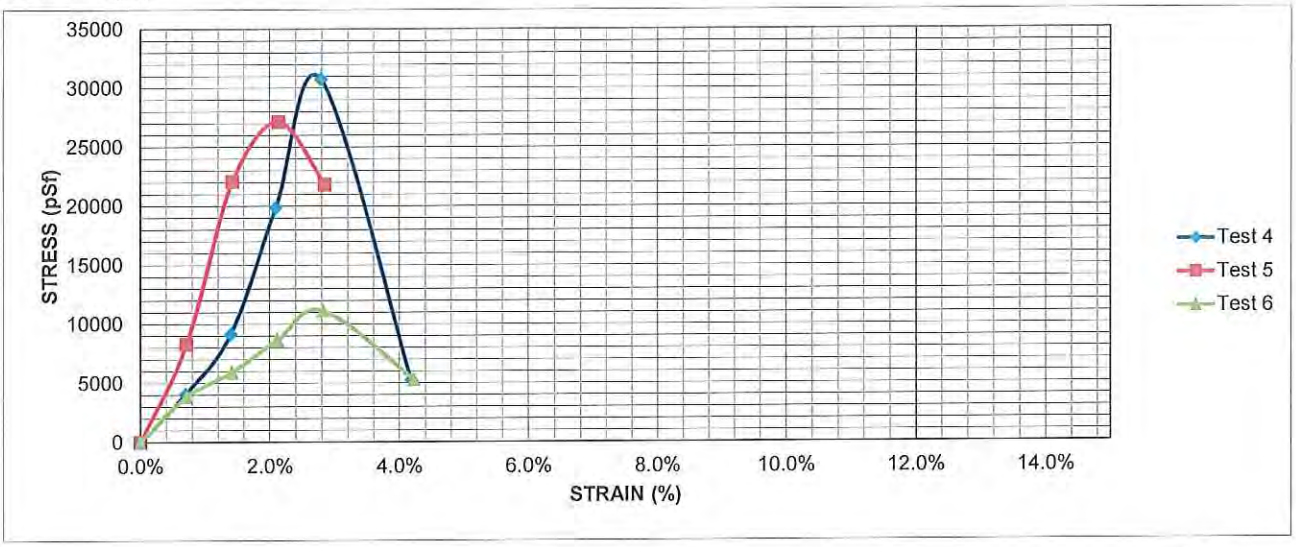
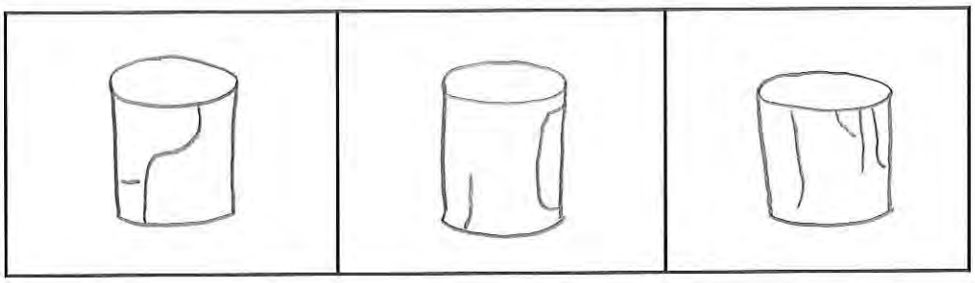
Laboratory Number G19-025

Specimen ID:	Test 4	Test 5	Test 6
	LB-1 RC - 393-398 feet	LB-2 RC - 160-165 feet	LB-2 RC - 205-210 feet
Soil Class:			
Dry Density (pcf):	112.1	115.1	111.2
Water Content:	17.2%	15.1%	16.9%
Sample Dia. (mm):	44.7	44.5	44.9
Sample Ht (mm):	91.2	89.4	90.2
Height/Diameter:	2.04	2.01	2.01
Unc. Strength (psf):	**30776**	**27159**	**11160**
Strain at Failure (%):	2.8	2.1	2.8





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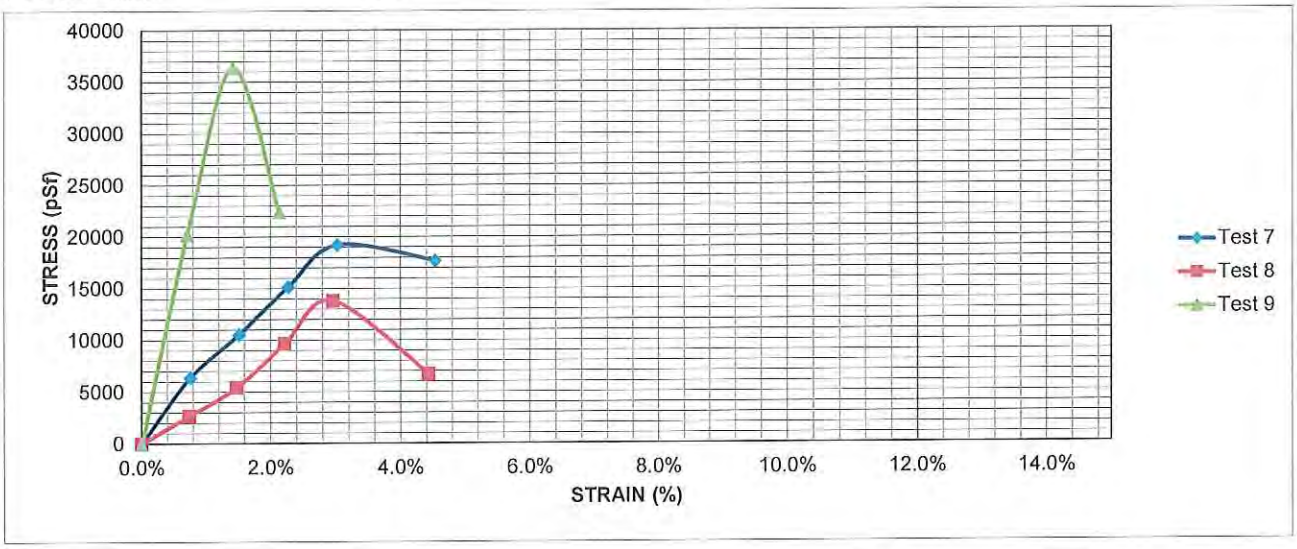
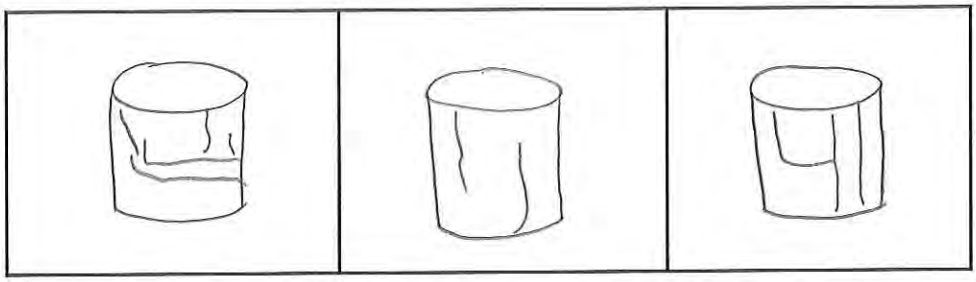
Laboratory Number G19-025

Specimen ID:	Test 7	Test 8	Test 9
	LB-2 RC - 265-270 feet	LB-2 RC - 360-365 feet	LB-2 RC - 395-400 feet
Soil Class:			
Dry Density (pcf):	119.6	114.6	109.5
Water Content:	14.6%	18.4%	18.1%
Sample Dia. (mm):	43.9	45.1	44.7
Sample Ht (mm):	84.1	86.0	89.5
Height/Diameter:	1.91	1.91	2.00
Unc. Strength (psf):	**19238**	**13841**	**36379**
Strain at Failure (%):	3.0	3.0	1.4





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ZGE 15-102

DATE: 6-Jun-19

COPIES TO:

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GES
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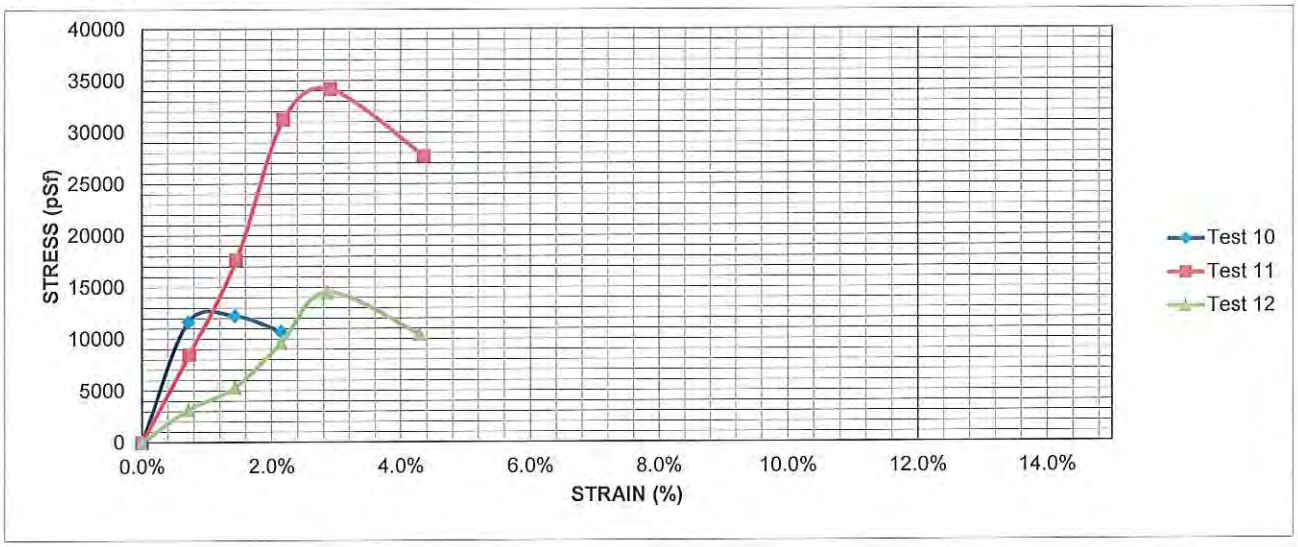
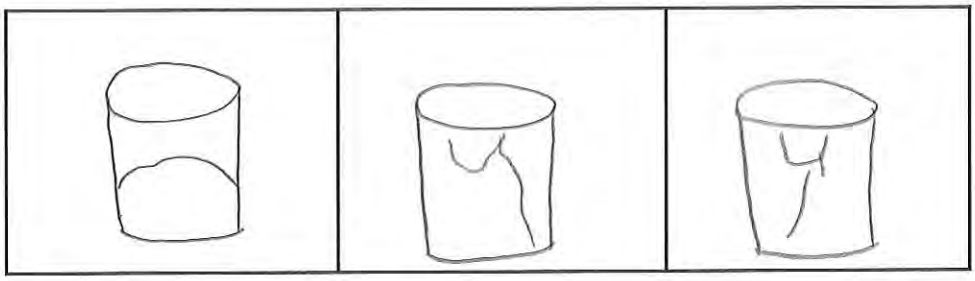
Eagan, MN 55121

Laboratory Number G19-025

Specimen ID:	Test 10	Test 11	Test 12
	LB-3 RC -257-262 feet	LB-3 RC - 297-302 feet	LB-3 RC - 362-367 feet
Soil Class:			
Dry Density (pcf):	108.8	113.8	116.1
Water Content:	17.8%	18.3%	17.2%
Sample Dia. (mm):	45.1	43.7	45.1
Sample Ht (mm):	88.9	87.3	88.9
Height/Diameter:	1.97	2.00	1.97
Unc. Strength (psf):	**12245**	**34215**	**14547**
Strain at Failure (%):	1.4	2.9	2.9





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Material Testing Services, LLC

by

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%		ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

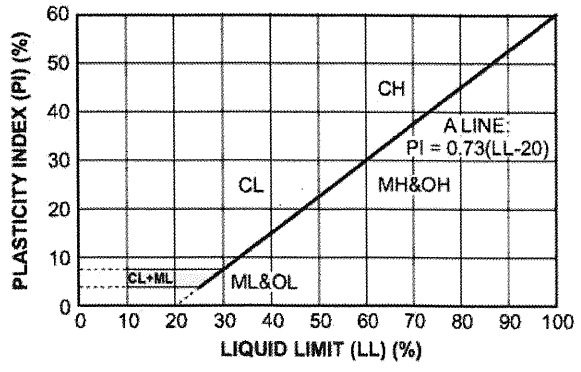
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent ..... GW, GP, SW, SP
More than 12 percent ..... GM, GC, SM, SC
5 to 12 percent ..... Borderline cases requiring dual symbols

PLASTICITY CHART



LABORATORY TEST RESULTS

Testing Scope

Laboratory testing was proposed to characterize soils index properties including Atterberg limits (liquid and plastic limits) and moisture content. Strength testing included unconfined compression testing.

Index Properties

Testing and classification of soils was performed in accordance with the Unified Soil Classification System as described in ASTM D 2487. Atterberg limits were performed according to ASTM D 4318. Moisture content was determined in accordance with ASTM D 4959 and D 4643. The dry density was determined with direct measurement procedures. Mechanical sieve analysis was done in accordance with ASTM D 422.

Strength Testing

The strength tests consisted of unconfined compression (QU) testing. The QU tests were conducted in accordance with ASTM D 2166.

CCI and Associates, Inc.

Geotechnical Investigation Report – Water-Based Borings

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Date:
July 9, 2020

Geotechnical Investigation Report – Water Based Borings

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

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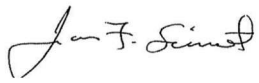

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Acronyms

ASTM	American Society for Testing and Materials
CCI	CCI and Associates, Inc.
ESC	Erickson Contract Surveying, Inc.
GES	Groundwater & Environmental Services, Inc.
HDD	horizontal directional drilling
HAS	hollow-stem auger
IDS	Interstate Drilling Services, LLP
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NDGFD	North Dakota Game and Fish Department
MTS	Material Testing Services, LLC
TGCRA	Tobacco Garden Creek Recreation Area
USACE	US Army Corp of Engineers

1 Introduction

This report presents the results of the geotechnical investigation that was performed by Groundwater and Environmental Services, Inc. (GES) for the project known as the WBI North Bakken Expansion Project in western North Dakota. Specifically, this report covers the geotechnical exploration at 6 water-based soil borings located along the proposed horizontal directional drilling (HDD) pipeline project under Lake Sakakawea/Missouri River (**Figure 1**). The proposed pipeline alignment under Lake Sakakawea is located approximately 1 mile northeast of the Tobacco Garden Creek Recreation Area (TGCRA). The TGCRA is located approximately 23 miles northeast of Watford City, North Dakota.

Services for this investigation were performed in general accordance with the April 1, 2019 Services Contract by and between CCI and Associates, Inc. (CCI) and GES.

1.1 Project Location and Scope

The objective of this phase of the geotechnical investigation is to assist CCI with evaluating the subsurface conditions at 6 water-based boring locations (WB-4 through WB-9) located along the proposed HDD pipeline alignment in Lake Sakakawea.

The scope of work included the following:

- Prepare a site-specific health and safety plan for GES employees and subcontractors for the proposed geotechnical investigation activities.
- Coordinate field activities and communication with project team and CCI.
- Participate in a pre-construction meeting with the Garrison Project Natural Resource Office of the US Army Corp of Engineers (USACE), TGCRA stakeholders, GES project team and WBI Energy representatives.
- Arrange for an inspection of all equipment entering the Lake by the North Dakota Game and Fish Department (NDGFD). Provide proof that equipment has been cleaned of aquatic nuisance species, mud, standing water and aquatic vegetation.
- Arrange for utility clearance through North Dakota One Call.
- Install crane mat protection along shoreline at barge assembly area located within the TGCRA.
- Mobilize the drilling team (Interstate Drilling Services, LLP (IDS)) and assembly and deploy the barge.
- Advance 6 water-based soil borings and collect samples at designated locations
- Clean barge sections and boats during final demobilization.

- Contract laboratory tests on soil samples obtained from the 6 water-based soil borings to evaluate physical properties.
- Provide a written geotechnical report.

Photographs taking during the project are provided in **Appendix A.**

2 Methods

2.1 Soil Borings

GES contracted with IDS of Grand Forks, North Dakota, to assemble the barge and advance the 6 water-based soil borings (**Figure 1**). IDS used a Diedrich D-50 track-mounted drill rig to advance the borings and collect soil samples.

The barge was deployed at the TGCRA at a location adjacent to the north side of the low-water boat ramp. Prior to deployment, crane mats, consisting of wood timbers were placed on the beach from the gravel driveway to approximately 5 feet from the water line in order to allow the crane to drive down to the water's edge while protecting the beach area and bank from damage. A 6" wattle was placed along the lake shore between the crane pad and water for erosion protection. The crane pad location is provided on **Figure 2**.

The crane pad was installed on May 4, 2020 and the crane, barge sections, push boat, drilling rig, equipment and supplies were mobilized to the TGCRA on May 5th.

Prior to placing into the lake, the barge sections and push-boat were power-washed and inspected for aquatic nuisance species by the NDGFD, per the USACE Permit DACW45-3-17-8010. A copy of the inspection is provided in **Appendix B**. Once approved by the NDGFD, the barge sections were placed into the lake and assembled. The barge consisted of six 10'x40' sections. Loading of the drilling rig, equipment and supplies onto the barge was completed on May 6th.

The barge was directed over the boring locations with assistance from Erickson Contract Surveying, Inc. (ECS) of Sidney, Montana. The boring locations were located via boat using a handheld GPS system and then demarcated with a 14" diameter red buoy. The buoys were deployed approximately 50 feet from the proposed pipeline alignment. Once the barge reached the buoy, ECS personnel collected a second measurement of the actual boring location. The borehole locations and mudline elevations using North Dakota – North, State Plane datum (NAD 83, 2011) are provided in **Table 1**. The water elevation for Lake Sakakawea during the project was generally stable at approximately 1,841 feet (NAVD88).

Table 1 - Borehole Locations					
Bore Hole	Easting	Northing	Mudline Elevation (feet)	Latitude	Longitude
WB-4	1335963.13	420346.33	1,811.7	N48°07'23.30"	W103°05'25.93
WB-5	1336623.75	422154.16	1,811.7	N48°07'42.24"	W103°05'15.52
WB-6	1337159.16	424253.25	1,811.9	N48°08'02.38"	W103°05'10.74
WB-7	1337758.65	425801.28	1,811.7	N48°08'17.93"	W103°05'01.65
WB-8	1338402.89	428621.66	1,812.7	N48°08'45.61"	W103°04'53.93
WB-9	1338983.19	430083.96	1,813.0	N48°09'00.54"	W103°04'45.07

Borehole advancement began on May 6, 2020 and the last boring was completed on the evening of May 16, 2020. The drilling operation consisted of 2 crews each working 12-hour shifts on the 24-hour operation. Work stoppages, due to high wind conditions occurred on May 8th, May 9th, May 12th and May 13th.

A hollow-stem auger (HSA) was used to collect soil samples while boring through soft lake sediment. Once competent sediment was encountered; a closed loop, fluid rotary drilling method was used to advance the borings through the sediments. Rock coring drilling methodology was then used to reach each boring terminus.

All borings were advanced to a total depth of 300 feet below the lake mudline except for WB-7 which was advanced to 315 feet and WB-9 which was advanced to 310 feet below the mudline. Upon completion, each boring was sealed from the boring terminus to the lake mudline with a concrete/bentonite slurry through a tremie rod.

During the fluid rotary drilling process, the spent drilling fluid was captured and run through a Mud Puppy 255 that removed drill cutting sand and grit from the drilling fluid, allowing the drilling fluid to be returned to the drilling operation. This process greatly reduced overall waste generation during the drilling process. Drilling cuttings and sediment were containerized for disposal and transported to the Grand Forks Landfill (Permit IT-202) located at 2701 North 69th Street, Grand Forks, North Dakota.

During HSA and fluid rotary methodologies, 1.5-foot samples were collected at 5 foot intervals using a split-spoon sampler in accordance with American Society for Testing and Materials (ASTM) D1586 (*Standard Test Method for Standard Penetration Test [SPT] and Split-Barrel Sampling of Soils*) using a 2-inch diameter split-spoon sampler. During rock coring drilling methodology, samples were generally collected at 5-foot sample intervals continuously in accordance with ASTM D2113 (*Standard Practice for Rock Core Drilling and Sampling of Rock for Site Exploration*) using a using a NQ3 size, triple-tube core barrel with a diamond bit.

Soils were classified in the field by a GES field geologist using ASTM Visual-Manual procedures (ASTM D2488, *Standard Practice for Description and Identification of Soils [Visual-Manual Procedure]*). The field geologist also collected samples from the split-spoon sampler and rock core sampler for geotechnical laboratory testing.

The boring logs and standard boring classification guidelines are contained in **Appendix C**.

2.2 Laboratory Testing

GES contracted with Material Testing Services, LLC (MTS) of Minot, North Dakota to provide geotechnical laboratory testing and evaluation services to aid in classifying and evaluating the physical properties of the soil/rock samples. Soil/rock sample selection and laboratory test parameters were determined by CCI.

The laboratory testing included the following:

- Moisture Content (ASTM D4959 - Standard Test Method for Determination of Water Content of Soil by Direct Heating and D4643 - Standard Test Method for Determination of Water Content of Soil and Rock by Microwave Oven Heating).
- Sieve Analysis (ASTM D422 – Test Method for Particle-size Analysis of Soils).
- Atterberg Limits (ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils).
- Unconfined Compression Testing (ASTM D2166 – Standard Test Method for Unconfined Compressive Strength of Cohesive Soils).

The laboratory data and reports are provided in **Appendix D.**

3 Site Conditions

The proposed HDD pipeline crossing traverses southwest to northeast across Lake Sakakawea approximately 1 mile northeast of the TGCRA. The physiographic regions where the proposed HDD pipeline crossing is located consist of the McKenzie Upland Unit, located south of the Missouri River and the Coteau Slope Unit, located north of the Missouri River. These units are part of the Great Plains and characterized by rolling to hilly plains with both erosional and glacial landforms. The proposed HDD crossing is located within the historic Missouri River floodplain that was flooded with the construction of the Garrison Dam in 1956 to form Lake Sakakawea. This area is located in the central portion of the Williston Basin.

The surface geology in the area consists of thin layers of glacial deposits underlain by the Paleocene-Aged Sentinel Butte Formation and the Bullion Creek Formation. The Sentinel Butte Formation consists of layers of silt, clay, sand, lignite, carbonaceous shale, and mudstone (Carlson, 1985). The Bullion Creek Formation underlies the Sentinel Butte Formation and consists of yellowish layers of silt, clay, and sand with interbedded sandstone, lignite, baked clay, and

limestone (Bluemle, 1977). Both formations are poorly lithified and form rolling topography over broad areas of Western North Dakota. The Sentinel Butte Formation outcrops along the north south shoreline of the Missouri River near WB-4 and both the Sentinel Butte and Bullion Creek Formations outcrop along the north shoreline of the Missouri River near WB-9 (Bluemle, 1977).

Soil borings WB-4 through WB-9 generally consist of silts and poorly graded sands and gravels in the upper portions of the borings, consistent with more recent alluvial deposits originating from the Missouri River. These alluvial deposits extend to approximately 45 feet below the mudline in borings WB-4 and WB-9, and to approximately 220 below the mudline at boring WB-7. Underlying the more recent alluvial deposits are deposits of the Sentinel Butte and Bullion Creek Formations.

4 Limitations

The data generated and conclusions and opinions provided are based on the scope of work performed. All work was conducted in a manner consistent with currently accepted geotechnical engineering practices exercised by members of the profession practicing under similar conditions. No other warranty, expressed or implied, is made.

The samples collected and described in this report are representative of the subsurface conditions at the sampled locations and intervals, and therefore, do not necessarily reflect strata variations that may exist between sampled intervals and locations. If variations from the subsurface conditions described in this study are noted during additional investigations and/or construction, recommendations in this report must be re-evaluated.

GES is not responsible for the independent conclusions, opinions, or recommendations made by others based on the data presented in this report. Nor can GES warrant that this report will satisfy the dictates of or provide a legal defense in connection with an environmental law or regulation.

The results reported and any opinions reached by GES are for the benefit of the CCI & Associates and their client and unless agreed to by GES in writing, are not to be disclosed to or relied upon by any third party. The results and opinions set forth by GES in this report will be valid as of the date of the report.

References

Bluemle, J.P. 1977. *Geologic Highway Map of North Dakota*. North Dakota Geological Survey Educational Series 11, Miscellaneous Map 19.

Carlson, Clarence G. 1985. *Geology of McKenzie County, North Dakota.* North Dakota Geological Survey, Bulletin 80 – Part 1 and North Dakota State Water Commission, County Groundwater Studies 37 – Part 1.

Figures

L:\Projects\CCI\GIS\CCI_Lake_Sakakawea_SBLM.mxd - Scale 1:36,000 - 7/1/2020 3:53:16 PM - dcleland - NAD 1983 StatePlane North Dakota North FIPS 3301 Feet

Water Boring Location Map

CCI and Associates, Inc.
WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Drawn **AMW**
Designed **DMC**
Approved **-**

Date **7/1/20**
Figure **1**

Scale In Feet (Approximate)
0 3,000

Groundwater & Environmental Services, Inc.

L:\Projects\CCI\GIS\CCI_Lake_Sakakawea_Barge Area.mxd - Scale 1:1,774 - 7/1/2020 5:04:52 PM - dcleland - NAD 1983 StatePlane North Dakota North FIPS 3301 Feet

Barge Assembly and Crane Location Area

CCI and Associates, Inc.
WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Drawn **AMW**
Designed **DMC**
Approved **-**

Date **7/1/20**
Figure **2**

Scale In Feet (Approximate)
0 150

Groundwater & Environmental Services, Inc.

Appendix A – Photographic Documentation Boring Logs

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
View of low-water boat ramp and location of crane mat area before mobilization

Direction of View:
Southeast

Date Taken:
04/29/2020

Description:
View of low-water boat ramp location of crane mat area before mobilization

Direction of View:
Westward

Date Taken:
04/29/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Placing crane mats in preparation of mobilizing barge

Direction of View:
Westward

Date Taken:
05/04/2020

Description:
Completion of crane pad area

Direction of View:
Southeast

Date Taken:
05/04/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Positioning of crane in preparation of barge mobilization

Direction of View:
Westward

Date Taken:
05/05/2020

Description:
Lifting first barge section to the water

Direction of View:
Westward

Date Taken:
05/05/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Placing the barge winch on the barge

Direction of View:
Northwest

Date Taken:
05/05/2020

Description:
Placement of drilling rig on barge

Direction of View:
Northwest

Date Taken:
05/05/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Placement of push boat in Lake

Direction of View:
Northeast

Date Taken:
05/05/2020

Description:
Placement of Spud on Barge

Direction of View:
Northward

Date Taken:
05/05/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
View of drilling rig and barge deck

Date Taken:
05/06/2020

Description:
Overhead view of barge

Date Taken:
05/06/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
View of barge deck and two spill kit barrels

Direction of View:
Port side of barge

Date Taken:
05/06/2020

Description:
Photo of Mud Puppy mud recycling unit and secondary containment

Direction of View:
Starboard side of barge

Date Taken:
05/06/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Barge deck and portable light towers in secondary containment

Direction of View:
At bow of barge

Date Taken:
05/07/2020

Description:
Drilling Rig preparing to begin at WB-5

Date Taken:
05/07/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Completing boring WB-9

Date Taken:
05/15/2020

Description:
Demobilization of equipment

Direction of View:
Northwest

Date Taken:
05/19/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Demobilization of drilling rig

Direction of View:
Northwest

Date Taken:
05/19/2020

Description:
Demobilization of equipment

Direction of View:
Northwest

Date Taken:
05/19/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Removal of push boat from water

Direction of View:
Northwest

Date Taken:
05/19/2020

Description:
Removal of barge sections during demobilization

Direction of View:
Eastward

Date Taken:
05/19/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Pressure washing barge sections during demobilization

Direction of View:
Eastward

Date Taken:
05/19/2020

Description:
Preparing to remove crane from crane pad during demobilization

Direction of View:
Southeast

Date Taken:
05/19/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Low water boat ramp and crane pad area after completion of demobilization

Direction of View:
Northwest

Date Taken:
05/19/2020

Description:
Low water boat ramp and crane pad area after completion of demobilization

Direction of View:
Southeast

Date Taken:
05/19/2020

Appendix B – Aquatic Nuisance Species Inspection

ANS INSPECTION REPORT - For equipment brought into or to be used in North Dakota
NORTH DAKOTA GAME AND FISH DEPARTMENT
FISHERIES DIVISION

Company name: Interstate Drilling **Contact:** Mike Zak	**E-mail address:** mikez@interstatedrilling.com	**Phone number:** (701) 741-9951

Water body: Lake Sakakawea **Location:** Tobacco Gardens
Equipment inspected: 6 barge sections, 1 tugboat, various aquatic equipment

Where equipment was last used

Tugboat and four sections of barge last used on Missouri River near Boonville, Mo (taken out 4/20/20)
One barge section has been sitting since December of 2019 – Rock River, Rock Island, IL (taken out DEC 2019)
One barge section has been sitting since August of 2019 – Missouri River, Nebraska City, NE (take out AUG 2019)

ANS Precautions used prior to equipment entering North Dakota

All barge sections were pressure washed with hot water prior to entering North Dakota. Additionally, barge sections and tugboat were dried for 2 weeks to 8 months.

Actual physical and visual ANS inspection

Barge section 1 – few very dry byssal threads found. No limpets or ZM. Cleared for launch.
Barge section 2 – numerous dried byssal threads and 2 dead zebra mussels found, all very dry. Required additional cleaning and inspection.
Barge section 3 – some byssal threads. No mussels or limpets. Cleared for launch.
Barge section 4 slanted – very few byssal threads. Cleared for launch.
Barge section 5 – no attached organism and very few dry byssal threads. Cleared for launch.
Barge section 6 – no attached organic material. Cleared for launch.
Tugboat – no byssal threads or mussels found on the outside of the boat. Required additional cleaning because it was not washed before entering North Dakota. Inside of tugboat does not take on water. No standing water or organics found inside, so did not require additional cleaning or disinfection inside.

Additional comments or notes:

One section of barge and the tugboat were power washed under supervision and were re-inspected. These were cleared to be put into Sakakawea.
Zebra mussels observed had desiccated organs, indicating that they were not alive. It is likely that the pressure washing in Missouri utilized hot water or the two week plus drying period allowed the mussels to die.
Crane did not get put in water – no inspection required.

Status:	**NDGF representative:**	**Date:**
Approved	Ben Holen, ANS Coordinator	5/5/2020

Barge section 2 and zebra mussel that was discovered on it.

Left: Pressure washing the tugboat. Right: Inside of tugboat. No standing water was present.

Line of barges.

Appendix C – Boring Logs

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
0				CL-ML: SILTY CLAY, with trace fine grained sand, very dark gray (5Y 3/1), very moist, soft.							
15	1	6 in.	2-2-2		0.25						
20	2	8 in.	1-12	SP: POORLY GRADED SAND, fine grained, dark gray (5Y 4/1), wet, very loose.	-						
25	3	15 in.	1-1-1		-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	4	10 in.	4-6-4	With trace medium grained sand and loose at 29.5 ft.	-						
35	5	10 in.	2-2-1		-						
40	6	10 in.	7-5-6	SP: POORLY GRADED SAND, medium to coarse grained, with little fine gravel, with trace small lignite pieces, olive (5Y 4/3), wet, medium dense.	-						
45	7	7 in.	4-4-6	SPG: POORLY GRADED SAND WITH GRAVEL, coarse grained with fine gravel, olive (5Y 4/3), wet, loose.	-						5.4
50	8	6 in.	6-9-11	SP: POORLY GRADED SAND, fine to medium grained, dark gray (5Y 4/1), wet, medium dense.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

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ID NO. **WB-4**

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Address: **NA** GES Job #: **3502056**

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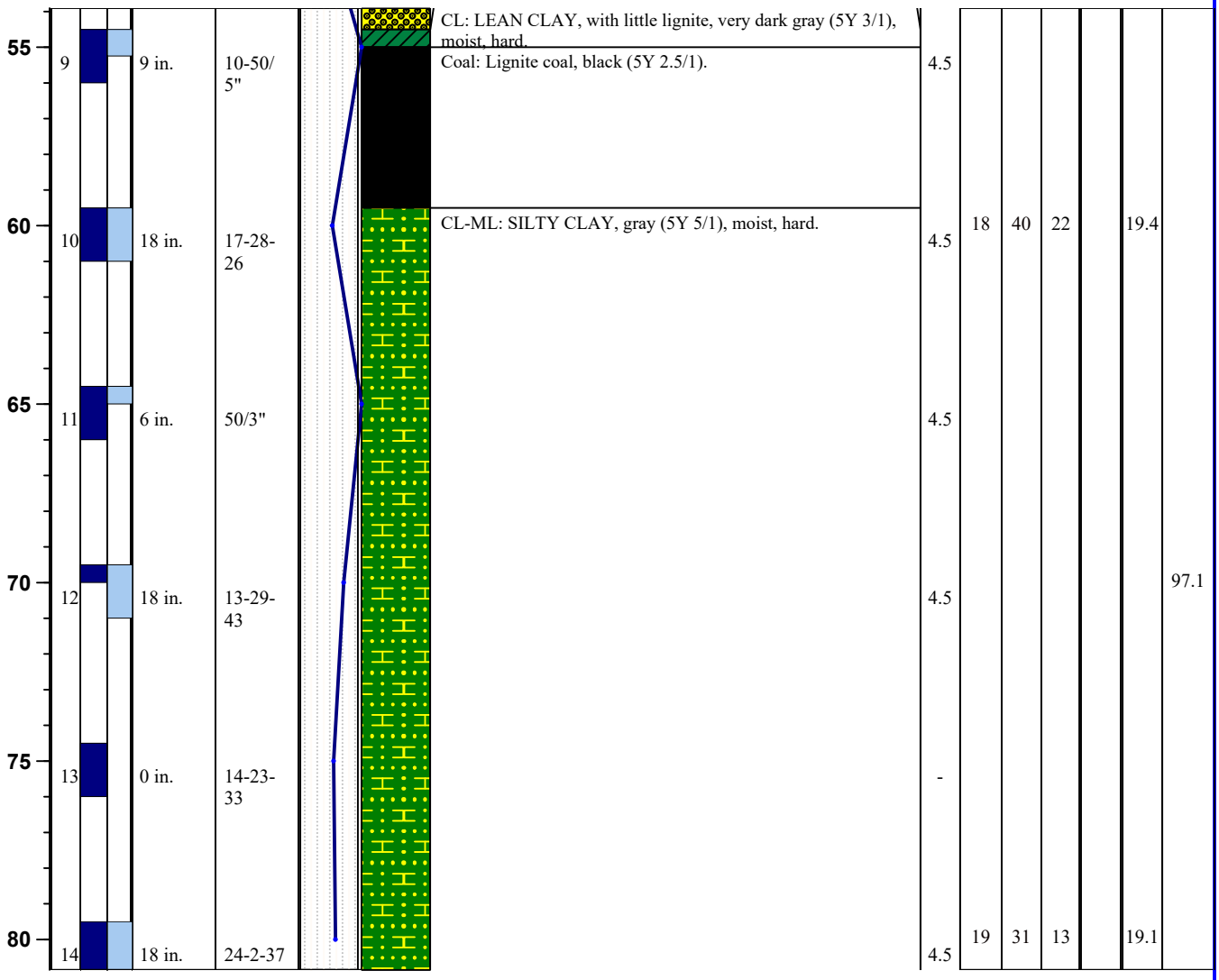
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**



Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
	9	9 in.	10-50/ 5"	CL: LEAN CLAY, with little lignite, very dark gray (5Y 3/1), moist, hard.							
				Coal: Lignite coal, black (5Y 2.5/1).	4.5						
	10	18 in.	17-28-26	CL-ML: SILTY CLAY, gray (5Y 5/1), moist, hard.	4.5	18	40	22		19.4	
	11	6 in.	50/3"		4.5						
	12	18 in.	13-29-43		4.5						97.1
	13	0 in.	14-23-33		-						
	14	18 in.	24-2-37		4.5	19	31	13		19.1	

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

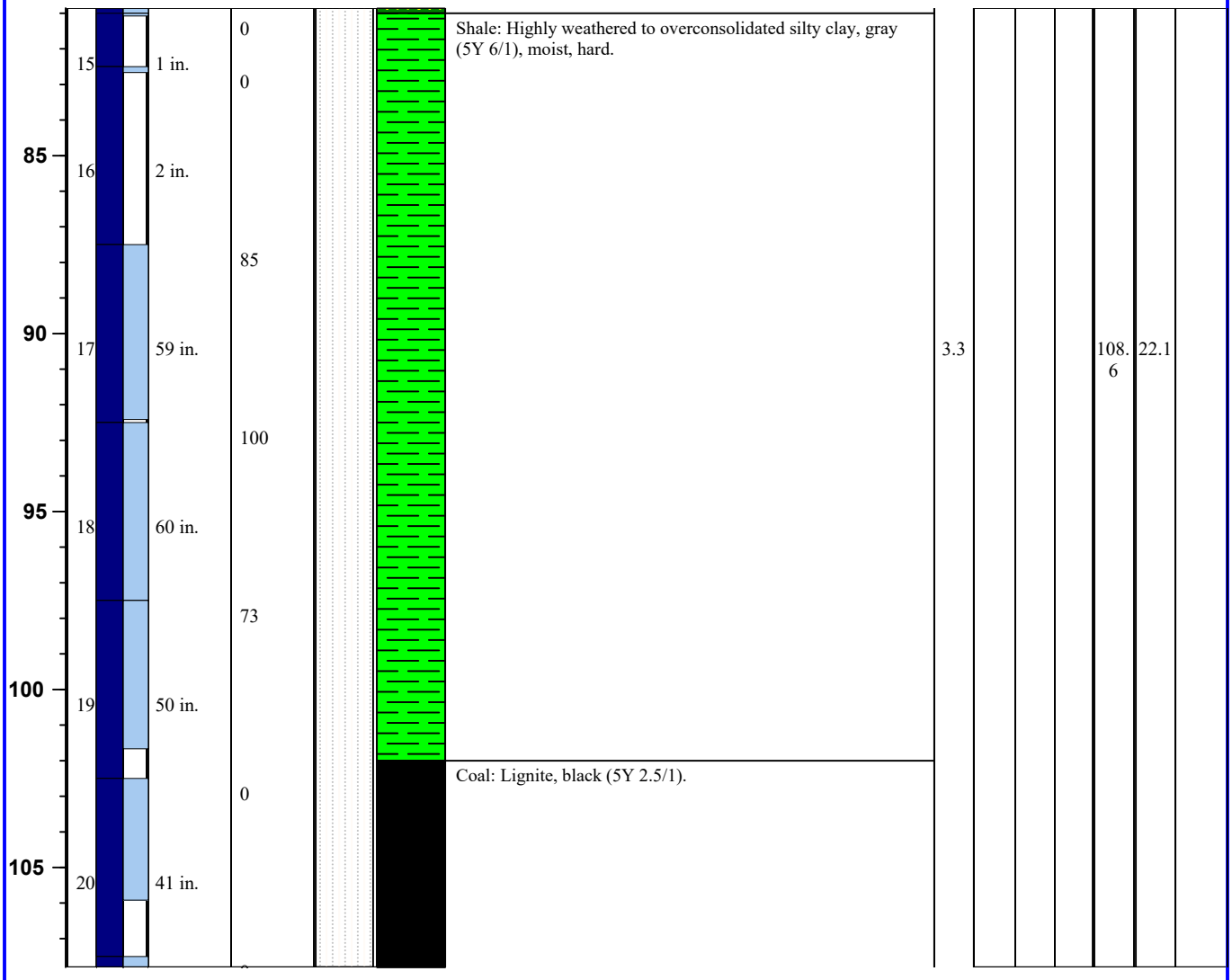
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**



Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
85	15	1 in.	0	Shale: Highly weathered to overconsolidated silty clay, gray (5Y 6/1), moist, hard.	3.3				108.6	22.1	
	16	2 in.	0								
			85								
90	17	59 in.									
			100								
95	18	60 in.									
			73								
100	19	50 in.									
			0	Coal: Lignite, black (5Y 2.5/1).							
105	20	41 in.									

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
110	21	60 in.	0	With some coarse sand from 110.5 to 112.5 ft.							
115	22	51 in.	0								
120	23	60 in.	0								
125	24	60 in.	78	Shale: Highly weathered to overconsolidated silty clay, gray (5Y 6/1), moist, hard.							
130	25	57 in.	83		11.3				113.7	15.2	

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	26	50 in.	93								
140	27	58 in.	85	Lignite seam 3 in. thick at 143 ft.							
145	28	55 in.	87	Lignite seam 2 in. thick at 145 ft.							
150	29	60 in.	95		17.6				118.9	15.5	
155	30	60 in.	0	SP: POORLY GRADED SAND, fine grained, gray (5Y 5/1).							
160	31	0 in.									

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
165	32	0 in.	0								
			0								
170	33	0 in.									
			0								
175	34	0 in.									
			7								
180	35	38 in.		Coal: Lignite, black (5Y 2.5/1).							
			85	Shale: Highly weathered to overconsolidated clay, gray (5Y 5/1), moist, hard.							
185	36	60 in.			23.8				115.1	19.1	
				Coal: Lignite, black (5Y 2.5/1).							
			87	Shale: Highly weathered to overconsolidated clay, gray (5Y							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
190	37	60 in.	85	5/1), moist, hard. Lignite seam 6 in. thick at 192 ft.							
195	38	58 in.	83	CL: LEAN CALY, with fine grained sand, gray (5Y 5/1), moist, hard. Coal: Lignite, black (5Y 2.5/1). SM: SILTY SAND, fine grained, gray (5Y 5/1), moist, very dense. Shale: Highly weathered to overconsolidated clay, gray (5Y 5/1), moist, hard.							
200	39	57 in.	100	Coal: Lignite, black (5Y 2.5/1). CL: LEAN CLAY, with trace fine grained sand, consolidated, to highly weathered shale, gray (5Y 5/1), moist, hard.							
205	40	60 in.	27	SP: POORLY GRADED SAND, fine grained, with trace silt, gray (5Y 5/1) moist, very dense.							
210	41	24 in.	10	Seam of consolidated clay 6 in. thick at 210 ft.							
215	42	44 in.									

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
220	43	45 in.	50	Coal: Lignite, black (5Y 2.5/1).							
			93	CL: LEAN CLAY, consolidated, to highly weathered shale, gray (5Y 5/1), moist, hard.							
225	44	60 in.	97	Sandstone: Fine grained, weakly cemented, with some silt, gray (5Y 5/1), moist, very dense.							
230	45	60 in.	88								
235	46	54 in.	100	Shale: Highly weathered, gray (5Y 5/1), moist, hard. Trace lignite less than 1 in. thick at 234 ft. Color turns to dark gray (5Y 5/1) at 237.5 ft.							
240	47	60 in.		Siltstone: With trace fine grained sand, weakly cemented, dark gray (5Y 4/1), moist, very dense.	5.7				113.9	15.2	

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
245	48	60 in.	100	Sandstone: Fine grained, weakly cemented, with some silt, dark gray (5Y 4/1), moist, very dense.							
250	49	60 in.	100		4.9				107.5	19.1	
255	50	60 in.	100								
260	51	60 in.	92								
265	52	57 in.	75								

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
270	53	45 in.	100	Seam of trace thin lignite laminations less than 1 in. thick from 269.5 to 270 ft.	4.5				109.4	18.6	
275	54	60 in.	0	Coal: Lignite, black (5Y 2.5/1).							
280	55	60 in.	0								
285	56	24 in.	93	Shale: Highly weathered, dark gray (5Y 4/1), moist, hard.							
290	57	60 in.	78		12.4				107.6	20.0	
				Coal: Lignite, black (5Y 2.5/1).							
295	58	60 in.		Shale: Highly weathered, dark gray (5Y 4/1), moist, hard.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
300	59	30 in.	100	EOB at 300 ft. Target depth reached.	11.1				105.9	21.1	

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-5**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/7/20 through 5/8/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/8/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 66 ft.), Fluid Rotary (74 to 160 ft.), NQ Rock Core (66 to 74 and 160 to 300 ft.)**

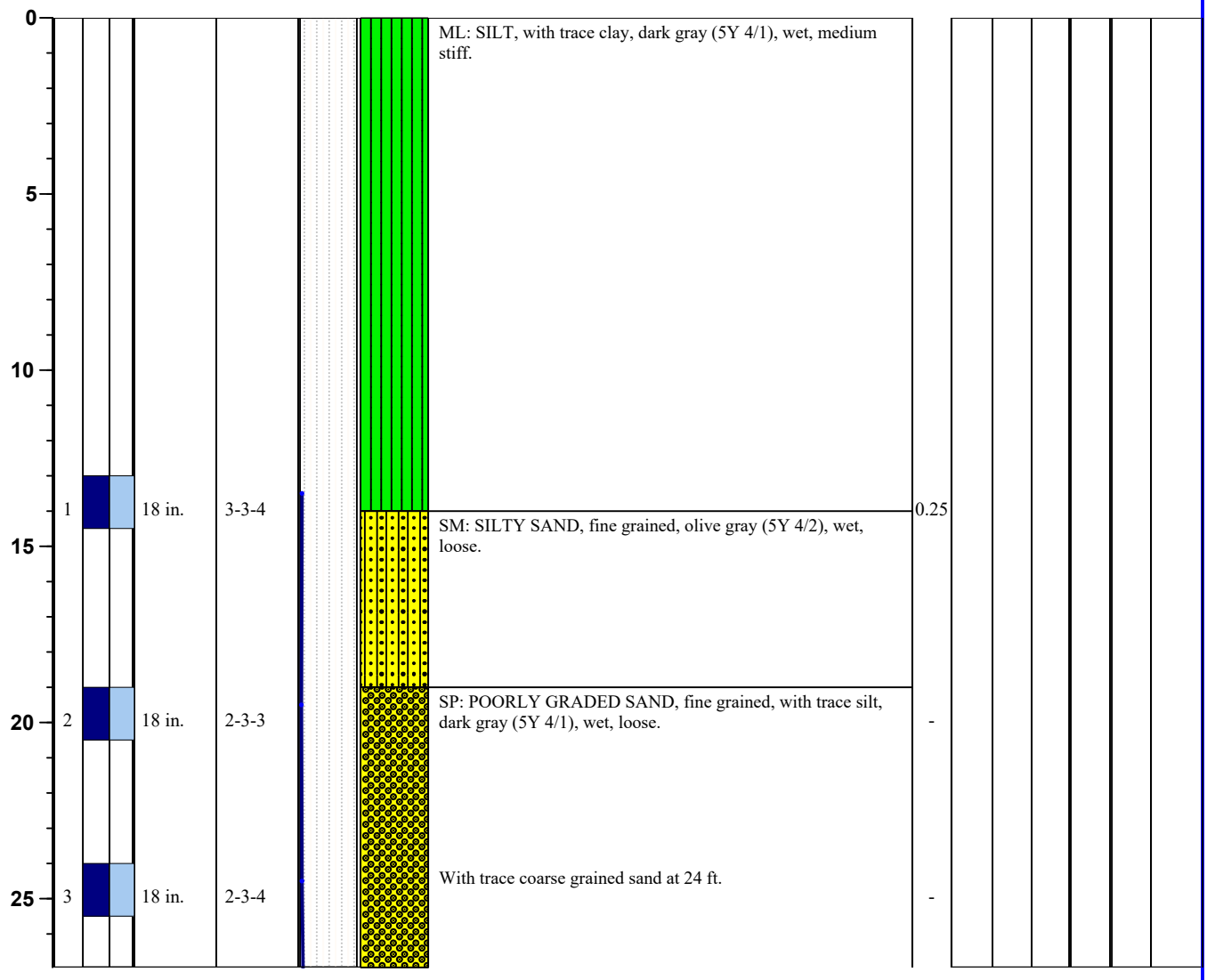
Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
0				ML: SILT, with trace clay, dark gray (5Y 4/1), wet, medium stiff.							
15	1	18 in.	3-3-4	SM: SILTY SAND, fine grained, olive gray (5Y 4/2), wet, loose.	0.25						
20	2	18 in.	2-3-3	SP: POORLY GRADED SAND, fine grained, with trace silt, dark gray (5Y 4/1), wet, loose.	-						
25	3	18 in.	2-3-4	With trace coarse grained sand at 24 ft.	-						



Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 42.24"

Lon: 103° 5' 15.52"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-5**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/7/20 through 5/8/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/8/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 66 ft.), Fluid Rotary (74 to 160 ft.), NQ Rock Core (66 to 74 and 160 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	4	18 in.	2-4-6	Fine to medium grained with trace coarse gained at 29 ft.	-						
35	5	0 in.	2-2-3	SPG: POORLY GRADED SAND WITH GRAVEL, coarse grained with fine gravel, dark gray (5Y 4/1), wet, loose.	-						
40	6	1 in.	4-4-4		-						
45	7	6 in.	10-7-6	With medium to coarse graind sand and medium dense at 44 ft.	-						7.7
50	8	4 in.	4-4-4	With trace medium to coarse graind sand and loose at 49 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 42.24"

Lon: 103° 5' 15.52"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-5**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/7/20 through 5/8/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/8/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 66 ft.), Fluid Rotary (74 to 160 ft.), NQ Rock Core (66 to 74 and 160 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
55	9		6 in.	9-14-14	With few medium to coarse graind sand and medium dense at 54 ft.	-						
60	10		16 in.	10-6-40	SPG: POORLY GRADED GRAVELLLY SAND, medium to coarse grained, dark gray (5Y 4/1), moist, dense.	-						
65	11		18 in.	10-13-17	CL: LEAN CLAY, consolidated, with trace silt, very dark gray (5Y 3/1), moist, very stiff.	3.75	22	47	25		28.0	
	12		16 in.	10								
70	13		24 in.	28	Coal: Lignite, black (2.5Y 2.5/1).							
75	14		0 in.	0	NO RECOVERY (suspect same noncohesive material as below) from 74 to 79 ft.							
80					SPG: POORLY GRADED GRAVELLLY SAND, fine grained, dark gray (5Y 4/1), moist, very dense.							

Notes:

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Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
85	15	12 in.	12-24-36	CL-ML: SILTY CLAY, dark gray (5Y 4/1), moist, hard.	4.5						
90	16	18 in.	20-28-33		3.0						
95	17	18 in.	15-18-13	SPG: POORLY GRADED GRAVELLLY SAND, fine grained, dark gray (5Y 4/1), moist, dense.	-						
				CL-ML: SILTY CLAY, with 2 in. thick coal seam at 95.5 ft., dark gray (5Y 4/1), moist, hard.							
100	18	18 in.	16-17-18	SC: CLAYEY SAND, fine grained, dark gray (5Y 4/1), moist, dense.	-						
				ML: SILT, with trace clay, dark gray (5Y 4/1), moist, hard.							
105	19	18 in.	13-16-26	SC: CLAYEY SAND, fine grained, with trace silt, dark gray (5Y 4/1), moist, dense.	-						

Notes:

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Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample	Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
110	20		18 in.	16-17-10		-						46.6
115	21		18 in.	9-13-14	CL-ML: SILTY CLAY, dark gray (5Y 4/1), moist, very stiff.	4.25						
120	22		11 in.	13-14-16	SP: POORLY GRADED SAND, fine to coarse grained, with trace silt, dark gray (5Y 4/1), wet, medium dense.	-						
125	23		18 in.	10-16-23	CL-ML: SILTY CLAY, dark gray (5Y 4/1), moist, hard.	4.25						
130	24		11 in.	43-50/3"	SP: POORLY GRADED SAND, fine grained, with trace silt, dark gray (5Y 4/1), wet, very dense.	-						

Notes:

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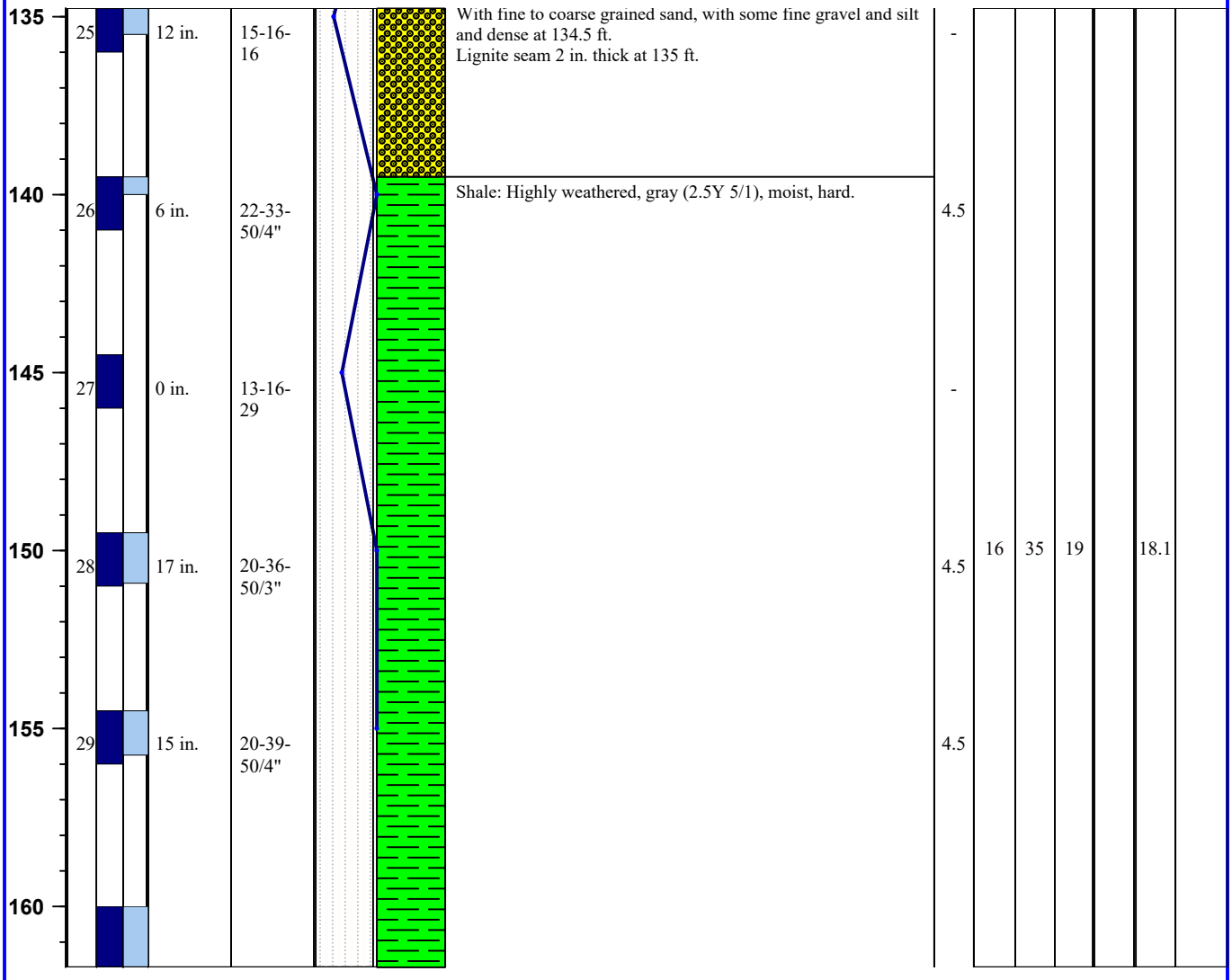
Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**



Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	25	12 in.	15-16-16	With fine to coarse grained sand, with some fine gravel and silt and dense at 134.5 ft. Lignite seam 2 in. thick at 135 ft.	-						
140	26	6 in.	22-33-50/4"	Shale: Highly weathered, gray (2.5Y 5/1), moist, hard.	4.5						
145	27	0 in.	13-16-29		-						
150	28	17 in.	20-36-50/3"		4.5	16	35	19		18.1	
155	29	15 in.	20-39-50/4"		4.5						
160											

Notes:

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Address: **NA** GES Job #: **3502056**

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Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 66 ft.), Fluid Rotary (74 to 160 ft.), NQ Rock Core (66 to 74 and 160 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample	Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
165	30		41 in.	53		2.5				108.2	66.2	
	31		43 in.	38								
170	32		13 in.	13	ML: SILT, gray (2.5Y 5/1), moist, very dense.							
	33		30 in.	18	Coal: Lignite, black (5Y 2.5/1).							
180	34		58 in.	85	Shale: Highly weathered, gray (2.5Y 5/1), moist, hard. Lignite seam 2 in. thick at 184 ft. Lignite seam 5 in. thick at 184.5 ft.	12.1				117.5	16.6	
185	35		60 in.	93								

Notes:

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Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
190				Color tunrs to gray (5Y 5/1) at 190 ft. Lignite seam 2 in. thick at 190.5 ft.							
	36	60 in.	97								
195				With small fine to medium grained sand seams at 195 ft.							
	37	47 in.	75								
200				Coal: Lignite, black (5Y 2.5/1).							
				Shale: Highly weathered, gray (5Y 5/1), moist, hard.							
	38	59 in.	83	Coal: Lignite, black (5Y 2.5/1).	9.6				116.3	14.2	
205				Shale: Highly weathered, gray (5Y 5/1), moist, hard.							
	39	56 in.	88								
210											
	40	60 in.	100								
215											

Notes:

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Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
	41	50 in.	75								
220				Lignite seam 6 in. thick at 219.5 ft.							
	42	60 in.	90		4.1				105.8	19.2	
				Fine grained sand seam 2 in. think at 223.3 ft. Trace lignite at 224 ft.							
225				Color tunrs to dark gray (5Y 4/1) at 225 ft.							
	43	55 in.	87								
230											
	44	60 in.	100								
235											
	45	60 in.	100	With some fine grained sand from 237 ft. to 240 ft.							
240											

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Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
245				SP: POORLY GRADED SAND, fine grained, with trace silt and trace clay, dark gray (5Y 4/1), moist, very dense.							
	47	58 in.	92		3.3				107.9	17.0	
250				Slightly cohesive to weakly cemented at 250 ft. and below.							
	48	59 in.	98								
255											
	49	58 in.	97								
260											
	50	58 in.	97								
265											
	51	60 in.	97	Coal: Lignite, black (5Y 2.5/1).	2.0				108.8	20.5	

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Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
270											
	52	60 in.	20								
275											
	53	30 in.	37	SP: POORLY GRADED SAND, fine grained, with trace silt and trace clay, slighly cohesive to weakly cemented, dark gray (5Y 4/1), moist, very dense.	8.7				106.5	20.2	
				Coal: Lignite, black (5Y 2.5/1).							
280				SP: POORLY GRADED SAND, fine grained, with trace silt and trace clay, slighly cohesive to weakly cemented, dark gray (5Y 4/1), moist, very dense.							
	54	60 in.	88								
285				CL: LEAN CLAY, with trace fine grained sand, consolidated, dark gray (5Y 4/1), moist, hard.							
	55	53 in.	78								
				Coal: Lignite, black (5Y 2.5/1).							
290				CL: LEAN CLAY, with trace fine grained sand, consolidated, dark gray (5Y 4/1), moist, hard.							
	56	60 in.	100								
295											

Notes:

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Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
300	57	37 in.	62	EOB at 300 ft. Target depth reached.	6.4				106.7	21.6	

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Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 42.24"

Lon: 103° 5' 15.52"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
0				SM: SILTY SAND, fine grained, very dark gray (2.5Y 3/1), wet, very loose.							
15	1	14 in.	1-2-1		-						
20	2	16 in.	3-9-9	Color turns to very dark grayish brown (2.5Y 3/2) and medium dense at 19.5 ft.	-						
25	3	4 in.	0-0-2	Very loose at 24.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	4		5 in.	1-1-1		-						
35	5		6 in.	2-3-5	Loose at 34.5 ft.	-						
40	6		6 in.	4-11-5	Medium dense at 39.5 ft.	-						
45	7		10 in.	2-3-3	Loose with coarse grained sand and fine gravel seam 5 in. thick at 45 ft.	-						
50	8		13 in.	8-32-24	Very dense with angular coarse sand and gravel seam 7 in. thick at 50 ft.	-						10

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

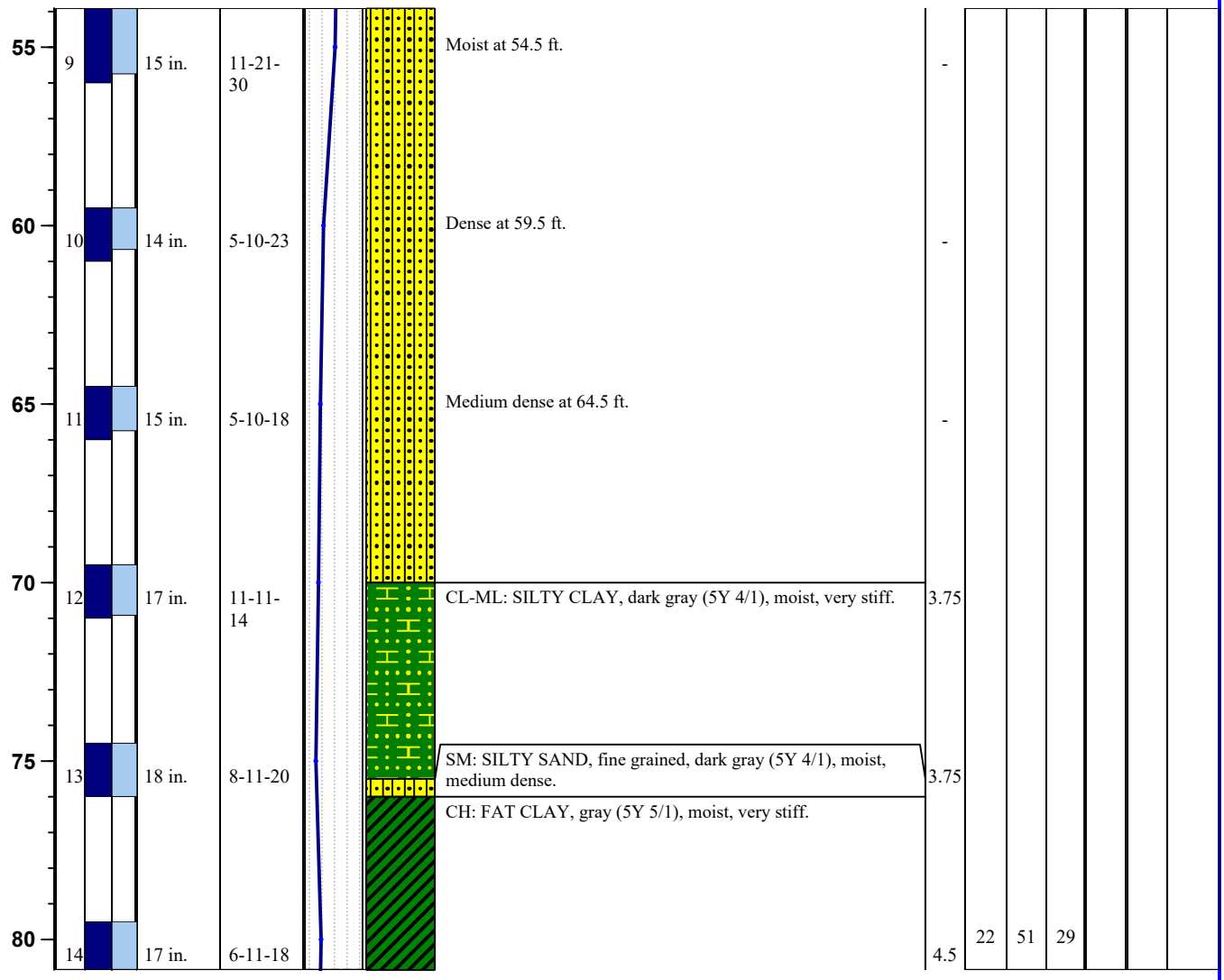
Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
55	9		15 in.	11-21-30	Moist at 54.5 ft.	-						
60	10		14 in.	5-10-23	Dense at 59.5 ft.	-						
65	11		15 in.	5-10-18	Medium dense at 64.5 ft.	-						
70	12		17 in.	11-11-14	CL-ML: SILTY CLAY, dark gray (5Y 4/1), moist, very stiff.	3.75						
75	13		18 in.	8-11-20	SM: SILTY SAND, fine grained, dark gray (5Y 4/1), moist, medium dense.	3.75						
					CH: FAT CLAY, gray (5Y 5/1), moist, very stiff.							
80	14		17 in.	6-11-18		4.5	22	51	29			



Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
85	15	18 in.	8-11-13		4.5						
90	16	18 in.	11-14-16		4.5						
95	17	18 in.	8-12-17	Color turns to dark gray (5Y 4/1) at 94.5 ft.	3.5						
100	18	18 in.	9-14-19	ML: SILT with some clay, gray (5Y 5/1), moist, dense.	3.5						
105	19	18 in.	13-18-26	SC: CLAYEY SAND, fine grained, with trace silt, dark gray (5Y 4/1), moist, dense.	1.5						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
110	20		18 in.	9-13-19	ML: SILT with trace clay, dark gray (5Y 4/1), moist, dense.	2.0	18	35	17		24.5	
115	21		14 in.	17-38-40	CL-ML: SILTY CLAY, gray (5Y 5/1), moist, hard.	4.5						
					SP: POORLY GRADED SAND, fine grained, gray (5Y 5/1), moist, very dense.							
120	22		18 in.	4-9-22	Fine to coarse grained, color turns to very dark grayish brown (2.5Y 3/2) and medium dense at 119.5 ft. Seam of lignite fragments 6 in. thick at 120.5 ft.	-						
125	23		10 in.	19-23-25	Dense at 124.5 ft.	-						
130	24		12 in.	16-24-25	With few gravel and color turns to dark olive brown (2.5Y 3/3) at 129.5 ft. and below.	-						6.4

Notes:

Soil Lithologies based on field observations and laboratory analysis.

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Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	25	13 in.	5-12-22	Wet at 134.5 ft. and below. Seam of lignite fragments 6 in. thick at 135.5 ft.	-						
140	26	13 in.	6-15-21		-						
145	27	18 in.	8-16-27		-						
150	28	12 in.	19-25-30	With lignite fragments and color turns to olive brown (5Y 4/2) at 149.5 ft.	-						
155	29	14 in.	23-24-28	Very dense at 154.5 ft.	-						
160	30	13 in.	29-38-38	Fine grained, color turns to gray (5Y 5/1) and very dense at 159.5 ft.	-						13.2

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
165	31	13 in.	29-31-41	With trace medium to coarse grained sand at 164.5 ft.	-						
170	32	13 in.	22-29-28		-						
175	33	12 in.	22-26-36	Fine to medium grained with trace coarse grains at 174.5 ft.	-						
180	34	8 in.	18-20-27	Medium to coarse grained with trace fine grains, color turns to olive brown (2.5Y 4/3) and dense at 179.5 ft.	-						
185	35	12 in.	22-29-37	Fine to medium grained, color turns to dark grayish brown (2.5Y 4/2) and very dense at 184.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

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Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
190	36		18 in.	22-31-29	Fine grained with trace medium grains, trace lignite fragments and color changes to dark olive gray (5Y 3/2) at 189.5 ft.	-						
195	37		9 in.	22-29-28	Fine to coarse grained with trace fine gravel and color turns to olive gray (5Y 4/2) at 194.5 ft.	-						6.7
200	38		17 in.	23-42-41	Fine to medium grained with fine grain sized lignite fragments and color turns to very dark gray (5y 3/1) at 199.5 ft. Coarse grained at 200.5 ft.	-						
205	39		10 in.	26-32-30	Fine to medium grained sand with trace fine gravel and color turns to olive (5Y 4/3) at 204.5 ft.	-						
210	40		10 in.	14-25-33	Color turns to olive gray (5Y 4/2) at 209.5 ft.	-						
215	41		14 in.	30-32-36	Fine to coarse grained with trace fine gravel and trace lignite fragments at 214.5 ft.	-						9.2

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

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Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample	Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
220	42		18 in.	16-24-30	Shale: Highly weathered, olive gray (2.5Y 4/2), moist, hard.	4.5						
225	43		18 in.	18-28-37	Color turns to dark gray (5Y 4/1) at 226 ft.	4.5					25.2	
	44		29 in.	60								
230	45		59 in.	78		8.0				102.7	23.1	
235	46		48 in.	62								
240												

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
245											
	48	58 in.	77		4.6				110.8	18.2	
250											
	49	60 in.	87								
255											
	50	58 in.	40								
260											
	51	60 in.	85								
265				Coal: Lignite, black (2.5Y 2.5/1).							
	52	56 in.	10	Highly weathered shale seam 6 in. thick at 268.5 ft.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
270											
	53	52 in.	70	Shale: Highly weathered, dark gray (5Y 4/1), moist, hard.							
275				Color turns to gray (5Y 5/1) at 275 ft.							
	54	60 in.	95								
280											
	55	60 in.	70								
				Coal: Lignite, black (5Y 2.5/1).							
285				Shale: Highly weathered, gray (5Y 5/1), moist, hard.							
	56	57 in.	95								
290											
	57	57 in.	95								
295											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
300	58	59 in.	98	EOB at 300 ft. Target depth reached.	23.4				110.6	17.1	

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
0				SP: POORLY GRADED SAND, fine grained, with trace silt, very dark gray (2.5Y 3/1), wet, very loose.							
10	1	3 in.	0-0-1		-						
15	2	0 in.	WOH		-						
20	3	12 in.	2-1-1	Color turns to olive gray (5Y 4/2) at 19.5 ft.	-						
25	4	0 in.	WOH		-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	5	18 in.	22-14-17	Medium dense at 29.5 ft.	-						
35	6	10 in.	1-2-1	Fine to medium grained with trace coarse grains, trace fine gravel and trace lignite fragments, very loose at 34.5 ft.	-						
40	7	9 in.	2-2-3	Loose at 39.5 ft.	-						
45	8	1 in.	7-8-11	GP: POORLY GRADED GRAVEL, coarse, olive gray (5Y 4/2), wet, medium dense.	-						
50	9	11 in.	8-9-10	SP: POORLY GRADED SAND, fine to medium grained, with trace lignite fragments, olive gray (5Y 4/2), wet, medium dense.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample	Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
55	10		14 in.	13-15-12	Fine grained with thin lignite laminations, color turns to dark gray (5Y 4/1) at 54.5 ft.	3.0						
					CL: LEAN CLAY, dark gray (5Y 4/1), moist, very stiff.							
60	11		18 in.	8-10-16	SM: SILTY SAND, fine grained, with trace clay, dark gray (5Y 4/1), wet, medium dense.	-					30.3	43.2
65	12		18 in.	1-5-8	SP: POORLY GRADED SAND, fine to medium grained, dark gray (5Y 4/1), wet, medium dense.	-						
70	13		18 in.	7-10-14	CL: LEAN CLAY, dark gray (5Y 4/1), moist, very stiff.	3.5						
75	14		18 in.	8-10-13		3.75	19	35	16		21.3	
80	15		18 in.	16-20-15	Hard at 79.5 ft.	3.5						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample	Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
85	16		18 in.	8-13-15	Very stiff at 84.5 ft.	4.0						
90	17		18 in.	8-19-22	Hard at 89.5 ft. SP: POORLY GRADED SAND, fine grained, dark gray (5Y 4/1), wet, dense.	3.5						
95	18		18 in.	3-10-28	Fine to medium grained at 94.5 ft.	-					27.0	8.0
100	19		17 in.	14-15-22	With trace lignite fragments and color turns to olive gray (5Y 4/2) at 99.5 ft. CL-ML: SILTY CLAY, with trace fine grained sand, olive gray (5Y 4/2), moist, hard.	-						
105	20		18 in.	9-13-20		2.5						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
110	21		18 in.	10-16-19		3.5						
115	22		18 in.	10-14-18		2.75	23	36	12		24.9	
120	23		12 in.	12-20-20	SP: POORLY GRADED SAND, fine to coarse grained, trace to few fine to medium gravel, trace silt and trace lignite fragments, olive gray (5Y 4/2), wet, dense.	-						
125	24		8 in.	12-20-18		-						
130	25		10 in.	16-22-22		-					13.3	6.5

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc. ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	26	11 in.	17-24-26		-						
140	27	13 in.	21-44-50/5"	Very dense at 139.5 ft.	-						
145	28	13 in.	25-31-34	Fine to medium grained with trace silt at 144.5 ft.	-					18.6	13.3
150	29	11 in.	20-35-50/4"	Fine grained with trace silt, trace lignite fragments and color changes to black (2.5Y 2.5/1) at 149.5 ft.	-						
155	30	14 in.	25-48-41	Fine grained with trace silt and color turns to olive gray (5Y 4/2) at 154.5 ft.	-						
160	31	15 in.	17-22-22	Fine to medium grained with trace silt and trace lignite fragments and dense at 159.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
165	32	16 in.	25-33-34	Fine grained with trace silt and very dense at 164.5 ft.	-					18.2	11.0
170	33	14 in.	21-32-38		-						
175	34	14 in.	19-23-36	Fine to coarse grained with trace silt and little lignite fragments at 174.5 ft.	-						
180	35	14 in.	26-30-30	Fine grained with trace silt at 179.5 ft.	-						
185	36	8 in.	30-50/6"	Fine to coarse grained with trace clay at 184.5 ft. Lignite lens 4 in. thick at 185 ft.	17.4				110.8	23.7	12.1

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
190	37		5 in.	20-25-34	Fine grained with trace silt and color changes to very dark gray (5Y 3/1) at 189.5 ft.	-						
195	38		6 in.	21-30-46		-						
200	39		14 in.	21-34-41	With trace lignite fragments at 199.5 ft.	-	23	37	14		13.1	
205	40		9 in.	49-50/6"		-						14.8
210	41		4 in.	50/4"	Shale: Highly weathered fragments, gray (2.5Y 6/1), moist, hard.	-						
215	42		0 in.	-	GP: NO RECOVERY, but drill cuttings appear to be angular	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
				fine gravel.							
220	43	8 in.	15-20-26	CH: FAT CLAY, with trace fine grained sand, gray (2.5Y 6/1), moist, hard.	4.5	17	57	40		21.6	
225	44	6 in.	18-23-27		4.5						
	45	12 in.	0	ML: SILT, with fine grained sand, non-cohesive, dark gray (5Y 4/1), moist.							
230	46	0 in.	-	NO RECOVERY, suspect same material as above.							
235	47	0 in.	-								
240											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
245	49	18 in.	0	Coal: Lignite, black (5Y 2.5/1). Trace large gravel at 245 ft.							
250	50	22 in.	32	Shale: Highly weathered, dark gray (5Y 4/1), moist, hard.	0.8				102.0	21.4	
255	51	60 in.	100	Siltstone to weathered shale with trace lignite at 255 ft.							
260	52	59 in.	93	With some siltstone layers and a lignite lens 1 in. thick at 260 ft.							
265	53	60 in.	100								

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
270											
	54	53 in.	67								
275				Lignite lens 8 in. thick at 274.5 ft.							
	55	60 in.	100		9.3				104.2	22.3	
280											
	56	48 in.	77								
285											
	57	55 in.	92								
290											
	58	60 in.	100								
295											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
300	59	60 in.	60	Coal: Lignite, black (5Y 2.5/1).	7.3				103.8	27.3	
	60	45 in.	0								
305	61	60 in.	38	Shale: Highly weathered, dark gray (5Y 4/1), moist, hard. Lignite lens 1 in. thick at 309 ft.							
310	62	60 in.	100							19.5	
315				EOB at 315 ft. Target depth reached.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
0				CL: LEAN CLAY, dark grayish brown (2.5Y 4/2), moist, medium stiff.							
5	1	8 in.	2-3-4		0.5						
10	2	18 in.	2-2-3		0.5						
15	3	10 in.	1-1-1	CL-ML: SILTY CLAY, olive brown (2.5Y 4/3), very moist, very soft.	0.25						
20	4	14 in.	1-1-1	ML: SILT, with trace clay, dark gray (5Y 4/1), moist, very loose.	0.25						
25	5	18 in.	1-1-1	CL-ML: SILTY CLAY, dark gray (5Y 4/1), moist, very soft.	0.25						
				ML: SILT, dark gray (5Y 4/1), moist, very loose.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

Lon: 103° 4' 53.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	6		15 in.	1-2-7	SP: POORLY GRADED SAND, fine grained, with trace silt, dark gray (5Y 4/1), wet, loose.	-						
35	7		18 in.	1-5-8	CL-ML: SILTY CLAY, very dark gray (5Y 3/1), very moist, stiff.	0.25						
40	8		11 in.	2-1-0	SM: SILTY SAND, fine grained, with trace clay, very dark gray (5Y 3/1), wet, very loose. Trace lignite fragments 1 in. thick at 40 ft.	-						
45	9		12 in.	3-5-5	SP: POORLY GRADED SAND, fine grained, with trace fine gravel, dark gray (5Y 4/1), wet, loose.	-					20.4	6.6
50	10		9 in.	7-9-6	Medium dense at 49.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
55	11	12 in.	4-6-6	Fine to medium grained with trace coarse grains at 54.5 ft.	-						
60	12	15 in.	4-9-12	Clay lens 6 in. thick at 60 ft. With thin lignite laminations at 60.5 ft.	-						
65	13	8 in.	4-7-5	SPG: POORLY GRADED SAND WITH GRAVEL, fine to medium grained with fine gravel, dark gray (5Y 4/1), wet, medium dense.	-					14.7	10.0
70	14	10 in.	3-5-5	SP: POORLY GRADED SAND, fine grained, with trace medium grains, dark gray (5Y 4/1), wet, loose.	-						
75	15	10 in.	5-9-17	Fine grained and medium dense at 74.5 ft. With a few thin lignite laminations at 75.5 ft.	-						
80	16	9 in.	15-16-18	Fine to medium grained with trace coarse grains and dense at 79.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
85	17	9 in.	11-11-13	Fine grained and medium dense at 84.5 ft.	-						
90	18	9 in.	13-12-15		-					27.7	10.1
95	19	9 in.	11-12-15		-						
100	20	10 in.	6-5-7		-						
105	21	12 in.	8-10-17	With trace lignite laminations throughout at 104.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
110	22	15 in.	23-28-37	Fine grained with trace medium grains and very dense at 109.5 ft.	-					23.7	7.0
115	23	5 in.	17-19-17	Fine to medium grained with trace coarse grains, trace fine gravel and trace lignite fragments at 114.5 ft.	-						
				GP: POORLY GRADED GRAVEL, with some fine to coarse sand, trace lignite fragments, dark gray (5Y 4/1), wet, very dense.							
120	24	12 in.	26-47-50/4"	ML: SILT, cohesive, with little fine grained sand, dark gray (5Y 4/1), wet, very dense.	0.5						
125	25	15 in.	24-47-51	SP: POORLY GRADED SAND, fine grained, with trace silt, dark gray (5Y 4/1), wet, very dense.	-						
130	26	16 in.	20-27-40		-						26.0

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	27	0 in.	17-25-36		-						
140	28	18 in.	20-25-39		-						
145	29	2 in.	50/3"	Lignite lens at least 2 in. thick at 144.5 ft.	-						
150	30	18 in.	20-25-49	Shale: Highly weathered to consolidated silty clay, gray (5Y 5/1), moist, hard.	4.5	17	46	29		21.0	
155	31	18 in.	24-31-50/3"	Lignite lens 2 in. thick at 155.75 ft.	4.5						
	32	42 in.	29	Coal: Lignite, black (2.5Y 2.5/1).							
160				Shale: Highly weathered to consolidated silty clay, gray (5Y 5/1), moist, hard.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
165	33	60 in.	92		12.3				115.0	16.1	
170	34	45 in.	70								
175	35	60 in.	98	Lignite lens 1 in. thick at 174 ft.							
180	36	44 in.	63								
185	37	60 in.	93		3.5				106.9	20.1	
	38	59 in.	77	Lignite lens 6 in. thick at 188 ft.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
190				Color turns to dark gray (5Y 4/1) and lignite lens 2 in. thick at 190 ft.							
	39	56 in.	93								
195											
	40	60 in.	100								
200											
	41	55 in.	92		10.5				107.0	21.3	
205											
	42	60 in.	97								
210											
	43	59 in.	98								
215											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
220	44	60 in.	100								
225	45	58 in.	97		7.7				108.9	20.3	
	46	60 in.	95								
230				Coal: Lignite, black (2.5Y 2.5/1).							
	47	60 in.	0								
235				Highly weathered shale lens 4 in. thick at 236 ft.							
	48	28 in.	7								
240				Shale: Highly weathered to consolidated silty clay, dark gray (5Y 4/1), moist, hard.							
		60 in.	85								

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

Lon: 103° 4' 53.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
245											
	50	34 in.	53		10.0				108.8	20.1	
250											
	51	27 in.	37								
255											
	52	60 in.	95								
260				Less weathered, fractured shale 1 in. thick at 260 ft.							
	53	0 in.	0								
265											
	54	60 in.	98		13.0				105.8	23.1	

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

Lon: 103° 4' 53.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
270											
	55	33 in.	38								
275											
	56	60 in.	100		23.9				107.2	20.8	
280											
	57	60 in.	100								
285											
	58	60 in.	88		6.5				106.1	24.0	
290				Coal: Lignite, black (5Y 2.5/1).							
	59	60 in.	0								
295											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

Lon: 103° 4' 53.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
	60	60 in.	0	EOB at 300 ft. Target depth reached.							
300											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

Lon: 103° 4' 53.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
0				CL-ML: SILTY CLAY, olive (5Y 4/4), very moist, very soft.							
15	1	15 in.	WOH		0						
20	2	13 in.	1-2-2	SM: SILTY SAND, fine grained with trace clay, olive gray (5Y 4/2), wet, very loose.	-						
25	3	10 in.	1-1-1	CL-ML: SILTY CLAY, with trace fine grained sand, olive gray (5Y 4/2), wet, very soft.	0						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 0.54"

Lon: 103° 4' 45.08"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	4	18 in.	2-2-4	SP-SC: POORLY GRADED SAND WITH CLAY, fine grained with little silt, very dark gray (5Y 3/1), wet, loose.	0						
35	5	6 in.	3-7-3	Fine to medium gravel lens 2 in. thick at 35 ft.	0						
				SM: SILTY SAND, fine to coarse grained with trace fine to medium gravel, dark olive gray (5Y 3/2), wet, medium dense.							
40	6	6 in.	4-5-7		-						
45	7	6 in.	3-3-7	SWG: WELL GRADED SAND WITH GRAVEL, fine to coarse grained with fine to medium gravel and trace silt, dark olive gray (5Y 3/2), wet, loose.	-						4.7
50	8	9 in.	11-24-18	Dense at 44.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
55	9		12 in.	2-3-4	SM: SILTY SAND, fine grained, dark olive gray (5Y 3/2), wet, loose.	-						
60	10		5 in.	20-34-34	Fine to coarse grained and very dense at 59.5 ft.	-						
65	11		15 in.	6-9-10	Fine grained and medium dense at 64.5 ft.	-					29.1	29.1
70	12		12 in.	12-16-10		-						
75	13		14 in.	13-14-12		-						
80	14		12 in.	10-13-15		-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
85	15	12 in.	12-13-14	Fine to medium gravel lens 4 in. thick at 84.5 ft. SPG: POORLY GRADED SAND WITH GRAVEL , fine to coarse grained with fine gravel and trace silt, dark olive gray (5Y 3/2), wet, medium dense.	-						7.6
90	16	0 in.	3-4-12		-						
95	17	6 in.	8-12-12	SM: SILTY SAND, fine grained, dark olive gray (5Y 3/2), wet, medium dense.	-						
100	18	5 in.	7-7-8	Fine to coarse grained at 99.5 ft.	-						
105	19	6 in.	6-10-10	Fine grained and color turns to very dark gray (5Y 3/1) at 104.5 ft.	-						20.2

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
110	20		10 in.	7-10-10		-						
115	21		12 in.	13-13-33	Dense at 114.5 ft.	-						
120	22		14 in.	23-30-37	SP-SC: POORLY GRADED SAND WITH CLAY, fine grained with some silt, gray (2.5Y 5/1), moist, very dense.	-						
125	23		16 in.	23-30-39	SM: SILTY SAND, fine grained with trace clay, gray (2.5Y 5/1), moist, very dense.	-					23.2	21.0
130	24		15 in.	22-28-42		-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	25	9 in.	32-50/3"	Lens of lignite fragments 1 in. thick at 135 ft.	-						
				Trace clay at 139.5 ft.							
140	26	12 in.	30-32-50/4"	Shale: SHALE, highly weathered to consolidated silty clay, gray (2.5Y 5/1), moist, hard.	-						
145	27	18 in.	24-28-36	Color turns to gray (5Y 6/1) at 146 ft.	4.5	17	27	10		20.5	
	28	35 in.	68								
150	29	48 in.	63	Lignite lens 1 in. thick at 152 ft.							
155				Siltstone: Gray (5Y 6/1), moist, very dense.							
	30	55 in.	80	Shale: Highly weathered to consolidated silty clay, gray (5Y 6/1), moist, hard.							
160				Lignite lens 1 in. thick at 159.5 ft.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 0.54"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

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Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
	31	58 in.	42	With trace lignite from 162 to 164 ft.							
165				Lignite lens 3 in. thick at 165.5 ft. Lignite lens 3 in. thick at 166 ft.							
	32	60 in.	95								
170						19	37	18			
	33	60 in.	95		12.7				108.6	20.4	
175				Lignite lens 1 in. thick at 174.5 ft.							
	34	48 in.	70								
180				Color turns to dark gray (5Y 4/1) at 180 ft.							
	35	48 in.	73								
185				Lignite lens 2 in. thick at 185 ft. Lignite lens 6 in. thick at 186 ft.							
	36	60 in.	86								

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

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Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
190											
	37	51 in.	85		11.1				116.3	14.2	
195											
	38	60 in.	58								
200											
	39	60 in.	100								
205											
	40	48 in.	77								
210											
	41	60 in.	100		7.2				104.4	23.0	
215											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 0.54"

Lon: 103° 4' 45.08"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
220	42	56 in.	93								
225	43	60 in.	100								
				Coal: Lignite, black (5Y 2.5/1).							
230	44	60 in.	0								
235	45	30 in.	8								
				Shale: Highly weathered to consolidated silty clay, dark gray (5Y 4/1), moist, hard.							
240	46	60 in.	98		16.6				108.5	19.7	
				Coal: Lignite, black (5Y 2.5/1).							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 0.54"

Lon: 103° 4' 45.08"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
245				Shale: Highly weathered to consolidated silty clay, dark gray (5Y 4/1), moist, hard.							
	48	60 in.	80								
250				Siltstone lens 1 in. thick at 251 ft.							
	49	29 in.	48								
255				Silt lens 2 in. thick at 256 ft.							
	50	32 in.	28		44.3				106.3	20.2	
260				NO RECOVERY, suspect more highly weathered shale material with trace lignite seams.							
	51	0 in.	0								
265											
	52	0 in.	0		5.0				112.7	15.3	

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 0.54"

Lon: 103° 4' 45.08"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
270											
	53	0 in.	0								
275											
	54	0 in.	0								
280				Shale: Highly weathered to consolidated silty clay, with trace fine grained sand, light gray (5Y 7/1), moist, hard.							
	55	18 in.	30								
285											
	56	41 in.	55								
290				Coal: Lignite, black (5Y 2.5/1).							
	57	43 in.	0								
295											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 0.54"

Lon: 103° 4' 45.08"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
300	58	60 in.	15	Shale: Highly weathered to consolidated silty clay, dark gray (5Y 4/1), moist, hard.							
				Coal: Lignite with few shale lenses, black (5Y 2.5/1).							
				Shale: Highly weathered to consolidated silty clay, dark gray (5Y 4/1), moist, hard.							
	59	60 in.	25	Coal: Lignite, black (5Y 2.5/1).							
305				Shale: Highly weathered to consolidated silty clay, dark gray (5Y 4/1), moist, hard.							
	60	55 in.	65	Lignite lens 1 in. thick at 308.25 ft.	15.2				117.6	14.2	
310				Sand with clay lens 9 in. thick at 309 ft.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 0.54"

Lon: 103° 4' 45.08"

Appendix D – Laboratory Reports

Project: **WBI N Bakken Expansion** Job Number: **G20-045** Sheet **1** of **4**

Manager: _____ Client: _____ Project Description: _____

Location: **Missouri River HDD Crossing** _____

_____ _____

Elevation Datum: _____

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
WB4 44.5				5.4									
WB4 59.5	40.3	18.3	22.0				19.4						
WB4 69.5				97.2									
WB4 79.5	31.3	18.7	12.0				19.1						
WB4 87.5							22.1						
WB4 132.5							15.2						
WB4 147.5							15.6						
WB4 182.5							19.1						
WB4 237.5							15.2						
WB4 247.5							19.1						
WB4 262.5							18.6						
WB4 287.5	103.4	31.1	72.0				20.0						
WB4 297.5							21.1						
WB5 44.0				7.7									
WB5 64.0	46.8	22.2	25.0				28.0						
WB5 109.5				46.6									
WB5 149.5	35.5	16.1	19.0				18.1						
WB5 180.0							16.6						
WB5 200.0							14.2						

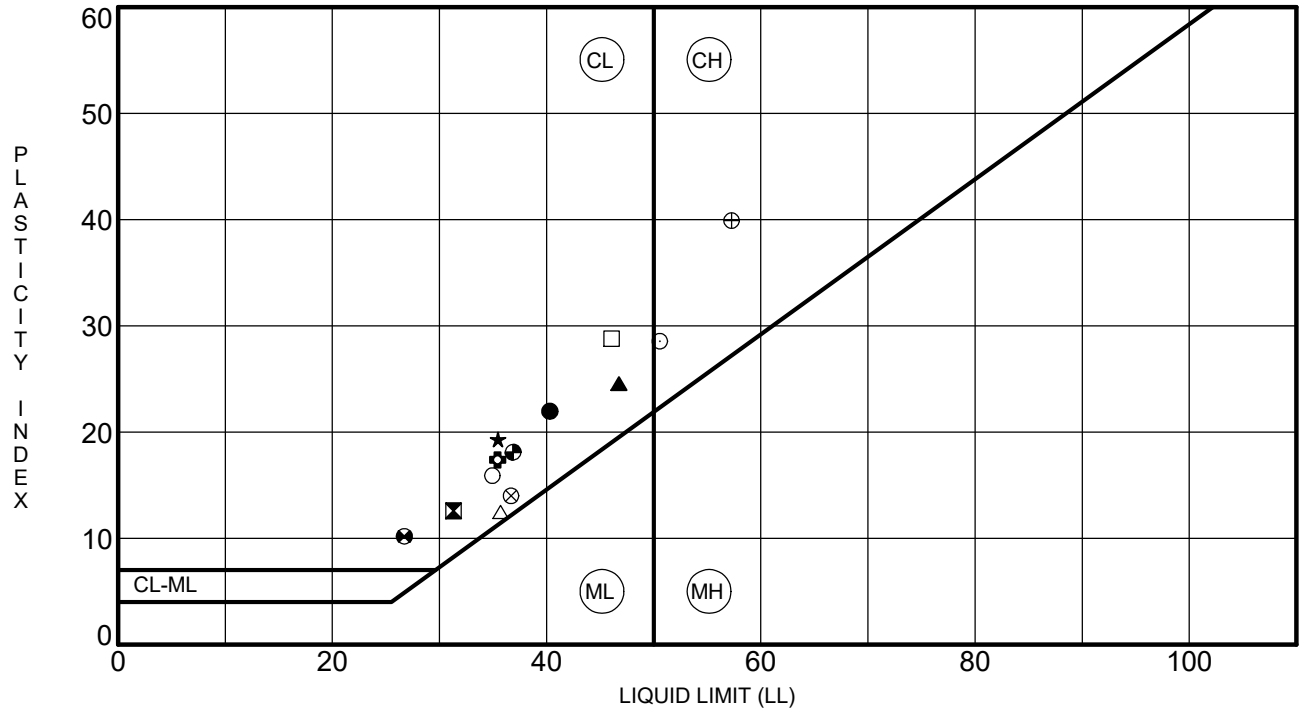
Material Testing Services, LLC	**Summary of Material Properties**	June 30, 2020

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
WB5 220.0							19.2						
WB5 245.0	90.5	26.3	65.0				17.0						
WB5 265.0							20.5						
WB5 275.0	149.2	22.3	127.0				20.2						
WB5 295.0							21.6						
WB6 49.5				10.0									
WB6 79.5	50.6	22.0	29.0										
WB6 109.5	35.4	18.0	17.0				24.5						
WB6 129.5				6.4									
WB6 159.5				13.2									
WB6 194.5				6.7									
WB6 214.5				9.2									
WB6 224.5	127.4	20.0	107.0				25.2						
WB6 230.0							23.1						
WB6 245.0							18.2						
WB6 275.0	162.4	20.6	141.0										
WB6 295.0							17.1						
WB7 59.5				43.2			30.3						
WB7 74.5	34.9	19.0	16.0				21.3						
WB7 94.5				8.0			27.0						
WB7 114.5	35.7	23.2	13.0				24.9						
WB7 129.5				6.5			13.3						

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
WB7 144.5				13.3			18.6						
WB7 164.5				11.0			18.2						
WB7 184.5				12.1			23.7						
WB7 202.5	36.7	22.7	14.0				13.1						
WB7 204.5				14.8									
WB7 219.5	57.3	17.3	40.0				21.6						
WB7 250.0							21.4						
WB7 275.0	203.2	23.7	179.0				22.3						
WB7 295.0							27.3						
WB7 310.0							19.5						
WB8 44.5				6.6			20.4						
WB8 64.5				10.0			14.7						
WB8 89.5				10.1			27.7						
WB8 109.5				6.9			23.7						
WB8 129.5				26.0									
WB8 149.5	46.1	17.3	29.0				21.0						
WB8 160.0							16.1						
WB8 180.0							20.1						
WB8 200.0							21.3						
WB8 220.0							20.3						
WB8 245.0							20.1						
WB8 265.0							23.1						

Project: **WBI N Bakken Expansion** Job Number: **G20-045** Sheet **4** of **4**

Borehole Depth / Elev.	Specimen Description	LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
WB8 275.0		169.4	22.6	146.0				20.8						
WB8 280.0								24.0						
WB9 44.5	WELL-GRADED SAND with GRAVEL				4.7									
WB9 64.5					29.2			29.1						
WB9 84.5					7.6									
WB9 104.5					20.2									
WB9 124.5					21.0			23.2						
WB9 144.5		26.7	16.5	10.0				20.5						
WB9 170.0		36.9	18.8	18.0				13.3						
WB9 190.0								20.4						
WB9 205.0								23.0						
WB9 235.0								19.7						
WB9 245.0		158.1	22.5	136.0				20.2						
WB9 255.0								15.3						
WB9 305.0								14.2						



Specimen Identification			LL	PL	PI	Fines	Classification
●	**WB4**	**59.5**	**40**	**18**	**22**		
⊠	**WB4**	**79.5**	**31**	**19**	**13**		
▲	**WB5**	**64.0**	**47**	**22**	**25**		
★	**WB5**	**149.5**	**35**	**16**	**19**		
⊙	**WB6**	**79.5**	**51**	**22**	**29**		
✿	**WB6**	**109.5**	**35**	**18**	**17**		
○	**WB7**	**74.5**	**35**	**19**	**16**		
△	**WB7**	**114.5**	**36**	**23**	**12**		
⊗	**WB7**	**202.5**	**37**	**23**	**14**		
⊕	**WB7**	**219.5**	**57**	**17**	**40**		
□	**WB8**	**149.5**	**46**	**17**	**29**		
⊛	**WB9**	**144.5**	**27**	**17**	**10**		
◕	**WB9**	**170.0**	**37**	**19**	**18**		

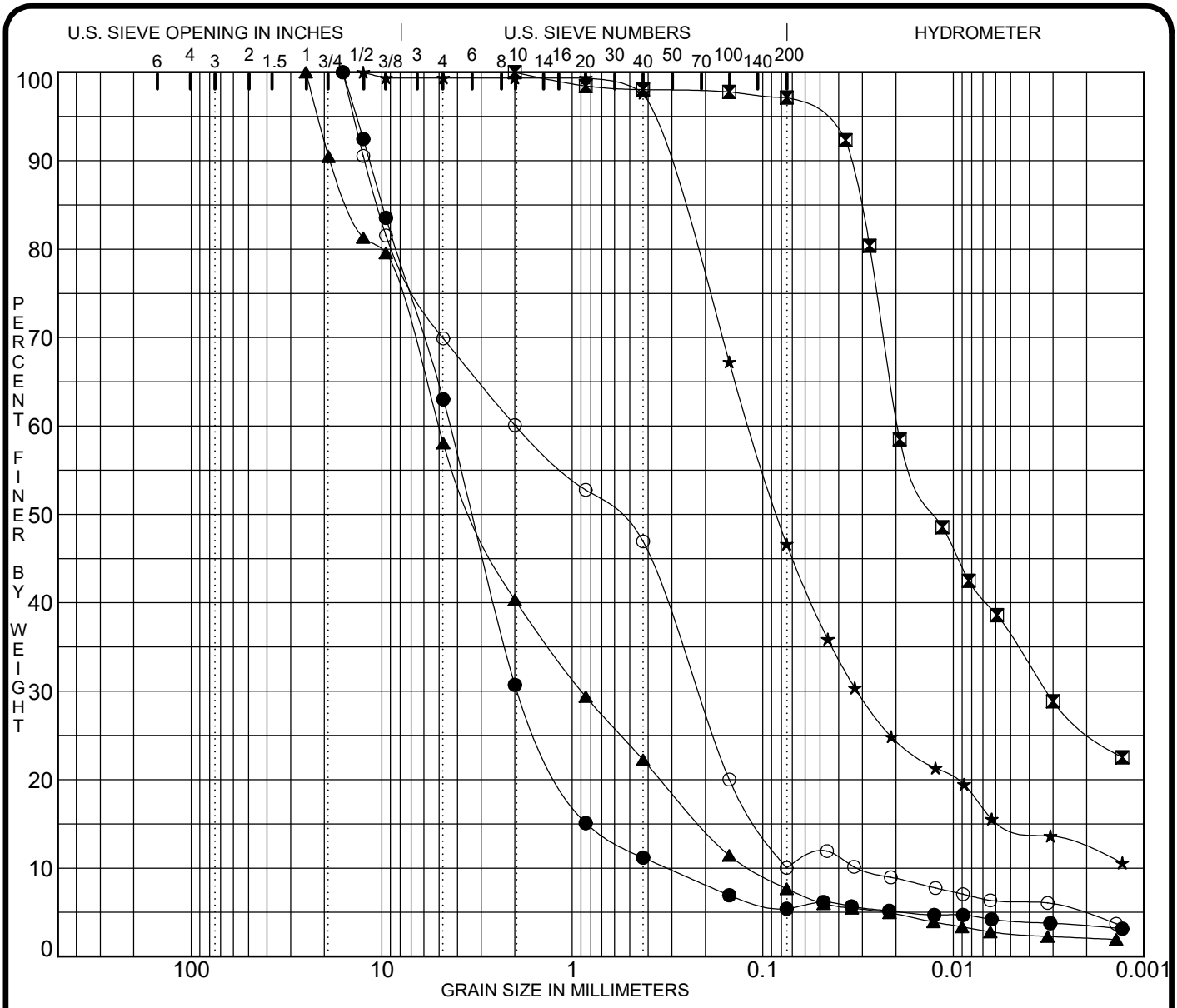
PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G20-045**

DATE **6/15/20**

ATTERBERG LIMITS' RESULTS

Material Testing Services, LLC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Classification	MC%	LL	PL	PI	Cc	Cu
●	**WB4**	**44.5**						**2.65**	**13.8**
⊠	**WB4**	**69.5**							
▲	**WB5**	**44.0**						**1.36**	**43.8**
★	**WB5**	**109.5**							
⊙	**WB6**	**49.5**						**0.34**	**27.3**

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**WB4**	**44.5**	**16.00**	**4.38**	**1.923**	**0.3184**	**37.0**	**57.6**	**1.3**	**4.1**
⊠	**WB4**	**69.5**	**2.00**	**0.02**	**0.003**		**0.0**	**2.8**	**60.9**	**36.2**
▲	**WB5**	**44.0**	**25.00**	**5.06**	**0.892**	**0.1154**	**41.9**	**50.4**	**5.1**	**2.6**
★	**WB5**	**109.5**	**12.50**	**0.12**	**0.032**		**0.6**	**52.7**	**31.7**	**14.9**
⊙	**WB6**	**49.5**	**16.00**	**1.98**	**0.221**	**0.0724**	**30.1**	**59.9**	**3.8**	**6.2**

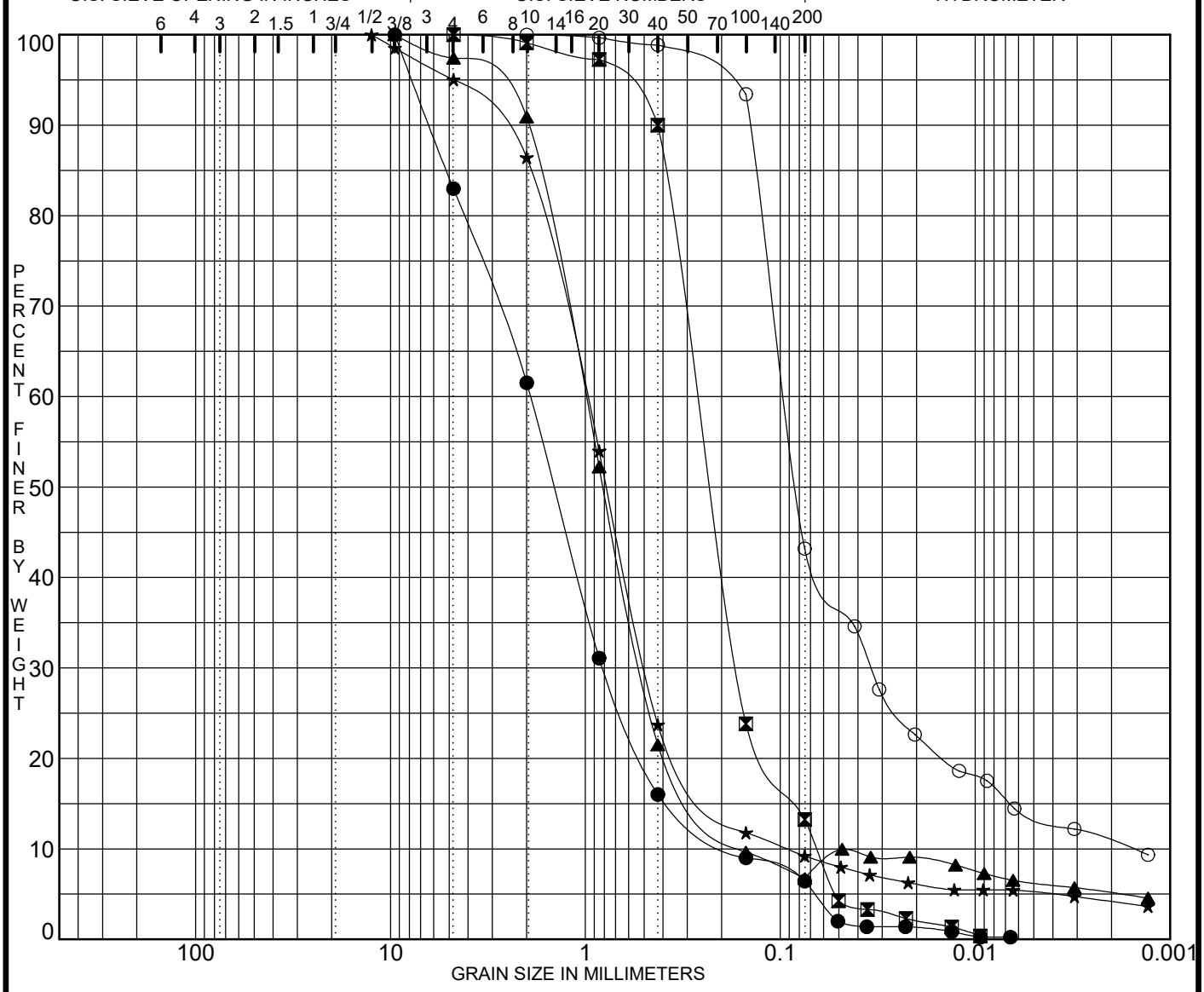
PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G20-045**

DATE **6/29/20**

PARTICLE SIZE ANALYSIS

Material Testing Services, LLC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Classification	MC%	LL	PL	PI	Cc	Cu
●	**WB6**	**129.5**						**1.96**	**11.0**
⊠	**WB6**	**159.5**						**1.59**	**4.1**
▲	**WB6**	**194.5**						**5.41**	**20.8**
★	**WB6**	**214.5**						**2.61**	**10.7**
⊙	**WB7**	**59.5**		**30**				**7.85**	**59.5**

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**WB6**	**129.5**	**9.50**	**1.92**	**0.809**	**0.1740**	**17.0**	**76.6**		
⊠	**WB6**	**159.5**	**4.75**	**0.27**	**0.165**	**0.0649**	**0.0**	**86.8**		
▲	**WB6**	**194.5**	**9.50**	**1.01**	**0.515**	**0.0486**	**2.6**	**90.7**	**0.5**	**6.2**
★	**WB6**	**214.5**	**12.50**	**1.00**	**0.491**	**0.0927**	**5.0**	**85.8**	**4.0**	**5.2**
⊙	**WB7**	**59.5**	**2.00**	**0.09**	**0.034**	**0.0016**	**0.0**	**56.8**	**29.5**	**13.7**

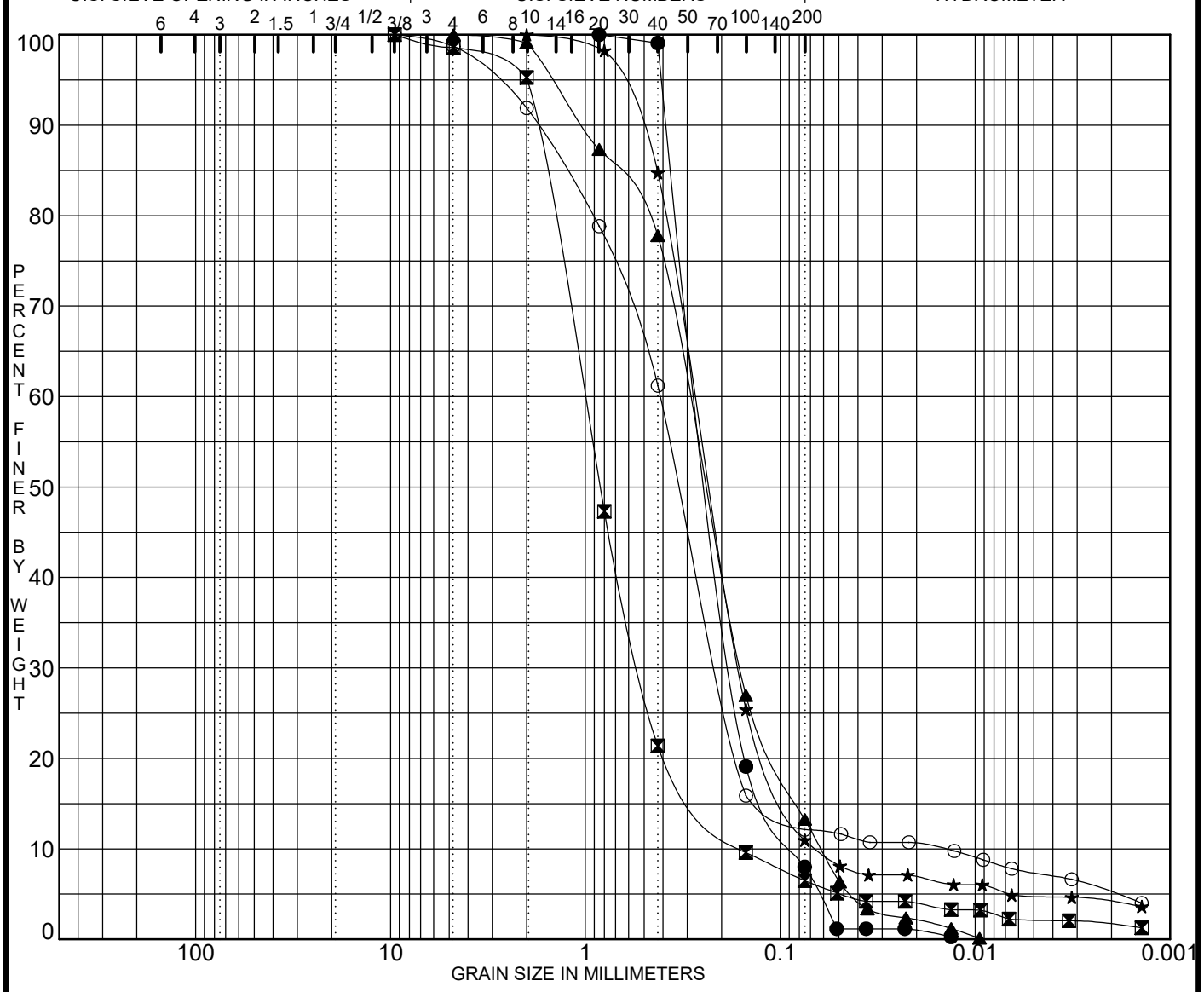
PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G20-045**

DATE **6/29/20**

PARTICLE SIZE ANALYSIS

Material Testing Services, LLC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Classification	MC%	LL	PL	PI	Cc	Cu
●	**WB7**	**94.5**		**27**				**1.38**	**3.0**
⊠	**WB7**	**129.5**		**13**				**1.73**	**6.5**
▲	**WB7**	**144.5**		**19**				**1.40**	**4.8**
★	**WB7**	**164.5**		**18**				**1.47**	**4.2**
⊙	**WB7**	**184.5**		**24**				**7.14**	**28.3**

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**WB7**	**94.5**	**0.85**	**0.26**	**0.173**	**0.0850**	**0.0**	**92.0**		
⊠	**WB7**	**129.5**	**9.50**	**1.02**	**0.524**	**0.1556**	**1.4**	**92.1**	**4.3**	**2.2**
▲	**WB7**	**144.5**	**4.75**	**0.30**	**0.160**	**0.0617**	**0.0**	**86.7**		
★	**WB7**	**164.5**	**2.00**	**0.28**	**0.163**	**0.0652**	**0.0**	**89.0**	**6.2**	**4.8**
⊙	**WB7**	**184.5**	**9.50**	**0.41**	**0.207**	**0.0146**	**1.3**	**86.6**	**4.7**	**7.4**

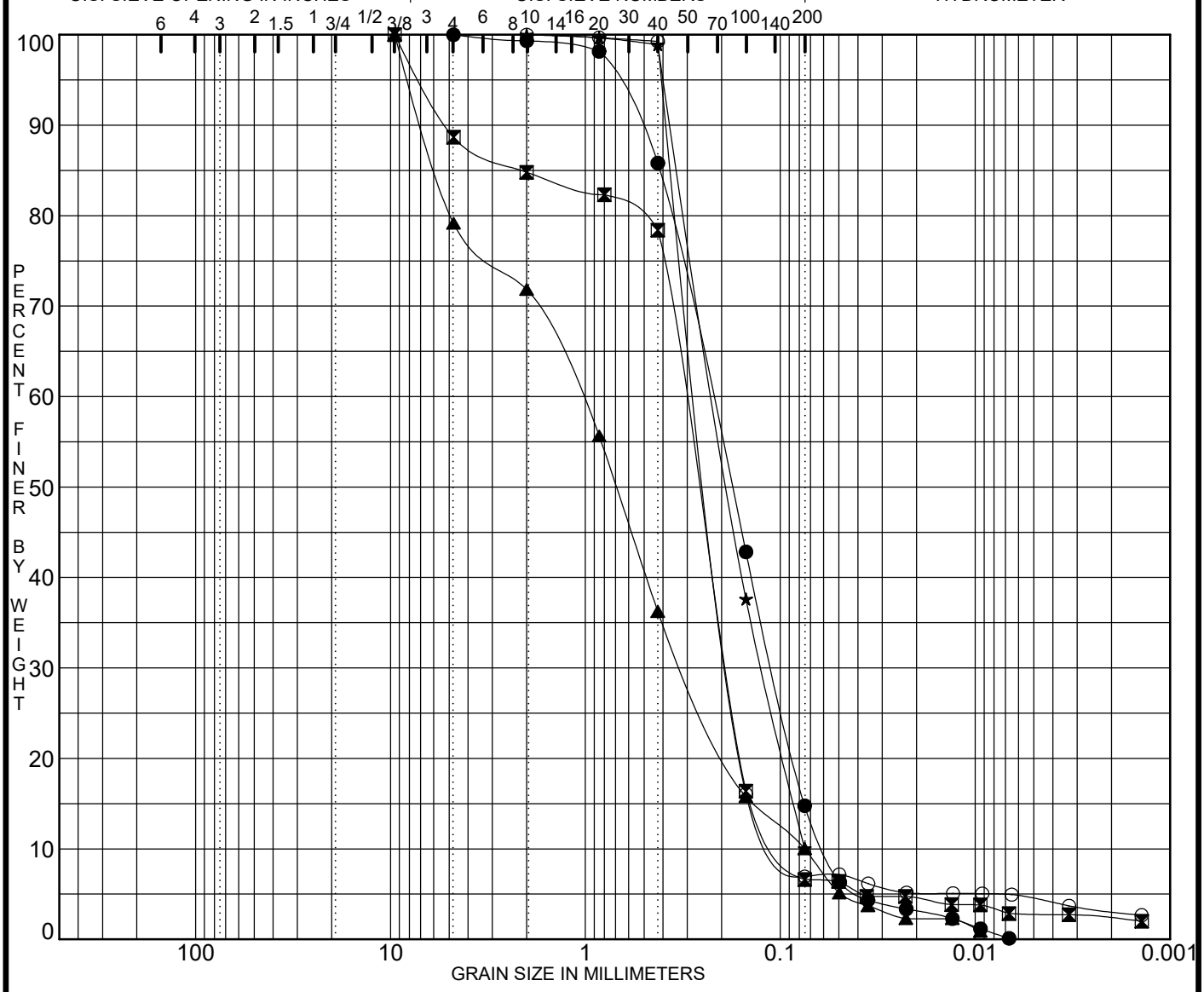
PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G20-045**

DATE **6/29/20**

PARTICLE SIZE ANALYSIS

Material Testing Services, LLC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Classification	MC%	LL	PL	PI	Cc	Cu
●	**WB7**	**204.5**						**0.88**	**3.8**
⊠	**WB8**	**44.5**		**20**				**1.19**	**3.3**
▲	**WB8**	**64.5**		**15**				**1.19**	**14.3**
★	**WB8**	**89.5**		**28**				**0.93**	**2.9**
⊙	**WB8**	**109.5**		**24**				**1.73**	**3.7**

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**WB7**	**204.5**	**4.75**	**0.23**	**0.109**	**0.0594**	**0.0**	**85.2**		
⊠	**WB8**	**44.5**	**9.50**	**0.31**	**0.189**	**0.0954**	**11.3**	**82.1**	**3.8**	**2.8**
▲	**WB8**	**64.5**	**9.50**	**1.07**	**0.309**	**0.0750**	**20.8**	**69.2**		
★	**WB8**	**89.5**	**2.00**	**0.22**	**0.124**		**0.0**	**89.9**	**10.1**	
⊙	**WB8**	**109.5**	**2.00**	**0.26**	**0.179**	**0.0709**	**0.0**	**93.1**	**2.5**	**4.5**

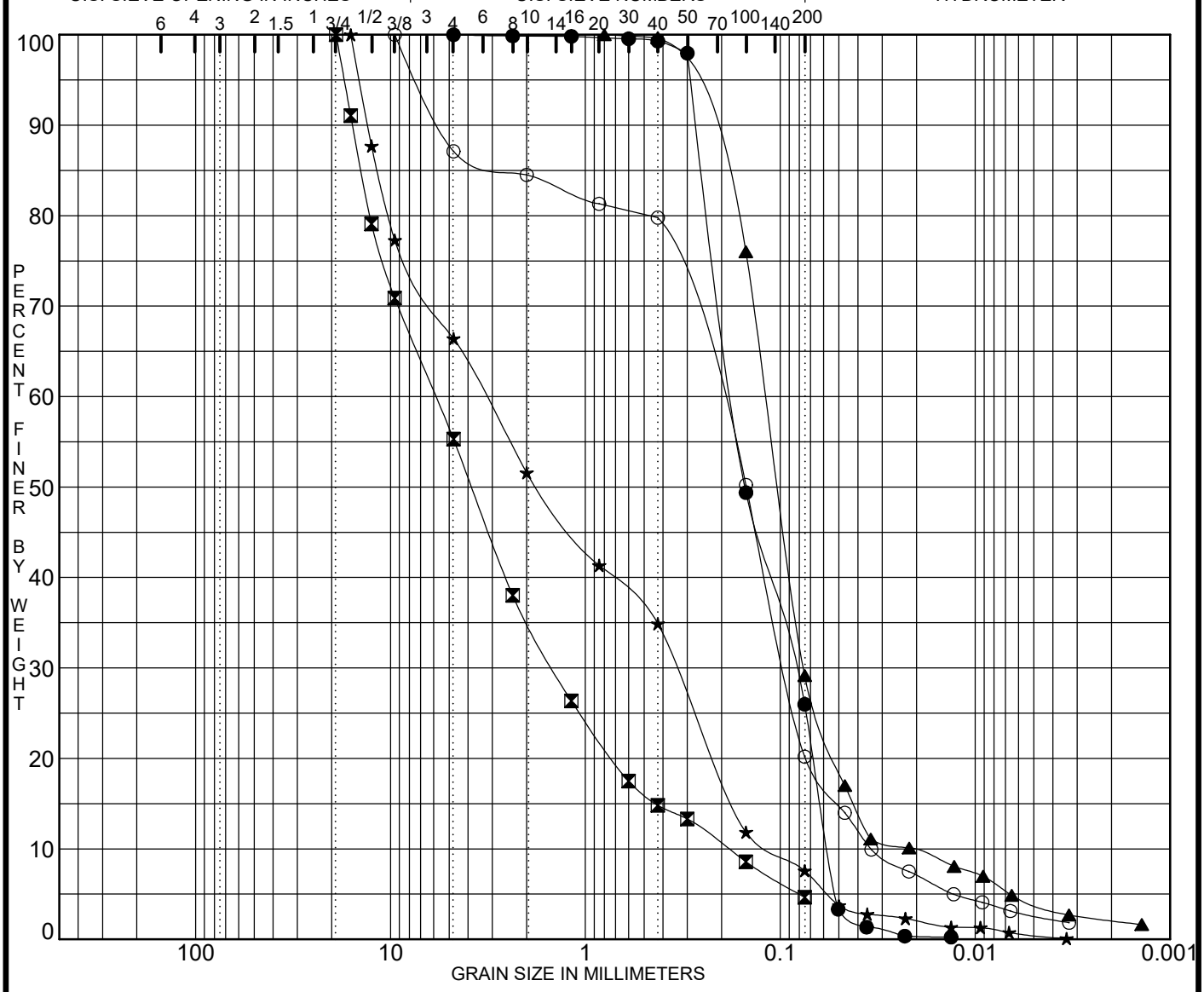
PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G20-045**

DATE **6/29/20**

PARTICLE SIZE ANALYSIS

Material Testing Services, LLC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Classification	MC%	LL	PL	PI	Cc	Cu
●	**WB8**	**129.5**						**0.72**	**3.1**
⊠	**WB9**	**44.5**	**WELL-GRADED SAND with GRAVEL SW**					**1.98**	**31.7**
▲	**WB9**	**64.5**		**29**				**2.29**	**5.6**
★	**WB9**	**84.5**						**0.32**	**29.4**
⊙	**WB9**	**104.5**						**1.22**	**6.2**

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**WB8**	**129.5**	**4.75**	**0.17**	**0.084**	**0.0567**	**0.0**	**74.0**		
⊠	**WB9**	**44.5**	**19.00**	**5.86**	**1.465**	**0.1848**	**44.7**	**50.6**	**4.7**	
▲	**WB9**	**64.5**	**0.80**	**0.12**	**0.076**	**0.0213**	**0.0**	**70.8**	**25.1**	**4.0**
★	**WB9**	**84.5**	**16.00**	**3.27**	**0.341**	**0.1112**	**33.6**	**58.8**	**7.1**	**0.5**
⊙	**WB9**	**104.5**	**9.50**	**0.21**	**0.094**	**0.0343**	**12.9**	**66.9**	**17.6**	**2.6**

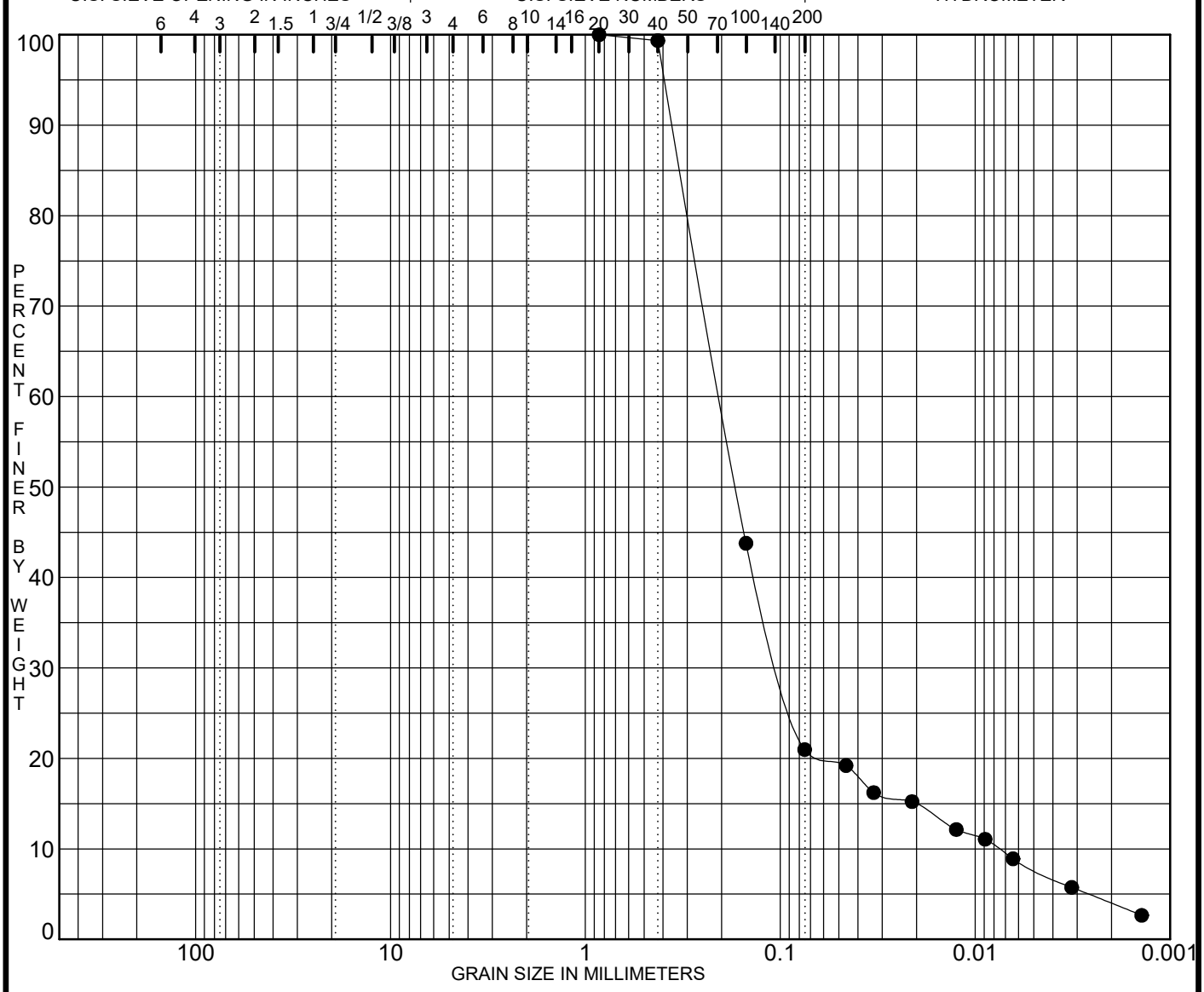
PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G20-045**

DATE **6/29/20**

PARTICLE SIZE ANALYSIS

Material Testing Services, LLC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Classification	MC%	LL	PL	PI	Cc	Cu
●	**WB9**	**124.5**		**23**				**6.33**	**26.9**

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**WB9**	**124.5**	**0.85**	**0.20**	**0.099**	**0.0076**	**0.0**	**79.0**	**13.2**	**7.8**

PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G20-045**

DATE **6/29/20**

PARTICLE SIZE ANALYSIS

Material Testing Services, LLC

MATERIAL TESTING SERVICES, LLC

P.O. Box 634
Minot, ND 58702
(701) 852-5553

P.O. Box 1093
Williston, ND 58802
(701) 572-4226

UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

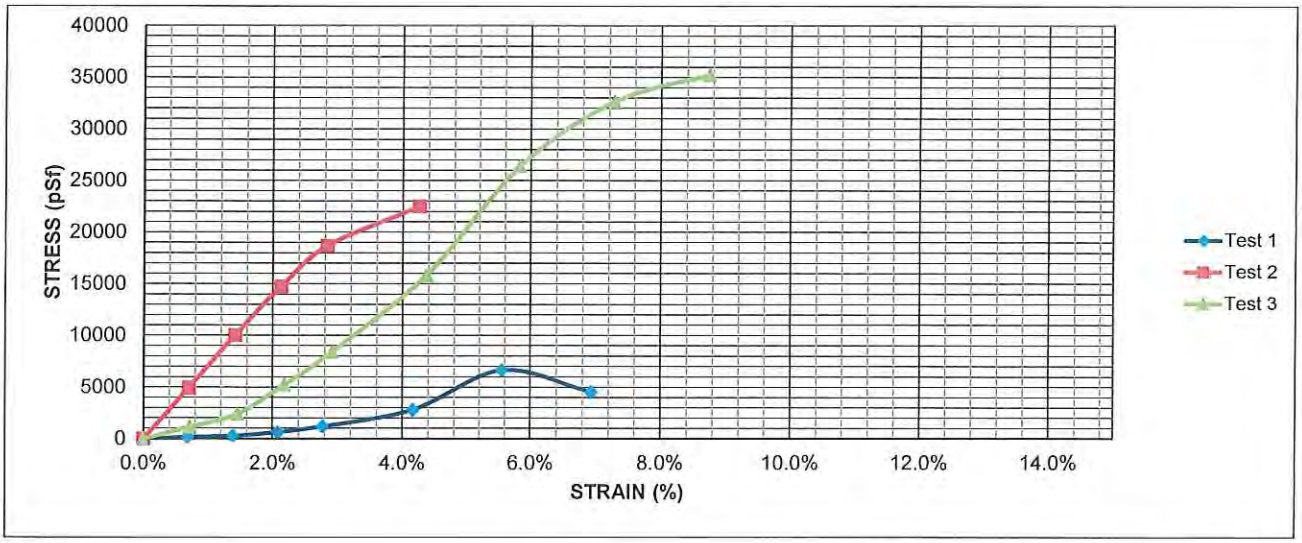
DATE: 4-Jun-20

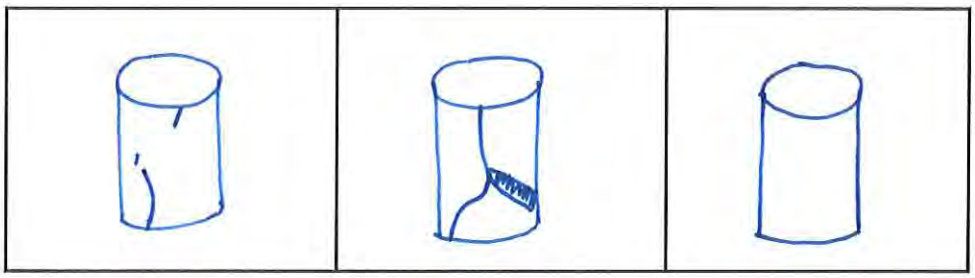
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 1	Test 2	Test 3
	WB-4 RC - 87.5-92.5 feet	WB-4 RC - 127.5-132.5 feet	WB-4 RC - 147.5-152.5 feet
Soil Class:			
Dry Density (pcf):	108.6	113.7	118.9
Water Content:	22.1%	15.2%	15.5%
Sample Dia. (mm):	45.1	44.8	44.4
Sample Ht (mm):	91.5	89.4	87.2
Height/Diameter:	2.03	2.00	1.96
Unc. Strength (psf):	**6646**	**22535**	**35246**
Strain at Failure (%):	5.6	4.3	7.3





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MISSOURI RIVER HDD CROSSING

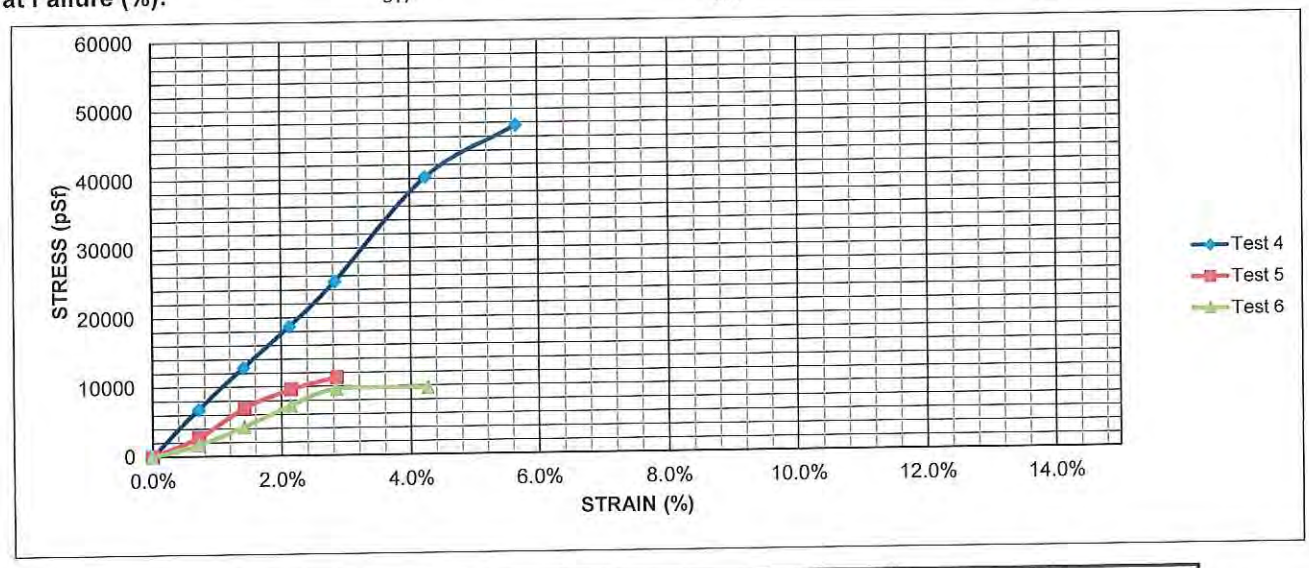
DATE: 4-Jun-20

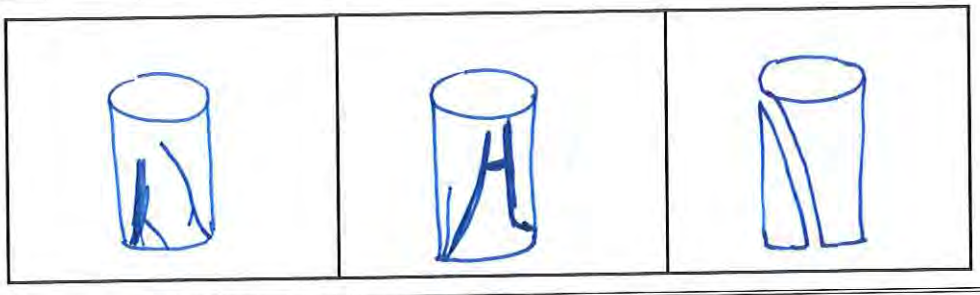
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 4 WB-4 RC - 182.5-187.5 feet	Test 5 WB-4 RC - 237.5-242.5 feet	Test 6 WB-4 RC - 247.5-252.5 feet
Soil Class:			
Dry Density (pcf):	115.1	113.9	107.5
Water Content:	19.1%	15.2%	19.1%
Sample Dia. (mm):	44.6	45.3	45.7
Sample Ht (mm):	89.7	88.9	89.2
Height/Diameter:	2.01	1.96	1.95
Unc. Strength (psf):	**47624**	**11336**	**9726**
Strain at Failure (%):	5.7	2.9	4.3





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MISSOURI RIVER HDD CROSSING

DATE: 4-Jun-20

COPIES TO:

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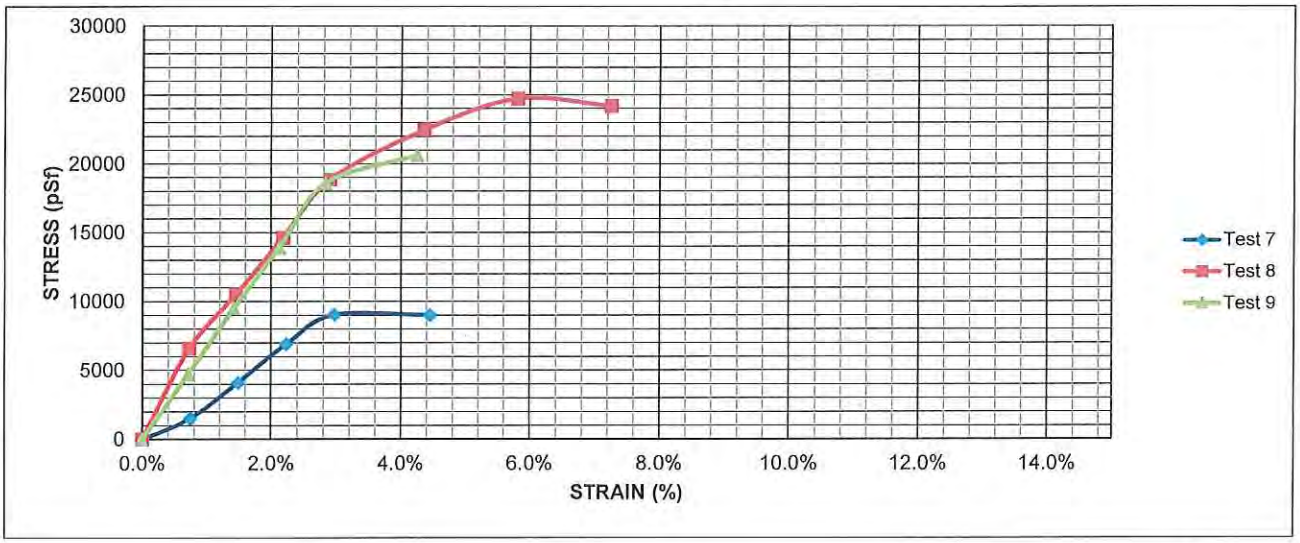
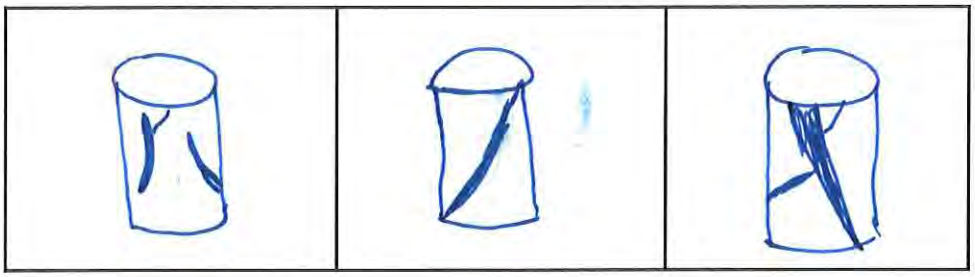
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 7	Test 8	Test 9
	WB-4 RC - 262.5-272.5 feet	WB-4 RC - 287.5-292.5 feet	WB-4 RC - 297.5-300 feet
Soil Class:			
Dry Density (pcf):	109.4	107.6	105.9
Water Content:	18.6%	20.0%	21.1%
Sample Dia. (mm):	45.7	44.4	44.6
Sample Ht (mm):	85.5	87.4	89.7
Height/Diameter:	1.87	1.97	2.01
Unc. Strength (psf):	**9054**	**24774**	**22188**
Strain at Failure (%):	3.0	5.8	4.2





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UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

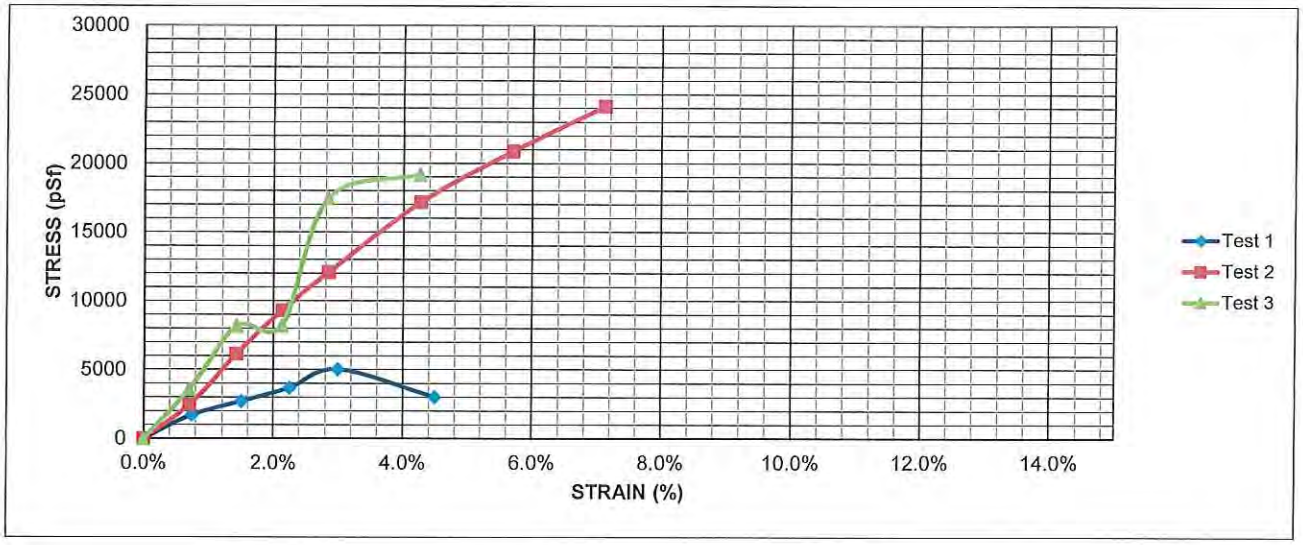
DATE: 5-Jun-20

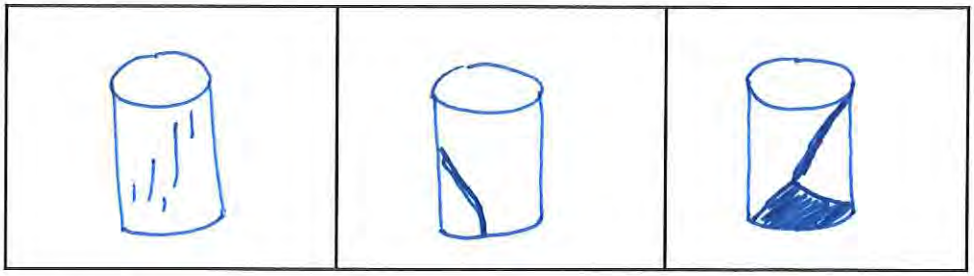
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 1	Test 2	Test 3
	WB-5	WB-5	WB-5
	RC - 160-165 feet	RC - 180-185 feet	RC - 200-205 feet
Soil Class:			
Dry Density (pcf):	108.2	117.5	116.3
Water Content:	66.2%	16.6%	14.2%
Sample Dia. (mm):	42.9	44.2	44.6
Sample Ht (mm):	84.8	89.2	89.5
Height/Diameter:	1.98	2.02	2.01
Unc. Strength (psf):	**5047**	**24258**	**19234**
Strain at Failure (%):	3.0	7.1	4.3





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UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

DATE: 5-Jun-20

COPIES TO:

REPORTED TO: Attn: James Simonet, PG
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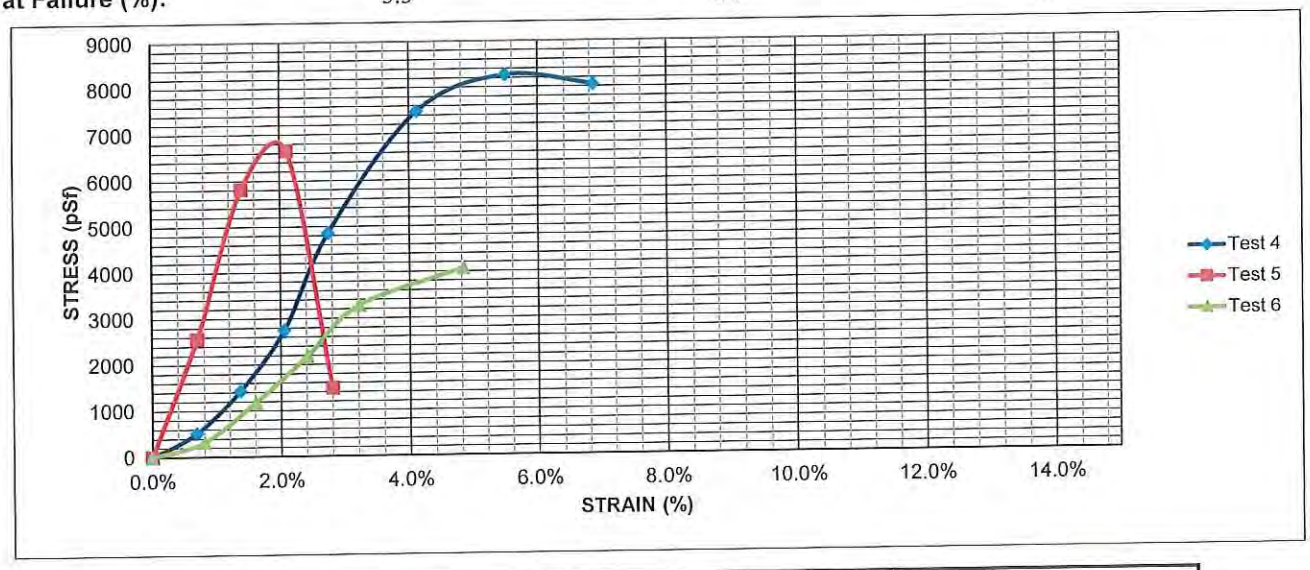
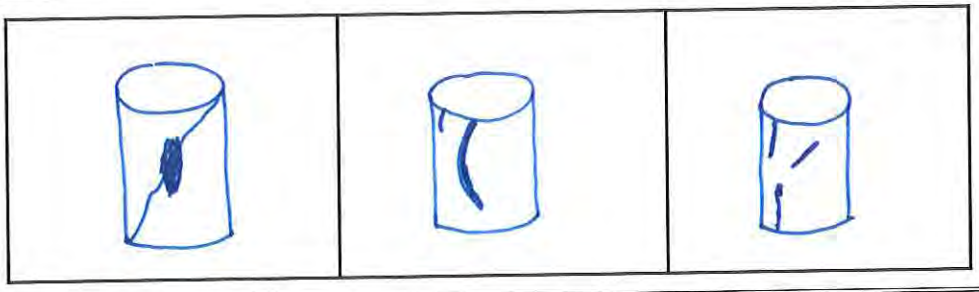
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 4 WB-5 RC - 220-225 feet	Test 5 WB-5 RC - 245-250 feet	Test 6 WB-5 RC - 265-270 feet
Soil Class:			
Dry Density (pcf):	105.8	107.9	108.8
Water Content:	19.2%	17.0%	20.5%
Sample Dia. (mm):	46.0	45.7	44.9
Sample Ht (mm):	92.5	90.5	78.9
Height/Diameter:	2.01	1.98	1.75
Unc. Strength (psf):	**8272**	**6658**	**4075**
Strain at Failure (%):	5.5	2.1	4.8





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UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

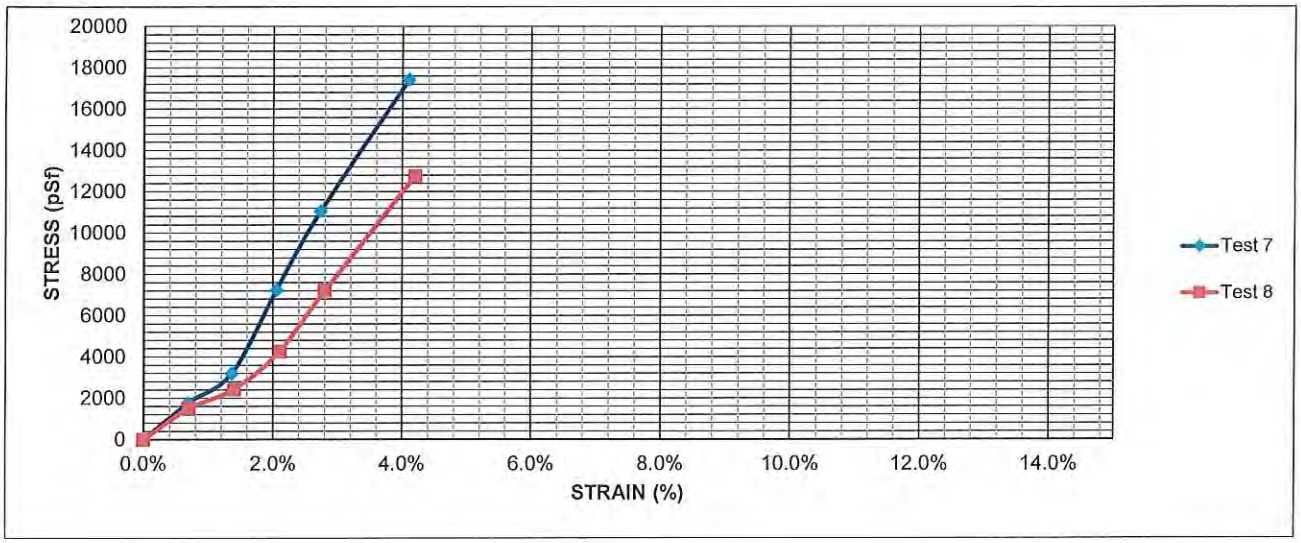
DATE: 7-Jun-20

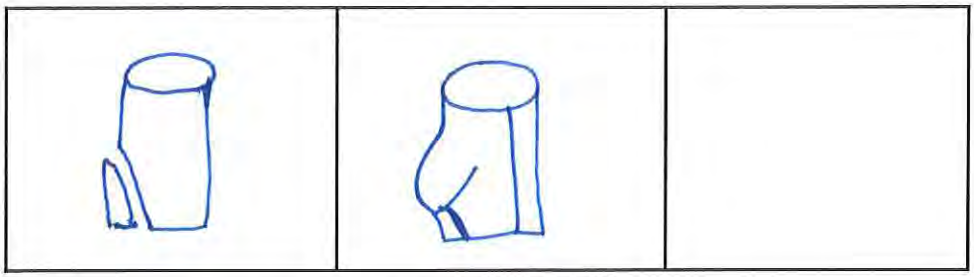
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 7	Test 8
	WB-5	WB-5
	RC - 275-280 feet	RC - 295-300 feet
Soil Class:		
Dry Density (pcf):	106.5	106.7
Water Content:	20.2%	21.6%
Sample Dia. (mm):	44.6	45.7
Sample Ht (mm):	92.9	90.7
Height/Diameter:	2.08	1.98
Unc. Strength (psf):	**17425**	**12763**
Strain at Failure (%):	4.1	4.2





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UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

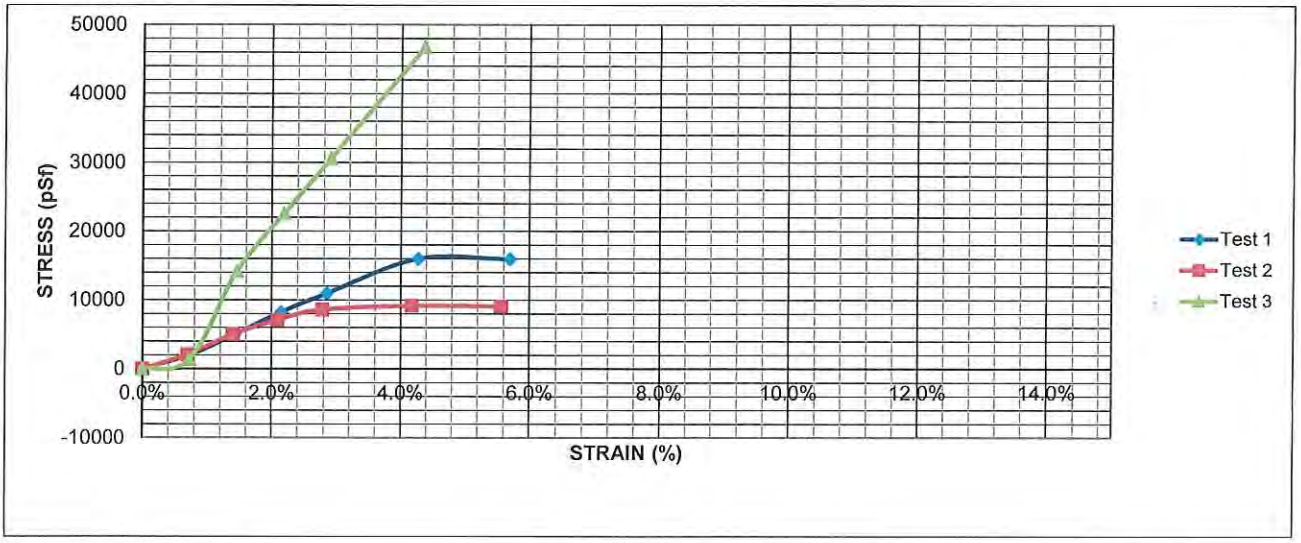
DATE: 10-Jun-20

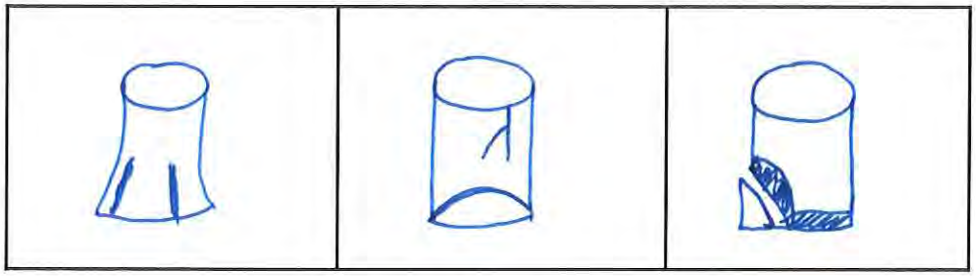
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 1	Test 2	Test 3
	WB-6 RC - 230-2355 feet	WB-6 RC - 245-250 feet	WB-6 RC - 295-300 feet
Soil Class:			
Dry Density (pcf):	102.7	110.8	110.6
Water Content:	23.1%	18.2%	17.1%
Sample Dia. (mm):	44.7	45.2	44.8
Sample Ht (mm):	89.2	91.4	87.3
Height/Diameter:	2.00	2.02	1.95
Unc. Strength (psf):	**16058**	**9230**	**46813**
Strain at Failure (%):	3.0	4.2	4.4





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UNCONFINED COMPRESSIVE STRENGTH
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PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

DATE: 4-Jun-20

COPIES TO:

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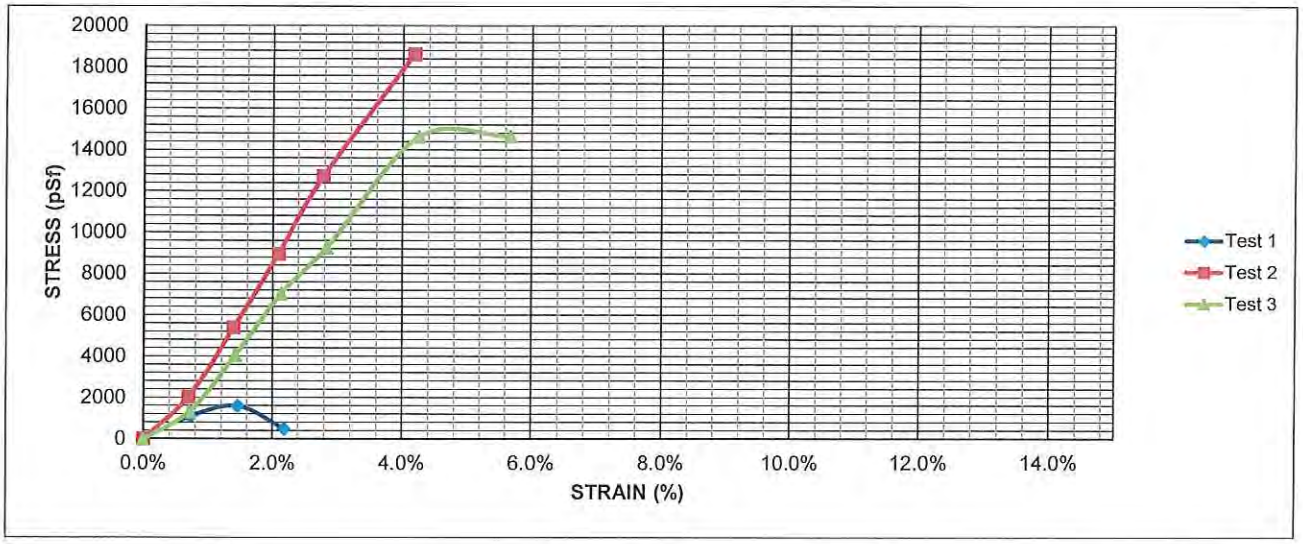
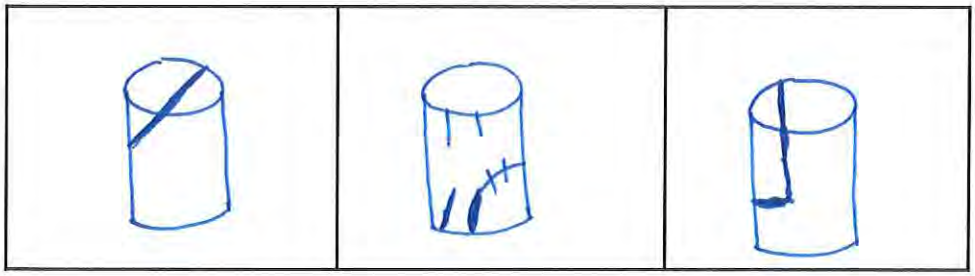
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 1	Test 2	Test 3
	WB-7	WB-7	WB-7
	RC - 250-255 feet	RC - 275-280 feet	RC - 295-300 feet
Soil Class:			
Dry Density (pcf):	102.0	104.2	103.8
Water Content:	21.4%	22.3%	27.3%
Sample Dia. (mm):	44.3	45.7	44.8
Sample Ht (mm):	87.2	91.1	89.6
Height/Diameter:	1.97	1.99	2.00
Unc. Strength (psf):	**1599**	**18637**	**14666**
Strain at Failure (%):	1.5	4.2	5.7





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DATE: 4-Jun-20

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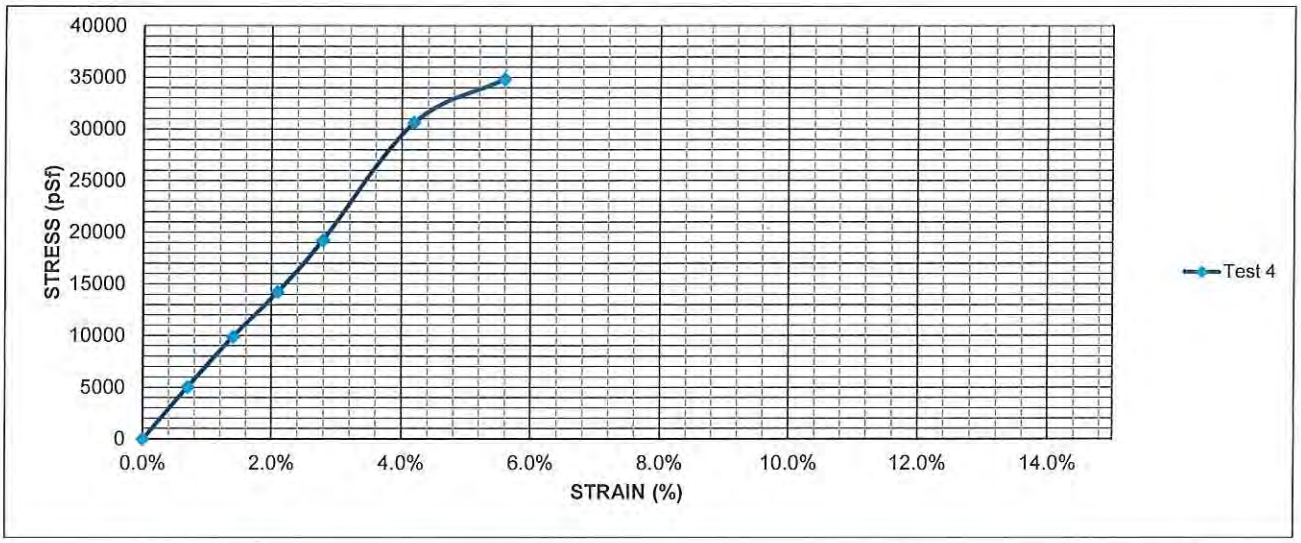
GES
1301 Corporate Center Drive
Eagan, MN 55121

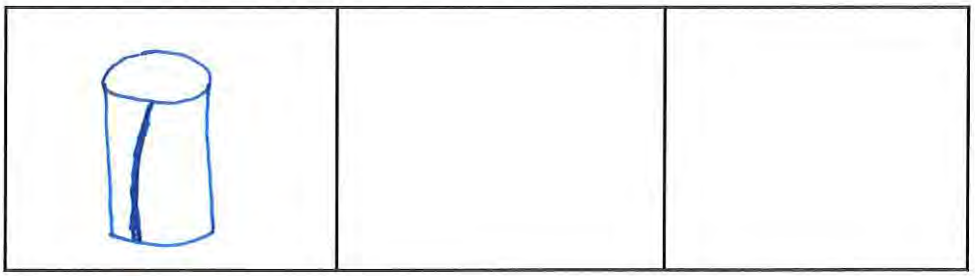
Laboratory Number G20-046

Specimen ID: **Test 4**
WB-7
RC - 182.5-187.5 feet

Soil Class:

Dry Density (pcf):	110.8
Water Content:	19.1%
Sample Dia. (mm):	45.1
Sample Ht (mm):	91.0
Height/Diameter:	2.02
Unc. Strength (psf):	**34830**
Strain at Failure (%):	5.6





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(701) 852-5553

P.O. Box 1093
Williston, ND 58802
(701) 572-4226

UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

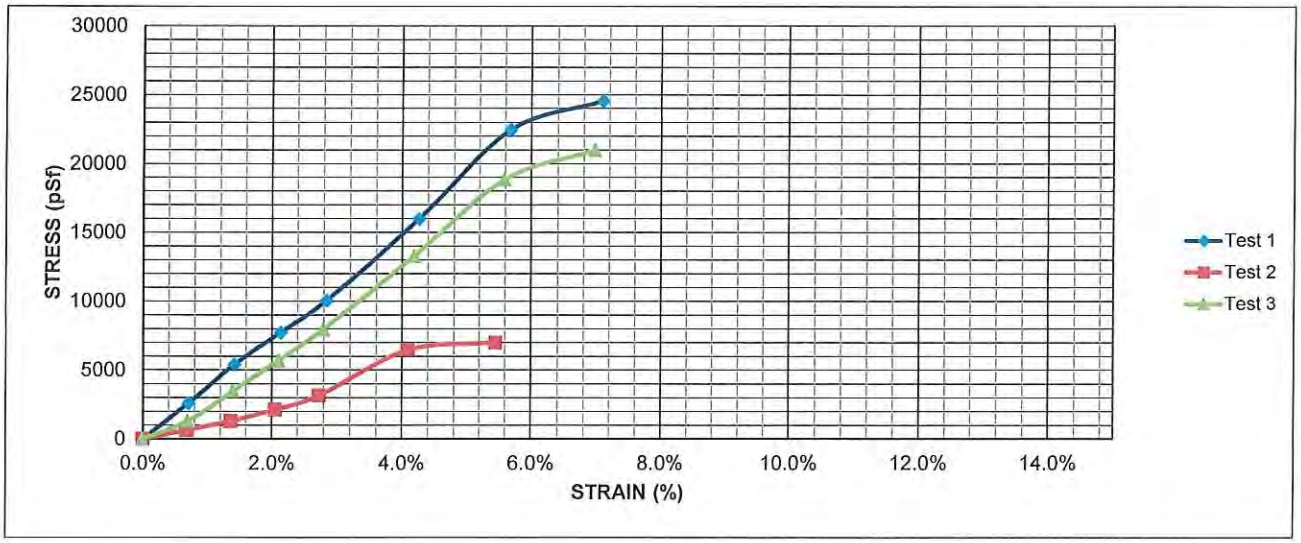
DATE: 5-Jun-20

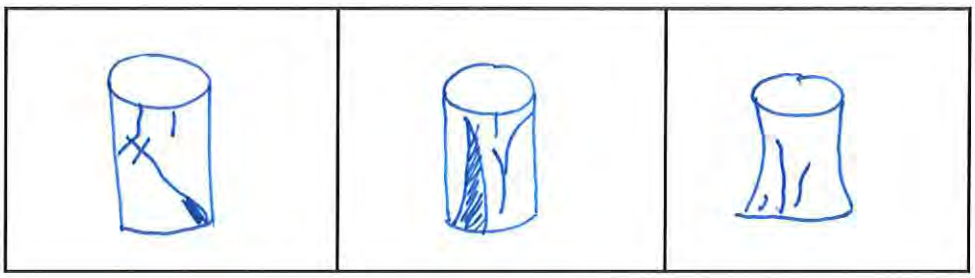
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 1	Test 2	Test 3
	WB-8 RC -160-165 feet	WB-8 RC - 180-185 feet	WB-8 RC - 200-205 feet
Soil Class:			
Dry Density (pcf):	115.0	106.9	107.0
Water Content:	16.1%	20.1%	21.3%
Sample Dia. (mm):	45.4	46.5	45.7
Sample Ht (mm):	89.4	93.2	91.0
Height/Diameter:	1.97	2.00	1.99
Unc. Strength (psf):	**24564**	**7009**	**21013**
Strain at Failure (%):	7.1	5.5	7.0





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Material Testing Services, LLC

by

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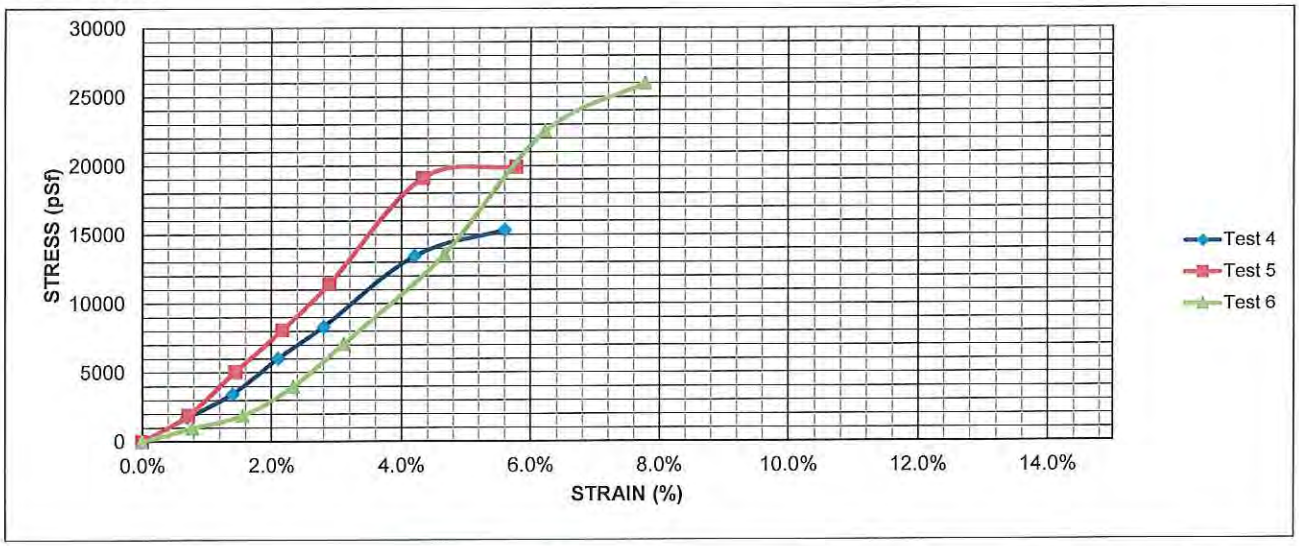
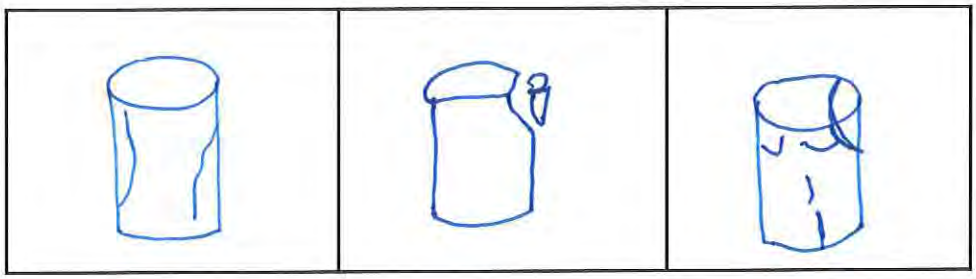
Specimen ID:	Test 4	Test 5	Test 6
	WB-8 RC - 220-225 feet	WB-8 RC - 245-250 feet	WB-8 RC - 265-270 feet
Soil Class:			
Dry Density (pcf):	108.9	108.8	105.8
Water Content:	20.3%	20.1%	23.1%
Sample Dia. (mm):	45.4	45.3	44.7
Sample Ht (mm):	90.6	87.9	81.6
Height/Diameter:	1.99	1.94	1.83
Unc. Strength (psf):	**15346**	**19931**	**26024**
Strain at Failure (%):	5.6	5.8	7.8





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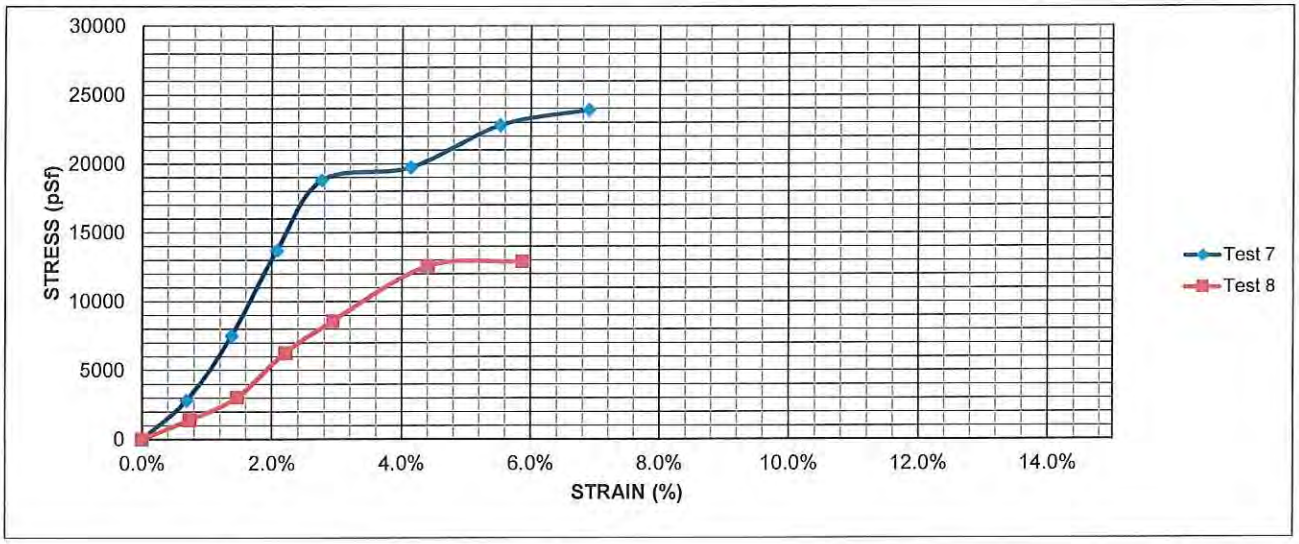
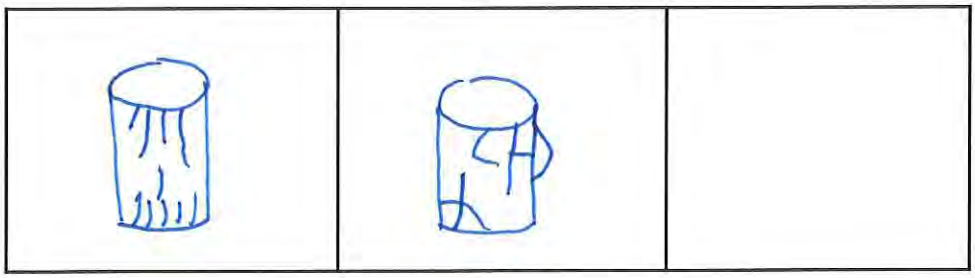
Laboratory Number G20-046

Specimen ID:	**Test 7**	**Test 8**
	WB-8	WB-4
	RC - 275-280 feet	RC - 287.5-292.5 feet
Soil Class:		
Dry Density (pcf):	107.2	106.1
Water Content:	20.8%	24.0%
Sample Dia. (mm):	45.3	45.0
Sample Ht (mm):	92.0	86.5
Height/Diameter:	2.03	1.92
Unc. Strength (psf):	**23927**	**12917**
Strain at Failure (%):	6.9	5.9





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DATE: 7-Jun-20

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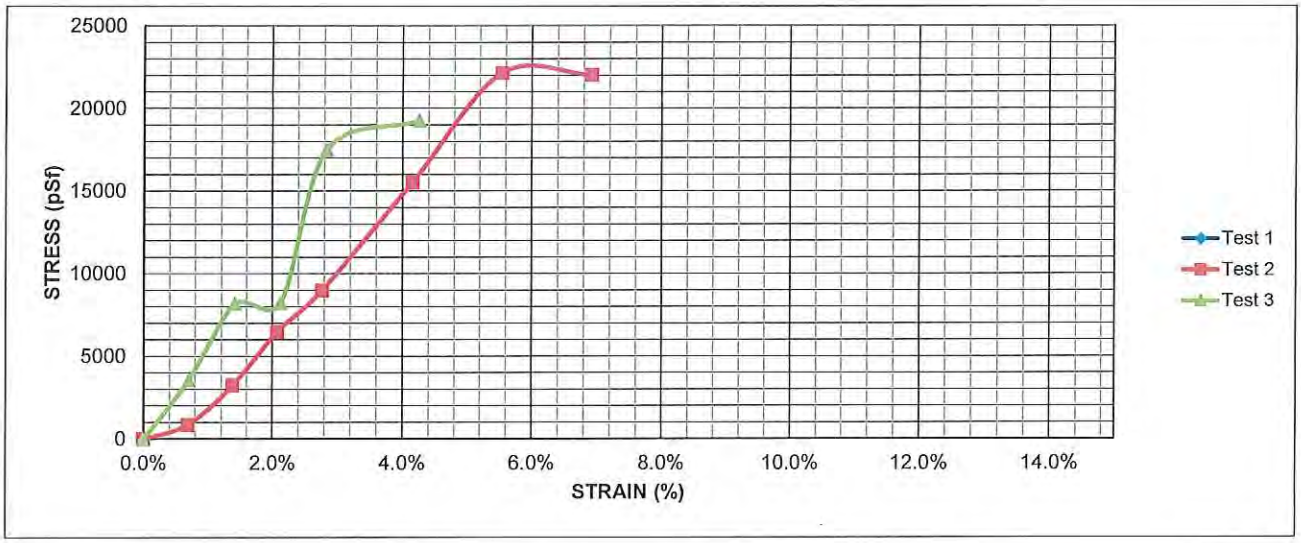
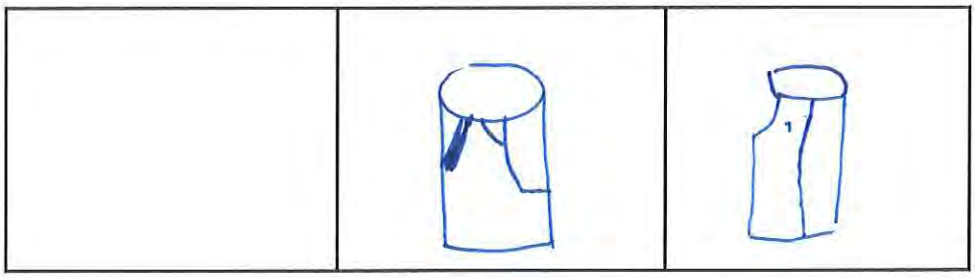
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 1	Test 2	Test 3
	WB-5	WB-9	WB-9
	RC - 87.5-92.5 feet	RC - 170-175 feet	RC - 190-195 feet
Soil Class:			
Dry Density (pcf):	Unable to Run	108.6	116.3
Water Content:		20.4%	14.2%
Sample Dia. (mm):		45.2	44.6
Sample Ht (mm):		91.7	89.5
Height/Diameter:		2.03	2.01
Unc. Strength (psf):		**25355**	**22155**
Strain at Failure (%):		4.1	5.3





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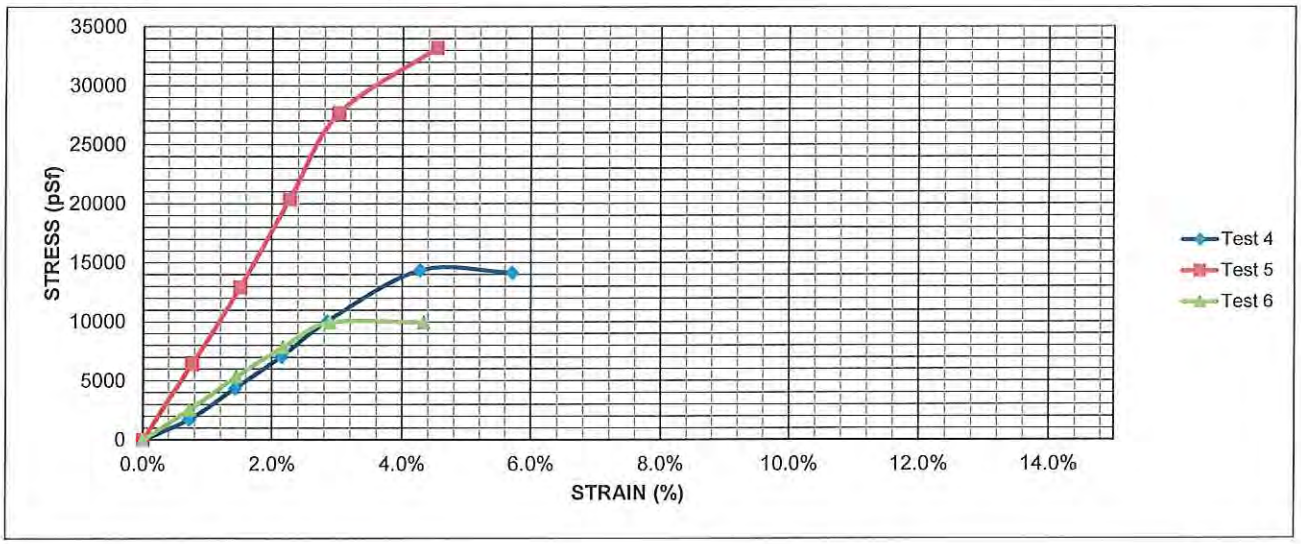
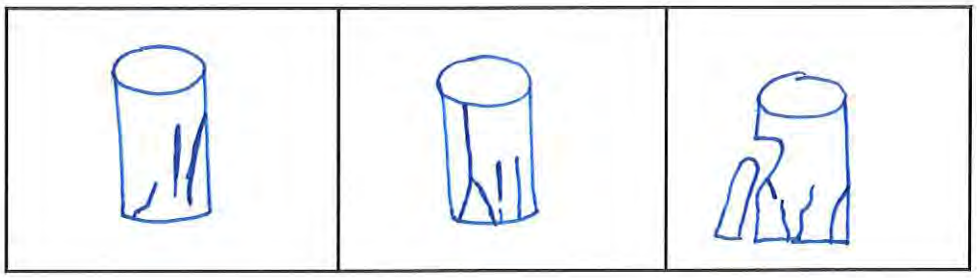
Specimen ID:	Test 4	Test 5	Test 6
	WB-9	WB-5	WB-5
	RC - 210-215 feet	RC - 235-240 feet	RC - 265-270 feet
Soil Class:			
Dry Density (pcf):	104.4	108.5	106.3
Water Content:	23.0%	19.7%	20.2%
Sample Dia. (mm):	45.6	44.5	44.5
Sample Ht (mm):	88.9	83.9	87.8
Height/Diameter:	1.95	1.89	1.97
Unc. Strength (psf):	**14375**	**33239**	**9965**
Strain at Failure (%):	4.3	4.5	4.3





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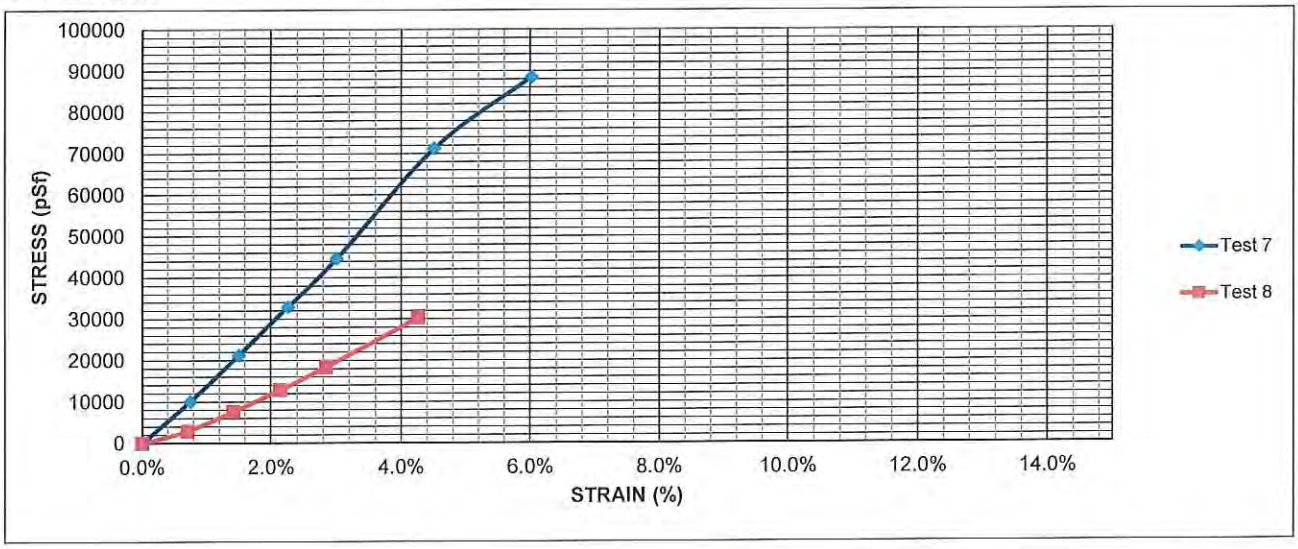
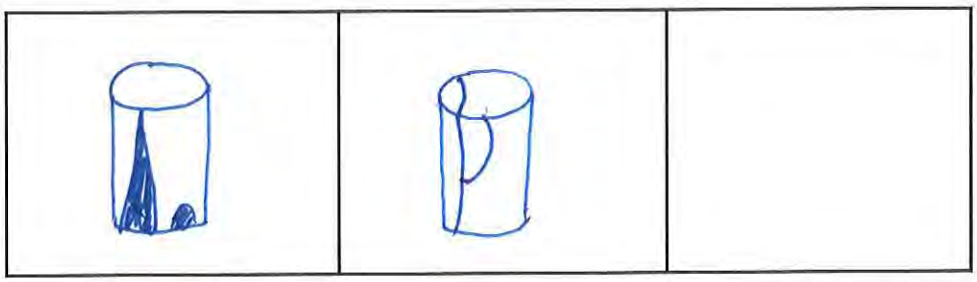
Specimen ID:	Test 7	Test 8
	WB-9 RC - 255-260 feet	WB-9 RC - 305-310 feet
Soil Class:		
Dry Density (pcf):	112.7	117.6
Water Content:	15.3%	14.2%
Sample Dia. (mm):	42.2	44.9
Sample Ht (mm):	84.3	89.2
Height/Diameter:	2.00	1.99
Unc. Strength (psf):	**88505**	**30377**
Strain at Failure (%):	6.0	4.3





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Material Testing Services, LLC

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LABORATORY TEST RESULTS

Testing Scope

Laboratory testing was proposed to characterize soils index properties including Atterberg limits (liquid and plastic limits) and moisture content. Strength testing included unconfined compression testing.

Index Properties

Testing and classification of soils was performed in accordance with the Unified Soil Classification System as described in ASTM D 2487. Atterberg limits were performed according to ASTM D 4318. Moisture content was determined in accordance with ASTM D 4959 and D 4643. The dry density was determined with direct measurement procedures. Mechanical sieve analysis was done in accordance with ASTM D 422.

Strength Testing

The strength tests consisted of unconfined compression (QU) testing. The QU tests were conducted in accordance with ASTM D 2166.

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%		ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

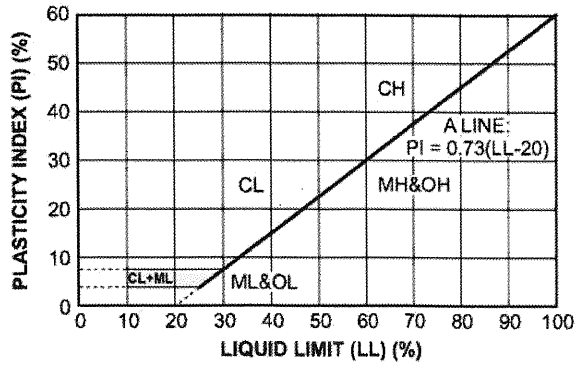
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent ..... GW, GP, SW, SP
More than 12 percent ..... GM, GC, SM, SC
5 to 12 percent ..... Borderline cases requiring dual symbols

PLASTICITY CHART



NORTH BAKKEN EXPANSION PROJECT

Plan of Development

APPENDIX E

Blasting Plan

WBI ENERGY TRANSMISSION, INC.

North Bakken Expansion Project

Plan of Development

Appendix E

Blasting Plan

February 2020

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT
BLASTING PLAN

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ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
EI	Environmental Inspector
PPV	peak particle velocity
Project	North Bakken Expansion Project
WBI Energy	WBI Energy Transmission, Inc.

1.0 INTRODUCTION

This Blasting Plan was prepared for WBI Energy Transmission, Inc.'s (WBI Energy) proposed North Bakken Expansion Project (Project). No blasting is anticipated during construction of the Project. In the unlikely event that blasting is necessary to excavate the trench, WBI Energy will conduct blasting in accordance with pertinent regulations and this Blasting Plan. This Blasting Plan outlines the procedures and safety measures that WBI Energy's construction contractor will adhere to while implementing blasting activities along the pipeline rights-of-way.

2.0 OBJECTIVE

This Blasting Plan is intended to identify blasting procedures, including safety, use, storage, and transportation of explosives that are consistent with minimum safety requirements as defined by federal (e.g., Title 27 of the Code of Federal Regulations [CFR] Part 181, Commerce in Explosives; 49 CFR 177, Carriage by Public Highway; 29 CFR 1926.900 et seq., Safety and Health Regulations for Construction – Blasting and Use of Explosives; 29 CFR 1910.109, Explosives and Blasting Agents, Occupational Safety and Health Administration), state, and local regulations. Additionally this plan is intended to address environmental aspects of blasting activities, and to identify areas of concern along the proposed pipeline routes.

3.0 GENERAL REQUIREMENTS

Blasting operations shall be conducted by or under the direct and constant supervision of experienced personnel legally licensed and certified to perform such activity in the jurisdiction where blasting occurs. Prior to any blasting activities, the contractor shall provide WBI Energy with appropriate information documenting the experience, licenses, and permits associated with blasting personnel.

Blasting-related operations including obtaining, transporting, storing, handling, loading, detonating, and disposing of blasting material; drilling; and ground-motion monitoring shall comply with applicable federal, state, and local regulations; permit conditions; and the construction contract.

Blasting for grade or trench excavation shall be used only after other reasonable means of excavation have been used and are unsuccessful in achieving the required results. WBI Energy may specify locations (e.g., foreign line crossings, nearby structures, etc.) where consolidated rock shall be removed by approved mechanical equipment such as rock-trenching machines, rock saws, hydraulic rams, or jack hammers in lieu of blasting.

Before blasting, a site-specific blasting plan must be submitted by its Contractor to WBI Energy for approval. The site-specific blasting plan will be reviewed by WBI Energy's Designated Representative. The engineer will analyze the data to determine the combined stress level of any nearby, affected pipeline and will make recommendations and/or forward approval to WBI Energy before blasting may commence.

Drilling and blasting shall be done with one of WBI Energy's Environmental Inspectors (EI) present. The EI's approval is required to proceed prior to each blast. Approval does not relieve the Contractor from responsibility or liability.

4.0 PRE-BLASTING REQUIREMENTS

Prior to the initiation of blasting operations, the Contractor shall comply with the following:

- The Contractor will obtain all required federal, state, and local permits relating to the transportation, storage, handling, loading, and detonation of explosives.
- The Contractor shall place all necessary “one calls” 48 hours prior to construction where one-call system(s) are in place.
- The Contractor shall be responsible for the protection of existing underground facilities.
- Before performing any right-of-way work, the Contractor shall verify with WBI Energy that all affected property owners have been notified of the impending construction.

5.0 SITE-SPECIFIC BLASTING PLANS

The Contractor’s site-specific blasting plan shall include at a minimum the following information:

- Explosive type, product name and size, weight per unit, and density;
- Delay type, sequence, and delay;
- Use of non-electrical initiation systems for all blasting operations;
- Stemming material and tamping method;
- Hole depth, diameter, and pattern;
- Explosive depth, distribution, and maximum charge and weight per delay;
- Number of holes per delay;
- Dates and hours of conducting blasting;
- Distance and orientation to nearest aboveground structure;
- Distance and orientation to nearest underground structure, including pipeline;
- Procedures for:
    - Storing, handling, transporting, loading, and firing explosives;
    - Fire prevention;
    - Inspections after each blast;

- Misfires, flyrock, and noise prevention;
- Stray current accidental-detonation prevention;
- Signs and flagmen;
- Warning signals prior to each blast;
- Where the pipeline route:
  - Parallels or crosses an electrical transmission corridor, cable or pipeline;
  - Parallels or crosses a highway or road;
  - Within or adjacent to treed areas;
  - Approaches within 100 feet of a water well or spring; and
  - Approaches within 1,000 feet of any residence, building, or occupied structure;
- Notification prior to blasting; and
- Disposal of waste blasting material;

- Seismograph company, names, equipment and sensor location;
- Copies of all required federal, state, and local permits;
- Blaster's name, company, copy of license, and statement of qualifications;
- Magazine type and locations for explosives and detonating caps;
- Typical rock type and geology structure (solid, layered, or fractured); and
- Pipeline location (milepost and stationing) and applicable alignment sheet numbers.

6.0 MONITORING

During blasting operations, the Contractor will be required to monitor operations in the following manner:

- The Contractor shall provide seismographic equipment to measure the peak particle velocity (PPV) of all blasts in the vertical, horizontal, and longitudinal directions. Seismic monitoring can only be discontinued if: a) the blasting schedule and blasting performance consistently produce PPVs at the pipeline that are lower than the maximum allowable limit; and b) WBI Energy's Designated Representative provides written authorization.

- The contractor shall measure the PPV at the adjacent pipeline, any water wells or potable springs, and any aboveground structure within 150 feet of the blasting.

- The contractor shall complete the Blasting Log Record immediately after each blast and submit a copy to WBI Energy's Designated Representative.

7.0 LIMITS ON PEAK PARTICLE VELOCITY

The contractor is limited to a specified PPV of 4 inches per second measured adjacent to an underground pipeline that will be subject to approval by WBI Energy's Designated Representative.

For any aboveground structure (including water wells), the PPV shall not exceed 2 inches per second.

For all aboveground facilities within 150 feet of the blasting, the contractor shall provide additional seismograph equipment to determine the PPV at the aboveground facility. If the measured PPV at an existing pipeline or other structure exceeds the above limits, the contractor shall stop blasting activities immediately and notify WBI Energy. The site-specific Blasting Plan must be modified to reduce the PPV prior to any further blasting.

Note: Limits on PPV for surface structures are based on studies that established the limits at which plaster in homes will crack. The primary purpose of the limit is to prevent damage to homes. WBI Energy's EI may increase the limit for other structures such as steel transmission line towers, as appropriate. WBI Energy's EI may approve higher velocities for given site-specific conditions in advance.

8.0 SAFETY

8.1 PROTECTION OF ABOVEGROUND AND UNDERGROUND STRUCTURES

The Contractor will exercise control to prevent damage to aboveground and underground structures including buildings, pipelines, utilities, springs, and water wells. The following procedures will be implemented:

- If blasting occurs within 200 feet of identified water wells or potable springs, water flow performance, and water quality testing will be conducted before blasting. If a water well or spring is damaged, either the well owner will be compensated for damages or a new well will be provided. WBI Energy will provide an alternative potable water supply to the landowner until repairs occur.

- If blasting occurs within 200 feet of any aboveground structures, the contractor and WBI Energy's Designated Representative will inspect structures before and after blasting. In the unlikely event that damage occurs to an aboveground structure, the owner will be compensated.

- The contractor shall be responsible for all damage claims resulting from blasting.

- Blasting will not be allowed within 15 feet of an existing pipeline unless authorized by WBI Energy.

- Holes which have contained explosive material shall not be re-drilled. Holes shall not be drilled where danger exists of intersecting another hole containing explosive material.

- Blasting mats or padding shall be used on all shots where necessary to prevent scattering of loose rock onto adjacent property and to prevent damage to nearby structures and overhead utilities. In cases where such a procedure is not deemed to be feasible, an alternative procedure must be submitted for review by WBI Energy's personnel and the site in question must be visited and examined by WBI Energy's Designated Representative before any approval is granted.

- Blasting shall not begin until occupants of nearby buildings, stores, residences, places of business, places of public gathering, and farms have been notified by the contractor sufficiently in advance to protect personnel, property, and livestock. The contractor shall notify all such occupants at least 48 hours prior to blasting.

- Blasting in or near environmentally sensitive areas such as streams and wildlife areas may include additional restrictions as determined by WBI Energy.

- All blasting shall be subject to the following limitations:

    - Maximum PPV of 12.0 inches per second in any of three mutually perpendicular axes, measured at the lesser distance of the nearest facility or the edge of the permanent easement.

    - Maximum drill size shall be 2.5 inches unless approved by WBI Energy.

    - Maximum quantity of explosive per delay shall be governed by the recorded measurements as influenced by work site conditions.

    - Explosive agents and ignition method shall be approved by WBI Energy. ANFO (ammonium nitrate/fuel oil) and other free-flowing explosives and blasting agents are not acceptable and shall not be used.

    - Drill holes shall not be left loaded overnight.

- The drilling pattern shall be set in a manner to achieve smaller rock fragmentation (maximum 1 foot in diameter) in order to use as much as possible of the blasted rock as backfill material after the pipe has been padded in accordance with the specifications. The proposed drilling pattern shall be submitted for approval by WBI Energy.

- Under pipeline crossings and all other areas where drilling and blasting is required within 15 feet of existing or third-party facilities:

    - Drill holes shall be reduced to a maximum of 2 inches or less in diameter.

    - The number of holes per blast shall be limited to three unless otherwise approved by WBI Energy.

8.2 PROTECTION OF PERSONNEL

The Contractor shall include in its procedures all federal, state, county, and local safety requirements for blasting. The contractor's procedures shall address, as a minimum, the following requirements:

- Only authorized, qualified, and experienced personnel shall handle explosives.
- No explosive material shall be located where it may be exposed to flame, excessive heat, sparks, or impact. Smoking, firearms, matches, open flames, and heat-and-spark-producing devices shall be prohibited in or near explosive magazines or while explosives are being handled, transported, or used.
- A code of blasting signals shall be established, posted in conspicuous places, and utilized during blasting operations. Employee training shall be conducted on the use and implementation of the code.
- The contractor shall use every reasonable precaution including, but not limited to, visual and audible warning signals, warning signs, flag person, and barricades to ensure personnel safety.
- Warning signs, with lettering a minimum of 4 inches in height on a contrasting background, will be erected and maintained at all approaches to the blast area.
- Flaggers will be stationed on all roadways passing within 1,000 feet of the blast area to stop all traffic during blasting operations.
- All personnel not involved in the actual detonation shall stand back at least 1,000 feet and workers involved in the actual detonation shall stand back at least 650 feet from the time the blast signal is given until the "ALL CLEAR" has been sounded.
- An audible blasting signal (air horn or siren) shall be sounded 5 minutes before and after each blast.
- Blasting operations shall be conducted during daylight hours.
- No loaded holes shall be left unattended or unprotected. No explosives or blasting agent shall be abandoned. No loaded holes shall be left overnight.
- In the case of a misfire, the blaster shall provide proper safeguards for personnel until the misfire has been re-blasted or safely removed.
- WBI Energy may employ two-way radios for communication between vehicles and office facilities. The contractor shall advise WBI Energy and other pipeline contractors of any need to cease use of such equipment during blasting activities.
- All loading and blasting activity shall cease and personnel in and around the blast area will retreat to a position of safety during the approach and progress of an

electrical storm irrespective of the type of explosives or initiation system used. This is a major safety precaution and will always be observed. All explosive materials, all electrical initiation systems, and all non-electric initiation systems are susceptible to premature initiation by lightning.

- Previous blast areas must be inspected to verify the absence of misfires. No drilling may commence until such inspection occurs. If a misfire occurs adjacent to a hole to be drilled, the misfire will be cleared by the blaster using whatever techniques are called for by the situation prior to commencement of drilling. If a misfire occurs at some distance from the drilling area, drilling may be stopped while clearing preparations are underway. When the misfire is to be cleared by reshooting, drilling will be shut down and personnel evacuated to a place of safety prior to detonation.

- All transportation of explosives will be in accordance with applicable federal, state, and local laws and regulations. Vehicles used to transport explosives shall be in proper working condition and equipped with tight wooden or non-sparking metal floor and sides. If explosives are carried in an open-bodied truck, they will be covered with a waterproof and flame-resistant tarpaulin. Wiring will be fully insulated to prevent short-circuiting and at least two fire extinguishers will be carried. The truck will be plainly marked to identify its cargo so that the public may be adequately warned. Metal, flammable, or corrosive substances will not be transported in the same vehicle with explosives. There will be no smoking and unauthorized or unnecessary personnel will not be allowed in the vehicle. Loading and unloading of explosives will be done carefully by competent, qualified personnel.

- No sparking metal tools will be used to open kegs or wooden cases of explosives. Metallic slitters will be used to open fiberboard cases, provided the metallic slitter does not come in contact with the metallic fasteners of the case. There will be no smoking, no matches, no open lights, or other fire or flame nearby while handling or using explosives. Explosives will not be placed where they are subject to flame, excessive heat, sparks, or impact. Partial cases or packages of explosives will be reclosed after use. No explosives will be carried in the pockets or clothing of personnel. The wires of an electric blasting cap shall not be tampered with in any way. Wires will not be uncoiled. The use of electric blasting caps will not be permitted during dust storms or near any other source of large charges of static electricity. Uncoiling of the wires or use of electric caps will not be permitted near radio-frequency transmitters. The firing circuit will be completely insulated from the ground or other conductors.

- No electric wires or cables of any kind will be permitted near electric blasting caps or other explosives except at the time and for the purpose of firing the blast. All electric blasting caps, either singly or when connected in a series circuit, will be tested using a blasting galvanometer specifically designed for the purpose. Electric blasting caps used in circuit shall be of the same style or function, and of the same manufacture, and blasting shall be carried out in accordance with the manufacturer's recommendations. No attempt will be made to fire a circuit of electric blasting caps with less than the minimum current specified by the

manufacturer. All wires to be connected will be bright and clean. All electric blasting cap wires will be short-circuited until ready to fire.

- No blast will be fired without a positive signal from the person in charge. This person will have made certain that all surplus explosives are in a safe place; all persons and vehicles are at a safe distance; and adequate warning has been given. Adequate warning of a blast will consist of but not be limited to the following:
  - Notification of the day and time given to railroads, highway departments, city engineer, county sheriff, utility owners etc., as applicable. Notification must be given at least 48 hours prior to blasting;
  - Notification of occupants of nearby buildings, stores, residences, places of business, places of public gathering, and farms. Notification must be given at least 48 hours prior to blasting;
  - Stopping vehicular and/or pedestrian traffic near the blast site; and
  - Signal given by an air horn, whistle, or similar device using standard warning signals.
- Only authorized and necessary personnel will be present where explosives are being handled or used.
- The condition of the hole will be checked with a wooden tamping pole prior to loading. Surplus explosives will not be stacked near working areas during loading. Detonating fans will be cut from spool before loading the balance of charge into the hole. No explosives will be forced into a bore hole past an obstruction. Loading will be done by a blaster holding a valid license or by personnel under his direct supervision.
- Fly-rock leaving the right-of-way shall be collected immediately and disposed of at disposal sites approved by WBI Energy. This work shall not be left to the cleanup crew.

8.3 LIGHTNING HAZARD

A risk of accidental detonation caused by lightning strikes exists at any time the workplace is experiencing an electrical storm and there are loaded holes on site. If this hazard is judged to exist, work shall discontinue at all operations and workers will be moved to secure positions away from the loaded holes when an approaching storm front is within 5 miles. Furthermore, workers shall not return to the work site until the storm has passed and the closest point of lightning activity has moved at least 5 miles beyond the drilling area.

WBI Energy shall have on site approved lightning detectors capable of measuring the degree of electrical activity as a storm approaches, and the distance to the storm front from the instrument on the right-of-way.

9.0 IN-WATER BLASTING

Underwater blasting is not anticipated to be required for the Project.

10.0 STORAGE REQUIREMENTS

All explosives, blasting agents, and initiation devices shall be stored in locked magazines that have been located, constructed, approved, and licensed in accordance with local, state, and federal regulations. Magazines shall be dry, well ventilated, reasonably cool (painting of the exterior with a reflective color) bullet and fire resistant and kept clean.

Initiation devices shall not be stored in the same box, container, or magazine with other explosives. Explosives, blasting agents or initiation devices shall not be stored in wet or damp areas; near oil, gasoline, or cleaning solvents; or near sources of heat radiators, steam pipes, stoves, etc. No metal or metal tools shall be stored in the magazine. There shall be no smoking, matches, open lights, or other fire or flame inside or within 50 feet of storage magazines or explosive materials. The loading and unloading of explosive materials into or out of the magazine shall be done in a business-like manner.

Magazines shall be kept locked at all times unless explosives are being delivered or removed by authorized personnel. Admittance shall be restricted to the magazine keeper, blasting supervisor, or licensed blaster. Magazine construction shall meet the requirements of ATF P5400.7 “Explosives Law and Regulations” (U.S. Department of Justice, Bureau of Alcohol Tobacco, Firearms and Explosives) and be in accordance with local, state, or federal regulations and the most recent edition of the Blasters Handbook.

Accurate and current records shall be kept of the explosive material inventory to ensure that oldest stocks are utilized first, regulatory requirements are satisfied, and to allow for immediate notification of any loss or theft. Magazine records shall reflect the quantity of explosives removed, the amount returned, and the net quantity used at the blasting site.

When explosive materials are taken from the storage magazine, they shall be kept in the original containers until used. Small quantities of explosive materials may be placed in day boxes, powder chests, or detonator boxes. Any explosive material not used at the blast site shall be returned to the storage magazine and replaced in the original container as soon as possible.

Magazine locations shall be in accordance with local, state, or federal regulations. Where no regulations apply, magazines shall be located in accordance with the latest edition of the Blaster’s Handbook and ATF P5400.7 “Explosives Law and Regulations” (U.S. Department of Justice, Bureau of Alcohol Tobacco, Firearms and Explosives).

Magazines shall be marked in minimum 3-inch-high letters with the words “DANGER - EXPLOSIVES” prominently displayed on all sides and roof.

11.0 GENERAL BLASTING PROCEDURE

The following lists of steps will be performed in all cases. These steps represent a minimum requirement and give a general order to the blasting procedure:

- A safety meeting will be held prior to any blasting activities. Everyone who is involved with the blasting in any form must attend. Safety rules and signaling should be reviewed.
- Warning signs should be erected.
- Lightning detectors should be set up.
- Drilled holes should be measured accurately for depth and location.
- Seismic equipment should be set up to measure velocities near the pipeline and any structures 150 feet or less from the blast.
- Distances to any nearby structure (aboveground or belowground) suspected of being less than 200 feet from the blast shall be measured.
- Clear the blasting affected zone.
- Give the warning signal.
- Give the blast signal.
- Detonate the blast.
- After the blaster has checked for misfires and given the “ALL CLEAR” signal, Inspectors will inspect any aboveground or underground facilities for damage.
- Complete the Blasting Log Record.

North Bakken Expansion Project

Plan of Development

APPENDIX F

FERC Plan and Procedures

Federal Energy Regulatory Commission

Office of Energy Projects

May 2013

UPLAND EROSION CONTROL, REVEGETATION, AND MAINTENANCE PLAN

Washington, DC 20426

MAY 2013 VERSION

UPLAND EROSION CONTROL, REVEGETATION, AND MAINTENANCE PLAN

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UPLAND EROSION CONTROL, REVEGETATION, AND MAINTENANCE PLAN (PLAN)

I. APPLICABILITY

A. The intent of this Plan is to assist project sponsors by identifying baseline mitigation measures for minimizing erosion and enhancing revegetation. Project sponsors shall specify in their applications for a new FERC authorization and in prior notice and advance notice filings, any individual measures in this Plan they consider unnecessary, technically infeasible, or unsuitable due to local conditions and fully describe any alternative measures they would use. Project sponsors shall also explain how those alternative measures would achieve a comparable level of mitigation.

Once a project is authorized, project sponsors can request further changes as variances to the measures in this Plan (or the applicant's approved plan). The Director of the Office of Energy Projects (Director) will consider approval of variances upon the project sponsor's written request, if the Director agrees that a variance:

1. provides equal or better environmental protection;

2. is necessary because a portion of this Plan is infeasible or unworkable based on project-specific conditions; or

3. is specifically required in writing by another federal, state, or Native American land management agency for the portion of the project on its land or under its jurisdiction.

Sponsors of projects planned for construction under the automatic authorization provisions in the FERC's regulations must receive written approval for any variances in advance of construction.

Project-related impacts on wetland and waterbody systems are addressed in the staff's Wetland and Waterbody Construction and Mitigation Procedures (Procedures).

II. SUPERVISION AND INSPECTION

A. ENVIRONMENTAL INSPECTION

1. At least one Environmental Inspector is required for each construction spread during construction and restoration (as defined by section V). The number and experience of Environmental Inspectors assigned to each construction spread shall be appropriate for the length of the construction spread and the number/significance of resources affected.

2. Environmental Inspectors shall have peer status with all other activity inspectors.

3. Environmental Inspectors shall have the authority to stop activities that violate the environmental conditions of the FERC's Orders, stipulations of other environmental permits or approvals, or landowner easement agreements; and to order appropriate corrective action.

B. RESPONSIBILITIES OF ENVIRONMENTAL INSPECTORS

At a minimum, the Environmental Inspector(s) shall be responsible for:

1. Inspecting construction activities for compliance with the requirements of this Plan, the Procedures, the environmental conditions of the FERC's Orders, the mitigation measures proposed by the project sponsor (as approved and/or modified by the Order), other environmental permits and approvals, and environmental requirements in landowner easement agreements.

2. Identifying, documenting, and overseeing corrective actions, as necessary to bring an activity back into compliance;

3. Verifying that the limits of authorized construction work areas and locations of access roads are visibly marked before clearing, and maintained throughout construction;

4. Verifying the location of signs and highly visible flagging marking the boundaries of sensitive resource areas, waterbodies, wetlands, or areas with special requirements along the construction work area;

5. Identifying erosion/sediment control and soil stabilization needs in all areas;

6. Ensuring that the design of slope breakers will not cause erosion or direct water into sensitive environmental resource areas, including cultural resource sites, wetlands, waterbodies, and sensitive species habitats;

7. Verifying that dewatering activities are properly monitored and do not result in the deposition of sand, silt, and/or sediment into sensitive environmental resource areas, including wetlands, waterbodies, cultural resource sites, and sensitive species habitats; stopping dewatering activities if such deposition is occurring and ensuring the design of the discharge is changed to prevent reoccurrence; and verifying that dewatering structures are removed after completion of dewatering activities;

8. Ensuring that subsoil and topsoil are tested in agricultural and residential areas to measure compaction and determine the need for corrective action;

9. Advising the Chief Construction Inspector when environmental conditions (such as wet weather or frozen soils) make it advisable to restrict or delay construction activities to avoid topsoil mixing or excessive compaction;

10. Ensuring restoration of contours and topsoil;

11. Verifying that the soils imported for agricultural or residential use are certified as free of noxious weeds and soil pests, unless otherwise approved by the landowner;

12. Ensuring that erosion control devices are properly installed to prevent sediment flow into sensitive environmental resource areas (e.g., wetlands, waterbodies, cultural resource sites, and sensitive species habitats) and onto roads, and determining the need for additional erosion control devices;

13. Inspecting and ensuring the maintenance of temporary erosion control measures at least:

    a. on a daily basis in areas of active construction or equipment operation;

    b. on a weekly basis in areas with no construction or equipment operation; and

    c. within 24 hours of each 0.5 inch of rainfall;

14. Ensuring the repair of all ineffective temporary erosion control measures within 24 hours of identification, or as soon as conditions allow if compliance with this time frame would result in greater environmental impacts;

15. Keeping records of compliance with the environmental conditions of the FERC's Orders, and the mitigation measures proposed by the project sponsor in the application submitted to the FERC, and other federal or state environmental permits during active construction and restoration;

16. Identifying areas that should be given special attention to ensure stabilization and restoration after the construction phase; and

17. Verifying that locations for any disposal of excess construction materials for beneficial reuse comply with section III.E.

III. PRECONSTRUCTION PLANNING

The project sponsor shall do the following before construction:

A. CONSTRUCTION WORK AREAS

1. Identify all construction work areas (e.g., construction right-of-way, extra work space areas, pipe storage and contractor yards, borrow and disposal areas, access roads) that would be needed for safe construction. The project sponsor must ensure that appropriate cultural resources and biological surveys are conducted, as determined necessary by the appropriate federal and state agencies.

2. Project sponsors are encouraged to consider expanding any required cultural resources and endangered species surveys in anticipation of the need for activities outside of authorized work areas.

3. Plan construction sequencing to limit the amount and duration of open trench sections, as necessary, to prevent excessive erosion or sediment flow into sensitive environmental resource areas.

B. DRAIN TILE AND IRRIGATION SYSTEMS

1. Attempt to locate existing drain tiles and irrigation systems.

2. Contact landowners and local soil conservation authorities to determine the locations of future drain tiles that are likely to be installed within 3 years of the authorized construction.

3. Develop procedures for constructing through drain-tiled areas, maintaining irrigation systems during construction, and repairing drain tiles and irrigation systems after construction.

4. Engage qualified drain tile specialists, as needed to conduct or monitor repairs to drain tile systems affected by construction. Use drain tile specialists from the project area, if available.

C. GRAZING DEFERMENT

Develop grazing deferment plans with willing landowners, grazing permittees, and land management agencies to minimize grazing disturbance of revegetation efforts.

D. ROAD CROSSINGS AND ACCESS POINTS

Plan for safe and accessible conditions at all roadway crossings and access points during construction and restoration.

E. DISPOSAL PLANNING

Determine methods and locations for the regular collection, containment, and disposal of excess construction materials and debris (e.g., timber, slash, mats, garbage, drill cuttings and fluids, excess rock) throughout the construction process. Disposal of materials for beneficial reuse must not result in adverse environmental impact and is subject to compliance with all applicable survey, landowner or land management agency approval, and permit requirements.

F. AGENCY COORDINATION

The project sponsor must coordinate with the appropriate local, state, and federal agencies as outlined in this Plan and/or required by the FERC's Orders.

1. Obtain written recommendations from the local soil conservation authorities or land management agencies regarding permanent erosion control and revegetation specifications.

2. Develop specific procedures in coordination with the appropriate agencies to prevent the introduction or spread of invasive species, noxious weeds, and soil pests resulting from construction and restoration activities.

3. Develop specific procedures in coordination with the appropriate agencies and landowners, as necessary, to allow for livestock and wildlife movement and protection during construction.

4. Develop specific blasting procedures in coordination with the appropriate agencies that address pre- and post-blast inspections; advanced public notification; and mitigation measures for building foundations, groundwater wells, and springs. Use appropriate methods (e.g., blasting mats) to prevent damage to nearby structures and to prevent debris from entering sensitive environmental resource areas.

G. SPILL PREVENTION AND RESPONSE PROCEDURES

The project sponsor shall develop project-specific Spill Prevention and Response Procedures, as specified in section IV of the staff's Procedures. A copy must be filed with the Secretary of the FERC (Secretary) prior to construction and made available in the field on each construction spread. The filing requirement does not apply to projects constructed under the automatic authorization provisions in the FERC's regulations.

H. RESIDENTIAL CONSTRUCTION

For all properties with residences located within 50 feet of construction work areas, project sponsors shall: avoid removal of mature trees and landscaping within the construction work area unless necessary for safe operation of construction equipment, or as specified in landowner agreements; fence the edge of the construction work area for a distance of 100 feet on either side of the residence; and restore all lawn areas and landscaping immediately following clean up operations, or as specified in landowner agreements. If seasonal or other weather conditions prevent compliance with these time frames, maintain and monitor temporary erosion controls (sediment barriers and mulch) until conditions allow completion of restoration.

I. WINTER CONSTRUCTION PLANS

If construction is planned to occur during winter weather conditions, project sponsors shall develop and file a project-specific winter construction plan with the FERC application. This filing requirement does not apply to projects constructed under the automatic authorization provisions of the FERC's regulations.

The plan shall address:

1. winter construction procedures (e.g., snow handling and removal, access road construction and maintenance, soil handling under saturated or frozen conditions, topsoil stripping);

2. stabilization and monitoring procedures if ground conditions will delay restoration until the following spring (e.g., mulching and erosion controls, inspection and reporting, stormwater control during spring thaw conditions); and

3. final restoration procedures (e.g., subsidence and compaction repair, topsoil replacement, seeding).

IV. INSTALLATION

A. APPROVED AREAS OF DISTURBANCE

1. Project-related ground disturbance shall be limited to the construction right-of-way, extra work space areas, pipe storage yards, borrow and disposal areas, access roads, and other areas approved in the FERC's Orders. Any project-related ground disturbing activities outside these areas will require prior Director approval. This requirement does not apply to activities needed to comply with the Plan and Procedures (i.e., slope breakers, energy-dissipating devices, dewatering structures, drain tile system repairs) or minor field realignments and workspace shifts per landowner needs and requirements that do not affect other landowners or sensitive environmental resource areas. All construction or restoration activities outside of authorized areas are subject to all applicable survey and permit requirements, and landowner easement agreements.

2. The construction right-of-way width for a project shall not exceed 75 feet or that described in the FERC application unless otherwise modified by a FERC Order. However, in limited, non-wetland areas, this construction right-of-way width may be expanded by up to 25 feet without Director approval to accommodate full construction right-of-way topsoil segregation and to ensure safe construction where topographic conditions (e.g., side-slopes) or soil limitations require it. Twenty-five feet of extra construction right-of-way width may also be used in limited, non-wetland or non-forested areas for truck turn-arounds where no reasonable alternative access exists.

   Project use of these additional limited areas is subject to landowner or land management agency approval and compliance with all applicable survey and permit requirements. When additional areas are used, each one shall be identified and the need explained in the weekly or biweekly construction reports to the FERC, if required. The following material shall be included in the reports:

   a. the location of each additional area by station number and reference to previously filed alignment sheets, or updated alignment sheets showing the additional areas;

   b. identification of the filing at FERC containing evidence that the additional areas were previously surveyed; and

c. a statement that landowner approval has been obtained and is available in project files.

Prior written approval of the Director is required when the authorized construction right-of-way width would be expanded by more than 25 feet.

B. TOPSOIL SEGREGATION

1. Unless the landowner or land management agency specifically approves otherwise, prevent the mixing of topsoil with subsoil by stripping topsoil from either the full work area or from the trench and subsoil storage area (ditch plus spoil side method) in:

   a. cultivated or rotated croplands, and managed pastures;

   b. residential areas;

   c. hayfields; and

   d. other areas at the landowner's or land managing agency's request.

2. In residential areas, importation of topsoil is an acceptable alternative to topsoil segregation.

3. Where topsoil segregation is required, the project sponsor must:

   a. segregate at least 12 inches of topsoil in deep soils (more than 12 inches of topsoil); and

   b. make every effort to segregate the entire topsoil layer in soils with less than 12 inches of topsoil.

4. Maintain separation of salvaged topsoil and subsoil throughout all construction activities.

5. Segregated topsoil may not be used for padding the pipe, constructing temporary slope breakers or trench plugs, improving or maintaining roads, or as a fill material.

6. Stabilize topsoil piles and minimize loss due to wind and water erosion with use of sediment barriers, mulch, temporary seeding, tackifiers, or functional equivalents, where necessary.

C. DRAIN TILES

1. Mark locations of drain tiles damaged during construction.

2. Probe all drainage tile systems within the area of disturbance to check for damage.

3. Repair damaged drain tiles to their original or better condition. Do not use filter-covered drain tiles unless the local soil conservation authorities and the landowner agree. Use qualified specialists for testing and repairs.

4. For new pipelines in areas where drain tiles exist or are planned, ensure that the depth of cover over the pipeline is sufficient to avoid interference with drain tile systems. For adjacent pipeline loops in agricultural areas, install the new pipeline with at least the same depth of cover as the existing pipeline(s).

D. IRRIGATION

Maintain water flow in crop irrigation systems, unless shutoff is coordinated with affected parties.

E. ROAD CROSSINGS AND ACCESS POINTS

1. Maintain safe and accessible conditions at all road crossings and access points during construction.

2. If crushed stone access pads are used in residential or agricultural areas, place the stone on synthetic fabric to facilitate removal.

3. Minimize the use of tracked equipment on public roadways. Remove any soil or gravel spilled or tracked onto roadways daily or more frequent as necessary to maintain safe road conditions. Repair any damages to roadway surfaces, shoulders, and bar ditches.

F. TEMPORARY EROSION CONTROL

Install temporary erosion controls immediately after initial disturbance of the soil. Temporary erosion controls must be properly maintained throughout construction (on a daily basis) and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls or restoration is complete.

1. Temporary Slope Breakers

   a. Temporary slope breakers are intended to reduce runoff velocity and divert water off the construction right-of-way. Temporary slope

breakers may be constructed of materials such as soil, silt fence, staked hay or straw bales, or sand bags.

b. Install temporary slope breakers on all disturbed areas, as necessary to avoid excessive erosion. Temporary slope breakers must be installed on slopes greater than 5 percent where the base of the slope is less than 50 feet from waterbody, wetland, and road crossings at the following spacing (closer spacing shall be used if necessary):

Slope (%)	Spacing (feet)
5 - 15	300
>15 - 30	200
>30	100

c. Direct the outfall of each temporary slope breaker to a stable, well vegetated area or construct an energy-dissipating device at the end of the slope breaker and off the construction right-of-way.

d. Position the outfall of each temporary slope breaker to prevent sediment discharge into wetlands, waterbodies, or other sensitive environmental resource areas.

2. Temporary Trench Plugs

Temporary trench plugs are intended to segment a continuous open trench prior to backfill.

a. Temporary trench plugs may consist of unexcavated portions of the trench, compacted subsoil, sandbags, or some functional equivalent.

b. Position temporary trench plugs, as necessary, to reduce trenchline erosion and minimize the volume and velocity of trench water flow at the base of slopes.

3. Sediment Barriers

Sediment barriers are intended to stop the flow of sediments and to prevent the deposition of sediments beyond approved workspaces or into sensitive resources.

a. Sediment barriers may be constructed of materials such as silt fence, staked hay or straw bales, compacted earth (e.g., driveable berms across travelways), sand bags, or other appropriate materials.

b. At a minimum, install and maintain temporary sediment barriers across the entire construction right-of-way at the base of slopes greater than 5 percent where the base of the slope is less than 50 feet from a waterbody, wetland, or road crossing until revegetation is successful as defined in this Plan. Leave adequate room between the base of the slope and the sediment barrier to accommodate ponding of water and sediment deposition.

c. Where wetlands or waterbodies are adjacent to and downslope of construction work areas, install sediment barriers along the edge of these areas, as necessary to prevent sediment flow into the wetland or waterbody.

4. Mulch

a. Apply mulch on all slopes (except in cultivated cropland) concurrent with or immediately after seeding, where necessary to stabilize the soil surface and to reduce wind and water erosion. Spread mulch uniformly over the area to cover at least 75 percent of the ground surface at a rate of 2 tons/acre of straw or its equivalent, unless the local soil conservation authority, landowner, or land managing agency approves otherwise in writing.

b. Mulch can consist of weed-free straw or hay, wood fiber hydromulch, erosion control fabric, or some functional equivalent.

c. Mulch all disturbed upland areas (except cultivated cropland) before seeding if:

(1) final grading and installation of permanent erosion control measures will not be completed in an area within 20 days after the trench in that area is backfilled (10 days in residential areas), as required in section V.A.1; or

(2) construction or restoration activity is interrupted for extended periods, such as when seeding cannot be completed due to seeding period restrictions.

d. If mulching before seeding, increase mulch application on all slopes within 100 feet of waterbodies and wetlands to a rate of 3 tons/acre of straw or equivalent.

e. If wood chips are used as mulch, do not use more than 1 ton/acre and add the equivalent of 11 lbs/acre available nitrogen (at least 50 percent of which is slow release).

f. Ensure that mulch is adequately anchored to minimize loss due to wind and water.

g. When anchoring with liquid mulch binders, use rates recommended by the manufacturer. Do not use liquid mulch binders within 100 feet of wetlands or waterbodies, except where the product is certified environmentally non-toxic by the appropriate state or federal agency or independent standards-setting organization.

h. Do not use synthetic monofilament mesh/netted erosion control materials in areas designated as sensitive wildlife habitat, unless the product is specifically designed to minimize harm to wildlife. Anchor erosion control fabric with staples or other appropriate devices.

V. RESTORATION

A. CLEANUP

1. Commence cleanup operations immediately following backfill operations. Complete final grading, topsoil replacement, and installation of permanent erosion control structures within 20 days after backfilling the trench (10 days in residential areas). If seasonal or other weather conditions prevent compliance with these time frames, maintain temporary erosion controls (i.e., temporary slope breakers, sediment barriers, and mulch) until conditions allow completion of cleanup.

   If construction or restoration unexpectedly continues into the winter season when conditions could delay successful decompaction, topsoil replacement, or seeding until the following spring, file with the Secretary for the review and written approval of the Director, a winter construction plan (as specified in section III.I). This filing requirement does not apply to projects constructed under the automatic authorization provisions of the FERC's regulations.

2. A travel lane may be left open temporarily to allow access by construction traffic if the temporary erosion control structures are installed as specified in section IV.F. and inspected and maintained as specified in sections II.B.12 through 14. When access is no longer required the travel lane must be removed and the right-of-way restored.

3. Rock excavated from the trench may be used to backfill the trench only to the top of the existing bedrock profile. Rock that is not returned to the trench shall be considered construction debris, unless approved for use as mulch or for some other use on the construction work areas by the landowner or land managing agency.

4. Remove excess rock from at least the top 12 inches of soil in all cultivated or rotated cropland, managed pastures, hayfields, and residential areas, as well as other areas at the landowner's request. The size, density, and distribution of rock on the construction work area shall be similar to adjacent areas not disturbed by construction. The landowner or land management agency may approve other provisions in writing.

5. Grade the construction right-of-way to restore pre-construction contours and leave the soil in the proper condition for planting.

6. Remove construction debris from all construction work areas unless the landowner or land managing agency approves leaving materials onsite for beneficial reuse, stabilization, or habitat restoration.

7. Remove temporary sediment barriers when replaced by permanent erosion control measures or when revegetation is successful.

B. PERMANENT EROSION CONTROL DEVICES

1. Trench Breakers

a. Trench breakers are intended to slow the flow of subsurface water along the trench. Trench breakers may be constructed of materials such as sand bags or polyurethane foam. Do not use topsoil in trench breakers.

b. An engineer or similarly qualified professional shall determine the need for and spacing of trench breakers. Otherwise, trench breakers shall be installed at the same spacing as and upslope of permanent slope breakers.

c. In agricultural fields and residential areas where slope breakers are not typically required, install trench breakers at the same spacing as if permanent slope breakers were required.

d. At a minimum, install a trench breaker at the base of slopes greater than 5 percent where the base of the slope is less than 50 feet from a waterbody or wetland and where needed to avoid draining a waterbody or wetland. Install trench breakers at wetland boundaries, as specified in the Procedures. Do not install trench breakers within a wetland.

2. Permanent Slope Breakers

a. Permanent slope breakers are intended to reduce runoff velocity, divert water off the construction right-of-way, and prevent sediment deposition into sensitive resources. Permanent slope breakers may be constructed of materials such as soil, stone, or some functional equivalent.

b. Construct and maintain permanent slope breakers in all areas, except cultivated areas and lawns, unless requested by the landowner, using spacing recommendations obtained from the local soil conservation authority or land managing agency.

In the absence of written recommendations, use the following spacing unless closer spacing is necessary to avoid excessive erosion on the construction right-of-way:

Slope (%)	Spacing (feet)
5 - 15	300
>15 - 30	200
>30	100

c. Construct slope breakers to divert surface flow to a stable area without causing water to pool or erode behind the breaker. In the absence of a stable area, construct appropriate energy-dissipating devices at the end of the breaker.

d. Slope breakers may extend slightly (about 4 feet) beyond the edge of the construction right-of-way to effectively drain water off the disturbed area. Where slope breakers extend beyond the edge of the construction right-of-way, they are subject to compliance with all applicable survey requirements.

C. SOIL COMPACTION MITIGATION

1. Test topsoil and subsoil for compaction at regular intervals in agricultural and residential areas disturbed by construction activities. Conduct tests on the same soil type under similar moisture conditions in undisturbed areas to approximate preconstruction conditions. Use penetrometers or other appropriate devices to conduct tests.

2. Plow severely compacted agricultural areas with a paraplow or other deep tillage implement. In areas where topsoil has been segregated, plow the subsoil before replacing the segregated topsoil.

If subsequent construction and cleanup activities result in further compaction, conduct additional tilling.

3. Perform appropriate soil compaction mitigation in severely compacted residential areas.

D. REVEGETATION

1. General

a. The project sponsor is responsible for ensuring successful revegetation of soils disturbed by project-related activities, except as noted in section V.D.1.b.

b. Restore all turf, ornamental shrubs, and specialized landscaping in accordance with the landowner's request, or compensate the landowner. Restoration work must be performed by personnel familiar with local horticultural and turf establishment practices.

2. Soil Additives

Fertilize and add soil pH modifiers in accordance with written recommendations obtained from the local soil conservation authority, land management agencies, or landowner. Incorporate recommended soil pH modifier and fertilizer into the top 2 inches of soil as soon as practicable after application.

3. Seeding Requirements

a. Prepare a seedbed in disturbed areas to a depth of 3 to 4 inches using appropriate equipment to provide a firm seedbed. When hydroseeding, scarify the seedbed to facilitate lodging and germination of seed.

b. Seed disturbed areas in accordance with written recommendations for seed mixes, rates, and dates obtained from the local soil conservation authority or the request of the landowner or land management agency. Seeding is not required in cultivated croplands unless requested by the landowner.

c. Perform seeding of permanent vegetation within the recommended seeding dates. If seeding cannot be done within those dates, use appropriate temporary erosion control measures discussed in section IV.F and perform seeding of permanent vegetation at the beginning of the next recommended seeding season. Dormant seeding or temporary

seeding of annual species may also be used, if necessary, to establish cover, as approved by the Environmental Inspector. Lawns may be seeded on a schedule established with the landowner.

d. In the absence of written recommendations from the local soil conservation authorities, seed all disturbed soils within 6 working days of final grading, weather and soil conditions permitting, subject to the specifications in section V.D.3.a through V.D.3.c.

e. Base seeding rates on Pure Live Seed. Use seed within 12 months of seed testing.

f. Treat legume seed with an inoculant specific to the species using the manufacturer's recommended rate of inoculant appropriate for the seeding method (broadcast, drill, or hydro).

g. In the absence of written recommendations from the local soil conservation authorities, landowner, or land managing agency to the contrary, a seed drill equipped with a cultipacker is preferred for seed application.

Broadcast or hydroseeding can be used in lieu of drilling at double the recommended seeding rates. Where seed is broadcast, firm the seedbed with a cultipacker or roller after seeding. In rocky soils or where site conditions may limit the effectiveness of this equipment, other alternatives may be appropriate (e.g., use of a chain drag) to lightly cover seed after application, as approved by the Environmental Inspector.

VI. OFF-ROAD VEHICLE CONTROL

To each owner or manager of forested lands, offer to install and maintain measures to control unauthorized vehicle access to the right-of-way. These measures may include:

A. signs;

B. fences with locking gates;

C. slash and timber barriers, pipe barriers, or a line of boulders across the right-of-way; and

D. conifers or other appropriate trees or shrubs across the right-of-way.

VII. POST-CONSTRUCTION ACTIVITIES AND REPORTING

A. MONITORING AND MAINTENANCE

1. Conduct follow-up inspections of all disturbed areas, as necessary, to determine the success of revegetation and address landowner concerns. At a minimum, conduct inspections after the first and second growing seasons.

2. Revegetation in non-agricultural areas shall be considered successful if upon visual survey the density and cover of non-nuisance vegetation are similar in density and cover to adjacent undisturbed lands. In agricultural areas, revegetation shall be considered successful when upon visual survey, crop growth and vigor are similar to adjacent undisturbed portions of the same field, unless the easement agreement specifies otherwise.

   Continue revegetation efforts until revegetation is successful.

3. Monitor and correct problems with drainage and irrigation systems resulting from pipeline construction in agricultural areas until restoration is successful.

4. Restoration shall be considered successful if the right-of-way surface condition is similar to adjacent undisturbed lands, construction debris is removed (unless otherwise approved by the landowner or land managing agency per section V.A.6), revegetation is successful, and proper drainage has been restored.

5. Routine vegetation mowing or clearing over the full width of the permanent right-of-way in uplands shall not be done more frequently than every 3 years. However, to facilitate periodic corrosion/leak surveys, a corridor not exceeding 10 feet in width centered on the pipeline may be cleared at a frequency necessary to maintain the 10-foot corridor in an herbaceous state. In no case shall routine vegetation mowing or clearing occur during the migratory bird nesting season between April 15 and August 1 of any year unless specifically approved in writing by the responsible land management agency or the U.S. Fish and Wildlife Service.

6. Efforts to control unauthorized off-road vehicle use, in cooperation with the landowner, shall continue throughout the life of the project. Maintain signs, gates, and permanent access roads as necessary.

B. REPORTING

1. The project sponsor shall maintain records that identify by milepost:

   a. method of application, application rate, and type of fertilizer, pH modifying agent, seed, and mulch used;

   b. acreage treated;

   c. dates of backfilling and seeding;

   d. names of landowners requesting special seeding treatment and a description of the follow-up actions;

   e. the location of any subsurface drainage repairs or improvements made during restoration; and

   f. any problem areas and how they were addressed.

2. The project sponsor shall file with the Secretary quarterly activity reports documenting the results of follow-up inspections required by section VII.A.1; any problem areas, including those identified by the landowner; and corrective actions taken for at least 2 years following construction.

   The requirement to file quarterly activity reports with the Secretary does not apply to projects constructed under the automatic authorization, prior notice, or advanced notice provisions in the FERC's regulations.

Federal Energy Regulatory Commission

Office of Energy Projects

May 2013

WETLAND AND WATERBODY CONSTRUCTION AND MITIGATION PROCEDURES

Washington, DC 20426

MAY 2013 VERSION

WETLAND AND WATERBODY CONSTRUCTION AND MITIGATION PROCEDURES

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WETLAND AND WATERBODY
CONSTRUCTION AND MITIGATION PROCEDURES (PROCEDURES)

I. APPLICABILITY

A. The intent of these Procedures is to assist project sponsors by identifying baseline mitigation measures for minimizing the extent and duration of project-related disturbance on wetlands and waterbodies. Project sponsors shall specify in their applications for a new FERC authorization, and in prior notice and advance notice filings, any individual measures in these Procedures they consider unnecessary, technically infeasible, or unsuitable due to local conditions and fully describe any alternative measures they would use. Project sponsors shall also explain how those alternative measures would achieve a comparable level of mitigation.

Once a project is authorized, project sponsors can request further changes as variances to the measures in these Procedures (or the applicant's approved procedures). The Director of the Office of Energy Projects (Director) will consider approval of variances upon the project sponsor's written request, if the Director agrees that a variance:

1. provides equal or better environmental protection;

2. is necessary because a portion of these Procedures is infeasible or unworkable based on project-specific conditions; or

3. is specifically required in writing by another federal, state, or Native American land management agency for the portion of the project on its land or under its jurisdiction.

Sponsors of projects planned for construction under the automatic authorization provisions in the FERC's regulations must receive written approval for any variances in advance of construction.

Project-related impacts on non-wetland areas are addressed in the staff's Upland Erosion Control, Revegetation, and Maintenance Plan (Plan).

B. DEFINITIONS

1. "Waterbody" includes any natural or artificial stream, river, or drainage with perceptible flow at the time of crossing, and other permanent waterbodies such as ponds and lakes:

   a. "minor waterbody" includes all waterbodies less than or equal to 10 feet wide at the water's edge at the time of crossing;

   b. "intermediate waterbody" includes all waterbodies greater than 10 feet wide but less than or equal to 100 feet wide at the water's edge at the time of crossing; and

   c. "major waterbody" includes all waterbodies greater than 100 feet wide at the water's edge at the time of crossing.

2. "Wetland" includes any area that is not in actively cultivated or rotated cropland and that satisfies the requirements of the current federal methodology for identifying and delineating wetlands.

II. PRECONSTRUCTION FILING

A. The following information must be filed with the Secretary of the FERC (Secretary) prior to the beginning of construction, for the review and written approval by the Director:

1. site-specific justifications for extra work areas that would be closer than 50 feet from a waterbody or wetland; and

2. site-specific justifications for the use of a construction right-of-way greater than 75-feet-wide in wetlands.

B. The following information must be filed with the Secretary prior to the beginning of construction. These filing requirements do not apply to projects constructed under the automatic authorization provisions in the FERC's regulations:

1. Spill Prevention and Response Procedures specified in section IV.A;

2. a schedule identifying when trenching or blasting will occur within each waterbody greater than 10 feet wide, within any designated coldwater fishery, and within any waterbody identified as habitat for federally-listed threatened or endangered species. The project sponsor will revise the schedule as necessary to provide FERC staff at least 14 days advance notice. Changes within this last 14-day period must provide for at least 48 hours advance notice;

3. plans for horizontal directional drills (HDD) under wetlands or waterbodies, specified in section V.B.6.d;

4. site-specific plans for major waterbody crossings, described in section V.B.9;

5. a wetland delineation report as described in section VI.A.1, if applicable; and

6. the hydrostatic testing information specified in section VII.B.3.

III. ENVIRONMENTAL INSPECTORS

A. At least one Environmental Inspector having knowledge of the wetland and waterbody conditions in the project area is required for each construction spread. The number and experience of Environmental Inspectors assigned to each construction spread shall be appropriate for the length of the construction spread and the number/significance of resources affected.

B. The Environmental Inspector's responsibilities are outlined in the Upland Erosion Control, Revegetation, and Maintenance Plan (Plan).

IV. PRECONSTRUCTION PLANNING

A. The project sponsor shall develop project-specific Spill Prevention and Response Procedures that meet applicable requirements of state and federal agencies. A copy must be filed with the Secretary prior to construction and made available in the field on each construction spread. This filing requirement does not apply to projects constructed under the automatic authorization provisions in the FERC's regulations.

1. It shall be the responsibility of the project sponsor and its contractors to structure their operations in a manner that reduces the risk of spills or the accidental exposure of fuels or hazardous materials to waterbodies or wetlands. The project sponsor and its contractors must, at a minimum, ensure that:

a. all employees handling fuels and other hazardous materials are properly trained;

b. all equipment is in good operating order and inspected on a regular basis;

c. fuel trucks transporting fuel to on-site equipment travel only on approved access roads;

d. all equipment is parked overnight and/or fueled at least 100 feet from a waterbody or in an upland area at least 100 feet from a wetland boundary. These activities can occur closer only if the Environmental Inspector determines that there is no reasonable alternative, and the

project sponsor and its contractors have taken appropriate steps (including secondary containment structures) to prevent spills and provide for prompt cleanup in the event of a spill;

e. hazardous materials, including chemicals, fuels, and lubricating oils, are not stored within 100 feet of a wetland, waterbody, or designated municipal watershed area, unless the location is designated for such use by an appropriate governmental authority. This applies to storage of these materials and does not apply to normal operation or use of equipment in these areas;

f. concrete coating activities are not performed within 100 feet of a wetland or waterbody boundary, unless the location is an existing industrial site designated for such use. These activities can occur closer only if the Environmental Inspector determines that there is no reasonable alternative, and the project sponsor and its contractors have taken appropriate steps (including secondary containment structures) to prevent spills and provide for prompt cleanup in the event of a spill;

g. pumps operating within 100 feet of a waterbody or wetland boundary utilize appropriate secondary containment systems to prevent spills; and

h. bulk storage of hazardous materials, including chemicals, fuels, and lubricating oils have appropriate secondary containment systems to prevent spills.

2. The project sponsor and its contractors must structure their operations in a manner that provides for the prompt and effective cleanup of spills of fuel and other hazardous materials. At a minimum, the project sponsor and its contractors must:

a. ensure that each construction crew (including cleanup crews) has on hand sufficient supplies of absorbent and barrier materials to allow the rapid containment and recovery of spilled materials and knows the procedure for reporting spills and unanticipated discoveries of contamination;

b. ensure that each construction crew has on hand sufficient tools and material to stop leaks;

c. know the contact names and telephone numbers for all local, state, and federal agencies (including, if necessary, the U. S. Coast Guard and the National Response Center) that must be notified of a spill; and

d. follow the requirements of those agencies in cleaning up the spill, in excavating and disposing of soils or other materials contaminated by a spill, and in collecting and disposing of waste generated during spill cleanup.

B. AGENCY COORDINATION

The project sponsor must coordinate with the appropriate local, state, and federal agencies as outlined in these Procedures and in the FERC's Orders.

V. WATERBODY CROSSINGS

A. NOTIFICATION PROCEDURES AND PERMITS

1. Apply to the U.S. Army Corps of Engineers (COE), or its delegated agency, for the appropriate wetland and waterbody crossing permits.

2. Provide written notification to authorities responsible for potable surface water supply intakes located within 3 miles downstream of the crossing at least 1 week before beginning work in the waterbody, or as otherwise specified by that authority.

3. Apply for state-issued waterbody crossing permits and obtain individual or generic section 401 water quality certification or waiver.

4. Notify appropriate federal and state authorities at least 48 hours before beginning trenching or blasting within the waterbody, or as specified in applicable permits.

B. INSTALLATION

1. Time Window for Construction

Unless expressly permitted or further restricted by the appropriate federal or state agency in writing on a site-specific basis, instream work, except that required to install or remove equipment bridges, must occur during the following time windows:

a. coldwater fisheries - June 1 through September 30; and

b. coolwater and warmwater fisheries - June 1 through November 30.

2. Extra Work Areas

a. Locate all extra work areas (such as staging areas and additional spoil storage areas) at least 50 feet away from water's edge, except where

the adjacent upland consists of cultivated or rotated cropland or other disturbed land.

b. The project sponsor shall file with the Secretary for review and written approval by the Director, site-specific justification for each extra work area with a less than 50-foot setback from the water's edge, except where the adjacent upland consists of cultivated or rotated cropland or other disturbed land. The justification must specify the conditions that will not permit a 50-foot setback and measures to ensure the waterbody is adequately protected.

c. Limit the size of extra work areas to the minimum needed to construct the waterbody crossing.

3. General Crossing Procedures

a. Comply with the COE, or its delegated agency, permit terms and conditions.

b. Construct crossings as close to perpendicular to the axis of the waterbody channel as engineering and routing conditions permit.

c. Where pipelines parallel a waterbody, maintain at least 15 feet of undisturbed vegetation between the waterbody (and any adjacent wetland) and the construction right-of-way, except where maintaining this offset will result in greater environmental impact.

d. Where waterbodies meander or have multiple channels, route the pipeline to minimize the number of waterbody crossings.

e. Maintain adequate waterbody flow rates to protect aquatic life, and prevent the interruption of existing downstream uses.

f. Waterbody buffers (e.g., extra work area setbacks, refueling restrictions) must be clearly marked in the field with signs and/or highly visible flagging until construction-related ground disturbing activities are complete.

g. Crossing of waterbodies when they are dry or frozen and not flowing may proceed using standard upland construction techniques in accordance with the Plan, provided that the Environmental Inspector verifies that water is unlikely to flow between initial disturbance and final stabilization of the feature. In the event of perceptible flow, the project sponsor must comply with all applicable Procedure requirements for "waterbodies" as defined in section I.B.1.

4. Spoil Pile Placement and Control

   a. All spoil from minor and intermediate waterbody crossings, and upland spoil from major waterbody crossings, must be placed in the construction right-of-way at least 10 feet from the water's edge or in additional extra work areas as described in section V.B.2.

   b. Use sediment barriers to prevent the flow of spoil or silt-laden water into any waterbody.

5. Equipment Bridges

   a. Only clearing equipment and equipment necessary for installation of equipment bridges may cross waterbodies prior to bridge installation. Limit the number of such crossings of each waterbody to one per piece of clearing equipment.

   b. Construct and maintain equipment bridges to allow unrestricted flow and to prevent soil from entering the waterbody. Examples of such bridges include:

      (1) equipment pads and culvert(s);
      (2) equipment pads or railroad car bridges without culverts;
      (3) clean rock fill and culvert(s); and
      (4) flexi-float or portable bridges.

      Additional options for equipment bridges may be utilized that achieve the performance objectives noted above. Do not use soil to construct or stabilize equipment bridges.

   c. Design and maintain each equipment bridge to withstand and pass the highest flow expected to occur while the bridge is in place. Align culverts to prevent bank erosion or streambed scour. If necessary, install energy dissipating devices downstream of the culverts.

   d. Design and maintain equipment bridges to prevent soil from entering the waterbody.

   e. Remove temporary equipment bridges as soon as practicable after permanent seeding.

   f. If there will be more than 1 month between final cleanup and the beginning of permanent seeding and reasonable alternative access to the right-of-way is available, remove temporary equipment bridges as soon as practicable after final cleanup.

g. Obtain any necessary approval from the COE, or the appropriate state agency for permanent bridges.

6. Dry-Ditch Crossing Methods

a. Unless approved otherwise by the appropriate federal or state agency, install the pipeline using one of the dry-ditch methods outlined below for crossings of waterbodies up to 30 feet wide (at the water's edge at the time of construction) that are state-designated as either coldwater or significant coolwater or warmwater fisheries, or federally-designated as critical habitat.

b. Dam and Pump

(1) The dam-and-pump method may be used without prior approval for crossings of waterbodies where pumps can adequately transfer streamflow volumes around the work area, and there are no concerns about sensitive species passage.

(2) Implementation of the dam-and-pump crossing method must meet the following performance criteria:

(i) use sufficient pumps, including on-site backup pumps, to maintain downstream flows;
(ii) construct dams with materials that prevent sediment and other pollutants from entering the waterbody (e.g., sandbags or clean gravel with plastic liner);
(iii) screen pump intakes to minimize entrainment of fish;
(iv) prevent streambed scour at pump discharge; and
(v) continuously monitor the dam and pumps to ensure proper operation throughout the waterbody crossing.

c. Flume Crossing

The flume crossing method requires implementation of the following steps:

(1) install flume pipe after blasting (if necessary), but before any trenching;

(2) use sand bag or sand bag and plastic sheeting diversion structure or equivalent to develop an effective seal and to divert stream flow through the flume pipe (some modifications to the stream bottom may be required to achieve an effective seal);

(3) properly align flume pipe(s) to prevent bank erosion and streambed scour;

(4) do not remove flume pipe during trenching, pipelaying, or backfilling activities, or initial streambed restoration efforts; and

(5) remove all flume pipes and dams that are not also part of the equipment bridge as soon as final cleanup of the stream bed and bank is complete.

d. Horizontal Directional Drill

For each waterbody or wetland that would be crossed using the HDD method, file with the Secretary for the review and written approval by the Director, a plan that includes:

(1) site-specific construction diagrams that show the location of mud pits, pipe assembly areas, and all areas to be disturbed or cleared for construction;

(2) justification that disturbed areas are limited to the minimum needed to construct the crossing;

(3) identification of any aboveground disturbance or clearing between the HDD entry and exit workspaces during construction;

(4) a description of how an inadvertent release of drilling mud would be contained and cleaned up; and

(5) a contingency plan for crossing the waterbody or wetland in the event the HDD is unsuccessful and how the abandoned drill hole would be sealed, if necessary.

The requirement to file HDD plans does not apply to projects constructed under the automatic authorization provisions in the FERC's regulations.

7. Crossings of Minor Waterbodies

Where a dry-ditch crossing is not required, minor waterbodies may be crossed using the open-cut crossing method, with the following restrictions:

a. except for blasting and other rock breaking measures, complete instream construction activities (including trenching, pipe installation, backfill, and restoration of the streambed contours) within 24 hours.

Streambanks and unconsolidated streambeds may require additional restoration after this period;

b. limit use of equipment operating in the waterbody to that needed to construct the crossing; and

c. equipment bridges are not required at minor waterbodies that do not have a state-designated fishery classification or protected status (e.g., agricultural or intermittent drainage ditches). However, if an equipment bridge is used it must be constructed as described in section V.B.5.

8. Crossings of Intermediate Waterbodies

Where a dry-ditch crossing is not required, intermediate waterbodies may be crossed using the open-cut crossing method, with the following restrictions:

a. complete instream construction activities (not including blasting and other rock breaking measures) within 48 hours, unless site-specific conditions make completion within 48 hours infeasible;

b. limit use of equipment operating in the waterbody to that needed to construct the crossing; and

c. all other construction equipment must cross on an equipment bridge as specified in section V.B.5.

9. Crossings of Major Waterbodies

Before construction, the project sponsor shall file with the Secretary for the review and written approval by the Director a detailed, site-specific construction plan and scaled drawings identifying all areas to be disturbed by construction for each major waterbody crossing (the scaled drawings are not required for any offshore portions of pipeline projects). This plan must be developed in consultation with the appropriate state and federal agencies and shall include extra work areas, spoil storage areas, sediment control structures, etc., as well as mitigation for navigational issues. The requirement to file major waterbody crossing plans does not apply to projects constructed under the automatic authorization provisions of the FERC's regulations.

The Environmental Inspector may adjust the final placement of the erosion and sediment control structures in the field to maximize effectiveness.

10. Temporary Erosion and Sediment Control

Install sediment barriers (as defined in section IV.F.3.a of the Plan) immediately after initial disturbance of the waterbody or adjacent upland.

Sediment barriers must be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls or restoration of adjacent upland areas is complete. Temporary erosion and sediment control measures are addressed in more detail in the Plan; however, the following specific measures must be implemented at stream crossings:

a. install sediment barriers across the entire construction right-of-way at all waterbody crossings, where necessary to prevent the flow of sediments into the waterbody. Removable sediment barriers (or driveable berms) must be installed across the travel lane. These removable sediment barriers can be removed during the construction day, but must be re-installed after construction has stopped for the day and/or when heavy precipitation is imminent;

b. where waterbodies are adjacent to the construction right-of-way and the right-of-way slopes toward the waterbody, install sediment barriers along the edge of the construction right-of-way as necessary to contain spoil within the construction right-of-way and prevent sediment flow into the waterbody; and

c. use temporary trench plugs at all waterbody crossings, as necessary, to prevent diversion of water into upland portions of the pipeline trench and to keep any accumulated trench water out of the waterbody.

11. Trench Dewatering

Dewater the trench (either on or off the construction right-of-way) in a manner that does not cause erosion and does not result in silt-laden water flowing into any waterbody. Remove the dewatering structures as soon as practicable after the completion of dewatering activities.

C. RESTORATION

1. Use clean gravel or native cobbles for the upper 1 foot of trench backfill in all waterbodies that contain coldwater fisheries.

2. For open-cut crossings, stabilize waterbody banks and install temporary sediment barriers within 24 hours of completing instream construction activities. For dry-ditch crossings, complete streambed and bank stabilization before returning flow to the waterbody channel.

3. Return all waterbody banks to preconstruction contours or to a stable angle of repose as approved by the Environmental Inspector.

4. Install erosion control fabric or a functional equivalent on waterbody banks at the time of final bank recontouring. Do not use synthetic monofilament

mesh/netted erosion control materials in areas designated as sensitive wildlife habitat unless the product is specifically designed to minimize harm to wildlife. Anchor erosion control fabric with staples or other appropriate devices.

5. Application of riprap for bank stabilization must comply with COE, or its delegated agency, permit terms and conditions.

6. Unless otherwise specified by state permit, limit the use of riprap to areas where flow conditions preclude effective vegetative stabilization techniques such as seeding and erosion control fabric.

7. Revegetate disturbed riparian areas with native species of conservation grasses, legumes, and woody species, similar in density to adjacent undisturbed lands.

8. Install a permanent slope breaker across the construction right-of-way at the base of slopes greater than 5 percent that are less than 50 feet from the waterbody, or as needed to prevent sediment transport into the waterbody. In addition, install sediment barriers as outlined in the Plan.

   In some areas, with the approval of the Environmental Inspector, an earthen berm may be suitable as a sediment barrier adjacent to the waterbody.

9. Sections V.C.3 through V.C.7 above also apply to those perennial or intermittent streams not flowing at the time of construction.

D. POST-CONSTRUCTION MAINTENANCE

1. Limit routine vegetation mowing or clearing adjacent to waterbodies to allow a riparian strip at least 25 feet wide, as measured from the waterbody's mean high water mark, to permanently revegetate with native plant species across the entire construction right-of-way. However, to facilitate periodic corrosion/leak surveys, a corridor centered on the pipeline and up to 10 feet wide may be cleared at a frequency necessary to maintain the 10-foot corridor in an herbaceous state. In addition, trees that are located within 15 feet of the pipeline that have roots that could compromise the integrity of the pipeline coating may be cut and removed from the permanent right-of-way. Do not conduct any routine vegetation mowing or clearing in riparian areas that are between HDD entry and exit points.

2. Do not use herbicides or pesticides in or within 100 feet of a waterbody except as allowed by the appropriate land management or state agency.

3. Time of year restrictions specified in section VII.A.5 of the Plan (April 15 – August 1 of any year) apply to routine mowing and clearing of riparian areas.

VI. WETLAND CROSSINGS

A. GENERAL

1. The project sponsor shall conduct a wetland delineation using the current federal methodology and file a wetland delineation report with the Secretary before construction. The requirement to file a wetland delineation report does not apply to projects constructed under the automatic authorization provisions in the FERC's regulations.

   This report shall identify:

   a. by milepost all wetlands that would be affected;

   b. the National Wetlands Inventory (NWI) classification for each wetland;

   c. the crossing length of each wetland in feet; and

   d. the area of permanent and temporary disturbance that would occur in each wetland by NWI classification type.

   The requirements outlined in this section do not apply to wetlands in actively cultivated or rotated cropland. Standard upland protective measures, including workspace and topsoiling requirements, apply to these agricultural wetlands.

2. Route the pipeline to avoid wetland areas to the maximum extent possible. If a wetland cannot be avoided or crossed by following an existing right-of-way, route the new pipeline in a manner that minimizes disturbance to wetlands. Where looping an existing pipeline, overlap the existing pipeline right-of-way with the new construction right-of-way. In addition, locate the loop line no more than 25 feet away from the existing pipeline unless site-specific constraints would adversely affect the stability of the existing pipeline.

3. Limit the width of the construction right-of-way to 75 feet or less. Prior written approval of the Director is required where topographic conditions or soil limitations require that the construction right-of-way width within the boundaries of a federally delineated wetland be expanded beyond 75 feet. Early in the planning process the project sponsor is encouraged to identify site-specific areas where excessively wide trenches could occur and/or where spoil piles could be difficult to maintain because existing soils lack adequate unconfined compressive strength.

4. Wetland boundaries and buffers must be clearly marked in the field with signs and/or highly visible flagging until construction-related ground disturbing activities are complete.

5. Implement the measures of sections V and VI in the event a waterbody crossing is located within or adjacent to a wetland crossing. If all measures of sections V and VI cannot be met, the project sponsor must file with the Secretary a site-specific crossing plan for review and written approval by the Director before construction. This crossing plan shall address at a minimum:

   a. spoil control;

   b. equipment bridges;

   c. restoration of waterbody banks and wetland hydrology;

   d. timing of the waterbody crossing;

   e. method of crossing; and

   f. size and location of all extra work areas.

6. Do not locate aboveground facilities in any wetland, except where the location of such facilities outside of wetlands would prohibit compliance with U.S. Department of Transportation regulations.

B. INSTALLATION

1. Extra Work Areas and Access Roads

   a. Locate all extra work areas (such as staging areas and additional spoil storage areas) at least 50 feet away from wetland boundaries, except where the adjacent upland consists of cultivated or rotated cropland or other disturbed land.

   b. The project sponsor shall file with the Secretary for review and written approval by the Director, site-specific justification for each extra work area with a less than 50-foot setback from wetland boundaries, except where adjacent upland consists of cultivated or rotated cropland or other disturbed land. The justification must specify the site-specific conditions that will not permit a 50-foot setback and measures to ensure the wetland is adequately protected.

   c. The construction right-of-way may be used for access when the wetland soil is firm enough to avoid rutting or the construction right-of-way has been appropriately stabilized to avoid rutting (e.g., with timber riprap, prefabricated equipment mats, or terra mats).

      In wetlands that cannot be appropriately stabilized, all construction equipment other than that needed to install the wetland crossing shall

use access roads located in upland areas. Where access roads in upland areas do not provide reasonable access, limit all other construction equipment to one pass through the wetland using the construction right-of-way.

d. The only access roads, other than the construction right-of-way, that can be used in wetlands are those existing roads that can be used with no modifications or improvements, other than routine repair, and no impact on the wetland.

2. Crossing Procedures

a. Comply with COE, or its delegated agency, permit terms and conditions.

b. Assemble the pipeline in an upland area unless the wetland is dry enough to adequately support skids and pipe.

c. Use "push-pull" or "float" techniques to place the pipe in the trench where water and other site conditions allow.

d. Minimize the length of time that topsoil is segregated and the trench is open. Do not trench the wetland until the pipeline is assembled and ready for lowering in.

e. Limit construction equipment operating in wetland areas to that needed to clear the construction right-of-way, dig the trench, fabricate and install the pipeline, backfill the trench, and restore the construction right-of-way.

f. Cut vegetation just above ground level, leaving existing root systems in place, and remove it from the wetland for disposal.

The project sponsor can burn woody debris in wetlands, if approved by the COE and in accordance with state and local regulations, ensuring that all remaining woody debris is removed for disposal.

g. Limit pulling of tree stumps and grading activities to directly over the trenchline. Do not grade or remove stumps or root systems from the rest of the construction right-of-way in wetlands unless the Chief Inspector and Environmental Inspector determine that safety-related construction constraints require grading or the removal of tree stumps from under the working side of the construction right-of-way.

h. Segregate the top 1 foot of topsoil from the area disturbed by trenching, except in areas where standing water is present or soils are

saturated. Immediately after backfilling is complete, restore the segregated topsoil to its original location.

i. Do not use rock, soil imported from outside the wetland, tree stumps, or brush riprap to support equipment on the construction right-of-way.

j. If standing water or saturated soils are present, or if construction equipment causes ruts or mixing of the topsoil and subsoil in wetlands, use low-ground-weight construction equipment, or operate normal equipment on timber riprap, prefabricated equipment mats, or terra mats.

k. Remove all project-related material used to support equipment on the construction right-of-way upon completion of construction.

3. Temporary Sediment Control

Install sediment barriers (as defined in section IV.F.3.a of the Plan) immediately after initial disturbance of the wetland or adjacent upland. Sediment barriers must be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench). Except as noted below in section VI.B.3.c, maintain sediment barriers until replaced by permanent erosion controls or restoration of adjacent upland areas is complete. Temporary erosion and sediment control measures are addressed in more detail in the Plan.

a. Install sediment barriers across the entire construction right-of-way immediately upslope of the wetland boundary at all wetland crossings where necessary to prevent sediment flow into the wetland.

b. Where wetlands are adjacent to the construction right-of-way and the right-of-way slopes toward the wetland, install sediment barriers along the edge of the construction right-of-way as necessary to contain spoil within the construction right-of-way and prevent sediment flow into the wetland.

c. Install sediment barriers along the edge of the construction right-of-way as necessary to contain spoil and sediment within the construction right-of-way through wetlands. Remove these sediment barriers during right-of-way cleanup.

4. Trench Dewatering

Dewater the trench (either on or off the construction right-of-way) in a manner that does not cause erosion and does not result in silt-laden water flowing into any wetland. Remove the dewatering structures as soon as practicable after the completion of dewatering activities.

C. RESTORATION

1. Where the pipeline trench may drain a wetland, construct trench breakers at the wetland boundaries and/or seal the trench bottom as necessary to maintain the original wetland hydrology.

2. Restore pre-construction wetland contours to maintain the original wetland hydrology.

3. For each wetland crossed, install a trench breaker at the base of slopes near the boundary between the wetland and adjacent upland areas. Install a permanent slope breaker across the construction right-of-way at the base of slopes greater than 5 percent where the base of the slope is less than 50 feet from the wetland, or as needed to prevent sediment transport into the wetland. In addition, install sediment barriers as outlined in the Plan. In some areas, with the approval of the Environmental Inspector, an earthen berm may be suitable as a sediment barrier adjacent to the wetland.

4. Do not use fertilizer, lime, or mulch unless required in writing by the appropriate federal or state agency.

5. Consult with the appropriate federal or state agencies to develop a project-specific wetland restoration plan. The restoration plan shall include measures for re-establishing herbaceous and/or woody species, controlling the invasion and spread of invasive species and noxious weeds (e.g., purple loosestrife and phragmites), and monitoring the success of the revegetation and weed control efforts. Provide this plan to the FERC staff upon request.

6. Until a project-specific wetland restoration plan is developed and/or implemented, temporarily revegetate the construction right-of-way with annual ryegrass at a rate of 40 pounds/acre (unless standing water is present).

7. Ensure that all disturbed areas successfully revegetate with wetland herbaceous and/or woody plant species.

8. Remove temporary sediment barriers located at the boundary between wetland and adjacent upland areas after revegetation and stabilization of adjacent upland areas are judged to be successful as specified in section VII.A.4 of the Plan.

D. POST-CONSTRUCTION MAINTENANCE AND REPORTING

1. Do not conduct routine vegetation mowing or clearing over the full width of the permanent right-of-way in wetlands. However, to facilitate periodic corrosion/leak surveys, a corridor centered on the pipeline and up to 10 feet wide may be cleared at a frequency necessary to maintain the 10-foot corridor in an herbaceous state. In addition, trees within 15 feet of the pipeline with roots that could compromise the integrity of pipeline coating may be selectively cut and removed from the permanent right-of-way. Do not conduct any routine vegetation mowing or clearing in wetlands that are between HDD entry and exit points.

2. Do not use herbicides or pesticides in or within 100 feet of a wetland, except as allowed by the appropriate federal or state agency.

3. Time of year restrictions specified in section VII.A.5 of the Plan (April 15 – August 1 of any year) apply to routine mowing and clearing of wetland areas.

4. Monitor and record the success of wetland revegetation annually until wetland revegetation is successful.

5. Wetland revegetation shall be considered successful if all of the following criteria are satisfied:

   a. the affected wetland satisfies the current federal definition for a wetland (i.e., soils, hydrology, and vegetation);

   b. vegetation is at least 80 percent of either the cover documented for the wetland prior to construction, or at least 80 percent of the cover in adjacent wetland areas that were not disturbed by construction;

   c. if natural rather than active revegetation was used, the plant species composition is consistent with early successional wetland plant communities in the affected ecoregion; and

   d. invasive species and noxious weeds are absent, unless they are abundant in adjacent areas that were not disturbed by construction.

6. Within 3 years after construction, file a report with the Secretary identifying the status of the wetland revegetation efforts and documenting success as defined in section VI.D.5, above. The requirement to file wetland restoration reports with the Secretary does not apply to projects constructed under the automatic authorization, prior notice, or advance notice provisions in the FERC's regulations.

   For any wetland where revegetation is not successful at the end of 3 years after construction, develop and implement (in consultation with a

professional wetland ecologist) a remedial revegetation plan to actively revegetate wetlands. Continue revegetation efforts and file a report annually documenting progress in these wetlands until wetland revegetation is successful.

VII. HYDROSTATIC TESTING

A. NOTIFICATION PROCEDURES AND PERMITS

1. Apply for state-issued water withdrawal permits, as required.

2. Apply for National Pollutant Discharge Elimination System (NPDES) or state-issued discharge permits, as required.

3. Notify appropriate state agencies of intent to use specific sources at least 48 hours before testing activities unless they waive this requirement in writing.

B. GENERAL

1. Perform 100 percent radiographic inspection of all pipeline section welds or hydrotest the pipeline sections, before installation under waterbodies or wetlands.

2. If pumps used for hydrostatic testing are within 100 feet of any waterbody or wetland, address secondary containment and refueling of these pumps in the project's Spill Prevention and Response Procedures.

3. The project sponsor shall file with the Secretary before construction a list identifying the location of all waterbodies proposed for use as a hydrostatic test water source or discharge location. This filing requirement does not apply to projects constructed under the automatic authorization provisions of the FERC's regulations.

C. INTAKE SOURCE AND RATE

1. Screen the intake hose to minimize the potential for entrainment of fish.

2. Do not use state-designated exceptional value waters, waterbodies which provide habitat for federally listed threatened or endangered species, or waterbodies designated as public water supplies, unless appropriate federal, state, and/or local permitting agencies grant written permission.

3. Maintain adequate flow rates to protect aquatic life, provide for all waterbody uses, and provide for downstream withdrawals of water by existing users.

4. Locate hydrostatic test manifolds outside wetlands and riparian areas to the maximum extent practicable.

D. DISCHARGE LOCATION, METHOD, AND RATE

1. Regulate discharge rate, use energy dissipation device(s), and install sediment barriers, as necessary, to prevent erosion, streambed scour, suspension of sediments, or excessive streamflow.

2. Do not discharge into state-designated exceptional value waters, waterbodies which provide habitat for federally listed threatened or endangered species, or waterbodies designated as public water supplies, unless appropriate federal, state, and local permitting agencies grant written permission.

North Bakken Expansion Project

Plan of Development

APPENDIX G

Fugitive Dust Control Plan

WBI ENERGY TRANSMISSION, INC.

North Bakken Expansion Project

Plan of Development

Appendix G

Fugitive Dust Control Plan

Final

February 2020

NORTH BAKKEN EXPANSION PROJECT
WBI ENERGY TRANSMISSION, INC.
FUGITIVE DUST CONTROL PLAN

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ACRONYMS AND ABBREVIATIONS

BMP	best management practice
EI	Environmental Inspector
NDAC	North Dakota Administrative Code
Project	North Bakken Expansion Project
WBI Energy	WBI Energy Transmission, Inc.

1.0 INTRODUCTION

This *Fugitive Dust Plan* was prepared for WBI Energy Transmission, Inc.'s (WBI Energy) proposed North Bakken Expansion Project (Project). This *Fugitive Dust Control Plan* was developed as a guide for construction and field personnel on the implementation of appropriate measures to minimize and control the generation of fugitive dust during construction activities associated with the Project. It will be the responsibility of the Project contractors, working with WBI Energy field representatives, to identify activities that are generating dust and to at all times control airborne dust levels during construction activities to acceptable levels that are in compliance with any applicable standards, including those established by the North Dakota Department of Health, and other regulating agencies and local ordinances.

Construction of the Project will involve land disturbing activities, which can increase the susceptibility of soils to erosion caused by wind and water. Wind erosion can damage the productivity of the land by reducing soil moisture, altering soil structure, and carrying away soil nutrients and topsoil. A small amount of soil loss from wind erosion occurs naturally; however, human activity, such as pipeline construction, can dramatically increase soil loss due to wind erosion (fugitive dust) and potentially create conditions that could be detrimental to air quality and safety. Fugitive dust is a type of non-point source air pollution that can cause respiratory distress for construction workers as well as nearby residents and wildlife. Additionally, fugitive dust can create a safety hazard by obscuring visibility for equipment operators, construction personnel, and traffic on public roads near the Project.

2.0 NORTH DAKOTA REGULATORY REQUIREMENTS

Fugitive dust emissions are regulated under the North Dakota Administrative Code (NDAC) Title 33, Article 15, Chapter 17. This regulation dictates that, "No person shall cause or permit fugitive emissions from any source whatsoever, including a building, its appurtenances, or a road, to be used, constructed, altered, repaired, or demolished; or activities such as loading, unloading, storing, handling, or transporting of materials without taking reasonable precautions to prevent such emissions from causing air pollution as defined in NDAC Section 33-15-01-04."

Specifically, NDAC § 33-15-17-02 restricts emissions of fugitive particulate [dust] which:

- "Exceed the ambient air quality standards of chapter 33-15-02 at or beyond the property line of the source.
- Exceed the prevention of significant deterioration of air quality increments of chapter 33-15-15 at or beyond the property line of the source for sources subject to chapter 33-15-15.
- Exceed the restrictions on the emission of visible air contaminants of chapter 33-15-03, at or beyond the property line of the source, except as provided in section 33-15-03-04.
- Would have an adverse impact on visibility, as defined in chapter 33-15-19, on any class I federal area."

Title 33, Article 15, Chapter 17, Section 03, Subdivision 29 of the NDAC lists reasonable precautions for abating and preventing fugitive particulate [dust] emissions. Abatement and preventative fugitive particulate control measure include, but are not limited to:

(1) "Wetting down, including prewatering.
(2) Landscaping and replanting with native vegetation.
(3) Covering, shielding or enclosing the area.
(4) Paving, temporary or permanent.
(5) Treating, the use of dust palliatives and chemical stabilization.
(6) Detouring.
(7) Restricting the speed of vehicles on sites.
(8) Preventing the deposit of dirt and mud on improved streets and roads.
(9) Minimizing topsoil disturbance and reclaiming as soon as possible."

3.0 FUGITIVE DUST SOURCES

Fugitive dust is created when particulate matter is disturbed and becomes airborne. During construction of the Project, various activities have the potential to cause emissions of fugitive dust. These activities include, but may not be limited to:

- Vegetation clearing activities;
- Grading of topsoil and subsoil, including cut-and-fill areas on steep side slopes;
- Excavation, temporary side casting of spoil, and backfilling;
- Blasting;
- Grading associated with reestablishing contours and restoring segregated topsoil;
- Vehicle traffic on unpaved access roads;
- Vehicle track-out onto roads;
- Vehicle and equipment travel down the Project right-of-way;
- Loading bulk materials; and
- Open-bodied trucks hauling sand, soil, gravel, or other materials.

WBI Energy's contractors and field representatives will identify activities that are generating fugitive dust, implement feasible dust abatement techniques or best management practices (BMP) to control dust, and maintain compliance with applicable fugitive dust regulations.

4.0 BEST PRACTICAL METHODS OF FUGITIVE DUST CONTROL

Dust suppression measures will be employed as necessary to control fugitive dust emissions to maintain compliance with the regulations set forth in the NDAC. To minimize wind erosion and fugitive dust emissions during construction, WBI Energy will implement the following reasonably available control measures:

- To the extent possible, utilize existing highways, frontage roads, and secondary roads, for access to the Project's construction right-of-way;

- Keep paved access roads free of mud and soil that is tracked onto the road surface from construction vehicles;

- If soil is transported onto a public road surface or other paved area, including parking lots, by construction equipment and vehicles, it will be removed as soon as practical from the road by shoveling or sweeping, and will be transported back to a designated sediment control disposal area within the construction right-of-way;

- Use dust abatement techniques (i.e., applying water or approved nontoxic chemical dust suppressants) on unpaved or un-vegetated areas or other areas susceptible to wind erosion, including the Project's construction right-of-way, approved work areas, and unpaved roads, at least daily as needed in areas of active construction. Application of dust suppressants will be repeated as necessary and as determined by an Environmental Inspector (EI);

- Water for dust control will be obtained from municipal sources and nearby water sources where the necessary permits required by federal, state, and local agencies for the procurement of water have been secured. No unapproved water sources may be used for Project activities including dust control;

- Temporarily stockpiled soils (topsoil and spoil) will be stabilized by spraying with water or an approved chemical dust suppressant to create a semi-hard protective layer to minimize wind erosion or with a temporary cover species such as oats or ryegrass, when necessary, and as determined by an EI;

- Project-related traffic speeds will be controlled on the construction right-of-way and within other Project facilities to limit the amount of disturbance from vehicle traffic;

- Speed limits will be decreased when excessive winds prevail and where sensitive areas such as public roads are adjacent to access roads or the construction right-of-way;

- Open-bodied trucks carrying sand, soil, gravel, or other materials will be covered where necessary to prevent such materials from being expelled;

- Construction entrance/exit access locations onto paved roads will be cleaned at a minimum of once every 48 hours, or as needed, if materials are observed to be accumulating on the road surface;

- In construction areas adjacent to highways where dust could cause poor visibility, WBI Energy will implement additional BMPs to minimize dust and potential safety issues. These additional BMPs may include applying water as close to earth-moving equipment as possible, slowing the speed of construction equipment, spacing equipment further apart, increased traffic control, or shutting down operations during high wind periods. WBI Energy will coordinate with the appropriate highway authorities to ensure adequate traffic control measures are in place, including the possibility of using flaggers to control traffic if extreme low visibility conditions develop;

- When opacity along dirt roads and the right-of-way exceeds 20 percent (objects partially obscured), construction activity shall cease until dust control measures are employed; and

- Other dust control measures, such as the use of wind fences or berms, may also be implemented as needed.

The frequency of water application will largely depend on weather conditions. Additionally, WBI Energy will attempt to begin cleanup and rough grading within 72 hours after backfilling and complete cleanup within 20 days after backfilling, weather and soil conditions permitting. If seasonal or other weather conditions prevent compliance with the time frames, the contractor shall stabilize the right-of-way and maintain erosion and sediment control measures until cleanup can be conducted. Disturbed areas will be permanently revegetated in accordance with applicable permit conditions and landowner requirements.

5.0 RESPONSIBLE PARTY

WBI Energy or their designated contractor will be responsible for all dust control in their respective Project areas during the construction phase of the Project (7 days a week, including weekends and holidays). WBI Energy or their designated contractor will have a copy of this *Fugitive Dust Control Plan* available on-site at all times. Problem areas or potential problem areas that are identified during construction must be controlled as soon as possible after being brought to the attention of the contractor.

6.0 PROJECT CONTACT FOR LANDOWNERS

An environmental complaint resolution process will be implemented for the Project to quickly and effectively remedy environmental issues that may be reported by landowners. Prior to construction, landowners will be provided with a Project phone number to facilitate communication regarding environmental complaints, including fugitive dust.

7.0 GENERAL CONTRACTORS

The general contractors' contact information will be incorporated into this plan prior to construction. The contractors chosen for the Project will implement the dust control measures specified in this plan, while WBI Energy's EIs will be primarily responsible for monitoring and enforcing the implementation of needed dust control measures as well as ensuring that dust control is effective and proper documentation is maintained. All construction site personnel will be educated on the measures outlined in this plan.

North Bakken Expansion Project

Plan of Development

APPENDIX H

Plan for Unanticipated Discovery of Paleontological Resources During Construction

WBI ENERGY TRANSMISSION, INC.

North Bakken Expansion Project

Plan of Development

Appendix H

Plan for Unanticipated Discovery of Paleontological Resources During Construction

Draft

September 2020

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT
PLAN FOR UNANTICIPATED DISCOVERY OF PALEONTOLOGICAL RESOURCES DURING CONSTRUCTION

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ACRONYMS AND ABBREVIATIONS

EI	Environmental Inspector
Project	North Bakken Expansion Project
WBI Energy	WBI Energy Transmission, Inc.

1.0 INTRODUCTION

This Plan for Unanticipated Discovery of Paleontological Resources during Construction was prepared for WBI Energy Transmission, Inc.'s (WBI Energy) proposed North Bakken Expansion Project (Project). This plan identifies procedures to be implemented in the event that previously unreported and unanticipated paleontological resources are found during construction of the Project.

2.0 TRAINING

Prior to the commencement of construction, WBI Energy and contractor personnel will receive environmental training that will include instruction on the identification of paleontological resources and implementation of the procedures outlined in this plan.

3.0 UNANTICIPATED DISCOVERY OF PALEONTOLOGICAL RESOURCES

Paleontological resources on land owned by the State of North Dakota and its political subdivisions are protected and managed under Chapters 54-17.3 and 43-04 of the North Dakota Century Code and North Dakota Administrative Code, respectively. A permit is required to investigate, excavate, collect, or otherwise record paleontological resources on these lands (North Dakota Geological Survey, 2016). North Dakota Century Code Chapter 54-17.3-05 requires the reporting of all quaternary paleontological finds that potentially or actually contain cultural resources to the state historical society in addition to the State Geologist (State of North Dakota, 2016).

Paleontological resources on U.S. Army Corps of Engineers and U.S. Forest Service lands are protected under the Paleontological Resources Preservation Act per Title 36 of the Code of Federal Regulations Part 291.1. WBI Energy obtained an Archaeological Resources Protection Act permit, which is required to conduct paleontological surveys within U.S. Forest Service and U.S. Army Corps of Engineers lands. These surveys were completed in October 2019.

WBI Energy will implement the following procedures if paleontological resources are discovered during construction on federal, state, or private lands:

1. The contractor will stop work in the immediate area of the find to protect the integrity of the find.

2. The contractor will notify WBI Energy's Environmental Inspector (EI) of the find. The contractor will not restart work in the area of the find until approved by the EI.

Environmental Inspector:
Name To be determined
Cell: To be determined
Email: To be determined

3. The EI will notify WBI Energy's Designated Representative. The representative will notify the Federal Energy Regulatory Commission Project Manager of the find.

WBI Energy Designated Representative:
Name: Greg Huncovsky
Address: 2010 Montana Avenue, Glendive, MT 59330
Phone: 406-359-7451
Cell: 406-989-1068
Email: Greg.Huncovsky@WBIEnergy.com

Federal Energy Regulatory Commission Project Manager:
Name: Dawn Ramsey
Address: 888 First Street, Washington, DC 20426
Phone: 202-502-6856
Email: dawn.ramsey@ferc.gov

4. The EI will confirm the presence of paleontological resources. Upon confirmation, the EI will photograph representative specimens of fossils identified at the site. The EI will prepare a brief written description that identifies the location of the potential fossil material along the route, the depth and apparent thickness of the stratum containing the fossil material, local topography, and other pertinent conditions or observations.

5. If the paleontological resources are identified on federally owned land, the WBI Energy Designated Representative will notify the U.S. Army Corps of Engineers or U.S. Forest Service representative in order to determine if a permit will be required to investigate, excavate, collect, or otherwise record the fossil resources.

U.S. Army Corp of Engineers:
Name: Richard Rogers
Address: 201 1st Street, Room 210
Phone: 701-654-7744
Email: richard.r.rogers@usace.army.mil

U.S. Forest Service:
Name: Cale Bickerdyke
Address: 1905 South Main Street, Watford City
Phone: 701-842-8502
Email: cale.bickerdyke@usda.gov

6. If the paleontological resources are identified on state-owned land, the WBI Energy Designated Representative will notify the North Dakota Geological Survey in order to determine if a North Dakota Paleontological Resource Collecting Permit will be required to investigate, excavate, collect, or otherwise record the fossil resources.

North Dakota Geological Survey:
Name: Jeff Person, Paleontologist
Phone: 701-328-8000
Email: jjperson@nd.gov

7. The WBI Energy Designated Representative will notify the State Geologist and, upon request, provide copies of the written and photographic documentation of the paleontological materials.

   State Geologist: Edward Murphy
   Phone: 701-328-8000
   Email: emurphy@nd.gov

8. Once documentation of the find is completed, WBI Energy's Designated Representative will direct the EI to grant clearance to the contractor to resume work in the vicinity of the site.

North Bakken Expansion Project

Plan of Development

APPENDIX I

Plan for Unanticipated Discovery of Contaminated Environmental Media

WBI ENERGY TRANSMISSION, INC.

North Bakken Expansion Project

Plan of Development

Appendix I

Plan for Unanticipated Discovery of Contaminated Environmental Media

Final

February 2020

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT
PLAN FOR UNANTICIPATED DISCOVERY OF CONTAMINATED ENVIRONMENTAL MEDIA

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ACRONYMS AND ABBREVIATIONS

EI	Environmental Inspector
Project	North Bakken Expansion Project
WBI Energy	WBI Energy Transmission, Inc.

1.0 INTRODUCTION

WBI Energy Transmission, Inc. (WBI Energy) has developed this Plan for Unanticipated Discovery of Contaminated Environmental Media for its proposed North Bakken Expansion Project (Project). WBI Energy recognizes there is the potential to encounter contaminated soil or sediment during construction activities associated with the Project. This plan describes the steps that WBI Energy and its Contractors will implement in the unanticipated event that contaminated environmental media is encountered during construction.

2.0 IDENTIFICATION OF CONTAMINATED MEDIA AND INITIAL RESPONSE

During Project activities, construction personnel and WBI Energy's Environmental Inspectors (EI) will observe work areas for signs of potential contamination such as:

- discoloration of soils;
- chemical-like odors from soils or water;
- oily sheens on soils or water;
- buried drums or other waste containers; and
- buried waste such as garbage, debris, etc.

If signs of contamination are encountered, the Contractors will stop work in the vicinity of the suspected contamination, restrict access to the suspected contamination site, and immediately notify the EI and Spill Coordinator of the find. The EI will contact the WBI Energy Designated Representative as soon as possible after discovery of the site. The WBI Energy Designated Representative or Land Agent will inform the landowner of the site.

Environmental Inspector:	To Be Determined
Phone:	To Be Determined
Spill Coordinator:	To Be Determined
Phone:	To Be Determined
WBI Energy Designated Representative:	Greg Huncovsky
Office Phone:	406-359-7451
Cell Phone:	406-989-1068
Land Agent:	To Be Determined
Phone:	To Be Determined

3.0 CONTAMINATED MEDIA CONTAINMENT, TESTING, AND NOTIFICATION PROCEDURES

The EI and Contractor will initiate measures to avoid the spread of contaminants until the nature and type of contamination is properly evaluated. Work in the area will not resume until an assessment of the types and levels of contaminants has been determined by qualified personnel.

Measures to avoid the spread of potential contamination will vary depending on the situation. The following measures will be implemented as appropriate:

- If potentially contaminated soil or groundwater is exposed during excavation, work will stop in the area of contamination and the EI will take measures, if safe to do so, to flag the area.

- If potentially contaminated soil has been excavated and stockpiled, it may be transferred to a bermed area lined with a sheet of impervious plastic, with a second sheet of impervious plastic placed over the new stockpile and berm. These measures will be implemented to prevent surface water or precipitation from carrying contaminants off the site. The contaminated media will not be removed from the site unless approved to do so by the EI or WBI Energy.

- If groundwater is draining from the sides of the excavation and standing in the trench, temporary trench plugs may be installed to avoid migration of the groundwater and spread of contaminants through water.

- In the unlikely event that groundwater is to rise above the surface of the trench, berms or spill control booms will be placed around the open portion of the trench to contain the water and prevent the spread of contaminants.

- All potentially contaminated media will be handled in accordance with all federal, state, and local regulations.

Concurrent with the installation of containment measures, the potential contaminant will be characterized. Representative samples of soils or groundwater will be collected and analyzed, as necessary. Appropriate tests or analyses will be conducted by a qualified laboratory based on field observations and the suspected nature of the contaminants as well as any recommendations from qualified environmental contractors and regulatory agencies if consulted. Laboratory analyses may include: Total Petroleum Hydrocarbons, Oil & Grease, Volatile Hydrocarbons, Semi-volatile Hydrocarbons, metals, polychlorinated biphenyls, and pH.

Depending on the nature of the contamination, WBI Energy will notify the appropriate federal, state, and local regulatory agencies. Appropriate agencies include, but may not be limited to, the following:

- North Dakota Department of Health – Spill Investigation Program
  Bill Suess – Spill Investigation Program Manager
  Phone: 701-328-5216
  Email: bsuess@nd.gov

- The National Response Center (Washington, D.C.) at 1-800-424-8802 (24 hours).

4.0 AVOIDANCE OR RESPONSE PLANS

If the contaminant identified is found to be a health or safety hazard, the area of contamination will be evacuated and secured until trained personnel are on site and mitigation measures are implemented to allow the safe installation of Project facilities. Alternatively,

reroutes or new aboveground facility sites may be considered to avoid the area of contamination. Applicable permits and regulatory approvals will be obtained prior to proceeding with a reroute.

If the contaminant does not pose a health or safety concern and will not otherwise interfere with the Project, a plan for completing construction within the contaminated area will be prepared. Test pits or borings may be excavated within the right-of-way or aboveground facility site to assess the extent of the contamination. Depending on the nature and extent of the contaminated media, site-specific measures will be identified to complete construction across the contaminated area. These measures may include:

- storing excavated soil on a sheet of impervious plastic;
- avoiding water withdrawals from the trench;
- removing and properly disposing of contaminated media;
- replacing contaminated soil with clean backfill; and/or
- implementing staged withdrawal and disposal of standing trench water during backfilling to avoid overflow and runoff.

Contaminated soil will not be placed back in the trench unless approved by the appropriate regulatory agency and by WBI Energy in writing. Special construction plans developed for areas of contamination will be in compliance with environmental regulations, and approval of the plans by appropriate jurisdictional agencies will be obtained prior to implementation.

North Bakken Expansion Project

Plan of Development

APPENDIX J

Spill Prevention, Control, and Countermeasure Plan

WBI ENERGY TRANSMISSION, INC.

North Bakken Expansion Project

Plan of Development

Appendix J

Spill Prevention, Control, and Countermeasure Plan

September 2020

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT
SPILL PREVENTION, CONTROL, AND COUNTERMEASURE PLAN

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ACRONYMS AND ABBREVIATIONS

EI	Environmental Inspector
Project	North Bakken Expansion Project
SPCC Plan	Spill Prevention, Control, and Countermeasure Plan
WBI Energy	WBI Energy Transmission, Inc.

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT

1.0 INTRODUCTION

This Spill Prevention, Control, and Countermeasure Plan (SPCC Plan) was prepared for WBI Energy Transmission, Inc.'s (WBI Energy) proposed North Bakken Expansion Project (Project) to be implemented during construction of the Project. This SPCC Plan outlines specific preventive measures and practices to reduce the likelihood of an accidental release of a hazardous or regulated liquid and, in the event such a release occurs, to expedite the response to and remediation of the release.

This SPCC Plan restricts the location of fuel storage, fueling activities, and construction equipment maintenance along the construction right-of-way and provides procedures for these activities. Training and lines of communication to facilitate the prevention, response, containment, and cleanup of spills during construction activities are also described.

All contractor personnel working on the Project are responsible for implementation of the measures and procedures defined in this SPCC Plan. Contractors are expected to meet or exceed WBI Energy's standards for spill response, reporting, and cleanup. Contractors whose activities could result in a spill of fuel or other regulated or hazardous materials on the right-of-way will adopt the measures identified in this SPCC Plan. All measures outlined in this SPCC Plan are consistent with the applicable requirements of the Federal Energy Regulatory Commission's *Wetland and Waterbody Construction and Mitigation Procedures*.

1.1 TRAINING

Experienced, well-trained staff are essential for the successful implementation of the SPCC Plan. Contractors will provide spill prevention training as well as safety training to their work crews. The training program will be designed to improve awareness of safety requirements, pollution control laws, and proper operation and maintenance of equipment. Contractors will train all employees who handle fuels and other regulated substances to prevent spills and to quickly and effectively contain and clean up spills in accordance with applicable regulations and the provisions of this plan.

1.2 ROLES AND RESPONSIBILITIES

1.2.1 Spill Coordinator

Contractors will appoint a Spill Coordinator who will be responsible for coordinating Contractor Work Crews for spill cleanup, conducting site investigations, and assisting with completing spill reports. The Spill Coordinator will report all spills to an Environmental Inspector (EI). The Spill Coordinator will be responsible for completing WBI Energy's internal Spill Report Form as soon as possible but no later than the end of the work day that the spill occurred, regardless of the size of the spill. The Spill Report Form will be submitted to the WBI Energy Designated Representative.

Spill Coordinator:	[To Be Determined Prior to Construction]
Phone Number:	[To Be Determined Prior to Construction]

1.2.2 Contractor Work Crews

Contractor Work Crews will comply with this SPCC Plan and will notify the Spill Coordinator immediately of any spill of fuel or other regulated or hazardous material, regardless of the volume of the spill. Contractor Work Crews will assist with the cleanup of the spill as directed by the Spill Coordinator, if trained to do so.

1.2.3 Environmental Inspectors

The EIs will monitor the Contractors' compliance with the provisions of the SPCC Plan to ensure that spill resources are allocated and cleanup accomplished in accordance with this plan and any applicable regulatory requirements. The EIs will work in conjunction with WBI Energy's Designated Representative to promptly report spills to appropriate federal, state, and local agencies, as required, and to coordinate with these agencies regarding contacting additional parties or agencies.

Environmental Inspector:	[To Be Determined Prior to Construction]
Phone Number:	[To Be Determined Prior to Construction]

1.2.4 WBI Energy's Designated Representative

The Designated Representative has the authority to commit resources to implement this SPCC Plan. The Designated Representative will work in conjunction with the EIs to promptly report spills to appropriate federal, state, and local agencies.

ALL SPILLS, REGARDLESS OF SIZE, MUST BE REPORTED TO THE SPILL COORDINATOR AND ENVIRONMENTAL INSPECTORS

2.0 PREVENTATIVE MEASURES

Contractors will minimize the potential for a spill during construction activities at WBI Energy's facilities and on its right-of-way by implementing appropriate measures to prevent and contain spills. Equipment and materials will be located on site to meet the provisions of this SPCC Plan. The Contractor shall supply each construction crew with a quantity of absorbent and barrier materials sufficient to contain and recover spills that could potentially occur from the equipment with the largest on-board volume of fuel and lubricant. These materials may include, but are not limited to, drip pans, buckets, absorbent pads, containment booms, straw bales, absorbent clay, saw dust, floor drying agents, spill containment barriers, plastic sheeting, skimmer pumps, covered holding tanks, and fire extinguishers.

The Contractor shall make known to all construction personnel the locations of staging areas where spill response equipment and materials are stored, and have them readily accessible during construction. Contractors will comply with applicable environmental and safety laws and regulations and will ensure that a copy of this plan is available on site to all Construction Work Crew members.

In addition, periodic discussions between construction personnel and their supervisors must be held. These are conversations where problems in field operations are discussed and solved. This SPCC Plan, together with specific techniques, will be reviewed with the appropriate employees at a safety meeting before construction starts.

The contractor will provide, maintain, and make available the appropriate Safety Data Sheets for vehicle and equipment fuel, lubricating oil, and any other regulated or hazardous materials utilized for the Project.

The following sections describe spill prevention measures to be taken on Project locations.

2.1 PETROLEUM AND HAZARDOUS LIQUID STORAGE, REFUELING, AND EQUIPMENT MAINTENANCE

2.1.1 Staging Areas and Facility Sites:

- Contractors will construct temporary liners and seamless impermeable berms, or other appropriate containment, around aboveground storage containers so that liquids will be contained and collected in specified areas isolated from waterbodies in the event of a leak or spill. Storage containers will not be placed in areas subject to periodic flooding and washout.

- Contractors will visually inspect aboveground storage containers for leaks and spills frequently and whenever containers are refilled.

- Secondary containment structures must provide a containment volume equal to a minimum of 110 percent of the maximum storage volume of the largest storage container in the containment structure.

- Secondary containment structures must be constructed so that no outlet is provided and any spill will be contained within the containment structure. Accumulated rainwater may be removed if authorized by an EI. Accumulated water with a visible sheen will be collected for proper storage, transport and disposal.

- Contractors will remove all secondary containment structures at the conclusion of the Project. Contractors also will be responsible for returning any storage impoundment areas to original contours and appearance upon completion of the Project.

- Fuels and lubricants will be stored only at designated staging areas and in appropriate service vehicles. The storage areas will be located at least 100 feet away from edges of wetlands and waterbodies, at least 100 feet away from designated municipal watershed areas, at least 200 feet away from private water supply wells, and at least 400 feet away from municipal water-supply wells unless a larger buffer is required by regulatory agencies.

- Storage containers will display labels that identify the contents of the container and whether the contents are hazardous. Contractors will maintain and provide to WBI Energy, when requested, copies of all Safety Data Sheets.

- Contractors will conduct routine equipment maintenance such as oil changes in staging areas, or as necessary in additional temporary workspace, and will dispose of waste oil in an appropriate manner (e.g. the Contractors will collect the waste oil in labeled, sealed containers and transport the waste oil to a recycling facility).

- Contractors will correct visible leaks in storage containers as soon as possible. Leaks outside of secondary containment, regardless of volume, will be reported to an EI.

- All fuel nozzles will be equipped with functional automatic shut-off valves.

- The drivers of tank trucks will be responsible for spill prevention and secondary containment during loading and unloading operations. Procedures for loading and unloading tank trucks will meet the minimum requirements established by applicable regulations. Drivers will observe and control the fueling operations at all times to prevent overfilling. Contractors will be responsible for training drivers of tank trucks to comply with these provisions.

- Prior to departure of any tank truck, all outlets of the vehicle will be closely examined by the driver for leakage and tightened, adjusted, or replaced, as necessary, to prevent liquid leakage while in transit. Contractors will be responsible for training drivers of tank trucks to comply with these provisions.

2.1.2 Project Right-of-Way

- All machinery will arrive on the right-of-way in a clean, washed condition, and free of fluid leaks.

- Contractors will wash, refuel, and service machinery at locations well away from any wetlands and waterbodies to prevent petroleum or chemical substances from entering surface waters.

- Overnight parking of equipment, as well as refueling and lubricating of construction equipment, will be restricted to upland areas at least 100 feet away from stream channels and wetlands, at least 200 feet from private water-supply wells, and at least 400 feet from municipal water-supply wells. Where this is not possible, and where an EI finds in advance no reasonable alternative, the equipment will be fueled by designated personnel with specific training in refueling, spill containment, and cleanup, under the supervision of an EI. Prior to refueling, appropriate steps will be taken (including deployment of secondary containment structures) to prevent spills and provide for prompt cleanup in the event of a spill.

- Fuel trucks transporting fuels to construction areas will only travel on approved access roads.

- Contractors will keep a spill kit on site in case of machinery leaks or spills.

2.1.3 Restricted Refueling Areas

Restricted refueling areas include areas where the appropriate buffer (e.g., 100 feet from a wetland or waterbody) cannot be maintained. All restricted refueling areas will be identified in the field with flagging or signs. A site-specific plan and written approval from an EI will be required to refuel in restricted areas.

- Approval must be received from an EI and, where necessary, appropriate regulatory permits must be obtained, prior to refueling in restricted refueling areas.

- In large wetlands where no upland site is available for refueling, auxiliary fuel tanks may be mounted to equipment to minimize the need for refueling.

- Trained personnel must be available for refueling, and an EI must be present unless a case-specific exemption is obtained in writing from WBI Energy's Designated Representative.

- Equipment such as large, stationary pumps will be fitted with auxiliary tanks as appropriate. The auxiliary tanks will be placed within secondary containment which provides for a containment volume equal to a minimum of 110 percent of the volume of the largest tank in the containment structure.

- Refueling within restricted refueling areas will take place only in areas designated by an EI. Fuel trucks with a capacity in excess of 300 gallons will not be allowed within a restricted refueling area unless adequate secondary containment is provided.

- Refueling of dewatering pumps, generators, and other small, portable equipment will be performed using approved containers with a maximum volume of 5 gallons.

- Fuel trucks will be prohibited from traveling on temporary equipment bridges at stream crossings. An EI may waive this restriction on a site-specific basis if a reasonable refueling option is not available. Such case-specific exemptions must be approved in writing by WBI Energy's Designated Representative.

2.2 SPILL RESPONSE EQUIPMENT

2.2.1 Staging Areas and Facility Sites

- Contractors will stock a sufficient supply of sorbent and barrier materials at construction staging areas to allow the rapid containment and recovery of spilled material. Sorbent and barrier materials will also be used to contain runoff from spill areas.

- Shovels and labeled drums will be kept at each of the individual staging areas. If small quantities of soil become contaminated within the staging area, they will be collected and placed in the drums. Large quantities of contaminated soil will be

collected using heavy equipment and will be stored in drums, lined bermed areas, or other suitable containment, prior to disposal. The Contractors will dispose of all contaminated soil in accordance with applicable state and federal regulations.

2.2.2 Project Right-of-Way

- Each construction crew must have adequate absorbent materials and containment booms on hand to enable the rapid and complete cleanup of spills, as well as sufficient tools and materials to stop leaks.

- Contractors must maintain spill kits containing a sufficient quantity of absorbent and barrier materials to adequately contain and recover foreseeable spills. These kits may include, but are not limited to, absorbent pads, straw bales, absorbent clay, saw dust, floor drying agents, spill containment barriers, plastic sheeting, skimmer pumps, and drums. The equipment will be located near fuel storage areas and other locations as necessary to be readily available in the event of a spill.

- All fuel, and where possible, service trucks, will carry adequate spill response materials. Spill response materials present on trucks should consist of absorbent pads, absorbent material, plastic bags, and a shovel.

- The Spill Coordinator will inform an EI, and all Contractor personnel of the location of spill control equipment and materials, and have them readily accessible while construction activities are occurring.

2.3 CONCRETE COATING

Concrete coating activities will not be performed within 100 feet of a wetland or waterbody unless the location is an existing industrial site designated for such use.

3.0 STORAGE, CONTAINMENT AND FACILITY TRANSFER

All chemical storage containers, tanks, or barrels will be made of compatible materials with the appropriate temperature and pressure rating, overpressure protection, valving, and equalization lines necessary to comply with the appropriate state and federal regulations regarding storage of regulated substances. All chemicals, regardless of container size, will be stored in secondary containment or designated storage areas when not actively in use.

Fuel valves used for the final control of flow shall be of the self-closing type and shall be manually held open except were automatic means are provided for shutting off the flow when the vehicle is full.

Contaminated liquids inside containment areas will not be allowed to be drained outside the containment structures onto the ground or into any open water course. These liquids will be pumped or wiped out of containment structures and disposed of appropriately.

4.0 SPILL RESPONSE

Any employee who detects a spill incident while it is occurring should take the necessary measures to stop the flow but only if that employee has been trained to do so. If the employee is unprepared to effectively control the spill, caution and good judgment should be used as to personal safety until a cleanup crew arrives. Immediate containment by the discovering person can reduce the extent of the spill damage.

4.1 FIRST PRIORITIES

The first priorities after discovering a spill are to protect the safety of personnel and the public, minimize damage to the environment, and control costs associated with cleanup and reclamation. Actions to be taken immediately following a spill include the following:

1. Assess the safety of the situation (including the surrounding public).
2. Sources of ignition will be removed from the area, **if safe to do so**.
3. The source of the spill will be shut off, **if safe to do so**.
4. Efforts to contain the spill immediately will be initiated, **if safe to do so**.

Cleanup activities will be initiated as soon as possible after the spill is contained using properly trained and protected personnel with adequate spill cleanup materials and equipment.

5.0 SPILL REPORTING

All spills will be reported immediately to the Spill Coordinator who will in turn work with an EI and WBI Energy's Designated Representative to address and report the spill as necessary. The Spill Coordinator will record at a minimum the following information (found on the Spill Report Form in appendix A):

1. Date, time, and location of the spill.
2. Type of material spilled.
3. Amount of material spilled.
4. Extent of spill area.
5. Whether the material has reached or has the potential to reach a waterbody.
6. Status of spill containment and cleanup.
7. Circumstances leading up to the spill.

WBI Energy's Designated Representative will report the spill to the appropriate regulatory agencies if the spill meets or exceeds a reportable threshold. Appropriate agencies include, but may not be limited to, the following:

1. North Dakota Department of Health at 1-701-328-5210 for non-emergencies or North Dakota Department of Emergency Services at 1-800-472-2121 (24 hour hotline) for emergencies. The North Dakota Department of Health also requires completion of an online "General Environmental Incident" form available at http://www.ndhealth.gov/ehs/eir/eirform.htm for any spill of any volume.

2. National Spill Response Center (Washington D.C.) at 1-800-424-8802 (24 hours).

3. U.S. Army Corp of Engineers – Jeremy Thury (701-654-7761) and Reece Nelson (402-995-2505) for any spills occurring on U.S. Army Corp of Engineers owned land.

4. U.S. Forest Service Little Missouri National Grasslands– McKenzie Ranger District (701-842-8500) Cale Bickerdyke or Kim Grotte for any spills occurring on U.S Forest Service owned land.

Contractors are responsible for assisting WBI Energy with preparing follow-up written incident reports to regulatory agencies upon request and with accommodating any inspections performed by regulatory agencies.

WBI Energy's internal Spill Report Form will be completed by the Spill Coordinator and provided to WBI Energy's Designated Representative as soon as possible but no later than the end of the day on the day the spill event occurred so agencies can be notified in a timely manner and pertinent information is available for reporting. State and federal agencies must be notified within 24 hours of a reportable spill event. Field personnel will report the spill to the state and federal agencies only if the WBI Energy's Designated Representative is unavailable to do so. All Spill Report Forms and other reporting documentation will be kept on file by WBI Energy's Designated Representative.

6.0 SPILL CONTROL AND CLEANUP

Spill control should only be done by employees trained and prepared to effectively control the spill. Good judgment should be made by employees as to their personal role in the containment actions; however, prompt action can often prevent extensive spill damage. Employees engaged in spill control will use the proper precautions and safety equipment as specified in the Safety Data Sheet(s). The Designated Representative and EI will devise a cleanup plan, as necessary, based on location, quantity, and type of substance spilled.

Upon learning of the spill, the Spill Coordinator will implement the measures in the following sections.

6.1 LAND SPILL

- As necessary, berms will be constructed with available equipment to physically contain the spill and sorbent materials will be applied to the spill area. Traffic on contaminated soils will be minimized.

- Contaminated soils and vegetation will be removed and disposed of at a licensed waste disposal facility.

- Waste materials from the spill will be disposed of according to state and federal regulatory requirements.

- The following information will be provided to the EI and the WBI Energy Designated Representative:

    - The amount of spilled material that was recovered during cleanup.

- Proposed reclamation of remaining contaminated areas.
- Storage method for the contaminated waste material before transport and disposal.
- Transport and disposal documentation for the contaminated waste material.

6.2 WETLAND AND WATERBODY SPILL

Regardless of size, the following conditions apply if a spill occurs near or into a stream, wetland, or an open surface water source.

- For spills in standing water, floating booms, skimmer pumps, and holding tanks shall be used as appropriate by the contractor to recover and contain released materials on the surface of the water.
- For a spill threatening a waterbody, berms and/or trenches will be constructed to contain the spill before it reaches the waterbody. Deployment of booms, sorbent materials, and skimmers may be necessary if the spill reaches the water. The spilled product will be collected and the affected area cleaned up in accordance with appropriate state or federal regulations.
- Contaminated soils in wetlands must be excavated from the wetland. The soils must be placed on and covered by plastic sheeting in approved containment areas a minimum of 100 feet away from wetlands or waterbodies. Contaminated soil will be disposed of as soon as possible in accordance with appropriate state or federal regulations.

All cleanup activities will be conducted according to this SPCC Plan. Personnel involved in cleanup activities will meet the minimum requirements for hazardous materials training and will use approved Occupational Safety and Health Administration safety equipment.

WBI Energy's contractor responsible for the HDD has also developed an activity-specific SPCC plan for the HDD of Lake Sakakawea. In event of a spill or inadvertent release of drilling fluid during the HDD crossing of Lake Sakakawea, the SPCC plan included as Appendix B will be implemented.

NORTH BAKKEN EXPANSION PROJECT
Spill Prevention, Control, and Countermeasure Plan

APPENDIX A
Spill Report Form

WBI Energy Transmission, Inc. Spill Report Form		
Date of Spill:	Date of Spill Discovery:	
Time of Spill:	Time of Spill Discovery:	
Name and Title of Discoverer:		
Type of material spilled and manufacturer's name:		
Legal description of spill location to the quarter section:		
Directions to nearest community:		
Estimated volume of spill (gallons):		
Weather conditions:		
Topography and surface conditions of spill site:		
Spill medium (pavement, sandy soil, water, etc.)		
Proximity of spill to surface waters:		
Did the spill reach a waterbody?	Yes	No
If so, was a sheen present?	Yes	No
Describe the causes and circumstances of the spill:		
Describe the extent of observed contamination, both horizontal and vertical (i.e., spill-stained soil in a 5-foot radius to a depth of 1 inch):		
Describe immediate spill control and/or cleanup methods used and implementation schedule:		
Current status of cleanup actions:		
Name and Company of:		
Construction Superintendent:		
Spill Coordinator:		
Environmental Inspector:		
Person who reported spill:		
Form completed by:	Date:	

NORTH BAKKEN EXPANSION PROJECT
Spill Prevention, Control, and Countermeasure Plan

APPENDIX B
Michels SPCC Plan

SPILL PREVENTION/CONTROL/ COUNTERMEASURE PLAN (SPCC)

For HDD - Crossings

A DIVISION OF MICHELS CORPORATION

DIRECTIONAL DRILLED CROSSINGS

Revision 1
August 4, 2020

MICHELS DIRECTIONAL CROSSINGS
A DIVISION OF MICHELS CORPORATION

SPILL PREVENTION CONTROL AND COUNTERMEASURE PLAN (SPCC)

HORIZONTAL DIRECTIONAL DRILLING

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Attachment C Petroleum and Hazardous Material Spill Report

Attachment D Emergency Response/Hospital Location

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I. Introduction

This Spill Prevention Control and Countermeasure Plans (SPCC) have been developed by Michels Corporation (Michels) to serve as a guideline for horizontal directional drilling (HDD) operations. This plan is intended to ensure that the equipment utilized to perform the work and the fuel, oil, and lubricant products used in the day to day operation of the equipment will have no long-term adverse environmental impact on the staging areas required for construction. The guidelines contained in this plan will be implemented by field personnel to prevent accidental releases of hazardous material to the environment and to outline measures taken should an accidental release occur. The drilling project manager for the project is experienced in these matters and is typically the designated Spill Coordinator for Michels.

This SPCC plan was developed using Federal Energy Regulatory Commission (FERC) guidelines for construction activities along a pipeline right-of-way. This plan is intended to comply with all applicable requirements of FERC and local State and County authorities. Since HDD operations are generally confined to two distinct locations, the rig (entry) side and pipe (exit) side, this SPCC plan addresses construction operations at these specific locations only for hazardous materials. This SPCC plan consists of three sections:

- Preventative measures to be taken prior to initiating construction with hazardous materials;
- Preventative procedures to be followed while using hazardous materials during construction;
- Procedures to be implemented should an accidental spill of hazardous material occur;

II. Pre-Construction Hazardous Material Spill Prevention

Prior to construction, all Michels' personnel who will be performing work on site will have attended a FERC-approved environmental training program within the last year. This training program will serve to indoctrinate the personnel and make them aware of the pollution control laws, rules, and regulations applicable to the pipeline right-of-ways. Michels' personnel are highly experienced with the equipment to be used in HDD operations and have worked on numerous FERC governed projects in the past. However all personnel will be refreshed by the project manager and drill superintendent in the operation and maintenance of construction equipment to prevent the accidental discharge or spill of fuel, oil, or lubricants.

Through the environmental training program and the project manager's guidance along with knowledge obtained from past experience, all Michels' personnel will be thoroughly educated on the following topics:

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- Precautionary measures to prevent spills;
- Potential sources of spills, such as equipment failure or malfunction and re-fueling procedures;
- Standard operating procedures in case of a spill, including applicable notification requirements;
- Equipment, Materials, and Supplies available for clean-up of a spill;
- Review of known spill events, if any.

Prior to mobilizing equipment to the proposed alignment R.O.W., Michels will thoroughly inspect and if necessary repair or replace equipment components that could potentially leak hazardous material. The equipment will be cleaned of any debris or material observed to be hazardous. All hazardous material storage containers and secondary containment devices will be inspected and if necessary repaired or replaced.

The spill containment and clean-up materials used by Michels will be inventoried and if necessary re-stocked prior to initiating construction operations. At a minimum, the following spill containment and clean-up materials will be located in a central location at each side of the HDD crossings where equipment is in use or hazardous materials are stored in sufficient quantities to contain and clean-up a spill or release should one occur:

- Spill containment kits typically consisting of the following items
  - 1 x 55 gal poly drum
  - 50 x 18” x 18” absorbent pads
  - 8 x 3” x 4’ absorbent socks
  - 6 x 18” x 18” absorbent pillows
  - 3 x 5” x 10’ absorbent booms
  - 4 Disposable plastic bags with ties
  - 4 pair nitrile gloves
- Plastic sheeting
- Floor Dry absorbent material (50 pound bag-typical)
- Personal protective equipment (i.e. gloves and safety glasses)
- Replacement parts and equipment for repair of tanks, hoses, nozzles, etc.
- Equipment and tools to divert spilled fluids and create earthen barriers

III. HDD Construction Operations Hazardous Material Spill Prevention

Once construction activities for the HDD are underway, hazardous material spill prevention will be a continuous element of the operations. During equipment set up, potential sources of hazardous material releases, i.e. fuel tanks, hydraulic oil tanks and hoses, antifreeze tanks, and lubricant storage bins will be located as far away as practicably possible from streams, wetlands, and drainage ways. If necessary, and if practicable, temporary barriers may be constructed or placed between the potential sources of spills and areas identified as extremely sensitive to accidental

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spills. Spill containment and clean-up materials/kits will be located in a central location at each side of the drill site location where equipment is in operation or hazardous materials are stored and all personnel will be made aware of the location.

Secondary containment devices will be placed to enclose major sources of potential hazardous spill locations (i.e. fuel storage tanks and hazardous materials storage areas). A site layout drawing for entry locations and exit locations showing the placement of significant sources of hazardous material releases and secondary containment measures are attached in **Appendix A** of this plan. The exact location of the equipment will vary to address specific site conditions after the temporary work space has been prepared for equipment set-up. Access to the sites will be limited by the Project Manager to only authorized personnel and visitors.

During construction, spill refresher briefings will be scheduled quarterly and conducted by Michels. The briefings will refresh Michels' personnel on the topics covered during the pre-construction environmental training as well as review operations to date, including any accidental spills that may have occurred and measures taken for prevention of future spills.

Michels will store, handle and transfer hazardous materials used during HDD operations in a manner to prevent accidental releases or spills of these materials. **Table-1** attached in **Appendix-A** to this plan summarizes the hazardous materials, combined expected volumes, and storage methods for both the entry and exit locations. The Material Safety Data Sheets (MSDS) for every product used by Michels are maintained on file in the drilling survey trailer on site should they be required to assess the hazard potential of a spill. The list of primary hazardous materials (petroleum-based products) to be used by Michels over the course of each HDD crossing is as follows:

- Gasoline
- Diesel Fuel
- Hydraulic Oil
- Lubricants
- Penetrating Oils
- Antifreeze

Michels' personnel will follow specific guidelines set forth in this plan during operation and maintenance of equipment and vehicles used in support of the HDD operations. All waste oil or fuel collected during routine maintenance of the equipment will be contained and disposed of in accordance with state and federal requirements.

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IV. Potential Sources of Hazardous Spill-Preventative Measures to be Implemented

For day to day operations, Michels' personnel will follow these guidelines to prevent the accidental release or spill of hazardous materials:

Potential Source of Hazardous Spill	Preventative Measures To be Implemented
Fuel stored in a storage tank	• Except as specified in **Attachment-A** of Appendix-B, locate storage tank at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. • Install secondary containment devices around tank in excess of 150% of the maximum volume to be stored. • Inspect tank and secondary containment daily and before filling, implement corrective action upon discovery of deterioration that could cause a spill or result in a leak. Record inspection results weekly on log attached in the appendix to this plan. • Remove any precipitation found within the secondary containment. Prior to removing the precipitation, inspect for film, sheen, discoloration, sludge, emulsion or tarry residue, if present then collect the liquid for disposal. Do not discharge to land or surface waters. • Plug or close all tank openings when not in use. • Maintain sufficient quantities of spill control and clean-up materials in a central location near the storage tank, inspect supply daily. • Provide security measures to protect against vandalism of stored materials
Liquid material stored in a container	• Except as specified in **Attachment-A** of Appendix-B, store container at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. • If practicable and if room allows, store containers in a central location within a common secondary containment device. All significant container storage (i.e. greater than 5 gallon) will have secondary containment in excess of 150% of the maximum volume proposed to be stored. • Use small containers which are in good condition (maximum 55 gallon drum). • Take measures to protect the containers from the elements or physical damage. • Inspect containers daily, replace immediately if damaged or leaking. Record inspection results weekly on log attached in **Attachment-B** of Appendix-B to this plan • Close containers when not in use. • Maintain sufficient quantities of spill control and clean-up materials in a central location where the containers are regularly used, inspect supply daily. • Provide security measures to protect against vandalism of stored materials

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Liquid material transferred from a storage tank or container to vehicles or equipment	• Except as specified in **Attachment-A** of Appendix-B**,** transfer materials at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. Exercise extreme caution for transfers in areas where set-back distances from sensitive areas cannot be met such as placement of absorbent pads or drip pans beneath transfer points, creating temporary earthen berms, or other similar precautionary spill measures. • Transfer during daylight hours or where lighting is adequate to illuminate the area. • Monitor transfer operations at all times. • Maintain sufficient quantities of spill control and clean-up materials in a central location where transfers regularly occur, inspect supply daily. • Provide security measures to protect against vandalism of stored materials

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Liquid material used in vehicles and equipment	• Except as specified in **Attachment-A** of Appendix-B, park at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. • Inspect daily for leaks or signs of deterioration that could result in a leak. • Repair or replace defective tanks, hoses, fittings, etc. • Maintain sufficient quantities of spill control and clean-up materials in a central location where equipment or vehicles are in use, inspect supply daily. • Provide security measures to protect against vandalism of stored materials

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Liquid material transferred from tank vehicle to vehicles & equipment	• Except as specified in **Attachment A** of Appendix-B, tank vehicle used during re-fueling operations shall be specifically designed for supplying fuel to vehicle or equipment tanks and will comply with the requirements of NFPA 385 and other applicable state and federal requirements. • Tank vehicle and its equipment shall be maintained in good repair. • Drivers to be thoroughly trained in the proper method and operation of tank vehicles and in acceptable unloading procedures. • The driver or operator will not leave vehicle unattended during re-fueling operations • All engines to be shut off and operators not on the equipment during refueling operations. • Smoking is to be forbidden on or near any vehicle involved in re-fueling operations. Extreme precaution shall be exercised to prevent people in the vicinity from smoking, lighting matches, or carrying any flame or lighted device. Signs prohibiting smoking or open flames to be prominently displayed in open view on the tank vehicle. • Re-fueling procedures will not be initiated until precautions have been taken to prevent the motion of vehicles involved. Parking brakes to be utilized if available. • Length of refueling hose is typically limited to 50-feet from the hose reel. Tank vehicle to be positioned with respect to vehicles being fueled in order to prevent unwanted traffic between the tank vehicle and vehicle/equipment being fueled. • Each vehicle must contain one portable fire extinguisher that has a minimum rating of 4A, or 4-B,C. Ratings to be in accordance with NFPA-10. Signage on vehicles shall clearly indicate location of fire extinguisher. • Fueling/Re-fueling operations should typically take place during daylight hours. Nighttime fueling operations conducted in adequately lighted areas. • Documentation of training to be made available upon request. • Provide security measures to protect against vandalism of stored materials

Should these guidelines prove to be inadequate to prevent the accidental release or spill of hazardous material, they will be revised and implemented as required to ensure that every possible preventative effort is being taken. All personnel will be made aware of any such revisions at the time of the revision and at the environmental refresher meetings.

V. HDD Construction Operations Hazardous Material Spill Procedures

A spill is an unintentional release of hazardous material to the environment. In the unlikely event that an inadvertent spill of a hazardous material occurs the following steps will be followed at a minimum:

- Step 1 - Containment: Assess the situation prior to attempting to control the spill. Secure the spill scene and attempt to identify and stop the source of spill and

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contain at source. Limit access to the site in order to prevent/limit personal and/or property damage. Responders must have knowledge of the spilled material and immediately utilize all available resources (i.e. equipment, personnel, and materials), to contain spill. If adequate resources are not available, expedite mobilization of additional resources from other construction activities as required to fully contain the spill. If the spill cannot be adequately handled by additional resources, Michels will arrange for an approved spill response contractor to mobilize to the site and contain, clean up, and perform required sampling and disposal of spilled materials and residual contaminated debris.

- Step 2 - Remediation: Properly trained personnel shall clean up hazardous material immediately after spill is contained to prevent further migration of hazardous materials into the environment. Responders should consult with proper governmental resource agencies as required. In no case shall containment equipment be used to permanently store contaminated material. Containerize in DOT-approved containers, label, and remove all contaminated material from the construction area and dispose of material in accordance with applicable regulatory guidelines (i.e. transport to hazardous waste disposal facility by licensed waste hauler). The Owner will be provided with proper documentation showing that material was disposed of in a proper manner.

- Step 3 - Notification: Reporting requirements will depend on the quantity of spill. A spill constituting less than a significant spill event will be reported to Owner and/or Owner's representative Chief Inspector **(CI)-_____: ( ) - (office), or ( ) - (cell).**

  Significant spills are defined as: any amount of petroleum, oils, or lubricants discharged to a receiving stream that causes a film, sheen, or discoloration of surface water or adjoining shoreline; or any reportable quantity of hazardous material as defined by 40CFR320. If a significant spill should take place, Michels' Project Manager (PM), will notify the Prime Contractors' Project Manager and Owner's representative Chief Inspector **(CI)-_____( ) - (office), or ( ) - (cell)** of the spill as soon as he has confirmed that the spill has been completely contained. Michels' PM will assist the Owner's representative in submitting the regulatory-required information for hazardous spill notification in accordance with Governing Agency procedures. At the very minimum the project superintendent will provide the CI with the information required on the "Spill Report" included as **Attachment C** in Appendix C.

- Step 4 – Michels' Project Manager will be responsible for any applicable agency reporting requirements. The notification requirements for petroleum and hazardous materials spills are as follows:

  - Federal Contacts:
    National Spill Response Center 1-800-424-8802

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- State Contacts:
  State Department of Environmental
  Quality - Spill Notification ( ) - (Business Hours)
  ( ) - (After Hours)

- Local Contacts:
  Local Fire Department _____

- A completed Petroleum and Hazardous Materials Spill Report must be submitted to OWNER & Governmental Agencies within 48 hours.
- Prior to continuing work, Michels will determine the cause of the spill and implement measures to ensure that further spills will not occur.

A More detailed list of Local Emergency Response Personnel and Hospital Location will be attached and filled out as **Attachment D** in Appendix C.

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APPENDIX-A

TABLE I

HAZARDOUS SUBSTANCE INVENTORY

Material	Quantity (gallons)	Storage Location	Reportable Quantity (include reference)
Oil/Fuel:			
Unleaded Gasoline	**10 Gallons**	**5 Gallon DOT-Approved Re-fill able Cans - Storage Trailer**	
	80 Gallons	**Fuel Tank in Bed of Pick-Up Truck**	
Diesel Fuel	**120 Gallons**	**Fuel Tank in Bed of Pick-Up Truck**	
	500 Gallons	**Fuel Tank w/Secondary Containment on Site in excess of 150% of maximum volume**	
Motor Oil	**1 or 5 Gallons**	**Reinforced Plastic Container - Storage Trailer**	
Hydraulic Oil	**110-Gallons**	**Two 55-gallon drums w/Secondary Containment on Site in excess of 150% of maximum volume**	
Commercial Chemicals:			
Ethylene Glycol	**40-Gallons**	**1 or 5 Gallon Reinforced Plastic Containers - Storage Trailer**	
Hazardous Wastes:			

APPENDIX-B

Attachment A

The setbacks specified for refueling, fuel storage, and parking of equipment may not be practicable for certain construction activities, including horizontal directional drilling. Exceptions to the setback requirements may be allowed for:

- Areas where removing equipment from a wetland for servicing or overnight parking would increase adverse impacts to the wetland and/or result in significant construction delays;
- Construction sites where moving equipment to refueling stations from pre-fabricated equipment pads is impracticable or where there is a natural barrier from the water-body or wetland (i.e., dike, road or railroad);
- Locations where the water-body or wetland is located adjacent to a road crossing (from which the equipment can be serviced);
- Refueling and fuel storage for immobile equipment including, but not limited to, bending and boring machines, air compressors, padding machines, and hydro-test fill pumps.

ATTACHMENT B
WEEKLY HAZARDOUS MATERIALS/WASTE INSPECTION LOG

For each item listed below, Contractor will indicate whether existing conditions are acceptable (A) or unacceptable (U). Resolution of all unacceptable conditions must be documented. Contractor will inspect all storage facilities on a regular basis, but not less than weekly. Contractor will keep records of all inspections on file. Contractor will provide a coy of the completed form to the Chief Inspector and Environmental Inspector on a weekly basis.

I. STORAGE AREAS FOR FUELS, LUBRICANTS AND CHEMICALS

General

A/U

_____ Construction yard or storage areas secured

_____ National Fire Protection Association symbol posted in storage area or at yard entrance

_____ Storage areas properly prepared and signed

_____ Material Safety Data Sheets available

_____ Hazardous Materials Management Plan/Spill Prevention and Countermeasure Plan available

Hazardous Materials Management

A/U

_____ No evidence of spilled or leaking materials

_____ Incompatible materials separated

_____ All containers labeled properly

_____ All containers securely closed

_____ All containers upright

_____ No evidence of container bulging, damage, rust or corrosion

Secondary Containment Areas

A/U

_____ Containment berm intact and capable of holding 110% of material stored plus precipitation

_____ Lining intact

_____ No materials overhanging berms

_____ No materials stored on berms

_____ No flammable materials used for berms

Compressed Gases

A/U

_____ Cylinders labeled with contents

_____ Cylinders secured from falling

_____ Oxygen stored at least 25 feet away from fuel

_____ Cylinders in bulk storage are separated from incompatible materials by fire barriers or by appropriate distance

II. HAZARDOUS WASTE MANAGEMENT

Waste Container Storage

A/U

_____ No evidence of spilled or leaking wastes

_____ Adequate secondary containment for all wastes

_____ Separate containers for each waste stream—no piles

_____ Waste area not adjacent to combustibles or compressed gases

_____ All containers securely closed

_____ Bungs secured tightly

_____ Open-top drum hoops secured

_____ All containers upright

_____ No evidence of container bulging, corrosion

_____ No severe container damage or rust

_____ Containers are compatible with waste (e.g. plastic liner for corrosives, metal liner for solvents)

_____ No smoking and general danger/warning signs posted

Waste Container Labeling

A/U

_____ Containers properly labeled

_____ Name, address and EPA ID number or ID Number of generator listed (Not required if Contractor is an exempt small quantity generator.)

_____ Accumulation start date listed

_____ Storage start date listed

_____ Chemical and physical composition of waste listed

_____ Hazardous property listed

Nonhazardous Waste Areas

A/U

_____ No litter in yard

_____ No hazardous wastes or used oil mixed with trash (e.g., contaminated soil, oily rags, diapers, or other oily materials)

_____ Empty oil and aerosol containers for disposal are completely emptied

III. EMERGENCY RESPONSE EQUIPMENT

A/U

_____ Shovels

_____ Absorbent materials (booms, pads, pillows, socks, “Speedy Dry”

_____ Personal protective equipment (goggles, gloves)

_____ Fire-fighting equipment

_____ First aid supplies (e.g. medical supplies, squeeze bottle eye wash)

_____ DOT-approved containers

_____ Plastic sheeting, bags and ties

_____ Communication equipment

_____ Bung wrench (non-sparking)

(Required for all unacceptable conditions)

IV. CORRECTIVE ACTIONS TAKEN

_____

_____

_____

_____

_____

_____

_____

_____

_____

Date: _____ **Contractor Name :** _____

Inspected by (Contractor’s Inspector): _____

Signature: _____

APPENDIX-C

ATTACHMENT C

Petroleum and Hazardous Material Spill Report

Date of spill: _____ Incident No: _____ Date of spill discovery: _____

Time of spill: _____ Time of spill recovery: _____

Location Name: _____ Spread: _____ County: _____

Section: _____ Township: _____ Range: _____

Name and Title of Discoverer: _____

Type of material spilled and product name: _____

Manufacturer's Name: _____

Legal description of spill location: _____

Directions from nearest community: _____

_____

_____

Estimated volume of spill: _____ Estimated material recovered: _____

Weather Conditions: _____

Topography and surface conditions of spill site: _____

Spill medium (pavement, sandy soil, water, etc.): _____

Proximity of spill to surface waters or wetland: _____

Did the spill reach a water body? _____ Yes _____ No

If so, was a sheen present? _____ Yes _____ No

Direction and time of travel (if in stream): _____

Responsible party (name, phone number): _____

Describe the causes and circumstances resulting in the spill: _____

_____

_____

Describe the extent of observed contamination, both horizontal and vertical (i.e., spill-stained soil in a 5'' radius to a depth of 1"):

_____

_____

Resources and installations that may be affected: _____

_____

_____

Potential impact on human health: _____

Describe immediate spill control and/or cleanup methods used and implementation schedule: _____

Current status of cleanup actions: _____

Name/Company/Address/Phone Number for the following:

Construction Superintendent: _____

OWNER
Representative: _____

Environmental Director: _____

Person Who Reported the Spill: _____

Environmental Inspector: _____

On-Scene Agency Coordinator (where applicable): _____

Form completed by: _____ Date: _____

The Contractor must complete this for any petroleum or hazardous material spill regardless of size, and submit the form to OWNER or OWNER's designated representative for construction observation within 48 hours of the occurrence.

ATTACHMENT D
LOCAL Emergency RESPONSE PERSONNEL-HOSPITAL LOCATION

The contractor should provide a listing by municipality of the local emergency response organizations near the HDD project site, and the name and phone number of a contact person for each. For example, list fire and police departments, emergency management organizations, etc. The contractor should update and complete this information as required for his/her work locations. Additions will be made by the Project Manager once they become available prior to drilling operations.

Local Emergency Contacts

- Federal Contacts:

National Spill Response Center	1-800-424-8802
US Army Corps of Engineers	(402) 995-2505 office (785) 213-1507 cell

- State Contacts:

North Dakota Department of Emergency Services	(701) 328-8100 (24 hr.) (800) 773-3259 (toll free) (800) 472-2121 (Div. State Radio Notification)
North Dakota Department of Health	(701) 328-5210 (24 hr.)
North Dakota Oil & Gas Division	(701) 328-8020

- Local Contacts:

Emergency Response -	
Emergency Response -	
Local Fire Department	911
Local Police Department	911

- Nearest Hospital:

North Drill Site: **Tioga Medical Center** - Hospital
810 Welo St N
Tioga, ND 58852
(701) 664-3305

South Drill Site: **McKenzie County Healthcare Systems, Inc.** - Hospital
709 4th Ave NE
Watford City, ND 58854
(701) 842-3000

Other Phone Numbers to be added to this form if necessary.

NORTH BAKKEN EXPANSION PROJECT

Plan of Development

APPENDIX K

Noxious Weeds Management Plan

WBI ENERGY TRANSMISSION, INC.

North Bakken Expansion Project

Plan of Development

Appendix K

Noxious Weeds Management Plan

Final

September 2020

NORTH BAKKEN EXPANSION PROJECT
WBI ENERGY TRANSMISSION, INC.
NOXIOUS WEED MANAGEMENT PLAN

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Table 2-1 Designated Noxious Weed Species within the Project Area 2

LIST OF ATTACHMENTS

Attachment A Noxious Weeds Identified During Field Surveys

ACRONYMS AND ABBREVIATIONS

EI	Environmental Inspector
NDCC	North Dakota Century Code
Project	North Bakken Expansion Project
WBI Energy	WBI Energy Transmission, Inc.

1.0 INTRODUCTION

This *Noxious Weed Management Plan* was prepared for WBI Energy Transmission, Inc.'s (WBI Energy) proposed North Bakken Expansion Project (Project) to identify noxious weed control practices that will be implemented for the Project. Pursuant to North Dakota Century Code (NDCC) § 4.1-47, North Dakota Law requires that measures be taken to control the spread of noxious weeds. Noxious weeds have the potential to invade areas disturbed by construction and may spread along the cleared areas of the pipeline rights-of-way. Soil disturbance may also allow weed seed already present to germinate and grow.

Weeds are defined as plant species that grow out of place and are "competitive, persistent, and pernicious" (James et al., 1991). Noxious weeds are plant species designated by federal, state, or county governments as injurious to public health, agriculture, recreation, wildlife, or property (Sheley et al., 1999). Under NDCC § 4.1-47, 11 plant species have been designated as noxious weeds. In addition, North Dakota law allows county and city weed boards to develop lists of additional noxious weeds.

NDCC § 4.1-47 requires "every person to do all things necessary and proper to control the spread of noxious weeds." At the state and county levels, the State Agricultural Commissioner and County Weed Control Officer respectively, are responsible for the enforcement of the weed laws. Once a noxious weed problem has been identified, it is the responsibility of the landowner to control or rectify the problems. In addition, it is a Class B misdemeanor to willfully do the following:

- transport any material that contains noxious weed seeds or propagating parts on a public road in a manner that allows for the dissemination of noxious weeds;
- drive or transport any equipment on a public road in a manner that allows for the dissemination of noxious weeds; or
- dispose of any material that contains noxious weeds or propagating parts in a manner that allows for the dissemination of noxious weeds.

1.1 PLAN PURPOSE

The purpose of this plan is to prescribe methods to prevent and control the spread of noxious weeds (hereinafter referred to as weeds) during and following construction of the Project. WBI Energy and their contractors will be responsible for carrying out the methods described in this plan.

This plan is applicable to the installation of the pipelines and aboveground facilities within the temporary construction right-of-way, permanent operational right-of-way, staging areas, access roads, and other areas disturbed by the Project's construction activities.

1.2 GOALS AND OBJECTIVES

The goals of weed control are to implement preventative measures to eliminate the spread of weeds during construction of the pipelines and to implement prescribed treatments to eliminate, to the maximum extent possible, the invasion of weeds from surrounding lands. Monitoring during construction and operation of the Project will ensure that these goals are achieved.

2.0 WEED INVENTORY

WBI Energy identified the presence of noxious weeds in the right-of-way using field surveys (attachment A) and online research to identify existing weed infestations along the pipeline rights-of-way and adjacent extra workspaces, along new or improved access roads, and within aboveground facility locations where clearing will be required. Early identification of existing infestations is intended to help minimize the spread of weeds by identifying sites where preventive measures could be implemented. Information resulting from identification before, during, and after construction, including species identified within or adjacent to the Project area, locations of infestations, and extent of infestations will be kept on file by WBI Energy.

Table 2-1 lists the weeds that have the potential to occur within the four counties crossed by each Project's facilities (as identified on agency websites).

TABLE 2-1

North Bakken Expansion Project
Designated Noxious Weed Species within the Project Area

Noxious Weed Species	McKenzie County	Williams County	Burke County	Mountrail County
Absinth wormwood (*Artemisia absinthium L.*)	X			
Baby's breath (*Gypsophila paniculata*)	X			
Black Henbane (*Hyoscyamus niger L.*)	X			
Common tansy (*Tanacetum vulgare*)			X	X
Common burdock (*Arctium minus)*	X			
Canada thistle (C*irsium arvense (L.) Scop.*)	X			
Dalmatian toadflax (*Linaria genistifolia spp. dalmatica*)	X			
Diffuse knapweed (*Centaurea diffusa Lam.*)	X			
Halogeton (*Halogeton glomeratus*)	X			
Houndstongue (*Cynoglossum officinale L.*)	X			
Leafy spurge (*Euphorbia esula L.*)	X			
Musk thistle (*Carduus nutans L.*)	X			
Narrowleaf hawksbeard (*Crepis tectorum*)		X		
Palmer amaranth (*Amaranthus palmeri*)	X	X		
Purple loosestrife (*Lythrum salicaria L., Lythrum virgatum L., and all cultivars*)	X			
Russian knapweed (*Centaurea repens L.*)	X			
Saltcedar (*Tamarisk spp.*)	X			
Spotted knapweed (*Centaurea maculosa Lam.*)	X			
Yellow toadflax (*Linaria vulgaris*)	X			

3.0 WEED MANAGEMENT

Weeds are spread by a variety of means including pedestrian vectors (e.g., hiking, recreation, etc.), construction equipment, construction and reclamation materials, livestock, and wildlife. Implementation of preventative measures to control the spread of weeds is the most cost

effective management approach. WBI Energy will implement weed control management measures that are consistent with state and county regulations.

3.1 EDUCATION

WBI Energy and the Environmental Inspectors (EI) will provide information regarding weed identification, management, and impacts on agriculture, livestock, and wildlife to their employees prior to the commencement of construction. Critical information regarding the prevention of spreading weeds in areas not infested, controlling the proliferation of weeds already present, adhering to measures to prevent the spread of weeds (e.g., not driving off the cleared right-of-way, cleaning equipment that collects soil and plant seeds, and quickly identifying new infestations of weeds) will be provided to all personnel working on the Project.

3.2 PREVENTIVE MEASURES

The following preventive measures will be used to prevent the spread of weeds along the Project right-of-way and within aboveground facilities:

- Prior to construction, the EIs will mark areas of noxious weed infestation, including additional areas identified during preconstruction inspections, by using color-coded flagging, staking, and/or signs on the construction right-of-way to alert construction personnel to implement weed control measures during construction.

- All contractor equipment will arrive at the work site clean and weed-free. Prior to being allowed access to the right-of-way or aboveground facilities, verification that all equipment will be power or high-pressure air washed will be provided. In addition, all equipment leaving an area infested with noxious weeds will first be cleaned with an air compressor to limit the spread of noxious weed seeds and propagules.

- An EI or other designated personnel will ensure that equipment is free of soil and debris capable of transporting weed seeds, roots, or rhizomes.

- In the construction right-of-way, topsoil will be segregated and will not be mixed with spoil material before or during replacement. Once the disturbed areas have been de-compacted as needed, topsoil will be re-distributed over the entire disturbed area from which it was salvaged and re-contoured. Final revegetation will occur within the approved seeding window.

- The contractor will implement reclamation of disturbed lands following construction as outlined in the Federal Energy Regulatory Commission's *Upland Erosion Control, Revegetation, and Maintenance Plan* and *Wetland and Waterbody Construction and Mitigation Pro*cedures. Continuing revegetation efforts will ensure adequate vegetative cover to prevent the invasion of weeds.

- The contractor will ensure that straw bales, used on the Project for sediment barrier installations, or mulch, are certified weed-free.

- Equipment will not be sprayed with pre-emergent chemicals as a preventive measure as these chemicals target a wide range of vegetation. As a result, the use of such chemicals could affect the success of revegetation efforts.

3.3 TREATMENT METHODS

Weed controls will be used in accordance with existing regulations and landowner or agency agreements.

Prior to clearing and grading operations, pre-treatment of noxious weed infestations may be conducted if it is determined that pre-treatment will aid in controlling the spread of weeds during construction. The weed control measures implemented at these locations may include the application of herbicide or mechanical measures. The weed control measure chosen will be the best method available for the time, location, and species of weed.

- Herbicide application is an effective means of reducing the size of weed populations. Herbicide application and handling methods are described in section 4.0 below.

- Mechanical methods such as mowing or disking are reliant on the use of equipment to disk or excavate weed populations. Because of the timing of the Project (late summer and fall construction), mechanical methods are not likely to be effective control methods. However, this method may be used during operation of the Project.

During construction, WBI Energy or their contractor will periodically monitor the Project right-of-way to allow for early detection of noxious weed species infestations. If such species are found in numbers that are significantly different from existing nearby off right-of-way locations, appropriate control measures will be implemented in an attempt to eradicate the identified weed infestations along the right-of-way and to reduce the spread or proliferation of weeds. Post-construction monitoring and control measures are discussed in section 5.0 below.

4.0 HERBICIDE APPLICATION, HANDLING, SPILLS, AND CLEANUP

Herbicide selection (if required) will be based on information gathered from local county weed control districts and/or the North Dakota Department of Agriculture.

4.1 HERBICIDE APPLICATION AND HANDLING

Prior to herbicide application, WBI Energy's contractor will obtain any required permits or approvals from the local weed district and landowner. The chemical application will be done by a licensed contractor in accordance with all applicable laws and regulations.

Herbicide label instructions and manufacturer's guidelines will be strictly adhered to. For example, manufacturer's guidelines recommend that herbicides only be applied under appropriate weather conditions (i.e., periods of low wind speeds, when precipitation is not imminent, etc.), that application sprayers be mounted low to the ground, and that sprayer booms incorporate specialized nozzles designed to produce large droplet sizes with limited drift potential. Adherence to these specifications and manufacturer label directions would minimize the potential for drift or transport of herbicides to off right-of-way areas.

Vehicle-mounted sprayers (e.g., handgun, boom, and injector) will be used primarily in open areas that are readily accessible by vehicle. Hand application methods (e.g., backpack spraying) that target individual plants will be used to treat small scattered weed populations in rough terrain. Calibration checks of equipment will be conducted at the beginning of spraying and periodically thereafter to ensure proper application rates are being achieved.

Herbicides will be transported daily to the Project site with the following provisions:

- Herbicides will be premixed and delivered in returnable/refillable containers and transferred by closed system to application tanks to limit worker and environmental exposure and eliminate the need for disposal of herbicide containers in area landfills.
- Herbicides will be transported in a manner that will prevent tipping or spilling.
- Mixing of surfactants or other additives with water or other carriers and refilling of containers will typically be conducted at road crossings, and no mixing or filling will occur within 100 feet of open or flowing water, wetlands, or other sensitive resources, greater than 200 feet from private wells, and greater than 400 feet from public wells.
- Mixing and application procedures will be supervised by a licensed commercial applicator, and monitoring will be conducted to ensure that proper mixing, application, cleanup, personal protection and safety procedures are followed.
- All herbicide equipment and containers will be inspected daily for leaks.

4.2 HERBICIDE SPILLS AND CLEANUP

WBI Energy has developed a *Spill Prevention, Control, and Countermeasure Plan* that incorporates reasonable precautions to be taken to avoid spills of potentially hazardous materials. In the event of a spill, cleanup will be immediate. Herbicide contractors will be responsible for keeping spill kits in their vehicles and in herbicide storage areas to allow for quick and effective response to spills.

Response to an herbicide spill will vary depending on the material spilled and the size/location of the spill. The order of priorities after discovering a spill are to protect the safety of personnel and the public, minimize damage to the environment, and conduct cleanup and remediation activities.

4.3 WORKER SAFETY AND SPILL REPORTING

Herbicide contractors will obtain and have readily available copies of the appropriate Safety Data Sheets and the product labels for the herbicides used. Herbicide spills will be reported in accordance with applicable laws and requirements. Further information regarding spill response and reporting is provided in the WBI Energy's *Spill Prevention, Control, and Countermeasure Plan*.

5.0 MONITORING AND OPERATION

Following construction, weed infestations will be monitored as part of the WBI Energy's restoration monitoring activities. WBI Energy's operations staff will monitor and treat noxious weeds as a part of its normal operations and maintenance activities in accordance with state regulations.

Weed control measures will be implemented at those locations where noxious weed populations are greater than the surrounding areas. WBI Energy may implement post-construction application of herbicides or mechanical measures to control noxious weeds. The weed control measure chosen will be the best method available for the time, location, and species of weed.

- Herbicide application is an effective means of reducing the size of weed populations. Herbicide application and handling methods are described in section 4.0 above.

- Mechanical methods such as mowing or disking are reliant on the use of equipment to disk or excavate weed populations. Mechanical treatments will be conducted prior to seed maturation if needed. In addition, subsequent reseeding will be conducted, if necessary, to re-establish a desirable vegetative cover that will stabilize the soils and slow the potential of reinvasion of noxious weeds.

- Where appropriate, WBI Energy will further consult with the county weed boards regarding the use of biological and other alternate noxious weed control methods. These may be implemented consultation with and approval of private landowners.

6.0 REFERENCES

James, L., J. Evans, M. Ralphs, and R. Child, editors.1991. Noxious Range Weeds. Westview Press. Boulder, CO.

Sheley, R., J. Petroff, M. Borman. 1999. Introduction to Biology and Management of Noxious Rangeland Weeds, Corvallis, OR.

NORTH BAKKEN EXPANSION PROJECT

Noxious Weeds Management Plan

ATTACHMENT A
Noxious Weeds Identified Within or Adjacent to Project Workspaces During Field Surveys

ATTACHMENT A

North Bakken Expansion Project
Noxious Weeds Identified Within or Adjacent to Project Workspaces During Field Surveys

Species	Route Identifier	Start Milepost	End Milepost [a]	Length [b] (feet)	Acres [c]
Absinth wormwood (*Artemisia absinthium L.*)	Line Section 25 Loop	19.3	19.3	179.8	0.1
Canada thistle (*Cirsium arvense* (*L.*) *Scop.*)	Schmidt Yard	NA	NA	NA	NA
	Tioga-Elkhorn Creek	40.9	NA	NA	NA
	Tioga-Elkhorn Creek	53.6	53.7	286.5	<0.1
	Tioga-Elkhorn Creek	62.4	NA	NA	NA
Leafy spurge (*Euphorbia esula L.*)	Boehm Staging Yard	NA	NA	NA	NA
	Bore #4	0.0	NA	NA	NA
	Bore #4	0.1	NA	NA	NA
	Bore #4	0.1	NA	NA	NA
	Line Section 25 Loop	5.0	5.0	53.9	<0.1
	Line Section 25 Loop	5.1	5.1	57.4	<0.1
	Line Section 25 Loop	5.1	5.1	NA	N/A
	Tioga Compressor Lateral	0.4	NA	NA	NA
	Tioga-Elkhorn Creek	0.4	NA	NA	NA
	Tioga-Elkhorn Creek	5.9	5.9	23.8	<0.1
	Tioga-Elkhorn Creek	16.9	NA	NA	NA
	Tioga-Elkhorn Creek	17.9	NA	NA	NA
	Tioga-Elkhorn Creek	19.1	19.3	954.1	2.0
	Tioga-Elkhorn Creek	51.5	NA	NA	NA
Purple loosestrife (*Lythrum salicaria* [*L.*, *Lythrum vigatum L.*], and all cultivars)	Line Section 25 Loop	4.7	NA	NA	NA
Russian knapweed (*Centaurea repens L.*)	Line Section 30 Loop	3.4	3.5	428.7	0.1

[a] Points were taken for many of these noxious weed locations; however, end mileposts were not recorded. Therefore, not applicable (NA) was recorded.

[b] Length (feet) of proposed pipeline centerlines crossed. NA = Not applicable as the distance was minimal.

[c] Points were taken for many of these noxious weed locations, and acreages were not calculated; therefore, not applicable (NA) was recorded.

NORTH BAKKEN EXPANSION PROJECT

Plan of Development

APPENDIX L

Biological Evaluation

Filed Under Separate Cover CUI/PRIV – Do Not Release

NORTH BAKKEN EXPANSION PROJECT

Plan of Development

APPENDIX M

Biological Assessment

Filed Under Separate Cover CUI/PRIV – Do Not Release

NORTH BAKKEN EXPANSION PROJECT

Plan of Development

APPENDIX N

Plan for Unanticipated Discovery of Historic Properties or Human Remains During Construction

WBI ENERGY TRANSMISSION, INC.

North Bakken Expansion Project

Plan of Development

Appendix N

Plan for Unanticipated Discovery of Historic Properties or Human Remains During Construction

Draft

September 2020

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT
PLAN FOR UNANTICIPATED DISCOVERY OF HISTORIC PROPERTIES OR HUMAN REMAINS DURING CONSTRUCTION

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Attachment A U.S. Army Corps of Engineers, Omaha District – Discovery of Human Remains

Attachment B U.S. Forest Service, Northern Region – Unanticipated Discovery Plan and Discovery of Human Remains Protocols

ACRONYMS AND ABBREVIATIONS

COE	U.S. Army Corps of Engineers
EI	Environmental Inspector
FERC	Federal Energy Regulatory Commission
Project	North Bakken Expansion Project
SHSND	State Historical Society of North Dakota
THPO	Tribal Historic Preservation Officer
USFS	U.S. Forest Service
WBI Energy	WBI Energy Transmission, Inc.

1.0 INTRODUCTION

This plan identifies procedures to be implemented in the event that previously unreported and unanticipated cultural materials, human remains, or paleontological remains are found during construction of WBI Energy Transmission, Inc.'s (WBI Energy) North Bakken Expansion Project (or Project).

2.0 TRAINING

Prior to the start of construction, WBI Energy will conduct environmental training, including instruction on the identification of cultural materials, unmarked burials, and human remains, for Company and Contractor personnel. WBI Energy also will provide large-group training sessions before each work crew commences construction with periodic follow-up training for groups of newly assigned personnel.

3.0 UNANTICIPATED DISCOVERY OF CULTURAL MATERIALS OR HUMAN REMAINS

The following measures will be implemented if known or suspected cultural materials, unmarked burials, or human remains are discovered during construction.

1. The Contractor will stop work in the area of the find (i.e., within 100 feet of the find or the outer perimeter of a group of finds) to protect the integrity of the find.

2. The Contractor will notify a WBI Energy Environmental Inspector (EI) of the find. The Contractor will not restart work in the area of the find until approved by an EI.

3. The EI will notify WBI Energy's Designated Representative, who will coordinate with WBI Energy's Archaeological Consultant to conduct a preliminary assessment of the find.

    a. If the find occurs on lands owned by the U.S. Army Corps of Engineers (COE), WBI Energy's Designated Representative will call the Omaha District Hotline and follow their directions. See attachment A for instructions on responding to unanticipated finds of human remains on COE lands in the Omaha District.

    b. If the find occurs on lands owned by the U.S. Forest Service (USFS), WBI Energy's Designated Representative will notify the USFS of the find by telephone and follow their directions. See attachment B for instructions on responding to finds of unanticipated cultural resources or human remains on USFS lands.

4. Following the investigation, the Archaeological Consultant will notify WBI Energy's Designated Representative by telephone regarding the preliminary assessment of the find.

5. WBI Energy's Designated Representative will notify the Federal Energy Regulatory Commission (FERC), State Historical Society of North Dakota (SHSND), COE (for finds on COE lands), USFS (for finds on USFS lands), and

federally recognized Indian tribes (as appropriate) by telephone regarding the preliminary evaluation of the find.

6. If the materials found are cultural materials (e.g., artifacts or archaeological features), the procedures in section 4.0 will be implemented. If the materials found are human remains, the procedures in section 5.0 will be implemented.

4.0 DISCOVERY OF CULTURAL MATERIALS

1. The EI will flag or fence off the site (including the area within 100 feet of the find or the outer perimeter of a group of finds).

2. WBI Energy's Designated Representative will direct the Archaeological Consultant to begin an assessment of the significance of the find and the potential effect of construction on the site.

3. The Archaeological Consultant will assess and document the find within 2 days of its discovery.

4. If the Archaeological Consultant determines the find is not significant, and the FERC, SHSND, COE (for finds on COE lands), USFS (for finds on USFS lands), and any consulting federally recognized Indian tribes concur, the Archaeological Consultant will notify WBI Energy's Designated Representative that construction may proceed across the find without additional action. The Archaeological Consultant will prepare a brief report on the find for submittal to the FERC, SHSND, COE (for finds on COE lands), USFS (for finds on USFS lands), and any consulting federally recognized Indian tribes within 7 days of discovery of the find.

5. If the Archaeological Consultant determines that the find may be significant, and the FERC, SHSND, COE (for finds on COE lands), USFS (for finds on USFS lands), and any consulting federally recognized Indian tribes concur, then the following additional steps will be implemented.

6. WBI Energy's Designated Representative will notify other parties of the find as directed by the FERC, SHSND, COE (for finds on COE lands), and/or USFS (for finds on USFS lands).

7. If the find is determined to be significant and continuing construction may damage more of the find, WBI Energy's Designated Representative will request recommendations from the FERC, SHSND, COE (for finds on COE lands), USFS (for finds on USFS lands), and any consulting federally recognized Indian tribes regarding measures for site treatment. These measures may include:

   a. a variance request to re-route the pipeline around the site;

   b. archaeological evaluation of the site;

   c. site visits by the FERC, SHSND, COE (for finds on COE lands), USFS (for finds on USFS lands), and any consulting federally recognized Indian tribes;

d. preparation of a mitigation plan by WBI Energy for approval by the FERC, SHSND, COE (for finds on COE lands), USFS (for finds on USFS lands), and any consulting federally recognized Indian tribes;

e. implementation of the mitigation plan; and

f. approval to resume construction following completion of the fieldwork component of the mitigation plan.

8. If, upon further analysis by the Archaeological Consultant, the find is determined to lack significance, WBI Energy's Designated Representative will consult with the FERC, SHSND, COE (for finds on COE lands), USFS (for finds on USFS lands), and any consulting federally recognized Indian tribes and will request approval to resume construction subject, as warranted, to further mitigation required by the FERC.

9. WBI Energy's Designated Representative will notify the EI who will grant clearance to the Contractor to start work.

5.0 DISCOVERY OF UNMARKED BURIALS OR HUMAN REMAINS

1. If an unmarked human burial or skeletal remains are encountered during construction activities, WBI Energy will comply with North Dakota's "Protection of human remains, and burial goods – Unlawful acts – Penalties - Exceptions" law (North Dakota Century Code [NDCC] 23-06-27) and its accompanying administrative rules (North Dakota Administrative Code [NDAC] 40-02-03).

2. If an unmarked human burial, skeletal remains, or associated or unassociated funerary objects or objects of cultural patrimony are discovered on federal lands, WBI Energy will comply with the requirements of the Native American Graves Protection and Repatriation Act, as directed by the COE (for finds on COE lands) or USFS (for finds on USFS lands).

3. WBI Energy's Designated Representative will direct the EI to flag or fence off the find (including the area within 100 feet of the find or the outer perimeter of a group of finds), and will notify the appropriate local law enforcement agency as required by NDCC 23-06-27.

4. WBI Energy's Designated Representative will notify the FERC, SHSND, COE (for finds on COE lands), USFS (for finds on USFS lands), and any consulting federally recognized Indian tribes of the find.

5. If the local law enforcement agency determines that the remains are not modern or do not reflect a crime scene, and/or if they otherwise relinquish their jurisdiction over the remains, the FERC, COE (for finds on COE lands), and/or USFS (for finds on USFS lands) will consult appropriate parties (e.g., WBI Energy, SHSND, federally recognized Indian tribes, and the landowner) regarding additional steps to be followed.

6. If it can be determined that the identified human remains have affinity to federally recognized Native American tribes, a reasonable effort will be made to identify, locate, and notify these tribes.

7. The parties will make a good faith effort to exclude the public from viewing Native American burial sites or associated funerary artifacts and that no photographs of Native American burial sites or associated funerary artifacts are released to the press or public.

8. The measures to protect the remains and associated artifacts will remain in effect until they have been fully evaluated, appropriate treatment of the discovery (if applicable) has been completed, and WBI Energy has received written notice from the FERC to proceed with construction at the discovery site.

9. WBI Energy's Designated Representative will notify the EI who will grant clearance to the Contractor to resume work at the discovery site.

6.0 CONTACTS FOR UNANTICIPATED DISCOVERIES

WBI ENERGY CONTACTS:

Lead Environmental Inspector
Name: To be determined
Cell: To be determined
Email: To be determined

Environmental Inspector
Name: To be determined
Cell: To be determined
Email: To be determined

WBI Energy Designated Representative
Name: Greg Huncovsky
Address: 2010 Montana Avenue, Glendive, MT 59330
Phone: 406-359-7451
Cell: 406-989-1068
Email: Greg.Huncovsky@WBIEnergy.com

Archaeological Consultant
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Cell: 404-317-0543
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FEDERAL CONTACTS:

FERC Project Manager and Archaeologist
Name: Dawn Ramsey
Address: 888 First Street, Washington, DC 20426
Phone: 202-502-6856
Email: dawn.ramsey@ferc.gov

U.S. Forest Service
Name: Liv Fetterman
Address: 2000 Miriam Circle, Bismarck, ND 58501
Phone: 701-989-7306
Email: liv.fetterman@usda.gov

U.S. Army Corps of Engineers
Name: Omaha District Hotline
Phone: 888-761-2772

U.S. Army Corps of Engineers
Name: Richard R. Rogers
Address: 201 1st Street, RM210, Riverdale, ND 58565
Phone: 701-654-7744
Email: Richard.r.rogers@usace.army.mil

STATE CONTACTS:

State Historical Society of North Dakota, Division Director
Name: Fern Swenson
Address: 612 East Boulevard Avenue, Bismarck, ND 58505
Phone: 701-328-2666
Email: fswenson@nd.gov

State Historical Society of North Dakota, State Archaeologist

Name: Andrew Clark
Address: 612 East Boulevard Avenue, Bismarck, ND 58505
Phone: 701-328-3574
Email: andrewclark@nd.gov

TRIBAL CONTACTS:

Northern Cheyenne Tribe, Tribal Historic Preservation Officer (THPO)
Name: Teanna Limpy
Address: PO Box 128, Lame Deer, MT 59043
Phone: 406-477-4839
Email: teanna.limpy@cheyennenation.com

Three Affiliated Tribe of the Fort Berthold Reservation, THPO
Name: Pete Coffey
Address: 404 Frontage Road, New Town, ND 5863-9404
Phone: 701-862-247
Email: pcoffey@mhanation.com

Assiniboine and Sioux Tribes of the Fort Peck Reservation, THPO

Name: Dyan Youpee
Address: PO Box 1027, Poplar, MT 59255
Phone: 406-768-2382
Email: d.youpee@fortpecktribes.net

Rosebud Sioux Tribe, THPO
Name: Ben Rhodd
Address: PO Box 809, Rosebud, SD 57570
Phone: 605-747-4255
Email: brodd1@yahoo.com

Fort Belknap Indian Community, THPO
Name: Michael Black Wolf
Address: 656 Agency Main Street, Harlem, MT 59526
Phone: 406-353-2295
Email: mblackwolf@ftbelknap.org

Oglala Sioux Tribe, THPO
Name: Tom Brings
Address: PO Box 320, Pine Ridge, SD 57770-2070
Phone: 605-867-5624
Email: t.brings@oglala.org

Standing Rock Sioux Tribe, THPO
Name: Jon Eagle
Address: PO Box D, Fort Yates, ND 58538
Phone: 701-854-8645
Email: j.eagle@standingrock.org

Northern Arapaho Tribe, THPO
Name: Ben Ridgley
Address: PO Box 67, St. Stevens, WY 82524
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Email: benridgley007@gmail.com

Cheyenne River Sioux Tribe, THPO
Name: Steven Vance
Address: PO Box 590, Eagle Butte, SD 57625
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Email: steve.vance@crstpreservation@outlook.com

Spirit Lake Tribe, THPO
Name: Dr. Erich Longie
Address: PO Box 76, Fort Totten, ND 58335
Phone: 701-766-4032
Email: thpo@gondtc.com

Yankton Sioux Tribe, THPO
Name: Kip Spotted Eagle
Address: Box 1153 / 800 Main Avenue SW, Wagner, SD 57380
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Email: yst.thpo@gmail.com

Turtle Mountain Band of Chippewa, THPO
Name: Jeff Desjarlais, Jr.
Address: PO Box 900, Belcourt, ND 58316
Phone: 701-477-2640
Email: desjarlaisjr.jerffrey@yahoo.com

Sisseton Wahpeton Oyate, THPO
Name: Dianne Desrosiers
Address: PO Box 907, Sisseton, SD 57262
Phone: 605-698-3584
Email: dianned@swo-nsn.gov

LOCAL LAW ENFORCEMENT CONTACTS:

Burke County Sheriff
Name: Shawn Brien
Address: 103 Railway Street SE, Bowbells, ND 58721
Phone: 701-377-2311
Email: To be determined

Mountrail County Sheriff
Name: Corey Bristol
Address: 101 N Main St, Stanley, ND 58784
Phone: 701-628-2975
Email: coreyb@co.mountrail.nd.us

Williams County Sheriff
Name: Verlan Kvande
Address: 223 East Broadway, Williston, ND 58801
Phone: 701-577-7700
Email: sheriff@co.williams.nd.us

McKenzie County Sheriff
Name: Matthew Johansen
Address: 1201 12th Street SE, Suite B, Watford City, ND 58854
Phone: 701-444-3654
Email: To be determined

NORTH BAKKEN EXPANSION PROJECT

Plan for Unanticipated Discovery of Historic Properties or Human Remains During Construction

Attachment A
U.S. Army Corps of Engineers, Omaha District
Discovery of Human Remains

US Army Corps
of Engineers
Omaha District

DISCOVERY OF HUMAN REMAINS

If you suspect that you have found human remains on property managed by the Corps of Engineers, please follow these steps:

1. Do not collect or move the remains.
2. Visually mark your location. The exact location is very important.
3. Take a photo or GPS point, if you have the equipment available.
4. If the remains are in danger of being damaged or removed by others, try to camouflage the remains with vegetation, sand, soil, etc.
5. Call the Omaha District Hotline at 888-761-2772. You will be asked a series of questions and your discovery will be logged. The hotline operator will contact Rick Rogers, Sandy Barnum and Julie Price. One of these individuals will contact you as soon as possible. Have maps and photos ready to email.
6. A site visit may be needed, and you may be asked to accompany an archeologist to the site.
7. The archeologist will follow the necessary steps to properly protect the remains.

HOTLINE: 888-761-2772

NORTH BAKKEN EXPANSION PROJECT

Plan for Unanticipated Discovery of Historic Properties or Human Remains During Construction

Attachment B
U.S. Forest Service, Northern Region
Unanticipated Discovery Plan and
Discovery of Human Remains Protocols

Unanticipated Discovery Plan and Discovery of Human Remains Protocols

Northern Region, USDA Forest Service

If unanticipated cultural resources or human remains are identified during project activity and construction, Northern Region forests and grasslands will ensure that the agency and its agents (contractors, cooperators) comply with the following protocols. These protocols are based on federal law, regulation and Forest Service Manual (FSM) policy and direction.

Unanticipated Discovery of Cultural Resources (see FSM 2364.13)

1. Forest Service line officer (Forest Supervisor, District Ranger) or delegated staff will:

   A. Cease all project activity within (at minimum) 100ft of the unanticipated discovery until after the affected cultural resource(s) is evaluated and adverse effects to the cultural resource have been avoided, minimized, or mitigated.

   B. Notify the Contracting Officer of work-stoppage if this discovery was caused by a contractor or cooperator. Ensure that the appropriate contracting procedures are being followed.

   C. Protect the discovery from further damage, theft, or removal. Leave all artifacts and cultural materials in place. Involve law enforcement as necessary.

   D. Follow the protocols below if the discovery involves human remains.

   E. Follow the requirements of NAGPRA if associated or unassociated funerary objects or objects of cultural patrimony are discovered.

   F. Involve FS Law Enforcement if the unanticipated discovery also involves deliberate removal or destruction of cultural resources.

   G. Allow resumption of work only following resolution of the discovery incident. In most cases, this decision will be the District Ranger, but when human remains are involved the Forest Supervisor will make this decision.

2. Forest Heritage Program Leader, or delegated heritage program staff, will:

   A. Document the unanticipated discovery using appropriate site recordation procedures and forms. This should include, but is not limited to, documenting exposed artifacts and features; mapping the extent of artifacts, features, and cultural horizons; and documenting natural and cultural stratigraphy in open trenches or pits.

   B. Notify the SHPO, tribes, and other consulting parties, including any cultural resource consultants assigned to the project as appropriate.

   C. Evaluate the cultural resources for National Register of Historic Places (NR) eligibility. Testing will be limited to a sufficient level needed to provide a recommendation of NR eligibility. Funding to support evaluation may provided by benefiting function (or the cause of unanticipated discovery).

1) If the affected cultural resource is eligible for the NR, the heritage program leader will consult with the SHPO, tribes and consulting parties about measures to avoid, minimize, or mitigate further effects to the NR eligible cultural resource. Mitigation measures will be contingent on the type and extent of the disturbed resource, the extent of the adverse effect, and whether or not it is possible to avoid any further effects.

2) If the affected cultural resource is determined to be NR-ineligible, with SHPO concurrence, work may resume with appropriate monitoring for further cultural resource disturbances.

3) If NR evaluation is not possible due to circumstances beyond control, the affected cultural resource will be treated as NR eligible in accordance with FSM 2363.22.

D. Develop an action plan, mitigation plan, or emergency treatment plan for the affected cultural resources if the cultural resource is NR eligible or is being treated as eligible absent formal evaluation. Fund the action plan and necessary emergency treatment or mitigation work via benefiting function or heritage program contingent on the cause and nature of the discovery.

E. Document the unanticipated discovery in annual reports to the SHPO under programmatic agreements, and include an Event record in Infra, as appropriate.

<u>Discovery of Human Remains (FSM 2361.3 and 2364.1)</u>

Heritage professionals are often the first point of contact when human remains are discovered on National Forest System land. Advise the appropriate line officer to follow State burial laws or and these protocols.

1. Forest Service line officer (Forest Supervisor, District Ranger) or delegated staff will:

   A. Ensure that all discovered human remains are treated with dignity and respect. Viewing and photographing exposed human remains by agency employees is generally an affront to American Indian peoples and may compromise forensic or law enforcement efforts.

   B. Ensure that the discovery area is secure the area; leave human remains in place; cease project activity as necessary until a plan of action is developed and; involve law enforcement as necessary

   C. Allow resumption of work only when the disposition of the human remains is determined and a written binding agreement is executed between the necessary parties in accordance with 43 CFR Part 10.4(e).

2. Forest Heritage Program Leader or delegated heritage program staff will:

   A. Promptly notify SHPO, the appropriate Indian tribe(s), and the County Coroner/Medical Examiner, who will officially determine the nature of the remains (forensic or archaeological).

      1) If the remains are not forensic and non-Native American, leave the remains in place and assist in the development of a plan for avoidance (in place preservation) or removal. Consult with SHPO and other interested parties as appropriate.

2) If the remains are not forensic and Native American, ensure that NAGPRA regulations at Section 10.4 of Title 43, Code of Federal Regulations, Part 10, are followed. Notify the appropriate Indian tribe(s) by telephone followed by written confirmation as soon as practicable. Develop an Action Plan for disposition of Human Remains.

3) If the remains are forensic, Forest Service law enforcement and/or the County Coroner/Medical Examiner take control of the situation.

B. Coordinate and communicate with the Line Officer, forest staff, tribes, SHPO, and consulting contractors regarding progress and status of human remains discovery incident, as necessary and appropriate. Otherwise, treat this information as confidential.

C. Document the human remains incidents in annual reports to the SHPO under programmatic agreements, and include an Event record in Infra, as appropriate. Specifics of the discovery incident may be inappropriate but a general summary is important since these incidents are important to track.

NORTH BAKKEN EXPANSION PROJECT

Plan of Development

APPENDIX O

USFS Recommended Seed Mixtures

WBI ENERGY TRANSMISSION, INC.

North Bakken Expansion Project

Plan of Development

Appendix O

USFS Recommended Seed Mixture

September 2020

#37-28A Seed Mixture (Revised 07/18/2013)

Company:
Well ID:
Date:

Seeding Rate Guidelines
Scenario #13 All Sites

			A	B	C	D	E
Species	**Preferred Cultivar, Ecotype, or Germplasm**	**Common Name**	**% of Mix**	**Number Seed per lb.**	**Number Seed per ft²**	**Number Seed per acre**	**Drilled PLS lb./acre**
Cool Season Grasses:							
Elymus canadensis	Mandan	Canada wildrye	0.15	115,000	7.5	326,700	2.8
Nassella viridula	Lodorm	Green needlegrass	0.20	180,000	10.0	435,600	2.4
Pascopyrum smithii	Rodan	Western wheatgrass	0.25	112,000	12.5	544,500	4.9
Warm Season Grasses							
Bouteloua gracilis	Bad River	Blue grama	0.10	750,000	5.0	217,800	0.3
Calamovilfa longifolia	Goshen	Prairie sandreed	0.10	275,000	5.0	217,800	0.8
Schizachyrium scoparium	Badlands	Little bluestem	0.10	286,000	5.0	217,800	0.8
Alternate Warm Season (for one of above species)							
Bouteloua curtipendula	Pierre	Sideoats grama	0.10	180,000	5.0	217,800	1.2
Forbs							
Dalea purpurea	Local[1]	Purple prairieclover	0.04	290,000	1.8	78,408	0.25
OR							
Dalea candida	Antelope[1]	White prairieclover	0.04	278,000	1.8	78,408	0.3
Helianthus pauciflorus	Bismarck[1]	Stiff sunflower	0.03	85,000	1.4	60,984	0.7
OR							
Solidago rigida	Local[1]	Stiff goldenrod	0.03	656,000	1.4	60,984	0.1
Echinacea angustifolia	Bismarck[1]	Purple coneflower	0.03	120,000	1.4	60,984	0.5
OR							
Ratibida columnifera	Local[1]	Prairie coneflower	0.03	737,000	1.4	60,984	0.1
Totals			100%		49.6	Forbs Alternate Forbs	13.4 (12.5)

Seeding Rates Formulas

A - % of Mix
B - Number of seeds per lb.
C - Number of seeds per ft² (C = A x 50)
D - Number of seeds per acre (D = C x 43560)
E - Drilled Pure Live Seed (PLS) lb./acre (E = D / B)

(See page 2 for additional information)

- Use of Pure Live Seed (PLS) for calculating seed mixtures.
  - Planting is based on approximately 50 seed per square foot and/or 12-16 pounds PLS per acre.
  - All of the seed mixtures in this guide give the rate of PLS for each species per acre. These rates were derived using three basic figures: percent of each species desired by composition, number of seeds per pound according to species, and total number of PLS per square foot.
  - The following equation should be used to calculate how much seed is needed to provide the required pounds of PLS needed.

    % Purity x Germination Rate % = % PLS
    Pounds of PLS Desired divided by %PLS = Pounds of Seed Required

    An example of this is: 10 lbs. of PLS is required. The given seed lot for this species has a purity of 95% and a germination rate of 85%. How many pounds of seed will be necessary to have 10 PLS?

    .95 (Purity) x .85 (germination rate) = .81 (% PLS)
    10 (required poundage) divided by .81 (%PLS) = 12.3
    12.3 pounds of seed will be necessary to provide 10 lbs PLS of seed.

- Cultivars listed in the second column are preferred, but local seed collections grown for harvest are acceptable if performance and origin are certified or documented. All seed sources should be derived from loal collections or a general area extening 300 miles north and 200 miles south of the area to be reclaimed, and within similar elevation and precipatuion zones as western North Dakota, ie from Jamestown on the east to Billings, MT on the west.

- A local source for forbs is Prairies Diversified located in Bismarck, ND (Roger Rostvet, 701-258-0181). Other sources may be used but they must be verified as local collections and not obtained from a distant source that are distributed by a local dealer.

- Seeding depth should be one-half inch or less for drilled seed.

- For broadcast seeding, multiply pounds of each species seeded by 1.5. Seed bed should be thoroughly worked and firm.

- Best average seeding dates for cool and warm season mixes is May – June. Earlier of later (fall dormant) seeding is likely to result in poor establishment of warm season species and is therefore discouraged.

- Seed mix may need to be adjusted due to site characteristics and/or lack of available seed for some species. In the latter case, adjust species seeding rates by formulas below table to obtain approximately 50 seed per square foot and/or 12-16 lbs. of PLS per acre for drilled seed and 18-24 lbs. per acre for broadcast seeding.

- Note: The following are required as per Conditions of Approval #28 B, Certification & Reporting
  1. Report of Seeding (#37-28B)
  2. Certification of Seed Mixture from Seed Company and seed tags from bags or copy of seed tags for all planted material must be submitted to the appropriate Medora or McKenzie Ranger Districts.

- Call the appropriate Medora or McKenzie Ranger Districts if there are any questions.
  - Medora Ranger District: 701-227-7800.
  - McKenzie Ranger District: 701-842-2393.

NORTH BAKKEN EXPANSION PROJECT

Agency Correspondence – Bureau of Land Management (BLM)

NORTH BAKKEN EXPANSION PROJECT
CONFERENCE CALL NOTES

MEETING TOPIC:
North Bakken Expansion Project Update

DATE OF MEETING:
August 12, 2020 at 1:00 p.m. PST – Project Conference Call

ATTENDEES:
Environmental Resources Management (ERM)
Andrea Thornton

Bureau of Land Management (BLM)
Lisa Scheirer

MEETING NOTES:

Ms. Thornton went through a few project updates with Ms. Scheirer including the reduction in project capacity and reduced compression at the Tioga Compressor Station. Ms. Thornton informed Ms. Scheirer that all aboveground facilities are located on private land. Ms. Thornton then discussed some of the minor route changes that have occurred since WBI Energy filed their Federal Energy Regulatory Commission Application in February 2020 including a few changes on U.S. Forest Service land to avoid sensitive resources.

Ms. Thornton asked Ms. Scheirer to please reach out if she has any questions and that she would be in touch as WBI Energy gets closer to filing the revised Plan of Development.

Andrea Thornton

From: Andrea Thornton
Sent: Wednesday, August 12, 2020 7:00 AM
To: 'Scheirer, Lisa L'
Subject: RE: [EXTERNAL] WBI Energy - North Bakken Expansion Project

Hi Lisa –

Let's do 2pm MDT this afternoon. I will send you a meeting invite so it is on our calendars.

Thanks for getting back so quickly!

-Andrea

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

Environmental Resources Management (ERM)
1050 SW 6th Avenue, Suite 1650 | Portland, Oregon | 97204
M 503-459-6864
E andrea.thornton@erm.com | **W** www.erm.com

From: Scheirer, Lisa L <lscheirer@blm.gov>
Sent: Wednesday, August 12, 2020 6:45 AM
To: Andrea Thornton <Andrea.Thornton@erm.com>
Subject: Re: [EXTERNAL] WBI Energy - North Bakken Expansion Project

Hi Andrea! I'm open today - maybe around 11am MDT this morning or 2 pm MDT this afternoon?

Thanks!
Lisa

Lisa Scheirer
Realty Specialist
North Dakota Field Office
99 23rd Ave West, Suite A
Dickinson, ND 58601
701-227-7711

From: Andrea Thornton <Andrea.Thornton@erm.com>
Sent: Tuesday, August 11, 2020 4:15 PM

To: Scheirer, Lisa L <lscheirer@blm.gov>
Subject: [EXTERNAL] WBI Energy - North Bakken Expansion Project

This email has been received from outside of DOI - Use caution before clicking on links, opening attachments, or responding.

Hi Lisa –

I was hoping you might have sometime this week for a call to catch up on the North Bakken Expansion Project. My schedule is pretty open so please let me know if there is a day/time that works for you.

Thanks,
Andrea

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

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E andrea.thornton@erm.com | **W** www.erm.com

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Andrea Thornton

From: Scheirer, Lisa L <lscheirer@blm.gov>
Sent: Thursday, September 17, 2020 10:14 AM
To: Andrea Thornton
Subject: Re: [EXTERNAL] WBI Energy September 11 2020 Supplemental Filing Privileged and Confidential Documents

Thank you Andrea!

Lisa Scheirer
Realty Specialist
North Dakota Field Office
99 23rd Ave West, Suite A
Dickinson, ND 58601
701-227-7711

From: Andrea Thornton <Andrea.Thornton@erm.com>
Sent: Thursday, September 17, 2020 11:07 AM
To: Scheirer, Lisa L <lscheirer@blm.gov>
Subject: RE: [EXTERNAL] WBI Energy September 11 2020 Supplemental Filing Privileged and Confidential Documents

Hi Lisa –

Here is Dave Linn's contact information :

David Linn **PE PMP**
Senior Engineering and Projects Manager
WBI Energy
2010 Montana Ave
Glendive Montana 59330
Ph (406) 359-7333
e-mail dave.linn@wbienergy.com

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

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M 503-459-6864
E andrea.thornton@erm.com | **W** www.erm.com

From: Scheirer, Lisa L <lscheirer@blm.gov>
Sent: Thursday, September 17, 2020 8:16 AM

To: Andrea Thornton <Andrea.Thornton@erm.com>
Subject: Re: [EXTERNAL] WBI Energy September 11 2020 Supplemental Filing Privileged and Confidential Documents

Hi Andrea!

Thank you for updating me on the contact info for WBI. Katie West is in the same office as me. If the reports in the past were sent to Seth, please just send them to me and I'll pass them on to her. Otherwise, her mailing address is the same as mine.

Thank you!
Lisa

Lisa Scheirer
Realty Specialist
North Dakota Field Office
99 23rd Ave West, Suite A
Dickinson, ND 58601
701-227-7711

From: Andrea Thornton <Andrea.Thornton@erm.com>
Sent: Thursday, September 17, 2020 8:59 AM
To: Scheirer, Lisa L <lscheirer@blm.gov>
Subject: RE: [EXTERNAL] WBI Energy September 11 2020 Supplemental Filing Privileged and Confidential Documents

Hi Lisa –

I'm still waiting to hear back from WBI on this. The hard copies of the cultural reports are going out today. Is Katie West in the same office as you? I do not have a mailing address for her on file. Or should the hard copy be sent directly to you?

Thanks,
Andrea

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

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From: Scheirer, Lisa L <lscheirer@blm.gov>
Sent: Wednesday, September 16, 2020 3:10 PM
To: Andrea Thornton <Andrea.Thornton@erm.com>
Subject: Re: [EXTERNAL] WBI Energy September 11 2020 Supplemental Filing Privileged and Confidential Documents

Andrea,

Thank you for the files! I have a question. I'm working on a congressional notification, and I wondered who should be listed as the principal contact for WBI?

Thank you!
Lisa

Lisa Scheirer
Realty Specialist
North Dakota Field Office
99 23rd Ave West, Suite A
Dickinson, ND 58601
701-227-7711

MEETING NOTES

LOG OF IN PERSON MEETING

MEETING ATTENDEES:

Jon Eagle – Standing Rock Sioux Tribe Tribal Historic Preservation Officer
Ben Rhodd – Rosebud Sioux Tribe Archaeologist
Katie West – Bureau of Land Management (BLM)
Jill Linn – WBI Energy Transmission, Inc. (WBI Energy)
Wade Burns – Beaver Creek Archaeology (BCA)
Raina Hanley – BCA
Larry Pallozzi – BCA
Jayson Zoino – Environmental Resource Group (ERM)

DATE:	TIME OF CONVERSATION:
September 17, 2020	10 am to 1 pm

RE:

North Bakken Expansion Project

LOG OF CONVERSATION:

ERM visited sites 32MZ3382, 32MZ3383, and 32MZ3385 on U.S. Forest Service lands with representatives of the Standing Rock Sioux Tribe, Rosebud Sioux Tribe, BLM, WBI Energy, and BCA.[1] ERM documented these sites in the summer of 2020 during survey for WBI Energy's North Bakken Expansion Project. Tribal cultural specialists representing the Standing Rock Sioux Tribe, Rosebud Sioux Tribe (including one specialist working on behalf of the Sisseton Wahpeton Oyate Tribe), Assiniboine & Sioux Tribes, and Turtle Mountain Band of Chippewa Indians monitored ERM's delineation of the sites; however, the specialists did not uniformly concur with the interpretation of the finds as archaeological. Some of the specialists concluded that the remains documented by ERM are non-cultural.

The visits to 32MZ3382, 32MZ3383, and 32MZ3385 allowed Mr. Eagle and Mr. Rhodd to inspect the sites and features recorded by ERM. Mr. Eagle and Mr. Rhodd each concurred with the interpretation of the finds as archaeological and agreed with a majority of ERM's feature classifications for the sites. Mr. Eagle and Mr. Rhodd provided additional interpretation of some features, which will be incorporated into the cultural heritage forms for these sites. This includes an expansion of the area at 32MZ3383 to be recorded as a cultural heritage site to encompass a cluster of Echinacea identified near the archaeological features.

[1] The U.S. Forest Service was unable to participate in the site visits.

NORTH BAKKEN EXPANSION PROJECT

Agency Correspondence – U.S. Army Corps of Engineers (USACE)

Andrea Thornton

From: Andrea Thornton
Sent: Tuesday, July 21, 2020 10:48 AM
To: Thury, Jeremy J CIV USARMY CENWO (USA)
Cc: Wade Hammer
Subject: North Shore Access

Hi Jeremy –

We are looking to identify an access point to the north shore for contingency planning in case of an inadvertent return during HDD construction. When we completed the least tern piping plover surveys the crew utilized 110th Ave NW, parked and walked down to the shore. As you area aware, as you head west along the shore from this point there are multiple water pipes that are blocking the shore, and depending on the water levels would hinder a cleanup vehicle from passing. There appears to be another access point further east (in screenshot below). Do you know if this would be available for use if access were required? If not do you have any other suggestions?

Thanks,
Andrea

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

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Call Log

Log of Telephone Conversation

Call To/From Whom	Rick Rogers
Phone number	701-301-0018
Company	USACE
ERM Contact	Kevin Malloy
Phone number	906-285-0361
Date	July 22, 2020
Time of Conversation	2:25 p.m
Reference	North Bakken Expansion Project (Project)
Signature	

LOG OF CONVERSATION

Rick Rogers from the USACE called me to discuss the results of the gradiometry survey conducted on the USACE lands on July 8-9. I gave him a brief overview of what was found and informed him that we would be submitting a testing plan in the next couple of days.

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Pat Robblee

From: Kevin Malloy
Sent: Monday, July 27, 2020 5:34 PM
To: Rogers, Richard R II CIV USARMY CENWO (USA)
Cc: Pat Robblee
Subject: Site 32WI976 Testing Plan and Gradiometer Survey Results
Attachments: 32WI976 Site Testing Plan 20202707.docx; ERM 070920 Ray ND.dwg; ERM 070920 Ray ND_report.pdf

Hi Rick,

I hope this email finds you well. Please find attached the results from Enviroprobe Services, Inc.'s (Enviroprobe) gradiometer survey, including the .DWG file and the report Enviroprobe produced for the study. In addition, I have included the site testing plan we've drafted based on these findings. The plan consists of a combination of 1x1 m test units and shovel tests throughout the site to examine the magnetic anomalies identified during Enviroprobe's survey. Testing will also focus on additional investigation of the interior of the site boundary to further examine the vertical extent of the site's deposits.

After you have reviewed it and discussed it with the interested consulting parties, we can discuss any revisions to the methodology if necessary, and then submit it to the SHSND for their approval as well.

Please feel free to reach out to me with any questions or concerns with this approach.

Kind regards,
Kevin

ERM

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80 South Eighth Street
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Fax: +1 612 347 6780

www.erm.com

Call Log

Log of Telephone Conversation

Call To/From Whom	Rick Rogers
Phone number	701-301-0018
Company	USACE
ERM Contact	Kevin Malloy
Phone number	906-285-0361
Date	July 30, 2020
Time of Conversation	12:43; 1:36, 2:03 p.m.
Reference	North Bakken Expansion Project (Project)
Signature	

LOG OF CONVERSATION

12:43 – Rick Rogers from the USACE called me to discuss the site testing plan we submitted to him earlier this week for site 32WI976. He stated that he thought it looked good and he would be in touch once he'd communicated with the tribal stakeholders and SHSND. We discussed time frame of when we would be planning to conduct the testing. I informed him that I anticipated having a crew back out in September. He said that was fine and to let him know if anything changes.

1:36 – I called Rick back after speaking with the Project Manager, Andrea Thornton, who asked me to see if there was a way to expedite the stakeholder's review so we could potentially test the site in the next couple of weeks. He said that he was planning on sending it to all the tribal stakeholders for the Project and that he would give them two weeks to comment. He did not anticipate hearing back from many of them.

2:03 – Rick called me to ask about one of the figures in the testing plan and then suggested that we may want to conduct soil probing at some of the magnetic anomalies we plan on testing, instead of shovel testing. I told him I would review that option and update the figure he asked about and get the plan back to him shortly.

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Pat Robblee

From: Kevin Malloy
Sent: Friday, July 31, 2020 4:16 PM
To: Rogers, Richard R II CIV USARMY CENWO (USA)
Subject: Revised Testing Plan
Attachments: 32WI976 Site Testing Plan 20203107.pdf

Hi Rick,

Please find attached the revised testing plan per our conversation yesterday for 32WI976. I've updated the text to incorporate soil probing in lieu of shovel testing at some locations, and have updated the figures to reflect our current plan.

Please feel free to reach out to me with any questions.

Kind regards,
Kevin

ERM

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Call Log

Log of Telephone Conversation

Call To/From Whom	Rick Rogers
Phone number	701-301-0018
Company	USACE
ERM Contact	Kevin Malloy
Phone number	906-285-0361
Date	August 5, 2020
Time of Conversation	3:40 pm
Reference	North Bakken Expansion Project (Project)
Signature	

LOG OF CONVERSATION

Rick Rogers from the USACE called me to discuss the site testing plan we submitted to him for site 32WI976. He just wanted to provide an update on the tribes' review of the testing plan and gave some preliminary/unofficial feedback to consider about unit size.

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Andrea Thornton

Subject: North Bakken Expansion Project
Location: Microsoft Teams Meeting

Start: Mon 8/10/2020 1:30 PM
End: Mon 8/10/2020 2:00 PM
Show Time As: Tentative

Recurrence: (none)

Meeting Status: Not yet responded

Organizer: Andrea Thornton
Required Attendees: Renschler, Jason J CIV USARMY CENWO (USA); Wade Hammer

OnlineMeetingConfLink: conf:sip:Andrea.Thornton@erm.com;gruu;opaque=app:conf:focus:id:teams:2:0!19:meeting_ZmVlNjBjODItM2FjYi00NTA3LTg2NjctNjY4ZTkxZjQ4MGRm-thread.v2!a469a6e44ee74096ae664c925db5696f!f2fe6bd39c4a485bae69e18820a88130

SchedulingServiceMeetingOptionsUrl:
https://teams.microsoft.com/meetingOptions/?organizerId=a469a6e4-4ee7-4096-ae66-4c925db5696f&tenantId=f2fe6bd3-9c4a-485b-ae69-e18820a88130&threadId=19_meeting_ZmVlNjBjODItM2FjYi00NTA3LTg2NjctNjY4ZTkxZjQ4MGRm@thread.v2&messageId=0&language=en-US

SchedulingServiceUpdateUrl:
https://scheduler.teams.microsoft.com/teams/f2fe6bd3-9c4a-485b-ae69-e18820a88130/a469a6e4-4ee7-4096-ae66-4c925db5696f/19_meeting_ZmVlNjBjODItM2FjYi00NTA3LTg2NjctNjY4ZTkxZjQ4MGRm@thread.v2/0

SkypeTeamsMeetingUrl: https://teams.microsoft.com/l/meetup-join/19%3ameeting_ZmVlNjBjODItM2FjYi00NTA3LTg2NjctNjY4ZTkxZjQ4MGRm%40thread.v2/0?context=%7b%22Tid%22%3a%22f2fe6bd3-9c4a-485b-ae69-e18820a88130%22%2c%22Oid%22%3a%22a469a6e4-4ee7-4096-ae66-4c925db5696f%22%7d

SkypeTeamsProperties: {"cid":"19:meeting_ZmVlNjBjODItM2FjYi00NTA3LTg2NjctNjY4ZTkxZjQ4MGRm@thread.v2","private":true,"type":0,"mid":0,"rid":0,"uid":null}

TeamsVtcConferenceId: 1262484751
TeamsVtcTenantId: f2fe6bd3-9c4a-485b-ae69-e18820a88130

Quick call to discuss the North Bakken Expansion Project. Jason let me know if this time does not work for you and we can reschedule.

-Andrea

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Conference ID: 807 741 304#

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195471110@teams.bjn.vc VTC Conference ID: 1262484751

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NORTH BAKKEN EXPANSION PROJECT
CONFERENCE CALL NOTES

MEETING TOPIC:
Section 404 Permitting Approach – Project Updates and U.S. Army Corps of Engineers Updates Regarding Nationwide Permit 12

DATE OF MEETING:
August 10, 2020 at 3:30 p.m. CST (1:30 p.m. PST) – Project Conference Call

ATTENDEES:
Environmental Resources Management (ERM)
Andrea Thornton
Wade Hammer

U.S. Army Corps of Engineers (USACE)
Jason Renschler

MEETING NOTES:

- Andrea Thornton opened the call by informing Jason Renschler that WBI Energy Transmission, Inc. (WBI) continued to further evaluate if the North Bakken Expansion Project (Project) would seek use of the reinstated Nationwide Permit 12 for Utility Lines (NWP 12) or an Individual Section 404 Permit. Andrea asked if Jason had any updates and inquired if there were other pipeline projects that were utilizing an individual permit, given the potential for further legal action directed at NWP. Jason said that the other pipeline projects that he is aware of are all using NWP 12.
- Jason stated that the Regional General Permit (RGP) that the Omaha District is developing for use in North Dakota continues to be on track for issuance (previously Jason had expected issuance of this RGP in early 2021).
- Jason also offered that he had received recent correspondence that revised NWPs may be issued in the coming week or weeks. These revised NWPs were initially going to be issued as draft for review in mid-June 2020, around the same time as the new Waters of the U.S. rule.
- Andrea asked what the process would be if WBI sought a NWP 12 verification, and after the verification was issued there was a challenge to NWP 12. Jason stated that how this was handled previously, during the spring 2020 legal challenge of NWP 12, where verifications of NWP 12 were issued prior to the court ruling, these verifications were upheld.
- Andrea notified Jason that some reroutes were still being considered to avoid sensitive resources and due to landowner requests. Additional information associated with these minor reroutes were going to be incorporated and WBI was working to freeze the route. Jason noted he had been made aware during a FERC call that these changes were coming and the Environmental Assessment schedule was going to be pushed back from an early September 2020 schedule. Andrea confirmed this was accurate.
- Andrea noted that WBI was finalizing the Section 408 application and intentions were to submit the Section 408 application later this week. Jason noted that this

was good given the Section 408 review needed to be completed before he could finalize the Section 404 permit.

- The call ended at approximately 3:50 p.m. Central.

Andrea Thornton

From: Nelson, Reece E CIV USARMY CENWO (USA) <Reece.E.Nelson@usace.army.mil>
Sent: Tuesday, August 11, 2020 7:46 PM
To: Andrea Thornton
Cc: Thury, Jeremy J CIV USARMY CENWO (USA)
Subject: RE: North Bakken Expansion Project - 408 Permit Application Update (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Good evening Andrea,

Confirmed, that worked just fine. Please CC Jeremy when you send.

-Reece

From: Andrea Thornton [mailto:Andrea.Thornton@erm.com]
Sent: Tuesday, August 11, 2020 4:05 PM
To: Nelson, Reece E CIV USARMY CENWO (USA) <Reece.E.Nelson@usace.army.mil>
Subject: [Non-DoD Source] North Bakken Expansion Project - 408 Permit Application Update

Hi Reece –

We are finalizing the 408 Permit Application files this week and I wanted to confirm with you that the submittal process we used in February (sending an email with the transmittal letter and transmitting files via SharePoint) worked well for you.

We should have the updated files over to you by the end of the week.

Thanks,
Andrea

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

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CLASSIFICATION: UNCLASSIFIED

Andrea Thornton

From: Nelson, Reece E CIV USARMY CENWO (USA) <Reece.E.Nelson@usace.army.mil>
Sent: Wednesday, August 12, 2020 10:10 AM
To: Andrea Thornton; Thury, Jeremy J CIV USARMY CENWO (USA)
Cc: Linn, Jill; Linn, Dave; Huncovsky, Greg; Wade Hammer
Subject: RE: WBI Energy North Bakken Expansion Project 408 Permit Submittal (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Received and downloaded, thank you Andrea. Will review and prep to load to Projnet for technical team review.

-Reece

-----Original Message-----
From: Andrea Thornton [mailto:Andrea.Thornton@erm.com]
Sent: Wednesday, August 12, 2020 11:34 AM
To: Nelson, Reece E CIV USARMY CENWO (USA) <Reece.E.Nelson@usace.army.mil>; Thury, Jeremy J CIV USARMY CENWO (USA) <Jeremy.J.Thury@usace.army.mil>
Cc: Linn, Jill <Jill.Linn@wbienergy.com>; Linn, Dave <Dave.Linn@WBIEnergy.com>; Huncovsky, Greg <Greg.Huncovsky@WBIEnergy.com>; Wade Hammer <Wade.Hammer@erm.com>
Subject: [Non-DoD Source] WBI Energy North Bakken Expansion Project 408 Permit Submittal
Importance: High

Hi Reece and Jeremy -

Attached is our transmittal letter for submitting a draft of the 408 Permit Application for the North Bakken Expansion Project. Due to the size of the files we have created a One Drive folder for you to access the documents. Please note that the link to this page will only work for one week so please pull the documents onto your computer and server for storage. I've have included a combined permit package file, and individual files. Please note that the appendices to Attachment 6 (Operation and Maintenance Plan) are Privileged and Confidential.

Blockedhttps://eur01.safelinks.protection.outlook.com/?url=https%3A%2F%2Ftheermgroup-my.sharepoint.com%2F%3Af%3A%2Fg%2Fpersonal%2Fandrea_thornton_erm_com%2FEpm2qpOlAwhHgilrwrO8TUMBlSbDf95P1Ko8dLOFtXsFCg%3Fe%3DszGKxW&data=02%7C01%7C%7C6cbfdfda6a914306116d08d83ee29acf%7Cf2fe6bd39c4a485bae69e18820a88130%7C0%7C0%7C637328490291074506&sdata=KoTCkeyPw6DowOkxE7hxawZy2LiqtlNxKrvu5zvs4yE%3D&reserved=0

Please let me know if you have any questions or issues accessing the file.

Thank you,

Andrea

Andrea Thornton

Principal Consultant

Pronouns: she/her/hers

Environmental Resources Management (ERM)

1050 SW 6th Avenue, Suite 1650 | Portland, Oregon | 97204

M 503-459-6864

E andrea.thornton@erm.com <mailto:andrea.thornton@erm.com> | W Blockedhttps://eur01.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.erm.com%2F&data=02%7C01%7C%7C6cbfdfda6a914306116d08d83ee29acf%7Cf2fe6bd39c4a485bae69e18820a88130%7C0%7C0%7C637328490291074506&sdata=X9mRw6kSLHdSpqMjVU1FioUWqIJ05qsMArp6TCvjy3g%3D&reserved=0 <Blockedhttps://eur01.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.erm.com%2F&data=02%7C01%7C%7C6cbfdfda6a914306116d08d83ee29acf%7Cf2fe6bd39c4a485bae69e18820a88130%7C0%7C0%7C637328490291074506&sdata=X9mRw6kSLHdSpqMjVU1FioUWqIJ05qsMArp6TCvjy3g%3D&reserved=0>

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WBI ENERGY TRANSMISSION, INC.
1250 West Century Ave.
P.O. Box 5601
Bismarck, ND 58506-5601
(701) 530-1600
www.wbienergy.com

August 12, 2020

Reece Nelson
U.S. Army Corps of Engineers
1616 Capitol Ave., Suite 9000
Omaha, NE 68102 (P: 402-995-2229)

Re: WBI Energy Transmission, Inc. – North Bakken Expansion Project
Section 408 Application - Crossing of Lake Sakakawea and
Adjacent Army Corps Real Estate

Mr. Nelson,

WBI Energy Transmission, Inc. (WBI Energy) proposes to install approximately 93 miles of pipeline, including new pipeline, pipeline looping and upgrades to existing pipelines, as well as construction and upgrades to compressor stations and other appurtenances to transport natural gas from WBI Energy's existing Tioga Compressor Station near Tioga, Williams County, North Dakota, to a new interconnect with Northern Border's mainline southeast of Watford City, McKenzie County, North Dakota. The North Bakken Expansion Project (Project) would include the crossing of Lake Sakakawea and adjacent U.S. Army Corps of Engineers (USACE) land with a 24-inch-diameter natural gas pipeline. WBI Energy is proposing to cross both the lake and the USACE property using horizontal directional drilling (HDD) methodologies to avoid surface disturbance of both.

WBI Energy will be submitting Project materials in pursuit of a section 404/10 permit for review of Project dredge and fill activities and the crossing of Lake Sakakawea, a Section 10 waterbody, to the Bismarck, North Dakota Regulatory office in coordination with this section 408 application. In addition, the Project is being reviewed according to the National Environmental Policy Act by the Federal Energy Regulatory Commission (FERC), under section 7(c) of the Natural Gas Act. The timing of submittals to all federal agencies simultaneously in the FERC review process requires the coordination of these submittals. Environmental review materials necessary to support the section 408 review will be available as the USACE section 404/10 permit and FERC reviews are completed, and copies of supporting documentation can be provided upon request.

WBI Energy is submitting the enclosed section 408 application to replace a draft application that was submitted in February 2020 in coincidence with the FERC filing submitted at the same time. This updated application includes materials as discussed with the USACE over the past approximately half year to provide the necessary information to complete the section 408 review of the planned HDD crossing of Lake Sakakawea. The application includes additional materials that incorporate information gathered during the geotechnical work completed along the HDD alignment in May 2020, as well as both updated project design plans and supporting documents related to the HDD crossing of Lake Sakakawea. With this application WBI is seeking

authorization to both cross Lake Sakakawea and maintain a permanent pipeline easement across USACE owned lands both within and adjacent to Lake Sakakawea.

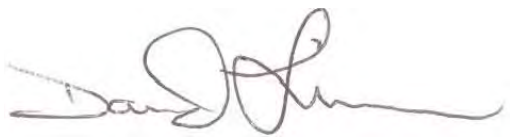
The following attachments are included in this submittal:

ATTACHMENTS:

- U.S. Army Corps of Engineers Form ENG4345
- Figure 1 – Lake Sakakawea HDD Extent and Associated USACE Owned Lands Crossing
- Attachment 1 – Lake Sakakawea - Horizontal Directional Drilling Installation Plan
- Attachment 2 – Surface Use Plan of Operation (Including USACE Property Plats)
- Attachment 3 – Erosion and Sedimentation Control Plan
- Attachment 4 – Spill Prevention, Control, and Countermeasure Plan
- Attachment 5 – Emergency Response Plan, Facility Response Plan, and Geographical Response Plan
- Attachment 6 – Operation and Maintenance Plan (including WBI Energy's Gas System Operation and Maintenance Manual and Control Room Management Manual – ***Marked CUI/PRIV - DO NOT RELEASE***)
- Attachment 7 – Reclamation and Monitoring Plan
- Attachment 8 – Risk Assessment Plan

WBI Energy appreciates your assistance and review of the enclosed materials and should you have questions or require additional information during your review, please contact Dave Linn (406) 359-7333.

Respectfully submitted,



Dave Linn
Senior Engineering and Projects Manager
WBI Energy Transmission, Inc.

Cc:

Greg Huncovsky, WBI

Andrea Thornton, ERM

U.S. Army Corps of Engineers Form ENG4345

U.S. Army Corps of Engineers (USACE)

APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT

33 CFR 325. The proponent agency is CECW-CO-R.

Form Approved - OMB No. 0710-0003 Expires: 02-28-2022

The public reporting burden for this collection of information, OMB Control Number 0710-0003, is estimated to average 11 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR APPLICATION TO THE ABOVE EMAIL.

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned. System of Record Notice (SORN). The information received is entered into our permit tracking database and a SORN has been completed (SORN #A1145b) and may be accessed at the following website: http://dpcld.defense.gov/Privacy/SORNsIndex/DOD-wide-SORN-Article-View/Article/570115/a1145b-ce.aspx

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETE

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME	8. AUTHORIZED AGENT'S NAME AND TITLE (agent is not required)
First - Greg Middle - Last - Huncovsky	First - Middle - Last -
Company - WBI Energy Transmission, Inc.	Company -
E-mail Address - Greg.Huncovsky@WBIEnergy.com	E-mail Address -
6. APPLICANT'S ADDRESS:	**9. AGENT'S ADDRESS:**
Address- 1250 W Century Ave	Address-
City - Bismarck State - ND Zip - 58503 Country - USA	City - State - Zip - Country -
7. APPLICANT'S PHONE NOs. w/AREA CODE	**10. AGENTS PHONE NOs. w/AREA CODE**
a. Residence b. Business 406-359-7451 c. Fax	a. Residence b. Business c. Fax

STATEMENT OF AUTHORIZATION

11. I hereby authorize, _____ to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

_____ SIGNATURE OF APPLICANT _____ DATE

NAME, LOCATION, AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE (see instructions)
North Bakken Expansion Project

13. NAME OF WATERBODY, IF KNOWN (if applicable)	14. PROJECT STREET ADDRESS (if applicable)
Lake Sakakawea (coordinates provided near center of the work area)	Address See Enclosed Figure
15. LOCATION OF PROJECT	City - State- Zip-
Latitude: °N 48.139049 Longitude: °W -103.084383	

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN (see instructions)

State Tax Parcel ID Municipality

Section - See Range List Township - T 154N Range - R 96W (S.19 & 30) and R 97W (S. 25 & 36)

17. DIRECTIONS TO THE SITE

From Bismark, North Dakota, take U.S. Highway 83 north toward Minot. At State Highway (ND) 23 turn left (west) and continue until ND 23 becomes ND 10 and continue west. At ND 1806 turn right (north) and remain on highway 1806 until reaching the destination at Tobacco Garden Creek Recreation Area and boat ramp.

18. Nature of Activity (Description of project, include all features)

The proposed action includes the crossing of Lake Sakakawea using the horizontal directional drilling (HDD) method to install the FERC regulated, North Bakken Expansion Project, (Project) a natural gas pipeline. The proposed action involves crossing Lake Sakakawea, a U.S. Army Corps of Engineers (USACE) civil works project area (Garrison Dam) and crossing of adjacent USACE-owned property. Therefore, WBI is requesting Section 408 review and authorization for the Project. The HDD of Lake Sakakawea and the adjacent USACE-owned property will not require disturbance of the lake or the adjacent USACE property; both will be crossed under utilizing the HDD method. Attachments included with this submittal are based on requirements outlined during meetings with USACE - Omaha District staff during the fall 2019 and a meeting in Omaha, Nebraska on January 10, 2020. Attachments include Figure 1 that illustrates the HDD across Lake Sakakawea and USACE-owned property, as well as a series of plans (Attachments 1 through 9) including plans for: HDD Installation, Surface Use, Erosion and Sediment Control, Spill Prevention and Countermeasures, Emergency Response, HDD Fluid Monitoring, Operations/Maintenance (including Privileged and Confidential information), Reclamation/Monitoring, Risk Assessment

19. Project Purpose (Describe the reason or purpose of the project, see instructions)

WBI Energy Transmission, Inc. (WBI Energy) proposes to install a new approximately 60-mile-long, 24-inch-diameter natural gas pipeline from WBI Energy's existing Tioga Compressor Station to a new interconnect with Northern Border's mainline southeast of Watford City, North Dakota. WBI Energy intends to construct the project to transport natural gas from the Bakken region to Northern Border's existing mainline. The Project will help to satisfy natural gas demand in the midcontinent region of the United States. The Project will also provide an outlet for this natural gas that will help in the industry-wide effort to reduce flaring of this valuable energy resource. The Project would include the crossing of Lake Sakakawea and WBI Energy proposes the lake crossing be completed using HDD methodologies.

USE BLOCKS 20-23 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

No discharge within waters of the U.S. is proposed to cross Lake Sakakawea since the use of the HDD method to install the pipeline would avoid disturbance to the USACE civil works project and USACE-owned property. The reason for crossing the USACE-owned property and Garrison Dam project area (Lake Sakakawea) is that the crossing of Lake Sakakawea is necessary to connect key receipt and delivery points for the Project.

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards:

Type Amount in Cubic Yards	Type Amount in Cubic Yards	Type Amount in Cubic Yards
No discharge proposed	No discharge proposed	No discharge proposed

22. Surface Area in Acres of Wetlands or Other Waters Filled (see instructions)

Acres No discharge proposed

or

Linear Feet

23. Description of Avoidance, Minimization, and Compensation (see instructions)

No impacts on or loss of waters of the U.S. are planned according to the Horizontal Directional Drilling Installation Plan (Attachment 1). The HDD method is proposed in order to avoid impacts to Lake Sakakawea.

24. Is Any Portion of the Work Already Complete? ☐ Yes ☒ No IF YES, DESCRIBE THE COMPLETED WORK

25. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (If more than can be entered here, please attach a supplemental list).

a. Address- N/A adjoining property owners are the U.S. Army Corps and U.S. Government.

City - State - Zip -

b. Address-

City - State - Zip -

c. Address-

City - State - Zip -

d. Address-

City - State - Zip -

e. Address-

City - State - Zip -

26. List of Other Certificates or Approvals/Denials received from other Federal, State, or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED
None					

* Would include but is not restricted to zoning, building, and flood plain permits

27. Application is hereby made for permit or permits to authorize the work described in this application. I certify that this information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

SIGNATURE OF APPLICANT — 8-11-20 DATE — SIGNATURE OF AGENT — DATE

The Application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

Appendix B

U.S. Army Corps of Engineers Section 408 Permit Application and Attachments,

(Figure 1, HDD Crossing Plan, and Associated Plans)

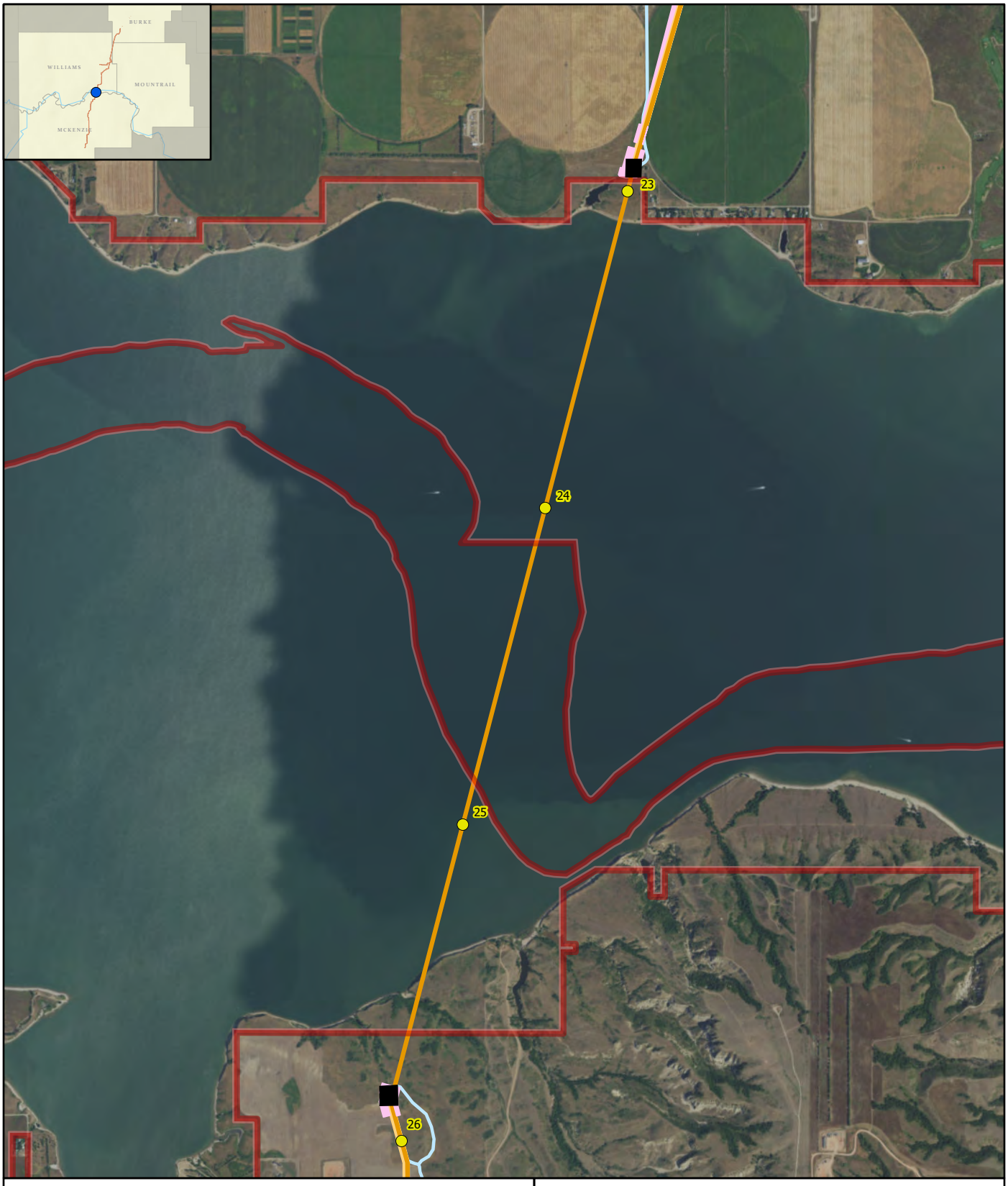


Figure 1
North Bakken Expansion Project
Lake Sakakawea HDD Extent
and Associated USACE Owned Lands Crossing

WBI ENERGY TRANSMISSION

File: M:\Clients\V-X\WBI\North_Bakken_Expansion_ArcGIS\Wetland_WaterbodyReportMaps\USACE_NWP_Report.aprx | Revised: 1/31/2020 | Scale: 1:40,000 Drawn By: RJC

Attachment 1

Horizontal Directional Drilling Installation Plan

HORIZONTAL DIRECTIONAL DRILLING INSTALLATION PLAN

WBI Energy Transmission
Lake Sakakawea/ Missouri River HDD Crossing

Proprietary ... Michels Corp

MICHELS®

August 10, 2020
REVISION -2

MICHELS®

HDD INSTALLATION PLAN
Michels Directional Crossings
WBI Energy Transmission
North Bakken Expansion Project
Lake Sakakawea / Missouri River Crossing
Installation of ~15,442' / 24" Steel Pipe

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Drill Work Sites	Page 2
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Pull Pipe	Page 8
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Solids Control and Separation	Page 8
Demobilization	Page 8

Intro:
The proposed Lake Sakakawea/Missouri River HDD crossing consists of installation of ~15,442' of 24" steel pipe. HDD has been the selected installation method to minimize surface and water body disruption/impact. Environmental considerations were also a factor in choosing HDD as the construction method. HDD is a trenchless installation method that installs the pipeline far deeper under the waterbody with minimal surface and environmental impact when compared to traditional open-cut installations.

Drill Support and Manpower:
Michels proposes drilling and installing this crossing utilizing the pilot-hole intersect method, which requires cutting edge directional drilling technology & the use of two drill rigs drilling simultaneously toward each other in performance of the installation. Michels has been perfecting this unique cutting-edge method for the past 12-years, while successfully completing numerous complicated and long distance directional drill installations that otherwise would not have been attempted. Each drill rig site requires one shift of 8-12 men. The primary drill rig to be utilized will be a minimum DD-840 Drill Rig with the secondary rig being a minimum DD-840 Drill Rig. The crews will be scheduled to work approximately 12 to 14 hours per day and up to 7-days per week. 24-hour per day operations may be required at any given time on the crossing depending on conditions encountered in the bore-hole & specific requirements which must be met. Michels reserves the right to supply and substitute personnel as required but will provide WBI Energy notice prior to personnel changes being implemented.
(Attachment – Potential On-Site Specialized Manpower and Resumes)
(Attachment- Safety and JSA Information)
(Attachment- SPCC Plan)
(Attachment – Drill Rig Specifications)

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Drill Configuration/Geometry:
Directional drilling using the pilot-hole intersect method is proposed for this crossing. The planned borehole geometry is anticipated to follow the attached HDD plan and profile drawing. Adequate depth of cover should be maintained beneath contours and obstacles in accordance with industry standards at all crossings to minimize the risk for inadvertent drilling fluid returns. The HDD crossing will be installed within the tolerances listed in the construction contract so that the factor of safety ratings will be maintained. Conductor casing may also be installed at either or both the entry and exit locations in order to traverse unconsolidated formation if necessary, this is done in order to alleviate conditions associated with inadvertent drilling fluid returns and settlement or to allow a better transition into more consolidated formation.

(Attachment – HDD Plan and Profile Drawing)

Drill Work Sites Preparation:
The drill work sites required for staging equipment should be prepared by the prime contractor readied for Michels' mobilization to the job site. Cleared and level work pads at both sides of the crossing are necessary for the support and movement of semi-trucks and heavy equipment. The pad may require the installation of matting, gravel or other means for a stable workable surface. A work pad is required at both sides of the proposed crossing capable of supporting a drill rig with ancillary equipment. The two work areas are shown on the attached HDD design drawing and pipe laydown drawing. The two work areas should be connected by a straight centerline alignment. A drill rig dead-man is typically installed in front of the unit to support minimal movement of the rig during drilling operations. The dead-man consists of an 8' x 20' steel plate installed vertically down into the ground placed in front of the rig. It is used to distribute load bearing support across and to the surrounding ground formation during rigorous drilling operations.
(Attachment – Anticipated Entry/Exit Equipment)
(Attachment – HDD Equipment Noise Information)

Pilot Hole:
Michels uses two main pilot hole tracking systems for large scale HDDs such as the Lake Sakakawea / Missouri River crossing. The first being a wireline tracking system called the Para-track system. This system requires a surface cable or solenoid. The second pilot hole tracking system is the Gyroscope which requires no surface cable or solenoid. The typical hole intersect procedure for the two systems are described separately below.

Hole Intersect using the Para-Track System
A 12-1/4" drill bit is advanced from the entry points (Rig Side Entry and Pipe Side Entry) toward the pre-designated intersect point along the proposed bore-hole path alignment using a directional jetting bottom-hole assembly or mud motor with bit and bottom-hole assembly. The pilot hole drilling from Rig Side Entry can be prior to or concurrent with pilot hole drilling from the pipe side entry as intersect procedures do not have to occur at exactly half the distance. The intersect location ±500 feet is pre-determined prior to drilling however, conditions encountered during pilot hole drilling will dictate the approximate location of performing the intersect. The bottom-hole assembly will be advanced from the entry side toward the second pilot-hole projection which will be drilled or is being drilled from the other side. The bottom-hole assembly includes the bit (12-1/4" in diameter), drilling mud motor if required, orientation and pressure measurement sub, steering guidance tool (Vector Magnetics Para Track2 Survey and Guidance System) and non-magnetic drill collars. The drill stem

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added behind this bottom-hole assembly will be S-135 grade 7 5/8" FHDS (Full Hole Double Shoulder) series drill pipe or better and in random 30(±) foot lengths.

The location of the pilot-hole drill paths will be continuously monitored, surveyed then recorded from its respective drill rig location utilizing the data from the down-hole probe (Para Track2 Probe) as drilling proceeds. Critical tracking information to be processed includes elevation, alignment and distance away from each rig which is calculated then recorded in accordance with industry standard, once at the end of every drill stem length (approximately 30-feet).

Constant communication is maintained between the two drill crews as pilot-hole intersect operations progress. Prior to the pilot holes reaching the projected intersect location, the magnetic signal being monitored on the instrument tracking computer inside the control trailer will increase in strength. After the two pilot holes are overlapped by approximately 30', a PMR (Passive Magnetic Ranging) survey will be conducted. At this time, the Para Track2 Probe will be used to collect static magnetic field readings relative to the adjacent drill stem. To perform this operation, the 7 5/8" drill pipe positioned in the previously drilled borehole from the entry end will be retracted in predetermined distance increments, these distance retractions are sensed by the probe and recorded. The magnetic field readings collected by the Para Track2 probe will then be analyzed to verify that sufficient and accurate data has been collected and a position offset between the two boreholes can be calculated and determined. This PMR survey will be repeated once every 30' until the two boreholes are connected.

Hole Intersect using the Gyroscope System

A 12-1/4" drill bit is advanced from the entry points (Rig Side Entry and Pipe Side Entry) toward the pre-designated intersect point along the proposed bore-hole path alignment using a directional jetting bottom-hole assembly or mud motor with bit and bottom-hole assembly. The pilot hole drilling from Rig Side Entry can be prior to or concurrent with pilot hole drilling from the pipe side entry as intersect procedures do not have to occur at exactly half the distance. The intersect location (±500 feet) is pre-determined prior to drilling however, conditions encountered during pilot hole drilling will dictate the approximate location of performing the intersect. The bottom-hole assembly will be advanced from the entry side toward the second pilot-hole projection which will be drilled or is being drilled from the other side. The bottom-hole assembly includes the bit (12-1/4" in diameter), drilling mud motor if required, orientation and pressure measurement sub, steering guidance tool (Gyroscope Guidance System). The drill stem added behind this bottom-hole assembly will be S-135 grade minimum 7 5/8" FHDS (Full Hole Double Shoulder) series drill pipe or better and in random 30(±) foot lengths.

The location of the pilot-hole drill paths will be continuously monitored, surveyed then recorded from its respective drill rig location utilizing the data from the down-hole probe (Gyroscope) as drilling proceeds. Critical tracking information to be processed includes elevation, alignment and distance away from each rig which is calculated then recorded in accordance with industry standard, once at the end of every drill stem length (approximately 30-feet).

As the pilot holes approach the planned intersect area the following steps are typically followed to complete the intersect:

1. A pair of radars are placed, one behind each gyro on either side.
2. The drilling surveyors on both sides stay in contact sharing their survey data as the bore progresses.

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3. When they get within 30’ of the bits overlapping, one side will pull a joint of pipe to the top of the rig and wait for the opposite side to overlap their hole with the bit.
4. While the drilling side is progressing, the other side will monitor annular pressure (if annular pressure is being monitored) and watch for vibrations indicated on survey readouts.
5. If at this time the drilling side notices any changes to the push or rotation indicating they may be coming into the hole drilled from the opposite side, the side which is waiting will slowly push down and see if they bump into the other bit. If they do bump, the drilling superintendent and surveyors will then decide based on the angles at which the intersect occurred, the push and torque on the strings of pipe, and the distance from the intersect point to the ends of the hole, which side will push out of the ground. They will also decide, based on ground conditions how much space to keep between the bits as one side pulls back and the other pushes forward.
6. If the bits do no bump after the two holes are overlapped in a horizontal direction, the side which is not drilling forward will pull back drill stem and bit an appropriate distance so that the drilling side can drill far enough forward without the bits being overlapped until the side which is waiting can push down slowly while the other side monitors for vibrations until the radars are parallel to each other.
7. At this time the surveyors will take a radar survey. Based on the survey, the drilling superintendent and surveyors will determine the best option to drill from one side or the other until the holes are intersected. Usually, another radar survey will be taken in 1 to 3 drill pipes as the hole progresses to verify that the distance between the holes is matching what is expected based on the first set of data.
8. When the holes get close enough in a lateral and vertical direction that intersection is expected one side will pull back far enough that the drilling side can safely drill into the hole without causing damage to the tools. When the drilling superintendent and surveyor believe based on the pressures and survey data the holes are intersected, the other side will push down slowly until the bits are verified to have touched. Usually this is accomplished by pushing until either the push pressure rises above that in open hole, or the other side notices movement. Then one side will move a set distance and see if the other side can now push freely again.
9. When it is verified that the holes are intersected the drilling superintendent and surveyors will then decide based on the angles at which the intersect occurred, the push and torque on the strings of pipe, and the distance from the intersect point to the ends of the hole, which side will push out of the ground. They will also decide, based on ground conditions how much space to keep between the bits as one side pulls back and the other pushes forward. They will also decide, based on ground conditions how much space to keep between the bits as one side pulls back and the other pushes forward.
10. If the ground is soft, it can be necessary for both sides to bump the bits against each other and one side to push as the other side pulls back slowly maintaining contact with the bits to insure that the pushing side stays in the hole.

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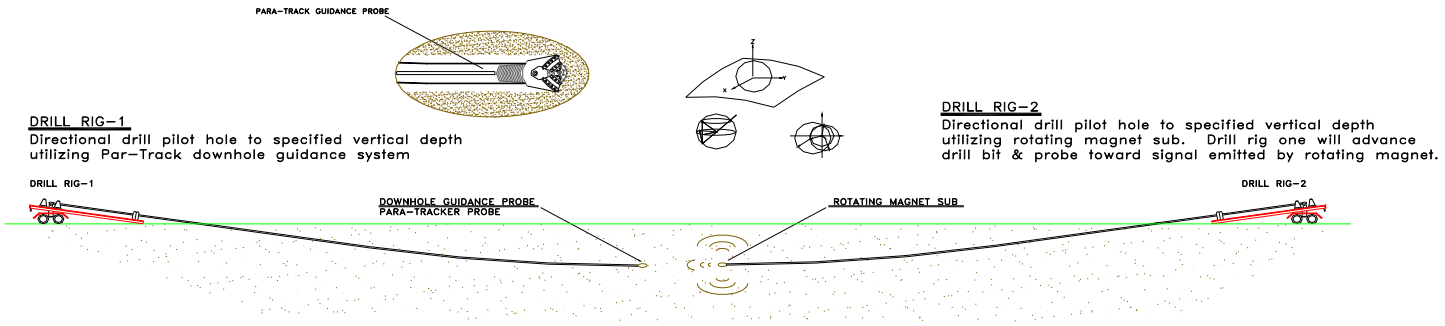
Pilot Hole Intersect Sketch



(Attachment – MGS Steer Tool System; Attachment – Gyroscope; Attachment - Para Tracker Gyro Module; Attachment - Para Tracker, Attachment Tensteer Tool, Attachment – Drill Rig Specification Hercules 1200, Atlas-840, Titan-440 and UNI 250X400, Attachment – Daily Tracking Forms)

Drilling Fluids:

Essential to any successful HDD process is the selection and proper utilization of drilling fluid, which is primarily made up of water and bentonite having pH values between 8 and 9. Bentonite is a naturally occurring, non-toxic, inert substance that meets NSF/ANSI-60 Drinking Water Additive Standards and is used for drilling potable water wells. Often soda ash is added to the drilling fluid to increase the pH to 8 and reduce the soluble calcium. This allows bentonite to perform at its maximum and reduces the amount of bentonite added to the drilling fluid. Soda ash is also NSF standard 60 certified and is used to drill potable water wells. Using these products minimizes the impact to any environmentally sensitive area in the unlikely event that an inadvertent return should occur.

Bentonite serves many notable purposes in the HDD process, which includes but is not limited to:

1) Cleans the drilled cuttings from the bore hole and cools the drilling tools,
2) Transports cuttings to the surface for recycling,
3) Aids in stabilizing formations by supplying a cohesive nature to the surrounding geological formation and preventing fluid loss from the bore hole,
4) Provides lubrication for the drill string and downhole assembly, which reduces frictional forces at the formation,
5) Drives a down-hole drill motor for rock drilling,
6) Provides hydrostatic fluid pressure in the bore hole to offset ground formation pressures.

Drilling fluid is composed of a carrier fluid and solids. The selected carrier fluid for this crossing consists of water (approximately 96%) and an inorganic, bentonite clay (approximately 4%). Michels has access to

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several different brands of bentonite. The selection of which brand to use is typically based on price, availability and proximity to the proposed drill site. The following brands all exhibit similar characteristics providing the same results as listed above.
(Attachment – Potential Bentonite Brands – Product Data Sheets/MSDS Sheets)

Potential Bentonite Brands

- Max Gel
- Super-Gel X
- Bara-Kade

The bentonite will be mixed in a mud mixing tank of up to 5,000 gallons, depending on mud rig size, in accordance with manufacturer's recommendation. Approximately 15 to 20 pounds of powder bentonite will be mixed with 100 gallons of fresh water *(Mud Composition),* and will be used throughout the entire drilling process to establish and maintain optimum drilling fluid properties. Estimated proportions listed above are based on past experience and do not take into account unexpected conditions encountered. Michels maintains fluid performance through the daily sampling, testing and recording of fluid properties throughout drilling operations. This provides Michels' Mud Technician the information required to make educated recommendations regarding maintenance of efficient drilling fluid rheology consistent with hole-stabilization with the intention of limiting inadvertent surface returns and optimizing drilling fluid performance. Following is one of the tables used as a guideline by the Mud Technician referencing recommended fluid consistencies targeted during typical testing. Consistencies of powder and water are varied to achieve these recommended viscosities.

Targeted Drilling Fluid Viscosities Recommended	
Sand	60-80 Viscosity
Silt	50-70 Viscosity
Clay	40-50 Viscosity
Rock	60-80 Viscosity
Gravel	70-90 Viscosity

Once the drilling fluid is thoroughly mixed to an acceptable consistency, it is pumped from the mud tank to the back end of the drill rig. From here it is injected under high pressure through the drill stem at a rate of between 300 to 800 gpm to the apex of the drill head. The spent drill fluid with mixed cuttings maintains a return flow back along the annular space created between the drill stem and the formation wall. Drill fluid returns to the entry pit where it is pumped by a 6hp submersible pump to the fluid recycle and processing system.

Additives may be deemed necessary based on evaluations and recommendations made by the Mud Technician during drilling and hole-opening operations. If the need for drill fluid additives does arise, it is anticipated that one of the attached additives may be required in order to maintain adequate fluid rheology down-hole. Michels formally submits the attached drilling fluid additives for approval and use on this project. (Attachment – Drilling Additives / LCMs for approval)

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Reaming Passes:
Michels anticipates performing one ream pass with a final hole dimeter of ~36" accommodate the 24" steel pipe. However, the final determination as to size and number of ream passes will be based on conditions encountered during pilot-hole drilling and the initial reaming operation.

The reamers proposed for the crossings will be various types of dirt and rock reamers custom fabricated by Michels specifically for this type of formation, which could include conventional fly-cutter type reamers and hole-openers. Michels also has additional resources for various rock-tooling which can be supplied at a moment's notice if needed. Equivalent or better tools may be substituted depending on availability of other supplier's products or if changes in anticipated drilling conditions are encountered.
(Attachment- Michels' Downhole Tools)

Cleaning Pass:
A swab pass will need to be conducted up to the same size as the final ream pass but no larger. The swab pass is typically pulled back from exit to entry.

Drill Mud Cleaning:
The first phase of the mud cleaning system is displacement of solid returns at the shaker. Heavy solids are sifted out by a shaker with screens and deposited into a pit. From here they will be transported by dump truck to a site for disposal.

Drill Mud Cleaning Equipment Specifications

Volume of Mixing/Scalper Tank	54.0-Bbls
Volume of Desander Tank	72.0-Bbls
Volume of Desilter Tank	72.0-Bbls
Quantity of Scalping Shakers	1.0-Shakers
Mesh Size of Scalping Shakers	10-20 Double Stacked
Desander Capability	2 @ 500-GPM (1,000 GPM Total)
Desander Cones	2.0-Cones
Desander Mesh Size	40 to 165
Quantity of Desilter Cones	10 Ea @ 100-GPM
Desilter Mesh Size	60 to 250
Steel Mud Circulating Tank Volume	160-Bbls
Returns Tank Volume (Mud Pit)	320-Bbls
Cuttings Tank Volume (20-yd Roll-off)	150-Bbls
Mud Screening, Max Pass Size	40-Mesh

(Attachment – Mud Cleaning Equipment Specifications)

Bentonite Pump Capabilities (ENTRY/EXIT) (Based on Availability)

Name Brand	Ellis Williams W-446 Triplex Piston Model
Liner Size	6-Inches
Maximum Pressure	1,027 PSI
Maximum Flow Rate	661 GPM
Gallons Per Stroke	2.20 Gallons Per Stroke

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Bentonite Pump Capabilities (ENTRY/EXIT) (Based on Availability)

Name Brand ..... Gardner Denver OPI-350
Liner Size 6-Inches
Maximum Pressure .....1,469 PSI
Maximum Flow Rate..... 529 GPM
Gallons Per Stroke ..... 2.94 Gallons Per Stroke

Pull Pipe:
The 24" pipe will be welded and placed on top of rollers in preparation for pullback. The pipe will be pulled into place utilizing an approved pull head, swivel and reamer from exit to entry. This is a continuous operation which takes place until the product pipe is pulled through the opened hole back to the entry point.
(Attachment - Michels' Support Rollers)

Contingency Planning:
Contingency planning is conducted in response to unforeseen events and conditions which could occur during normal operating sequences.

Included in the contingency plans, Michels has developed an environmentally responsive set of contingency plans including contingency planning for inadvertent returns to be invoked for expeditious attention and handling of various incidence as they arise.
(*Attachment – Contingency Plans for HDD crossing)*

Solids Control and Separation:
The first phase of the mud cleaning system is displacement of solid returns at the shaker. Solid control systems will vary for the various drill rigs however the end product is the same. Heavy solids are sifted out by a shaker with screens and deposited into a pit. From here they will be transported by dump truck to a site for disposal. Spent drill fluids are collected at the drill site and transferred to tanker trucks for disposal at an approved location. *(Attachment – Drill Fluid Recycle Flow Chart)*

Demobilization:
Excess drilling fluid is removed from the site and transported to the approved disposal site. Equipment and personnel will be moved off-site after successful completion of the hydrostatic test and clean-up operations will take place. Mud pits will be backfilled with the native soil that was excavated and temporarily stored. Topsoil will be segregated separately from the subsoil and backfilled appropriately to restore conditions as close to pre-construction as possible.

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ATTACHMENT

ON SITE
SPECIALIZED MANPOWER
AND RESUMES

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PERSONNEL STATEMENT

Personnel for each newly contracted job, from the Project Manager to the Mud Technician, are duly assigned to a project based on a number of circumstances. These may include but are not limited to the following; current projects under contract, geographic location of previous project, scope of work required for the directional drill. Our personnel and equipment have been assembled so that they are interchangeable from project to project.

The key to any directional drilling project is obviously having qualified personnel who are experienced in dealing with unforeseen circumstances as they arise. Michels' personnel are some of the most experienced and highly qualified drilling experts in the industry, as demonstrated on past projects accumulated on our reference list. With the appropriate resources at their disposal, Michels has overcome risks associated with some of the most difficult drilling projects ever attempted and has evolved into one of the foremost leaders in the directional drilling industry.

Each of the Drilling Superintendents employed by Michels is highly experienced in utilizing drill rigs of every size. Michels' Drilling Superintendents are well respected throughout the industry, as represented on the attached resumes. Each has completed countless difficult drills including installation of large diameter pipe and at great lengths. Our Drilling Superintendents have worked up through the ranks providing them a complete and comprehensive understanding of safety, hazards, environmental monitoring, manpower, equipment operations and repairs for each phase of the directional drilling operation. Michels' personnel maintain continuous schooling for all phases of the drilling operation.

As noted on the attached resumes, each Superintendent has drilled throughout North America as well as internationally, and has encountered various soil conditions, from sands, gravels, clay and cobble to solid rock formations.

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Directional Crossings

A Division of Michels Corporation

Jeff Mueller
Vice President of Michels Directional Crossings

Sean Nicholson
Vice President of HSE

Jason Pederson
Director of Safety for HDD

Ed Dye
Safety Coordinator

Michael Miller
Safety Coordinator

Spencer Rusk
Safety Coordinator

Mark Franz
Environmental Manager

Tim McGuire
Senior Advisor

Paul Krings
Sr. Equipment and Logistics Manager

Eric McBrair
HDD Tooling Manager

Dan Pucker
Directional Drill Shop Manager

Scott Nehls
HDD Logistics QA/ QC Manager

Matt Smith
General Manager Contracts and Business Administration

Greg Goral
Senior Design Engineer

Brad Eifert
Engineering Tech

Zach Osborn
Estimator

Diane Dalle Nogare
Executive Assistant

Toni Budahn
Administrative Assistant

Dustin Branscomb
Trenchless Engineer

Don Mueller
Eastern Operations Manager

Bob Spennati
Assistant Operations Manager

Randy Robinson
Midwest Operations Manager

Kurt Myhre
Western Operations Manager

Ray Viator
Marine Operations Manager

Ted Foltz
Special Projects Manager

Project Managers: to be assigned to Operations Managers on a per project basis.

Ken Coleman	Wendell Long	Eric Frawley	Larry Shilman
Jim McGovern	Karl Kornkven	Rick Zavitz	Jeremiah Yliniemi
Dale Schinderle	Michael Geelan	Doug Houska	Chad Johnson

Field Superintendents: to be assigned to Operations Managers on a per project basis.

Mike Brever	Marcus Carratt	Jack Edmunds	Brian Guelig	Nick Leblanc	Tim Monroe	Clifford McLain	Seth Strean	Matt Rohwer	Brady Hickey	Branden Cole
Dan Kriesel	Curt Rischmueller	Steve Sanders	Richard Wulff	Bobby Skipworth	Dave Williams	James Day	Josh Bush	Garrett Derrerr	Steve Case	Carl Bresser
Jamie Hollenbeck	Mark Matthews	Doug Stebbins	Seth Matheny	Ryan Jackson	Nate Mecklenburg	Jason Freund	Tim Bunkelman	Brian Morgan		

Survey Engineers: to be assigned to Operations Managers on a per project basis.

Jeff Nehmer	Cale Mullenix
Lorenzo Rivera	Eric Riha
Jeremiah Erickson	Dan Reynolds

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Jeffrey S. Mueller

Vice President

PROFESSIONAL EXPERIENCE

2020 – Present: **Vice President | Michels Directional Crossings | Brownsville, WI**

Responsible for horizontal directional drilling division construction operations. Duties include profit and loss responsibility for multiple and simultaneous directional drilling gas, product, water, sewer, civil, electric, telephone cable, and environmental projects. Day-to-day involvement with bid estimating, construction feasibility evaluation, specification and design criteria review, proposal preparation, contract and subcontract negotiations, project planning and oversight, cost scheduling, allocation of divisional resources, and interface with utility construction managers, engineers, and owners. Report directly to the Senior Vice President and President of the company.

2003 – Present: **Operations Manager | Michels Directional Crossings | Brownsville, WI**

Supervisor of field operation superintendents and directional drilling project managers. Oversee large inventory of drilling tools and materials during storage and field use. Monitors production by Fleet Department of directional drilling personnel and equipment. Duties include coordinating and scheduling the mobilization of equipment, personnel and materials to remote job sites throughout the United States and Internationally. Involved in estimating of various directional drilling projects. Specialize in the engineering design, build and maintenance of directional drilling fleet. Responsible for pilot hole drilling & survey for complicated bores which include implementing and integrating new technology necessary for successful completion of leading edge HDD crossings (i.e. hole-intersects). Complete project experience available upon request.

Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
42"	3980'	Susquehanna River MP 99.6, PA	2018
20"	7354'	Susquehanna River, PA	2018
36"	6238'	Ohio River, OH/WV	2017
30"	3483'	Ford Island to Landing C, HI	2017
42" Steel with 36" HDPE	3983'	St John's River, FL	2016
30"	6119'	Lake Whitney, TX	2016
12"	11,548'	Union Canal & Martin Barge Canal, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
12"	11,563'	Holland Bottoms Wetlands, AR	2015
18"	12,459'	Houston Ship Channel, TX	2015
6"	6999'	Navajo Reservoir/San Juan River, NM	2014

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
48"	2060'	Tres Palacios River, TX	2014
36"	9040'	Mississippi River & Levees, Il/MO	2014
42"	3008'	I-95 & Tidal Wetlands, NJ	2013
30"	6544'	1st Street, NJ	2013
42"	4441'	Goethals Bridge, NY	2013
30"	8101'	Kill Van Kull River, NY/NJ	2013
30"	5378'	Hudson River, NY/NJ	2012
30"	4850'	Red River, TX/OK	2012
42"	4519'	Freeman Road, LA	2011
42"	5117'	Nature Conservatory, LA	2011

1996 – 2003: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record-keeping of plots and production. Oversees drilling survey during crossing.

1991 – 1996: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, WI**

Responsible for surveying, staking and design of directional drill path and curve, monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software. Complete surveying skills and experience utilizing a Total Station for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points. Additional duties include on-site maintenance of technical equipment and necessary record-keeping of plots and drilling logs.

1989 – 1991: **Skilled Laborer | Michels Directional Crossings | Brownsville, WI**

Experience in working on and around directional drilling rigs as an integral member of a specialized team. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs; hydraulics; fluids; set-up and operation of drill motors; power generators; mud pumps; bentonite mixers; drill pipe; reamers; couplings; and overall equipment maintenance and operation.

EDUCATION

1989 **Lomira High School | Lomira , WI**

High School Diploma

Tim McGuire

Senior Advisor

PROFESSIONAL EXPERIENCE

2020 – Present: **Senior Advisor | Michels Directional Crossings | Brownsville, WI**

Provide advice in the management of domestic and international horizontal directional drilling operations. Responsibilities include business development, contract procurement and negotiation, project oversight and management, and client communication.

2002 – 2020: **Vice President | Michels Directional Crossings | Brownsville, WI**

Responsible for horizontal directional drilling division construction operations. Duties include profit and loss responsibility for multiple and simultaneous directional drilling gas, product, water, sewer, civil, electric, telephone cable, and environmental projects. Day-to-day involvement with bid estimating, construction feasibility evaluation, specification and design criteria review, proposal preparation, contract and subcontract negotiations, project planning and oversight, cost scheduling, allocation of divisional resources, and interface with utility construction managers, engineers, and owners. Report directly to the Senior Vice President and President of the company.

1998 – 2002: **General Manager | Michels Directional Crossings | Brownsville, WI**

1994 – 1998: **Project Engineer/Project Manager | Michels Corporation | Brownsville, WI**

1992 – 1994: **Division Manager | Michels Environmental Services | Brownsville, WI**

1991 – 1992: **Drilling Division Manager | Harrison Western Mining Corporation | Denver, CO**

1987 – 1992: **Project Manager/Geotechnical & Environmental Engineer | Ebasco Corporation | Denver, CO**

INDUSTRY INVOLVEMENT

- MCI Engineer Training Seminar “Horizontal Directional Drilling Design, Specification and Construction for Trenchless Placement of Underground Utilities”
- Midwest Gas Association “Horizontal Directional Drilling Large Diameter Pipeline Installations”
- National Groundwater Association Outdoor Action Conference “Horizontal Directional Drilling Demonstration for Installation of Horizontal Wells”

EDUCATION

Colorado School of Mines | Golden, CO

Bachelor of Science: Geological Engineering - Minor: Hydrogeology

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Matthew Smith

General Manager/Contracts & Business Administration

PROFESSIONAL EXPERIENCE

2019 – Present: **General Manager/Contracts & Business Administration | Michels Directional Crossings | Brownsville, WI**

Oversee day-to-day divisional business operations and management of operational costs.
Duties include profit and loss responsibility for multiple and simultaneous trenchless construction projects in the oil/gas, civil, power and communication business sectors.
Day to day involvement with bid estimating, construction feasibility evaluation, specification and design criteria review, contract and subcontract negotiations, project planning, cost scheduling and interface with utility construction managers, engineers and owners.

2013 – 2019: **Manager-Direct Pipe | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating Direct Pipe projects for various size gas, water, sewer, electrical and communication lines. Assists with project design and methods of operation. Oversees clarification and interpretation of construction drawings. Assumes accountability for the direction and performance of construction personnel. Oversees project schedule, safety, profitability and cost control. Direct pipe installations/pipe assists:

Diameter	Length	Crossing/Location	Year
48"	651'	Juniata River, PA - HK 750PT Installation	2018
42"	484'	Highway 50, West Virginia - HK 500PT Installation	2018
36"	856'	Qu`Appelle River, Canada - HK 750PT Installation	2017
36"	1,280'	Highway #1, Canada - HK 750PT Installation	2017
36"	1,027'	United Blvd & Mundy Creek, Canada - HK 750PT Installation	2017
36"	1,047'	Lougheed Hwy, Canada - HK 750PT Installation	2017
42"	7,200'	Athabasca River, Canada - HK 750PT Installation	2016
36"	827'	Leslie Street, Ontario, Canada - HK 300PT Installation	2015
42"	1,299'	Lisgar Meadowbrook, Ontario, Canada - HK750PT Installation	2015
42"	1,008'	Highway 63, Canada - HK750PT Installation	2015
48"	4,039'	Dow Barge Channel, Clute TX - HK750PT Installation	2015
36"	1,002'	Hwy 225, Deer Park, TX - HK300PT Installation	2015
36"	1,092'	Lubrizol Drainage, LaPorte, TX - HK300PT Installation	2015
48"	2,455'	Rio Grande River, El Refugio, TX - HK750PT Installation	2014
42"	1,200'	Railroad Crossing, Groves, TX - HK750PT Installation	2014
42"	1,050'	Beaver River, Alberta, Canada - HK750PT Installation	2013
42"	470'	I-84, Westfall, PA - HK750PT Installation	2013

PROFESSIONAL EXPERIENCE (continued)

2013: **Project Manager | Michels Tunneling | New Berlin, WI**

Responsible for overall site/field management and safety of microtunneling/tunneling projects. Monitor project budget including month end computations and projections. Coordinate project development between project engineer, superintendent and foreman. Prepare/submit all submittals, RFIs, extra work, contract change orders and pay requests.

2011 – 2013: **Project Engineer | Michels Tunneling | New Berlin, WI**

Planned, scheduled, conducted, and coordinated assigned engineering work; monitored work for compliance to appplicable codes, accepted engineering practices, and ensured effective communication and coordination on projects between all disciplines and project participants.

2010: **Engineer Internship | Michels Tunneling | New Berlin, WI**

2009: **Pipeline Laborer | Michels Pipeline Construction | New Berlin**

2003 – 2007: **Concrete/General Laborer | Forino Developers | Skinking, PA**

PROJECT PROFILES

OCI Project No. DB10-WASD-01 ESP - Miami, FL
Mico-tunnel installation of 1200 LF of 72" Permalok steel casing under the Government Cut Channel in Miami. The casing will be installed through the coral rock formation from a shaft constructed by others on Fisher Island to a shaft in the water off South Beach.

Intracoastal Waterway Pipeline Relocation, Galveston Causeway, Galveston, TX
700' of 48" Permalok tunnel drives through clay underneath the Galveston Bay for installation of new waterline for the City of Galveston. Michels Tunneling was the 4th contractor to attempt this project and completed it successfully and under budget.

Akron II - Akron, Ohio
The second phase of a sewer installation, including 2 microtunneling runs installed 1,086 LF 48" Hobas.

Massillon Road Sanitary Sewer Improvement - Akron, Ohio
Massillon Road 2,925 LF of 42" Cenrifugally Cast Fiberglass Reinforced Polymer Motar Pipe sanitary sewer gravity sewer, microtunnel installation; 1,328 LF of 48" CCFRPM pipe on micropile support, 29 LF of 36" OH CCFRPM pipe, gravity sewer, micropile support. 7 EA shaft excavations with steel sheeted ground and 7 EA manholes structures. 250 LF of open cut excavation with steel sheeted support.

SFPUC Bay Tunnel - San Francisco, CA
The project includes 26,208 LF of 12'-10" diameter concrete segmented tunnel under the San Francisco Bay from Menlo Park on the S.F. Peninsula Bay to Newark in the East Bay area, two slurry diaphragm wall shafts, and 108" cement motor lined steel pipe welded in the tunnel and shafts as a final liner carrier pipe.

TRAINING & CERTIFICATIONS

- Crane Signaler Certified
- Confined Space Certified

INDUSTRY INVOLVEMENT

- 2018 Trent Ralston Young Trenchless Achievement Award
- No-Dig Paper Presentation (2019): Crossing the Calumet

INDUSTRY INVOLVEMENT (continued)

- No-Dig Paper Presentation (2018): Lengthy crossings shortened by Direct Pipe Technology
- No-Dig Paper Presentation (2017): Direct Pipe method using water

EDUCATION

Gonzaga University | Spokane, WA

Bachelors of Science: International Business

Greg Goral

Senior Design Engineer

PROFESSIONAL EXPERIENCE

1988 – Present: **Senior Design Engineer | Michels Directional Crossings | Brownsville, WI**

Create forms for and compile various informational submittals for Directional Drilling and Line and Cable Divisions. Planning and design drawings on AutoCAD from preliminary designs to as-built drawings. Developed computer programs for simplifying preliminary and correction computations required for Directional Drilling. Composed dissertations for various projects proposed and awarded. Compiled engineering computations and studied stress and loading analysis for pipeline installation. Responsible for take-offs, material estimates, material purchasing and project coordination, and map route reproduction.

1986 – 1987: **Estimator/Purchasing | LaForce Hardware and Manufacturing | Green Bay, WI**

Involved in the bid process using skills in estimating and pricing. Scheduled materials for architect's review and approval. Responsible for the purchasing of materials and coordinating shipments to job sites.

1981 – 1984: **Machine Operator | Badger Wood Products, Inc. | De Pere, WI**

Machine operator responsible for setup operations for various machines in a production line process. Responsible for quality control at various machines.

TRAINING & CERTIFICATIONS

- Construction Materials & Techniques
- General Construction Estimating
- Route Laying and Photogramitry
- Engineering Mechanics-Statics
- Elements of Surveying

EDUCATION

1986 **University of Wisconsin–Platteville | Platteville, WI**

Bachelor of Science with Construction Management Major

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Dustin Branscomb

Trenchless Engineer

PROFESSIONAL EXPERIENCE

2018 – Present: **Trenchless Engineer | Michels Directional Crossings | Brownsville, WI**

Responsible for the design & engineering evaluation of trenchless pipeline installations, inclusive but not limited to design & build projects, constructability, feasibility, plan & procedure creation, pre-qualifications, calculations, specification review and/or insight, bid & proposal process, submittals, estimating, scheduling, pre-bid meeting attendance, pre-construction meeting attendance, as-built's, design changes, and ensuring project continuity from inception to execution.

2011 – 2018: **Drilling Survey Supervisor | Michels Directional Crossings | Brownsville, WI**

Responsible for surveying, staking and design of directional drill path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Performed the above operations for crossings which include, but not limited to:

Diameter	Length	Crossing/Location	Year
42"	3087'	Victoria Harbor, Canada	2018
36"	1511'	Hwy #1, Canada	2017
36"	1116'	United Blvd & Mundy Creek, Canada	2017
36"	1076'	Hwy 7 & CP Rail, Canada	2017
36"	827'	Leslie Street, Ontario, Canada - HK 300PT Installation	2015
42"	1,299'	Lisgar Meadowbrook, Ontario, Canada - HK750PT Installation	2015
42"	1,008'	Highway 63, Canada - HK750PT Installation	2015
48"	4,039'	Dow Barge Channel, Clute TX - HK750PT Installation	2015
36"	1,002'	Hwy 225, Deer Park, TX - HK300PT Installation	2015
36"	1,092'	Lubrizol Drainage, LaPorte, TX - HK300PT Installation	2015
48"	2,455'	Rio Grande River, El Refugio, TX - HK750PT Install.	2014
8"	7321'	MP 49.3 Landslide, MT	2014
36"	9040'	Mississippi River, IL/MO	2014
36"	2264'	Otter Creek,IL	2013

PROFESSIONAL EXPERIENCE (continued)

36"	1311'	Fraizer Creek, IL	2013
36"	1518'	Vermillion River, IL	2013
48"	1943'	West Neck Creek, VA	2013
48"	819'	Hunt Club Creek, VA	2013
8"	7177'	115 KV Power Duct, SC	2013
8"	7304'	115 KV Power Duct, SC	2013
36"	3571'	Angelina River, TX	2013
36"	2908'	Neches River & RR, TX	2013
8"	3503'	Hamlin Creek, Charleston, SC	2013
8"	4911'	115 KV Power Duct, SC	2013
36"	1444'	Hwy 155 & UPRR, TX	2012
36"	1740'	Sabine River, TX	2012
30"	2906'	Hickory Creek, Marietta, OK	2012
30"	4850'	Red River, Thackerville, TX/OK	2012
42"	1661'	Cordele, TX	2012
16"	1656'	Chicolete River, TX	2012
16"	1717'	Morales, TX	2012
42"	1670'	Morales, TX	2012
42"	1658'	Dewitt, TX	2012
8"	6675'	Wilmington, NC	2012
8"	6669'	Wilmington, NC	2012

2006 – 2011: **Project Engineer | GeoEngineers, Inc. | Springfield, MO**

Responsible for project management, HDD Design, construction observation, field program planning and conducting technical briefings of field staff, feasibility studies for various natural gas and product pipeline projects, geotechnical exploratin, geotechnical borehole logging and soil classificatino, completion of technical reports and proposals, budget management, client billings and collections, and client interaction.

2004 – 2006: **Assistant Civil Engineer | Coastland Civil Engineering, Inc, | Santa Rosa, CA**

Responsible for project management, land development projects, improvement plan and map review, flood and drainage review, city master plan development, specification and eingineer's estimate development, city engineering and all-embracing experience in struction inspection.

TRAINING & CERTIFICATIONS

- HDD profile design
- Analysis of operating and installation stresses
- Determination of minimum allowable radius of curvature
- Evaluation of pipe buoyancy and potential pull loads
- Slope stability analysis, Subsurface exploration, Laboratory Testing and Structual design

INDUSTRY INVOLVEMENT

- Registered Professional Engineering, Licence No. 20100000796. Missouri Board for Architects, Professional Engineers, Professional Land Surveyors and Landscape Architects
- Registered Professional Engineer, License No. 108030. Texas Board of Professional Engineers
- LEED Accredited Professional. Leadership in Energy and Environmental Design Green Building Accredited Professional (LEED AP)
- National Association of the Remodeling Industry Certified Green Building Professional

EDUCATION

2004 **California Polytechnic State University | San Luis Obispo, CA**

Bachelor of Science, Civil Engineering 2004

El Molino High School | Forestville, CA

High School Diploma

Bradley J. Eifert

Engineering Technician

PROFESSIONAL EXPERIENCE

2005 – Present: **Engineering Technician | Michels Directional Crossings | Brownsville, WI**

Create forms for and compile various informational submittals for Directional Drilling. Planning and design drawings on AutoCAD from preliminary designs to as-built drawings. Developed computer programs for simplifying preliminary and correction computations required for Directional Drilling. Composed dissertations for various projects proposed and awarded. Compiled engineering computations and studied stress and loading analysis for pipeline installation. Responsible for take-offs, material estimates, and map route reproduction.

2004 – 2005: **Assistant Project Coordinator | Michels Directional Crossings | Brownsville, WI**

Performed As-builts, scheduling, dispatch, and project tracking for communication cable burial. Designed and preformed anticipated loads and stress calculations for the following projects:

Diameter	Length	Location	Year
24"	2645'	Corning, NY	2011
36"	4992'	Melville, LA	2011
30"	5786'	Sussex, NJ	2010
16"	9931'	Goose Creek, SC	2010
42"	4512’	Vicksburg, MS	2009
30” Steel	34,000’ (19 Drills)	Atlanta, GA	2008-2009
30” HDPE	3076’	Albany, NY	2008
36” HDPE	2144’	Charleston, SC	2007
8” Steel	8400’	Okaloosa, FL	2006
20” HDPE	2300’	Honolulu, HA	2006
30” Steel	5700’	Trinidad	2006
36” Steel	2130’	Albuquerque, NM	2006
42” Steel	2078’	South Amboy, NJ	2006
24” Steel	24,000’ (6 Drills)	Sacramento, CA	2005-2006

EDUCATION

2005 **Moraine Park Technical College | Fond du Lac, WI**

Associate Degree- Civil Engineering Technician

1995 **Hartford Union High School | Hartford, WI**

High School Diploma

Zach Osborn

Estimator

PROFESSIONAL EXPERIENCE

2019 – Present: **Estimator | Michels Directional Crossings | Brownsville, WI**

Prepare estimates for Directional Drill projects across the United States. Review designs and feasibility of projects. Point of contact for customers during bid process. GIS mapping and tracking of current bids. Follow up on project status. Hand offs to operations when a project is awarded.

2017 – 2019: **Assistant Project Manager | Michels Pipeline Construction | Lakeville, MN**

Oversee projects and provide estimates. Manage projects through the full cycle. Profile HDD's for crews and create asbuilts on completed projects. /worked directly with customer with HDD feasibility and design. Pursue new business opportunities and customer relations. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
10"	1948'	Roads & Bluff, MN	2019
24"	2000'	Woods and Creek, MN	2019
8"	4650'	Little Falls, MN	2019
16"	1200'	Hwy & Railroad, MN	2018
10"	2450'	Missouri River, MT	2018
24"	1200'	I-494, MN	2018
24"	1800'	Crossing Bluff, WI	2017

2015 – 2017: **Foreman | Michels Pipeline Construction | Lakeville, MN**

Point of contact for non contract bores for the Distribution West Division. Managed and tracked units for billing. Time and equipment recording. Managed HDD worksite and constructed gas service work. Worked with distribution crews on miscellaneous projects around the Twin Cities Metropolitan area.

2009 – 2015: **Laborer/Operator | Michels Pipeline Construction | Lakeville, MN**

Labored and Operated equipment for the Distribution West Division. Worked with HDD Operations. Fused for outside projects outside of Centerpoint contract. Traveled and worked on out of state projects.

TRAINING & CERTIFICATIONS

- Class A CDL, HDD Academy, EWN Proctor Certification

EDUCATION

University of Wisconsin - La Crosse | La Crosse , WI

Triton High School | Dodge Center, MN

Diploma

Don Mueller

Eastern Operations Manager

PROFESSIONAL EXPERIENCE

2011 – Present: **Eastern Operations Manager | Michels Directional Crossings | Brownsville, WI**

Supervisor of field operation superintendents and directional drilling project managers. Oversee large inventory of drilling tools and materials during storage and field use. Monitors production by Fleet Department of directional drilling personnel and equipment. Duties include coordinating and scheduling the mobilization of equipment, personnel and materials to remote job sites throughout the United States and Internationally. Involved in estimating of various directional drilling projects. Specialize in the engineering design, build and maintenance of directional drilling fleet. Responsible for pilot hole drilling & survey for complicated bores which include implementing and integrating new technology necessary for successful completion of leading edge HDD crossings (i.e. hole-intersects). Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	4381'	Pennsylvania Drive, PA	2019
16"	6601'	Arch Bishop/S Chester Rd, PA	2019
16"	4399'	Valley Rd/Darlington Rd, PA	2019
16"	7402'	Susquehanna River, PA	2019
30"	3746'	Dix River, KY	2019
16"	3728'	Village Square Dr, PA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
16"	3981'	Glendale Rd & Concord Ave, PA	2019
20"	2236'	Lower Piney Creek, PA	2018
20"	2355'	Joanna Road, PA	2018
12"	1369'	Rocky Point Landing, Jamaica	2018
20"	2209'	Horse Valley Road, PA	2018
20"	7354'	Susquehanna River, PA	2018
16"	2346'	Frankstown Branch-Juniata River, PA	2018
20"	3874'	Waltonville Rd, PA	2018
20"	1337'	Berry Ridge & Old Mill Rd, PA	2018
16"	5869'	Conrail RR, Perth Amboy, NJ	2018
16"	2766'	Hall Street, NJ	2018
16"	1999'	Route-35, Perth Amboy, NJ	2018
20"	5841'	Ohio River MP 33.8, OH/WV	2017
20"	4771'	Raystown Lake, PA	2017
48"	3595'	Road 771 Canal, TX	2017
48"	2222'	Hwy 803, CA Rd & Supply Canal, TX	2017

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
20"	2005'	Hwy 20, PA	2017
36"	6238'	Ohio River, OH/WV	2017
36"	7194'	Ohio River MP 16.07, OH/WV	2017
42"	2431'	Maumee River & State Hwy 24, OH	2017
48"	2807'	Oliver Creek & SH 188, TX	2017
48"	3291'	Meter to LNG Facility, TX	2017
48"	2263'	US Hwy 181/Hwy 35, TX	2017
30"	2278'	Chattahoochee River, GA	2017
24"	2293'	Interstate 20, GA	2017
36"	1606'	Hannahatchee Creek, GA	2017
30"	2757'	Little Rock River, IA	2016
30"	6328'	Big Sioux River, SD/IA	2016
16"	11,397'	Lake Sacagawea South, ND	2016
30"	5714'	James River, SD	2016
30"	2291'	PCN3/Wetland, SD	2016
30"	3352'	Cliff Crossing, ND	2016
30"	1791'	200th St, SD	2016
16"	11,229'	Lake Sacagawea North, ND	2016
30"	1516'	408th & Wetland MP 360, SD	2016
16"	1112'	Palermo Railroad, ND	2016
30"	1407'	Lewis & Clark/274th St, SD	2016
30"	1519'	Turtle Creek, SD	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
36"	1862'	State Highway 50, IL	2015
36"	3461'	Kennedy Ave/Griffith Terminal, IN	2015
36"	2510'	Deep Creek, IL	2015
36"	3011'	Highway 41 & RR, IN	2015
36"	5128'	Lake Ave & RR, IL	2015
10"	4654'	Allegheny River, PA	2015
18"	12,459	Houston Ship Channel, TX	2015
24"	2003'	Highway 612, MS	2014
24"	2750'	Escatawpa River, MS	2014
36"	9040'	Mississippi River, IL/MO	2014
20"	2364'	Missouri River, IA/NE	2014

PROFESSIONAL EXPERIENCE (continued)

1998 – 2011: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States and Canada; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Oversees drilling survey during crossing.

1996 – 1998: **Pipe-Side Superintendent/Pullback Coordinator | Michels Directional Crossings | Brownsville , WI**

Lead person responsible for coordinating the pipe string-out and welding subcontractor located at the exit side of directional drill. Duties include overseeing of pipe string for pullback without delay, maintenance of equipment, material organization, and coordination of labor for specialized pipe coating and testing. Accountable for the critical path of having pipe prepared for pullback. Responsible for maintaining constant communication with Drilling Superintendent during pullback operation and coordinating efforts to pull the pipe in one well-balanced effort.

1995 – 1996: **Operator | Michels Directional Crossings | Brownsville, WI**

Crane operator responsible for safe operation and timely placement of drill stem and equipment. Integral link in the drilling operation, from drill rig set-up, pipe pull back and rig-down of equipment. Also conducted pipe support operations at the exit side during pipeline pullback. Responsible for permitting and mobilization/demobilization of heavy and non-dimensional equipment to drill sites.

1993 – 1995: **Skilled Laborer | Michels Directional Crossings | Brownsville, WI**

Specialized in mechanical repairs, land surveying, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

1987 – 1993: **United States Marine Corps | San Diego, CA**

EDUCATION

1987 **Winnebago Luthern Academy | Fond du Lac, WI**

High School Diploma

Randy Robinson

Midwest Operations Manager

PROFESSIONAL EXPERIENCE

2015 – Present: **Midwest Operations Manager | Michels Directional Crossings | Brownsville, WI**

Manage field crews on the installation of assigned pipeline projects. Specific duties include: material and supply coordinator, field liaison between engineering, estimating and subcontractors to ensure construction compliance, monitor work performance and craft productivity, enforce project quality, safety and environmental issues, regulation and resolution of field construction problems. Plan day-to-day operations onsite and line up the necessary resources to accomplish the plan. Work hand in hand with customers and third party inspection personnel to resolve issues.

2003 – 2015: **Superintendent | Michels Pipeline Construction | Lakeville, MN**

Supervises and assigns duties to directional drill rig crews installing plastic and steel pipelines. Generates daily work progress reports, trains new staff and orders materials and equipment necessary for overall success of the project. Prepares documents on cost, budget, contracts, estimates and other essential aspects of operations.

1993 – 2003: **Crew Foreman | Mueller Pipeline | New Berlin, WI**

Worked in the capacity of a foreman on pipeline related projects. Responsible for safety, schedule and budget of all assigned work. Directly managed crews performing distribution of gas, electric, telephone, and water directional drill instillation. Ensured conformance to specifications, drawings, procedures, and quality.

1987 – 1992: **Line Supervisor | McNeilus Truck & Manufacturing, Inc. | Dodge Center, MN**

1985 – 1987: **Laborer | Donaldson Construction | Dodge Center, MN**

1984 – 1985: **Forklift & Crane Operator | McNeilus Truck & Manufacturing, Inc. | Dodge Center, MN**

1982 – 1984: **Laborer | Steve Kutzler Family Farm | West Concord, MN**

EDUCATION

Marquette University | Milwaukee, WI

EUC Academy for Management

West Concord High School | West Concord, MN

High School Diploma

Kurt Myhre

Western Operations Manager

PROFESSIONAL EXPERIENCE

2020 – Present: **Western Operations Manager | Michels Directional Crossings | Brownsville, WI**

Supervisor of field operation superintendents and directional drilling project managers. Oversee large inventory of drilling tools and materials during storage and field use. Monitors production by Fleet Department of directional drilling personnel and equipment. Duties include coordinating and scheduling the mobilization of equipment, personnel and materials to remote job sites throughout the United States and Internationally. Involved in estimating of various directional drilling projects. Specialize in the engineering design, build and maintenance of directional drilling fleet. Responsible for pilot hole drilling & survey for complicated bores which include implementing and integrating new technology necessary for successful completion of leading edge HDD crossings (i.e. hole-intersects).

2017 – 2020: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production recordkeeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
20"	2236'	Lower Piney Creek, PA	2018
20"	2209'	Horse Valley Road, PA	2018
16"	1912'	Trough Creek Valley Pike/SR 829, PA	2018
20"	1720'	Everett RR-Juniata River, PA	2018
20"	1507'	Trough Creek Valley Pike/SR 829, PA	2018
16"	2346'	Frankstown Branch-Juniata River, PA	2018
20"	1337'	Berry Ridge & Old Mill Rd, PA	2018
20"	1260'	Hollow Road, PA	2017
20"	2307'	Frankstown Branch-Juniata River, PA	2017
20"	4771'	Raystown Lake, PA	2017
36"	7194'	Ohio River MP 16.07, OH/WV	2017

2015 – 2017: **Pipeline Major Maintenance Superintendent | Phillips 66 Pipeline, LLC | Billings, MT**

Supervisor for seven maintenance team members and lead on special projects. Managed the execution for all pipeline and field major maintenance work including the 6 year Division River Mitigation Program.

PROFESSIONAL EXPERIENCE (continued)

2014 – 2015: **Maintenance Craft Team Leader | Phillips 66 Refining | Borger, TX**

Supervisor for area maintenance team and lead on special projects.

2012 – 2014: **Pipeline Major Maintenance Coordinator | Phillips 66 Pipeline, LLC | Missoula, MT**

Provided coordination and oversight for all pipeline maintenance and construction projects for pipeline assets in Montana, Idaho and Washington.

1996 – 2011: **Construction Superintendent | Michels Pipeline (Formally Pilchuck Contractors, Inc.) | Kirkland, WA**

Held multiple positions ranging form laborer to superintendent. Expertise included construction of gas pipelines, phone, fiber optics and installations by directional drilling.

TRAINING & CERTIFICATIONS

- CPR/1st Aid and OSHA 10
- Operator Qualifications for Liquid & Gas Pipelines
- Competent Person Trench Safety Training
- Asbestos Inspector Level Certified
- CEPA Erosion Training
- FMCSA Supervisor Training
- FEMA ICS 100 through 400

EDUCATION

Central Washington University

MICHELS®

Ray J. Viator

Marine Operations Manager

PROFESSIONAL EXPERIENCE

2002 – Present: **Marine Operations Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects across the country. Duties include mobilization of all equipment and personnel to remote job sites: the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment: and necessary record-keeping of plots and production. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
12" Beach Offshore	1,500'	Old Harbour, Jamaica	2018
16" Beach Approach	1,508'	Beverly Harbor, MA	2015
16"	3,27'	Collins Cove, MA	2015
8" Water Approach	7,177'	Charleston, SC	2013
8" Land to Water	7,304'	Charleston, SC	2013
8" Land to Water	3,580'	Charleston, SC	2013
30" Water Exit	5,378'	Hudson River, NY	2012
12" Water to Water	1612'	WBC62, Cameron, LA	2011
36" Beach Approach	3492'	Trinidad/Tabago	2010
42” Land to Water	2208’	Guam	2008
32” Land to Water	1943’	Guam	2007
30” Land to Water	5668’	Trinidad	2006
24”	6183’	Corsicana, TX	2005
30”	2996’	Columbia, LA	2005
24” Beach Approach	3402’	Trinidad & Tobago	2005
12” Beach Approach	2714’	Hadera, Israel	2004
30” Beach Approach	2823’	Dor, Israel	2004
30” Beach Approach	2836’	North Redding, Israel	2004
30” Beach Approach	2728’	South Redding, Israel	2004
30” Water to Water	4300’	Georges Island, MA	2003
30” Water to Water	4631’	Beverly, MA	2003
30” Land to Water	4829’	Salem, MA	2003
30” Land to Water	3041’	Weymouth, MA	2003

1989 – 2001: **Operations Manager | Smit Land & Marine, Inc. | Houston, TX**

Provided pre-contract technical input and operational management of directionally drilled crossings. Contracts completed are briefly described below:

PROFESSIONAL EXPERIENCE (continued)

1985 – 1989: **Rig Superintendent | Smit Land & Marine, Inc. | Houston, TX**
Provided technical input and site supervision of all horizontal directional drilled crossings throughout the United States.

PROJECT PROFILES

Jacob Riis State Park; Construction of 5800’ of 12”steel water main pipe. (2001) – Rockaway, NY

City of Newport | Construction of a 24" HDPE x 2800' and a 20" HDPE with two 4” steel cable ducts x 2800’ crossing of Yaquinna Bay on the Pacific coast at Newport Oregon. The pipelines will be used for sewer/reclaimed water and fiber optic cables.; (2001) – Newport, OR

Georgetown County Water & Sewer District | Design and construction of a 10" HDPE x 4530' crossing of the Waccamaw River near Myrtle Beach South Carolina. The pipeline will be used for potable water supply to Sandy Island.; (2001)

AT&T (Concert Global Networks USA) | Construction of four 5” x 3000’ to 3600’ shore crossings drilled in rock and exiting in 35’ water depths on the Pacific coast of California at Manchester. The 5" dia. drill pipe will be used as a conduit for fiber optic cables linking the US with Japan.; (2000)

Daikin America | Design and construction of a 16" HDPE x 3000' shore crossing into the Tennessee River. The pipeline will be used as a NaCl/water outfall.; (2000) – Decatur, AL

City of Fort Lauderdale | Construction of a 24” x 1230’ steel water main and 7 No. 6” x 1220’ HDPE ducts crossing the Intracoastal Waterway.; (2000) – Fort Lauderdale, FL

City of Austin | Construction of two 24” steel water main crossings for the Davenport Ranch Water Supply Line Project in Austin, Texas: 1640’ Lake Austin (Colorado River) crossing and 1170’ FM 2222 crossing.; (2000)

Solutia | Construction of a 24" x 900' railroad and pipeline corridor crossing.; (1999) – Chocolate Bayou, TX

Exxon Pipeline Company | Construction of a 20" x 3830' shore crossing for the Hoover Offshore Oil Production System.; (1999) – Freeport, TX

Conoco, Inc. | Construction of a 10” x 4650’ crossing of the Old & Lost River Lake to replace an existing ethane line.; (1999) – Mont Belvieu, TX

Exxon Pipeline Company | Construction of the following crude and products pipelines for the “SOLA Project,” 24" x 2300' Mississippi River crossing, Dual 12” x 4300’ Mississippi River crossing, 24” x 4300’ Mississippi River crossing, Dual 12” + 24” x 1200’ Intracoastal Waterway cr; (1998) – Baton Rouge, LA

A.K. Steel | Design and construction of a 16" x 2350' crossing through rock, below Interstate 75 and a creek for gas distribution.; (1998) – Middletown, OH

Dauphin Island Gathering Partners | Design and construction of a 24" x 1800' shore crossing for gas distribution.; (1998) – Mobile Bay, AL

PROJECT PROFILES (continued)

Transco | Design and construction of a 30" x 4000' shore crossing for gas distribution and a 30” x 2800’ water-to-water crossing of Dauphin Island. Drilled from 7' of water to 22' of water.; (1998) – Mobile Bay, AL

Beaufort Jasper Water & Sewer Authority | Design and construction of a 28; (1998) – Hilton Head Island, SC

Amoco Trinidad Oil Company | Design and construction of a 12" x 4030' shore crossing for Trinidad LNG Project.; (1997) – Galeota Point, Trinidad

Dauphin Island Gathering Partners (OEDC) | Construction of a 24” x 4700’ water-to-water crossing. Drilled from 12' of water to 20' of water.; (1997) – Dauphin Island, AL

City of Charleston, CPW | Construction of a 30; (1997) – Charleston, SC

Mobil E & P | Design and construction of a 5" x 5200' and a dual 2" x 5200' water-to-water crossings of Little Dauphin Island and a bundled 6"+2-3"+2" x 900' shore approach in Aloe Bay.; (1996-1997) – Alabama

Texas Eastern Products Pipeline | Construction of an 8" x 5500' crossing of the Red River, an 8" x 570' crossing of the Old River and 2900' of 8" conventionally laid with two (2) valve sites and tie-ins.; (1996) – Louisiana

Shell Pipeline | Construction of a 20” x 4000’ crossing of the Mississippi River at Nairn from outside the flood protection levee.; (1996) – Louisiana

City of Savannah | Construction of a 30” x 5300’ crossing under Presidents Street, Savannah with a 28” HDPE pipeline within a 30” steel casing pipe.; (1996) – Savannah, GA

Dixie Pipeline | Construction of 10" x 2800' gas pipeline crossing the Atchafalaya River.; (1995) – Louisiana

Chevron Pipeline | Design and construction of a 12" x 3500' water-to-water crossing. Drilled from 21' of water to 12' of water.; (1995) – Dauphin Island, AL

City of Charleston, CPW | Construction of a 26” x 5280' crossing of the N. Cooper River with a 24” HDPE pipeline within a 26” steel casing pipe. Construction of a 26” x 5100' shore crossings into 30' of water from Fort Moultrie into Charleston Bay near Fort Sumter again with a 24; (1995) – Charleston, SC

AT&T | Construction of four (4) 5” x 4300’ shore crossings drilled in rock and exiting in 35’ water depths on the Pacific coast of Oregon at Bandon. The 5" dia. drill pipe will be used as a conduit for fiber optic cables linking the US with Japan (the TPC-5 pro; (1995)

Hampton Roads Sanitation District | Construction of five (5) river crossings: Pagan River 24” x 1300’; Bennetts Creek 36” x 1600’; Cypress Creek 30” x 1850’; Nansemond River 30” x 4750’; and Chuckatuck Creek 30” x 3100’.; (1994-1995) – Virginia

PROJECT PROFILES (continued)

Chevron Company USA | Construction of two shore approaches with bundled pipelines from Fourchon with exits in 13' of water: 10"+8" x 1560' and 2-8"+3" x 1350'.; (1994) – Louisiana

Exxon Company USA | Construction of a 12" x 3550' shore approach drilled from Grand Isle with an exit in 12' of water and pipe lay by the SubSea Constructor.; (1994) – Louisiana

Mobile Gas Service Corp. | Construction of a 12" x 2000' gas pipeline crossing of the Mobile River.; (1994) – Alabama

Dixie Pipeline | Construction of a 12" x 3500' gas pipeline crossing of the Amite River.; (1993) – Louisiana

Dixie Pipeline | Construction of a 12" x 2500' gas pipeline crossing of Baton Rouge Bayou in Baker.; (1993) – Louisiana

ARCO | Operational assistance to South East Asian office for the construction of a 26" x 3300' shore approach (drilled from land with pullback from the McDermott derrick / laybarge DB15) and a 26" x 4000' crossing in the open waters of the Java Sea. The 4000' c; (1993) – Jakarta, Indonesia

Chevron Pipeline | Construction of a 20" x 1600' crude oil pipeline replacement crossing of a ship channel in open waters in the approaches to Gulfport. Drilled from lift-boat barges and pullback from a laybarge in water depths of 20'.; (1992) – Mississippi

Corpoven | Construction of a 36" x 4450' pipeline crossing of the Rio Orinoco at Puerto Ordaz.; (1992) – Venezuela

BP Exploration | Construction of 3-12" pipeline bundle under Dauphin Island with a drilled length of 3900'. Drilled from self elevating platforms (lift-boats) and pullback from a laybarge in water depths of 14' and 20' respectively.; (1991) – Alabama

Lagoven | Installation of a 36" x 3300' pipeline crossing of the Rio Morichal Largo on the "orimulsion" trunkline project.; (1991) – Venezuela

Lagoven | Construction of a 36" x 1700' pipeline crossing of the Rio Tigre as part of the "orimulsion" project.; (1991) – Venezuela

Shell Pipeline | Construction of a 4" x 3500' crossing of the Saginaw River in Bay City.; (1991) – Michigan

Columbia Gas | Installation of two 20" diameter pipeline river crossings - Mantua Creek (1650') and Raccoon Creek (1550').; (1990) – New Jersey

Sun Pipeline | Replacement of an 8" x 2200' gas pipeline by drilling through rock on hillside.; (1990) – Ohio

Shell Pipeline | Construction of a 10" x 1500' crossing of the Kawkawlin River.; (1990) – Michigan

Amoco Gas | Construction of a 16" x 3900' crossing of Wolf Creek in Dollar Bay, Texas City.; (1990) – Texas

PROJECT PROFILES (continued)

City of Norfolk | Construction of a 20" x 1600' water pipeline crossing of the Elizabeth River in Norfolk.; (1990) – Norfolk, VA

Seagull | Installation of two beach crossings (drilled from land) and two water-to-water crossings (drilled from spud barges) for a 1-10" and 3-8" pipeline bundle across the Houston Ship Channel at Baytown. The pipelines were pulled from a shallow draft laybarge. ; (1990) – Texas

Dixie Pipe Line | Construction of a 12" x 3000' emergency replacement crossing of the Tangipahoa River at Zachary.; (1990) – Louisiana

City of Chesapeake | Construction of a 24" x 1600' water pipeline crossing of the Elizabeth River at Chesapeake.; (1990) – Chesapeake, VA

Dixie Pipe Line | Installation of a 12" x 2300' crossing of the Comite River at Baton Rouge.; (1990) – Louisiana

Phillips Petroleum | Construction of two 12" diameter crossings near Houston: a 700' crossing of the Brazos River and a similar length crossing of Clear Creek.; (1990) – Texas

ARKLA | Installation of two 12" crossings near Fort Coffee: 2000' at the Arkansas River and 950' at the Poteau River.; (1990) – Oklahoma

Texas Power | Construction of three 16" crossings at Freeport as part of Wacker Oil's offshore development: 1600' Ship Channel crossing, 2300' Intracoastal Waterway crossing and 2700' shore approach.; (1989) – Texas

Transco | Installation of two 20" diameter crossings at Corpus Christi: an 1800' highway crossing and a 2000' lagoon crossing.; (1989) – Texas

Dixie Pipeline | Installation of a 12" x 1800' crossing of the Pearl River near Columbia.; (1989) – Mississippi

Union Camp | Construction of two Savannah River crossings: 42" x 1850' and 10"+6" bundle x 1850'.; (1989) – Georgia

Contel | Construction of a 5" x 750' crossing of the Altamaha River crossing near Jessup.; (1989) – Georgia

Phillips Petroleum | Installation of a 20" x 1800' crossing of the Brazos River at Freeport.; (1989) – Texas

Phillips Petroleum | Construction of two 2300' crossings of the Osage River at Jefferson City for 12" and 6" pipelines.; (1989) – Missouri

AT&T | Installation of five crossings with 5" conduit between Little Rock and Tulsa: Little Maumelle River - 1100' and 650', Fourche La Fave River - 550', Arkansas River - 2000' and Petit Jean River - 550'.; (1989) – Arkansas & Oklahoma

MICHELS®

Robert Spennati

Assistant Operations Manager

PROFESSIONAL EXPERIENCE

2020 – Present: **Assistant Operations Manager | Michels Directional Crossings | Brownsville**

Assistant Supervisor of field operation superintendents and directional drilling project managers. Oversee large inventory of drilling tools and materials during storage and field use. Monitors production by Fleet Department of directional drilling personnel and equipment. Duties include coordinating and scheduling the mobilization of equipment, personnel and materials to remote job sites throughout the United States and Internationally. Involved in estimating of various directional drilling projects. Specialize in the engineering design, build and maintenance of directional drilling fleet. Responsible for pilot hole drilling & survey for complicated bores which include implementing and integrating new technology necessary for successful completion of leading edge HDD crossings (i.e. hole-intersects). Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
16"	6976'	Matlock/W Chester Rd, PA	2020

1993 – 2020: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production record-keeping, and overall on-site management.

Diameter	Length	Location	Year
16"	4381'	Pennsylvania Drive, PA	2019
16"	6601'	Arch Bishop/S Chester Rd, PA	2019
16"	4399'	Valley Rd/Darlington Rd, PA	2019
16"	3728'	Village Square Dr, PA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
16"	3981'	Glendale Rd & CConcord Ave, PA	2019
12"	1070'	Indiana Harbor Canal - 12" & 10" Bundle, IN	2018
20"	7354'	Susquehanna River, PA	2018
20"	3874'	Waltonville Rd, PA	2018
16"	1198'	Harrisburg Pike, PA	2017
20"	2205'	Hwy 15, PA	2017
48"	2807'	Oliver Creek & SH 188, TX	2017
48"	2349'	Chiltipan Creek, TX	2017
48"	2263'	US Hwy 181/Hwy 35, TX	2017

PROFESSIONAL EXPERIENCE (continued)

36"	3829'	Flint River, GA	2016
12"	3144'	Monkton Swamp, VT	2016
12"	2765'	Lewis Creek, VT	2016
12"	1491'	Drinkwater Road, VT	2016
12"	2856'	Wetland Replacement, OH	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
24"	3716'	Barbour's Cut, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
24"	5908'	Tabbs Bay, TX	2015
10"	4654'	Allegheny River, PA	2015
28"	1741'	Lafayette River, VA	2014
12"	2557'	Arkansas River, AR	2014
20"	1193'	SR-265/Leatherwood Rd, OH	2014
36"	1277'	Bear Creek, IL	2013
36"	2264'	Hwy 336 & 172, IL	2013
30"	4987'	Monksville Reservoir, NJ	2013
42"	3008'	I-95 & Tidal Wetlands, NJ	2013
42"	4441'	Goethals Bridge, NY	2013
30"	8101'	Kill Van Kull River, NY/NJ	2013

1988 – 1993: **Labor/Operator/ Foreman | Henkles & McCoy**

Fiber Work

1987 – 1988: **Drywall/Construction**

1985 – 1987: **Gas work/Service Lines | Circle M Construction**

1978 – 1988: **United States Army**

1978-80, Germany, 1980-82 Georiga, 1982-84 Germany, 1984-85 Georiga, 1985-88 US Army Reserves PA

EDUCATION

1978 **Mount Union High School**

High School Diploma

MICHELS®

Paul Krings

Senior Equipment and Logistics Manager

PROFESSIONAL EXPERIENCE

2019 – Present: **Senior Equipment and Logistics Manager | Michels Directional Crossings | Brownsville, WI**

Strategically manage operations in overseeing the coordinating of equipment and personnel to project jobsites. Plan, direct, coordinate purchasing, distribution and forecasting of daily operations. Oversee equipment repair and building of new, inventory control, material handling, customer service, coordinate transportation and hiring of employees. Ensures that project milestones/goals are met and adhering to approved budgets.

Provides direct supervision to supervisors and field personnel in daily operational activities, maintains regular on-site contact to assure services being performed are within Company guidelines and in accordance with consumer specifications.

Reviews daily reports and time tickets to determine hours worked, mechanical problems, etc. to effectively plan and schedule daily operational activities.

Ensures routine and preventative maintenance and repairs to keep all equipment in optimum operating condition, thus minimizing down time.

1996 – 2019: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation.

Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
36"	5841'	Ohio River MP 33.8, OH/WV	2017
25"	5788'	Hwy 41/45, WI	2017
30"	1614'	Mill Creek, IA	2016
20"	996'	O'Plaine Road, IL	2016
30"	6119'	Lake Whitney, TX	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
24"	3716'	Barbour's Cut, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
24"	5908'	Tabbs Bay, TX	2015
36"	3461'	Kennedy Ave/Griffith Terminal, IN	2015
36"	2510'	Deep Creek, IL	2015

PROFESSIONAL EXPERIENCE (continued)

18"	12,459	Houston Ship Channel, TX	2015
1x6" & 2x4" Bundle	1568'	Bore #3, Nageezi, NM	2014
2 x 4" Bundle	1809'	Hwy 550, Nageezi, NM	2014
6"	6999'	Lake Navajo/San Juan River, NM	2014
36"	9040'	Mississippi River, IL/MO	2014
24"	2020'	Unnamed Creek, AL	2014
24"	2884'	Hatchett Creek, AL	2014
36"	1277'	Bear Creek, IL	2013
30"	4987'	Monksville Reservoir, NJ	2013
42"	4441'	Goethals Bridge, NY	2013
30"	8101'	Kill Van Kull River, NY/NJ	2013
30"	3042'	Wyalusing, PA	2012
36"	4505'	Medicine Hat, Alberta Canada	2012
24"	2458'	Jonestown, PA	2012
36"	4992'	Melville, LA	2011
42"	5732'	Melrose, LA	2011
24"	6091'	Homestead, FL	2011
16"	2566'	Hitchcock Plaza, SC	2010
42"	2144'	Lafourche, LA	2010

1992 – 1996: **Fluid Dynamics Technician and Laborer | Michels Directional Crossings | Brownsville, WI**

Solely responsible for mixing bentonite solution to the right consistency with an emphasis in directional drilling. Proficient working in and around drilling rigs and in the overall operation as an integral member of the specialized team. Multi-capable to assist with all types of drilling tasks and familiar with repair, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, steer tool wireline connections, couplings, etc. Involved in various types of directional drilling projects, line and cable, water and setting manholes.

TRAINING & CERTIFICATIONS

- OSHA 510 - OSHA Standards for Construction
- 40-Hour Hazmat Training – Approved for PPE Level A
- Safety Trained – Competent Person
- Veriforce and Various DOT Pipeline Safety Training
- Forklift Training
- CDL with ABCDMNT Endorsements

EDUCATION

1989 **Moraine Park Technical College**

Mig and Tig Welding; Rod, Wire and Brazing Applications;Torch Use, Cutting and Welding

1984 **Waupun High School | Waupun, WI**

High School Diploma

MICHELS®

Eric McBrair

Direct Pipe Equipment Manager

PROFESSIONAL EXPERIENCE

2017 – Present: **Direct Pipe Equipment Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for equipment logistics, as well as assisting with the oversight and management of direct pipe field personnel. Support Direct Pipe field operations by developing, initiating and managing appropriate action plans to ensure quality and efficient performance of Direct Pipe resources. Duties include but not limited to: Collaborate with field operations to determine most suitable resources and means and methods of construction, troubleshoot equipment operation issues. Develop, create and maintain maintenance protocols to be utilized across the division. Coordinate equipment needs between project managers and prioritize work assignments. Manage and coordinate division equipment assets, ensuring proper allocation and efficient utilization.

2011 – Present: **Superintendent/DIRECT PIPE | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling Direct Pipe boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for direct pipe & directional micro-tunnel operations as well as directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
20"	826'	Qu'Appelle River, Canada - HK750PT Installation	2017
36"	1,535'	Calumet River, IL - HK300PT Installation	2017
36"	827'	Leslie Street, Ontario, Canada - HK 300PT Installation	2015
42"	1,299'	Lisgar Meadowbrook, Ontario, Canada - HK 750PT Installation	2015
48"	4,039'	Dow Barge Channel, Clute TX - HK750PT Installation	2015
36"	1,002'	Hwy 225, Deer Park, TX - HK300PT Installation	2015
36"	1,092'	Lubrizol Drainage, LaPorte, TX-HK300PT Installation	2015
48"	2,455	Rio Grande River, El Refugio, TX-HK750PT Installation	2014
42"	1,200'	Railroad Crossing, Groves, TX-HK750PT Installation	2014
42"	1,050'	Beaver River, Alberta, Canada-HK750PT Installation	2013
42"	470'	I-84, Westfall, PA - HK750PT Installation	2013
48"	333'	18th Street, Jersey City, NJ - HK750PT Installation	2012

PROFESSIONAL EXPERIENCE (continued)

30"	5,378'	Hudson River, Manhattan, NJ/NY - HK300PT Assist	2012
36"	6,500'	St. Johns River, Jacksonville, FL - HK300PT Assist	2012
42"	426'	Chemung River, Corning, NY - HK750PT Installation	2011

2011 – 2014: **Operator/Surveyor HDD | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation.

2003 – 2011: **General Laboror | Michels Directional Crossings | Brownsville, WI**

Experience in working on and around directional drilling rigs as an integral member of a specialized team. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs; hydraulics; fluids; set-up and operation of drill motors; power generators; mud pumps; bentonite mixers; drill pipe; reamers; couplings; and overall equipment maintenance and operation.

2001 – 2003: **House Builder**

EDUCATION

2001 **Fox Valley Technical College | Appleton, WI**

2000 **Berlin High School | Berlin, WI**

High School Diploma

Scott Nehls

HDD Logistics QA/QC Manager

PROFESSIONAL EXPERIENCE

2009 – Present: **HDD Logistics QA/QC Manager**

Michels Directional Crossings | Brownsville, WI

Responsible for truck load out and receiving, organization of HDD tooling and equipment, coordination of drill stem supply, tracking and calibration, new hire training, orientation, dispatch, manage divisional labor pool, tractor trailer inspection/maintenance program implementation, safety training/OQ program implementation, on-site review of HDD personnel & operations.

1989 – 2009: **Project Manager**

Michels Directional Crossings | Brownsville, WI

Responsible for coordinating and drilling directional boring projects across the country. Duties include mobilization of all equipment and personnel to remote job sites; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Provides safety training and performs evaluations. Assists with estimating and bid preparation. Some more noteable crossings include, but are not limited to:

Diameter	Length	Location	Year
20” & 42”	1544’ & 2127’	Wisconsin River, WI	2007
20” & 42”	2530’ & 2299’	Chippewa River, WI	2007
20” & 42”	2280’ & 2294’	Flambeau River, WI	2007
42” (2)	2294’ & 2775’	Lake Arrowhead, WI	2007
24”	2172’	Biscayne Bay, FL	2006
30”	2453’	Jackson Creek, WI	2006
30”	1301’	Jackson Creek, WI	2006
30” (2)	1400’ & 2661’	Rausonville & Willis Rd, MI	2005
24”	2429’	Kinnickinnic River, WI	2005
36” (3)	1276’ to 1531’	Clarkston, MI	2005
8”	1374’	Detroit, MI	2005
12” (10)	375’ to 750’	Lansing, MI	2004
16” (2)	2723’ & 2925’	Packard Rd & Washtenaw Ave, MI	2004
22”	2308’	St. Joseph River, MI	2004
30” (2)	1532’ & 1661’	Darien, WI	2004

PROFESSIONAL EXPERIENCE (continued)

6" (6)	1564' to 1880'	Lean, WI	2004
12" (3)	1668' to 3524'	New York/New Jersey	2003
30"	1673'	Huron River, MI	2002
36"	3395'	Huron River, MI	2002

1986 – 1989: **Superintendent**

Michels Mid-America Line & Cable | Brownsville, WI

Working foreman responsible for managing utility construction crews. Accountable for tie-ins behind our rail-mounted plow which consists of horizontal boring operations and dig downs. Implemented supervisory skills for material and labor coordination.

1980 – 1986: **Equipment Operator**

Michels Mid-America Line & Cable | Brownsville, WI

Rubber tire backhoe operator responsible for location of utility line obstructions and the timely placement of telephone pedestals to keep production oriented cable placing operations flowing smoothly.

1977 – 1983: **Marine Corp Sergeant/Section Leader**

Active Reserve Company-G, 24th Marines, 4th Division | Madison, WI

1977 – 1980: **General Laborer/Operator**

Michels Mid-America Line & Cable | Brownsville, WI

General laborer responsible for boring operations for telephone cable with various types of equipment.

1973 – 1977: **Project Set-Up Coordinator**

Michels Pipeline Construction | Brownsville, WI

Involved in coordinating materials and supplies for various job locations. Helped in attaining storage yards for equipment and supplies around the United States. Responsible for establishing accounts at various retailers and suppliers within the job working area.

INDUSTRY INVOLVEMENT

- Midwest Energy Association (MEA) Evaluator

EDUCATION

1977 **Lomira High School | Lomira, WI**

High School Diploma

Sean O. Nicholson

Vice President of HSE

PROFESSIONAL EXPERIENCE

2017 – Present: **Vice President of HSE | Michels Corporation | Brownsville, WI**

2007 – 2017: **Director of Health & Safety | Michels Corporation | Brownsville, WI**

Assigned the responsibility of developing, implementing and maintaining the health, safety and environmental program for Michels Pipeline Construction and Michels Directional Crossing divisions of Michels Corporation. Advise executive management pertaining to matters of safety and health, and monitor day-to-day operations to ensure compliance with applicable regulatory requirements and the company's health and safety policies and procedures.

2000 – 2007: **Corporate Director HSE/Risk Management | Mears Group, Inc.**

Responsible for all facets of HSE initiative compliance and training on an international level. Complied and reviewed incident/injury data to determine trends and develop corrective actions and/or programs to prevent recurrence and improve performance. Managed/directed all aspects of litigation issues and legal proceedings. Conducted investigations on suspected workers' compensation and property damage fraud cases. Developed and audited HSE programs and policies to ensure compliance with regulatory agencies governing the energy industry.

1999 – 2001: **Regional Manager of Safety Training & Environmental Compliance | 360networks Inc.**

Planned, implemented and coordinated programs to reduce and eliminate occupational injuries, illnesses, fatalities and financial losses. Developed accident prevention, loss control systems and programs for incorporation into operational policies of the organization. Duties also included, preparing and presenting various required training; performing routine environmental and safety inspections; leading investigations of accidents and injuries.

1999: **Clearing Foreman–Railway Services Division | 360networks Inc./Ledcor Industries**

Trained and managed 45 flagmen and achieved significant improvements in their productivity and safety. Conferred with department heads concerning problems such as near misses and accidents, and recommended measures and procedure to improve safety.

1998 – 1999: **Lead Hand | Ledcor Communications**

Assisted superiors in planning and coordinating activities of workers engaged in constructing, installing and inspecting long haul fiber optic infrastructures. Inspected work in progress to ensure the work conformed to company specifications.

TRAINING & CERTIFICATIONS

- Certified HSE Auditor with the Albert Construction Safety Association
- Completed "Auditor Certification Training Program" with NCCER
- OSHA 500 and 510
- OSHA Outreach Instructor
- Certified in HSE Law from the Institute of Applied Management and Law
- Certified Defensive Driving Instructor with National Safety Council
- Certified Instructor "Speed Shore" (Competent Person, Trenching and Excavation)

TRAINING & CERTIFICATIONS (continued)

- Certified Instructor–American Traffic Safety Services Association
- Traffic Control Supervisor and Technician
- “TaprooT” Investigations Course
- Certified Medic First Aid/CPR
- Master Trainer–NCCER

EDUCATION

1997 **Trent University | Ontario, Canada**

Bachelor of Arts (Honors)

MICHELS®

Jason Pedersen, CSM

Safety Director

PROFESSIONAL EXPERIENCE

2017 – Present: **Safety Director | Michels Corporation | Brownsville, WI**

The primary function of the HSE Director is to work within corporate strategies and policy frameworks to design, implement and direct safety programs, guidelines and procedures. This position provides personal leadership and sets an example of following all safe work practices and procedures. Regularly interfaces with Senior Management, peers, subordinates and client personnel, overseeing project site HSE plans and alliance with corporate values, requirements and initiatives.

The primary responsibility is to coordinate the company's safety activities including:

- Develop procedures and lead the implementation of processes which have been established to ensure compliance with applicable standards, requirements and identified practices. Ensure Michels Corporation has effective programs to protect the safety of employees and comply with or exceed regulations through personal observation, HSE Manager review and audits.
- Demonstrate leadership by giving clear, complete, and accurate information on HSE requirements, process standards, potential health and safety hazards, and potential process difficulties. Interface with operations providing leadership and coaching to facilitate continuous HSE performance improvement.
- Participate in incident/injury investigations, including on-site presence, preparation of reports, analysis and exhibits. Identify regulatory and civil parties needing involvement.
- Work with all employees to instill a safe and environmentally conscientious work environment, determining the awareness level, discussing policies and procedures, advising on the best means of following those policies and procedures and coaching to improve behavior as needed.
- Recommend, implement, and manage safety devices, equipment, and/or products that help protect employees and customers and mitigate losses.
- Work closely with Operations, Quality Assurance, HR, Risk, and various other departments to enhance HSE systems. Communicate HSE information to key management as directed.

2013 – 2017: **HSE – Senior Manager, Compliance Specialist | Michels Pipeline Construction | Brownsville, WI**

Manage the HSE Team. Carry out supervisory responsibilities in accordance with the organization's policies and applicable laws. Responsibilities include interviewing, hiring, and training employees; planning, assigning, and directing work; providing feedback; rewarding and disciplining employees; addressing complaints and resolving problems. Identify and leverage HSE best practices across divisions. Maintain open communication with divisional and department leads to ensure coordination of HSE needs. Advises HSE Director on Health, Safety, and Environmental-related matters throughout the corporation. Review project safety requirements prior to bid and advise division on site specific training or equipment that may be needed. Is present at or delegates to HSE Coordinators to be present during regulatory site visits. Assist with and participate in client sales presentations and formal client meetings. Represent Michels at conferences, committees, and customer meetings. Work with Information Systems and Technology to identify and implement tools to drive better communication, process-management, and reporting tools. Other duties as assigned.

PROFESSIONAL EXPERIENCE (continued)

2006 – 2013: **Senior Project HSE Manager | Michels Pipeline Construction | Brownsville, WI**

2006: **IL & IA North West Region Local 309 Steward | Minnesota Limited, Inc. | Big Lake, MN**

2005: **IL & IA North West Region Local 309 Steward | J & L Pipeline Services, Inc. | Tipton, IA**

1996 – 2004: **Safety Coordinator/Foreman | Murphy Brothers, Inc. | East Moline, IL**

1989 – 1995: **United States Navy**

1988 – 1989: **Laborer/Oiler | Southern Gas Pipeline Company | Corpus Christie, TX**

PROJECT PROFILES

Dominion | Atlantic Coast Pipeline (ACP), Spread 2-1 and 6; Approximately 71.9 miles of 42" OD mainline pipeline. - Buckhannon, WV and Farmville, VA

Enbridge Energy | NEXUS Gas Transmission, Spreads 4, 3 and 1; Approximately a total of 177.2 miles of 36" steel pipeline. - Belleville, MI, Northwood, OH and Canton, OH

Sunoco | Mariner East II - PPP3, Spread 4; Approximately62.9 miles of dual line 20" and 16" steel pipeline. – Hollidaysburg & Shirleysburg, PA

Williams | Atlantic Sunrise Pipeline (ASR) - Spread 1; 37 miles of 30" – Tunkhannock, PA

Enbridge Energy | Line 3 Replacement, Segment 18; 13 miles of 36" – Superior, WI

Energy Transfer Company | Dakota Access Pipeline Project; 380 Miles of 30" pipe along three mainline spreads, thirteen HDD and three pump stations in Il, IA, SD, and ND

Enbridge | Flanagan South Pipeline Project; 300 miles of 36” – Illinois & Missouri

TransCanada | Keystone XL Gulf Coast Project; 360 miles of 36” – Texas & Oklahoma

Shell Appalachia | 70 miles 20” & 10”; Pennsylvania

Energy Transfer | Tiger Expansion Project; 27 miles 42” – Louisiana

Enbridge | Hot Works Line 6B Replacement Project; 67 Miles 30” – Michigan

Energy Transfer | Tiger Pipeline Project; 100 miles 42 – Louisiana

Enbridge | Alberta Clipper Project; 110 miles 42” – North Dakota & Minnesota

Enbridge/Michels/GPP | Southern Lights; 310 miles 42” & 20” – Wisconsin & Illinois

El Paso/Michels | Two Launcher Stations; 10 miles 30” & 16” – Wisconsin

Kinder Morgan | Rockies Express Project; 53 miles 42” – Ohio

Lake Head | 120 miles 36”; Illinois & Wisconsin

Alliance Ltd | 150 miles 36”; Illinois & Iowa

El Paso | 10 miles 20”; Indiana

TRAINING & CERTIFICATIONS

- Certified Safety Manger/Trainer (CSM)
- Certified Occupational Safety Specialist (COSS)
- DNV Incident Investigation Certified
- Safety Auditor Certificate (SAC)
- OSHA 502 - Update for Construction Trainers
- OSHA 500 - Trainer Course for the Construction Industry
- OSHA 510 - OSHA Standards for Construction
- OSHA 10- and 30-Hour Certified Trainer
- Accident Investigation Technician (AIT)
- Hazard Analysis Techinician (HAT)
- Safety Inspections Technician (SIT)
- CMC Confined Space Rescue
- Reasonable Suspicion Trainer
- HAZWOPER Certification 4 Hour
- NCCER Instructor / Performance Evaluator
- Certified MES Q41 Evaluator
- AMSE Rigging Trainer (Crosby)
- Hazardous Material Trainer
- National Safety Council Defensive Driving Certified Instructor
- ATSSA Flagger Instructor
- ATSSA Certified Traffic Control Supervisor/Technician
- Medic First Aid/CPR/AED Trainer
- Respirator Fit Testing & Certification

Mark Franz

Environmental Manager

PROFESSIONAL EXPERIENCE

2009 – Present: **Environmental Manager | Michels Corporation | Brownsville, WI**

Responsible for environmental due diligence, oversight and compliance for mainline spreads. Function as environmental liaison between Michels and Client.

2009: **Environmental Coordinator | Michels Corporation | Brownsville, WI**

Environmental oversight of Michels-Spread 2 of the Alberta Clipper Pipeline Project for client Enbridge Energy. Project consists of installation of 64 miles of 36” mainline pipeline crossing through 41 permitted waterbodies and 136 wetlands in northwestern Minnesota. Responsible for environmental crew management, and support and oversight for field construction issues. Functioned as environmental liaison between Michels and Enbridge.

2006 – 2009: **Environmental Manager | Global Pipeline Partners, LLC | New Berlin, WI**

Environmental oversight of Phase 1 of the alliance agreement between Global Pipeline Partners LLC (Michels Pipeline, Welded Construction, Precision Pipeline and U.S. Pipeline) and client Enbridge Energy. Phase 1 consisted of installation of 321 miles of 20” and 42” mainline pipeline crossing through over 800 permitted wetlands and 230 permitted water bodies. Responsible for contractor environmental planning, support and oversight for field construction issues. Function as environmental liaison between Enbridge and each of the four contractors. Also responsible for preparation of necessary baseline information, environmental variance submittals and management of contractor compliance issues related to the projects Wisconsin Department of Natural Resources and US Army Corp of Engineers execution permits.

2005 – 2006: **Natural Resource Specialist | Michels Corporation | Brownsville, WI**

Responsible for environmental due diligence, wetland delineations and assessments, storm water management, habitat assessments, regulatory permitting, threatened and endangered species survey, and water resource management. Proficient in native vegetation identification in the midwestern and southeastern United States, and in the use of AutoCAD and ArcGIS.

2004 – 2005: **Environmental Specialist/Project Manager | Earth Tech**

1999 – 2004: **Reclamation Specialist/Project Manager | Michels Corporation | Brownsville, WI**

1996 – 1999: **Ecologist | Biological Research Associates, Ltd.**

1994 – 1996: **Biologist | Sarasota County Department of Natural Resources**

1992 – 1994: **Environmental Scientist | Reynolds Smith and Hill, Inc.**

1990 – 1992: **Assistant Biologist | Florida Department of Environmental Protection**

1984 – 1987: **Assistant Planner | Wiles, Dailey, Kane & Associates**

EDUCATION

New College of the University of South Florida | Sarasota, FL

Bachelor of Arts, Biology/Environmental Science

Edward J. Dye

HDD Safety Coordinator

PROFESSIONAL EXPERIENCE

2017 – Present: **HDD Safety Coordinator**

Michels Directional Crossings | Brownsville, Wisconsin

Develop and implementation of on-site procedure, emergency response plan, on-site safety inspections, equipment inspections and reporting to supervisors. Assigned the responsibility for coordinating and maintaining the company safety program. Advises management in matters of safety and health, and monitors day-to-day operations to ensure that the company's safety policies and procedures are followed.

2016 – 2017: **HSE Coordinator**

Michels Pipeline Construction | Brownsville, WI

Promotes Michels' Core Values, leads by example and is an ambassador for HSE Department and Michels Corporation. Assigned the responsibility for coordinating and maintaining the company safety and health program. Advises management in matters of safety and health, and monitors day-to-day operations to ensure that the company's safety policies and procedures are followed. The primary responsibility is to coordinate the company's safety activities are: daily job safety audits, ensure safety on all construction projects, edit and submit safety plan for projects, Ensure all personal protective equipment in on site when necessary, new hire orientation process, assist with organization of annual safety training, tailgate safety meeting coordination, and write up job hazard analysis. Represents Michels during regulatory inspections, client audits and meetings.

2013 – 2016: **Foreman**

Michels Pipeline Construction | Brownsville, WI

Direct activities of workers pertaining to the repair, maintenance, construction, installation, and reconditioning of pipelines. Determine tie-in locations and coordinate their installations with operating units on project sites while providing leadership and support in field production operations. Lead the crews in quality, safety and environmental compliance.

2006 – 2013: **Foreman**

River City Cutting | River City Cutting, IA

Led a multifunctional team of 6 employees on the demolition and precision cutting of concrete. Bid projects by evaluating blueprints, timelines, square footage, and customer operational needs. All projects under my supervision met their timeline, came in at or under bid, and turned a profit for the company. Performed work at numerous types of project sites such as military installations, nuclear power plants, hospitals, schools, bridges, roads, courthouses, jails, and multiple lock and dams. Taught formal classes to apprentices through the union hall on the use of core drills, concrete chainsaws, walk-behind saws, and remote control wall saws. Conducted interviews and background checks on new employees.

2002 – 2006: **Laborer**

Valley Construction | Rock Island, IL

TRAINING & CERTIFICATIONS

- OSHA 30-Hour
- OSHA 510 - OSHA Standards for Construction

TRAINING & CERTIFICATIONS (continued)

- OSHA 500 - Trainer Course for the Construction Industry
- OSHA 3015 - Excavation, Trenching and Soil Mechanics
- Construction Plan Reading Course
- Power Industrial Truck Operations
- Coating Maintenance Course
- Scaffold Builder
- Locating Pipelines
- First Aid/CPR Certified
- Damage Prevention During Excavation First Aid
- Traffic Control Certification
- Leak and Strength Test Course
- Cathodic Protection Systems
- Backfilling
- Underground Clearance
- Receiving Pigs for Lines In-Service
- Internal Devices for Lines In-Service
- Mechanical Joints

Michael Miller

HSE Safety Coordinator

PROFESSIONAL EXPERIENCE

2019 – Present: **HSE Safety Coordinator | Michels Corporation | Brownsville, WI**

Promotes Michels' Core Values, leads by example and is an ambassador for the HSE Department and Michels Corporation. Assigned the responsibility for coordinating and maintaining the company safety and health program. Advises management in matters of safety and health, and monitors day-to-day operations to ensure that the company's safety policies and procedures are followed. The primary responsibility is to coordinate the company's safety activities, which include but are not limited to: daily job safety audits, ensuring the safety on all construction projects, editing and submitting safety plans for projects, ensuring all personal protective equipment is on site when necessary, new hire orientation process, assisting with the organization of annual safety training, tailgate safety meeting coordination, and writing up job hazard analysis. Represents Michels during regulatory inspections, client audits and meetings.

2014 – 2018: **Safety Coordinator | LMC Industrial Contractors, Inc.**

Responsible for coordinating all safety efforts in both LMC's 550,000 square foot facility, as well as on all active sites. Evaluating all personnel to be Veriforce certified. Properly practice respiratory protection, SABC, confined space principals, hazardous abatement procedures, fall protection practices, trenching & excavation safety and compliance, fatigue management, critical lifts, rigging best practices, electrical safety/LOTO, and proper equipment use. Forklift operator certification and Forklift operation trainer. Conduct new hire orientations for all employees and subcontractors. Lead daily safety meetings for all shop and field work. Perform weekly jobsite safety assessments and reporting any deficiencies and near misses/violations. Perform accident investigations/Root Cause Analysis and enforcement of all environmental, safety, health and accident prevention procedures. Reporting of near hits, spills, releases, and safety or environmental non-compliance issues. Create and review task specific safety analysis/JSA/JHA.

2014: **Safety Coordinator Assistant | Holloman Corporation**

Ensure strict compliance with all federal, state and local safety requirements. Properly practice respiratory protection, SABC, confined space principals, hazardous abatement procedures, fall protection practices and proper equipment use.

2013: **Fleet Vehicle Maintenance Inventory/Tracking | Somerset Regional Water Resources**

Maintained inventory tracking for 70+ company vehicles. Ensure safety, inspection, and scheduled maintenance for all assets.

1993 – 2013: **Aircraft Electrical & Environmental Systems Craftsman/Quality & Safety Inspector | United States Air Force**

Performed and supervised aircraft electrical functions and activities. Compiled maintenance data and daily safe maintenance practice evaluations. Performed off equipment maintenance of system components and associated/special test equipment. Performed cryogenic maintenance on mobile servicing units.

TRAINING & CERTIFICATIONS

- Crosby Communication 4 Hour Fundamentals of Rigging
- Erosion and Sediment Control Lead Certified

TRAINING & CERTIFICATIONS (continued)

- Erosion & Sediment Control Training
- OSHA 10-Hour – Construction Safety & Health
- OSHA 30-Hour Construction
- OSHA 500 - Trainer Course for the Construction Industry
- OSHA 510 - OSHA Standards for Construction
- OSHA 511 - Occupational Safety & Health Standards for General Industry
- OSHA 5810 - Hazards Recognition and Standards for On-Shore Oil and Gas Exploration and Production
- Rigging Training

EDUCATION

USAF Non-Commissioned Officer Academy

1998 **Airforce Leadership School**

1996 **Community College of the Air Force**

Business Associates Degree

1993 **Aircraft Electrical & Environmental System Technical School**

Honors

Spencer Rusk

PROFESSIONAL EXPERIENCE

2018 – Present: **HSE Safety Coordinator | Michels Corporation | Brownsville, WI**

Promotes Michels' Core Values, leads by example and is an ambassador for the HSE Department and Michels Corporation. Assigned the responsibility for coordinating and maintaining the company safety and health program. Advises management in matters of safety and health, and monitors day-to-day operations to ensure that the company's safety policies and procedures are followed. The primary responsibility is to coordinate the company's safety activities, which include but are not limited to: daily job safety audits, ensuring the safety on all construction projects, editing and submitting safety plans for projects, ensuring all personal protective equipment is on site when necessary, new hire orientation process, assisting with the organization of annual safety training, tailgate safety meeting coordination, and writing up job hazard analysis. Represents Michels during regulatory inspections, client audits and meetings.

2017 – 2018: **Welder Helper | Michels Corporation | Cedar Rapids, IA**

- Local 25 Plumbers/Pipefitters Welder Helper. Extra duties include sandblasting & painting pipe, hot wraps and applying epoxy coatings in compliance with OSHA.
- Performed pipeline construction removal and installation e.g. digging, backfilling, final grading while being vocal with peers to make sure Michels safety standards and policies were followed.
- Involved in pigging operations to ensure pipe is clean and inspected ensuring it is up to standards.
- Wrote JSA's, step back for safety cards and actively participated in safety meetings.

2009 – 2018: **Firefighter & EMT | Geneseo Fire Protection District | Geneseo, IL**

- Serve as both firefighter and EMT supporting basic life support/trauma and medical patient care.
- Trained in fire suppression, structural fire classes, vehicle and confined space training as well as vehicle extrication.
- Conduct and teach fire safety education and first aid throughout the area schools.

2005 – 2018: **Automotive Collision Repair Technician | Pro/Tech Auto Body Inc. & Pinks' Paint & Body | Geneseo, IL**

- Analyzed requirements on fulfilling estimation paperwork, while maintaining a budget and completing the job within the time requirements; ensuring damage was repaired flawlessly.
- Created detailed damage assessment to optimize vehicle quality after repairs.
- Worked with customers to answer all questions to ensure customer service was paramount.
- Kept accurate logs of MSDS for the chemicals and paints used on site.

TRAINING & CERTIFICATIONS

- OSHA 10-Hour – Construction Safety & Health
- OSHA 30-Hour Construction
- First Aid/CPR Certified
- Hazardous Materials Awareness
- Basic Wildland Firefighter: I-200, L-180, S-130, S-190
- Firefighter II
- EMT – Basic

Scott Nehls

HDD Logistics QA/QC Manager

PROFESSIONAL EXPERIENCE

2009 – Present: **HDD Logistics QA/QC Manager**

Michels Directional Crossings | Brownsville, WI

Responsible for truck load out and receiving, organization of HDD tooling and equipment, coordination of drill stem supply, tracking and calibration, new hire training, orientation, dispatch, manage divisional labor pool, tractor trailer inspection/maintenance program implementation, safety training/OQ program implementation, on-site review of HDD personnel & operations.

1989 – 2009: **Project Manager**

Michels Directional Crossings | Brownsville, WI

Responsible for coordinating and drilling directional boring projects across the country. Duties include mobilization of all equipment and personnel to remote job sites; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Provides safety training and performs evaluations. Assists with estimating and bid preparation. Some more noteable crossings include, but are not limited to:

Diameter	Length	Location	Year
20” & 42”	1544’ & 2127’	Wisconsin River, WI	2007
20” & 42”	2530’ & 2299’	Chippewa River, WI	2007
20” & 42”	2280’ & 2294’	Flambeau River, WI	2007
42” (2)	2294’ & 2775’	Lake Arrowhead, WI	2007
24”	2172’	Biscayne Bay, FL	2006
30”	2453’	Jackson Creek, WI	2006
30”	1301’	Jackson Creek, WI	2006
30” (2)	1400’ & 2661’	Rausonville & Willis Rd, MI	2005
24”	2429’	Kinnickinnic River, WI	2005
36” (3)	1276’ to 1531’	Clarkston, MI	2005
8”	1374’	Detroit, MI	2005
12” (10)	375’ to 750’	Lansing, MI	2004
16” (2)	2723’ & 2925’	Packard Rd & Washtenaw Ave, MI	2004
22”	2308’	St. Joseph River, MI	2004
30” (2)	1532’ & 1661’	Darien, WI	2004

PROFESSIONAL EXPERIENCE (continued)

6" (6)	1564' to 1880'	Lean, WI	2004
12" (3)	1668' to 3524'	New York/New Jersey	2003
30"	1673'	Huron River, MI	2002
36"	3395'	Huron River, MI	2002

1986 – 1989: **Superintendent**

Michels Mid-America Line & Cable | Brownsville, WI

Working foreman responsible for managing utility construction crews. Accountable for tie-ins behind our rail-mounted plow which consists of horizontal boring operations and dig downs. Implemented supervisory skills for material and labor coordination.

1980 – 1986: **Equipment Operator**

Michels Mid-America Line & Cable | Brownsville, WI

Rubber tire backhoe operator responsible for location of utility line obstructions and the timely placement of telephone pedestals to keep production oriented cable placing operations flowing smoothly.

1977 – 1983: **Marine Corp Sergeant/Section Leader**

Active Reserve Company-G, 24th Marines, 4th Division | Madison, WI

1977 – 1980: **General Laborer/Operator**

Michels Mid-America Line & Cable | Brownsville, WI

General laborer responsible for boring operations for telephone cable with various types of equipment.

1973 – 1977: **Project Set-Up Coordinator**

Michels Pipeline Construction | Brownsville, WI

Involved in coordinating materials and supplies for various job locations. Helped in attaining storage yards for equipment and supplies around the United States. Responsible for establishing accounts at various retailers and suppliers within the job working area.

INDUSTRY INVOLVEMENT

- Midwest Energy Association (MEA) Evaluator

EDUCATION

1977 **Lomira High School | Lomira, WI**

High School Diploma

Ken Coleman

Project Manager

PROFESSIONAL EXPERIENCE

2008 – Present: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production recordkeeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
24"	3183'	Crow River, MN	2019
24"	2100'	Spanish Lake, MO	2019
22"	4986'	Atchafalaya River, LA	2019
42"	4687'	Lake Scranton Finished H2O Tunnel, PA	2018
42"	3980'	Susquehanna River MP 99.6, PA	2018
42"	1810'	Interstate 80, PA	2018
42"	2826'	San Joaquin River, CA	2017
10"	5697'	Mississippi River, LA	2017
6"	3309'	Hauser River, MT	2017
8"	1980'	CHS Yellowstone River, MT	2017
30"	7531'	Lake Oahe & Missouri River, ND	2017
12"	1178'	Howard Cove, ME	2016
12"	1023'	Cutler Site, ME	2016
12"	1114'	Sunflower Field, VT	2016
12"	1129'	Arch Site & Town Hill Rd, VT	2016
12"	686'	Laplatte River, VT	2016
12"	922'	Arch Site & Monkton Rd, VT	2016
12"	492'	Arch Site, VT	2016
42" Steel with 36" HDPE	3983'	St John's River, FL	2016
27" HDPE Bundle	3737'	Little Creek, VA	2016
16"	2249'	Ohio River, OH/KY	2015
24"	1405'	Platte River, MO	2015
36"	1755'	New York St, IL	2015

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
36"	2303'	Liberty Street,IL	2015
24"	3275'	Transfer Line 1, IN	2014
8"	2545'	MP266, Mountain Green, UT	2013
30"	1881'	Bennekill Stream, NJ	2013
30"	6544'	1st Street, NJ	2013
36"	1392'	Seacaucus, NJ	2012
30"	1186'	Bowman Cty., ND	2011
20"	1814'	Marion, OR	2011
20"	3075'	Marion, OR	2011
30"	5786'	Vernon, NJ	2011
42"	3008'	White River, AR	2010
42"	1010'	Albany Ave, NJ	2010

1993 – 2008: **Supervisor | Mears**

Supervised over HDD projects with pipe diameters of 6” to 60” with lengths of 600’ to 7,200’ in the United States, Canada, and Mexico.

1990 – 1993: **Operator | ARB**

Experience operating the following equipment: forklift, front end loader, dozer scraper, motor grader, back hoe, excavator, crane, hot mix plants, trenching machine, rock crusher, horizontal drilling rig and fusing machines from 4” to 32” HDPE.

1968 – 1990: **Operator | Reading & Bates**

Worked as Operator, low boy driver, horizontal drilling rig, and supervisor of equipment yard and warehouse.

EDUCATION

1962 **Harrison Central High School | Gulfport, MS**

High School Diploma

Jim McGovern

Project Manager

PROFESSIONAL EXPERIENCE

1995 – Present: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production recordkeeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
24"	3183'	Crow River, MN	2019
20"	2740'	West Branch Escanaba River, MI	2019
20"	2173'	Escanaba River 2, MI	2019
20"	1421'	Middle Branch Escanaba River, MI	2019
42"	2007'	Las Moras Creek, TX	2019
36"	2438'	Huron River MP 117.2, OH	2018
36"	3199'	Vermillion River MP 104.4, OH	2018
36"	1863'	E. Branch Black River MP 86.7, OH	2018
36"	1886'	Nimisila Rexervoir MP 40.9, OH	2018
16"	5869'	Conrail RR, NJ	2018
16"	2766'	Hall Street, NJ	2018
16"	1999'	Route-35, NJ	2018
12"	5170'	Larch Dr & Wetland, MN	2017
24"	5788'	Hwy 41/45, WI	2017
16"	3065'	Rock Creek & US HWY 67, IA	2016
16"	6693'	Wapsipinicon River, IA	2016
24"	1898'	Vermillion River, IL	2016
20"	1904'	North St Mary's River, IN	2016
20"	1076'	South St Mary's River, IN	2016
36"	1862'	State Highway 50, IL	2015
36"	3461'	Kennedy Ave/Griffith Terminal, IN	2015
36"	1813'	Calumet Ave, IN	2015
36"	2510'	Deep Creek, IL	2015
36"	1803'	Dyer Ditch, IN	2015
36"	3011'	Highway 41 & RR, IN	2015
36"	5128'	Lake Ave & RR, IL	2015

36"	1812'	Highway 394, IL	2015
36"	9040'	Mississippi River, IL/MO	2014
36"	2264'	Otter Creek, IL	2013
36"	3544'	Illinois River, IL	2013
36"	1611'	Mackinaw Rover, IL	2013
36"	3892'	Red River, OK	2013
36"	4213'	Menard Creek, TX	2013
36"	3571'	Angelina River, TX	2013
36"	2908'	Neches River & RR, TX	2013
36"	1867'	Flora, TX	2012
36"	1740'	Sabine River, TX	2012
36"	2567'	South Sulphur River, TX	2012
30"	2906'	Hickory Creek, Marietta, OK	2012
16"	1656'	Chicolete River, TX	2012
42"	1650'	Chicolete River, TX	2012
16"	1717'	Morales, TX	2012
42"	1670'	Morales, TX	2012
16"	1658'	Cordele, TX	2012
42"	1658'	Dewitt, TX	2012
16"	1717'	Morales, TX	2012
16"	1664'	Morales, TX	2012
42"	3205'	Dewitt, TX	2012
42"	1661'	Morales, TX	2012
24"	1386'	Jonestown, PA	2012
24"	2458'	Jonestown, PA	2012
8"	6675'	Wilmington, NC	2012
8"	6669'	Wilmington, NC	2012
8"	7019'	Missouri River, NE	2011
42"	3035'	Rambling Bayou, LA	2011
42"	5340'	Boise Cascade, LA	2011
42"	4932'	Bayou Jean De Jean, LA	2011
12"	2484'	Wetland #13, NC	2011
42"	2094'	Hwy 9, LA	2010
42"	5248'	Saline Bayou, LA	2010
42"	1838'	Steep Bayou, LA	2010

42"	2243'	Beouf River, LA	2010

1991 – 2005: **Pipe-Side Superintendent/Pullback Coordinator | Michels Directional Crossings | Brownsville, WI**

Responsible for coordination of pipe welding subcontractor located on exit side of directional drill. Duties include operation and maintenance of equipment, coordination of labor for specialized pipe coating and testing. Solely responsible for maintaining constant communication with the driller during control of ballasting, which is one of the most critical aspects of pipe pulling.

1987 – 1991: **Operator/Foreman | Michels Directional Crossings | Brownsville, WI**

Skilled in the operation of technical, lifting and heavy equipment for directional drilling operation. Working knowledge of hydraulic engineering and applied mechanical engineering. Experience in working on and around directional drilling rigs as an integral member of a specialized team. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

1972 – 1987: **Operator | Gas Division of Michels Pipeline Construction | Brownsville, WI**

Track-hoe and backhoe operator responsible for maintaining line and grade on civil and gas pipeline projects. Duties include trench maintenance and safety as well as equipment repairs and maintenance.

1968 – 1972: **Skilled Laborer | Michels Pipeline Construction | Brownsville, WI**

Laborer working with underground construction crew. Responsibilities include upholding safety consciousness while performing various duties to help maintain progressive pipe/cable laying production.

EDUCATION

1967 **Waupun High School | Waupun, WI**

High School Diploma

MICHELS®

Larry Shilman

Project Manager

PROFESSIONAL EXPERIENCE

1999 – Present: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production recordkeeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	7402'	Susquehanna River, PA	2019
20"	2355'	Joanna Road, PA	2018
4"	1495'	Des Moines River, IA	2018
16"	5869'	Conrail RR, NJ	2018
36"	5841'	Ohio River MP 33.8, OH/WV	2017
14"	9154'	Nansemond River, VA/ ND	2017
30"	7531'	Lake Oahe & Missouri River, ND	2017
16"	11,397'	Lake Sacagawea South, ND	2016
30"	3352'	Cliff Crossing, ND	2016
16"	11,229'	Lake Sacagawea North, ND	2016
8"	4022'	Lake Macatawa, MI	2016
8"	1957'	Grand River, MI	2016
30"	1418'	Highway 250, OH	2015
16"	1402'	Deer Lake, ND	2015
10"	1971'	Tank Farm/Central Ave, PA	2015
8"	3320'	Yellowstone River, MT	2015
24" HDPE	1061'	Lake Sakakawea, ND	2014
8"	7321'	MP 49.3 Landslide, MT	2014
8"	4159'	MP 54.8 Landslide, MT	2014
20"	2364'	Missouri River, IA/NE	2014
16"	2951'	Line 82, ND	2014
36"	5687'	Missouri River, MO	2013
36"	2355'	Salt Fork River, MO	2013
36"	2077'	Chariton River, MO	2013
48"	1943'	West Neck Creek, VA	2013

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
48"	819'	Hunt Club Creek, VA	2013
8"	7177'	115 KV Power Duct, SC	2013
8"	7304'	115 KV Power Duct, SC	2013
8"	4911'	115 KV Power Duct, SC	2013
36"	1366'	Big Sandy, Maple Springs, TX	2012
36"	1444'	Hwy 155 & UPRR, Big Sandy, TX	2012
36"	1761'	Private Lake, Maple Springs, TX	2012
30"	4850'	Red River, Thackerville, TX/OK	2012
30"	3042'	Wyalusing, PA	2012
24"	2458'	Jonestown, PA	2012

1998 – 1999: **Construction Supervisor | InterCon Construction, Inc. | Lakeville, MN**

Supervisor of 210 mile fiber optic installation, underground and aerial in Minneapolis and surrounding suburbs. Responsible for subcontractors, directional drilling, underground, aerial and InterCon crews.

1998: **Project Engineer | Brungardt, Honimichl & Company, P.A. | Overland Park, KS**

AT&T switched engineering firms from C&S Contract Services to Brungardt, Honimichl & Company. Responsibilities included project management for concurrent multiple projects including route selection, courthouse search, surveying, land acquisition, writing job specifications, bid meetings, inspection, as-built records and permitting. Total start up to completion construction.

1990 – 1997: **Project Manager | C & S Contract Services, Inc. | Martinville, IN**

Responsibilities include project management for concurrent multiple projects including route selection, courthouse search, surveying, land acquisition, writing job specifications, bid meetings, inspection, as-built records and permitting. Total start up to completion construction.

1988 – 1990: **Right-of-Way Supervisor | Bucher, Willis & Ratliff, Inc. | Aurora, IL**

Responsibilities include all start up activities, pre-construction, construction and post-construction damages for 126 miles of fiber optic projects across Northern Indiana as well as three diversity routes in South Bend, Indiana.

EDUCATION

1990 **State of Indiana**

Real Estate License

1973 **Warner High School | Warner, SD**

High School Diploma

MICHELS®

Eric Frawley

Project Manager

PROFESSIONAL EXPERIENCE

2015 – Present: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production recordkeeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
30"	3746'	Dix River, KY	2019
20"	2355'	Joanna Rd, PA	2018
12"	1369'	Rocky Point Landing, Jamaica	2018
20"	7354'	Susquehanna River, PA	2018
20"	3874'	Waltonville Rd, PA	2018
16"	1198'	Harrisburg Pike, PA	2017
24"	2026'	Highway 120, GA	2017
24"	2293'	Interstate 20, GA	2017
16"	11,397'	Lake Sacagawea South, ND	2016
30"	2069'	Floyd River/RR/HWY 60, IA	2016
16"	11,229'	Lake Sacagawea North, ND	2016
16"	1112'	Palermo Railroad, ND	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
16"	1508'	Beverly Harbor, MA	2015
16"	3827'	Collins Cove, MA	2015

2013 – 2015: **Project Manager | Oceaneering International Inc. | Houston, TX**

2010 – 2013: **Project Manager and Project Coordinator | Triton Diving Services | Houston, TX**

2006 – 2009: **Commercial Diver/Saturation Diver | Deep Marine Technology | Houston, TX**

2003 – 2005: **Commercial Diver/Supervisor | Epic Divers | Harley, LA**

2001 – 2003: **Dive Tender/Commercial Diver/EMT | Torch Offshore | LA**

TRAINING & CERTIFICATIONS

- American Petroleum Institute - Certified RIgger an Crane Operator Class A per API RP 2D 2002
- Offshore Water Survival (HUET) per API RP T-4 and T-7

TRAINING & CERTIFICATIONS (continued)

- "Association of Diving Contractors International - Surface-Supplied Air Diver, Surface -Supplied Mixed Gas Diver, Saturation Diver
- American Red Cross - First Aid, Adult, Infant and Child CPR, and CPR for the Professional Rescuer
- TWIC (Transportation Worker Identification Credential)
- EPIC Divers - Visual Weld Inspection, Flange Trained, Safety Incident Support Team 2003
- EMT (Emergency Medical Technician) Nationally Registered 2002
- LOLER (Lifting Operations Lifting Equipment and Regulations)
- BOSET (Basic Offshore Safety and Emergency Training)
- HAZWOPER First Responder
- Hydrogen sulfide safety awareness certified
- Captain 100 Ton License USA Coast Guard
- NORM (Naturally Occurring Radioactive Material Surveyor)
- Confined Space Supervisor/Rescuer 2003

EDUCATION

2010 **VTC, Virtual Training Company**

Major: Microsoft Excel, Word, Projects, Outlook, Adobe Acrobat X

2000 **United States Coast Guard**

One Hundred Ton Captain License

1999 **Santa Barba City College | Santa Barbara, CA**

Major: Marine Diving Technology

MICHELS®

Dale Schinderle

Project Manager

PROFESSIONAL EXPERIENCE

2018 – Present: **Project Manager | Michels Directional Crossings**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production record-keeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	4145'	Loyalhanna Lake, PA	2020
24"	795'	Great Passage Blvd, VA	2018
24"	426'	Amanda Dr, VA	2018
24"	300'	Riva Ridge Dr, VA	2018

1998 – 2018: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
20"	1665'	Aughwick Creek, PA	2018
20"	2209'	Horse Valley Rd, PA	2018
20"	1337'	Berry Ridge & Old Mill Rd, PA	2018
20"	4771'	Raystown Lake, PA	2017
20"	1260'	Hollow Rd, PA	2017
20"	845'	Patterson Rd/RR, IL	2016
20"	748'	Wetlands #1, IL	2016
24"	1029'	Drainage Ditch, IL	2015
36"	9040'	Mississippi River & Levees, IL/MO	2014
12"	2535'	Arkansas River, AR	2014
36"	2908'	Neches River & RR, TX	2013

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
16"	1110'	New Berlin, WI	2012
10"	3745'	Fort Lauderdale, FL	2012
12"	4300'	Marathon County, WI	2012
30"	7600'	Livingston & Oakland County, MI	2011
12"	6106'	Westmoreland County, PA	2010

1992 – 1998: **Foreman | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring rigs for various size gas, water, sewer, electrical and communication lines throughout the United States. Complete knowledge of directional drilling technology and procedures. Duties include rig set-up, operation and maintenance, employee management.

1987 – 1992: **Laborer/Operator | Michels Pipeline Construction | Brownsville, WI**

Experience in working on and around directional drilling rigs as an integral member of a specialized team. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs; hydraulics; fluids; set-up and operation of drill motors; power generators; mud pumps; bentonite mixers; drill pipe; reamers; couplings; and overall equipment maintenance and operation. Was a member or the IBEW out of Michigan.

INDUSTRY INVOLVEMENT

- Member of Operating Engineers-1995

EDUCATION

NWTI (Northeast Wisconsin Technical Institute)

Mechanical Drawing

Michael Geelan

Project Manager

PROFESSIONAL EXPERIENCE

2016 – Present: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production recordkeeping, and overall on-site management.

Diameter	Length	Crossing/Location	Year
16"	3728'	Village Square Dr, PA	2019
24"	3817'	Missouri River, MO	2019
24"	6336'	Mississippi River, IL/MO	2019
12"	1070'	Indiana Harbor Canal - 12" & 10" Bundle, IN	2018
36"	1805'	Portage River MP162.5 OH	2018
36"	2730'	Sanddusky River MP145.8, OH	2018
36"	1522'	Findlay Road MP 179.96, OH	2018
36"	4034'	Maumee River MP 181.7, OH	2018
42"	1501'	Platte River, NE	2018
42"	1861'	San Martin Lake Channel, TX	2018
42"	3717'	Bahia Grande Channel #2, TX	2018
42"	4869'	Bahia Grande Channel #1, TX	2018
48"	3235'	Arroyo Colorado Canal, TX	2017
48"	3085'	Rancho Viego Floodway, TX	2017
48"	3649'	IBWC North Floodway, TX	2017
48"	3595'	Road 771 Canal, TX	2017
48"	2222'	Hwy 803, CA Rd & Supply Canal, TX	2017
48"	2033'	Resaca De Los Cuates Canal, TX	2017
48"	2183'	Resaca De Los Fresnos Canal #2, TX	2017
48"	2555'	Resaca De Los Fresnos Canal #1, TX	2017
48"	2126'	Pinson Rd Canal, TX	2017
48"	2042'	County Rd 300 Canal, TX	2017

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
48"	2398'	CR2340 & Los Olmos Creek, TX	2017
36"	1594'	Dupage River #2, IL	2017
36"	1525'	Dupage River #1, IL	2017
36"	1545'	Van Dyke Road, IL	2017
30"	7282'	Mississippi River, IA/IL	2016

2014 – 2016: **Project Manager | Michels Corporation | New York, NY**

Responsible for contract management and project coordination, including personnel and material, cost and budget control, tracking progress and schedule, submission of proper submittals and support engineering, and review of daily field reports. Serving as the point of contact for the project and maintaining communication with clients, general/subcontractors, vendors, and suppliers.

2011 – 2016: **HSE-Safety Coordinator | Michels Corporation | New York, NY**

Development and implementation of on-site procedure, emergency response plan, on-site safety inspections, equipment inspections and reporting to supervisors. Assigned the responsibility for coordinating and maintaining the company safety program. Advises management in matters of safety and health, and monitors day-to-day operations to ensure that the company's safety policies and procedures are followed.

2007 – 2011: **Project/Field Engineer | Michels Tunneling | New Berlin, WI**

Holds responsibility for coordination of all technical activities on assigned projects. Plans, schedules, conducts, and coordinates assigned engineering work; monitors work for compliance to applicable codes, accepted engineering practices, and ensures effective communication and coordination on assigned projects between all disciplines and all other project participants.

PROJECT PROFILES

MED609 – 62nd St. Tunnel Project; 620 LF of 76" Hard Rock Tunnel using a Robbins TBM. Included pipe jacking operations of 72" Casing pipe for a new water main. Construction in Manhattan – New York City. – New York, NY

East Side Access Tunnel – Contract CM005; interior structures, interior structures, and fit-out for caverns and tunnels beneath the existing Grand Central Terminal in Manhattan. Work included installation of piping/drainage systems, embedded conduits & ground mesh, waterproofing membrane & contact grout pipes, >9 million pounds of rebar, and placement of >70,000 cubic yards of concrete & wet/dry mix shotcrete. – New York, NY

Novartis Institute | Campus Expansion Project at 181 Massachusetts Ave.; Construct a 72" dia. steel Utility Tunnel by Microtunneling one run by jacking a 72" dia. Permalok steel casing pipe for a total of 120'. Jacking from a new building foundation excavation to and existing parking garage basement. – Cambridge, MA

University of Massachusetts | Central Campus Infrastructure; Construct a Jacking Shaft 30' diameter by 40' deep. Microtunnel two runs by jacking 48" dia. Permalok steel casing pipe for a total of 950'. Install 24" dia. PVC carrier pipe inside the casing pipe and gill the annulus with grout. – Amherst, MA

PROJECT PROFILES (continued)

City of Milwaukee | 26th Street Combined Sewer Sliplining; 4,500 LF of slip lining a 126” diameter Hobas pipe inside an existing 144” combined sewer concrete pipe. Included excavation of 2 access shafts (approx. 80’ deep) using rib and lagging construction methods to lower the Hobas pipe into the existing tunnel. – Milwaukee, WI

San Francisco Public Utilities Commission | Bay Division Pipeline Reliability Upgrade, Bay Tunnel; 26,208 LF of 12’ – 10” diameter concrete segmented tunnel under the San Francisco Bay from Menlo Park on the S.F. Peninsula Bay to Newark in the East Bay area, two slurry diaphragm wall shafts, and 108” cement motor lined steel pipe welded in the tunnel and shafts as a final liner carrier pipe. – San Francisco, CA

Massillon Road Sanitary Sewer Improvement; 2,925 LF of 42” Centrifugally Cast Fiberglass Reinforced Polymer Mortar Pipe sanitary sewer gravity sewer, microtunnel installation; 1,328 LF of 48” CCFRPM pipe on micropile support, 29 LF of 36” OH CCFRPM pipe, gravity sewer, micropile support. 7 EA shaft excavations with steel sheeted ground and 7 EA manholes structures. 250 LF of open cut excavation with steel sheeted ground support. – Akron, OH

Brazos River Authority East Williamson County Regional Water System Contract A; Raw Water Intake Pump Station; Two 60-inch Raw Water Intake Pipelines by Microtunnel Construction; 303 LF – Austin, TX

Galveston Causeway; Two 700’ tunnel drives through clay underneath Galveston Bay. 48” Permalok. – Galveston, TX

OCI Project No. DB10-WASD-01 ESP; 1,200 LF of 72” Permalok steel casing under the Government Cut Channel – Miami, FL

Fairfax Department of Public Works & Environmental Services | Dogue Creek Force Main Replacement; Dogue Creek Force Main Replacement – Fairfax County, VA 4,200 LF of 74” dia. Microtunnel between 6 drop shafts and tied into the existing pump station and out fall structures in order to replace an existing sewer. The majority of work performed on and coordinated with the Army Military Base – Fort Belvoir. – Fairfax County, VA

Milwaukee Metropolitan Sewer District | South 43rd Street Relief Sewer; Installation of 4500 LF of RCP using both a Akkerman MTBM slurry machine and Iseki MTBM slurry machine and 2000 LF of RCP using a Decker TBM with Direct Pipe Jacking. Job alsoconsisted of sheet pile shafts and rib and lagging/liner plate shafts at 15 structure locations. – Milwaukee, WI

Milwaukee Metropolitan Sewer District | Canal St. Wet Weather Relief Sewer; Installation of 6,000 LF RCP of Direct Pipe Jack using a 105” Lovat EPB TBM with Direct Pipe Jacking. Job also consisted of sheet pile shafts and rib and lagging/liner plate shafts at 18 structure locations. – Milwaukee, WI

Sacramento Regional County Sanitation District | Upper Northwest Interceptor Sewer 3 & 4; Installation of 3,000 LF of RCP using an 84” Akkerman MTBM slurry machine, 8,000 LF RCP Two-Pass Tunnel using a 130” Lovat TBM, and 6,000 LF RCP of Direct Pipe Jack using a 105” Lovat EPB TBM. Job also consisted of 12 sheet pile shafts and 6 drilled manhole shafts. – Sacramento, CA

TRAINING & CERTIFICATIONS

- OSHA 30-Hour
- OSHA 10-Hour
- OSHA 500 – Trainer Course for Construction (Qualified To train 10 to 30 Hour Classes)

TRAINING & CERTIFICATIONS (continued)

- BioMarine BioPak Re-breather Training and Certification
- Cal/OSHA Certified Gas Tester
- Cal/OSHA Licensed Tunnel Safety Representative
- Certified Associate Constructor - American Institute of Constructors (AIC)
- American HealthCare Assoc. Healthcare Provider Certification
- American HealthCare Assoc. Heartsaver First Aid Certification
- Rigging and Fall Protection Inspection Training (Competent Person)
- Medic First Aid Certification Renewal (CPR, AED, & First Aid)
- Qualified Rigger and Signal Person
- Confined Space Entry Awareness Training (Competent Person)
- Open Trench Safety Awareness Training (Competent Person)
- Wisconsin Lift Truck Operator Training
- Commercial Driver's License (Class ABC)
- 32-Hour Supported Scaffold Certified (NYC-DOB)
- Louisiana State Licensing Board for Contractors -- Pipe Work: 7-43 (Sewer Lines) 7-44 (Storm Drains) 7-45 (Water Lines) #25444
- Louisiana State Licensing Board for Contractors -- Specialty: 7-590 Telecommunications #25444
- North Carolina Licensing Board for General Contractors -- S (Boring & Tunneling) #29269
- State of Rhode Island: Contractors' Registration and Licensing Board -- Commercial & Residential Contractor Registration #40432
- South Carolina Department of Labor, Licensing and Regulation -- Class WL5 (water lines) & BT5 (bore & tunnel) #G10861

INDUSTRY INVOLVEMENT

- 2009 National AGG/ASC Heavy Civil Construction Competition – 4th Place
- 2008 Great Lakes Region AGG/ASC Heavy Civil Construction Competition – 1st Place
- 2007 Great Lakes Region AGG/ASC Heavy Civil Construction Competition – 3rd Place
- 2006 Lynn E. Legault Undergraduate Scholarship (AGC Education Research Foundation)

EDUCATION

University of Wisconsin–Stout | Menomonie, WI

Bachelors of Science – Construction; Minor – Risk Control & Business

University of Wisconsin–Fond du Lac | Fond du Lac, WI

Associates of Arts & Science Degree

MICHELS®

Richard Zavitz

Drilling Fluids Specialist/Project Manager

PROFESSIONAL EXPERIENCE

2012 – Present: **Drilling Fluids Specialist/Project Manager | Michels Directional Crossings | Brownsville, WI**

Develop detailed drilling fluid plans and contingencies based upon geotechnical reports, equipment and scope of project. Measure and testing of drilling fluids and supervising the mixing and pumping operations. Perform technical analysis and interpret geotechnical reports. Control and maintain drilling fluids parameters and provide technical recommendations. More notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	7402'	Susquehanna River, PA	2019
20"	1720'	Everett Railroad & Juniata River, PA	2018
42"	3980'	Susquehanna River MP 99.6, PA	2018
36"	2792'	Middle Island Creek, WV	2017
36"	5841'	Ohio River MP 33.8, OH/WV	2017
10"	5697'	Mississippi River, LA	2017
8"	1530'	SPL Yellowstone River, MT	2017
8"	1542'	YPL Yellowstone River, MT	2017
12"	1285'	XOM Yellowstone River, MT	2017
30"	7531'	Lake Oahe & Missouri River, ND	2017
16"	11,397'	Lake Sacagawea South, ND	2016
30"	3352'	Cliff Crossing, ND	2016
16"	11,229'	Lake Sacagawea North, ND	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
24"	3716'	Barbour's Cut, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
24"	5908'	Tabbs Bay, TX	2015
12"	11,563	Holland Bottoms Wetlands, AK	2015
48"	4039'	Dow Barge Channel, TX (Direct Pipe)	2015
36"	3461'	Kennedy Ave/Griffith Terminal, IN	2015
36"	3011'	Highway 41 & RR, IN	2015
36"	5128'	Lake Ave & RR, IL	2015
36"	1002'	Highway 255, TX (Direct Pipe)	2015
36"	1092'	Lubrizol Drainage, TX (Direct Pipe)	2015
18"	12,459'	Rio Grande River, TX	2014
48"	2400'	Rio Grande River, TX (Direct Pipe)	2014

PROFESSIONAL EXPERIENCE (continued)

42"	1200'	RR Crossing, TX (Direct Pipe)	2014
36"	9040'	Mississippi River, IL/MO	2014
30" & 24"	2,850',1,991', 2,732',2,983'	SE Market Expansion Project MS & AL	2014
36"	3544'	Illinois River, IL	2013
36"	4304'	Bois D' Arc, TX	2013
36"	3892'	Red River, OK/TX	2013
36"	3077'	UP RR & Jefferson St, OK	2013
36"	4213'	Menard Creek, TX	2013
36"	3239'	Clear Boggy Creek, OK	2013

2011 – 2012: **Drilling Fluid Specialist | Mears Group, Inc. | Billings, MT**

Developed detailed drilling fluid plans and contingencies based upon geotechnical reports, available equipment and scope of project. Selected bentonite and polymers based on characteristics required by the project. Trained field personnel on mud testing concepts and drilling fluid theology. Liaised with environmental regulators to obtain approval for drilling fluid products for projects.

2010 – 2011: **Territory Manager | Akkerman, Inc. | Billings, MT**

Sold tunneling and pipe jacking equipment. Analyzed and interpreted geotechnical reports to provide equipment recommendations.

2000 – 2010: **Technical Sales Engineer | Wyo-Ben, Inc. | Billings, MT**

Engineered fluids on HDD, microtunneling, pipe ramming, pipe jacking and auger boring projects. Analyzed geotechnical reports and developed mud/lubrication programs.

1998 – 2000: **Sales Representative | Surface to Surface | London, Ontario, Canada**

Trained new HDD operators. Sold pipe and cable locating equipment.

Colorado School of Mines

Taught bentonite and polymer course at Microtunneling Short Course.

TRAINING & CERTIFICATIONS

- OSHA 510 - OSHA Standards for Construction
- Apprenticed under oil field qualified mud engineer working on HDD projects
- OSHA 10-Hour
- Multiple OQ courses for various energy companies
- Multiple safety courses required by various energy companies
- OFITE trained in repair and calibration of OFITE Model 900 viscometer

EDUCATION

1988 **University of Western Ontario**

Bachelor of Arts, Kinesiology

2000 **Wyo-Ben, Inc. Intensive Mud School**

Graduated

MICHELS®

Wendell Long

Project Manager

PROFESSIONAL EXPERIENCE

2002 – Present: **Project Manager**

Michels Directional Crossings | Brownsville, WI

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production record-keeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
36"	6238'	Ohio River, OH/WV	2017
30"	2278'	Chattahoochee River, GA	2017
30"	2757'	Little Rock River, IA	2016
30"	6328'	Big Sioux River, SD/IA	2016
30"	1614'	Mill Creek, IA	2016
30"	6119'	Lake Whitney, TX	2016
16"	11,563	Holland Bottoms Wetlands, AK	2015
22"	2538'	Barrington Rd, IL	2015
36"	1147'	E. 138th Street, IL	2015
36"	2697'	Barrington Rd, IL	2015
48"	2060'	Tres Palacios River, TX	2014
48"	1692'	Navidad River, TX	2014
24"	2750'	Escatawpa River, MS	2014
24"	3030'	Big Creek Lake, AL	2014
30"	2774'	South Canadian River, OK	2013
28"	4270'	Saline Creek, Alberta, Canada	2013
12"	4272'	Saline Creek, Alberta, Canada	2013
36"	3618'	Johnson Creek, TX	2013
36"	3314'	East Fork Angelina River, TX	2013
36"	3130'	Cypress, TX	2012
16"	1664'	Morales, TX	2012
42"	1657'	Morales, TX	2012
20"	2108'	Bayonne, NJ	2012
24"	6091'	Homestead, FL	2011
36"	2373'	Ravenswood, LA	2011

PROFESSIONAL EXPERIENCE (continued)

10'	778'	Ft. Lauderdale, FL	2011
10"	964'	Ft. Lauderdale, FL	2011
16"	9931'	Cooper River, SC	2010
42"	1998'	I-49, LA	2010
16"	2566'	Hitchcock Plaza, SC	2010
30"	2176'	I-285, Atlanta, GA	2010

1994 – 2002: **Project Manager**

Michels Mid-America Line and Cable | Brownsville, WI

Job estimating, profit and loss coordination of materials and equipment. Labor and production jobs varying in size up to $25 million. Projects include aerial, buried, underground, cooper and fiber routes.

1987 – 1991: **Project Manager**

U.S. Sprint | Midwest and Eastern U.S.A.

Responsible for construction management, permits, schedules and daily work operation to meet completion dates. Jobs varying in size to $20 million.

1985 – 1986: **Senior Engineer**

U.S. Sprint | Midwest and Eastern U.S.A.

In charge of engineering and fiber construction for several miles.

1981 – 1984: **Construction and Maintenance Supervisor**

United Telephone of Florida | Fort Meyers, FL

Responsibilities include new construction, maintenance, splicing and cutover of offices in eight exchanges. Responsible for daily operation of 35 splicers.

1964 – 1980: **Cable Splicer**

United Telephone of Florida | Fort Meyers, FL

Spliced paper and plastic cable, exchange cutover and maintenance of all types of cable.

1962 – 1963: **Lineman**

United Telephone of Florida | Fort Meyers, FL

Worked on open wire circuits including toll circuits and placements of cable.

EDUCATION

1956 **Hardee High School | Wauchula, FL**

High School Diploma

Jeremiah Yliniemi

Project Manager

PROFESSIONAL EXPERIENCE

2020 – Present: **Project Manager | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production record-keeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	4813'	Raystown Lake, PA	2020

2006 – 2020: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	7402'	Susquehanna River, PA	2019
20"	2236'	Lower Piney Creek, PA	2018
20"	1720'	Everett RR-Juniata River, PA	2018
16"	2346'	Frankstown Branch-Juniata River, PA	2018
16"	1275'	Hollow Road, PA	2017
20"	1260'	Hollow Road, PA	2017
20"	4771'	Raystown Lake, PA	2017
36"	7194'	Ohio River MP 16.07, OH/MV	2017
30"	7531'	Lake Oahe & Missouri River, ND	2017
16"	11,397'	Lake Sacagawea, ND	2016
30"	3352'	Cliff Crossing, ND	2016
16"	1112'	Palermo Railroad, ND	2016
12"	7228'	Athabasca River, Alberta, Canada	2016

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
42"	3885'	Dover River, Alberta, Canada	2016
24"	1230'	Christina River, Wood Buffalo, Canada	2015
42"	7205'	Athabasca River, Alberta, Canada	2015
42"	1008'	Highway 63, Canada - Direct Pipe Installation	2015
42"	2510'	Ruth Lake, Fort McMurray, Canada	2015
12" and 6"	3173'	Beaver Lake, Alberta, Canada	2015
42"	3114'	Beaver Lake, Fort Mc Murray, Canada	2015
42"	3776'	MacKay River, Fort McMurray, Canada	2015
30"	2667'	South Fork Ten Mile Creek, PA	2014
20"	1193'	SR-265/Leatherwood Rd, OH	2014
24"	3269'	Transfer Line 2, IN	2014
36"	1874'	Wetland S-517C, IN	2014
42"	4284'	Vermillion River, Canada	2013
42"	3392'	N. Saskatchewan River, Canada	2013
42"	4441'	Goethals Bridge, NY	2013
30"	8101'	Kill Van Kull River, NY/NJ	2013
36"	2133'	Little River, OK	2013
36"	4342'	Deep Fork river, OK	2013
36"	4505'	Medicine Hat Alberta Canada	2012
36"	4993'	Atchafalaya River, LA	2011
20"	3080'	Rock Creek, OR	2011
42"	4272'	St. John's River, BC	2011
14"	1633'	Ocean Sciences, Newfoundland	2011
42"	2204'	Bayou Comitte, LA	2010
36"	1873'	Petitcodic River, Canada	2009

2004 – 2006: **Nick's Conoco | Park Rapids, MN**

EDUCATION

2002 **Park Rapids Area High School**

High School Diploma

MICHELS®

Doug Houska

Project Manager

PROFESSIONAL EXPERIENCE

2019 – Present: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production record-keeping, and overall on-site management.

1991 – 2019: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, WI**

Responsible for surveying, staking and design of directional drill path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Performed the above operations for crossings which include, but not limited to:

Diameter	Length	Location	Year
20"	13,247'	Lake Sakakawea River, ND	2019
8"	3768'	MP 50.8 Landslide, MT	2018
36"	1805'	Portage River MP 162.5, OH	2018
36"	2974'	Wetland MP 8.1, OH	2018
42"	3980'	Susquehanna River MP 99.6, PA	2018
42"	1810'	Interstate 80, PA	2018
48"	3649'	IBWC North Floodway, TX	2017
48"	3595'	Road 771 Canal, TX	2017
48"	2222'	Hwy 803, CA Rd & Supply Canal, TX	2017
48"	2033'	Resaca De Los Cuates Canal, TX	2017
30"	2555'	Resaca De Los Fresnos Canal #1, TX	2017
48"	2126'	Pinson Rd Canal, TX	2017
30"	3483'	Ford Island to Landing C, HI	2017
48"	2042'	County Rd 300 Canal, TX	2017
48"	2349'	Chiltipan Creek, TX	2017

PROFESSIONAL EXPERIENCE (continued)

30"	7531'	Lake Oahe & Missouri River, ND	2017
16"	6693'	Wapsipinicon River, IA	2016
30"	2757'	Little Rock River, IA	2016
12"	1114'	Sunflower Field, VT	2016
30"	5714'	James River, SD	2016
30"	2069'	Floyd River/RR/HWY 60, IA	2016
30"	2991'	PCN3/Wetland, SD	2016
30"	1791'	200th St, SD	2016
30"	1372'	183rd St & Wetland MP 331, SD	2016
30"	5154'	House River, Alberta, Canada	2016
42"	3885'	Dover River, Alberta, Canada	2016
42"	3399'	McKay River, Alberta, Canada	2016
24"	1230'	Christina River, Wood Buffalo, Canada	2015
42"	7205'	Athabasca River, Alberta, Canada	2015
36"	5128'	Lake Ave & RR, IL	2015
12" and 6"	3173'	Beaver Lake, Alberta, Canada	2015
42"	3776'	MacKay River, Fort McMurray, Canada	2015

1988 – 1991: **Project Coordinator | Mid America Line and Cable, Division of Michels Pipeline | Brownsville, WI**

Assisted Project Manager with coordinating field personnel for large scale telephone cable installation projects. Recorded and prepared field reports for project, office and customer needs. Acting liaison between project managers, public, existing utility representatives and customer representatives. Coordinated project between existing utilities and placement of new installation. Maintain material inventory required for projects.

1980 – 1988: **Project Assistant/Bookkeeper | Michels Pipeline Construction | Brownsville, WI**

Purchasing agent responsible for coordinating all materials to various locations along project routes for water line and telephone installations . Inventory control of materials. Prepared field reports to keep record of labor and production. Liaison between existing utility representatives and Michels.

EDUCATION

1980 **Mitchell Area Vocational Technical College | Mitchell, SD**

Two year Associate Degree Accounting

1978 **Kimball High School | Kimball, SD**

High School Diploma

Chad R. Johnson

Project Manager

PROFESSIONAL EXPERIENCE

2019 – Present: **Project Manager | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production record-keeping, and overall on-site management. Some more notable crossings include, but are not limited to:

2019: **HDD Operator | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production.

2017 – 2019: **Skilled Laborer | Michels Directional Crossings | Brownsville, Wisconsin**

Integral member of a specialized team working on and around directional drilling rigs. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

2004 – 2017: **Bore Coordinator, Project Manager, Construction Inspection & Water Treatment Operator | Xenia Rural Water District | Bouton, IA**

Coordinated the projects from mapping the project to scheduling of utility locations and equipment. Worked with the state, county and local officials for the projects and acquired DOT permits. Attended landowners meetings/conflict management, completed daily project reports and reported to the executive director. Installation of water lines 1" to 24" PVC, fusible PVC and HDPE and 8" to 36" steel. Operation of multiple pieces of equipment (bore machines, ditch witch, backhoes, track hoes and dozers).

TRAINING & CERTIFICATIONS

- Water Treatment and Distribution Grade II Certification
- Vocational Auto Mechanics

EDUCATION

Boone High School | Boone, IA

High School Graduate

MICHELS®

Karl Kornkven

Project Manager

PROFESSIONAL EXPERIENCE

2020 – Present: **Project Manager | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production record-keeping, and overall on-site management.

2002 – 2020: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	7595'	Houston Ship Channel, TX	2019
16"	6053'	Tabbs Bay, TX	2019
16"	3846'	Barbour's Cut, TX	2019
30"	3746'	Dix River, KY	2019
20"	2355'	Joanna Rd, PA	2018
36"	1886'	Nimisila Reservoir MP 40.9, OH	2018
20"	7354'	Susquehanna River, PA	2018
30"	7531'	Lake Oahe & Missouri river, ND	2017
30"	2991'	PCN3/Wetland, SD	2016
12"	7228'	Athabasca River, Alberta, Canada	2016
30"	5154'	House River, Alberta, Canada	2016
42"	3399'	McKay River, Fort McMurray, Cananda	2016
24"	1230'	Christina River, Wood Buffalo, Canada	2015

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
42"	7205'	Athabasca River, Alberta, Canada	2015
42"	2510'	Ruth Lake, Fort McMurray, Canada	2015
42"	3114'	Beaver Lake, Fort McMurray, Canada	2015
42"	3776'	MacKay River, Fort McMurray, Canada	2015
36"	1613'	Fish Pond, Alberta, Canada	2014
36"	1359'	Wetland Crossing #2, Alberta, Canada	2014
36"	9040'	Mississippi River, IL/MO	2014
42"	4284'	Vermillion River, Canada	2013
30"	4905'	Merseles, NJ	2013
30"	5378'	Hudson River, NJ/NY	2012
30"	4850'	Red River, TX/OK	2012
16"	1649'	Cordele, TX	2012
42"	1661'	Cordele, TX	2012
16"	3214'	Dewitt, TX	2012
42"	3205'	Dewitt, TX	2012
36"	4505'	Medicine Hat, Alberta, Canada	2012
36"	4993'	Atchafalaya River, LA	2011
42"	4272'	St. John's River, BC	2011
36"	4495'	Saskatchewan River, AB	2011
14"	1554'	St. John's Newfoundland	2010
42"	4322'	Cache River, AR	2010
42"	5084'	Mississippi River, AR	2010

2000 – 2002: **Drill Rig Operator | Michels Directional Crossings | Brownsville, WI**

Experience in working on and around directional drilling rigs as an integral member of a specialized team. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs; hydraulics; fluids; set-up and operation of drill motors; power generators; mud pumps; bentonite mixers; drill pipe; reamers; couplings; and overall equipment maintenance and operation.

1998 – 2000: **Drilling Fluid Technician | Michels Directional Crossings | Brownsville, WI**

Solely responsible for mixing bentonite to the right consistency with an emphasis in directional drilling. Proficient working in and around drilling rigs and overall operation as an integral member of the specialized team. Multi-capable to assist with all types of drilling tasks and familiar with repair, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, steer tool wireline connections, couplings, etc. Involved in various types of directional drilling projects, line and cable, water and setting manholes.

PROFESSIONAL EXPERIENCE (continued)

1991 – 1997: **Machinist | Nissen Manufacturing | Larimore, ND**

Machinist performing welding, drilling and assembly

1988 – 1991: **Air Traffic Controller | United States Air Force | Grand Forks, ND**

EDUCATION

University of North Dakota

Bottineau High School | Bottineau, ND

High School Diploma

MICHELS®

Dan Kriesel

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2006 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	3653'	Ship Road/King Road, PA	2019
16"	4358'	Phoenixville Pike Road, PA	2019
22"	4986'	Atchafalaya River, LA	2019
8"	3768'	MP 50.8 Landslide, MT	2018
42"	3980'	Susquehanna River MP 99.6, PA	2018
36"	5841'	Ohio River MP 33.8, OH/WV	2017
14"	9154'	Nansemond River, VA	2017
10"	5697'	Mississippi River, LA	2017
30"	3483'	Ford Island to Landing C, HI	2017
30"	7531'	Lake Oahe & Missouri River, ND	2017
16"	6693'	Wapsipinicon River, IA	2016
30"	6328'	Big Sioux River, SD/IA	2016
24"	4531'	Athabasca River, Alberta, Canada	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
24"	3716'	Barbour's Cut, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
30"	1418'	Highway 250, OH	2015
16"	1402'	Deer Lake, ND	2015
36"	3461'	Kennedy Ave/Griffith Terminal, IN	2015
36"	3011'	Highway 41 & RR, IN	2015
10"	4654'	Allegheny River, PA	2015
8"	3320'	Yellowstone River, MT	2015

24" HDPE	1061'	Lake Sakakawea, ND	2014
8"	7321'	MP 49.3 Landslide, MT	2014
8"	4159'	MP 54.8 Landslide, MT	2014
20"	2364'	Missouri River, NE/IA	2014
16"	2951'	Line 82, ND	2014
36"	2264'	Otter Creek, IL	2013
36"	1611'	Mackinaw River, IL	2013
48"	1943'	West Neck Creek, VA	2013
48"	819'	Hunt Club Creek, VA	2013
8"	7177'	115 KV Power Duct, SC	2013
8"	7304'	115 KV Power Duct, SC	2013
8"	3503'	Hamlin Creek, Charelston, SC	2013
8"	4911'	115 KV Power Duct, SC	2013
8"	12,902'	MP66, Wyola, MT	2012
8"	4475'	MP57, Lodge Grass, MT	2012
8"	2645'	Tioga Junction, PA	2012
16"	3894'	Roaring Branch, PA	2012
10"	1819'	Texas Creek, Tioga, PA	2011
16"	1818'	Texas Creek, Tioga, PA	2011
30"	5786'	Lake Conway, Vernon, NJ	2011
42"	992'	Bayou Rapids, Bunkie, LA	2011
42"	1223'	Bayou Robert, Bunkie, LA	2011
36"	3030'	Black Bear Forest, Bunkie, LA	2011
3"	1879'	Coquille River, Bandon, OR	2010
3"	1895'	Coquille River, Bandon, OR	2010
30"	1275'	Little Powder River, WY	2010

2006: **Operator | InterCon Construction | Madison, WI**

Duties include rig set-up, operation, maintenance, and mud technician for water lines.

2004 – 2006: **Foreman/Operator | Blue Badger, Inc. | Rosebush, MI**

Duties include walk over locating and operating of 80x100 rig for water, gas, fiber optic and sewer line installation.

2002 – 2004: **Operator/Laborer | Mears/HDD, LLC | Rosebush, MI**

Duties include wire line splice technician, mud technician, operate track hoe/back hoe and laborer for water, gas and sewer line installation.

EDUCATION

1994 **Mason County Central High School | Scottville, MI**

High School Diploma

MICHELS®

Marcus Carratt

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2000 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
16"	12,769'	Houston Ship Channel, TX	2019
16"	6053'	Tabbs Bay, TX	2019
8"	12,769'	Montezeuma Slough, CA	2019
24"	3341'	Hwy 367/Coldwater Creek, MO	2019
24"	3817'	Missouri River, MO	2019
36"	2611'	Tuscarawas River MP 47.8, OH	2018
16"	5869'	Conrail RR, NJ	2018
36"	5841'	Ohio River MP 33.8, OH/WV	2017
20"	4771'	Raystown Lake, PA	2017
48"	2349'	Chiltipan Creek, TX	2017
48"	3291'	Meter to LNG Facility, TX	2017
30"	5714'	James River, SD	2016
30"	1516'	408th & Wetland MP 360, SD	2016
30"	1519'	Turtle Creek, SD	2016
42"	3885'	Dover River, Alberta, Canada	2016
4-4" HDPE	764'	Fox River, WI	2015
48"	4039'	Dow Barge Channel, Clute TX - Direct Pipe	2015
36"	9040'	Mississippi River, IL/MO	2014
42"	1153'	Railroad Crossing, TX - Direct Pipe	2014
42"	3392'	N. Saskatchewan River, Canada	2013
42"	4441'	Goethals Bridge, NY	2013

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
42"	3186'	Arthur Kill, Staten Island, NJ/NY	2013
16"	1656'	Chicolete River, TX	2012
42"	1650'	Chicolete River, TX	2012
16"	1717'	Morales, TX	2012
42"	1670'	Morales, TX	2012
36"	4505'	Medicine Hat, Alberta, Canada	2012
24"	2458'	Jonestown, PA	2012
36"	4519'	Freeman Road, LA	2011
42"	5117'	Nature Conservatory, LA	2011
36"	4992'	Atchafalaya River, LA	2011
16"	9931'	Cooper River, SC	2010
42"	3485'	Quachita River, LA	2010
42"	4067'	LA State Hey 34, LA	2010

1999 – 2000: **Foreman | Schatz Underground Cable | Villa Ridge, MO**

Working foreman responsibilities included locating, operating Ditch Witch, directional boring rig, trencher, plow, back hoe, and small back hoe.

1997 – 1999: **Laborer | Michels Pipe Line Construction | Brownsville, WI**

Experience in working on and around directional drilling rigs as an integral member of a specialized team. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs; hydraulics; fluids; set-up and operation of drill motors; power generators; mud pumps; bentonite mixers; drill pipe; reamers; couplings; and overall equipment maintenance and operation.

1993 – 1997: **Beginning Manager | Driver, United States Marine Corps | Camp LeJeune, NC**

sgssg

TRAINING & CERTIFICATIONS

- PCST Certificate Renewal Course (2014)

EDUCATION

1986 **Waupun High School | Waupun, WI**

High School Diploma

Steve Sanders

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2003 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	2518'	Herman O.W. Drive, PA	2019
16"	6601'	Arch Bishp/S Chester Rd, PA	2019
42"	4687'	Lake Scranton Finished H2O Tunnel, PA	2018
36"	2974'	Wetland MP 8.1, OH	2018
30"	2273'	Susquehanna River @ MP 35, PA	2018
42"	2826'	San Joaquin River, CA	2017
12"	5741'	Rum River & Wetland, MN	2017
12"	5170'	Larch Dr & Wetland, MN	2017
6"	3309'	Hauser Lake, MT	2017
8"	1980'	CHS Yellowstone River, MT	2017
8"	1530'	SPL Yellowstone River, MT	2017
8"	1542'	YPL Yellowstone River, MT	2017
12"	1285'	XOM Yellowstone River, MT	2017
24"	1898'	Vermillion River, IL	2016
12"	3144'	Monkton Swamp, VT	2016
12"	1491'	Drinkwater Rd, VT	2016
20"	1904'	North St Mary's River, IN	2016
20"	1076'	South St Mary's River, IN	2016
30"	6119'	Lake Whitney, TX	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
24"	3716'	Barbour's Cut, TX	2015
24"	7432'	Houston Ship Channel, TX	2015

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
24"	5908'	Tabbs Bay, TX	2015
36"	1862'	State Highway 50, IL	2015
36"	1813'	Calumet Ave, IN	2015
36"	1803'	Dyer Ditch, IN	2015
36"	1812'	Highway 394, IL	2015
30"	1376'	Tom's Creek, MS	2014
24"	2750'	Escatawpa River, MS	2014
24"	3030'	Big Creek Lake, AL	2014
24"	2020'	Unnamed Creek, AL	2014
30"	2774'	South Canadian River, OK	2013
30"	4987'	Monksville Reservoir, NJ	2013
30"	1707'	Bayonne Inlet, NJ	2013
30"	8101'	Kill Van Kull River, NY/NJ	2013
20"	869'	Centerview, MO	2012
20"	2458'	Centerview, MO	2012
16"	3894'	Roaring Branch, PA	2012
20"	2513'	Tioga Junction, PA	2012
30"	5786'	Lake Conway, NJ	2011
42"	3008'	White River, AR	2010
42"	1851'	Siphon Creek, LA	2010
20"	5222'	Pokegama Carnegie, WI	2009
36"	2096'	Prairie River, MN	2009
20"	1130'	Wilson Bay, NC	2009

1995 – 2002: **HDD Rig Operator | Michels Directional Crossings | Brownsville, WI**

Experience in working on and around directional drilling rigs as an integral member of a specialized team. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs; hydraulics; fluids; set-up and operation of drill motors; power generators; mud pumps; bentonite mixers; drill pipe; reamers; couplings; and overall equipment maintenance and operation.

EDUCATION

1994 **University of Wisconsin–Stout | Menomonie, WI**

1990 **Berlin High School | Berlin , WI**

High School Diploma

MICHELS®

Jack Edmunds

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

1998 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record-keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down-hole survey along with surveying and surveying instrumentation.

Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
16"	4145'	Loyalhanna Lake, PA	2020
20"	13,247'	Lake Sakakawea, ND	2019
20"	6429'	Badlands Canyon, MT	2019
8"	12,769'	Montezeuma Slough, CA	2019
16"	2734'	Yellowstone River, MT	2019
22"	4986'	Atchafalaya River, LA	2019
42"	4687'	Lake Scranton Finished H2O tunnel, PA	2018
42"	1861'	San Martin Lake Channel, TX	2018
42"	3717'	Bahia Grande Channel #2, TX	2018
42"	4869'	Bahia Grande Channel #1, TX	2018
48"	3235'	Arroyo Colorado Canal, TX	2017
48"	3649'	IBWC North Floodway, TX	2017
48"	2222'	Hwy 803, CA Rd & Supply Canal, TX	2017
48"	2183'	Resaca De Los Fresnos Canal #2, TX	2017
48"	2555'	Resaca De Los Fresnos Canal #1, TX	2017
48"	2398'	CR2340 & Los Olmos Creek, TX	2017
48"	2807'	Oliver Creek & SH 188, TX	2017
48"	2263'	US Hwy 181/Hwy 35, TX	2017
30"	2782'	Mississippi River, IA/IL	2016
42" Steel with 36" HDPE	3983'	St John's River, FL	2016
27" HDPE Bundle	3737'	Little Creek, VA	2016
8"	1957'	Grand River, MI	2016

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
16"	1508'	Beverly Harbor, MA	2015
16"	3827'	Collins Cove, MA	2015
36"	2303'	Liberty Street, IL	2015
18"	12,459	Houston Ship Channel, TX	2015
36"	9040'	Mississippi River, IL/MO	2014
24"	3269'	Transfer Line 2, IN	2014
24"	3275'	Transfer Line 1, IN	2014
30"	2344'	Delaware River, PA/NJ	2013
42"	3008'	I-95 & Tidal Wetlands, NJ	2013
30"	4831'	18th Street, NJ	2013
16"	1664'	Morales, TX	2012
42"	1657'	Morales, TX	2012
10"	1495'	Missoula, MT	2012
24"	1546'	Colorado River, CO	2011
12"	1612'	WBC62 (Offshore), LA	2011

1981 – 1998: **Trenchless Technology Operator/Supervisor & Journeyman Welder | Michels Pipeline Construction | Brownsville, WI**

As Operator/Supervisor he completed profit and loss responsibility for performing trenchless casing installations for civil, pipeline, communications and power at roads, railroads and rivers. Coordinated and executed entire boring operation from mobilization to demobilization.

1977 – 1981: **Skilled Laborer/Operator | Beloit Pipe and Dredge Company | Beloit , WI**

Performed various duties in the construction of natural gas and petroleum product pipeline. Multi-capable to assist with all facets of product pipeline installation including conventional and trenchless methods of construction.

TRAINING & CERTIFICATIONS

- Certified for fusion of plastic natural gas pipe and fittings.
- Certified for butt, sidewall and/or socket fusion of Driscopipe polyethylene pipe and fittings.

INDUSTRY INVOLVEMENT

- Member of Local 601 of United Association of Journeyman and Apprentices for the Plumbing and Pipe Fitting Industry of the United States and Canada (Steamfitters).

EDUCATION

1995 **Moraine Park Technical College**

Welding Courses

1976 **Waupun High School | Waupun , WI**

High School Diploma

MICHELS®

Brian Guelig

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2006 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
20"	2740'	West Branch Escanaba River, MI	2019
20"	13,247'	Lake Sakakawea River, ND	2019
24"	6336'	Mississippi River, IL/MO	2019
42"	4687'	Lake Scranton Finished H2O Tunnel, PA	2018
20"	2355'	Joanna Rd, PA	2018
42"	1501'	Platte River, NE	2018
42"	1861'	San Martin Lake Channel, TX	2018
42"	3717'	Bahia Grande Channel #2, TX	2018
42"	4869'	Bahia Grande Channel #1, TX	2018
48"	3085'	Rancho Viejo Floodway, TX	2017
48"	3649'	IBWC North Floodway, TX	2017
48"	3595'	Road 771 Canal, TX	2017
48"	2033'	Resaca De Los Cuates Canal, TX	2017
48"	2555'	Resaca De Los Fresnos Canal #1, TX	2017
36"	7194'	Ohio River MP 16.07, OH/WV	2017
24"	2026'	Highway 20, GA	2017
36"	1606'	Hannahatchee Creek, GA	2017
36"	1907'	Earthen Dam, GA	2016
36"	3829'	Flint River, GA	2016
36"	4311'	Major Mackenzie Rd, Ontario, Canada	2016
36"	3901'	Rutherford Rd, Ontario, Canada	2016

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
36"	3160'	Christina River, Alberta, Canada	2016
42"	1411'	Torbram Rd, Ontario, Canada	2015
36"	3133'	Pamona Creek, Ontario, Canada	2015
36"	1559'	West Don River, Ontario, Canada	2015
36"	1352'	Bayview Road, Ontario, Canada	2015
36"	2992'	Alden Road, Ontario, Canada	2015
36"	3363'	Steeles Ave, Ontario, Canada	2015
36"	1588'	Hwy 404, Ontario, Canada	2015
36"	1355'	Beaver Creek, Ontario, Canada	2015
36"	3805'	Williamette River, OR	2014
16"	2951'	Line 82, ND	2014
36"	1874'	Wetland S-517C, IN	2014
8"	2545'	MP266, Mountain Green, UT	2013
30"	1881'	Bennekill Stream, NJ	2013
30"	6544'	1st Street, NJ	2013

2002 – 2006: **Operator | Michels Directional Crossings | Brownsville, WI**

Experience in working on and around directional drilling rigs as an integral member of a specialized team. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs; hydraulics; fluids; set-up and operation of drill motors; power generators; mud pumps; bentonite mixers; drill pipe; reamers; couplings; and overall equipment maintenance and operation.

1999 – 2002: **Laborer | Northeast Asphalt | Fond du Lac, WI**

EDUCATION

1999 **New Holstein High School | New Holstein, WI**

High School Diploma

MICHELS®

Nick LeBlanc

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2004 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, wi**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	6601'	Arch Bishop/S Chester Rd, PA	2019
42"	2007'	Las Moras Creek, TX	2019
20"	2355'	Joanna Rd, PA	2018
36"	4034'	Maumee River MP 181.7, OH	2018
16"	5869'	Conrail RR, NJ	2018
16"	2766'	Hall Street, NJ	2018
16"	1999'	Route-35, NJ	2018
30"	2278'	Chattahoochee River, GA	2017
16"	11,397'	Lake Sacagawea South, ND	2016
30"	3352'	Cliff Crossing, ND	2016
16"	11,229'	Lake Sacagawea North, ND	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
4-4" HDPE	764'	Fox River, WI	2015
12"	11,563	Holland Bottoms Wetlands, AK	2015
36"	2510'	Deep Creek, IL	2015
36"	5128'	Lake Ave & RR, IL	2015
18"	12,459	Houston Ship Channel, TX	2015
28"	1741'	Lafayette River, VA	2014
48"	2060'	Tres Palacios River, TX	2014
48"	1692'	Navidad River, TX	2014
36"	1311'	Fraizer Creek, IL	2013

36"	3544'	Illinois River, IL	2013
36"	3077'	UP RR & Jefferson St, Tushka, OK	2013
36"	1499'	60" Water Main, OK	2013
36"	2133'	Little River, OK	2013
36"	2610'	Stroud, OK	2013
30"	4850'	Red River, Thackerville, TX/OK	2012
24"	1386'	Jonestown, PA	2012
8"	6669'	Wilmington, NC	2012
24"	1701'	Howard, MD	2011
36"	2496'	Taterville, LA	2011
36"	5325'	Kingston, LA	2011
16"	9931'	Cooper River, SC	2010
42"	3485'	Quachita River, LA	2010
42"	4067'	LA State Hey 34, LA	2010
36"	5240'	Pokegama Carnegie, WI	2009
42"	3800'	Mississippi River, MO	2009

EDUCATION

1999 **Carencro High**

High School Diploma

MICHELS®

Dave Williams

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2015 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
16"	6976'	Matlock/W Chester Rd, PA	2020
36"	1321'	Saline River MP 237.4, MI	2018
36"	1863'	E. Branch Black River MP 86.7, OH	2018
20"	2355'	Joanna Rd, PA	2018
36"	1430'	Interstate 80 MP 110.3, OH	2018
36"	1810'	Interstate 80, PA	2018
36"	2836'	Nemadji Golf Course, WI	2017
42"	2826'	San Joaquin River, CA	2017
36"	1725'	Tower Ave/Hwy 35, WI	2017
42"	2431'	Maumee River & State Hwy 24, OH	2017
16"	3065'	Rock Creek & US HWY 67, IA	2016
30"	2757'	Little Rock River, IA	2016
30"	2069'	Floyd River/RR/HWY 60, IA	2016
30"	1791'	200th St, SD	2016
30"	1372'	183rd St & Wetland MP 331, SD	2016
30"	1278'	Wetland MP 311, SD	2016
30"	5154'	House River, Alberta, Canada	2016
36"	3160'	Christina River, Alberta, Canada	2016
36"	2215'	Bathurst Rd, Ontario, Canada	2015
36"	3363'	Steeles Ave, Ontario, Canada	2015
36"	1588'	Hwy 404, Ontario, Canada	2015

PROFESSIONAL EXPERIENCE (continued)

2008 – 2015: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
36"	3805'	Williamette River, OR	2014
24"	1961'	County Road 2, AL	2014
24"	2884'	Hatchett Creek, AL	2014
36"	1874'	Wetland S-517C, IN	2014
8"	2545'	MP266, UT	2013
30"	1881'	Bennekill Stream, NJ	2013
42"	3392'	N. Saskatchewan River, Canada	2013
30"	6544'	1st Street, NJ	2013
30"	1633'	Brooklyn, NY	2012
30"	5786'	Vernon, NJ	2011
42"	1851'	Siphin Creek,LA	2010
36"	2096'	Prairie River, MN	2009
36"	5237'	Pokegema Carnegie, WI	2009

1994 – 2008: **Operator | PTS Contractors | Green Bay, WI**

Sewer and water utility contractor.

EDUCATION

1986 **Amber Pocasset High School | Amber, OK**

High School Diploma

Ryan Jackson

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2012 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	2734'	Yellowstone River, MT	2019
22"	4986'	Atchafalaya River, LA	2019
42"	3717'	Bahia Grande Channel #2, TX	2018
42"	4869'	Bahia Grande Channel #1, TX	2018
48"	3235'	Arroyo Colorado Canal, TX	2017
48"	3649'	IBWC North Floodway, TX	2017
42"	3983'	42" Steel with 36" HDPE, St John's River, FL	2016
27"	3737'	27" HDPE Bundle, Little Creek, VA	2016
8"	1957'	Grand River, MI	2016
8"	4022'	Lake Macatawa, MI	2016
16"	1508'	Beverly Harbor, MA	2015
16"	3827'	Collins Cove, MA	2015
18"	12,459'	Houston Ship Channel, TX	2015
36"	3805'	Williamette River, OR	2014
30"	1701'	Red River, OK	2013
30"	2344'	Delaware River, PA/NJ	2013
30"	1246'	OK City Water Main, OK	2013
30"	4987'	Monksville Reservoir, NJ	2013
42"	4441'	Goethels Bridge, NY	2013
30"	4801'	18th Street, NJ	2013
30"	5378'	Hudson River, NY/NJ	2012

PROFESSIONAL EXPERIENCE (continued)

2007 – 2012: **HDD Operator | Michels Directional Crossings | Brownsville, Wisconsin**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation.

TRAINING & CERTIFICATIONS

- Safety Trained with Forklift & Excavator - Competent Person
- OSHA 30 Hour

EDUCATION

2004 **Winnebago Lutheran Academy | Fond du Lac, Wisconsin**

High School Graduate

Mark Matthews

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2017 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. More notable crossings include, but are not limited to:

Diameter	Length	Location	Year
42"	34551'	Bow River, Canada	2019
42"	2264'	Springbank Reservoir, Canada	2019
36"	6135'	Kakwa River 36" Bundle, Canada	2019
42"	3773'	Permanent Creek 42" Bundle, Canada	2019
42"	1640'	Pouce Coupe River, Canada	2019
36"	1749'	Deadhorse Creek, Canada	2018
12"	6986'	Mackenzie River, Canada	2018
42"	3087'	Victoria Harbor, Canada	2018
36"	1511'	Hwy #1, Canada	2017
48"	1112'	134 Street & 92nd Avenue, Canada	2017
36"	1116'	United Blvd & Mundy Creek, Canada	2017
36"	1076'	Hwy 7 & CP Rail, Canada	2017
48"	2349'	Chiltipan Creek, TX	2017

2011 – 2017: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
48"	2263'	US Hwy 181/Hwy 35, TX	2017
48"	2807'	Oliver Creek & SH 188, TX	2017
12"	7228'	Athabasca River, Alberta, Canada	2016
42"	3885'	Dover River, Alberta, Canada	2016

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
24"	1230'	Christina River, Wood Buffalo, Canada	2015
42"	7205'	Athabasca River, Alberta, Canada	2015
12"	3472'	Gilmore Lane, OR	2014
36"	1640'	LaMoine River, IL	2013
36"	5313'	Kansas City RR, LA	2011
42"	4952'	Rambling Bayou, LA	2011
36"	4993'	Atchafalaya Rivre, LA	2011
36"	1518'	Vermillion River, IL	2013
36"	4304'	Bois D' Arc, TX	2013
36"	3239'	Clear Boggy Creek, OK	2013
36"	1792'	North Canadian River, OK	2013
36"	1444'	Hwy 155 & UP RR, Big Sandy, TX	2012
36"	1761'	Private Lake, Maple Springs, TX	2012
36"	4505'	Medicine Hat Alberta, Canada	2012

2009 – 2011: **Operator | Michels Pipeline | Brownsville, WI**

Responsibilities included locating, operating Ditch Witch, directional boring rig, trencher, plow, back hoe, and small back hoe.

2006 – 2009: **Operator/Driller | Laney Directional Drilling | Humble, TX**

Operated Drill Rig, Trackhoe and Crane. Currently hold world record for drilling 6700' of 42" in Sulphur, LA (7/2008).

EDUCATION

1987 **Linville High School | Linville , LA**

High School Diploma

MICHELS®

Richard Wulff

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2015 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Some more notable crossings, but not limited to:

Diameter	Length	Location	Year
16"	2997'	Paoli Pike/E Boot Road, PA	2019
16"	3419'	Greenhill Road, PA	2019
12"	1070'	Indiana Harbor Canal - 12" & 10" Bundle, IN	2018
20"	1665'	Aughwick Creek, PA	2018
20"	2209'	Horse Valley Road, PA	2018
20"	1507'	Trough Creek Valley Pike/SR 829, PA	2018
16"	1999'	Route-35, NJ	2018
16"	1198'	Harrisburg Pike, PA	2017
20"	2005'	Hwy 15, PA	2017
36"	1545'	Van Dyke Road, IL	2017
24"	3166'	N Saskatchewan River, Alberta, Canada	2016
24"	4531'	Athabasca River, Alberta, Canada	2016
30"	2461'	Highway 63, Alberta, Canada	2015
24"	1956'	Clearwater River, Alberta, Canada	2015

1998 – 2015: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
36"	1613'	Fish Pond, Alberta, Canada	2014
36"	2274'	Highway 13, Alberta, Canada	2014
36"	2133'	Wetland Crossing, Alberta, Canada	2014
12"	4272'	Saline Creek, Alberta, Canada	2013
36"	3618'	Johnson Creek, TX	2013

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
36"	3314'	East Fork Angelina River, TX	2013
36"	1867'	Flora, TX	2012
20"	869'	Centerview, MO	2012
20"	2458'	Centerview, MO	2012
16"	3894'	Roaring Branch, PA	2012
30"	3455'	Marysville, MI-Searnia, Ontario	2011
16"	1413'	Mill Ln, NJ	2010
30"	1422'	Mill Ln/Hedding Ave, NJ	2010
36"	3999'	Mississippi River, MN	2009
42"	2429'	Scioto River, OH	2009
42"	3800'	Mississippi River, MO	2009
42"	3043'	Little Miami River, OH	2009
36"	2190'	Souris River, Manitoba	2009

1996 – 1998: **Operator | Haug Roofing | West Bend, WI**

Operate crane and skid loader. Knowledgeable on every aspect of the roofing business; design techniques, blueprints, drawings and structure.

EDUCATION

2003 **Fond du Lac High School | Fond du Lac, WI**

High School Diploma

MICHELS®

Seth Matheny

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2017 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	1933'	W Baltimore/Glenwood Rd, PA	2020
16"	4399'	Valley Rd/Darlington Rd, PA	2019
20"	1720'	Everett Railroad-Juniata River, PA	2018
20"	2209'	Horse Valley Road, PA	2018
20"	1416'	Blacklog Creek, PA	2018
16"	2766'	Hall Street, NJ	2018
36"	6238'	Ohio River, OH/WV	2017
16"	1260'	Hollow Road, PA	2017

2014 – 2016: **Foreman | Kirk Excavating | Columbus, OH**

Oversee day to day operations. Met with contractors. Operated various horizontal directional drills. Set-up and created bore profiles. Steered and/or located pilot bore. Mandated OSHA Regulations.

2011 – 2014: **Operator | Precise Boring of Ohio | Lancaster, OH**

Operated various horizontal directional drills. Operated and maintained mud cleaning systems. Set-up and created bore profiles. Steered and/or located pilot bore. Completed all necessary paperwork pertaing to the job. Mandated OSHA Regulations.

2007 – 2011: **Foreman | Sureshot Directional Drilling | Lancaster, OH**

Maintained inventory for all drilling needs. Fostered communication and relations with contractors and utility companies. Prepared job estimates and bids and trained new employees. Operated various horizontal directional drills. Set-up and created bore profiles. Steered and/or located pilot bore. Mandated OSHA Regulations.

2002 – 2007: **Operator | Tob Gobel Excavating and Well Drilling | Amanda, OH**

Operated backhoe, trackhoe, bulldozer and skid steer. Well driller assistant, grade checker and other duties as needed.

TRAINING & CERTIFICATIONS

- Class A CDL with Tanker Endorsement
- OSHA 10 Training
- Safeland and Safegulf Training
- HDPE Columbia Gas Fusion Certification

EDUCATION

2005 **Amanda-Clearcreek High School | Amanda, OH**

High School Graduate

Jamie Hollenbeck

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2018 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Some more notable crossings, but not limited to:

Diameter	Length	Crossing/Location	Year
20"	13,247'	Lake Sakakawea, ND	2019
20"	6429'	Badlands Canyon, MT	2019
8"	12,769'	Montezeuma Slough, CA	2019
24"	2100'	Spanish Lake, MO	2019
22"	4986'	Atchafalaya River, LA	2019
20"	1068'	Rahway River, NJ	2018
42"	3980'	Susquehanna River MP 99.6, PA	2018

2008 – 2018: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
36"	5841'	Ohio River MP 33.8, OH/WV	2017
10"	5697'	Mississippi River, LA	2017
30"	3483'	Ford Island to Landing C, HI	2017
30"	7531'	Lake Oahe & Missouri River, ND	2017
16"	6693'	Wapsipinicon River, IA	2016
30"	6328'	Big Sioux River, SD/IA	2016
24"	4531'	Athabasca River, Alberta, Canada	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
24"	3716'	Barbour's Cut, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
36"	3461'	Kennedy Ave/Griffith Terminal, IN	2015
36"	3011'	Highway 41 & RR, IN	2015

PROFESSIONAL EXPERIENCE (continued)

10"	4654'	Allegheny River, PA	2015
8"	3320'	Yellowstone River, MT	2015
24" HDPE	1061'	Lake Sakakawea, ND	2014
8"	7321'	MP 49.3 Landslide, MT	2014
8"	4159'	MP 54.8 Landslide, MT	2014
20"	2364'	Missouri River, NE/IA	2014
16"	2951'	Line 82, ND	2014
36"	2264'	Otter Creek, IL	2013
48"	1943'	West Neck Creek, VA	2013
8"	7177'	115 KV Power Duct, SC	2013
8"	7304'	115 KV Power Duct, SC	2013
8"	4911'	115 KV Power Duct, SC	2013
8"	12,902'	MP66, Wyola, MT	2012
8"	4475'	MP57, Lodge Grass, MT	2012
16"	3894'	Roaring Branch, PA	2012
16"	1818'	Texas Creek, Tioga, PA	2011
30"	5786'	Lake Conway, Vernon, NJ	2011
42"	992'	Bayou Rapids, Bunkie, LA	2011
42"	1223'	Bayou Robert, Bunkie, LA	2011
36"	3030'	Black Bear Forest, Bunkie, LA	2011

2005 – 2008: **Laborer | Ballard Utility**

Run Directional Drills

2001 – 2005: **Laborer | NPL**

Installed gas services and mains by Directional Drilling

1994 – 2000: **Operator | Mears Directional Drilling**

Worked as a laborer, became an operator for an excavator and final advancement operating a 24-40 drill rig.

MICHELS®

Doug Stebbins

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2018 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. More notable crossings include, but are not limited to:

Diameter	Length	Location	Year
42"	3451'	Bow River, Cananda	2019
24"	3183'	Crow River, MN	2019
20"	1010'	East Branch Escanaba River, MI	2019
20"	6429'	Badlands Canyon, MT	2019
20"	1421'	Middle Branch Escanaba River, MI	2019
24"	6336'	Mississippi River, IL/MO	2019
20"	2355'	Joanna Rd, PA	2018
36"	2611'	Tuscarawas River MP 47.8, OH	2018
42"	3980'	Susquehanna River MP 99.6, PA	2018
42"	1810'	Interstate 80, PA	2018

2007 – 2017: **HDD Operator | Michels Corporation | Brownsville, wi**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation. Responsible for surveying, staking and design of directional drill path and curve, drilling the pilot hole, monitoring the drill path and calculating and interpreting the ground elevations and contours. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). On-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
36"	1511'	Hwy #1, Canada	2017
36"	1116'	United Blvd & Mundy Creek, Canada	2017
36"	1076'	Hwy 7 & CP Rail, Canada	2017
16"	11,397'	Lake Sacagawea South, ND	2016
16"	11,229'	Lake Sacagawea North, ND	2016

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
12"	7228'	Athabasca River, Alberta, Canada	2016
42"	3399'	McKay River, Alberta, Canada	2016
42"	7205'	Athabasca River, Alberta, Canada	2015
8"	7321'	MP 49.3 Landslide, MT	2014
36"	4005'	Canadian River, OK	2013
36"	1792'	North Canadian River, OK	2013
36"	1366'	Big Sandy, Maple Springs, TX	2012
30"	3042'	Wyalusing, PA	2012
20"	2513'	Tioga Junction, PA	2012

2002 – 2007: **Operator/Foreman | InterCon Construction | Madison, WI**

Skilled in the operation of technical, lifting and heavy equipment for directional drilling operation. Working knowledge of hydraulic engineering and applied mechanical engineering. Experience in working on and around directional drilling rigs as an integral member of a specialized team. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill morors, power generators mud pmps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

EDUCATION

1995 **Wakefield High School | Michigan**

High School Diploma

MICHELS®

Curt Rischmueller

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2006 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville , WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	1933'	W Baltimore Pike/Glenwood Rd, PA	2020
20"	2236'	Lower Piney Creek, PA	2018
36"	2730'	Sanddusky River MP 145.8, OH	2018
20"	3874'	Waltonville Rd, PA	2018
36"	1525'	Dupage River #1, IL	2017
12"	1178'	Howard Cove, ME	2016
12"	1023'	Cutler Site, ME	2016
12"	2765'	Lewis Creek, VT	2016
12"	2856'	Wetland Replacement, OH	2016
20"	845'	Patterson Rd/RR, IL	2016
20"	1335'	Laraway Rd, IL	2016
12"	11,563	Holland Bottoms Wetlands, AK	2015
24"	1405'	Platte River, MO	2015
16"	2249'	Ohio River, OH/KY	2015
22"	2538'	Barrington Rd, IL	2015
36"	1147'	E. 138th Street, IL	2015
36"	2697'	Barrington Rd, IL	2015
36"	3031'	BNSF RR & Aurora Rd, IL	2015
12"	2557'	Arkansas River, AR	2014
36"	2355'	Salt Fork River, MO	2013
36"	2077'	Chariton River, MO	2013

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
36"	3892'	Red River, OK	2013
36"	4213'	Menard Creek, TX	2013
36"	3571'	Angelina River, TX	2013
36"	2908'	Neches River & RR, TX	2013
36"	4505'	S. Saskatchewan River, Alberta	2012
36"	2567'	S. Sulpher, Sandhill, TX	2012
36"	1640'	Sabine River, Pine Hurst Farm, TX	2012
30"	2133'	Alberta, Canada	2012
42"	3443'	Wetland R2, Bienville Parish, LA	2011
30"	5786'	Lake Conway, Vernon, NJ	2011
42"	1223'	Bunkie, LA	2011
20"	2855'	Suwannee River, FL	2010
42"	1786'	Big Creek, LA	2010

2000 – 2006: **HDD Foreman | InterCon Construction | Madison, WI**

Set up drill site location. Maintain daily operations of Directional Drill. Direct correspondence with contractors, landowners and other personnel dealing with drill operations.

1995 – 2000: **Fuser/Welder | InterCon Construction | Madison, WI**

Ran house service and mainline extension for MG&E and Wisconsin Power and Light.

EDUCATION

1980 **Sauk Prairie High School | Sauk City, WI**

High School Diploma

MICHELS®

Bobby Skipworth

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2017 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Some more notable crossings, but not limited to:

Diameter	Length	Location	Year
16"	2997'	Paoli Pike/E boot Road, PA	2019
16"	707'	Eagle View Blvd, PA	2019
16"	1152'	Meadow Ln & Shepard Ln, PA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
4"	1495'	Des Moines River, IA	2018
12"	1070'	Indiana Harbor Canal - 12" & 10" Bundle, IN	2018
12"	1369'	Rocky Point Landing, Jamaica	2018
16"	1999'	Route-35, NJ	2018
16"	1198'	Harrisburg Pike, PA	2017
10"	5697'	Mississippi River, LA	2017
30"	2278'	Chattahoochee River, GA	2017

2014 – 2016: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation.

Diameter	Length	Location	Year
12"	1178'	Howard Cove, ME	2016
12"	1023'	Cutler Site, ME	2016
12"	2765'	Lewis Creek, VT	2016
12"	2856'	Wetland Replacement, OH	2016
20"	845'	Patterson Rd/RR, IL	2016
20"	1335'	Laraway Rd, IL	2016
12"	11,563	Holland Bottoms Wetlands, AK	2015
24"	1405'	Platte River, MO	2015

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
16"	2249'	Ohio River, OH/KY	2015
22"	2538'	Barrington Rd, IL	2015
36"	1147'	E. 138th Street, IL	2015
36"	2697'	Barrington Rd, IL	2015
36"	3031'	BNSF RR & Aurora Rd, IL	2015
12"	2557'	Arkansas River, AR	2014
24"	3030'	Big Creek Lake, AL	2014

MICHELS®

Tim Monroe

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2016 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Some more notable crossings, but not limited to:

Diameter	Length	Location	Year
16"	3628'	Eagleview Blvd, PA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
16"	3981'	Glendale Rd & Concord Ave, PA	2019
36"	3199'	Vermillion River MP 104.4, OH	2018
36"	1522'	Findlay Road MP 179.9, OH	2018
16"	5869'	Conrail RR, NJ	2018
36"	2377'	Hydro Park MP 250.7, MI	2018
36"	6238'	Ohio River, OH/WV	2017
24"	983'	Mystic River, MA	2017
24"	2293'	Interstate 20, GA	2017
36"	3829'	Flint River, GA	2016
30"	5714'	James River, SD	2016
42" Steel w/ 36" HDPE	3983'	St John's River, FL	2016

2008 – 2016: **Drilling Fluids Technician/Laborer | Michels Directional Crossings | Brownsville, WI**

Integral member of a specialized team working on and around directional drilling rigs. Provide onsite services by measuring and testing of fluid mixing and pumping, including technical analysis and practical recommendations for controlling fluid properties. Maintain fluid properties on rig sites by testing fluid properties accurately. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
16"	1508'	Beverly Harbor, MA	2015
16"	3827'	Collins Cove, MA	2015
36"	2303'	Liberty Street, IL	2015
18"	12,459	Houston Ship Channel, TX	2015

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
36"	9040'	Mississippi River, IL/MO	2014
24"	3269'	Transfer Line 2, IN	2014
24"	3275'	Transfer Line 1, IN	2014
20"	1193'	SR-265/Leatherwood Rd, OH	2014
30"	2344'	Delaware River, PA/NJ	2013
42"	3008'	I-95 & Tidal Wetlands, NJ	2013
16"	1664'	Morales, TX	2012
42"	1657'	Morales, TX	2012
10"	1495'	Missoula, MT	2012
24"	1546'	Colorado River, CO	2011
12"	1612'	WBC62 (Offshore), LA	2011
10"	3447'	Grand Lake, OK	2011

EDUCATION

2003 **Fond du Lac High School | Fond du Lac, WI**

High School Diploma

MICHELS®

James Day

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2017 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
36"	2717'	N Saskatchewan River, Canada	2019
16"	7402'	Susquehanna River, PA	2019
20"	2236'	Lower Piney Creek, PA	2018
20"	1720'	Everett RR-Juniata River, PA	2018
20"	2209'	Horse Valley Road, PA	2018
20"	7354'	Susquehanna River, PA	2018
36"	5841'	Ohio River MP 33.8, OH/WV	2017
42"	2431'	Maumee River/State Hwy 24, OH	2017

2008 – 2017: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation. Some notable crossings include, but are not limited to:

Diameter	Length	Location	Year
30"	7531'	Lake Oahe & Missouri River, ND	2017
16"	6693'	Wapsipinicon River, IA	2016
30"	6328'	Big Sioux River, SD/IA	2016
12"	7228'	Athabasca River, Alberta, Canada	2016
42"	7205'	Athabasca River, Alberta, Canada	2015
36"	2510'	Deer Creek, IL	2015
42"	3776	Mackay River, Alberta, Canada	2015

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
6"	6999'	Navajo Reservoir/San Juan river, NM	2014
36"	9040'	Mississippi River & Levees, IL/MO	2014
24"	2020'	Unnamed Creek, AL	2014
42"	1252'	Battle River, Alberta, Canada	2013
30"	6544'	East 1st Street, NJ	2013
30"	4905'	Merseles Streer, NJ	2013
12"	4272'	Saline Creek, Alberta, Canada	2013
30"	5378'	Hudson River, NJ/NY	2012
30"	4850'	Red River, TX/OK	2012
42"	3205'	Dewitt, TX	2012
36"	4505'	Medicine Hat, Alberta, Canada	2012
36"	4993'	Atchafalaya River, LA	2011
42"	4272'	St. John's River, BC	2011
42"	2204'	Bayou Comitte, LA	2010
36"	1873'	Petitcodic River, Canada	2009
24"	3009'	Middle Salinas River, CA	2008
30"	1657'	St. Lucie Canal, FL	2008
30"	2739'	Couse Midden, FL	2008

2007 – 2008: **Laborer | Intercom Construction | Madison, WI**

Directional Drilling, Fusing and hand digging for services

EDUCATION

2002 **Boone High School | Boone, IA**

High School Graduate

MICHELS®

Cliff Mclain

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2006 – Present: **Field Operations Superintendent | Michels Corporation | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
20"	6429'	Badlands Canyon, MT	2019
30"	3746'	Dix River, KY	2019
36"	2974'	Wetland MP 8.1, OH	2018
36"	1886'	Nimisila Reservoir MP 40.9, OH	2018
36"	2611'	Tuscarawas River MP 47.8, OH	2018
30"	2273'	Susquehanna River @ MP 35, PA	2018
12"	5741'	Rum River & Wetland, MN	2017
12"	5170'	Larch Dr & Wetland, MN	2017
36"	1594'	Dupage River #2, IL	2017
30"	7282'	Mississippi River, IA/IL	2016
42"	3885'	Dover River, Alberta, Canada	2016
42"	7205'	Athabasca River, Alberta, Canada	2015
42"	2510'	Ruth Lake, Fort McMurray, Canada	2015
12"	3472'	Gilmore Lane, OR	2014
36"	1640'	LaMoine River, IL	2013
36"	4304'	Bois D' Arc, TX	2013
36"	4005'	Canadian River, OK	2013
36"	1792'	North Canadian River, OK	2013
30"	3042'	Wyalusing, PA	2012
16"	3894'	Roaring Branch, PA	2012
20"	2513'	Tioga Junction, PA	2012

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
12"	2530'	Cornwall, ONT, Canada	2011
10"	964'	US Route 1, Fort Lauderdale, FL	2011
30"	3455'	Marysville, MI-Searnia, Ontario	2011
42"	3008'	White River, Russell, AR	2010
42"	5084'	Mississippi River, Helena, AR	2010
42"	3497'	Little Red River, AR	2010
20"	5022'	Pokegama Carnegie, WI	2009
20"	5087'	Mississippi River, Empire, LA	2009

1995 – 2006: **Drill Operator | InterCon Construction | Madison, WI**

Crane operator responsible for safe operation and timely placement of drill stem and equipment. Integral link in the drilling operation, from drill rig set-up, pipe pull back and rig-down of equipment. Also conducted pipe support operations at the exit side during pipeline pullback. Responsible for permitting and mobilization/demobilization of heavy and non-dimensional equipment to drill sites.

EDUCATION

Florence High School | Florence, WI

High School Diploma

Josh Bush

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2017 – Present: **Field Operations Superintendent | Michels Directional Crossings**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	6976'	Matlock/W Chester Rd, PA	2020
16"	3728'	Village Square Dr, PA	2019
36"	1487'	River Raisin, MI	2018
36"	1805'	Portage River, OH	2018
16"	2346'	Frankstown Branch-Juniata River, PA	2018
20"	2307'	Frankstown Branch-Juniata River, PA	2017

2016 – 2017: **HDD Operator | Michels Directional Crossings**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation.

2013 – 2016: **Skilled Laborer | Michels Directional Crossings**

Integral member of a specialized team working on and around directional drilling rigs. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

2009 – 2013: **Diesel Mechanic | McCartney Produce | Paris, TN**

TRAINING & CERTIFICATIONS

- Respiratory Protection
- Respirable Crystalline Silica
- First Aid/CPR/AED Certification
- Confined Space Rescue Certification

EDUCATION

2011 **Gateway School | Paris, TN**

High School Graduate

MICHELS®

Jason Freund

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2020 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

2009 – 2020: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings, but not limited to:

Diameter	Length	Crossing/Location	Year
12"	1369'	Rocky Point Landing, Jamaica	2018
36"	2974'	Wetland MP 8.1, OH	2018
30"	2273'	Susquehanna River @ MP 35, PA	2018
42"	2826'	San Joaquin River, CA	2017
12"	5741'	Rum River & Wetland, MN	2017
12"	5170'	Larch Dr & Wetland, MN	2017
6"	3309'	Hauser Lake, MT	2017
8"	1980'	CHS Yellowstone River, MT	2017
8"	1530'	SPL Yellowstone River, MT	2017
8"	1542'	YPL Yellowstone River, MT	2017
12"	1285'	XOM Yellowstone River, MT	2017
24"	1898'	Vermillion River, IL	2016
12"	3144'	Monkton Swamp, VT	2016
12"	1491'	Drinkwater Rd, VT	2016
20"	1904'	North St Mary's River, IN	2016
20"	1076'	South St Mary's River, IN	2016
30"	6119'	Lake Whitney, TX	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
24"	3716'	Barbour's Cut, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
24"	5908'	Tabbs Bay, TX	2015
36"	1862'	State Highway 50, IL	2015
36"	1813'	Calumet Ave, IN	2015
36"	1803'	Dyer Ditch, IN	2015
36"	1812'	Highway 394, IL	2015

2000 – 2008: **Skilled Laborer | Michels Directional Crossings | Brownsville, WI**

Integral member of a specialized team working on and around directional drilling rigs. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

MICHELS®

Mike Brever

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2018 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Some more notable crossings, but not limited to:

Diameter	Length	Crossing/Location	Year
36"	3199'	Vermillion River MP 104.4, OH	2018
36"	2974'	Wetland MP 8.1, OH	2018

2009 – 2018: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
30"	3483'	Ford Island to Landing C, HI	2017
20"	2005'	Highway 15, PA	2017
36"	1535'	Calumet River, IL Direct Pipe	2017
36"	3901'	Rutherford Rd, Ontario, Canada	2016
42"	3885'	Dover River, Alberta, Canada	2016
36"	3160'	Christina River, Alberta, Canada	2016
30"	5154'	House River, Alberta, Canada	2015
12'	11,563'	Holland Bottoms Wetland, AR	2015
48"	4039'	Dow Barge Channel, TX Direct Pipe	2015
10"	4654'	Allegheny River, PA	2015
36"	3805'	Williamette River, OR	2014
24"	2884'	Hatchett Creek, AL	2014
16"	2951'	Line 82, ND	2014
8"	2545'	MP266, Mountain Green, UT	2013
30"	1881'	Bennekill Stream, NJ	2013
30"	6544'	1st Street, NJ	2013
42"	1670'	Lavaca River, TX	2012

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
42"	1650'	Chicolete River, TX	2017
30"	1633'	Paerdegat Basin, NY	2017
36"	1392'	Hackensack River, NJ	2017
24"	2645'	Chemung River, NY	2016
30"	5786'	Lake Coneay, NJ	2016

2005 – 2009: **Heavy Truck/Diesel Mechanic | Mike's Truck and Trailer Repair | New Brighton, MN**

EDUCATION

2006 **Henippen Technician College | Brooklyn Center, MN**

Heavy Truck Degree

2003 **Columbia Heights High School | Columbia Heights, MN**

High School Diploma

MICHELS®

Tim Bunkelman

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2018 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production.

Diameter	Length	Location	Year
16"	983'	N Chester Rd/Bancroft, PA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
20"	1665'	Aughwick Creek, PA	2018
20"	2209'	Horse Valley Road, PA	2018

1992 – 2018: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
20"	1507'	Trough Creek Valley Pike/SR 829, PA	2018
16"	1999'	Route-35, NJ	2018
16"	1198'	Harrisburg Pike, PA	2017
20"	2005'	Hwy 15, PA	2017
36"	1545'	Van Dyke Road, IL	2017
24"	3166'	N Saskatchewan River, Alberta, Canada	2016
24"	4531'	Athabasca River, Alberta, Canada	2016
30"	2461'	Highway 63, Alberta, Canada	2015
24"	1956'	Clearwater River, Alberta, Canada	2015
36"	1613'	Fish Pond, Alberta, Canada	2014
36"	1359'	Wetland Crossing #2, Alberta, Canada	2014
36"	9040'	Mississippi River, IL/MO	2014
42"	4284'	Vermillion River, Canada	2013
30"	4905'	Merseles, NJ	2013
30"	5378'	Hudson River, NJ/NY	2012

PROFESSIONAL EXPERIENCE (continued)

1989 – 1992: **Skilled Laborer | Michels Directional Crossings | Brownsville, WI**

Integral member of a specialized team working on and around directional drilling rigs. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

1987 – 1989: **Construction of Pole Buildings | Pro Builders | Lomira , WI**

1979 – 1986: **Heavy Equipment Diesel Mechanic | US Army**

EDUCATION

1979 **Campbellsport High School | Campbellsport, WI**

MICHELS®

Seth Strean

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2020 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

2012 – 2019: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings, but not limited to:

Diameter	Length	Crossing/Location	Year
20"	2236'	Lower Piney Creek, PA	2018
36"	2730'	Sanddusky River MP 145.8, OH	2018
20"	3874'	Waltonville Rd, PA	2018
36"	1525'	Dupage River #1, IL	2017
12"	1178'	Howard Cove, ME	2016
12"	1023'	Cutler Site, ME	2016
12"	2765'	Lewis Creek, VT	2016
12"	2856'	Wetland Replacement, OH	2016
20"	845'	Patterson Rd/RR, IL	2016
20"	1335'	Laraway Rd, IL	2016
12"	11,563	Holland Bottoms Wetlands, AK	2015
24"	1405'	Platte River, MO	2015
16"	2249'	Ohio River, OH/KY	2015
22"	2538'	Barrington Rd, IL	2015
36"	1147'	E. 138th Street, IL	2015
36"	2697'	Barrington Rd, IL	2015
36"	3031'	BNSF RR & Aurora Rd, IL	2015
12"	2557'	Arkansas River, AR	2014
36"	2355'	Salt Fork River, MO	2013
36"	2077'	Chariton River, MO	2013

PROFESSIONAL EXPERIENCE (continued)

2000 – 2012: **Skilled Laborer | Michels Directional Crossings | Brownsville , WI**

Integral member of a specialized team working on and around directional drilling rigs. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

EDUCATION

1999 **Goodrich High School | Fond du Lac, WI**

Matt Rohwer

Field Superintendent

PROFESSIONAL EXPERIENCE

2007 – Present: **Field Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical, and communication lines. Complete knowledge of directional drilling technology and procedures. Duties include mobilization of all equipment and personnel to job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; necessary record keeping of production and overall on-site management.

2005 – 2007: **Laborer | NPL | Lakeville, MN**

General labor installing utilities.

PROJECT PROFILES

2018 | CHS | Wastewater Force Main Project; HDD 24" pipe under BSF Railroad Tracks – Laurel, MT

2018 | MERC | Rochester Lateral; HDD 16" pipe under CP Railroad Tracks – Rocxhester, MN

2007-2017 | CPE | Multiple Pipe Sizes | Miscellaneus Railroad Tracks around Twin Cities; MN

TRAINING & CERTIFICATIONS

- ERail Safe

EQUIPMENT EXPERIENCE

- Drill Rig
- Excavator
- Mud Rig

EDUCATION

Triton High School | Dodge Center, MN

Brady Hickey

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2010 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites, set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Oversees drilling survey during crossing.

Diameter	Length	Location	Year
16"	4,100'	Hummelstown, PA	2020
10"	1,200'	Linn, MO	2019
24"	2,000'	Cologne, MN	2019
24"	1,000'	Cologne, MN	2019
8"	4,800'	Little Falls, MN	2019
8"	600'	Spokane, WA	2019

TRAINING & CERTIFICATIONS

- Safety training
- Veriforce training
- TWIC Card

EQUIPMENT EXPERIENCE

- Excavator
- Mud Rig
- Drill Rig

EDUCATION

Triton High School | Dodge Center, MN

Branden Cole

Field Superintendent

PROFESSIONAL EXPERIENCE

2019 – Present: **Field Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites, set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Oversees drilling survey during crossing.

2015 – 2019: **Foreman | Precision Pipeline | Eau Claire, WI**

Horizontal Directional Drilling of steel natural gas and petroleum pipelines. Ordered tooling for drills, supervised crew, interpreted blueprints and profiles, performed daily progress reports and time sheets, and tracking of expenditures on the job.

2009 – 2015: **Laborer | Roese Contracting/Pipeline LLC | Kawkawlin, MI**

Responsibilities included location utilities, installing fiber optic cable, plastic pipeline for gas distribution, gas service and meter sets to customer homes.

1994 – 2009: **Crew Member | Ironworkers Local 25 | Novi, MI**

Erected steel buildings, tied reinforcing steel for concrete placement, made connections on structural steel, steel welding, bolting up steel, setting beams on bridges, steel roofing, sheeting on buildings, and ornamental work.

PROJECT PROFILES

NPL | HDD; Rochester, MN

Sunoco | Manor East II HDD; Harrisburg, PA

DTE | HDD and Open Trench; Detroit, MI

Michigan DOT | Erected Bridges; Detroit, MI

DOW | Erected Buildings; Midland, MI

Michigan DOT | Welding on Bridges; Pontiac, MI

TRAINING & CERTIFICATIONS

- Class A Commercial Driver's License
- ASE Certified Mechanic
- Certified Welder
- First Aid/CPR/AED Certification
- Trenching/Excavation Safety Training
- OSHA 20-Hour

INDUSTRY INVOLVEMENT

- Operating Engineers Local 49
- Laborer's Union 1098
- Ironworkers Local 25

EQUIPMENT EXPERIENCE

- Track/Excavator

EQUIPMENT EXPERIENCE (continued)

- Front end loader
- Skytrac
- Roller
- Skid Steer
- Reclaimer
- Drill Rig

EDUCATION

1998 **Mott Community College | Flint, MI**

Construction Management

Steve Case

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2008 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
10"	2100'	Blue Line Replacvement, MO	2019
8"	3100'	Elkhorn River, NE	2019
20"	1800'	County Road B, MN	2019
16"	1400'	Rochester Greenfield Lateral, MN	2019
16"	2300'	Teton River, MT	2019

2006 – 2008: **Forman | Telecom Construction | Clearwater, MN**

Conduct daily tasks, install fiber optic cables, install phone and power cables using HDD methods. Read prints/alignment sheets, locate utility lines using electronic locating devices, set vaults for utilities

2004 – 2006: **Automotive Technician | Nokomis Auto Service | Alexandria, MN**

Perform inspections on automobiles and diagnose problem. Use of electronic scan tools to perform repairs on automobiles. Repair faulty part(s), replace, test vehicle.

INDUSTRY INVOLVEMENT

- Member of Operating Engineers Local 49

EQUIPMENT EXPERIENCE

- Drill Rig, Trackhoe, Dozer and Backhoe

EDUCATION

Park High School | Livingston , MT

High School Diploma

Garrett Derrer

Assistant Superintendent

PROFESSIONAL EXPERIENCE

2020 – Present: **Assistant Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

2016 – 2020: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation. Some more notable crossings, but not limited to:

Diameter	Length	Location	Year
16"	2518'	Herman O.W. Drive, PA	2019
16"	4381'	Pennsylvania Drive, PA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
16"	3981'	Glendale Rd & Concord Ave, PA	2019
36"	3199'	Vermillion River MP 104.4, OH	2018
16"	5869'	Conrail RR, NJ	2018
36"	2377'	Hydro Park MP 250.7, MI	2018
36"	6238'	Ohio River, OH/WV	2017
24"	983'	Mystic River, MA	2017
24"	2293'	Interstate 20, GA	2017
36"	3829'	Flint River, GA	2016
30"	5714'	James River, SD	2016

2016: **Welder | Whitehead Construction | Elizabethton, TN**

Welding and repairing electrostatic precipitator cleaning systems in power plants and coal burners

2015: **Pipe Fitter | Fagen Inc | Granite Falls, MN**

Installing piping systems and hydro testing product pipe for an ethanol plant

TRAINING & CERTIFICATIONS

- OSHA 30
- NCCER Level 4 Certifiation
- Pipe Fitting Diploma
- Professional Welding Diploma

EDUCATION

Tulsa Welding School | Tulsa , OK

Professional Welding and Pipe Fitting Diploma

TBAISD CTC | Traverse City, MI

Pre Trade Welding

Mancelona High School | Mancelona , MI

High School Diploma

MICHELS®

Jeff Nehmer

Drilling Survey Technician

PROFESSIONAL EXPERIENCE

1997 – Present: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, WI**

Responsible for surveying, staking and design of directional drill path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Performed the above operations to crossings which include, but not limited to:

Diameter	Length	Crossing/Location	Year
20"	2740'	West Branch Escanaba River, MI	2019
20"	6429'	Badlands Canyon, MT	2019
24"	3341'	Hwy 367/Coldwater Creek, MO	2019
24"	2100'	Spanish Lake, MO	2019
22"	4986'	Atchafalaya River, LA	2019
24"	3817'	Missouri River, MO	2019
24"	6336'	Mississippi River, IL/MO	2019
42"	4687'	Lake Scranton Finished H2O Tunnel, PA	2018
20"	2355'	Joanna Rd, PA	2018
20"	1720'	Everett RR-Juniata River, PA	2018
20"	1068'	Rahway River, NJ	2018
30"	2273'	Susquehanna River @ MP 35, PA	2018
36"	2836'	Nemadji Golf Course, WI	2017
20"	2005'	Hwy 15, PA	2017
12"	5741'	Rum River & Wetland, WI	2017
12"	5171'	Larch Dr & Wetland, MN	2017
36"	7194'	Ohio River MP 16.07, OH/WV	2017
24"	5788'	Hwy 41/45, WI	2017
36"	1545'	Van Dyke Road, IL	2017
24"	2293'	Interstate 20, GA	2017
12"	1285'	XOM Yellowstone River, MT	2017

12"	1178'	Howard Cove, ME	2016
12"	1023'	Cutler Site, ME	2016
12"	3144'	Monkton Swamp, VT	2016
12"	2765'	Lewis Creek, VT	2016
12"	1491'	Drinkwater Rd, VT	2016
12"	922'	Arch Site & Monkton Rd, VT	2016
42" Steel with 36" HDPE	3983'	St John's River, FL	2016
20"	983'	Schweitzer Rd, IL	2016
8"	1957'	Grand River, MI	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
16"	3827'	Collins Cove, MA	2015
36"	1147'	E. 138th Street, IL	2015
16"	2249'	Ohio River, OH/KY	2015
10"	4654'	Allegheny River, PA	2015
36"	3805'	Williamette River, OR	2014
24"	1935'	Coosa River, AL	2014
24"	2884'	Hatchett Creek, AL	2014
24"	3269'	Transfer Line 2, IN	2014
24"	3275'	Transfer Line 1, IN	2014
36"	1874'	Wetland S-517C, IN	2014
36"	3544'	Illinois River, IL	2013
8"	2545'	MP266, Mountain Green, UT	2013
30"	4987'	Monksville Reservoir, NJ	2013
30"	4905'	Merseles St, NJ	2013
30"	6544'	1st Street, NJ	2013
42"	4441'	Goethals Bridge, NY	2013
30"	8101'	Kill Van Kull River NY/NJ	2013

1995 – 1996: **Subsurface Exploration | Wisconsin Dept. of Transportation | Madison, WI**

Took core samples vertically from the ground and ran tests on soil conditions for roadways.

EDUCATION

1997 **MATC**

Degree as Civil Engineering Technician

1994 **Columbus High School | Columbus , WI**

High School Diploma

MICHELS®

Cale Mullenix

Drilling Survey Technician

PROFESSIONAL EXPERIENCE

1997 – Present: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, WI**

Responsible for surveying, staking and design of directional drill path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Performed the above operations for crossings which include, but not limited to:

Diameter	Length	Crossing/Location	Year
20"	13,247'	Lake Sakakawea, ND	2019
20"	6429'	Badlands Canyon, MT	2019
8"	12,769'	Montezeuma Slough, CA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
16"	3981'	Glendale Rd & Concord Ave, PA	2019
4"	1495'	Des Moines River, IA	2018
12"	1369'	Rocky Point Landing, Jamaica	2018
36"	2974'	Wetland MP 8.1, OH	2018
36"	2611'	Tuscarawas River, OH	2018
20"	7354'	Susquehanna River, PA	2018
42"	1501'	Platte River, NE	2018
36"	1370'	Interstate-80 MP 251.5, MI	2018
36"	2377'	Hydro Park MP 250.17, MI	2018
42"	4869'	Bahia Grande Channel #1, TX	2018
42"	2826'	San Joaquin River, CA	2017
14"	9154'	Nansemond River, VA	2017
10"	5697'	Mississippi River, LA	2017
12"	5171'	Larch Dr & Wetland, MN	2017
36"	7194'	Ohio River MP 16.07, OH/WV	2017
30"	3483'	Ford Island to Landing C, HI	2017
6"	3309'	Hauser Lake, MT	2017

36"	1545'	Van Dyke Road, IL	2017
30"	7531'	Lake Oahe & Missouri River, ND	2017
30"	2278'	Chattahoochee River, GA	2017
24"	2026'	Highway 120, GA	2017
30"	7282'	Mississippi River, IA/IL	2016
16"	11,397'	Lake Sacagawea South, ND	2016
30"	3352'	Cliff Crossing, ND	2016
16"	11,229'	Lake Sacagawea North, ND	2016
16"	1112'	Palermo Railroad, ND	2016
20"	1904'	North St Mary's River, IN	2016
20"	845'	Patterson Rd/RR, IL	2016
20"	871'	Wetlands #2, IL	2016
8"	1957'	Grand River, MI	2016
24"	7432'	Houston Ship Channel, TX	2015
16"	1508'	Beverly Harbor, MA	2015
16"	3827'	Collins Cove, MA	2015
36"	2510'	Deep Creek, IL	2015
36"	3011'	Highway 41 & RR, IN	2015
36"	2697'	Barrington Rd, IL	2015
36"	1755'	New York St, IL	2015
36"	2303'	Liberty Street, IL	2015
36"	3805'	Williamette River, OR	2014
2 x 4" Bundle	1809'	Hwy 550, Nageezi, NM	2014
6"	6999'	Lake Navajo/San Juan River, NM	2014
8"	7321'	MP 49.3 Landslide, MT	2014
8"	4159'	MP 54.8 Landslide, MT	2014
24"	1935'	Coosa River, AL	2014
16"	2951'	Line 82, ND	2014
36"	5687'	Missouri River, MO	2013
30"	1246'	OK City Water Main, OK	2013
30"	4987'	Monksville Reservoir, NJ	2013
12"	6209'	Jamacian Bay, NY	2013
42"	3008'	I-95 & Tidal Wetlands, NJ	2013
30"	4905'	Merseles St, NJ	2013
30"	6544'	1st Street, NJ	2013

PROFESSIONAL EXPERIENCE (continued)

1996 – 1997: **Fluid Dynamics Technician | Michels Directional Crossings | Brownsville, WI**

Accountable for mixing bentonite solution used throughout directional drilling and reaming operations. Trained to monitor viscosity of mixture and manipulate ratios of solids and fluid to maintain specific viscosities which continually change based on the environment and which vary by operation phases and subterrain. Experience in operation, maintenance and repair of bentonite mixing equipment.

EDUCATION

1996 **University of Wisconsin-Madison | Madison, WI**

1995 **Goodrich High School | Fond du Lac, WI**

High School Diploma

MICHELS®

Lorenzo Rivera Jr

Drilling Survey Technician

PROFESSIONAL EXPERIENCE

2017 – Present: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for surveying, staking and design of directional drill/Direct Pipe path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Performed the above operations for crossings which include, but not limited to:

Diameter	Length	Crossing/Location	Year
16"	7595'	Houston Ship Channel, TX	2019
24"	3183'	Crow River, MN	2019
20"	1421'	Middle Branch Escanaba River, MI	2019
16"	3628'	Eagleview Blvd, PA	2019
42"	2007'	Las Moras Creek, TX	2019
20"	2236'	Lower Piney Creek, PA	2018
42"	4687'	Lake Scranton Finished H2O Tunnel, PA	2018
36"	1863'	E Branch Black River MP 86.7, OH	2018
48"	651'	Juniata River, PA - HK750PT Installation	2018
36"	1682'	W Branch Black River MP 92.3, OH	2018
42"	1861'	San Martin Lake Channel, TX	2018
42"	899'	Highway 50, West Virginia - HK500PT Installation	2018
36"	1535'	Calumet River, IL - HK300PT Installation	2017
48"	2183'	Resaca De Los Fresnos Canal #2, TX	2017
48"	2555'	Resaca De Los Fresnos Canal #1, TX	2017
48"	2126'	Pinson Rd Canal, TX	2017
48"	2042'	County Rd 300 Canal, TX	2017
48"	2398'	CR2340 & Los Olmos Creek, TX	2017
48"	2349'	Chiltipan Creek, TX	2017

PROFESSIONAL EXPERIENCE (continued)

2013 – 2017: Operaor/Direct Pipe | Michels Directional Crossings | Brownsville, WI

Skilled equipment operator with the operation of technical, lifting and heavy equipment for direct pipe & directional micro-tunnel operations as well as directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

DIRECT PIPE INSTALLATIONS/PIPE ASSISTS

Diameter	Length	Crossing/Location	Year
36"	827'	Leslie Street, Ontario, Canada - HK 300PT Installation	2015
48"	4,039'	Dow Barge Channel, Clute TX - HK750PT Installation	2015
36"	1,002'	Hwy 225, Deer Park, TX - HK300PT Installation	2015
36"	1,092'	Lubrizol Drainage, LaPorte, TX-HK300PT Installation	2015
48"	2,455	Rio Grande River, El Refugio, TX-HK750PT Installation	2014
42"	1,200'	Railroad Crossing, Groves, TX-HK750PT Installation	2014

HDD PROJECTS

Diameter	Length	Crossing/Location	Year
30"	11,229'	Lake Sacagawea North, SD	2016
30"	6119'	Lake Whitney, TX	2016
12"	11,563	Holland Bottoms Wetlands, AK	2015
36"	2510'	Deep Creek, IL	2015
36"	5128'	Lake Ave & RR, IL	2015
18"	12,459	Houston Ship Channel, TX	2015
28"	1741'	Lafayette River, VA	2014
48"	2060'	Tres Palacios River, TX	2014
48"	1692'	Navidad River, TX	2014

2013: Truck Driver | Billy Cummings | TX

2012 – 2013: Bank Teller | City National Bank | TX

EDUCATION

2013 Texas Technical College | TX

Engineering Prerequisite Classes

2010 PJC Junior College | TX

Eric Riha

Drilling Survey Technician

PROFESSIONAL EXPERIENCE

2019 – Present: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for surveying, staking and design of directional drill path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs.

Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	2518'	Herman O.W. Drive, PA, PA	2019

2018 – 2019: **HDD Operator | Michels Directional Crossings | Brownsville, Wisconsin**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation.

2017 – 2018: **Skilled Laborer | Michels Directional Crossings | Brownsville, Wisconsin**

Integral member of a specialized team working on and around directional drilling rigs. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

2013 – 2015: **CNC Lathe Operator | D&S Machine Service Inc. | Luxemburg**

Operated a CNC lathe machine to precise dimensions per interpretation of blue prints, prioritize the tasks at hand for the day & operated a forklift.

EDUCATION

2015 **Northeast Wisconsin Technical College | Green Bay, WI**

Natural Gas Utility Construction

2012 **Kewaunee High School | Kewaunee , WI**

High School Graduate

MICHELS®

Jeremiah Erickson

Drilling Survey Technician

PROFESSIONAL EXPERIENCE

2008 – Present: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, WI**

Responsible for surveying, staking and design of directional drill/Direct Pipe path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Performed the above operations for crossings which include, but not limited to:

Diameter	Length	Location	Year
16"	3628'	Eagleview Blvd, PA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
16"	3981'	Glendale Rd & Concord Ave, PA	2019
36"	856'	Qu'Appelle River, Canada - HK750PT Installation	2017
42"	1861'	San Martin Lake Channel, TX	2017
36"	1535'	Calumet River, IL - HK300PT Installation	2017
20"	2005'	Highway 15, PA	2017
36"	1606'	Hannahatchee Creek, GA	2017
36"	3829'	Flint River, GA	2016
42"	7200'	Athabasca River, Canada - HK750PT Installation	2016
48"	4039'	Dow Barge Channel, Clute TX - HK750PT Installation	2015
36"	1002'	Hwy 225, Deer Park, TX - HK300PT Installation	2015
36"	1092'	Lubrizol Drainage, LaPorte, TX-HK300PT Installation	2015
48"	2455	Rio Grande River, El Refugio, TX-HK750PT Installation	2014
42"	1200'	Railroad Crossing, Groves, TX-HK750PT Installation	2014
8"	7321'	MP 9.3 Landslide, MT	2014
42"	1050'	Beaver River, Alberta, Canada-HK750PT Installation	2013
42"	470'	I-84, Westfall, PA - HK750PT Installation	2013
42"	4441'	Goethals Bridge, NY	2013
36"	5687'	Missouri River, MO	2013

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
36"	2958'	North Sulpher, Mount Joy, TX	2012
30"	4850'	Red River, Thackerville, TX/OK	2012
42"	1670'	Morales, TX	2012
42"	1658'	Dewitt, TX	2012
16"	5754'	New Berlin, WI	2012
20"	3075'	Rock Creek, OR	2011
42"	1826'	Interstate 49 and RR, LA	2011
42"	3443'	Wetland R2, LA	2011
42"	1704'	Willow Creek, LA	2010
42"	2015'	Flat Creek, LA	2010
42"	2129'	Ceasars Creek, OH	2009
36"	3031'	Four Legged Lake, MN	2009
42"	4068'	Illinois River, IL	2009
42"	2691'	200th Ave, IL	2009
42"	3627'	Salt River, MO	2009
42"	1992'	Hwy 67, TX	2008
42"	3705'	Neches River, TX	2008
42"	6004'	Old River, TX	2008

EDUCATION

2003 High School Graduate

MICHELS®

Dan Reynolds

Drilling Survey Technician

PROFESSIONAL EXPERIENCE

2006 – Present: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, WI**

Responsible for surveying, staking and design of directional drill path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Performed the above operations for crossings which include, but not limited to:

Diameter	Length	Crossing/Location	Year
30"	3746'	Dix River, KY	2019
22"	4986'	Atchafalaya River, LA	2019
20"	2236'	Lower Piney Creek, PA	2018
20"	2209'	Horse Valley Road, PA	2018
20"	1416'	Blacklog Creek, PA	2018
16"	2346'	Frankstown Branch-Juniata River, PA	2018
20"	1337'	Berry Ridge & Old Mill Rd, PA	2018
16"	5869'	Conrail RR, NJ	2018
20"	2307'	Frankstown Branch-Juniata River, PA	2017
36"	6238'	Ohio River, OH/WV	2017
12"	5741'	Rum River & Wetland, MN	2017
42"	2431'	Maumee River & State Hwy 24, OH	2017
48"	2807'	Oliver Creek & SH 188, TX	2017
48"	2263'	US Hwy 181/Hwy 35, TX	2017
36"	3829'	Flint River, GA	2016
30"	7282'	Mississippi River, IA/IL	2016
12"	2765'	Lewis Creek, VT	2016
12"	2856'	Wetland Replacement, OH	2016
42"	3885'	Dover River, Alberta, Canada	2016

"27" HDPE

Bundle"	3737'	Little Creek, VA	2016

12"	11,563	Holland Bottoms Wetlands, AK	2015
30"	1418'	Highway 250, OH	2015
24"	1405'	Platte River, MO	2015
22"	2538'	Barrington Road, IL	2015
12" and 6"	3173'	Beaver Lake, Alberta, Canada	2015
10"	1971'	Tank Farm/Central Ave, PA	2015
42"	3776'	MacKay River, Fort McMurray, Canada	2015
36"	1613'	Fish Pond, Alberta, Canada	2014
36"	1359'	Wetland Crossing #2, Alberta, Canada	2014
36"	2274'	Highway 13, Alberta, Canada	2014
36"	2133'	Wetland Crossing, Aberta, Canada	2014
30"	2667'	South Fork Ten Mile Creek, PA	2014
24"	2750'	Escatawpa River, MS	2014
20"	1193'	SR-265/Leatherwood Rd, OH	2014
36"	2355'	Salt Fork River, MO	2013
30"	2774'	South Canadian River, OK	2013
30"	4400'	Saline Creek, Alberta, Canada	2013
42"	4284'	Vermillion River, Alberta, Canada	2013
28"	4270'	Saline Creek, Alberta, Canada	2013
36"	4304'	Bois D' Arc, TX	2013
30"	1707'	Bayonne Inlet, NJ	2013
36"	2908'	Neches River & RR, TX	2013
8"	10,053'	Potomac River, VA/MD	2012
20"	3048'	St. Clair, Marysville, MI	2012
8"	12,885'	MP66, Big Horn County, MT	2012
8"	4400'	MP57, Big Horn County, MT	2012
30"	2906'	Hickory Creek, Marietta, OK	2012
36"	4505'	Medicine Hat, Alberta, Canada	2012
30"	2133'	Alberta, Canada	2012
8"	6669'	Wilmington, NC	2012

PROFESSIONAL EXPERIENCE (continued)

2003 – 2006: **Drilling Survey Technician | Southeast Pipeline Construction | Casa Grande, AZ**

All aspects of drilling and design utilizing Tru-Tracker software for contractor. Larger projects include:

Diameter	Length	Location/Customer
56" (3)	2100'-2520'	Bechtel/API
16" (9)	800'-3400'	Williston Basin
36"	1185'	Snelson Hoen Rd
24"	3385'	Carbon Mountain

2003: **Drilling Survey Technician | H.M.S. Construction | Rio Vista, CA**

All aspects of drilling and design utilizing Tru-Tracker software for contractor. Larger projects include:

Diameter	Length	Location/Customer
8" & 12"	450'	City of Waikiki, HI
HDPE	615'-1005' (6)	U.S. Navey Aloha-Aina Park
32"	2900'	AP & T Tidal Inlet

2002 – 2003: **Drilling Survey Technician | Thunderbird Exploration | Gilbert, AZ**

Steering hand working on communication projects. Larger projects include:

Diameter	Length	Location/Customer
8"	Various	Telecommunications
8" & 10"	600'-2400'	U.W. I.
24"	800'-1200'	Questar

1998 – 2002: **Drilling Survey Technician | Ozzie's Directional Drilling | Scottsdale, AZ**

EDUCATION

1980 **Soper High School | Soper, OK**

High School Diploma

ATTACHMENT

SAFETY AND JSA INFORMATION

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MICHELS®

Performance Indicators

Performance Measure	Target/Achievements
Lagging Indicators:	
Total # of Incidents	Should demonstrate that employees understand what is considered an incident and are appropriately reporting with an emphasis on **Near-Hit reporting**
Incident Severity Totals (near hit, minor, serious, major, critical)	1 Near Hit/Learning Event : 2,500 hours worked
Recordable Injury Related Incidents	No medical aid incidents
Total Exposure Hours	Contractor and Subcontractor total hours.
Total Spills/Releases	Demonstrates employee's knowledge of spill/release definition and the proper methods to use clean-up kits that are provided to all employees/jobs
Recordable Vehicle Incidents	No reportable vehicle incidents
Total Exposure Miles	For contractor and subcontractor
Leading Indicators	
Total # of Tailgate Meetings	Held Daily
Total # of Weekly Safety Meetings	Held Weekly
Total # Monthly Safety Meetings (Project Team)	Held Monthly
Total # of JSAs reviewed for quality assurance	# of JSAs developed and # reviewed
Total # of Safety Stand downs	List and Why they were held
Total # of Formal Inspections	When and Conducted by Whom
Total # Safety Meetings (Michels)	(as per Michels Site Specific Safety Plan (SSSP) • Monthly Safety meeting • Weekly / Shift Safety Meeting • Daily Tailgate Meeting • Total # of Safety Meetings per month
Work Site Inspection – formalized / documented (as per Contractor)	**(**Daily – Safety Inspector) (1 with Project Manager / construction manager) (2 with HSE Representative)
Michels Response to audit/inspection findings or any HSE related issues	Demonstration that Michels takes safety related issues seriously and implements effective controls in a timely manner to ensure a safe work site

STEP BACK FOR SAFETY

MICHELS HSE

CREW TYPE:	JOB#:
DATE:	TIME:

Top Three Hazards?

Controls in Place (PPE, Spotter, etc.)?

PRINT NAME	SIGNATURE	PRINT NAME	SIGNATURE
1.		7.	
2.		8.	
3.		9.	
4.		10.	
5.		11.	
6.		12.	

SUBMIT COMPLETED CARDS WITH YOUR DAILY JSA

JOB SAFETY ANALYSIS

PURPOSE:

A Job Safety Analysis (JSA) is a tool used to identify/recognize potential hazards at your work location, and to help implement solutions or correct actions to reduce or eliminate the hazard prior to the start of work to allow for a safe working environment.

ASSESS ***IDENTIFY*** ***CONTROL***

HAZARDS IDENTIFIED MAY INCLUDE BUT ARE NOT LIMITED TO:

1. Trip Hazards—Timber mats, rough terrain, etc.
2. Existing Utilities—Overhead/Underground
3. Pinch Points—Moving equipment/material
4. Slips & Trips—Slippery /obstructed work surfaces
5. Falls—Working at heights (6ft. or greater)
6. Excavations—Soil failure
7. Environmental—Excessive mud, water, dust, etc.
8. Chemicals—Hazardous substances
9. Wildlife—Venomous snakes & spiders
10. Plants—Poisonous plants

IF YOU HAVE A QUESTIONS…..ASK!!!

MICHELS CORPORATION

Project Name: _____ Project Location: _____
Inspected by: _____ Date of Inspection: _____
Equipment Name: _____ Number: _____
Hours/Mileage _____

CONSTRUCTION EQUIPMENT INSPECTION
*** Verbally report to supervisor and turn sheets in daily

CONSTRUCTION EQUIPMENT INSPECTION

		N/A	Remarks			N/A	Remarks
Tracks, tires, wheels				Motor (wiring)			
Brakes				Radiator			
Horn				Belts			
Lights				Hoses			
Clutch				Lubrication Points			
Windshield Wiper				Loose Bearings			
Glass				Guards			
Rear View Mirror				Belt Tension			
Body				Loose Gears			
Cover				Brakes			
Frame				Vibration			
Dump Mechanism				Pneu. Interlocks			
Steering				Exhaust System			
Fire Extinguisher				Proper RPM			
Signal System				Overload Protect			
Fuel & Gas Lines				Mech. Switch			
Fuel Tank				Ground Continuity			
Exhaust System				Limit Switches			
Boom				Cords			
Boom Hoist				Plugs/Receptacles			
Sheaves				Fan Shroud			
Hooks,				Back Up Alarm			
Grab Bars, Steps				Pins-Bushings			
Warning Lights				Pins-Keepers			
Cables							

Operator/Print Name _____ Operator/Signature _____

Foreman/Print Name _____ Foreman/Signature _____

Comments: _____

MICHELS®

DIRECTIONAL CROSSINGS
TAILGATE SAFETY MEETING MINUTES

Date: _____ **Job #** _____ **Location:** _____

Company: _____ **Foreman/Supervisor:** _____

First Aid Personnel: _____

	Name	Address	Phone #
NEAREST CLINIC:			
CLOSEST MAJOR INTERSECTION:			

FOR LIFE THREATENING INJURIES OR EMERGENCIES – DIAL 911 or:

 # In Crew: _____ **# Attending:** _____ **Current Weather:** _____

Competent Person(s) (if applicable): _____

Who Will Transport Injured Personnel? _____

Work To Be Performed: _____

Topics Discussed: _____

Potential Site Hazards: _____

Safety Recommendations: _____

Attendance (use additional paper if necessary)

Print	Sign	Print	Sign

JOB SAFETY ANALYSIS WORK SHEET

Tasks to be performed/critical steps to be taken (Check all that apply to job)	Potential Hazard (Check all that apply to tasks/steps from column 1)	Recommended Safe Job Procedures (Check all protective measures that apply to what was identified in column 2)	
☐ Driving	☐ Traffic hazards (vehicular & pedestrian)	☐ Designate a person for a specific task such as confined space attendant, fire watch, etc.	☐ Keep guards in place at all times – no modifications to tools or equipment
☐ Walking	☐ Working on rough/challenging/uneven terrain	☐ Hold a pre job meeting with all involved	☐ Use hearing protection
☐ Manual Digging	☐ Exposure to loud noise	☐ Utilize one call and pothole/daylight existing utilities BEFORE excavating	☐ Know the depth of water and stay out of it
☐ Mechanical Digging	☐ Overhead Utilities / Underground Utilities	☐ Inspect excavations & complete report	☐ Yield for pedestrians & equipment
☐ Manual Lifting	☐ Suspended Loads / Swinging Loads	☐ Barricade or mark areas of excavation	☐ Reduce speed and drive defensively
☐ Mechanical Lifting (Crane)	☐ Heavy Objects/ Back Injuries	☐ Utilize protective systems (shoring/sloping)	☐ Use of additional PPE (face shield, goggles, chaps etc.)
☐ Welding /Cutting/Grinding	☐ Heavy Lifting Equipment	☐ Nobody permitted to enter unsafe excavations (ensure access/egress is provided)	☐ Inspection and color coding of electrical tools
☐ Hauling Equipment/Materials	☐ Heavy Earthmoving Equipment	☐ Walk with small steps, take time & watch footing	☐ Inspect tools for signs of excessive wear/damage & replace if necessary
☐ Setting/Moving Timbers/Mats	☐ Trenches/Excavations (Engulfment/collapse)	☐ Never park a vehicle next to heavy equipment	☐ Stay clear of x-ray operations
☐ Coating	☐ Asphyxiation / confined space hazards	☐ Wear appropriate PPE at all times	☐ Install portable lighting in dark areas
☐ Sandblasting	☐ Slips, trips & falls – rough/slippery working surfaces	☐ Use taglines where appropriate	☐ Use bug spray or other means of pest control
☐ Rigging	☐ Possible hit/struck/crushed by moving trucks or equipment	☐ Stay a minimum of 25 ft. from loads and equipment	☐ Store cylinders upright, secured with the caps on and transport properly
☐ Line-ups	☐ Slings, Cables, Chains could break/fail	☐ Use proper lifting techniques (lift with legs)	☐ Identify and avoid poisonous plants
☐ End-facing/Beveling	☐ Exposure to gamma emitting sources & x-ray	☐ Stay clear of equipment when in operation	☐ Use spotter with warning device (air horn)
☐ Climbing to Lower Levels	☐ Abrasive materials (eye injuries/skin abrasions)	☐ Never stand/walk between two pieces of working equipment	☐ Drink plenty of water, take cool down/warm-up breaks
☐ Climbing to Higher Levels	☐ Multiple pinch/crush points	☐ Stay a minimum of 10 ft. from all power lines	☐ Install pressure relief valve (PRV)
☐ X-Raying	☐ Compressed Gases	☐ Utilize goal post system and spotters	☐ Test the atmospheres for hazards
☐ Cell Phone use	☐ Heat Stress/Hypothermia (Hot/Cold weather)	☐ Flashback arrestors must be in place	☐ Ensure proper ventilation
☐ Run cords, hydraulic lines and Kelley hose	☐ Inclement Weather (Lightning/Rain/Snow/Fog/Icy conditions)	☐ Ensure certifications are in place on all lifting equipment, devices and rigging	☐ Wear sunscreen and appropriate clothing
☐ Road Crossing	☐ Falls from an upper level	☐ Inspect pins and cables daily for problems	☐ Never lift with the teeth of buckets
☐ Loading/Offloading equipment/Materials	☐ Without proper communication drill string can turn inadvertently causing pinched by/ struck by	☐ Establish eye contact and intent with the operator of the equipment before approaching	☐ Visually inspect the leads as they are being run out
☐ Installing shoring/trench box	☐ Poisonous plants (Contact Dermatitis)	☐ Stay on designated ROW	☐ Ensure spill kit is readily available
☐ Break connections apart to install or remove rods or tooling	☐ Worn or damaged leads could cause shock or property damage	☐ Establish good communication between workers and drill operator before any operations start	☐ Ensure hoses are properly connected and whip-checks are in place
☐ Pumping	☐ Uneven/unsecured or bulky loads	☐ Only one person directing operator/driller	☐ Inspect wear points on hoses/HDPE and replace damaged/worn sections
☐ Lowering-in product	☐ Components/drill stem potentially remaining under pressure even after "ALL STOP"	☐ Stop work and take cover in inclement weather	
☐ Backfilling	☐ Overloading equipment – equipment failure	☐ Secure ladders, & ensure they are not damaged	☐ Ensure fall protection (tied-off/guard rails/hand rails) are in place
☐ Boring/Directional Drilling	☐ Welding, cutting, burning tools (Fire Hazard)	☐ Road/traffic signs must be up while working.	
☐ Pipe Entry	☐ Pipe falling off rollers or out of calipers	☐ Use flaggers to control vehicle/pedestrian traffic	☐ Inspect calipers for correct size before use
☐ Ballast operations/buoyancy	☐ Rotating tooling, pinched by, struck by	☐ Ensure adequate number of fire extinguishers on site and in vehicles	☐ Do not place hands in the box or on the ends of the drill stem/pipe
☐ Pre-heating	☐ Grinding tools - Flying Sparks and Debris	☐ Close observation of pipe rollers and cradles	☐ Use GFCI's and proper grounding
☐ Refueling	☐ Water Exposure/Drowning	☐ Install back-up alarms/ensure alarms are working	☐ Communicate with the railroad and ensure flagger protection is provided if necessary – don't work within 25 feet without flagger protection!
☐ Making wire connections	☐ Electrical Shock Hazards	☐ Never step or reach over rotating stems/pipe	
☐ Changing out hydraulic components	☐ Safety Latch on rigging inoperable/missing	☐ Position trailer on level terrain if possible	☐ Erect barricades and ensure personnel are kept clear of test area
☐ Break connections apart – EXIT SIDE	☐ Working near live railroad tracks (train traffic)	☐ Set parking brake on vehicles & equipment when not in use	
☐ Hydrotest product line	☐ Environmental release/spill		☐

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ATTACHMENT

SPCC PLAN

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SPILL PREVENTION/CONTROL/ COUNTERMEASURE PLAN (SPCC)

For HDD - Crossings

A DIVISION OF MICHELS CORPORATION

DIRECTIONAL DRILLED CROSSINGS

Revision 0
March 18, 2020

MICHELS DIRECTIONAL CROSSINGS
A DIVISION OF MICHELS CORPORATION

SPILL PREVENTION CONTROL AND COUNTERMEASURE PLAN (SPCC)

HORIZONTAL DIRECTIONAL DRILLING

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I. Introduction

This Spill Prevention Control and Countermeasure Plans (SPCC) have been developed by Michels Corporation (Michels) to serve as a guideline for horizontal directional drilling (HDD) operations. This plan is intended to ensure that the equipment utilized to perform the work and the fuel, oil, and lubricant products used in the day to day operation of the equipment will have no long-term adverse environmental impact on the staging areas required for construction. The guidelines contained in this plan will be implemented by field personnel to prevent accidental releases of hazardous material to the environment and to outline measures taken should an accidental release occur. The drilling project manager for the project is experienced in these matters and is typically the designated Spill Coordinator for Michels.

This SPCC plan was developed using Federal Energy Regulatory Commission (FERC) guidelines for construction activities along a pipeline right-of-way. This plan is intended to comply with all applicable requirements of FERC and local State and County authorities. Since HDD operations are generally confined to two distinct locations, the rig (entry) side and pipe (exit) side, this SPCC plan addresses construction operations at these specific locations only for hazardous materials. This SPCC plan consists of three sections:

- Preventative measures to be taken prior to initiating construction with hazardous materials;
- Preventative procedures to be followed while using hazardous materials during construction;
- Procedures to be implemented should an accidental spill of hazardous material occur;

II. Pre-Construction Hazardous Material Spill Prevention

Prior to construction, all Michels' personnel who will be performing work on site will have attended a FERC-approved environmental training program within the last year. This training program will serve to indoctrinate the personnel and make them aware of the pollution control laws, rules, and regulations applicable to the pipeline right-of-ways. Michels' personnel are highly experienced with the equipment to be used in HDD operations and have worked on numerous FERC governed projects in the past. However all personnel will be refreshed by the project manager and drill superintendent in the operation and maintenance of construction equipment to prevent the accidental discharge or spill of fuel, oil, or lubricants.

Through the environmental training program and the project manager's guidance along with knowledge obtained from past experience, all Michels' personnel will be thoroughly educated on the following topics:

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- Precautionary measures to prevent spills;
- Potential sources of spills, such as equipment failure or malfunction and re-fueling procedures;
- Standard operating procedures in case of a spill, including applicable notification requirements;
- Equipment, Materials, and Supplies available for clean-up of a spill;
- Review of known spill events, if any.

Prior to mobilizing equipment to the proposed alignment R.O.W., Michels will thoroughly inspect and if necessary repair or replace equipment components that could potentially leak hazardous material. The equipment will be cleaned of any debris or material observed to be hazardous. All hazardous material storage containers and secondary containment devices will be inspected and if necessary repaired or replaced.

The spill containment and clean-up materials used by Michels will be inventoried and if necessary re-stocked prior to initiating construction operations. At a minimum, the following spill containment and clean-up materials will be located in a central location at each side of the HDD crossings where equipment is in use or hazardous materials are stored in sufficient quantities to contain and clean-up a spill or release should one occur:

- Spill containment kits typically consisting of the following items
  - 1 x 55 gal poly drum
  - 50 x 18” x 18” absorbent pads
  - 8 x 3” x 4’ absorbent socks
  - 6 x 18” x 18” absorbent pillows
  - 3 x 5” x 10’ absorbent booms
  - 4 Disposable plastic bags with ties
  - 4 pair nitrile gloves
- Plastic sheeting
- Floor Dry absorbent material (50 pound bag-typical)
- Personal protective equipment (i.e. gloves and safety glasses)
- Replacement parts and equipment for repair of tanks, hoses, nozzles, etc.
- Equipment and tools to divert spilled fluids and create earthen barriers

III. HDD Construction Operations Hazardous Material Spill Prevention

Once construction activities for the HDD are underway, hazardous material spill prevention will be a continuous element of the operations. During equipment set up, potential sources of hazardous material releases, i.e. fuel tanks, hydraulic oil tanks and hoses, antifreeze tanks, and lubricant storage bins will be located as far away as practicably possible from streams, wetlands, and drainage ways. If necessary, and if practicable, temporary barriers may be constructed or placed between the potential sources of spills and areas identified as extremely sensitive to accidental

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spills. Spill containment and clean-up materials/kits will be located in a central location at each side of the drill site location where equipment is in operation or hazardous materials are stored and all personnel will be made aware of the location.

Secondary containment devices will be placed to enclose major sources of potential hazardous spill locations (i.e. fuel storage tanks and hazardous materials storage areas). A site layout drawing for entry locations and exit locations showing the placement of significant sources of hazardous material releases and secondary containment measures are attached in **Appendix A** of this plan. The exact location of the equipment will vary to address specific site conditions after the temporary work space has been prepared for equipment set-up. Access to the sites will be limited by the Project Manager to only authorized personnel and visitors.

During construction, spill refresher briefings will be scheduled quarterly and conducted by Michels. The briefings will refresh Michels' personnel on the topics covered during the pre-construction environmental training as well as review operations to date, including any accidental spills that may have occurred and measures taken for prevention of future spills.

Michels will store, handle and transfer hazardous materials used during HDD operations in a manner to prevent accidental releases or spills of these materials. **Table-1** attached in **Appendix-A** to this plan summarizes the hazardous materials, combined expected volumes, and storage methods for both the entry and exit locations. The Material Safety Data Sheets (MSDS) for every product used by Michels are maintained on file in the drilling survey trailer on site should they be required to assess the hazard potential of a spill. The list of primary hazardous materials (petroleum-based products) to be used by Michels over the course of each HDD crossing is as follows:

- Gasoline
- Diesel Fuel
- Hydraulic Oil
- Lubricants
- Penetrating Oils
- Antifreeze

Michels' personnel will follow specific guidelines set forth in this plan during operation and maintenance of equipment and vehicles used in support of the HDD operations. All waste oil or fuel collected during routine maintenance of the equipment will be contained and disposed of in accordance with state and federal requirements.

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IV. Potential Sources of Hazardous Spill-Preventative Measures to be Implemented

For day to day operations, Michels' personnel will follow these guidelines to prevent the accidental release or spill of hazardous materials:

Potential Source of Hazardous Spill	Preventative Measures To be Implemented
Fuel stored in a storage tank	• Except as specified in **Attachment-A** of Appendix-B, locate storage tank at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. • Install secondary containment devices around tank in excess of 150% of the maximum volume to be stored. • Inspect tank and secondary containment daily and before filling, implement corrective action upon discovery of deterioration that could cause a spill or result in a leak. Record inspection results weekly on log attached in the appendix to this plan. • Remove any precipitation found within the secondary containment. Prior to removing the precipitation, inspect for film, sheen, discoloration, sludge, emulsion or tarry residue, if present then collect the liquid for disposal. Do not discharge to land or surface waters. • Plug or close all tank openings when not in use. • Maintain sufficient quantities of spill control and clean-up materials in a central location near the storage tank, inspect supply daily. • Provide security measures to protect against vandalism of stored materials
Liquid material stored in a container	• Except as specified in **Attachment-A** of Appendix-B, store container at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. • If practicable and if room allows, store containers in a central location within a common secondary containment device. All significant container storage (i.e. greater than 5 gallon) will have secondary containment in excess of 150% of the maximum volume proposed to be stored. • Use small containers which are in good condition (maximum 55 gallon drum). • Take measures to protect the containers from the elements or physical damage. • Inspect containers daily, replace immediately if damaged or leaking. Record inspection results weekly on log attached in **Attachment-B** of Appendix-B to this plan • Close containers when not in use. • Maintain sufficient quantities of spill control and clean-up materials in a central location where the containers are regularly used, inspect supply daily. • Provide security measures to protect against vandalism of stored materials

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Liquid material transferred from a storage tank or container to vehicles or equipment	• Except as specified in **Attachment-A** of Appendix-B**,** transfer materials at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. Exercise extreme caution for transfers in areas where set-back distances from sensitive areas cannot be met such as placement of absorbent pads or drip pans beneath transfer points, creating temporary earthen berms, or other similar precautionary spill measures. • Transfer during daylight hours or where lighting is adequate to illuminate the area. • Monitor transfer operations at all times. • Maintain sufficient quantities of spill control and clean-up materials in a central location where transfers regularly occur, inspect supply daily. • Provide security measures to protect against vandalism of stored materials

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Liquid material used in vehicles and equipment	• Except as specified in **Attachment-A** of Appendix-B, park at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. • Inspect daily for leaks or signs of deterioration that could result in a leak. • Repair or replace defective tanks, hoses, fittings, etc. • Maintain sufficient quantities of spill control and clean-up materials in a central location where equipment or vehicles are in use, inspect supply daily. • Provide security measures to protect against vandalism of stored materials

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Liquid material transferred from tank vehicle to vehicles & equipment	• Except as specified in **Attachment A** of Appendix-B, tank vehicle used during re-fueling operations shall be specifically designed for supplying fuel to vehicle or equipment tanks and will comply with the requirements of NFPA 385 and other applicable state and federal requirements. • Tank vehicle and its equipment shall be maintained in good repair. • Drivers to be thoroughly trained in the proper method and operation of tank vehicles and in acceptable unloading procedures. • The driver or operator will not leave vehicle unattended during re-fueling operations • All engines to be shut off and operators not on the equipment during refueling operations. • Smoking is to be forbidden on or near any vehicle involved in re-fueling operations. Extreme precaution shall be exercised to prevent people in the vicinity from smoking, lighting matches, or carrying any flame or lighted device. Signs prohibiting smoking or open flames to be prominently displayed in open view on the tank vehicle. • Re-fueling procedures will not be initiated until precautions have been taken to prevent the motion of vehicles involved. Parking brakes to be utilized if available. • Length of refueling hose is typically limited to 50-feet from the hose reel. Tank vehicle to be positioned with respect to vehicles being fueled in order to prevent unwanted traffic between the tank vehicle and vehicle/equipment being fueled. • Each vehicle must contain one portable fire extinguisher that has a minimum rating of 4A, or 4-B,C. Ratings to be in accordance with NFPA-10. Signage on vehicles shall clearly indicate location of fire extinguisher. • Fueling/Re-fueling operations should typically take place during daylight hours. Nighttime fueling operations conducted in adequately lighted areas. • Documentation of training to be made available upon request. • Provide security measures to protect against vandalism of stored materials

Should these guidelines prove to be inadequate to prevent the accidental release or spill of hazardous material, they will be revised and implemented as required to ensure that every possible preventative effort is being taken. All personnel will be made aware of any such revisions at the time of the revision and at the environmental refresher meetings.

V. HDD Construction Operations Hazardous Material Spill Procedures

A spill is an unintentional release of hazardous material to the environment. In the unlikely event that an inadvertent spill of a hazardous material occurs the following steps will be followed at a minimum:

- Step 1 - Containment: Assess the situation prior to attempting to control the spill. Secure the spill scene and attempt to identify and stop the source of spill and

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contain at source. Limit access to the site in order to prevent/limit personal and/or property damage. Responders must have knowledge of the spilled material and immediately utilize all available resources (i.e. equipment, personnel, and materials), to contain spill. If adequate resources are not available, expedite mobilization of additional resources from other construction activities as required to fully contain the spill. If the spill cannot be adequately handled by additional resources, Michels will arrange for an approved spill response contractor to mobilize to the site and contain, clean up, and perform required sampling and disposal of spilled materials and residual contaminated debris.

- Step 2 - Remediation: Properly trained personnel shall clean up hazardous material immediately after spill is contained to prevent further migration of hazardous materials into the environment. Responders should consult with proper governmental resource agencies as required. In no case shall containment equipment be used to permanently store contaminated material. Containerize in DOT-approved containers, label, and remove all contaminated material from the construction area and dispose of material in accordance with applicable regulatory guidelines (i.e. transport to hazardous waste disposal facility by licensed waste hauler). The Owner will be provided with proper documentation showing that material was disposed of in a proper manner.

- Step 3 - Notification: Reporting requirements will depend on the quantity of spill. A spill constituting less than a significant spill event will be reported to Owner and/or Owner's representative Chief Inspector **(CI)-_____: ( ) - (office), or ( ) - (cell).**

  Significant spills are defined as: any amount of petroleum, oils, or lubricants discharged to a receiving stream that causes a film, sheen, or discoloration of surface water or adjoining shoreline; or any reportable quantity of hazardous material as defined by 40CFR320. If a significant spill should take place, Michels' Project Manager (PM), will notify the Prime Contractors' Project Manager and Owner's representative Chief Inspector **(CI)-_____( ) - (office), or ( ) - (cell)** of the spill as soon as he has confirmed that the spill has been completely contained. Michels' PM will assist the Owner's representative in submitting the regulatory-required information for hazardous spill notification in accordance with Governing Agency procedures. At the very minimum the project superintendent will provide the CI with the information required on the "Spill Report" included as **Attachment C** in Appendix C.

- Step 4 – Michels' Project Manager will be responsible for any applicable agency reporting requirements. The notification requirements for petroleum and hazardous materials spills are as follows:

  - Federal Contacts:
    National Spill Response Center 1-800-424-8802

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- State Contacts:
  State Department of Environmental
  Quality - Spill Notification ( ) - (Business Hours)
  ( ) - (After Hours)

- Local Contacts:
  Local Fire Department _____

- A completed Petroleum and Hazardous Materials Spill Report must be submitted to OWNER & Governmental Agencies within 48 hours.
- Prior to continuing work, Michels will determine the cause of the spill and implement measures to ensure that further spills will not occur.

A More detailed list of Local Emergency Response Personnel and Hospital Location will be attached and filled out as **Attachment D** in Appendix C.

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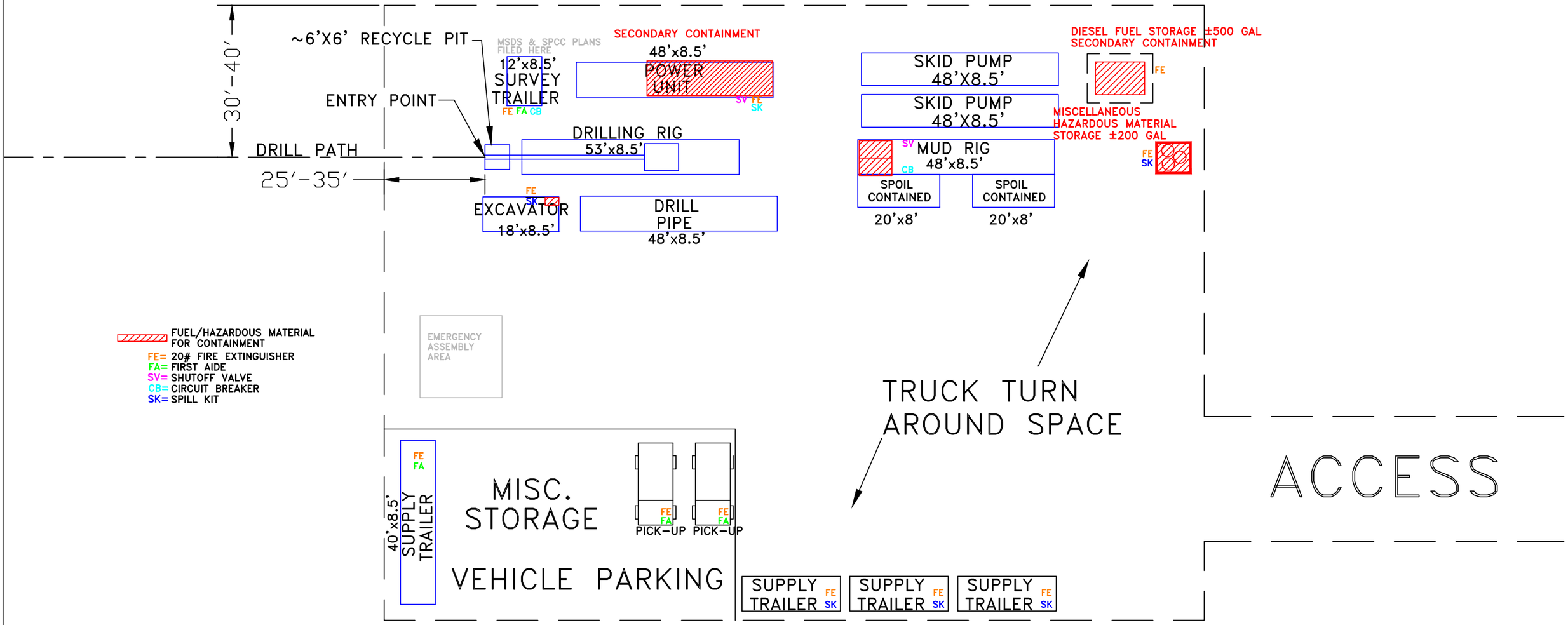
APPENDIX-A

EROSION CONTROL PLACED AROUND PERIMETER OF SITE

200'X150' TEMP WORKSPACE



PLAN VIEW

NOTE: THIS IS A TYPICAL SITE SET-UP. THERE ARE VARIOUS CONFIGURATIONS USED DEPENDING UPON SITE RESTRICTIONS. FIELD MODIFICATIONS TO SUIT SITE.

NOTE: BENTONITE SLURRY PUMPED FROM PIT, COLLECTED & RECYCLED OR DISPOSED OF AT AN APPROVED LOCATION

REVISIONS

NO.	DATE	REVISION DESCRIPTION	SOURCE DRAWING
0			

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PHONE: (920) 583-3132 FAX: (920) 924-4323

DIRECTIONAL BORE FOR: OWNER | PROJECT: PROJECT NAME

DRAWING: ANTICIPATED ENTRY SITE LAYOUT

SCALE: NTS | LOCATION: CROSSING NAME

DRAWN BY: B.J.E. | MDC JOB #: xxx | DATE: 3 / 18 / 20

TABLE I

HAZARDOUS SUBSTANCE INVENTORY

Material	Quantity (gallons)	Storage Location	Reportable Quantity (include reference)
Oil/Fuel:			
Unleaded Gasoline	**10 Gallons**	**5 Gallon DOT-Approved Re-fill able Cans - Storage Trailer**	
	80 Gallons	**Fuel Tank in Bed of Pick-Up Truck**	
Diesel Fuel	**120 Gallons**	**Fuel Tank in Bed of Pick-Up Truck**	
	500 Gallons	**Fuel Tank w/Secondary Containment on Site in excess of 150% of maximum volume**	
Motor Oil	**1 or 5 Gallons**	**Reinforced Plastic Container - Storage Trailer**	
Hydraulic Oil	**110-Gallons**	**Two 55-gallon drums w/Secondary Containment on Site in excess of 150% of maximum volume**	
Commercial Chemicals:			
Ethylene Glycol	**40-Gallons**	**1 or 5 Gallon Reinforced Plastic Containers - Storage Trailer**	
Hazardous Wastes:			

APPENDIX-B

Attachment A

The setbacks specified for refueling, fuel storage, and parking of equipment may not be practicable for certain construction activities, including horizontal directional drilling. Exceptions to the setback requirements may be allowed for:

- Areas where removing equipment from a wetland for servicing or overnight parking would increase adverse impacts to the wetland and/or result in significant construction delays;
- Construction sites where moving equipment to refueling stations from pre-fabricated equipment pads is impracticable or where there is a natural barrier from the water-body or wetland (i.e., dike, road or railroad);
- Locations where the water-body or wetland is located adjacent to a road crossing (from which the equipment can be serviced);
- Refueling and fuel storage for immobile equipment including, but not limited to, bending and boring machines, air compressors, padding machines, and hydro-test fill pumps.

ATTACHMENT B
WEEKLY HAZARDOUS MATERIALS/WASTE INSPECTION LOG

For each item listed below, Contractor will indicate whether existing conditions are acceptable (A) or unacceptable (U). Resolution of all unacceptable conditions must be documented. Contractor will inspect all storage facilities on a regular basis, but not less than weekly. Contractor will keep records of all inspections on file. Contractor will provide a coy of the completed form to the Chief Inspector and Environmental Inspector on a weekly basis.

I. STORAGE AREAS FOR FUELS, LUBRICANTS AND CHEMICALS

General

A/U

_____ Construction yard or storage areas secured

_____ National Fire Protection Association symbol posted in storage area or at yard entrance

_____ Storage areas properly prepared and signed

_____ Material Safety Data Sheets available

_____ Hazardous Materials Management Plan/Spill Prevention and Countermeasure Plan available

Hazardous Materials Management

A/U

_____ No evidence of spilled or leaking materials

_____ Incompatible materials separated

_____ All containers labeled properly

_____ All containers securely closed

_____ All containers upright

_____ No evidence of container bulging, damage, rust or corrosion

Secondary Containment Areas

A/U

_____ Containment berm intact and capable of holding 110% of material stored plus precipitation

_____ Lining intact

_____ No materials overhanging berms

_____ No materials stored on berms

_____ No flammable materials used for berms

Compressed Gases

A/U

_____ Cylinders labeled with contents

_____ Cylinders secured from falling

_____ Oxygen stored at least 25 feet away from fuel

_____ Cylinders in bulk storage are separated from incompatible materials by fire barriers or by appropriate distance

II. HAZARDOUS WASTE MANAGEMENT

Waste Container Storage

A/U

_____ No evidence of spilled or leaking wastes

_____ Adequate secondary containment for all wastes

_____ Separate containers for each waste stream—no piles

_____ Waste area not adjacent to combustibles or compressed gases

_____ All containers securely closed

_____ Bungs secured tightly

_____ Open-top drum hoops secured

_____ All containers upright

_____ No evidence of container bulging, corrosion

_____ No severe container damage or rust

_____ Containers are compatible with waste (e.g. plastic liner for corrosives, metal liner for solvents)

_____ No smoking and general danger/warning signs posted

Waste Container Labeling

A/U

_____ Containers properly labeled

_____ Name, address and EPA ID number or ID Number of generator listed (Not required if Contractor is an exempt small quantity generator.)

_____ Accumulation start date listed

_____ Storage start date listed

_____ Chemical and physical composition of waste listed

_____ Hazardous property listed

Nonhazardous Waste Areas

A/U

_____ No litter in yard

_____ No hazardous wastes or used oil mixed with trash (e.g., contaminated soil, oily rags, diapers, or other oily materials)

_____ Empty oil and aerosol containers for disposal are completely emptied

III. EMERGENCY RESPONSE EQUIPMENT

A/U

_____ Shovels

_____ Absorbent materials (booms, pads, pillows, socks, “Speedy Dry”

_____ Personal protective equipment (goggles, gloves)

_____ Fire-fighting equipment

_____ First aid supplies (e.g. medical supplies, squeeze bottle eye wash)

_____ DOT-approved containers

_____ Plastic sheeting, bags and ties

_____ Communication equipment

_____ Bung wrench (non-sparking)

IV. CORRECTIVE ACTIONS TAKEN (Required for all unacceptable conditions)

_____

_____

_____

_____

_____

_____

_____

_____

_____

Date: _____ **Contractor Name :** _____

Inspected by (Contractor’s Inspector): _____

Signature: _____

APPENDIX-C

ATTACHMENT C

Petroleum and Hazardous Material Spill Report

Date of spill: _____ Incident No: _____ Date of spill discovery: _____

Time of spill: _____ Time of spill recovery: _____

Location Name: _____ Spread: _____ County: _____

Section: _____ Township: _____ Range: _____

Name and Title of Discoverer: _____

Type of material spilled and product name: _____

Manufacturer's Name: _____

Legal description of spill location: _____

Directions from nearest community: _____

_____

_____

Estimated volume of spill: _____ Estimated material recovered: _____

Weather Conditions: _____

Topography and surface conditions of spill site: _____

Spill medium (pavement, sandy soil, water, etc.): _____

Proximity of spill to surface waters or wetland: _____

Did the spill reach a water body? _____ Yes _____ No

If so, was a sheen present? _____ Yes _____ No

Direction and time of travel (if in stream): _____

Responsible party (name, phone number): _____

Describe the causes and circumstances resulting in the spill: _____

_____

_____

Describe the extent of observed contamination, both horizontal and vertical (i.e., spill-stained soil in a 5'' radius to a depth of 1"):

_____

_____

Resources and installations that may be affected: _____

_____

_____

Potential impact on human health: _____

Describe immediate spill control and/or cleanup methods used and implementation schedule: _____

Current status of cleanup actions: _____

Name/Company/Address/Phone Number for the following:

Construction Superintendent: _____

OWNER
Representative: _____

Environmental Director: _____

Person Who Reported the Spill: _____

Environmental Inspector: _____

On-Scene Agency Coordinator (where applicable): _____

Form completed by: _____ Date: _____

The Contractor must complete this for any petroleum or hazardous material spill regardless of size, and submit the form to OWNER or OWNER's designated representative for construction observation within 48 hours of the occurrence.

ATTACHMENT D
LOCAL Emergency RESPONSE PERSONNEL-HOSPITAL LOCATION

The contractor should provide a listing by municipality of the local emergency response organizations near the HDD project site, and the name and phone number of a contact person for each. For example, list fire and police departments, emergency management organizations, etc. The contractor should update and complete this information as required for his/her work locations. Additions will be made by the Project Manager once they become available prior to drilling operations.

Local Emergency Contacts

- Federal Contacts:
  National Spill Response Center 1-800-424-8802

- State Contacts:
-
-
- Local Contacts:
  Emergency Response -
  Emergency Response -
  Local Fire Department 911
  Local Police Department 911

- Nearest Hospital:

Other Phone Numbers to be added to this form if necessary.

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ATTACHMENT

DRILL RIG SPECIFICATIONS

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Brownsville, WI 53006
Telephone: (920) 583-3132
Fax: (920) 583-3429
www.michels.us

HERCULES
(11) RIGS OWNED & OPERATED

DRILL RIG SPECIFICATIONS

Weight:	100,000 – 103,000 Pounds
Height:	13’ 6”
Length:	53’
Width:	8’ 6”
Horsepower:	1500+ HP (750 HP ea)

DRILL RIG CAPACITY

Torque Capacity:	164,500 Ft/Lbs
Max Spindle Speed:	90 RPM
Thrust/Pull:	1,260,000 Lbs

DRILLING SPECIFICATIONS (DIRT)

MAXIMUM RECOMMENDED

Back Ream:	96”
Drilling Distance:	8,000’

DRILLING SPECIFICATIONS (ROCK)

MAXIMUM RECOMMENDED

Back Ream:	60”
Drilling Distance:	8,000’

SURVEY SYSTEM SPECIFICATIONS

Type:	**Downhole probe** transmits tool face, 3 dimensional coordinate data	
Accuracy:	+/-0.1º All Angles	
Max Locating Depth:	Unlimited	
	Tool face	±0.5º
Type:	**Gyro-Steering Tool**	
Accuracy:	Inclination	±0.01°
	Azimuth	±0.04°
	Tool face	±0.02°

SECONDARY SURVEY SYSTEM SPECIFICATIONS

Type:	**ParaTrack**	
Accuracy:	Inclination	±0.1º
	Azimuth	±0.4º
	Tool face	±0.5º

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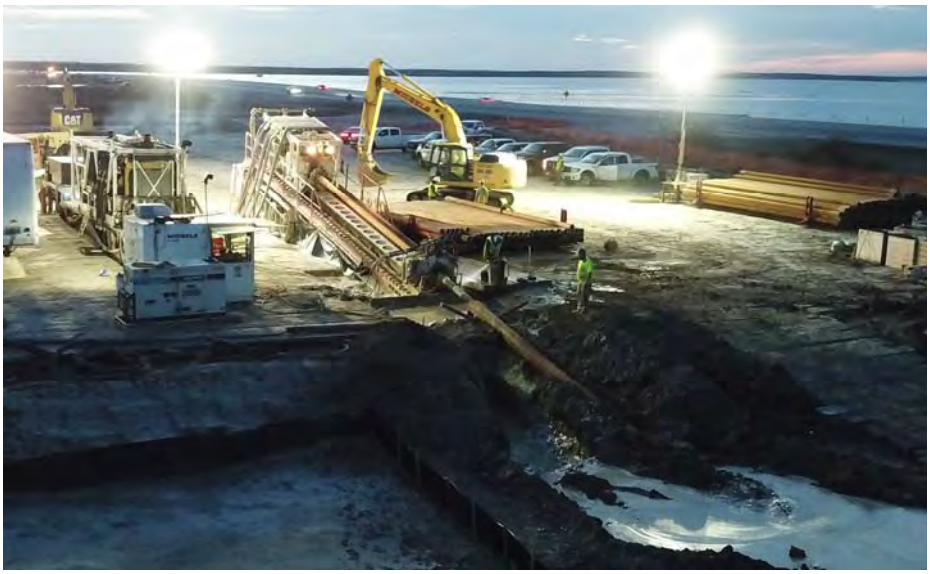

ATLAS 840
(7) RIGS OWNED & OPERATED

DRILL RIG SPECIFICATIONS

Weight:	88,000 – 93,000Lbs Varies
Height:	13’ 6”
Length:	54’
Width:	8’ 6”
Engine:	Dsl Cat Model 3456 or 3412
Horsepower:	660 HP or 750 HP

DRILL RIG CAPACITY

Torque Capacity:	164,500 Ft/Lbs
Max Spindle Speed:	100 RPM
Thrust/Pull:	840,000 Lbs

DRILLING SPECIFICATIONS (DIRT)

MAXIMUM RECOMMENDED

Back Ream:	60”
Drilling Distance:	6,500’

DRILLING SPECIFICATIONS (ROCK)

MAXIMUM RECOMMENDED

Back Ream:	52”
Drilling Distance:	6,500’

SURVEY SYSTEM SPECIFICATIONS

Type:	**Downhole probe** transmits tool face, 3 dimensional coordinate data	
Accuracy:	+/-0.1º All Angles	
Max Locating Depth:	Unlimited	
	Tool face	±0.5º
Type:	**Gyro-Steering Tool**	
Accuracy:	Inclination	±0.01°
	Azimuth	±0.04°
	Tool face	±0.02°

SECONDARY SURVEY SYSTEM SPECIFICATIONS

Type:	**ParaTrack**	
Accuracy:	Inclination	±0.1º
	Azimuth	±0.4º
	Tool face	±0.5º

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ATTACHMENT

HDD PLAN AND PROFILE DRAWING

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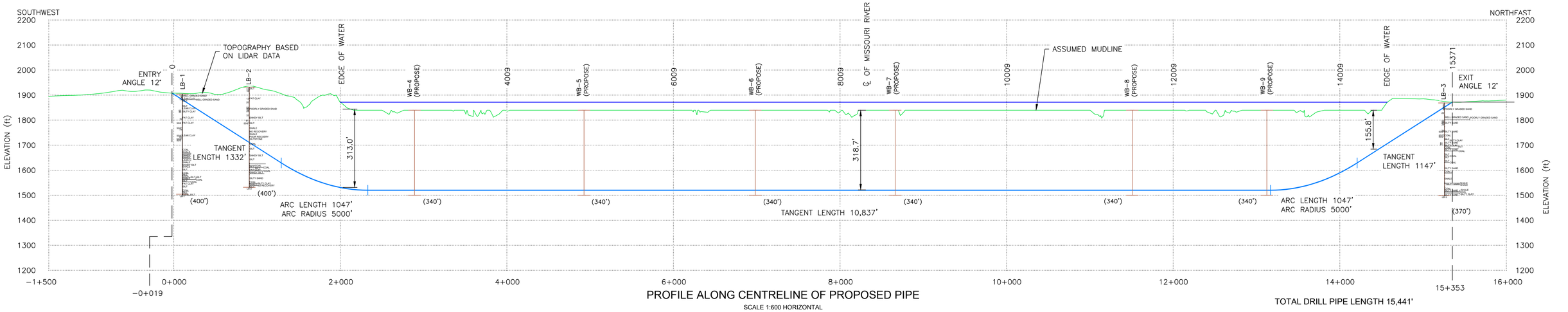
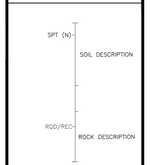
PLAN VIEW
SCALE 1-in:600-ft



PROFILE ALONG CENTRELINE OF PROPOSED PIPE
SCALE 1:600 HORIZONTAL
SCALE 1:300 VERTICAL

TOTAL DRILL PIPE LENGTH 15,441'

BORING LEGEND



HORIZONTAL DIRECTIONAL DRILL DATA MISSOURI RIVER		
DESCRIPTION	STATION (ft)	ELEVATION (ft)
ENTRY @ 12°	−0+019	1908.07
PC1 = 5000' RADIUS	1+293.20	1629.26
PT1 =	2+332.76	1520.00
PC2 = 5000' RADIUS	13+170.24	1520.00
PT2 =	14+210.00	1629.26
EXIT @ 12°	15+353.00	1872.17
HORIZONTAL DISTANCE (ft) = 15371		
DIRECTIONAL DRILL PIPE LENGTH (ft) = 15441.16		

REFERENCE DOCUMENT NO.	DATE
1.	

CCI & Associates Inc.
20333 State Highway 249, Suite 480
Houston, TX 77070
COR F-18518

ENGINEER AND PERMIT STAMPS

ISSUED FOR REVIEW NOT FOR CONSTRUCTION

PIPELINE SPECIFICATIONS

OUTSIDE DIAMETER (OD)(in)	24
WALL THICKNESS (WT)(in)	1.219
GRADE (psi)	52,000
PRODUCT	NATURAL GAS
MATERIAL	STEEL
SPECIFICATIONS	API 5L
INTERNAL COATING	N/A
OUTER COATING	DUAL FBE
MAX. OPER. PRESSURE (psi)	1,480
MIN. TEST PRESSURE (psi)	1,850
MAX. OPER. TEMP (°F)	100
MIN. INSTALLATION TEMP (°F)	23

STEERING TOLERANCES

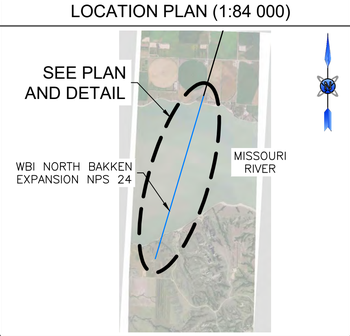
	30ft	100ft	330ft
MINIMUM RADIUS (ft)	1000	1450	4500

PULL FORCE / RIG SIZE / STRESS

PULL FORCE (w/ BUOYANCY CONTROL):	863,000 lbs (w/sf)
MINIMUM RECOMMENDED RIG SIZE:	1,000,000 lbs
COMBINED STRESS UNITY CHECK:	0.44
OPERATING STRESS	65.7%

DRAWING STATUS	DATE	DRN	CHK	DES	GEO	APR	CR
ISSUED FOR REVIEW	2019-12-19	MS		KP		KP	
PRELIMINARY	2019-10-23	MS		KP		KP	
PRELIMINARY	2019-07-25	TL	MAL	KP		KP	
PRELIMINARY	2019-06-14	RL		KP		KP	
PRELIMINARY	2019-06-11	RL		KP		KP	
PRELIMINARY	2019-03-11	AN		CG		KP	

LOCATION PLAN (1:84 000)



ND83-NF

WBI NORTH BAKKEN EXPANSION PROJECT

MISSOURI RIVER HDD CROSSING
PLAN AND PROFILE

WATFORD CITY / TIOGA, NORTH DAKOTA

SCALE	DWG. #	REVISION	SHEET
AS SHOWN	2386-EG-0101	A	1 OF 2

File Name: S:\Current Jobs\2386-WBI-N.Bakken Expansion\Eng\Drawings\01-Lake Sakakawea\Missouri River\Preliminary\2386-EG-0101-F.dwg Date/Time: 11-Dec-19 / 3:48:23 PM Last Saved By: Matthew.Smith

ATTACHMENT

ANTICIPATED ENTRY/EXIT EQUIPMENT

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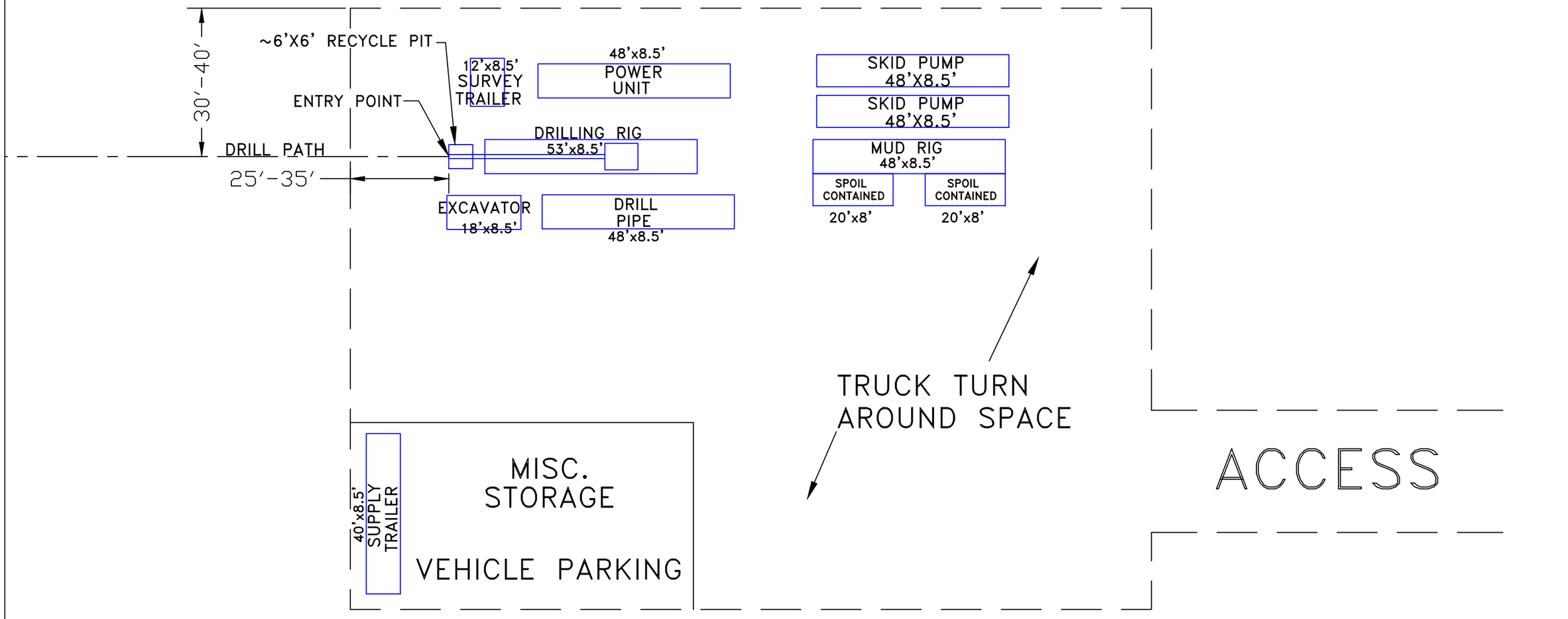
200'X150' TEMP WORKSPACE



PLAN VIEW

NOTE: THIS IS A TYPICAL SITE SET-UP. THERE ARE VARIOUS CONFIGURATIONS USED DEPENDING UPON SITE RESTRICTIONS. FIELD MODIFICATIONS TO SUIT SITE.

NOTE: BENTONITE SLURRY PUMPED FROM PIT, COLLECTED & RECYCLED OR DISPOSED OF AT AN APPROVED LOCATION

REVISIONS

NO.	DATE	REVISION DESCRIPTION	SOURCE DRAWING
0			

MICHELS®
817 W. MAIN ST. P.O. BOX 128 BROWNSVILLE, WISCONSIN 53006
PHONE: (920) 583-3132 FAX: (920) 924-4323

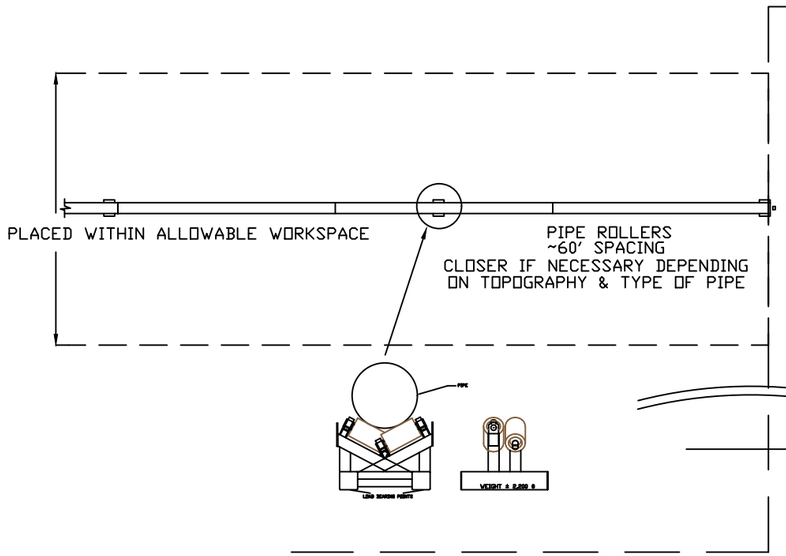
DIRECTIONAL BORE FOR: OWNER | PROJECT: PROJECT NAME

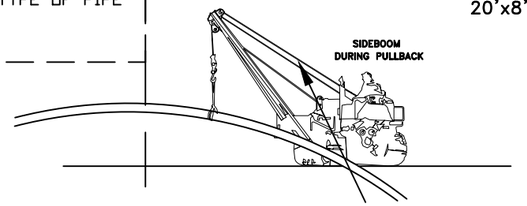
DRAWING: ANTICIPATED ENTRY SITE LAYOUT

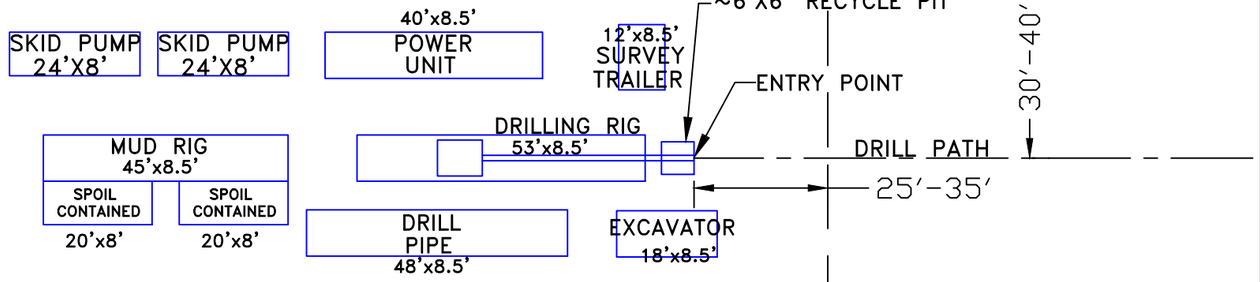
SCALE: NTS | LOCATION: CROSSING NAME

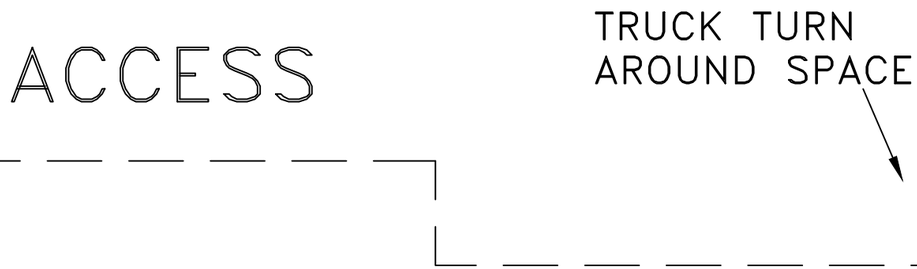
DRAWN BY: B.J.E. | MDC JOB #: xxx | DATE: 1/6/18

200'X150' TEMP WORKSPACE









PLAN VIEW

NOTE: RIG AND SUPPORT EQUIPMENT SHOWN MAY OR MAY NOT BE REQUIRED BUT SHALL BE PLANNED FOR IN CASE A HOLE INTERSECT IS REQUIRED AND/OR AS A HDD CONTINGENCY MEASURE

NOTE: THIS IS A TYPICAL SITE SET-UP. THERE ARE VARIOUS CONFIGURATIONS USED DEPENDING UPON SITE RESTRICTIONS. FIELD MODIFICATIONS TO SUIT SITE.

NOTE: BENTONITE SLURRY PUMPED FROM PIT, COLLECTED & RECYCLED OR DISPOSED OF AT AN APPROVED LOCATION

REVISIONS

NO.	DATE	REVISION DESCRIPTION	SOURCE DRAWING
0			

MICHELS®
817 W. MAIN ST. P.O. BOX 128 BROWNSVILLE, WISCONSIN 53006
PHONE: (920) 583-3132 FAX: (920) 924-4323

DIRECTIONAL BORE FOR: OWNER	PROJECT: PROJECT NAME
DRAWING: ANTICIPATED EXIT SITE LAYOUT	
SCALE: NTS	LOCATION: CROSSING NAME
DRAWN BY: B.J.E.	MDC JOB #: xxx
DATE: 1/6/18	

ATTACHMENT

MGS STEER TOOL SYSTEM

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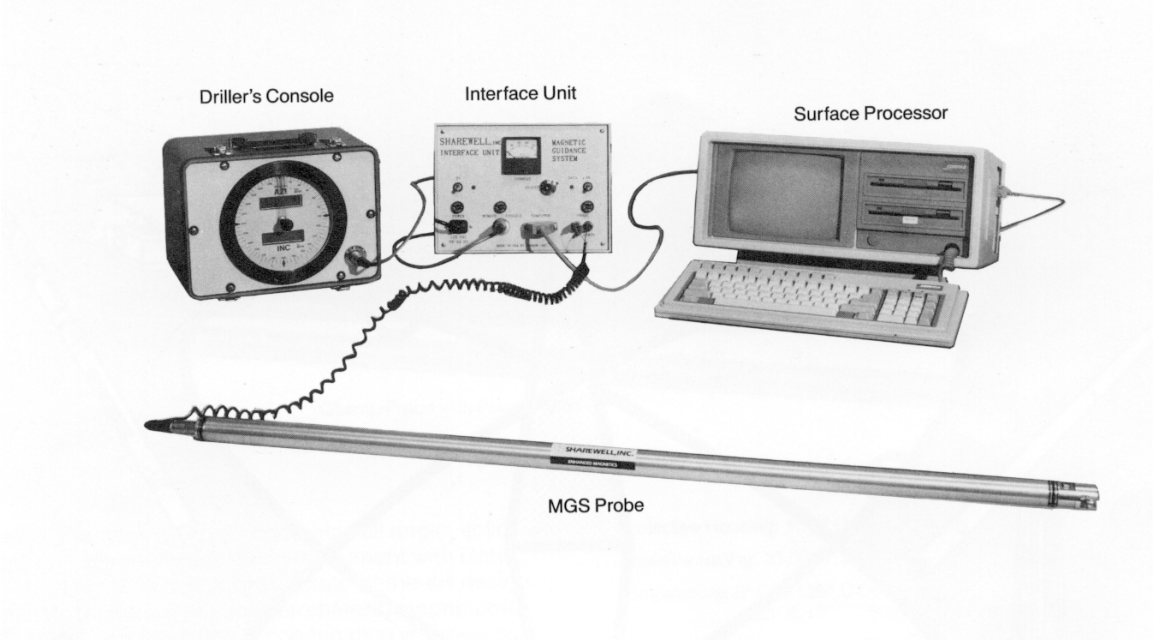
MAGNETIC GUIDANCE SYSTEM



The Magnetic Guidance System (M.G.S.) is designed to address a wide range of applications from normal oil and gas drilling to drainhole and pipeline river crossing drilling.

While directional drilling with either a downhole motor or jetting operation, the system permits you to guide the bit with utmost accuracy. Data is transmitted to surface via a single-conductor wireline.

The system comprises three main sub-sections: the downhole probe, the surface processing unit, and the driller's remote display.

Useful features include the ability to monitor the magnetic moments during drilling operations and to perform probe operational diagnostics while downhole as well as to verify probe calibration at the drilling location.

The directional engineer has the option to drill using either magnetic tool face or gravity tool face, along with having the magnetic hole direction and hole inclination displayed on a continuous basis from the remote readout. The surface processing unit provides duplicate output as the remote display, as well as the magnetic parameters including voltage temperature. A printed record of the data is available at selected intervals by the operator. The M.G.S. downhole probe incorporates the latest technology in accelerometers, magnetometers, calibration and modeling techniques to provide a rugged and reliable tool.

PROBE SPECIFICATIONS

SENSORS:

3 Axis Accelerometers → All Angle Capability
3 Axis Magnetometers → All Angle Capability

DIMENSION & RATING:

Probe Length	47.25"
Probe Diameter	1.38"
Protective Housing	1.75" x 6'
Protective Housing Pressure Rating	20,000 P.S.I.
Maximum Operating Temperature	125°C
Repeatability	0.2° at Horizontal 0.5° at 4° or Less
Accuracy	± 1%

DRILLER'S CONSOLE:

Two 4-character L.C.D. displays for Inclination, Azimuth and Tool Face Mode
360° Rotating Pointer for Tool Face Position
Hermetically Sealed Unit
12 Vac Operation
Electronics Isolated From Case
Easily Positioned Near Driller

SOFTWARE:

Displays Individual Sensor Values
Display of All Magnetic Parameters
Tool Face Offset Option
Complete Diagnostic Check
Automatic Tool Face Switching Mode Option
Data Printout on Request
Menu Driven
Borehole Survey Calculations

SURFACE PROCESSOR:

COMPAQ Portable or IBM Compatible with Printer

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ATTACHMENT

GYROSCOPIC
STEER TOOL SYSTEM

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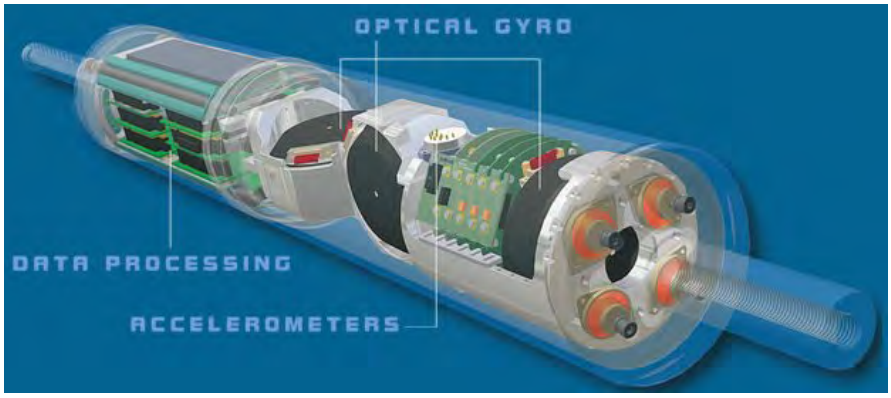
DRILLGUIDE GYRO STEERING TOOL



Technical Specifications –

Electric Power (Input on surface)	110-Volts AC / 50 Hz
Electric Power (Output to Downhole Tool)	48-Volts AC
Tool OD	6-5/8-inches
Tool Length	9-ft
Tool Joint Connection (Box Up x Pin Down)	4-1/2 IF
Maximum Allowed Torque (on Tool Housing)	18,000-foot pounds
Maximum Allowed Push/Pull (on Tool Housing)	75,000-pounds
Maximum Allowed Temperature (on Tool)	120-f
Maximum Allowed Shock (on Tool)	50-g (half sine wave)
Maximum Allowed Vibration (on Tool)	20-g up to 200-Hz
Maximum Allowed Mud Pressure (on Tool)	650-psi
Maximum Allowed Side Load (on Tool Housing)	33,000-pounds

Accuracy –

Azimuth	0.04°
Inclination	0.01°
Tool Face	0.02°

For additional information - http://www.drillguide.com

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ATTACHMENT

PARA TRACKER SYSTEM

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Vector Magnetics LLC
236 Cherry Street
Ithaca, New York 14850
607-273-8351 Fax: 607-273-6137

ParaTrack2 Survey and Guidance System Specifications

Downhole Survey Probe

Shock mounted triaxial accelerometers and magnetometers, temperature sensor and digitizing circuitry contained in 1.750 in. dia. x 55.3 in. long beryllium copper pressure barrel. Telemetry and power via wireline.

Temperature Rating:	85°C
Pressure Rating:	1200 bar
Survey Accuracy:	
Inclination:	±0.1°
Azimuth:	±0.4°
Toolface:	±0.5°
Maximum wireline length:	5000 meters

Interface Unit

Input:	85-265 VAC 50-60 HZ
Output:	48VDC, 50 mA

Guidance System

A single signal wire earthed at each end or with a return wire to close the loop.

Guidance Unit Input:	85-265 VAC 50-60 HZ
Guidance Unit Output:	34 VRMS, 6 Amps p-p max.
Position Accuracy:	±2% of separation from signal wire

Drillpipe and Borehole Pressure Module

(requires compatible survey probe)

Borehole gauge, 0-500 psi Full Scale, 1200 psi survival, 2400 psi burst
Drillpipe gauge, 0-2000 psi Full Scale, 6000 psi survival, 10000 psi burst
Non-linearity +/-0.1 %FS
Hysteresis +/-0.015 %FS
Repeatability +/-0.01 %FS

ATTACHMENT

PARA TRACK GYRO MODULE

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PGM

PARATRACK GYRO MODULE

IMMUNE TO MAGNETIC INTERFERENCE

The ParaTrack Gyro Module (PGM) is the latest in a long line of Vector Magnetics innovations for the HDD market. With no concern of magnetic interference from nearby active utility lines, shorepiles, ship traffic or other transportation activity, drilling may be carried out confidently, regardless of surrounding conditions.

The PGM runs in conjunction with the ParaTrack Steering Tool, providing the ability to tie in with the entire ParaTrack System of tools and software. The PGM is especially effective for initial surface entry, while absolute position may then be verified via the ParaTrack2 Guide Wire or Beacon Tracker, providing confidence that the bore is placed properly relative to the planned exit location prior to punch out.

Features

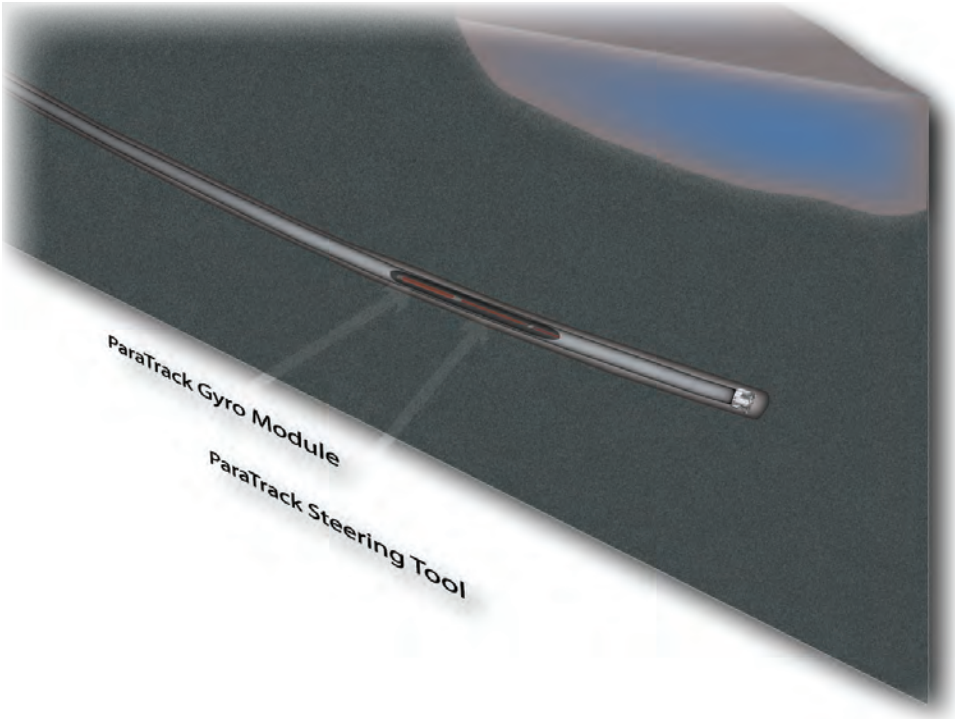
- Fiber optic north seeking gyro system
- Compatible with the entire ParaTrack line of Steering, Tracking and Surveying tools

Benefits

- Accurate surveying in cases of severe magnetic interference
- No specialized handling or personnel required
- Surveys immune from drillstring vibration

Applications

- Surveying in densely developed urban areas
- Verification and correction of magnetic azimuth in long unguided sections



Specifications

Outside Diameter: 2.75" (requires 3.5" collar)

Length: Head to foot - 48"

Internal Operating Temperature: 0-70C

Electrical Connection: 1-3/16", 12 tpi (standard wet connect)

Copyright © 2017 Vector Magnetics LLC

ATTACHMENT

TENSTEER TOOL

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TENSTEER DRILLER'S CONSOLE

- Features a 10.4" TFT color LCD with backlight that is sunlight readable
- Physical dimensions are 12.3" X 10.3" X 4.0"
- Weight is less than 12 lbs
- Operating temperature is –10° C to 70° C
- Internally protected against shock and vibration
- Sealed, metal construction that is resistant to dust, dirt and liquids
- 24V DC input power provided by Tensteer Steering Tool Receiver (STR)
- Inclination: Digital Display, ±90° range with 0.1° resolution
- Azimuth: Digital Display, 360° range with 0.1° resolution
- Tool Face: Digital Display, 360° range with 2.0° resolution
- Tool Face has magnetic and high side indicators
- Values for HTOT and GTOT are displayed
- Pipe and Annulus Pressure are capable of being displayed

For more information, contact Tensteer LLC at the following:

4245 Gattis School Rd Round Rock, TX 78664
Phone: 512-670-0447
Fax: 512-670-1070
Email: fred@tensteer.com
Website: www.tensteer.com

TENSTEER HIGH RESOLUTION STEERING TOOL PROBE

- Probe size: 1.75” diameter x 49” long
- Operating temperature: -20°C to 75°C
- Pressure rating: 12,000 psi
- Shock: 1000g, 0.5 msec, half sine
- Vibration: 30g peak, 30 to 500 Hz
- Maximum lateral displacement error: 2.6 ft. per 1000 ft. or a conical uncertainty of ±0.15°
- Survey resolution: 0.02°
- Magnetic resolution: <0.5 nT
- Power: 36 - 42 VDC, 70 mA
- Can track with DC power supply or welder
- Pressure and gamma upgradable
- Compatible with TrueGyde Software
- Can upgrade Tensor Probes

For more information, contact Tensteer LLC at the following:

4245 Gattis School Rd Round Rock, TX 78664
Phone: 512-670-0447
Fax: 512-670-1070
Email: fred@tensteer.com
Website: www.tensteer.com

TENSTEER STEERING TOOL RECEIVER (STR)

- Physical dimensions: 8.2″ X 8.3″ X 11″
- Weight: under 10 lbs
- Operating temperature: -20°C to 70°C
- Internal shock and vibration protection
- Powered by 110 VAC, 60Hz or 220 VAC 50 Hz, 60W max
- Three communication ports – USB, 9 Pin RS232, 25 Pin RS232
- Compatible with Tensor STDC and future Tensteer Driller's Consoles
- Wireline current shown on analog meter
- Power and data status shown on LED lamps

For more information, contact Tensteer LLC at the following:

4245 Gattis School Rd Round Rock, TX 78664
Phone: 512-670-0447
Fax: 512-670-1070
Email: fred@tensteer.com
Website: www.tensteer.com

ATTACHMENT

DAILY TRACKING FORMS

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Date:
Location:
Superintendent:

MICHELS®

FIELD REPORT

Tester Name
Michels Directional Crossings
817 W. Main Street, Brownsville, WI 53006
E-mail address

TIME	DENSITY "MUD WEIGHT" (lbs/gal)	FUNNEL VISCOSITY use Marsh funnel (sec/qt)	Solids/Sand Content (% by Vol)	pH	Comments

DRILL FLUID PRODUCT USED		DRILL FLUID HAULED OFF
Bentonite Type:	**Additives:**	
Drill-Terge:		

MICHELS DIRECTIONAL CROSSINGS
DAILY PROGRESS REPORT

DATE:
WEATHER:
PREPARED BY:
LOCATION: *ENTRY:* *EXIT:*

MICHELS JOB #

MICHELS®

	EMPLOYEE	CLASS	HOURS	
ENTRY SIDE				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.

	EMPLOYEE	CLASS	HOURS	
EXIT SIDE				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.

OPERATIONAL INFORMATION

CONDUCTOR CASING:	*Entry:*				
	Exit:				
HOLE SIZE / OPERATION:	*Entry Side*				
TOOL USED:					
TODAY's FOOTAGE:					
TOTAL FOOTAGE:					
% COMPLETED:					
COMPLETED PILOT HOLE:					

DRILLING FLUIDS INFORMATION

	ENTRY			EXIT	
BENTONITE TODAY:					Pallets
BENTONITE TO DATE:		Pallets			Pallets
WATER USED TODAY:					Gal.
WATER USED TOTAL:		Gal.			Gal.
LOSE CIRCULATION TODAY:					
VAC TRUCKS HAULED TODAY:		Ea.			Ea.
DISPOSAL VOLUME TODAY:		Gal.			
DISPOSAL VOLUME TOTAL:		Gal.			Gal.
DUMP TRUCKS TODAY:		Ea.			Ea.
SOLIDS DISPOSED TODAY:		Yds.			Yds.
SOLIDS DISPOSED TOTAL:		Yds.			Yds.

SUMMARY OF DAILY ACTIVITIES AND PROGRESS:

MICHELS®

PROJECT:
LOCATION:
JOB #:
SHEET #:

DATE	SURVEY #	MD	INC	FINAL AZI	HTOTAL	DIP	P2 ELEV	P2 RT	CALC STATION	CALC ELEV	CALC RIGHT	3 JOINT INC RADIUS	3 JOINT AZI RADIUS

MICHELS®

ATTACHMENT

BENTONITE BRANDS
PRODUCT DATA SHEETS

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MAX GEL ™

Certified to ANSI/NSF 60

MAX GEL viscosifier is a premium Wyoming bentonite blended with special extenders producing a viscosifier that will yield more than twice as much viscosity as regular Wyoming bentonite. MAX GEL is a high-yielding, easily mixed, superior mud making bentonite in fresh water.

APPLICATIONS

MAX GEL is used in the following applications to rapidly build mud viscosity and provide superior hole cleaning, as well as to help control lost circulation, formation sloughing and promote hole stability in unconsolidated formations.

- Potable water wells
- Mineral exploration (coring and rotary drilling)
- Horizontal directional drilling
- Blast holes
- Shaft drilling
- Monitor / observation wells
- Gel-foam air drilling applications

ADVANTAGES

- Yields more quickly than API-standard bentonite
- Non-toxic and proven suitable for use in drilling potable water wells
- Increased penetration rates are exhibited due to lower solids content than regular bentonite systems
- Transportation and storage costs are reduced due to lower treatment requirements as compared to bentonite

TYPICAL AMOUNTS OF MAX GEL ADDITIONS ADDED TO FRESH WATER

Drilling Application/Desired Results	lb/100gal	lb/bbl	kg/m3
Normal drilling	15 - 25	6 - 11	15 - 30
In gravel or other poorly consolidated formation	25 - 40	12 - 18	35 - 50
Lost circulation control	35 - 45	15 - 20	40 - 45
Added to freshwater mud to improve hole cleaning properties, increase hole stability and develop filter cakes	5 - 10	2 - 5	6 - 14

LIMITATIONS

- Loses effectiveness in water containing >7500 mg/l sodium chloride / 240 mg/l calcium
- If dispersants or thinners are to be used, they should be added sparingly, using 50% or less of the normal treatment

TYPICAL PHYSICAL PROPERTIES

Physical appearance..... Light tan / gray – green powder
Specific gravity ..... 2.3 - 2.5
Approximate yield..... 220 bbl/ton

TOXICITY AND HANDLING

Bioassay information available upon request. No special requirements are necessary for handling and storage. Avoid inhalation of dust. A dust respirator and goggles are recommended if mixing in an enclosed area.

PACKAGING AND STORAGE

MAX GEL is packaged in 50 lb. (22.7-kg), multi-wall, paper sacks and is available in bulk. Store in a dry location (slip hazard when wet) and minimize dust (use dust-less systems for handling, storage and cleanup).

This material is supplied solely for informational purposes and M-I L.L.C. makes no guarantees or warranties, either expressed or implied, with respect to the accuracy or use of this data. All product warranties and guarantees shall be governed by the Standard Terms of Sale.

MATERIAL SAFETY DATA SHEET
MAX GEL

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

TRADE NAME: MAX GEL

OTHER NAME: Bentonite

CHEMICAL CLASS: Naturally occuring mineral.

APPLICATIONS: Oil well drilling fluid additive. Viscosifier.

EMERGENCY TELEPHONE: 281-561-1600

SUPPLIER: Supplied by a Business Unit of
M-I L.L.C.
P.O. Box 42842, Houston, Texas 77242-2842
See cover sheet for local supplier.

TELEPHONE: 281-561-1509
FAX: 281-561-7240

CONTACT PERSON: Sam Hoskin - Manager, Occupational Health

2. COMPOSITION, INFORMATION ON INGREDIENTS

INGREDIENT NAME:	CAS No.:	CONTENTS :	EPA RQ:	TPQ:
Silica, crystalline, quartz	14808-60-7	2-15 %		
Bentonite	1302-78-9	70-95 %		
Silica, crystalline, Cristobalite	14464-46-1	2-12 %		
Silica, crystalline, Tridymite	15468-32-3	1-5 %		
Gypsum	13397-24-5	0-1 %		

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW:

CAUTION! MAY CAUSE EYE, SKIN AND RESPIRATORY TRACT IRRITATION. Avoid contact with eyes, skin and clothing. Avoid breathing airborne product. Keep container closed. Use with adequate ventilation. Wash thoroughly after handling.

This product is a/an gray to tan powder. Slippery when wet. No significant immediate hazards for emergency response personnel are known.

ACUTE EFFECTS:

HEALTH HAZARDS, GENERAL:

Particulates may cause mechanical irritation to the eyes, nose, throat and lungs. Particulate inhalation may lead to pulmonary fibrosis, chronic bronchitis, emphysema and bronchial asthma. Dermatitis and asthma may result from short contact periods.

INHALATION: May be irritating to the respiratory tract if inhaled.

INGESTION: May cause gastric distress, nausea and vomiting if ingested.

SKIN: May be irritating to the skin.

EYES: May be irritating to the eyes.

CHRONIC EFFECTS:
CARCINOGENICITY:

IARC: Not listed. NTP: Not listed. OSHA: Not regulated.

ATTENTION! CANCER HAZARD. CONTAINS CRYSTALLINE SILICA WHICH CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.

IARC Monographs, Vol. 68, 1997, concludes that there is sufficient evidence that inhaled crystalline silica in the form of quartz or cristobalite from occupational sources causes cancer in humans. IARC classification Group 1.

ROUTE OF ENTRY:

Inhalation. Skin and/or eye contact.

TARGET ORGANS:

Respiratory system, lungs. Skin. Eyes.

4. FIRST AID MEASURES

GENERAL: Persons seeking medical attention should carry a copy of this SDS with them.

INHALATION: Move the exposed person to fresh air at once. Perform artificial respiration if breathing has stopped. Get medical attention.

INGESTION: Drink a couple of glasses water or milk. Do not give victim anything to drink of he is unconscious. Get medical attention.

SKIN: Wash skin thoroughly with soap and water. Remove contaminated clothing. Get medical attention if any discomfort continues.

EYES: Promptly wash eyes with lots of water while lifting the eye lids. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

5. FIRE FIGHTING MEASURES

AUTO IGNITION TEMP. (?F): N/D
FLAMMABILITY LIMIT - LOWER(%): N/D
FLAMMABILITY LIMIT - UPPER(%): N/D

EXTINGUISHING MEDIA:

This material is not combustible. Use extinguishing media appropriate for surrounding fire.

SPECIAL FIRE FIGHTING PROCEDURES:

No specific fire fighting procedure given.

UNUSUAL FIRE & EXPLOSION HAZARDS:

No unusual fire or explosion hazards noted.

HAZARDOUS COMBUSTION PRODUCTS:

Not relevant.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS:

Wear proper personal protective equipment (see SDS Section 8).

SPILL CLEAN-UP PROCEDURES:

Avoid generating and spreading of dust. Shovel into dry containers. Cover and move the containers. Flush the area with water. Do not contaminate drainage or waterways. Repackage or recycle if possible.

7. HANDLING AND STORAGE

HANDLING PRECAUTIONS:

Avoid handling causing generation of dust. Wear full protective clothing for prolonged exposure and/or high concentrations. Eye wash and emergency shower must be available at the work place. Wash hands often and change clothing when needed. Provide good ventilation. Mechanical ventilation or local exhaust ventilation is required.

STORAGE PRECAUTIONS:

Store at moderate temperatures in dry, well ventilated area. Keep in original container.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

		OSHA PEL:		ACGIH TLV:		OTHER:		
INGREDIENT NAME:	**CAS No.:**	**TWA:**	**STEL:**	**TWA:**	**STEL:**	**TWA:**	**STEL:**	**UNITS:**
Silica, crystalline, quartz	14808-60-7	*		0.1				mg/m3 resp.dust
Bentonite	1302-78-9	5		3				mg/m3 resp.dust
Silica, crystalline, Cristobalite	14464-46-1	*		0.05				mg/m3 resp.dust
Silica, crystalline, Tridymite	15468-32-3	*		0.05				mg/m3 resp.dust
Gypsum	13397-24-5	15						mg/m3 total dust

INGREDIENT COMMENTS:

* OSHA PELs for Mineral Dusts containing crystalline silica are 10 mg/m3 / (%SiO2+2) for quartz and 1/2 the calculated quartz value for cristobalite and tridymite.

PROTECTIVE EQUIPMENT:

ENGINEERING CONTROLS:

Use appropriate engineering controls such as, exhaust ventilation and process enclosure, to reduce air contamination and keep worker exposure below the applicable limits.

VENTILATION: Supply natural or mechanical ventilation adequate to exhaust airborne product and keep exposures below the applicable limits.

RESPIRATORS: Use at least a NIOSH-approved N95 half-mask disposable or reuseable particulate respirator. In work environments containing oil mist/aerosol use at least a NIOSH-approved P95 half-mask disposable or reuseable particulate respirator. For exposures exceeding 10 x PEL use a NIOSH-approved N100 Particulate Respirator.

PROTECTIVE GLOVES:

Use suitable protective gloves if risk of skin contact.

EYE PROTECTION:

Wear dust resistant safety goggles where there is danger of eye contact.

PROTECTIVE CLOTHING:

Wear appropriate clothing to prevent repeated or prolonged skin contact.

HYGIENIC WORK PRACTICES:
Wash promptly with soap and water if skin becomes contaminated. Change work clothing daily if there is any possibility of contamination.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE/PHYSICAL STATE:	Powder, dust.
COLOR:	Grey. to Tan.
ODOR:	Odorless or no characteristic odor.
SOLUBILITY DESCRIPTION:	Insoluble in water.
DENSITY/SPECIFIC GRAVITY (g/ml):	2.3-2.6 TEMPERATURE (?F): 68
BULK DENSITY:	67 lb/ft3; 1068 kg/m3
VAPOR DENSITY (air=1):	N/A
VAPOR PRESSURE:	N/A TEMPERATURE (?F):

10. STABILITY AND REACTIVITY

STABILITY: Normally stable.

CONDITIONS TO AVOID:
N/A.

HAZARDOUS POLYMERIZATION:
Will not polymerize.

POLYMERIZATION DESCRIPTION:
Not relevant.

MATERIALS TO AVOID:
N/A

HAZARDOUS DECOMPOSITION PRODUCTS:
No specific hazardous decomposition products noted.

11. TOXICOLOGICAL INFORMATION

TOXICOLOGICAL INFORMATION:
No toxicological data is available for this product.

12. ECOLOGICAL INFORMATION

ECOLOGICAL INFORMATION:
Contact M-I Environmental Affairs for ecological information.

13. DISPOSAL CONSIDERATIONS

WASTE MANAGEMENT:
This product does not meet the criteria of a hazardous waste if discarded in its purchased form. Under RCRA, it is the responsibility of the user of the product to determine at the time of disposal, whether the product meets RCRA criteria for hazardous waste. This is because product uses, transformations, mixtures, processes, etc, may render the resulting materials hazardous. Empty containers retain residues. All labeled precautions must be observed.

DISPOSAL METHODS:

Recover and reclaim or recycle, if practical. Should this product become a waste, dispose of in a permitted industrial landfill. Ensure that containers are empty by RCRA criteria prior to disposal in a permitted industrial landfill.

14. TRANSPORT INFORMATION

PRODUCT RQ: N/A

U.S. DOT:
U.S. DOT CLASS: Not regulated.

CANADIAN TRANSPORT:
TDGR CLASS: Not regulated.

SEA TRANSPORT:
IMDG CLASS: Not regulated.

AIR TRANSPORT:
ICAO CLASS: Not regulated.

15. REGULATORY INFORMATION

REGULATORY STATUS OF INGREDIENTS:

NAME:	CAS No:	TSCA:	CERCLA:	SARA 302:	SARA 313:	DSL(CAN):
Silica, crystalline, quartz	14808-60-7	Yes	No	No	No	Yes
Bentonite	1302-78-9	Yes	No	No	No	Yes
Silica, crystalline, Cristobalite	14464-46-1	Yes	No	No	No	Yes
Silica, crystalline, Tridymite	15468-32-3	Yes	No	No	No	Yes
Gypsum	13397-24-5	Yes	No	No	No	Yes

US FEDERAL REGULATIONS:
WASTE CLASSIFICATION: Not a hazardous waste by U.S. RCRA criteria. See Section 13.

REGULATORY STATUS: This Product or its components, if a mixture, is subject to following regulations (Not meant to be all inclusive - selected regulations represented):

SECTION 313: This product does not contain toxic chemical subject to the reporting requirements of Section 313 of Title III of the Superfund Amendment and Reauthorization Act of 1986 and 40 CFR Part 372.

SARA 311 Categories:
1: Immediate (Acute) Health Effects.
2. Delayed (Chronic) Health Effects.

The components of this product are listed on or are exempt from the following international chemical registries:
TSCA (U.S.)
DSL (Canada)
EINECS (Europe)

STATE REGULATIONS:

STATE REGULATORY STATUS:

This product or its components, if a mixture, is subject to following regulations (Not meant to be all inclusive - selected regulations represented):.

None.

PROPOSITION 65: This product contains the following chemical(s) considered by the State of California's Safe Drinking Water and Toxic Enforcement Act of 1986 as causing cancer or reproductive toxicity, and for which warnings are now required: Silica, crystalline

CANADIAN REGULATIONS:
LABELS FOR SUPPLY:

REGULATORY STATUS:

This Material Safety Data Sheet has been prepared in compilance with the Controled Product Regulations.

Canadian WHMIS Classification: D2A - Other Toxic Effects: Very Toxic Material

16. OTHER INFORMATION

NPCA HMIS HAZARD INDEX: * 1 Slight Hazard
FLAMMABILITY: 0 Minimal Hazard
REACTIVITY: 0 Minimal Hazard
NPCA HMIS PERS. PROTECT. INDEX: E - Safety Glasses, Gloves, Dust Respirator

USER NOTES:

N/A = Not applicable N/D = Not determined

INFORMATION SOURCES:

OSHA Permissible Exposure Limits, 29 CFR 1910, Subpart Z, Section 1910.1000, Air Contaminants.

ACGIH Threshold Limit Values and Biological Exposure Indices for Chemical Substances and Physical Agents (latest edition).

Sax's Dangerous Properties of Industrial Materials, 9th ed., Lewis, R.J. Sr., (ed.), VNR, New York, New York, (1997).

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans, Silica, Some Silicates, Coal Dust, and para-Aramid Fibrils, Vol. 68, World Health Organization, Lyon, France, 1997.
Product information provided by the commercial vendor(s).

PREPARED BY: Sam Hoskin/bb

REVISION No.: 0

SDS STATUS: Approved.

DATE: June 1, 1999

DISCLAIMER:

SDS furnished independent of product sale. While every effort has been made to accurately describe this product, some of the data are obtained from sources beyond our direct supervision. We cannot make any assertions as to its reliability or completeness; therefore, user may rely on it only at user's risk. We have made no effort to censor or conceal deleterious aspects of this product. Since we cannot anticipate or control the conditiions under which this information and product may be used, we make no guarantee that the precautions we have suggested will be adequate for all individuals and/or situations. It is the obligation of each user of this product to comply with the requirements of all applicable laws regarding use and disposal of this product. Additional information will be furnished upon request to assist the user; however, no warranty, either expressed or implied, nor liability of any nature with respect to this product or to the data herein is made or incurred hereunder.

Water Well Drilling &
Mineral Exploration Products

AMERICAN Colloid Company
Water/Mineral Division

Super Gel-X
High Yield Bentonite

DESCRIPTION:

- Super Gel-X is a 200 mesh, high viscosity 200-bbl yield, sodium bentonite for use in all freshwater drilling conditions.

RECOMMENDED USE:

- May be used for all types of freshwater mud rotary drilling.

CHARACTERISTICS:

- Highly concentrated for maximum yield.
- Fast and easy mixing.
- Reduces solids and increases lifting power.
- Removes cuttings.
- Cools and lubricates bit.
- Stabilizes bore holes.

MIXING AND APPLICATION:

- Mixing ratios are based on 200-bbl yield material using freshwater. Level of water purity will affect bentonite performance.

- Super Gel-X mixing ratio in lbs. per 100 gallons of water:

  Normal conditions ..... 15 to 25 lbs.
  Sand and gravel ..... 25 to 35 lbs.
  Fluid loss controls ..... 35 to 40 lbs.

PACKAGING:

- 50 pound, multi-wall, non-tear, waterproof bags, 48 bags per pallet, and all pallets are stretch-wrapped.

1500 W. Shure Drive **Arlington Heights, IL 60004** **1434-(3112) 392-4600**

The information and data contained herein are believed to be accurate and reliable. American Colloid Company makes no warranty of any kind and accepts no responsibility for the results obtained through this application of this information.

MATERIAL SAFETY DATA SHEET

May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

PRODUCT NAME: SUPER GEL-X™

Section I MANUFACTURER'S INFORMATION

MANUFACTURER'S NAME & ADDRESS:

CETCO – *Drilling Products Group*
1500 West Shure Drive
Arlington Heights, IL 60004

Date Prepared: June 1, 2002

Telephone Number: 847-392-5800 Fax 847-506.6150
EMERGENCY CONTACT: CHEMTREC 800-424-9300
E-mail: www.cetco.com

Section II HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

HAZARDOUS COMPONENTS: (Specific Chemical Identity: Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Crystalline Quartz: CAS# 14808-60-7			*	< 6%
Respirable Crystalline Quartz:			NIOSH	< 2%
Present (TWA)	0.1 mg/m^3	0.1 mg/m^3	50 ug/m^3	
Proposed (TWA)		50.0 ug/m^3		
Nuisance Dust:				
Respirable	5 mg/m^3	5 mg/m^3		
Total Dust	15 mg/m^3	10 mg/m^3		

*** WARNING:** This product contains a small amount of crystalline silica, which may cause delayed respiratory disease if inhaled over a prolonged period of time. Avoid breathing dust. Use NIOSH/MSHA approved respirator where TLV for crystalline silica (Quartz) may be exceeded. IARC Monographs on the evaluation of the Carcinogenic Risk of Chemicals to Humans (volume 68, 1997) concludes that crystalline silica is carcinogenic to humans in the form of quartz. IARC classification 1.

The small quantities of crystalline silica (quartz) found in this product are, under normal conditions, naturally coated with an unremovable layer of amorphous silica and/or bentonite clay. IARC (vol. 68, 1997, pg. 191-192) has stated that crystalline silica (quartz) can differ in toxicity depending on the minerals with which it is combined, citing studies in IARC (vol. 42, 1987, p. 86) which stated that the toxic effect of crystalline silica (quartz) is reduced by the "protective effect...due mainly to clay minerals..."

National Institute for Occupational Safety and Health (NIOSH) has recommended that the permissible exposure limit be changed to 50 micrograms respirable free silica per cubic meter of air (0.05 mg/ m^3) as determined by a full shift sample up to a 10 hour working day, 40 hours per week. *See*: 1974 NIOSH criteria for a recommended Standard for Occupational Exposure to Crystalline Silica should be consulted for more detailed information.

PEL - OSHA Permissible Exposure Limit.

TLV - American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value.

TWA - 8 hour time weighted average

Note: The Permissible Exposure Limits (PEL) reported above are the pre - 1989 limits that were reinstated by OSHA June 30, 1993 following a decision by the United States Circuit Court of Appeals for the 11th Circuit. Federal OSHA is now enforcing these PELs. More restrictive exposure limits may be enforced by some other jurisdictions.

PRODUCT IDENTIFICATION:

Chemical Name: Dry Mixture of Inorganic Mineral Compounds.
NFPA/HMIS: Health - 2, Fire - 0, Reactivity - 0, Specific Hazard - *See Section VI.*
Shipping Class: Not Regulated (DOT / 49CFR, IMDG, ICAO / IATA).

Section III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point: Not Applicable.
Vapor Pressure (mm Hg.)**:** Not Applicable.
Vapor Density (AIR = 1)**:** Not Applicable.
Solubility in Water: Negligible.
Specific Gravity (H_2O = 1)**:** 2.5
Melting Point: 1400°F
Evaporation Rate (Butyl Acetate = 1)**:** Not Applicable.
Appearance and Odor: Tan or beige to light gray colored powder to fine granules, odorless.

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PRODUCT NAME: SUPER GEL-X™

Section IV FIRE AND EXPLOSION HAZARD DATA

Flash Point (*Method Used*)**:** Not Available. **Flammable Limits:** Not Available. **LEL** - NA. **UEL** - NA.
Extinguishing Media: Not Applicable. **Special Fire Fighting Procedure:** Not Applicable.
Unusual Fire/Explosion Hazards: Product may pose possible dust explosion under *extremely rare* circumstances or conditions.

Section V REACTIVITY DATA

Stability: Stable **Conditions to Avoid** - None Known.
Incompatibility (*Materials to Avoid*)**:** Powerful oxidizing agents such as fluorine, chlorine trifluoride, manganese trioxide, etc.
Hazardous Decomposition or By-products: Silica will dissolve in hydrofluoric acid producing a corrosive gas, silicon tetrafluoride.
Hazardous Polymerization: Will Not Occur **Conditions to Avoid** - None Known.

Section VI HEALTH HAZARD DATA

Route(s) of Entry: Inhalation? Yes Skin? No Ingestion? No
Health Hazards (Acute and Chronic):

Inhalation: Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may have the following serious chronic health effects:
Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness and reduced pulmonary function. Smoking exacerbates this disease. Individuals with silicosis are predisposed to develop tuberculosis.
Cancer Status: The International Agency for Research on Cancer has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1 - carcinogenic to humans). Refer to *IARC Monograph 68, Silica, Some Silicates and Organic Fibers* (published in June 1997) in conjunction with the use of these
materials. The National Toxicology Program classifies respirable crystalline silica as "reasonably anticipated to be a carcinogen". For further information *See*: "Adverse effects of Crystalline Silica Exposure" published by the American Thoracic Society Medical Section of the American Lung Association, American Journal of Respiratory and Critical Care Medicine, Volume 155, page 761-765, 1997.

Other Data with Possible Relevance to Human Health: The small quantities of crystalline silica (quartz) found in this product are, under normal conditions, naturally coated with an unremovable layer of amorphous silica and/or bentonite clay. IARC (Vol. 68, 1997, pg. 191-192) has stated that crystalline silica (quartz) can differ in toxicity depending on the minerals with which it is combined, citing studies in IARC (Vol. 42, 1987 pg. 86) which stated that the toxic effect of crystalline silica (quartz) is reduced by the "protective effect....due mainly to clay minerals..."

Carcinogenicity: NTP? No IARC Monographs? Yes OSHA Regulated? No

Signs and Symptoms of Exposure: Excessive inhalation of generated dust may result in shortness of breath and reduced pulmonary function.

Medical Conditions Generally Aggravated by Exposure: Individuals with respiratory disease, including but not limited to, asthma and bronchitis, or subject to eye irritation should not be exposed to respirable crystalline silica (quartz) dust.

Emergency and First Aid Procedures:
Eyes & Skin: Flush with water.
Gross Inhalation of Dust: Remove to fresh air; give oxygen or artificial respiration if necessary; seek medical attention.
Ingestion: If large amounts are swallowed, get immediate medical attention.

Section VII PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken in Case Material is Released or Spilled: Vacuum if possible to avoid generating airborne dust. Avoid breathing dust. Wear an approved respirator. Avoid adding water; product will become slippery when wet.
Waste Disposal Method: Bury in an approved sanitary landfill, in accordance with federal, state and local regulations.
Precautions to Be Taken in Handling and Storing: Avoid breathing dust, use NIOSH/MSHA approved respirator where TLV limits for Crystalline Silica may be exceeded.
Other Precautions: Slippery when wet.

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PRODUCT NAME: SUPER GEL-X™

Section VIII CONTROL MEASURES

Respiratory Protection: Use appropriate respiratory protection for respirable particulate based on consideration of airborne workplace concentration and duration of exposure arising from intended end use. Refer to the most recent standards of ANSI (z88.2) OSHA (29 CFR 1910.134), MSHA (30 CFR Parts 56 and 57) and NIOSH Respirator Decision Logic.

Ventilation: Use local exhaust as required to maintain exposures below applicable occupational exposure limits (*See Section II*). See also ACGIH "Industrial Ventilation – A Manual for Recommend Practice", (*current edition*).

Protective Gloves: Not Required. **Eye Protection:** Recommended.

Other Protective Clothing or Equipment: None. **Work/Hygienic Practices:** Use good housekeeping practices.

Section IX REGULATORY INFORMATION

SARA 311/312: Hazard Categories for SARA Section 311/312 Reporting: Chronic Health
SARA 313: This product contains the following chemicals subject to annual release reporting requirements under the SARA section 313 (40 CFR 372): None

CERCLA section 103 Reportable Quantity: None

California Proposition 65: *This product contains the following substances known to the state of California to cause cancer and/or reproductive harm: This product contains crystalline silica (respirable); however, the user should note that the small quantities of crystalline silica (quartz) found in this product are, under normal conditions, naturally coated with an unremovable layer of amorphous silica and/or bentonite clay. IARC (Vol. 68, 1997, pg. 191-192) has stated that crystalline silica (quartz) can differ in toxicity depending on the minerals with which it is combined. Citing studies in IARC (Vol. 42, 1987, p. 86) which stated that the toxic effect of crystalline silica (quartz) is reduced by the "protective effect....due mainly to clay minerals...".*

Toxic Substances Control Act: All of the components of this product are listed on the EPA TSCA Inventory or are exempt from notification requirements.

Canadian Environmental Protection Act: All the components of this product are listed on the Canadian Domestic Substances List or exempt from notification requirements.

European Inventory of Commercial Chemical Substances: All the components of this product are listed on the EINECS Inventory or exempt from notification requirements. (The EINECS number for Quartz: 231-545-5)
European Community Labeling Classification: Harmful (Xn)
European Community Risk and Safety Phrases: R40, R48, S22

Japan MITI: All the components of this product are existing chemical substances as defined in the Chemical Substance Control Law.

Australian Inventory of Chemical Substances: All the components of this product are listed on the AICS Inventory or exempt from notification requirements.

Canadian WHMIS Classification: Class D, Division 2, Subdivision A (Very Toxic Material causing other Toxic Effects)

NF-+PA Hazard Rating: Health: 2 Fire: 0 Reactivity: 0
HMIS Hazard Rating: Health: * Fire: 0 Reactivity: 0

***Warning** - Chronic health effect possible - inhalation of silica dust may cause lung injury/disease (silicosis). Take appropriate measures to avoid breathing dust. *See Section II*.

REFERENCES:

Registry for Toxic Effects of Chemical Substances (RTECS), 1995.

Patty's Industrial Hygiene and Toxicology.

NTP Seventh Annual Report on Carcinogens, 1994.

IARC Monograph Volume 68, Silica, Some Silicates and Organic Fibers, 1997.

The information herein has been compiled from sources believed to be reliable and is accurate to the best of our knowledge. However, CETCO cannot give any guarantees regarding information from other sources, and expressly does not make any warranties, nor assumes any liability, for its use.

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MATERIAL SAFETY DATA SHEET

Product Trade Name: **BARA-KADE® BENTONITE**

Revision Date: 31-Mar-2005

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Trade Name: BARA-KADE® BENTONITE
Synonyms: None
Chemical Family: Mineral
Application: Additive

Manufacturer/Supplier

BPM Minerals LLC
3000 N Sam Houston Parkway East
Houston, TX 77032

Telephone: (281) 871-7900
Fax: (281) 871-7940
Emergency Telephone: (800) 666-9260 or (713) 753-3000

Prepared By

Chemical Compliance
Telephone: 1-580-251-4335

2. COMPOSITION/INFORMATION ON INGREDIENTS

SUBSTANCE	CAS Number	PERCENT	ACGIH TLV-TWA	OSHA PEL-TWA
Crystalline silica, cristobalite	14464-46-1	0 - 1%	0.05 mg/m^3	1/2 x $\frac{10 \text{ mg/m}^3}{\%SiO2 + 2}$
Crystalline silica, tridymite	15468-32-3	0 - 1%	0.05 mg/m^3	1/2 x $\frac{10 \text{ mg/m}^3}{\%SiO2 + 2}$
Crystalline silica, quartz	14808-60-7	1 - 5%	0.05 mg/m^3	$\frac{10 \text{ mg/m}^3}{\%SiO2 + 2}$
Bentonite	1302-78-9	60 - 100%	Not applicable	Not applicable

More restrictive exposure limits may be enforced by some states, agencies, or other authorities.

3. HAZARDS IDENTIFICATION

Hazard Overview

CAUTION! - ACUTE HEALTH HAZARD
May cause eye and respiratory irritation.

DANGER! - CHRONIC HEALTH HAZARD
Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposures below recommended exposure limits. Wear a NIOSH certified, European Standard EN 149, or equivalent respirator when using this product. Review the Material Safety Data Sheet (SDS) for this product, which has been provided to your employer.

4. FIRST AID MEASURES

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Skin Wash with soap and water. Get medical attention if irritation persists.

Eyes In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Ingestion Under normal conditions, first aid procedures are not required.

Notes to Physician Treat symptomatically.

5. FIRE FIGHTING MEASURES

Flash Point/Range (F):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (F):	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined

Fire Extinguishing Media All standard firefighting media.

Special Exposure Hazards Not applicable.

Special Protective Equipment for Fire-Fighters Not applicable.

NFPA Ratings: Health 0, Flammability 0, Reactivity 0
HMIS Ratings: Flammability 0, Reactivity 0, Health 0*

6. ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures Use appropriate protective equipment. Avoid creating and breathing dust.

Environmental Precautionary Measures None known.

Procedure for Cleaning / Absorption Collect using dustless method and hold for appropriate disposal. Consider possible toxic or fire hazards associated with contaminating substances and use appropriate methods for collection, storage and disposal.

7. HANDLING AND STORAGE

Handling Precautions This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposure below recommended exposure limits. Wear a NIOSH certified, European Standard En 149, or equivalent respirator when using this product. Material is slippery when wet.

Storage Information Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits listed in Section 2.

Respiratory Protection Wear a NIOSH certified, European Standard EN 149, or equivalent respirator when using this product.

Hand Protection Normal work gloves.

Skin Protection Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.

Eye Protection Wear safety glasses or goggles to protect against exposure.

Other Precautions None known.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid
Color:	Various
Odor:	Odorless
pH:	8-10
Specific Gravity @ 20 C (Water=1):	2.65
Density @ 20 C (lbs./gallon):	Not Determined
Bulk Density @ 20 C (lbs/ft3):	50-70
Boiling Point/Range (F):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (F):	Not Determined
Freezing Point/Range (C):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Insoluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (lbs./gallon):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistrokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data: Stable

Hazardous Polymerization: Will Not Occur

Conditions to Avoid	None anticipated
Incompatibility (Materials to Avoid)	Hydrofluoric acid.
Hazardous Decomposition Products	Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	Eye or skin contact, inhalation.
Inhalation	Inhaled crystalline silica in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (IARC, Group 1). There is sufficient evidence in experimental animals for the carcinogenicity of tridymite (IARC, Group 2A). Breathing silica dust may cause irritation of the nose, throat, and respiratory passages. Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may also have serious chronic health effects (See "Chronic Effects/Carcinogenicity" subsection below).
Skin Contact	May cause mechanical skin irritation.
Eye Contact	May cause eye irritation.
Ingestion	None known
Aggravated Medical Conditions	Individuals with respiratory disease, including but not limited to asthma and bronchitis, or subject to eye irritation, should not be exposed to quartz dust.
Chronic Effects/Carcinogenicity	Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis. Cancer Status: The International Agency for Research on Cancer (IARC) has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources can cause lung cancer in humans (Group 1 - carcinogenic to humans) and has determined that there is sufficient evidence in experimental animals for the carcinogenicity of tridymite (Group 2A - possible carcinogen to humans). Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997) in conjunction with the use of these minerals. The National Toxicology Program classifies respirable crystalline silica as "Known to be a human carcinogen". Refer to the 9th Report on Carcinogens (2000). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies crystalline silica, quartz, as a suspected human carcinogen (A2). There is some evidence that breathing respirable crystalline silica or the disease silicosis is associated with an increased incidence of significant disease endpoints such as scleroderma (an immune system disorder manifested by scarring of the lungs, skin, and other internal organs) and kidney disease.

Other Information For further information consult "Adverse Effects of Crystalline Silica Exposure" published by the American Thoracic Society Medical Section of the American Lung Association, American Journal of Respiratory and Critical Care Medicine, Volume 155, pages 761-768 (1997).

Toxicity Tests

Oral Toxicity: Not determined

Dermal Toxicity: Not determined

Inhalation Toxicity: Not determined

Primary Irritation Effect: Not determined

Carcinogenicity Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997).

Genotoxicity: Not determined

Reproductive / Developmental Toxicity: Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air) Not determined

Persistence/Degradability Not determined

Bio-accumulation Not Determined

Ecotoxicological Information

Acute Fish Toxicity: TLM96: 10000 ppm (Oncorhynchus mykiss)
Acute Crustaceans Toxicity: Not determined
Acute Algae Toxicity: Not determined

Chemical Fate Information Not determined

Other Information Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method Bury in a licensed landfill according to federal, state, and local regulations.

Contaminated Packaging Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Land Transportation

DOT
Not restricted

Canadian TDG
Not restricted

ADR Not restricted

Air Transportation

ICAO/IATA Not restricted

Sea Transportation

IMDG
Not restricted

Other Shipping Information

Labels: None

15. REGULATORY INFORMATION

US Regulations

US TSCA Inventory	All components listed on inventory.
EPA SARA Title III Extremely Hazardous Substances	Not applicable
EPA SARA (311,312) Hazard Class	Acute Health Hazard Chronic Health Hazard
EPA SARA (313) Chemicals	This product does not contain a toxic chemical for routine annual "Toxic Chemical Release Reporting" under Section 313 (40 CFR 372).
EPA CERCLA/Superfund Reportable Spill Quantity For This Product	Not applicable.
EPA RCRA Hazardous Waste Classification	If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.
California Proposition 65	The California Proposition 65 regulations apply to this product.
MA Right-to-Know Law	One or more components listed.
NJ Right-to-Know Law	One or more components listed.
PA Right-to-Know Law	One or more components listed.

Canadian Regulations

Canadian DSL Inventory	All components listed on inventory.
WHMIS Hazard Class	D2A Very Toxic Materials (Crystalline silica)

16. OTHER INFORMATION

The following sections have been revised since the last issue of this SDS
Not applicable

Additional Information

For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Material Safety Data Sheet for this or other Halliburton products, contact Chemical Compliance at 1-580-251-4335.

Disclaimer Statement

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

*****END OF SDS*****

MATERIAL SAFETY DATA SHEET

Product Trade Name: **BARA-KADE® BENTONITE**

Revision Date: 31-Mar-2005

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Trade Name: BARA-KADE® BENTONITE
Synonyms: None
Chemical Family: Mineral
Application: Additive

Manufacturer/Supplier

BPM Minerals LLC
3000 N Sam Houston Parkway East
Houston, TX 77032

Telephone: (281) 871-7900
Fax: (281) 871-7940
Emergency Telephone: (800) 666-9260 or (713) 753-3000

Prepared By

Chemical Compliance
Telephone: 1-580-251-4335

2. COMPOSITION/INFORMATION ON INGREDIENTS

SUBSTANCE	CAS Number	PERCENT	ACGIH TLV-TWA	OSHA PEL-TWA
Crystalline silica, cristobalite	14464-46-1	0 - 1%	0.05 mg/m^3	1/2 x $\frac{10 \text{ mg/m}^3}{\%SiO2 + 2}$
Crystalline silica, tridymite	15468-32-3	0 - 1%	0.05 mg/m^3	1/2 x $\frac{10 \text{ mg/m}^3}{\%SiO2 + 2}$
Crystalline silica, quartz	14808-60-7	1 - 5%	0.05 mg/m^3	$\frac{10 \text{ mg/m}^3}{\%SiO2 + 2}$
Bentonite	1302-78-9	60 - 100%	Not applicable	Not applicable

More restrictive exposure limits may be enforced by some states, agencies, or other authorities.

3. HAZARDS IDENTIFICATION

Hazard Overview

CAUTION! - ACUTE HEALTH HAZARD
May cause eye and respiratory irritation.

DANGER! - CHRONIC HEALTH HAZARD
Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposures below recommended exposure limits. Wear a NIOSH certified, European Standard EN 149, or equivalent respirator when using this product. Review the Material Safety Data Sheet (SDS) for this product, which has been provided to your employer.

4. FIRST AID MEASURES

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Skin Wash with soap and water. Get medical attention if irritation persists.

Eyes In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Ingestion Under normal conditions, first aid procedures are not required.

Notes to Physician Treat symptomatically.

5. FIRE FIGHTING MEASURES

Flash Point/Range (F):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (F):	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined

Fire Extinguishing Media All standard firefighting media.

Special Exposure Hazards Not applicable.

Special Protective Equipment for Fire-Fighters Not applicable.

NFPA Ratings: Health 0, Flammability 0, Reactivity 0
HMIS Ratings: Flammability 0, Reactivity 0, Health 0*

6. ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures Use appropriate protective equipment. Avoid creating and breathing dust.

Environmental Precautionary Measures None known.

Procedure for Cleaning / Absorption Collect using dustless method and hold for appropriate disposal. Consider possible toxic or fire hazards associated with contaminating substances and use appropriate methods for collection, storage and disposal.

7. HANDLING AND STORAGE

Handling Precautions This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposure below recommended exposure limits. Wear a NIOSH certified, European Standard En 149, or equivalent respirator when using this product. Material is slippery when wet.

Storage Information Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits listed in Section 2.

Respiratory Protection Wear a NIOSH certified, European Standard EN 149, or equivalent respirator when using this product.

Hand Protection Normal work gloves.

Skin Protection Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.

Eye Protection Wear safety glasses or goggles to protect against exposure.

Other Precautions None known.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid
Color:	Various
Odor:	Odorless
pH:	8-10
Specific Gravity @ 20 C (Water=1):	2.65
Density @ 20 C (lbs./gallon):	Not Determined
Bulk Density @ 20 C (lbs/ft3):	50-70
Boiling Point/Range (F):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (F):	Not Determined
Freezing Point/Range (C):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Insoluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (lbs./gallon):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistrokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data: Stable

Hazardous Polymerization: Will Not Occur

Conditions to Avoid	None anticipated
Incompatibility (Materials to Avoid)	Hydrofluoric acid.
Hazardous Decomposition Products	Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	Eye or skin contact, inhalation.
Inhalation	Inhaled crystalline silica in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (IARC, Group 1). There is sufficient evidence in experimental animals for the carcinogenicity of tridymite (IARC, Group 2A). Breathing silica dust may cause irritation of the nose, throat, and respiratory passages. Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may also have serious chronic health effects (See "Chronic Effects/Carcinogenicity" subsection below).
Skin Contact	May cause mechanical skin irritation.
Eye Contact	May cause eye irritation.
Ingestion	None known
Aggravated Medical Conditions	Individuals with respiratory disease, including but not limited to asthma and bronchitis, or subject to eye irritation, should not be exposed to quartz dust.
Chronic Effects/Carcinogenicity	Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis. Cancer Status: The International Agency for Research on Cancer (IARC) has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources can cause lung cancer in humans (Group 1 - carcinogenic to humans) and has determined that there is sufficient evidence in experimental animals for the carcinogenicity of tridymite (Group 2A - possible carcinogen to humans). Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997) in conjunction with the use of these minerals. The National Toxicology Program classifies respirable crystalline silica as "Known to be a human carcinogen". Refer to the 9th Report on Carcinogens (2000). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies crystalline silica, quartz, as a suspected human carcinogen (A2). There is some evidence that breathing respirable crystalline silica or the disease silicosis is associated with an increased incidence of significant disease endpoints such as scleroderma (an immune system disorder manifested by scarring of the lungs, skin, and other internal organs) and kidney disease.

Other Information For further information consult "Adverse Effects of Crystalline Silica Exposure" published by the American Thoracic Society Medical Section of the American Lung Association, American Journal of Respiratory and Critical Care Medicine, Volume 155, pages 761-768 (1997).

Toxicity Tests

Oral Toxicity: Not determined

Dermal Toxicity: Not determined

Inhalation Toxicity: Not determined

Primary Irritation Effect: Not determined

Carcinogenicity Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997).

Genotoxicity: Not determined

Reproductive / Developmental Toxicity: Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air) Not determined

Persistence/Degradability Not determined

Bio-accumulation Not Determined

Ecotoxicological Information

Acute Fish Toxicity: TLM96: 10000 ppm (Oncorhynchus mykiss)
Acute Crustaceans Toxicity: Not determined
Acute Algae Toxicity: Not determined

Chemical Fate Information Not determined

Other Information Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method Bury in a licensed landfill according to federal, state, and local regulations.

Contaminated Packaging Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Land Transportation

DOT
Not restricted

Canadian TDG
Not restricted

ADR Not restricted

Air Transportation

ICAO/IATA Not restricted

Sea Transportation

IMDG
Not restricted

Other Shipping Information

Labels: None

15. REGULATORY INFORMATION

US Regulations

US TSCA Inventory	All components listed on inventory.
EPA SARA Title III Extremely Hazardous Substances	Not applicable
EPA SARA (311,312) Hazard Class	Acute Health Hazard Chronic Health Hazard
EPA SARA (313) Chemicals	This product does not contain a toxic chemical for routine annual "Toxic Chemical Release Reporting" under Section 313 (40 CFR 372).
EPA CERCLA/Superfund Reportable Spill Quantity For This Product	Not applicable.
EPA RCRA Hazardous Waste Classification	If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.
California Proposition 65	The California Proposition 65 regulations apply to this product.
MA Right-to-Know Law	One or more components listed.
NJ Right-to-Know Law	One or more components listed.
PA Right-to-Know Law	One or more components listed.

Canadian Regulations

Canadian DSL Inventory	All components listed on inventory.
WHMIS Hazard Class	D2A Very Toxic Materials (Crystalline silica)

16. OTHER INFORMATION

The following sections have been revised since the last issue of this SDS
Not applicable

Additional Information

For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Material Safety Data Sheet for this or other Halliburton products, contact Chemical Compliance at 1-580-251-4335.

Disclaimer Statement

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

*****END OF SDS*****

MICHELS®

ATTACHMENT

DRILLING ADDITIVES / LCMs FOR APPROVAL

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MICHELS®

Product Name	Manufacturer	Generic Name	Intended Use	NSF 60 APPROVED?
Platinum PAC	M I Swaco	PAC	Fluid Loss Inhibitor	YES
Platinum PAC UL	M I Swaco	PAC	Fluid Loss Inhibitor	YES
Ringfree	M I Swaco	Thinner	Drill Mud Thinner	YES
Torqmaster	WyoBen, Inc.	Surfactant	Torque reduction / reduce bit balling	NO
Plugz It	WyoBen, Inc.	Proprietary bentonite blend	Lost Circulation Material	YES
Clay Cutter	Cetco	Clay Inhibitor	Inhibit swelling of clay formations	NO
Clay Breaker	DCS Fluids	Clay Inhibitor	Inhibit swelling of clay formations	NO
Torque Breaker	DCS Fluids	Surfactant	Torque reduction / reduce bit balling	NO
Ball Buster	DCS Fluids	SAPP	Reduce bit / reamer balling	YES
Soda Ash	Various	pH Enhancement	Increase pH and reduce hardness of make up water	YES
Sodium Bicarbonate	Various	Calcium Control	Reduce calcium contamination of mud from drilling grout	YES
Citric Acid	Various	pH Reducer	Reduce pH when drilling grout	YES

MICHELS®

POTENTIAL ADDITIVIVE

PLATINUM PAC

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SDS no. 12391
Version 7
Revision date 21/Jul/2014
Supersedes date 20/Dec/2013

Safety Data Sheet
PLATINUM PAC†

1. Identification of the substance/preparation and of the Company/undertaking

1.1 Product identifier

Product name PLATINUM PAC†
Product code 12391

1.2 Relevant identified uses of the substance or mixture and uses advised against

Recommended Use Drilling fluid additive Fluid loss reducer.

Uses advised against Consumer use

1.3 Details of the supplier of the safety data sheet

Supplier
M-I L.L.C.
P.O.Box 42842
Houston, TX 77242
www.miswaco.slb.com

Prepared by
Global Chemical Regulatory Compliance (GCRC) , Bethicia Prasek

1.4 Emergency Telephone Number

Emergency telephone - (24 Hour) Australia +61 2801 44558, Asia Pacific +65 3158 1074, China +86 10 5100 3039, Europe +44 (0) 1235 239 670, Middle East and Africa +44 (0) 1235 239 671, New Zealand +64 9929 1483, USA 001 281 561 1600
Telephone Number - 281-561-1512

2. Hazards identification

2.1 Classification of the substance or mixture

GHS - Classification

Health hazards Not classified

Environmental hazards Not classified

Physical Hazards

Combustible dust	-

2.2 Label elements

Signal word
WARNING

May form combustible dust concentrations in air

Precautionary statements
P240 - Ground/bond container and receiving equipment
P243 - Take precautionary measures against static discharge

P241 - Use explosion-proof electrical/ ventilating/ lighting/ equipment

3. Composition/information on Ingredients

3.1 Substances

Component	CAS-No	Weight % - range
Carboxymethylcellulose sodium salt	9004-32-4	99

3.2 Mixtures

Not Applicable

4. First aid measures

4.1 Description of first-aid measures

Inhalation — If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Ingestion — Rinse mouth. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Seek medical attention if irritation occurs.

Skin contact — Wash off immediately with soap and plenty of water removing all contaminated clothes and shoes. Get medical attention immediately if symptoms occur.

Eye contact — Promptly wash eyes with lots of water while lifting eye lids. Remove contact lenses. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

4.2 Most important symptoms and effects, both acute and delayed

General advice — The severity of the symptoms described will vary dependant of the concentration and the length of exposure. If adverse symptoms develop, the casualty should be transferred to hospital as soon as possible.

Main symptoms

Inhalation	Please see Section 11. Toxicological Information for further information.
Ingestion	Please see Section 11. Toxicological Information for further information.
Skin contact	Please see Section 11. Toxicological Information for further information.
Eye contact	Please see Section 11. Toxicological Information for further information.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician Treat symptomatically.

5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Fog, Alcohol Foam, CO_2, Dry Chemical.

Extinguishing media which shall not be used for safety reasons
None known.

5.2 Special hazards arising from the substance or mixture

Unusual fire and explosion hazards
Suspended dust may present a dust explosion hazard.

Hazardous combustion products
Carbon oxides (COx).

5.3 Advice for firefighters

Special protective equipment for fire-fighters
As in any fire, wear self-contained breathing apparatus and full protective gear.

Special Fire-Fighting Procedures
Containers close to fire should be removed immediately or cooled with water.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Extinguish all ignition sources. Avoid sparks, flames, heat and smoking. Evacuate personnel to safe areas. Use personal protective equipment. See also section 8. If spilled, take caution, as material can cause surfaces to become very slippery.

6.2 Environmental precautions

The product should not be allowed to enter drains, water courses or the soil.

Environmental exposure controls
Avoid release to the environment.

6.3 Methods and materials for containment and cleaning up

Methods for containment
Prevent further leakage or spillage if safe to do so.

Methods for cleaning up
Sweep up and shovel into suitable containers for disposal. After cleaning, flush away traces with water. Material becomes slippery when wet. Use caution if wet.

6.4 Reference to other sections

See section 13 for more information.

7. Handling and storage

7.1 Precautions for safe handling

Handling
Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin and eyes. Avoid dust formation.

Hygiene measures
Use good work and personal hygiene practices to avoid exposure. Do not eat, drink or smoke when using this product.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/precautions Ensure adequate ventilation. Provide appropriate exhaust ventilation at places where dust is formed. Keep airborne concentrations below exposure limits.

Storage precautions Keep away from open flames, hot surfaces and sources of ignition. Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure controls/personal protection

8.1 Control parameters

Exposure limits Control as an ACGIH particulate not otherwise specified (PNOS): 10 mg/m^3 (Inhalable); 3 mg/m^3 (Respirable) and an OSHA particulate not otherwise regulated (PNOR): 15 mg/m^3 (Total); 5 mg/m^3 (Respirable).

Component	ACGIH TLV	OSHA PEL
Carboxymethylcellulose sodium salt 9004-32-4 (99)	Not Determined	Not Determined

8.2 Exposure controls

All chemical Personal Protective Equipment (PPE) should be selected based on an assessment of both the chemical hazard present and the risk of exposure to those hazards. The PPE recommendations below are based on an assessment of the chemical hazards associated with this product. Where this product is used in a mixture with other products or fluids, additional hazards may be created and as such further assessment of risk may be required. The risk of exposure and need of respiratory protection will vary from workplace to workplace and should be assessed by the user in each situation.

Engineering measures to reduce exposure
Ensure adequate ventilation.

Personal protective equipment

Eye protection It is good practice to wear goggles when handling any chemical. Tightly fitting safety goggles.

Hand protection Wear chemical resistant gloves such as nitrile or neoprene.

Respiratory protection	All respiratory protection equipment should be used within a comprehensive respiratory protection program that meets the requirements of 29 CFR 1910.134 (U.S. OSHA Respiratory Protection Standard) or local equivalent. If exposed to airborne mist/aerosol of this product, use at least a NIOSH-approved N95 half-mask disposable or re-usable particulate respirator. In work environments containing oil mist/aerosol, use at least a NIOSH-approved P95 half-mask disposable or reuseable particulate respirator. If exposed to vapors from this product use a NIOSH/MSHA-approved respirator with an Organic Vapor cartridge.
Skin and body protection	Wear suitable protective clothing.
Hygiene measures	Wash hands before eating, drinking or smoking, Remove and wash contaminated clothing before re-use.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

Physical state	Solid powder
Appearance	Opaque
Odor	Mild Odorless
Color	Off-white - Tan
Odor threshold	Not applicable

Property	**Values**	**Remarks**
pH	No information available	
pH @ dilution	6.5-8.0 @ 1% in H2O	
Melting/freezing point		
Boiling point/range	No information available	
Flash point	Does not flash	
Evaporation rate (BuAc =1)		
Flammability (solid, gas)	Not Applicable	
Flammability Limits in Air		
Upper flammability limit	Not applicable	
Lower flammability limit	Not applicable	
Vapor pressure	0 mmHg	
Vapor density	Not applicable	
Specific gravity	1.5 - 1.6	
Bulk density	No information available	
Relative density	No information available	
Water solubility	Gels on contact with water	
Solubility in other solvents	No information available	
Autoignition temperature	No information available	
Decomposition temperature	No information available	
Kinematic viscosity	No information available	
Dynamic viscosity	No information available	
Log Pow	Not determined	
Explosive properties	Not Applicable	
Oxidizing properties	None known.	

9.2 Other information

Pour point	No information available
Molecular weight	No information available
VOC content(%)	None
Density	No information available

10. Stability and reactivity

10.1 Reactivity

No specific reactivity hazards associated with this product.

10.2 Chemical stability

Stable under normal temperature conditions and recommended use.

10.3 Possibility of Hazardous Reactions

Hazardous polymerization
Hazardous polymerization does not occur.

Hazardous Reactions
None known.

10.4 Conditions to avoid

Heat, flames and sparks.

10.5 Incompatible materials

Strong oxidizing agents.

10.6 Hazardous decomposition products

Carbon oxides (COx).

11. Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Inhalation — Inhalation of dust may cause shortness of breath, tightness of the chest, a sore throat and cough.

Eye contact — Dust may cause mechanical irritation.

Skin contact — Repeated exposure may cause skin dryness or cracking.

Ingestion — Irritant; may cause pain or discomfort to mouth, throat and stomach.

Acute toxicity — 0% of the mixture consists of ingredient(s) of unknown toxicity.

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Carboxymethylcellulose sodium salt	= 27000 mg/kg (Rat)	> 2 g/kg (Rabbit)	> 5800 mg/m³ (Rat) 4 h

Sensitization — This product does not contain any components suspected to be sensitizing.

Mutagenic effects — This substance has no evidence of mutagenic properties.

Carcinogenicity — This substance has no evidence of carcinogenic properties.

Reproductive toxicity	None known.
Developmental toxicity	Not known to cause birth defects or have a deleterious effect on a developing fetus.
Routes of exposure	Inhalation. Skin contact. Eye contact.
Routes of entry	None known.
Specific target organ toxicity (single exposure)	Not classified
Specific target organ toxicity (repeated exposure)	Not classified.
Aspiration hazard	Not Applicable.

12. Ecological information

12.1 Toxicity

Toxicity to algae
See component information below.

Toxicity to fish
See component information below.

Toxicity to daphnia and other aquatic invertebrates
See component information below.

Component	Toxicity to fish	Toxicity to algae	Toxicity to daphnia and other aquatic invertebrates
Carboxymethylcellulose sodium salt	No information available	No information available	No information available

12.2 Persistence and degradability

No product level data available.

12.3 Bioaccumulative potential

No data available.

12.4 Mobility in soil

No information available.

12.5 Results of PBT and vPvB assessment

This substance is not considered to be persistent, bioaccumulating or toxic (PBT)
This substance is not considered to be very persistent nor very bioaccumulating (vPvB)

12.6 Other adverse effects.

None known. Check for additional information in sect. 7.

13. Disposal considerations

13.1 Waste treatment methods

Waste from residues / unused products	Dispose of in accordance with local regulations.
Contaminated packaging	Empty containers should be taken for local recycling, recovery or waste disposal.

14. Transport information

14.1 UN Number

UN/ID No. (ADR/RID/ADN/ADG)	Not regulated
UN No. (IMDG)	Not regulated
UN No. (ICAO)	Not regulated
UN No. (DOT)	Not regulated

14.2 Proper shipping name

Not regulated for transportation by DOT, TDG, IMDG and ICAO/IATA.

14.3 Hazard class(es)

ADR/RID/ADN Hazard class	Not regulated
IMDG Hazard class	Not regulated
ICAO Hazard class/division	Not regulated
DOT Hazard class	Not regulated

14.4 Packing group

ADR/RID/ADN Packing Group	Not regulated
IMDG Packing group	Not regulated
ICAO Packing group	Not regulated
DOT Packing group	Not regulated

14.5 Environmental hazard

No

14.6 Special precautions

Not Applicable

15. Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

International inventories

USA (TSCA)	Complies
European Union (EINECS and ELINCS)	Complies
Canada (DSL)	Complies
Philippines (PICCS)	Complies
Japan (ENCS)	Complies
China (IECSC)	Complies
Australia (AICS)	Complies
Korean (KECL)	Complies
New Zealand (NZIoC)	Complies

U.S. Federal and State Regulations

SARA 311/312 Hazard Catagories Not a SARA 311/312 hazard.

SARA 302/304, 313, CERCLA RQ, California Proposition 65
Note: If no components are listed below, this product is not subject to the referenced SARA and CERCLA regulations and is not known to contain a Proposition 65 listed chemical at a level that is expected to pose a significant risk under anticipated use conditions.

This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class Not a controlled product.

16. Other information

Supersedes date 20/Dec/2013

Revision date 21/Jul/2014

Version 7

The following sections have been revised All sections.

HMIS classification

Health	0
Flammability	1
Physical hazard	0
PPE	E

N/A - Not Applicable, N/D - Not Determined.

†A mark of M-I L.L.C.

Disclaimer
The information provided in this Material Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

MICHELS®

POTENTIAL ADDITIVIVE

PLATINUM PAC UL

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SDS no. 12481
Version 4
Revision date 08/Jan/2015
Supersedes date 14/Feb/2012

Safety Data Sheet
PLATINUM PAC† UL

1. Identification

1.1 Product identifier

Product name PLATINUM PAC† UL

Product code 12481

1.2 Relevant identified uses of the substance or mixture and uses advised against

Recommended Use Drilling fluid additive.

Uses advised against Consumer use

1.3 Details of the supplier of the safety data sheet

Supplier
M-I L.L.C.
P.O.Box 42842
Houston, TX 77242
www.miswaco.slb.com

Prepared by
Global Chemical Regulatory Compliance (GCRC) , Bethicia Prasek

1.4 Emergency Telephone Number

Emergency telephone (24 Hour) Australia +61 2801 44558, Asia Pacific +65 3158 1074, China +86 10 5100 3039, Europe +44 (0) 1235 239 670, Middle East and Africa +44 (0) 1235 239 671, New Zealand +64 9929 1483, USA 001 281 561 1600
Telephone Number - 281-561-1511

2. Hazards identification

2.1 Classification of the substance or mixture

GHS - Classification

Health hazards Not classified

Environmental hazards Not classified

Physical Hazards

Combustible dust	-

2.2 Label elements

Signal word
WARNING

May form combustible dust concentrations in air

Precautionary statements
P240 - Ground/bond container and receiving equipment
P243 - Take precautionary measures against static discharge

P241 - Use explosion-proof electrical/ ventilating/ lighting/ equipment

Unknown acute toxicity 0% of the mixture consists of ingredient(s) of unknown toxicity.

3. Composition/information on Ingredients

3.1 Substances

Not Applicable

3.2 Mixtures

Component	CAS-No	Weight % - range
Carbohydrate	Proprietary	60 - 100

Comments
The exact percentage (concentration) of composition has been withheld as a trade secret

4. First aid measures

4.1 First-Aid Measures

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Ingestion Rinse mouth. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Seek medical attention if irritation occurs.

Skin contact Wash off immediately with soap and plenty of water removing all contaminated clothes and shoes. Get medical attention immediately if symptoms occur.

Eye contact Promptly wash eyes with lots of water while lifting eye lids. Remove contact lenses. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

4.2 Most important symptoms and effects, both acute and delayed

General advice	The severity of the symptoms described will vary dependant of the concentration and the length of exposure. If adverse symptoms develop, the casualty should be transferred to hospital as soon as possible.
Main symptoms	
Inhalation	Please see Section 11. Toxicological Information for further information.
Ingestion	Please see Section 11. Toxicological Information for further information.
Skin contact	Please see Section 11. Toxicological Information for further information.
Eye contact	Please see Section 11. Toxicological Information for further information.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician Treat symptomatically

5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Fog, Alcohol Foam, CO_2, Dry Chemical.

Extinguishing media which shall not be used for safety reasons
None known.

5.2 Special hazards arising from the substance or mixture

Unusual fire and explosion hazards
Suspended dust may present a dust explosion hazard.

Hazardous combustion products
Carbon oxides (COx).

5.3 Advice for firefighters

Special protective equipment for fire-fighters
As in any fire, wear self-contained breathing apparatus and full protective gear.

Special Fire-Fighting Procedures
Containers close to fire should be removed immediately or cooled with water.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Extinguish all ignition sources. Avoid sparks, flames, heat and smoking. Evacuate personnel to safe areas. Use personal protective equipment. See also section 8. If spilled, take caution, as material can cause surfaces to become very slippery.

6.2 Environmental precautions

As local regulations may vary; all waste must be disposed/recycled/reclaimed in accordance with federal, state, and local environmental control regulations.

Environmental exposure controls
Avoid dust formation.

6.3 Methods and materials for containment and cleaning up

Methods for containment
Prevent further leakage or spillage if safe to do so.

Methods for cleaning up
Sweep up and shovel into suitable containers for disposal. After cleaning, flush away traces with water. Material becomes slippery when wet. Use caution if wet.

6.4 Reference to other sections

See section 13 for more information.

7. Handling and storage

7.1 Precautions for safe handling

Handling
Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin and eyes. Avoid dust formation.

Hygiene measures
Use good work and personal hygiene practices to avoid exposure. Do not eat, drink or smoke when using this product.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/precautions Ensure adequate ventilation. Provide appropriate exhaust ventilation at places where dust is formed. Keep airborne concentrations below exposure limits.

Storage precautions Keep away from open flames, hot surfaces and sources of ignition. Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure controls/personal protection

8.1 Control parameters

Exposure limits **Control as an ACGIH particulate not otherwise specified (PNOS): 10 mg/m³ (Inhalable); 3 mg/m³ (Respirable) and an OSHA particulate not otherwise regulated (PNOR): 15 mg/m³ (Total); 5 mg/m³ (Respirable).**

Component	ACGIH TLV	OSHA PEL
Carbohydrate	Not Determined	Not Determined

8.2 Exposure controls

All chemical Personal Protective Equipment (PPE) should be selected based on an assessment of both the chemical hazard present and the risk of exposure to those hazards. The PPE recommendations below are based on an assessment of the chemical hazards associated with this product. Where this product is used in a mixture with other products or fluids, additional hazards may be created and as such further assessment of risk may be required. The risk of exposure and need of respiratory protection will vary from workplace to workplace and should be assessed by the user in each situation.

Engineering measures to reduce exposure
Ensure adequate ventilation.

Personal protective equipment

Eye protection	Tightly fitting safety goggles.
Hand protection	Wear chemical resistant gloves such as nitrile or neoprene.
Respiratory protection	All respiratory protection equipment should be used within a comprehensive respiratory protection program that meets the requirements of 29 CFR 1910.134 (U.S. OSHA Respiratory Protection Standard) or local equivalent. If exposed to airborne mist/aerosol of this product, use at least a NIOSH-approved N95 half-mask disposable or re-usable particulate respirator. In work environments containing oil mist/aerosol, use at least a NIOSH-approved P95 half-mask disposable or reuseable particulate respirator. If exposed to vapors from this product use a NIOSH/MSHA-approved respirator with an Organic Vapor cartridge.
Skin and body protection	Wear suitable protective clothing.
Hygiene measures	Wash hands before eating, drinking or smoking, Remove and wash contaminated clothing before re-use.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

Physical state	Solid powder
Appearance	Opaque
Odor	Mild Odorless
Color	White - Yellow
Odor threshold	Not applicable

Property	**Values**	**Remarks**
pH		
pH @ dilution	6.5-8.5 @ 1% in H2O	
Melting/freezing point		
Boiling point/range	No information available	
Flash point	Does not flash	
Evaporation rate (BuAc =1)	No information available	
Flammability (solid, gas)	Not Applicable	
Flammability Limits in Air		
Upper flammability limit	No information available	
Lower flammability limit	No information available	
Vapor pressure	0 mmHg	
Vapor density	Not applicable	
Specific gravity	0.3 - 0.5	
Bulk density	No information available	
Water solubility	Soluble in water	
Solubility in other solvents	No information available	
Autoignition temperature	No information available	
Decomposition temperature	No information available	
Kinematic viscosity	No information available	
Dynamic viscosity	No information available	
Log Pow	Not determined	
Explosive properties	Not Applicable	
Oxidizing properties	None known.	

9.2 Other information

Pour point	No information available
Molecular weight	No information available

VOC content(%) None
Density No information available

10. Stability and reactivity

10.1 Reactivity

No specific reactivity hazards associated with this product.

10.2 Chemical stability

Stable under normal temperature conditions and recommended use.

10.3 Possibility of Hazardous Reactions

Hazardous polymerization
Hazardous polymerization does not occur.

Hazardous Reactions
None known.

10.4 Conditions to avoid

Heat, flames and sparks.

10.5 Incompatible materials

Strong oxidizing agents.

10.6 Hazardous decomposition products

Carbon oxides (COx).

11. Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Inhalation Inhalation of dust may cause shortness of breath, tightness of the chest, a sore throat and cough.

Eye contact Dust may cause mechanical irritation.

Skin contact Repeated exposure may cause skin dryness or cracking.

Ingestion Irritant; may cause pain or discomfort to mouth, throat and stomach.

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Carbohydrate	= 27000 mg/kg (Rat)	> 2 g/kg (Rabbit)	> 5800 mg/m³ (Rat) 4 h

Component	IARC Group 1 or 2	ACGIH - Carcinogens	OSHA listed carcinogens	NTP
Carbohydrate	No data available	No data available	No data available	No data available

Sensitization This product does not contain any components suspected to be sensitizing.

Mutagenic effects This substance has no evidence of mutagenic properties.

Carcinogenicity	This substance has no evidence of carcinogenic properties.
Reproductive toxicity	None known.
Developmental toxicity	Not known to cause birth defects or have a deleterious effect on a developing fetus.
Routes of exposure	Inhalation. Skin contact. Eye contact.
Routes of entry	None known.
Specific target organ toxicity (single exposure)	Not classified
Specific target organ toxicity (repeated exposure)	Not classified.
Aspiration hazard	Not Applicable.

12. Ecological information

12.1 Toxicity

Toxicity to algae
See component information below.

Toxicity to fish
See component information below.

Toxicity to daphnia and other aquatic invertebrates
See component information below.

Component	Toxicity to fish	Toxicity to algae	Toxicity to daphnia and other aquatic invertebrates
Carbohydrate (60 - 100)	No information available	No information available	No information available

12.2 Persistence and degradability

No product level data available.

12.3 Bioaccumulative potential

No data available.

12.4 Mobility in soil

No information available.

12.5 Results of PBT and vPvB assessment

This substance is not considered to be persistent, bioaccumulating or toxic (PBT)
This substance is not considered to be very persistent nor very bioaccumulating (vPvB)

12.6 Other adverse effects.

None known.

13. Disposal considerations

13.1 Waste treatment methods

Disposal Method Disposal should be made in accordance with federal, state and local regulations.

Contaminated packaging Empty containers should be taken for local recycling, recovery or waste disposal.

14. Transport information

14.1 UN Number

UN/ID No. (ADR/RID/ADN/ADG)	Not regulated
UN No. (IMDG)	Not regulated
UN No. (ICAO)	Not regulated
UN No. (DOT)	Not regulated

14.2 Proper shipping name

Not regulated for transportation by DOT, TDG, IMDG and ICAO/IATA.

14.3 Hazard class(es)

ADR/RID/ADN Hazard class	Not regulated
IMDG Hazard class	Not regulated
ICAO Hazard class/division	Not regulated
DOT Hazard class	Not regulated

14.4 Packing group

ADR/RID/ADN Packing Group	Not regulated
IMDG Packing group	Not regulated
ICAO Packing group	Not regulated
DOT Packing group	Not regulated

Marine pollutant
No

14.6 Special precautions
Not Applicable

15. Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

International inventories

USA (TSCA)	Complies
European Union (EINECS and ELINCS)	Complies
Canada (DSL)	Complies
Philippines (PICCS)	Complies
Japan (ENCS)	Complies

China (IECSC)	Complies
Australia (AICS)	Complies
Korean (KECL)	Complies
New Zealand (NZIoC)	Complies

U.S. Federal and State Regulations

SARA 311/312 Hazard Categories
Not a SARA 311/312 hazard.

SARA 302/304, 313, CERCLA RQ, California Proposition 65
Note: If no components are listed below, this product is not subject to the referenced SARA and CERCLA regulations and is not known to contain a Proposition 65 listed chemical at a level that is expected to pose a significant risk under anticipated use conditions.

Component	SARA 302 / TPQs	SARA 313	CERCLA RQ
Carbohydrate	N/A	N/A	N/A

State Comments
Proposition 65: This product is not known to contain chemicals considered by the State of California's Safe Drinking Water and Toxic Enforcement Act of 1986 as causing cancer and/or reproductive toxicity at levels that are expected to pose a significant risk under anticipated use conditions.

Canadian Classification

This product has been classified in accordance with the hazard criteria of the CPR and the SDS contains all the information required by the CPR.

WHMIS Hazard Class Not a controlled product.

16. Other information

Supersedes date 14/Feb/2012

Revision date 08/Jan/2015

Version 4

The following sections have been revised All sections. Updated according to GHS/CLP.

HMIS classification

Health	0
Flammability	1
Physical hazard	0
PPE	E

N/A - Not Applicable, N/D - Not Determined.

†A mark of M-I L.L.C.

Disclaimer
The information contained herein is considered in good faith as reliable of the date issued and is based upon on measurements, tests or data derived from supplier's own study or furnished by others. In providing this SDS information, Supplier makes no express or implied warranties as to the information or product; merchantability or fitness of purpose; any express or implied warranty; or non-infringement of intellectual property rights; and supplier assumes no responsibility for any direct, special or consequential damages, results obtained, or the activities of others. To the maximum extent permitted by law, supplier's warranty obligations and buyer's sole remedies are as stated in separate agreement between the parties.

MICHELS®

POTENTIAL ADDITIVIVE

RING FREE

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SDS no. 12003
Version 3
Revision date 24/Jul/2014
Supersedes date 27/Dec/2013

Safety Data Sheet
RINGFREE†

1. Identification of the substance/preparation and of the Company/undertaking

1.1 Product identifier

Product name RINGFREE†
Product code 12003

1.2 Relevant identified uses of the substance or mixture and uses advised against

Recommended Use Drilling fluid additive

Uses advised against Consumer use

1.3 Details of the supplier of the safety data sheet

Supplier
M-I L.L.C.
P.O.Box 42842
Houston, TX 77242
www.miswaco.slb.com

Prepared by
Global Chemical Regulatory Compliance (GCRC) , Mike McDowell

1.4 Emergency Telephone Number

Emergency telephone - (24 Hour) Australia +61 2801 44558, Asia Pacific +65 3158 1074, China +86 10 5100 3039, Europe +44 (0) 1235 239 670, Middle East and Africa +44 (0) 1235 239 671, New Zealand +64 9929 1483, USA 001 281 561 1600
Telephone Number - 281-561-1512

2. Hazards identification

2.1 Classification of the substance or mixture

GHS - Classification

Not a dangerous substance or mixture according to the Globally Harmonized System (GHS)

Health hazards Not classified

Environmental hazards Not classified

Physical Hazards Not classified

2.2 Label elements

Not a dangerous substance or mixture according to the Globally Harmonized System (GHS)
Hazard statements
None

Precautionary statements
None

-

3. Composition/information on Ingredients

3.1 Substances

Not Applicable

3.2 Mixtures

Not Applicable

Comments
No classified ingredients, or those having occupational exposure limits, present above the level of disclosure.

4. First aid measures

4.1 Description of first-aid measures

Inhalation — If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Ingestion — Rinse mouth. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Get medical attention if symptoms occur.

Skin contact — Wash off immediately with soap and plenty of water removing all contaminated clothes and shoes. Get medical attention immediately if symptoms occur.

Eye contact — Remove contact lenses. Promptly wash eyes with lots of water while lifting eye lids. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

4.2 Most important symptoms and effects, both acute and delayed

General advice — The severity of the symptoms described will vary dependant of the concentration and the length of exposure. If adverse symptoms develop, the casualty should be transferred to hospital as soon as possible.

Main symptoms

Inhalation — Please see Section 11. Toxicological Information for further information.

Ingestion — Please see Section 11. Toxicological Information for further information.

Skin contact — Please see Section 11. Toxicological Information for further information.

Eye contact — Please see Section 11. Toxicological Information for further information.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician Treat symptomatically.

5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media
Use extinguishing media appropriate for surrounding material.

Extinguishing media which shall not be used for safety reasons
None known.

5.2 Special hazards arising from the substance or mixture

Unusual fire and explosion hazards
None known.

Hazardous combustion products
Carbon oxides (COx).

5.3 Advice for firefighters

Special protective equipment for fire-fighters
As in any fire, wear self-contained breathing apparatus and full protective gear.

Special Fire-Fighting Procedures
Containers close to fire should be removed immediately or cooled with water.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. See also section 8.

6.2 Environmental precautions

The product should not be allowed to enter drains, water courses or the soil.

Environmental exposure controls
Avoid release to the environment.

6.3 Methods and materials for containment and cleaning up

Methods for containment
Prevent further leakage or spillage if safe to do so. Dike far ahead of liquid spill for later disposal.

Methods for cleaning up
Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. After cleaning, flush away traces with water.

6.4 Reference to other sections

See section 13 for more information.

7. Handling and storage

7.1 Precautions for safe handling

Handling
Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin and eyes. Do not breathe vapors or spray mist. Avoid spills and splashing during use.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/precautions	Ensure adequate ventilation. Keep airborne concentrations below exposure limits.
Storage precautions	Keep containers tightly closed in a dry, cool and well-ventilated place.
Packaging material	Use specially constructed containers only

8. Exposure controls/personal protection

8.1 Control parameters

Exposure limits The product does not contain any hazardous materials with occupational exposure limits established.

8.2 Exposure controls

All chemical Personal Protective Equipment (PPE) should be selected based on an assessment of both the chemical hazard present and the risk of exposure to those hazards. The PPE recommendations below are based on an assessment of the chemical hazards associated with this product. Where this product is used in a mixture with other products or fluids, additional hazards may be created and as such further assessment of risk may be required. The risk of exposure and need of respiratory protection will vary from workplace to workplace and should be assessed by the user in each situation.

Engineering measures to reduce exposure
Ensure adequate ventilation.

Personal protective equipment

Eye protection	It is good practice to wear goggles when handling any chemical. Tightly fitting safety goggles.
Hand protection	Wear chemical resistant gloves such as nitrile or neoprene.
Respiratory protection	No personal respiratory protective equipment normally required, In case of insufficient ventilation wear suitable respiratory equipment.
Skin and body protection	Wear suitable protective clothing, Provide eyewash station.

Hygiene measures Wash hands before eating, drinking or smoking, Remove and wash contaminated clothing before re-use.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

Physical state	Liquid
Appearance	Transparent
Odor	Mild
Color	Light yellow
Odor threshold	Not applicable

Property	Values	Remarks
pH	6 - 8	

pH @ dilution	
Melting/freezing point	
Boiling point/range	90 °C / 194 °F
Flash point	No information available
Evaporation rate (BuAc =1)	
Flammability (solid, gas)	Not Applicable
Flammability Limits in Air	
Upper flammability limit	Not applicable
Lower flammability limit	Not applicable
Vapor pressure	No information available
Vapor density	No information available
Specific gravity	1.27
Bulk density	No information available
Relative density	No information available
Water solubility	Slightly soluble in water.
Solubility in other solvents	No information available
Autoignition temperature	No information available
Decomposition temperature	No information available
Kinematic viscosity	No information available
Dynamic viscosity	No information available
Log Pow	Does not bioaccumulate
Explosive properties	No information available
Oxidizing properties	No information available

9.2 Other information

Pour point	No information available
Molecular weight	No information available
VOC content(%)	No information available
Density	No information available

10. Stability and reactivity

10.1 Reactivity

No specific reactivity hazards associated with this product.

10.2 Chemical stability

Stable under normal temperature conditions and recommended use.

10.3 Possibility of Hazardous Reactions

Hazardous polymerization
Hazardous polymerization does not occur.

10.4 Conditions to avoid

None known.

10.5 Incompatible materials

Strong oxidizing agents.

10.6 Hazardous decomposition products

Carbon oxides (COx).

11. Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Inhalation	Inhalation of vapors in high concentration may cause irritation of respiratory system.
Eye contact	May cause slight irritation.
Skin contact	Prolonged contact may cause redness and irritation.
Ingestion	Ingestion may cause stomach discomfort.
Acute toxicity	0% of the mixture consists of ingredient(s) of unknown toxicity.

Sensitization	This product does not contain any components suspected to be sensitizing.
Mutagenic effects	No evidence of mutagenic properties.
Carcinogenicity	No evidence of carcinogenic properties.
Reproductive toxicity	No evidence of toxicity to reproduction.
Developmental toxicity	Not known to cause birth defects or have a deleterious effect on a developing fetus.
Routes of exposure	Eye contact. Skin contact. Inhalation.
Routes of entry	No route of entry noted.
Specific target organ toxicity (single exposure)	Not classified
Specific target organ toxicity (repeated exposure)	Not classified.
Aspiration hazard	Not Applicable.

12. Ecological information

12.1 Toxicity

Toxicity to algae
See component information below.

Toxicity to fish
See component information below.

Toxicity to daphnia and other aquatic invertebrates
See component information below.

12.2 Persistence and degradability

No product level data available.

12.3 Bioaccumulative potential

No data available.

12.4 Mobility in soil

No information available.

12.5 Results of PBT and vPvB assessment

This preparation contains no substance considered to be persistent, bioaccumulating nor toxic (PBT)
This preparation contains no substance considered to be very persistent nor very bioaccumulating (vPvB)

12.6 Other adverse effects.

None known.

13. Disposal considerations

13.1 Waste treatment methods

Waste from residues / unused products	Dispose of in accordance with local regulations.
Contaminated packaging	Empty containers should be taken for local recycling, recovery or waste disposal.

14. Transport information

14.1 UN Number

UN/ID No. (ADR/RID/ADN/ADG)	Not regulated
UN No. (IMDG)	Not regulated
UN No. (ICAO)	Not regulated
UN No. (DOT)	Not regulated

14.2 Proper shipping name

Not regulated for transportation by DOT, TDG, IMDG and ICAO/IATA.

14.3 Hazard class(es)

ADR/RID/ADN Hazard class	Not regulated
IMDG Hazard class	Not regulated
ICAO Hazard class/division	Not regulated
DOT Hazard class	Not regulated

14.4 Packing group

ADR/RID/ADN Packing Group	Not regulated
IMDG Packing group	Not regulated
ICAO Packing group	Not regulated
DOT Packing group	Not regulated

14.5 Environmental hazard

No

14.6 Special precautions
Not Applicable

15. Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

International inventories

USA (TSCA)	Complies
European Union (EINECS and ELINCS)	Does not Comply
Canada (DSL)	Complies
Philippines (PICCS)	Complies
Japan (ENCS)	Complies
China (IECSC)	Complies
Australia (AICS)	Complies
Korean (KECL)	Complies
New Zealand (NZIoC)	Complies

IMPORTS, Canada
No import volume restrictions.

U.S. Federal and State Regulations

SARA 311/312 Hazard Catagories Not a SARA 311/312 hazard.

State Comments
Proposition 65: This product is not known to contain chemicals considered by the State of California's Safe Drinking Water and Toxic Enforcement Act of 1986 as causing cancer and/or reproductive toxicity at levels that are expected to pose a significant risk under anticipated use conditions.

This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class Not a controlled product.

16. Other information

Supersedes date	27/Dec/2013
Revision date	24/Jul/2014
Version	3
The following sections have been revised	All sections. Updated according to GHS.

Health	0
Flammability	1
Physical hazard	0
PPE	E

Disclaimer
The information provided in this Material Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

MICHELS®

POTENTIAL ADDITIVIVE

TORQMASTER

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WYO-BEN, INC.

SAFETY DATA SHEET

1. PRODUCT AND COMPANY IDENTIFICATION

Product identifier
Product Code 25392
Product Name **TORQMASTER®**

Other means of identification

Recommended use of the chemical and restrictions on use
Use only for the purpose on the product label.

Details of the supplier of the safety data sheet

Manufacturer / Manufactured For
WYO-BEN
1345 Discovery Dr
Billings, Montana 59102
Phone: 406-652-6351
Emergency telephone number
24 Hour Emergency Phone Number: 1-800-535-5053

2. HAZARDS IDENTIFICATION

This product is not classified according to paragraph (d) of 29 CFR 1910.1200 and does not require a hazard warning label.

Hazard Classification

Acute aquatic toxicity	Category 3
Chronic aquatic toxicity	Category 3

Signal Word
None

Hazard Statements
Harmful to aquatic life with long lasting effects

Hazard Symbol
None

Precautionary Statements - Prevention
Avoid release to the environment.

Precautionary Statements - Response
Specific Treatment (See Section 4 on the SDS).
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
IF ON SKIN: Wash with plenty of soap and water. Wash contaminated clothing before reuse.
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
IF SWALLOWED: Rinse mouth. DO NOT induce vomiting. Drink plenty of water.

Precautionary Statements – Storage
Keep out of reach of children.

Precautionary Statements - Disposal
Dispose of contents/container to an approved waste disposal plant.

Hazards not otherwise classified (HNOC)

Other Information

Unknown Acute Toxicity 0.06% of the mixture consists of ingredient(s) of unknown toxicity.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS No.	Weight-%	Trade Secret
PROPRIETARY	Proprietary	1-5	*
Sodium Carbonate	497-19-8	1-5	*

*The exact percentage (concentration) of composition has been withheld as a trade secret.

4. FIRST AID MEASURES

First aid measures

Skin Contact Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Wash contaminated clothing before reuse. If skin irritation persists, call a physician.

Eye contact Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. If irritation persists, call a physician.

Inhalation If mists/vapors are formed or irritation occurs, leave area and do not return until mists/vapors have dissipated. If irritation persists, see a physician.

Ingestion Rinse mouth. Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Drink plenty of water. If irritation persists, see a physician.

Most important symptoms and effects, both acute and delayed

Symptoms No Information available.

Indication of any immediate medical attention and special treatment needed

Note to physicians Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media

Caution: Use of water spray when fighting fire may be inefficient.

Specific hazards arising from the chemical

No Information available.

Explosion data

Sensitivity to Mechanical Impact None
Sensitivity to Static Discharge None

Protective equipment and precautions for firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA **Health Hazard 0** **Fire Hazard 0** **Reactivity 0**

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions Ensure adequate ventilation, especially in confined areas.

Environmental precautions

Environmental precautions See Section 12 for additional ecological information.

Methods and material for containment and cleaning up

Methods for containment Prevent further leakage or spillage if safe to do so.

Methods for cleaning up Soak up with inert absorbent material. Pick up and transfer to properly labeled containers.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage, including any incompatibilities

Storage Conditions Keep containers tightly closed in a dry, cool and well-ventilated place.

Incompatible materials None known based on information supplied.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Appropriate engineering controls

Engineering Controls Showers, Eyewash stations & Ventilation systems.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin and body protection Wear chemical resistant gloves.

Respiratory protection If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators or air purifying respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.

General Hygiene Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Viscous Liquid
Appearance	Pink, Dark
Odor	Mild
Odor threshold	No Information available

Property	Values
pH	9.5 - 11.5
Specific Gravity	1.01
Viscosity	No Information available
Melting point/freezing point	No Information available
Boiling point / boiling range	> 212 / ° F Degrees
Flash point	> 212 / ° F Degrees
Evaporation rate	No Information available
Flammability (solid, gas)	No Information available
Upper flammability limit:	No Information available
Lower flammability limit:	No Information available
Vapor pressure	No Information available
Vapor density	No Information available
Bulk Density Lbs/Gal	No Information available
Water solubility	Complete
Partition Coefficient (n-octanol/water)	No Information available
Autoignition temperature	No Information available
Decomposition temperature	No Information available
VOC Content (%)	No Information available

10. STABILITY AND REACTIVITY

Reactivity
No data available

Chemical stability
Stable under recommended storage conditions.

Possibility of Hazardous Reactions
None under normal processing.

Conditions to avoid
Extremes of temperature and direct sunlight.

Incompatible materials
None known based on information supplied.

Hazardous Decomposition Products
None known based on information supplied.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information No data available

Inhalation No data available.

Eye contact No data available.

Skin Contact No data available.

Ingestion No data available.

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50
Sodium Carbonate 497-19-8	= 4090 mg/kg (Rat)	-	= 2300 mg/m³ (Rat) 2 h

Information on toxicological effects

Symptoms No Information available.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Sensitization	No Information available.
Germ cell mutagenicity	No Information available.
Carcinogenicity	No Information available.
Reproductive toxicity	No Information available.
STOT - single exposure	No Information available.
STOT - repeated exposure	No Information available.
Aspiration hazard	No Information available.

Numerical measures of toxicity - Product Information

Unknown Acute Toxicity 0.05% of the mixture consists of ingredient(s) of unknown toxicity.
This is based upon values calculated per chapter 3.1 of the GHS document.

12. ECOLOGICAL INFORMATION

Ecotoxicity

0.05% of the mixture consists of components(s) of unknown hazards to the aquatic environment

Chemical Name	Algae/aquatic plants	Fish	Crustacea
PROPRIETARY	-	LC50 Oncorhynchus mykiss, 96 hr.,1.2 mg/L:	LC50 Daphnia sp., 48 hr., 5.3 mg/L
Sodium Carbonate 497-19-8	EC 50 Nitzschia sp.,120 hr.,242 mg/L	LC 50 Lepomis macrochirus, 96 hr., 300 mg/L static LC50 Pimephales promelas, 96 hr., 310 - 1220 mg/L., static	EC50 Daphnia magna, 48 hr., 265 mg/L

Persistence and degradability
No Information available.

Bioaccumulation
No Information available.

Other adverse effects No Information available.

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Disposal of wastes Disposal should be in accordance with applicable regional, national and local laws and regulations.

Contaminated packaging Do not reuse container.

This product contains one or more substances that are listed with the State of California as a hazardous waste.

Chemical Name	California Hazardous Waste Status
Sodium Carbonate 497-19-8	Corrosive

14. TRANSPORT INFORMATION

The shipping classification information in this section (Section 14) is meant as a guide to the overall classification of the product. However, transportation classifications may be subject to change with changes in package size. Consult shipper requirements under 49 CFR, IATA and IMDG to assure regulatory compliance.

DOT Not regulated

15. REGULATORY INFORMATION

International Inventories

TSCA	Complies
DSL/NDSL	Complies
EINECS/ELINCS	Does not comply
ENCS	Does not comply
IECSC	Does not comply
KECL	Does not comply
PICCS	Does not comply
AICS	Does not comply

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory.
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List.
EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances.
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
AICS - Australian Inventory of Chemical Substances

US Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311/312 Hazard Categories

Acute health hazard	No
Chronic Health Hazard	No
Fire hazard	No
Sudden release of pressure hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

US State Regulations

California Proposition 65

This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

This product does not contain chemicals subject to Right-To-Know regulations in other states.

U.S. EPA Label Information

EPA Pesticide Registration Number Not Applicable

16. OTHER INFORMATION

Prepared	12/17/2019
Last Revision	01/17/2020

DISCLAMER

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text. No warranty or guarantee, expressed or implied is made by WYO-BEN, INC. as to this information, or as to the safety, toxicity or effect of the use of this product.

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PLUGZ IT

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WYO-BEN, INC.

SAFETY DATA SHEET

SECTION 1 — CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Trade Name:	**PLUGZ-IT™ MAX**
Chemical Family:	Mineral
Application:	Sealing
Manufacturer/Supplier:	Wyo-Ben, Inc. 1345 Discovery Drive Billings, MT 59102 USA Telephone: 800.548.7055 Facsimile: 406.656.0748
Emergency Phone Number	CHEMTREC® 800.424.9300

SECTION 2 — HAZARD IDENTIFICATION

Hazard Symbol: Health Hazard

Signal Word: Warning

Hazard Overview:

ACUTE HEALTH HAZARD
May cause eye and respiratory irritation.

CHRONIC HEALTH HAZARD
Breathing crystalline silica can cause lung disease, including silicosis and lung cancer.

SECTION 3 — COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	Percent	ACGIH TLV-TWA	OSHA PEL-TWA*
Crystalline Silica, quartz	14808-60-7	1 – 6%	0.025 mg/m^3	$\frac{10\ mg/m^3}{\%SiO2 + 2}$

*More restrictive exposure limits may be enforced by some states, agencies, or other authorities.
Non-hazardous components > 94%

SECTION 4 — FIRST AID MEASURES

Inhalation:	If inhaled, remove to a dust free area. Get medical attention if respiratory irritation develops or if breathing becomes difficult. Inhalation may aggravate existing respiratory illness.
Skin:	Wash with soap and water until clear. Seek medical attention if irritation persists.
Eyes:	In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.
Ingestion:	No adverse effects.
Notes to Physician:	Treat Symptomatically.

SECTION 5 — FIRE FIGHTING MEASURES

Flash Point/Range (F):	Not applicable
Flash Point/Range (C):	Not applicable
Flash Point Method:	Not applicable
Autoignition Temperature (F):	Not applicable
Autoignition Temperature (C):	Not applicable
Flammability Limits in Air – Lower (%):	Not applicable
Flammability Limits in Air – Upper (%):	Not applicable
Fire Extinguishing Media:	All standard firefighting media. (Caution slippery when wet.)
Special Exposure Hazards:	Not applicable
Special Protective Equipment for Firefighters:	Not applicable
NFPA Ratings:	Health 0, Flammability 0, Reactivity 0

SECTION 6 — ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures:	Use appropriate protective equipment. Avoid creating and breathing dust.
Environmental Precautionary Measures:	None known.
Procedure for Cleaning/Absorption:	Collect using appropriate dustless method and hold for appropriate disposal.

SECTION 7 — HANDLING AND STORAGE

Handling Precautions:	This product contains quartz which may become airborne. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposure below recommended exposure limits. Wear a NIOSH/MSHA European Standard En 149, or equivalent certified for silica bearing dust, respirator when using this product. Material is slippery when wet. Promptly clean up spills to avoid breathing airborne dust.
Storage Information:	Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container.

SECTION 8 — EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls:	Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits.
Personal Protective Equipment:	If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.
Respiratory Protection:	Not normally needed. If significant exposures are possible use NIOSH/MSH respirator approved for silica bearing dust.
Hand Protection:	Normal work gloves.
Skin Protection:	Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.
Eye Protection:	Wear safety glasses or goggles to protect against exposure.
Other Precautions:	None known.

SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid
Color:	Light tan to gray as dry powder
Odor:	Odorless
pH:	8 – 10 (5% aqueous solution)
Specific Gravity @ 20 C (Water=1):	2.45 – 2.55
Density @ 20 C (lbs/gallon):	Not determined
Bulk Density @ 20 C (lbs/ft^3):	60 – 66
Boiling Point/Range (F):	Not applicable
Boiling Point/Range (C):	Not applicable
Freezing Point/Range (F):	Not applicable
Freezing Point/Range (C):	Not applicable
Vapor Pressure @ 20 C (mmHg):	Not applicable
Vapor Density (Air=1):	Not applicable
Percent Volatiles:	Not applicable
Evaporation Rate (Butyl Acetate=1):	Not applicable
Solubility in Water (g/100ml):	Insoluble, forms colloidal suspension
Solubility in Solvents (g/100ml):	Not applicable
VOCs (lbs/gallon):	Not applicable
Viscosity, Dynamic @ 20 C (centipoise):	240
Viscosity, Kinematic @ 20 C (centistrokes):	Not applicable
Partition Coefficient/n-Octanol/Water:	Not applicable
Molecular Weight (g/mole):	Not applicable

SECTION 10 — STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid:	None anticipated
Incompatibility (Materials to Avoid):	Hydrofluoric Acid
Hazardous Decomposition Products:	None
Additional Guidelines:	Not applicable

SECTION 11 — TOXICOLOGICAL INFORMATION

Principle Route of Exposure:	Eye or skin contact, inhalation.
Inhalation:	Inhaled crystalline silica in the form or quartz from occupational sources is carcinogenic to humans (IARC, Group 1).
Skin Contact:	May cause mechanical skin irritation.
Eye Contact:	May cause eye irritation.
Ingestion:	None known
Aggravated Medical Conditions:	Individuals with respiratory disease, including but not limited to asthma and bronchitis, or subject to eye irritation, should not be exposed to respirable quartz-bearing dust.
Chronic Effects/Carcinogenicity:	Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis. Cancer Status: The International Agency for Research on Cancer (IARC, 1997) concludes that there is sufficient evidence in humans for carcinogenicity of inhaled crystalline silica from occupational sources (IARC Group 1), that carcinogenicity was not detected in all industrial circumstances studied and that carcinogenicity may depend on characteristics of the crystalline silica or on external factors affecting its biological activity. See IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997). The National Toxicology Program (NTP) classifies respirable crystalline silica as "Known to be a human carcinogen" (NTP 9th Report on Carcinogens, 2000). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies crystalline silica, quartz, as a suspected human carcinogen (A2).
Other Information:	See "Adverse Effects of Crystalline Silica Exposure" published by the American Thoracic Society Medical Section of the American Lung Association, American Journal of Respiratory and Critical Care Medicine, Volume 155, pages 761-768 (1997).
Toxicity Tests	
Oral Toxicity:	Not determined (on FDA GRAS list; used as a food additive)
Dermal Toxicity:	Not determined (on FDA GRAS list; used in cosmetic preparations)
Inhalation Toxicity:	Not determined
Primary Irritation Effect:	Not determined
Carcinogenicity:	Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997).
Genotoxicity:	Not determined
Reproductive/Developmental Toxicity:	Not determined

SECTION 12 — ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air):	Not determined
Persistence/Degradability:	Not determined
Bio-accumulation:	Not determined

Ecotoxicological Information

Acute Fish Toxicity:	Not determined
Acute Crustaceans Toxicity:	Not determined
Acute Algae Toxicity:	Not determined

Chemical Fate Information:	Not determined
Other Information:	Not applicable

SECTION 13 — DISPOSAL CONSIDERATIONS

Disposal Method:	Bury in a licensed landfill according to federal, state and local regulations.
Contaminated Packaging:	Follow all applicable national or local regulations.

SECTION 14 — TRANSPORT INFORMATION

Land Transportation

DOT – Not Restricted
Canadian TDG – Not Restricted
ADR – Not Restricted

Air Transportation

ICAO/IATA – Not Restricted

Sea Transportation

IMDG – Not Restricted

Other Transportation Information

Labels: None

SECTION 15 — REGULATORY INFORMATION

US Regulations

US TSCA Inventory	All components listed on inventory or are exempt.
EPA SARA Title III Extremely Hazardous Substances	Not applicable
EPA SARA (311, 312) Hazard Class	Acute Health Hazard Chronic Health Hazard
EPA SARA (313) Chemicals	This product does not contain a toxic chemical for routine annual “Toxic Chemical Release Reporting” under Section 313 (40 CFR 372).

EPA CERCLA/Superfund Reportable Spill Quantity	Not applicable
EPA RCRA Hazardous Waste Classification	If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.
California Proposition 65	This product contains crystalline silica (respirable) which is a substance known to the State of California to cause cancer.

Canadian Regulations

Canadian DSL Inventory	All components listed on inventory are exempt.
WHMIS Hazard Class	This product contains crystalline silica (respirable) and is classified as a Class D, Division 2, Subdivision A substance.

SECTION 16 — OTHER INFORMATION

Prepared	03/18/2015
Last Revision	07/23/2015

DISCLAIMER

All information presented herein is believed to be accurate; however, it is the user's responsibility to determine in advance of need that the information is current and suitable for their circumstances. No warranty or guarantee, expressed or implied is made by WYO-BEN, INC. as to this information, or as to the safety, toxicity or effect of the use of this product.

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CLAY CUTTER

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MATERIAL SAFETY DATA SHEET

1. Product and Company Identification

Material name CLAY CUTTER™

Version # 05

Revision date 19-December-2008

Chemical name Formation Inhibitor

Chemical description Liquid

CAS # Mixture

Manufacturer

CETCO
Drilling Products Group
2870 Forbs Avenue
Hoffman Estates, IL 60192 US
safetydata@amcol.com
http://www.cetco.com/
General Information (800) 527-9948
CHEMTREC® (800) 424-9300

2. Hazards Identification

Emergency overview No hazards resulting from the material as supplied. Health injuries are not known or expected under normal use.

OSHA regulatory status While this material is not considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200), this MSDS contains valuable information critical to the safe handling and proper use of the product. This MSDS should be retained and available for employees and other users of this product.

Potential health effects

Eyes Contact with eyes may cause irritation.

Skin May cause skin irritation in susceptible persons.

Inhalation Health injuries are not known or expected under normal use.

Ingestion Ingestion of this product may cause nausea, vomiting and diarrhea.

3. Composition / Information on Ingredients

The manufacturer lists no ingredients as hazardous according to OSHA 29 CFR 1910.1200.

Composition comments This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

4. First Aid Measures

First aid procedures

Eye contact Immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation develops or persists.

Skin contact Wash off with soap and water. Remove contaminated clothing. Get medical attention if irritation develops or persists.

Inhalation Remove to fresh air. If the affected person is not breathing, apply artificial respiration. If breathing is difficult, give oxygen. Get medical attention, if needed.

Ingestion Give victim water or milk. If swallowed, do NOT induce vomiting. Never give anything by mouth to an unconscious person. Obtain medical attention.

General advice If you feel unwell, seek medical advice (show the label where possible).

5. Fire Fighting Measures

Flammable properties Not a fire hazard.

Extinguishing media

Suitable extinguishing media Use any media suitable for the surrounding fires.

Protection of firefighters

Protective equipment and precautions for firefighters	Move containers from fire area if you can do it without risk. Cool containers with flooding quantities of water until well after fire is out.
Hazardous combustion products	None known.

6. Accidental Release Measures

Environmental precautions	Prevent spreading over a wide area (e.g. by containment or oil barriers). Prevent further leakage or spillage if safe to do so. Do not flush into surface water or sanitary sewer system.
Methods for containment	Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible.
Methods for cleaning up	Absorb spill with inert material (e.g., dry sand or earth), then place in a chemical waste container. Do not allow the spilled product to enter public drainage system or open water courses. Wear appropriate protective equipment and clothing during clean-up.

7. Handling and Storage

Handling	Use only in well-ventilated areas. Provide sufficient air exchange and/or exhaust in work rooms. In case of insufficient ventilation, wear suitable respiratory equipment.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Store in original container.

8. Exposure Controls / Personal Protection

Engineering controls	Good general ventilation should be sufficient to control airborne levels. Local exhaust is suggested for use, where possible, in enclosed or confined spaces. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower.

Personal protective equipment

Eye / face protection	Wear safety glasses; chemical goggles (if splashing is possible).
Skin protection	Wear appropriate chemical resistant gloves. Use of an impervious apron is recommended.
Respiratory protection	None required where adequate ventilation conditions exist.
General hygeine considerations	Use good industrial hygiene practices in handling this material. Wash hands before breaks and immediately after handling the product.

9. Physical & Chemical Properties

Appearance	Not available.
Color	Not available.
Odor	Not available.
Odor threshold	Not available.
Physical state	Liquid.
Form	Liquid.
pH	Not available.
Melting point	Not available.
Freezing point	Not available.
Boiling point	Not available.
Flash point	Not available.
Evaporation rate	Not available.
Flammability	Not available.
Flammability limits in air, upper, % by volume	Not available.
Flammability limits in air, lower, % by volume	Not available.
Vapor pressure	Not available.
Vapor density	Not Determined
Specific gravity	Not available.
Relative density	Not available.
Solubility (water)	Not available.

Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Percent volatile	50 % v/v

10. Chemical Stability & Reactivity Information

Chemical stability	No hazards to be especially mentioned. Stable at normal conditions.
Conditions to avoid	None known.
Incompatible materials	None known.
Hazardous decomposition products	Upon decomposition, this product may yield gaseous nitrogen oxides, carbon monoxide, carbon dioxide and/or low molecular weight hydrocarbons.
Possibility of hazardous reactions	Will not occur.

11. Toxicological Information

Component analysis - LD50	This product is judged to have an acute oral LD50 (rat) greater than 5 g/kg of body weight, and ar acute dermal LD50 (rabbit) greater than 3.16 g/kg of body weight.
Further information	This product has no known adverse effect on human health.

12. Ecological Information

Ecotoxicity	This material is not expected to be harmful to aquatic life. This material has a biodegradatior percentage of 85.2% and is considered to have ready biodegradability. This material exceeds the OECD Guideline 301B for environmental friendliness
Environmental effects	Ecological injuries are not known or expected under normal use.
Persistence and degradability	Not available.

13. Disposal Considerations

Disposal instructions	Dispose in accordance with all applicable regulations.

14. Transport Information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory Information

US federal regulations	OSHA Process Safety Standard: This material is not known to be hazardous by the OSHA Highly Hazardous Process Safety Standard, 29 CFR 1910.119.

CERCLA (Superfund) reportable quantity

None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - No Delayed Hazard - No Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No
Section 302 extremely hazardous substance	No
Section 311 hazardous chemical	No

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	No

Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	No
Europe	European Inventory of New and Existing Chemicals (EINECS)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	No
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	No

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

State regulations This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

16. Other Information

Further information This safety datasheet only contains information relating to safety and does not replace any product information or product specification.

HMIS ratings

NFPA ratings Health: 0
Flammability: 0
Instability: 0

Disclaimer The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The manufacturer expressly does not make any representations, warranties, or guarantees as to its accuracy, reliability or completeness nor assumes any liability, for its use. It is the user's responsibility to verify the suitability and completeness of such information for each particular use.

Third party materials: Insofar as materials not manufactured or supplied by this manufacturer are used in conjunction with, or instead of this product, it is the responsibility of the customer to obtain, from the manufacturer or supplier, all technical data and other properties relating to these and other materials and to obtain all necessary information relating to them. No liability can be accepted in respect of the use of this product in conjunction with materials from another supplier.

Issue date 19-December-2008

This data sheet contains changes from the previous version in section(s): Composition / Information on Ingredients: Component information

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POTENTIAL ADDITIVIVE

CLAY BREAKER

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1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

TRADE NAME: ClayBreaker

24-HOUR EMERGENCY TELEPHONE: 1-800-535-5053 (Infotrac)

SUPPLIER: DCS Fluids Solutions LP
P.O. Box 1027
Graham, TX 76450
(940) 521-0400

Product Use: Well Stimulation Additive, Clay Stabilizer
CAS #: Mixture

2. COMPOSITION, INFORMATION ON INGREDIENTS

No hazardous ingredients as defined by OSHA 29 CFR 1910.1200

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Colorless to amber liquid with a strong odor. May be irritating to eyes, skin and respiratory tract. May be harmful if swallowed. Avoid contact with skin, eyes and clothing.

POTENTIAL HEALTH HAZARDS:

- **INHALATION:** May cause irritation of respiratory tract.
- **INGESTION:** May cause irritation of the gastrointestinal tract including nausea, vomiting and diarrhea.
- **SKIN:** May cause skin irritation.
- **EYES:** May cause eye irritation.

CHRONIC EFFECTS: None known

Ingredients found on one of the OSHA designated carcinogen lists are listed below.

No ingredients listed in this section.

4. FIRST AID MEASURES

INHALATION: If breathing is difficult, remove to fresh air and keep at rest in a comfortable position for breathing. Obtain immediate medical attention.

INGESTION: If swallowed, seek immediate medical attention and show this container or label. Do not induce vomiting without medical advice.

SKIN: Wash skin thoroughly with soap and water. Remove contaminated clothing. Get medical attention if any irritation continues.

EYES: Immediately flush eyes with large quantities of water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of all eye and lid tissue. Get medical attention if irritation develops.

ADVICE TO PHYSICIANS: No specific treatment. Treat according to symptoms present.

5. FIRE FIGHTING MEASURES

FLASH POINT: >200° F (>93.3° C)
FLAMMABLE LIMITS: LEL: N/A
UEL: N/A

EXTINGUISHING AGENTS:

Water, dry chemical, CO2, water spray or regular foam.
Do not use a solid water stream as it may scatter and spread fire.

SPECIAL FIRE FIGHTING PROCEDURES:

Wear positive-pressure, self-contained breathing apparatus (SCBA) and protective fire fighting clothing (including fire fighting helmet, coat, pants, boots, and gloves). If protective equipment is not available or not used, fight fire from a protected location or safe distance.

UNUSUAL FIRE & EXPLOSION HAZARDS:

Always stay away from tanks engulfed in flame. Withdraw immediately in case of rising sound from venting safety devices of any discoloration of tanks due to fire. Move containers from fire area if you can do it without risk. Do not scatter spilled material with high pressure water streams. Use water spray to cool unopened containers. Cool containers with flooding quantities of water until well after fire is out.

6. ACCIDENTAL RELEASE MEASURE

PERSONAL PROTECTION:

Don appropriate personal protective equipment prior to entering spill/leak area.
(See Section 8)

SPILL CLEAN-UP PROCEDURES:

Limit access to area, as necessary. Shut off leak if it can be done safely. Contain spill with dike. Prevent run-off into sewers or waterways. Pump large spills into salvage containers. Soak up residue and small spills with vermiculite, paper, clay or other absorbent material. Remove affected soils. Place in salvage containers. Continue to observe handling precautions.

WASTE DISPOSAL METHOD:

Follow approved local beneficial reuse guidelines for uncontaminated spent drilling fluids. If contaminated, dispose of in a licensed industrial landfill according to local, state and federal regulations. If released to the environment for other than its intended purpose, this product, in its current state, does not meet the definition of a hazardous waste under 40 CFR 261.

7. HANDLING AND STORAGE

HANDLING PRECAUTIONS:

Always wear recommended personal protection equipment. Do not get in eyes, on skin or clothing. Avoid breathing mist or vapor. Use only with adequate ventilation or wear respiratory protection.

STORAGE PRECAUTIONS:

Keep containers tightly closed and properly labeled. Store at moderate temperatures in dry, well-ventilated area. Keep container closed when not in use. Keep in original container. Store containers in upright position. Since emptied containers retain product residue, follow hazard precautions even when empty.

HYGIENIC WORK PRACTICES:

Use good personal hygiene practices. Wash hands and skin thoroughly after handling. Promptly remove contaminated clothing and wash before reuse. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

ENGINEERING CONTROLS:

There are no occupational exposure limits established at this time. Since this material may be irritating to skin and mucous membranes, general room ventilation plus local exhaust at points of emission should be used to maintain levels of airborne contaminants as low as feasibly possible.

PERSONAL PROTECTION EQUIPMENT

RESPIRATORY:

Respiratory protection is not required under normal use. Wear a NIOSH/MSHA approved respirator following manufacturer's recommendations where airborne contaminants may occur.

EYE / FACE PROTECTION:

Wear chemical safety goggles or face shield to protect against splashing.

SKIN PROTECTION:

Chemical resistant gloves and splash aprons made of impermeable material should be worn.

9. PHYSICAL AND CHEMICAL PROPERTIES

- **Appearance and Odor:** Colorless to amber liquid with strong odor.
- **Physical State:** Liquid
- **pH:** 6.5 – 9
- **Vapor Pressure:** Not determined
- **Vapor Density:** Not determined
- **Boiling Point:** Not determined
- **Melting Point:** 469.4° F estimated
- **Solubility in Water:** Complete
- **Specific Gravity:** 1.01 – 1.03

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable at normal conditions**.**

CONDITIONS TO AVOID: Heat, flames and sparks.

MATERIALS TO AVOID: Strong acids.

HAZARDOUS DECOMPOSITION PRODUCTS: None expected.

HAZARDOUS POLYMERIZATION: Does not occur.

11. TOXICOLOGICAL INFORMATION

ACUTE EFFECTS:

Acute LD50: 400 – 4000 mg/kg, Rat, Oral
Acute LC50: > 4000 mg/kg, Rat, Dermal

Not expected to be hazardous by OSHA criteria.

CHRONIC EFFECTS:

None known. Not expected to be hazardous by OSHA criteria.
This product has no known adverse effect on human health.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL INFORMATION:

ClayBreaker has a biodegradation percentage of 85.2% and is considered to have ready biodegradability. Test of ready biodegradability are stringent tests that provide limited opportunity for acclimation and biodegradation to occur. A positive result in a test of ready biodegradability is an indication that the test substance will undergo rapid and ultimate biodegradation in the environment. OECD Guideline 301B has set the standard for ready biodegradability at 60%. ClayBreaker exceeds this standard for environmental friendliness.

13. DISPOSAL CONSIDERATIONS

Follow approved local beneficial reuse guidelines for uncontaminated spent drilling fluids. If contaminated, dispose of in a licensed industrial landfill according to local, state and federal regulations. If released to the environment for other than its intended purpose, this product does not meet, in its present state, the definition of a hazardous waste under 40 CFR 261. Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for a hazardous waste. Dispose in accordance with all applicable regulations.

14. TRANSPORTATION INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION (DOT):

Not regulated as dangerous goods.

CANADIAN TRANSPORTATION OF DANGEROUS GOODS (TDG):

Not regulated as dangerous goods.

IMDG:

Not regulated as dangerous goods.

IATA:

Not regulated as dangerous goods.

15. REGULATORY INFORMATION

OSHA: This product is not a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200. We request that you make all information in the Material Safety Data Sheet available to your employees.

TSCA: Not on inventory.

SARA TITLE III/CERCLA:

To aid our customers in complying with regulatory requirements, SARA Title III Hazard Categories for this product are indicated below. If the word "YES" appears next to any category, this product may be reportable by you under the requirements of 40 CFR Part 370. Please consult those regulations for details.

Immediate (Acute) Health:	YES
Delayed (Chronic) Health:	NO
Fire Hazard:	NO
Reactive Hazard:	NO
Sudden Release of Pressure:	NO

Reportable Quantity: Not reportable

Spills/release resulting in the loss of any ingredient at or above its RQ requires immediate notification to the National Response Center (1-800-424-8802) and to your Local Emergency Planning Committee.

16. OTHER INFORMATION

HMIS RATINGS: HEALTH (1) FLAMMABILITY (0) PHYSICAL HAZARD (0)
Based on the NPCA HMIS III rating system.

CURRENT ISSUE DATE: August 1, 2014
Updated information on LD50 and LC50.

DCS Fluid Solutions LP believes the information contained in this material safety data sheet is accurate based on the information supplied by reputable suppliers of our raw materials. We cannot make any assertions as to its reliability or completeness; therefore, the user may rely on it only at user's risk. We have made no effort to censor or conceal deleterious aspects of this product. Since we cannot anticipate or control the conditions under which this information and product may be used, we make no guarantee that the precautions we have suggested will be adequate for all individuals and/or situations. It is the obligation of each user of this product to comply with the requirements of all applicable laws regarding use and disposal of this product. Neither warranty, either expressed or implied, nor liability of any nature with respect to this product or to the data herein is made or incurred hereunder.

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POTENTIAL ADDITIVIVE

TORQUE BREAKER

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MATERIAL SAFETY DATA SHEET

5/04/04

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: TorqBreaker™
Chemical Family: Surfactant
Supplier: DCS Fluid Solutions.
PO Box1027
Graham TX 76450
940-521-0500

2. COMPOSITION/INFORMATION ON INGREDIENTS

OSHA Regulated Components: None

3. HAZARDS IDENTIFICATION

Acute Health Effects: None
Chronic Health Effects: None
Carcinogen: No

PRIMARY ENTRY ROUTES:

1) Skin and Eyes: Repeated contact with the skin may be irritating. Eye contact may be irritating.
2) Ingestion: May be harmful.
3) Inhalation: Not considered a hazard.

4. FIRST AID MEASURES

SKIN CONTACT: Remove contaminated clothing without delay. Wash skin thoroughly with water. If irritation persists, get medical attention.
EYE CONTACT: Rinse thoroughly with plenty of water for 15 minutes. In case of persistent eye irritation, consult a physician.
INGESTION: Give large volumes of water. Do not induce vomiting. Get medical attention.
INHALATION: N/A

5. FIRE FIGHTING MEASURES

FLASH POINT: None (will not burn)
EXTINGUISHING MEDIA: N/A
FIRE FIGHTING PROCEDURES: N/A

UNUSUAL FIRE AND EXPLOSION HAZARD: Fire fighters should observe all precautions that apply to any fire where chemicals are stored.

6. ACCIDENTAL RELEASE MEASURES

If product leaks or spills, flood area with water. Mop up and dispose to sanitary sewer. Adhere to all Federal, State and Local Regulations.

7. HANDLING AND STORAGE

Store containers tightly closed and in an upright position.
Do not destroy or deface the label.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Food, beverages and tobacco products should not be carried, stored or consumed where this material is in use. Before eating, drinking or smoking, wash face and hands with soap and water. Avoid skin contact. Protective clothing such as impervious gloves are recommended to prevent skin contact. For operations where eye or face contact can occur, wear eye protection such as chemical splash proof goggles or face shield.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Viscous Liquid
Color:	Red
Odor:	Slight Citrus
Solubility:	Completely soluble in water
Specific Gravity:	1.035
pH	10.0
Freezing Point:	N/A
Flash Point:	None (will not burn)
Vapor Pressure	N/A

10. STABILITY AND REACTIVITY

STABILITY: Stable Conditions to Avoid: None known
POLYMERIZATION: Will not occur. Conditions to Avoid: None known

11. TOXICOLOGICAL INFORMATION

None Available

12. ECOLOGICAL INFORMATION

None Available

13. DISPOSAL INFORMATION

If released into the environment for other than its intended purpose, this product does not meet the definition of a hazardous waste under 40 CFR 261. Follow approved local beneficial reuse guidelines for uncontaminated spent drilling fluids. If contaminated, dispose of in a licensed industrial landfill according to local, state and federal regulations..Recover and reuse if possible.

14. TRANSPORT INFORMATION

SHIPPING NAME: Not applicable/Not Regulated
HAZARD CLASS: Not applicable
UN NUMBER: Not applicable
DOT HAZARDOUS SUBSTANCES: Not applicable
TRANSPORT LABEL: None Required

15. REGULATORY INFORMATION

US TSCA: All components of this product are included on the TSCA Inventory in compliance with the Toxic Substances Control Act, 15 U.S.C. 2601

SECTION 313 SUPPLIER NOTIFICATION (SARA): This product contains the following toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right to Know Act of 1986 and of 40 CFR 372: None.

16. OTHER INFORMATION – NFPA Hazard Rating

Fire
0
Health 0 0 Reactivity
2
PPE

Health: 0=minimal
1=slightly hazardous
2=hazardous
3=serious hazard
4=severe hazard

Fire: 0=will not burn
1=FP>141F
2=FP>73=<141F
3=FP<73F
4=BP<95F FP by Pensky Marten closed cup

Reactivity: 0=None

PPE 0=not necessary

1=mild	1=goggles
2=strong	2=goggles, gloves
	3=goggles, gloves, protective clothes
	4=goggles, gloves, respirator

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BALL BUSTER

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BHS Marketing

Western Briquette

BALLBUSTER

MATERIAL SAFETY DATA SHEET

Sodium Acid Pyrophosphate

Date: June 20, 2001

I Company Identification

Company Name:	BHS Marketing / Western Briquette
Mailing Address:	P.O. Box 27955 SLC, UT 84127-0955
Physical Address:	2320 West Indiana Ave. SLC, UT 84104
Telephone:	(801) 973-8232
Fax:	(801) 973-8838
Emergency Number:	Chemtrec (800) 424-9300

II Product Identification

Product Name:	Sodium Acid Pyrophosphate, SAPP, Disodium pyrophosphate
Chemical Formula:	$Na_2H_2P_2O_7$
Molecular Weight:	221.96
CAS Number:	7758-16-9

III Typical Physical Properties

Physical Appearance:	White powder
Odor:	Odorless
Bulk Density:	0.9 kg/l approx.
pH (1% aqueous solution):	3.7-4.4
Melting Point:	Decomposes at 220°C
Solubility in Water:	approx. 13g in 100g water, room temperature
Vapor Pressure:	Negligible

IV Reactivity Data

Chemical Stability:	Stable
Materials to Avoid:	Avoid contact with strong bases

V Toxicological Information

Toxicity:	Oral-rat LD-50: > 1000 mg/kg

VI Hazard Data

Acute	
Eye Contact:	Causes irritation
Skin Contact:	Causes irritation
Ingestion:	Causes irritation
Inhalation:	Causes irritation
Symptoms of Overexposure:	Irritant to eyes, skin and respiratory systems. Ingestion can cause vomiting and diarrhea

VII Recommended First Aid Measures

General First Aid:	Remove the person from source of exposure. Wash with plenty of water. Upon ingestion, if the person is conscious, cause him/her to vomit. Get medical attention

VIII Fire Fighting Measures

Flash Point:	Not flammable
Extinguishing Media:	Not combustible
Special Firefighting Procedures:	Protective clothing and self contained breathing apparatus

IX Accidental Release Measures

Clean up & Disposal of Spills:	Spillage or leakages are cleaned up by mechanical removal, if possible. Flushing with plenty of water

X Handling & Storage

Handling:	Avoid inhalation, contact with eyes, skin or clothing. Do not ingest
Storage:	Store in a cool, well ventilated, dry place, in tightly closed containers

XI Exposure Controls/ Personal Protection

Appropriate Hygienic Practices:	As part of good industrial, personal hygiene and safety procedure, avoid all unnecessary exposure to the product and ensure prompt removal from eyes, skin and clothing. Maintain good housekeeping to control dust accumulations.

Personal Protection Equipment

Eye Protection:	Use safety glasses
Skin Protection:	Wear protective clothing, gloves and dust respirator if necessary
Ventilation Protection:	Adequate ventilation

XII Additional Information

The information in this MSDS was obtained from sources, which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness.

The conditions or methods of handling, storage, use and disposal are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use or disposal of the product.

*n/a= Not Applicable

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POTENTIAL ADDITIVIVE

SODA ASH

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Soda Ash / Sodium Carbonate

Revision Date: 1/18/2016

SAFETY DATA SHEET

1 PRODUCT AND COMPANY IDENTIFICATION

1.1 PRODUCT IDENTIFIERS

Product Name:	Soda Ash or Sodium Carbonate
Chemical Name:	Sodium Carbonate
Synonyms / Common Names:	Carbonic Acid Sodium Salt
Registration Number REACH:	01-2119485498-19-0011
Product Type REACH:	Substance/mono-constituent
CAS Number:	497-19-8
EC Index Number:	011-005-00-2
EC Number:	207-838-8
RTECS Number:	VZ4050000

1.2 RELEVANT IDENTIFIED USES

Glass production	Paper production	Manufacture of substances
Detergent component	Laboratory chemicals	Acidity regulator

1.3 MANUFACTURER

Ciner Wyoming LLC
254 County Road 4-6
Green River, Wyoming 82935
United States
Telephone Number: (307) 875-2600
www.ciner.us.com

1.4 EMERGENCY TELEPHONE NUMBER

Emergency Response Information Provider: CHEMTREC

Within the United States Emergency Telephone Number: 1-800-424-9300

Outside the United States / International Emergency Telephone Number: +1-703-527-3887

2 HAZARD(S) IDENTIFICATION

2.1 CLASSIFICATION OF THE SUBSTANCE OR MIXTURE

GHS Classification in accordance with 29 CFR 1910 (OSHA HazCom Standard):

Eye Irritation (Category 2A), H319

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS LABEL ELEMENTS, INCLUDING PRECAUTIONARY STATEMENTS

Pictograms:

Irritant

Signal Word: Warning

Hazard Statement(s):

H319 Causes serious eye irritation.

Precautionary Statement(s):

P264 Wash skin thoroughly after handling.

P280 Wear eye protection / face protection.

P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P337 + P313 If eye irritation persists: Get medical advice / attention.

2.3 HAZARDS NOT OTHERWISE CLASSIFIED OR NOT COVERED BY GHS

None

3 COMPOSITION / INFORMATION ON INGREDIENTS

3.1 SUBSTANCES

Synonyms:	Soda Ash, Sodium Carbonate, Carbonic Acid Sodium Salt
Formula:	Na_2CO_3

Molecular Weight: 105.99 g/mol

Component (REACH Registration)	CAS # / EC #	Concentration	Classifications	Remark
Sodium carbonate (01-2119485498-19-0011)	CAS #: 497-19-8 EC #: 207-838-8	≥ 99%	Eye Irrit. 2A, H319	Mono-constituent

* For the full text of the H-Statements mentioned in this Section, see Section 16.

4 FIRST-AID MEASURES

4.1 DESCRIPTION OF FIRST-AID MEASURES

General - Check the vital functions. Unconscious: maintain adequate airway and respiration. Respiratory arrest: artificial respiration or oxygen. Cardiac arrest: perform resuscitation. Victim conscious with labored breathing: half-seated. Victim in shock: on his back with legs slightly raised. Vomiting: prevent asphyxia/aspiration pneumonia. Prevent cooling by covering the victim (no warming up). Keep watching the victim. Give psychological aid. Keep the victim calm, avoid physical strain. Depending on the victim's condition: doctor/hospital.

After inhalation - Remove the victim into fresh air. Respiratory problems: consult a doctor/medical service.

After skin contact - Rinse with water. Soap may be used. Do not apply (chemical) neutralizing agents. Take victim to a doctor if irritation persists.

After eye contact - Rinse immediately with plenty of water for at least 15 minutes. Do not apply neutralizing agents. Take victim to an ophthalmologist if irritation persists.

After ingestion - Rinse mouth with water. Immediately after ingestion: give lots of water to drink. Do not induce vomiting. Consult a doctor/medical service if victim is unwell.

4.2 MOST IMPORTANT SYMPTOMS AND EFFECTS, BOTH ACUTE AND DELAYED

4.2.1 Acute Symptoms

If inhaled - Dry/sore throat. Coughing. Slight irritation. Exposure to high concentrations: Irritation of the respiratory tract. Irritation of the nasal mucous membranes. Respiratory difficulties.

In case of skin contact - Not irritating

In case of eye contact - Inflammation/damage of the eye tissue. Corrosion of the eye tissue. Lacrimation.

If swallowed – After absorption of high quantities: Nausea. Vomiting. Abdominal pain. Irritation of the gastric/intestinal mucosa.

4.2.2 Delayed Symptoms

No effects known.

4.3 INDICATION OF ANY IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED

No data available.

5 Fire-Fighting Measures

5.1 Extinguishing Media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

Upon combustion CO and CO2 are formed. Reacts on exposure to water with some metals. CO2 generation occurs when mixed with acidic materials.

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Special protective equipment for firefighters

Gloves. Safety glasses. Protective clothing. Dust cloud protection and heat/fire exposure: Compressed air respirator.

6 Accidental Release Measures

6.1 Personal Precautions, Protective Equipment and Emergency Procedures

Use personal protective equipment. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions

Contain released substance, pump into suitable containers. Plug the leak, cut off the supply. Knock down/dilute dust cloud with water spray. Violent exothermic reaction with some acids; release of harmful gases/vapors (carbon dioxide). Carbon dioxide is heavier than air and will collect in ducts, drains and low lying areas. Prevent spreading in sewers.

6.3 Methods and material for containment and cleaning up

Prevent dust cloud formation. Scoop solid spill material into closed containers. Carefully collect the spill. Clean contaminated surfaces with an excess of water. Wash clothing and equipment after handling.

6.4 Reference to other sections

For disposal see section 13.

7 HANDLING AND STORAGE

7.1 PRECAUTIONS FOR SAFE HANDLING

Avoid contact with skin and eyes. Use air conveying/mechanical systems for bulk transfer to storage. Provide appropriate exhaust ventilation at places where dust is formed. In case of insufficient ventilation, wear suitable respiratory equipment if release of airborne dust is expected.

7.2 CONDITIONS FOR SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES

Store in original container. Keep in properly labeled containers. Keep container tightly closed.

7.3 SUITABLE PACKAGING MATERIAL

No data available

7.4 INCOMPATIBLE PRODUCTS

Aluminum, powdered aluminum, and acids.

8 EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 COMPONENTS WITH WORKPLACE CONTROL PARAMETERS

Contains no substances with occupational exposure limit values.

8.2 EXPOSURE CONTROLS

Appropriate engineering controls – Avoid formation of dust. Keep away from ignition sources. Keep container tightly closed. Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

8.3 PERSONAL PROTECTIVE EQUIPMENT

Eye / Face Protection - Safety glasses with side shields or protective goggles. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection - Handle with gloves, butyl rubber or PVC, which have good resistance. Gloves must be inspected prior to use. Use proper glove removal technique to avoid skin contact with product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection – Protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection – For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator. For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

8.4 CONTROL OF ENVIRONMENTAL EXPOSURE

Prevent leakage or spillage if safe to do so. Do not let product enter drains. See section 6.2, 6.3, and 13.

9 PHYSICAL AND CHEMICAL PROPERTIES

9.1 INFORMATION ON BASIC PHYSICAL AND CHEMICAL PROPERTIES

Appearance Form:	Crystalline Solid / Crystalline Powder / Grains / Lumps
Color:	Colorless
Odor:	Odorless
Odor Threshold:	No data available
Particle Size:	694 µm
pH:	11.6; 5.0%
Melting Point / Freezing Point:	851 °C / 1,564 °F
Boiling Point	1,600 °C / 2,912 °F
Flash Point:	No data available
Explosion Limits:	No data available
Evaporation Rate:	No data available
Flammability:	Non Combustible
Log Kow:	-6.19 Estimated value
Viscosity:	No data available
Vapor Pressure:	No data available
Vapor Density:	No data available
Solubility water:	212.5 g/l; 20 °C / 68 °F
Relative Density:	2.52 -253; 20 °C / 68 °F
Absolute Density:	2,530 kg/m^3
Decomposition temperature:	>1600 °C / >2912 °F
Auto-ignition temperature:	>400 °C / >752 °F
Explosive Properties:	No data available
Oxidizing Properties:	No data available

9.2 PHYSICAL HAZARDS

No data available

10 STABILITY AND REACTIVITY

10.1 REACTIVITY

None under normal use conditions.

10.2 CHEMICAL STABILITY

Stable. Decomposes by reaction with strong acid.

10.3 POSSIBILITY OF HAZARDOUS REACTIONS

None under normal processing.

10.4 CONDITIONS TO AVOID

Exposure to air or moisture over prolonged periods.

10.5 INCOMPATIBLE MATERIALS

Aluminum, powdered aluminum, and acids.

10.6 HAZARDOUS POLYMERIZATION

Hazardous polymerization does not occur.

---

11 TOXICOLOGICAL INFORMATION

11.1 INFORMATION ON TOXICOLOGICAL EFFECTS

11.1.1 Acute toxicity

LD50 Oral - rat – 2,800 mg/kg
LD50 Dermal – rabbit >2,000 mg/kg
LD50 Inhalation - rat – 2.30 mg/l, 2 hour exposure time

11.1.2 Corrosion / irritation

Skin - rabbit
Result: Mild skin irritation – 24 hours

11.1.3 Serious eye damage / eye irritation

Eyes - rabbit
Result: Severe eye irritation – 24 hours

11.1.4 Respiratory or skin sensitization

Inhalation - no data available
Skin Sensitization: no data available

11.1.5 Germ cell mutagenicity

No data available

11.1.6 Carcinogenicity

No data available

11.1.7 Reproductive toxicity

No data available

11.1.8 Specific target organ toxicity - single exposure

No data available

11.1.9 Specific target organ toxicity - repeated exposure

No data available

11.1.10 Chronic effects from short and long-term exposure

On continuous / repeated exposure / contact: Red skin. Dry skin. Tingling / irritation of the skin. Affection of the nasal septum.

12 ECOLOGICAL INFORMATION

12.1 TOXICITY

	Parameter	Method	Value	Duration	Species	Test design	Fresh / salt water	Value determination
Acute toxicity fishes	LC50	Other	300 mg/l	96 h	Lepomis macrohirus	Static system	Fresh water	Experimental value
Acute toxicity invertebrates	EC50	Other	200 - 227 mg/l	48 h	Ceriodaphnia sp.	Semi-static	Fresh water	Experimental value
Toxicity algae and other aquatic plants	EC50		242 mg/l	5 days	Algae			Experimental value

12.2 PERSISTENCE AND DEGRADABILITY:

Biodegradability: not applicable

12.3 BIOACCUMULATIVE POTENTIAL:

Low potential for bioaccumulation (Log Know <4)

12.4 MOBILITY IN SOIL:

Low potential for absorption in soil.

12.5 RESULTS OF PBT AND VPVB ASSESSMENT:

PBT/vPvB assessment not available as chemical safety assessment is not required/not conducted.

12.6 OTHER ADVERSE EFFECTS:

No data available

13 DISPOSAL CONSIDERATIONS

13.1 WASTE DISPOSAL

Remove waste in accordance with local and/or national regulations. Contact a licensed professional waste disposal service to dispose of this material. Different types of hazardous waste should not be mixed together if it will entail a risk of pollution or create problems for the further management of the waste. Hazardous waste shall be managed responsibly. Do not discharge into drains.

14 TRANSPORT INFORMATION

14.1 UNITED STATES DEPARTMENT OF TRANSPORTATION (DOT)
Non-regulated

14.2 INTERNATIONAL MARITIME DANGEROUS GOODS (IMDG)
Non-regulated

14.3 INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA)
Non-regulated

14.4 TDG / ADN / RID / ADR
Non-regulated

15 REGULATORY INFORMATION

15.1 SARA 302 COMPONENTS
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

15.2 SARA 313 COMPONENTS
SARA 313: This material does not contain any chemical with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

15.3 SARA 311/312 HAZARDS
Acute Health Hazard

15.4 PENNSYLVANIA RIGHT TO KNOW COMPONENTS
Sodium carbonate, CAS-No: 497-19-8

15.5 NEW JERSEY RIGHT TO KNOW COMPONENTS
Sodium carbonate, CAS-No: 497-19-8

15.6 WHMIS CLASSIFICATION: C, D2
Note: The product listed on this SDS has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations.

16 OTHER INFORMATION

16.1 FULL TEXT OF H-STATEMENTS REFERRED TO UNDER SECTION 2 AND 3.

Eye Irrit.	Eye Irritation
H319	Causes serious eye irritation

16.2 HMIS RATING

Health Hazard:	2
Flammability:	0
Physical Hazard:	0

16.3 NFPA RATING

Health Hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

16.4 NOTICE

The above information is believed to be correct but is not intended to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Ciner and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product.

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POTENTIAL ADDITIVIVE

SODIUM BICARBONATE

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Soda Ash / Sodium Carbonate

Revision Date: 7/27/2018

SAFETY DATA SHEET

1 PRODUCT AND COMPANY IDENTIFICATION

1.1 PRODUCT IDENTIFIERS

Product Name:	Soda Ash or Sodium Carbonate
Chemical Name:	Sodium Carbonate
Synonyms / Common Names:	Carbonic Acid Sodium Salt
Product Type REACH:	Substance/mono-constituent
CAS Number:	497-19-8
EC Index Number:	011-005-00-2
EC Number:	207-838-8
RTECS Number:	VZ4050000

1.2 RELEVANT IDENTIFIED USES

Glass Production	Paper Production	Manufacture of Substances
Detergent Component	Laboratory Chemicals	Acidity Regulator

1.3 MANUFACTURER

Ciner Wyoming LLC
254 County Road 4-6
Green River, Wyoming 82935
United States
Telephone Number: (307) 875-2600
www.ciner.us.com

1.4 EMERGENCY TELEPHONE NUMBER

Emergency Response Information Provider: CHEMTREC
Within the United States Emergency Telephone Number: 1-800-424-9300
Outside the United States / International Emergency Telephone Number: +1-703-527-3887

2 HAZARD(S) IDENTIIFICATION

2.1 CLASSIFICATION OF THE SUBSTANCE OR MIXTURE

GHS Classification in accordance with 29 CFR 1910 (OSHA HazCom Standard):
Eye Irritation (Category 2A), H319
For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS LABEL ELEMENTS, INCLUDING PRECAUTIONARY STATEMENTS

Pictograms:

Irritant

Signal Word: Warning

Hazard Statement(s):
H319 Causes serious eye irritation.

Precautionary Statement(s):
P264 Wash skin thoroughly after handling.

P280 Wear eye protection / face protection.

P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P337 + P313 If eye irritation persists: Get medical advice / attention.

2.3 HAZARDS NOT OTHERWISE CLASSIFIED OR NOT COVERED BY GHS

None

---

3 COMPOSITION / INFORMATION ON INGREDIENTS

3.1 SUBSTANCES

Synonyms: Soda Ash, Sodium Carbonate, Carbonic Acid Sodium Salt
Formula: Na_2CO_3
Molecular Weight: 105.99 g/mol

Component (REACH Registration)	CAS #	Concentration	Classifications	Remark
Sodium Carbonate (01-2119485498-19-0011)	CAS #: 497-19-8	≥ 99%	Eye Irrit. 2A, H319	Monoconstituent

* For the full text of the H-Statements mentioned in this Section, see Section 16.

4 FIRST-AID MEASURES

4.1 DESCRIPTION OF FIRST-AID MEASURES

General - Check the vital functions. Unconscious: maintain adequate airway and respiration. Respiratory arrest: artificial respiration or oxygen. Cardiac arrest: perform resuscitation. Victim conscious with labored breathing: half-seated. Victim in shock: on his back with legs slightly raised. Vomiting: prevent asphyxia/aspiration pneumonia. Prevent cooling by covering the victim (no warming up). Keep watching the victim. Give psychological aid. Keep the victim calm, avoid physical strain. Depending on the victim's condition: doctor/hospital.

After inhalation - Remove the victim into fresh air. Respiratory problems: consult a doctor/medical service.

After skin contact - Rinse with water. Soap may be used. Do not apply (chemical) neutralizing agents. Take victim to a doctor if irritation persists.

After eye contact - Rinse immediately with plenty of water for at least 15 minutes. Do not apply neutralizing agents. Take victim to an ophthalmologist if irritation persists.

After ingestion - Rinse mouth with water. Immediately after ingestion: give lots of water to drink. Do not induce vomiting. Consult a doctor/medical service if victim is unwell.

4.2 MOST IMPORTANT SYMPTOMS AND EFFECTS, BOTH ACUTE AND DELAYED

4.2.1 Acute Symptoms

If inhaled - Dry/sore throat. Coughing. Slight irritation. Exposure to high concentrations: Irritation of the respiratory tract. Irritation of the nasal mucous membranes. Respiratory difficulties.

In case of skin contact - Not irritating

In case of eye contact - Inflammation/damage of the eye tissue. Corrosion of the eye tissue. Lacrimation.
If swallowed – After absorption of high quantities: Nausea. Vomiting. Abdominal pain. Irritation of the gastric/intestinal mucosa.

4.2.2 Delayed Symptoms

No effects known.

4.3 INDICATION OF ANY IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED

No data available.

5 FIRE-FIGHTING MEASURES

5.1 EXTINGUISHING MEDIA

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 SPECIAL HAZARDS ARISING FROM THE SUBSTANCE OR MIXTURE

Upon combustion CO and CO2 are formed. Reacts on exposure to water with some metals. CO2 generation occurs when mixed with acidic materials.

5.3 ADVICE FOR FIREFIGHTERS

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 SPECIAL PROTECTIVE EQUIPMENT FOR FIREFIGHTERS

Gloves. Safety glasses. Protective clothing. Dust cloud protection and heat/fire exposure: Compressed air respirator.

6 ACCIDENTAL RELEASE MEASURES

6.1 PERSONAL PRECAUTIONS, PROTECTIVE EQUIPMENT AND EMERGENCY PROCEDURES

Use personal protective equipment. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 ENVIRONMENTAL PRECAUTIONS

Contain released substance, pump into suitable containers. Plug the leak, cut off the supply. Knock down/dilute dust cloud with water spray. Violent exothermic reaction with some acids; release of harmful gases/vapors (carbon dioxide). Carbon dioxide is heavier than air and will collect in ducts, drains and low-lying areas. Prevent spreading in sewers.

6.3 METHODS AND MATERIAL FOR CONTAINMENT AND CLEANING UP

Prevent dust cloud formation. Scoop solid spill material into closed containers. Carefully collect the spill. Clean contaminated surfaces with an excess of water. Wash clothing and equipment after handling.

6.4 REFERENCE TO OTHER SECTIONS

For disposal see section 13.

7 HANDLING AND STORAGE

7.1 PRECAUTIONS FOR SAFE HANDLING

Avoid contact with skin and eyes. Use air conveying/mechanical systems for bulk transfer to storage. Provide appropriate exhaust ventilation at places where dust is formed. In case of insufficient ventilation, wear suitable respiratory equipment if release of airborne dust is expected.

7.2 CONDITIONS FOR SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES

Store in original container. Keep in properly labeled containers. Keep container tightly closed.

7.3. SUITABLE PACKAGING MATERIAL

No data available.

7.4 INCOMPATIBLE PRODUCTS

Aluminum, powdered aluminum, and acids.

8 EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 COMPONENTS WITH WORKPLACE CONTROL PARAMETERS

Contains no substances with occupational exposure limit values.

8.2 EXPOSURE CONTROLS

Appropriate engineering controls – Avoid formation of dust. Keep away from ignition sources. Keep container tightly closed. Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

8.3 PERSONAL PROTECTIVE EQUIPMENT

Eye / Face Protection - Safety glasses with side shields or protective goggles. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin Protection - Handle with gloves, butyl rubber or PVC, which have good resistance. Gloves must be inspected prior to use. Use proper glove removal technique to avoid skin contact with product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection – Protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory Protection – For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator. For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

8.4 CONTROL OF ENVIRONMENTAL EXPOSURE

Prevent leakage or spillage if safe to do so. Do not let product enter drains. See section 6.2, 6.3, and 13.

9 PHYSICAL AND CHEMICAL PROPERTIES

9.1 INFORMATION ON BASIC PHYSICAL AND CHEMICAL PROPERTIES

Appearance Form:	Crystalline Solid / Crystalline Powder / Grains / Lumps
Color:	Colorless
Odor:	Odorless
Odor Threshold:	No data available
Particle Size:	694 µm
pH:	11.6; 5.0%
Melting Point / Freezing Point:	851°C / 1,564°F
Boiling Point:	1,600°C / 2,912°F
Flash Point:	No data available
Explosion Limits:	No data available
Evaporation Rate:	No data available
Flammability:	Non-Combustible
Log Kow:	-6.19 Estimated Value
Viscosity:	No data available
Vapor Pressure:	No data available
Vapor Density:	No data available
Solubility Water:	212.5 g/l; 20°C / 68°F
Relative Density:	2.52 – 2.53; 20°C / 68°F
Absolute Density:	2,530 kg/m^3
Decomposition Temperature:	>1600°C / >2912°F
Auto-Ignition Temperature:	>400°C / >752°F
Explosive Properties:	No data available
Oxidizing Properties:	No data available

9.2 PHYSICAL HAZARDS
No data available.

10 STABILITY AND REACTIVITY

10.1 REACTIVITY
None under normal use conditions.

10.2 CHEMICAL STABILITY
Stable. Decomposes by reaction with strong acid.

10.3 POSSIBILITY OF HAZARDOUS REACTIONS
None under normal processing.

10.4 CONDITIONS TO AVOID
Exposure to air or moisture over prolonged periods.

10.5 INCOMPATIBLE MATERIALS
Aluminum, powdered aluminum, and acids.

10.6 HAZARDOUS POLYMERIZATION
Hazardous polymerization does not occur.

11 TOXICOLOGICAL INFORMATION

11.1 INFORMATION ON TOXICOLOGICAL EFFECTS

11.1.1 Acute toxicity
LD50 Oral - rat – 2,800 mg/kg
LD50 Dermal - rabbit >2,000 mg/kg
LD50 Inhalation - rat – 2.30 mg/l, 2-hour exposure time

11.1.2 Corrosion/irritation
Skin - rabbit
Result: Mild skin irritation – 24 hours

11.1.3 Serious eye damage/eye irritation
Eyes - rabbit
Result: Severe eye irritation – 24 hours

11.1.4 Respiratory or skin sensitization
Inhalation - no data available
Skin Sensitization: no data available

11.1.5 Germ cell mutagenicity
No data available

11.1.6 Carcinogenicity
No data available

11.1.7 Reproductive toxicity
No data available

11.1.8 Specific target organ toxicity - single exposure
No data available

11.1.9 Specific target organ toxicity - repeated exposure
No data available

11.1.10 Chronic effects from short and long-term exposure
On continuous / repeated exposure / contact: Red skin. Dry skin. Tingling / irritation of the skin. Affection of the nasal septum.

12 ECOLOGOCAL INFORMATION

12.1 TOXICITY

	Parameter	Method	Value	Duration	Species	Test Design	Fresh/Salt Water	Value Determination
Acute toxicity fishes	LC50 Other	Other	300 mg/l	96 h	Lepomis macronhirus	Static system	Fresh water	Experimental value
Acute toxicity invertebrates	EC50	Other	200-227 mg/l	48 h	Ceriodaphnia sp.	Semi-static	Fresh water	Experimental value
Toxicity algae and other aquatic plants	EC50		242 mg/l	5 days	Algae			Experimental value

12.2 PERSISTENCE AND DEGRADABILITY:
Biodegradability: not applicable

12.3 BIOACCUMULATIVE POTENTIAL:
Low potential for bioaccumulation (Log Kow <4)

12.4 MOBILITY IN SOIL:
Low potential for absorption in soil.

12.5 RESULTS OF PBT AND VPVB ASSESSMENT:
PBT/vPvB assessment not available as chemical safety assessment is not required/not conducted.

12.6 OTHER ADVERSE EFFECTS:
No data available.

13 DISPOSAL CONSIDERATIONS

13.1 WASTE DISPOSAL
Remove waste in accordance with local and/or national regulations. Contact a licensed professional waste disposal service to dispose of this material. Different types of hazardous waste should not be mixed together if it will entail a risk of pollution or create problems for the further management of the waste. Hazardous waste shall be managed responsibly. Do not discharge into drains.

14 TRANSPORT INFORMATION

14.1 UNITED STATES DEPARTMENT OF TRANSPORTATION (DOT)
Non-regulated

14.2 INTERNATIONAL MARITIME DANGEROUS GOODS (IMDG)
Non-regulated

14.3 INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA)
Non-regulated

14.4 TDG/ADN/RID/ADR
Non-regulated

15 REGULATORY INFORMATION

15.1 SARA 302 COMPONENTS
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

15.2 SARA 313 COMPONENTS
SARA 313: This material does not contain any chemical with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

15.3 SARA 311/312 HAZARDS
Acute Health Hazard

15.4 PENNSYLVANIA RIGHT TO KNOW COMPONENTS
Sodium carbonate, CAS-No: 497-19-8

15.5 NEW JERSEY RIGHT TO KNOW COMPONENTS
Sodium carbonate, CAS-No: 497-19-8

15.6 WHMIS CLASSIFICATION: C, D2
Note: The product listed on this SDS has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations.

15.7 US CALIFORNIA SAFE DRINKING WATER & TOXIC ENFORCEMENT ACT (PROPOSITION 65)
This product does not contain any chemicals known to the State of California to cause cancer, birth, or any other reproductive defects.

16 OTHER INFORMATION

16.1 FULL TEXT OF H-STATEMENTS REFERRED TO UNDER SECTION 2 AND 3.

Eye Irrit.	Eye Irritation
H319	Causes serious eye irritation

16.2 HMIS RATING

Health Hazard:	2
Flammability:	0
Physical Hazard:	0

16.3 NFPA RATING

Health Hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

16.4 NOTICE

The above information is believed to be correct but is not intended to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Ciner and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product.

16.5 PRODUCT CERTIFICATIONS

This product is certified to NSF/ANSI Standard 60 for use in drinking water treatment at the specified maximum use limit. The MUL (maximum use level) for sodium carbonate anhydrous is 100 mg/L under NSF/ANSI Standard 60.

OU Kosher Certification

CERTIFIED HALAL حلال ISLAMIC FOOD AND NUTRITION COUNCIL OF AMERICA

NSF Certified to NSF/ANSI 60

MICHELS®

POTENTIAL ADDITIVIVE

CITRIC ACID

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Univar USA Inc Safety Data Sheet

SDS No:	
Version No:	003 2015-06-02
Order No:	

3075 Highland Pkwy, Ste 200, Downers Grove, IL 60515
(425) 889 3400

Emergency Assistance

For emergency assistance involving chemicals call
Chemtrec - (800) 424-9300

Safety Data Sheet

CITRIC ACID FCC/USP PWD

SECTION 1:IDENTIFICATION OF THE SUBSTANCE/ MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1 PRODUCT IDENTIFIER

- Chemical name	Citric acid - Food grade
- REACH Registration Number	01-2119457026-42-0031

1.2 RELEVANT IDENTIFIED USES OF THE SUBSTANCE AND USES ADVISED AGAINST

Citric acid can be used in food as food additives and also in technical application as clarifying agent, water softener, buffer, foam booster and stabilizer, complexing agent and as an intermediate in production of organic chemicals.

1.3 DETAILS OF THE SUPPLIER

- Company identification

US:
Tate & Lyle Ingredients Americas, LLC.
2200 E.Eldorado Street
Decatur, IL 62521

Europe:
Tate & Lyle Slovakia s.r.o.
Boleraz 114
919 08 boleraz
Slovakia

1.4 EMERGENCY PHONE NR.

CHEMTREC
Toll-Free: 1-800-424-9300 (USA and Canada)
Non Toll-Free +1-703-527-3887 (Global)

SECTION 2:HAZARDS IDENTIFICATION

2.1. CLASSIFICATION OF THE SUBSTANCE OR MIXTURE

According with the version of the Globally Harmonized system of Classification and labeling adopted in the United states and Regulation 1272/2008/EC [CLP]: Eyes irritant category 2(H319)

Safety Data Sheet

CITRIC ACID FCC/USP PWD

2.2 LABEL ELEMENTS

GHS07

Signal word:
Warning

Hazard Statement:
Causes serious eye irritation. H319

Precautionary Statement:
Wash hands thoroughly after handling. P264
Wear eye protection. P280

Precautionary Statement. IF IN EYES: P305
Response :
Rinse cautiously with water for several minutes. P351
Remove contact lenses, if present and easy to do Continue rinsing. P338
If eye irritation persists: P337
Get medical advice/attention. P313

2.3. OTHER HAZARDS
FIRE AND EXPLOSION HAZARD:
May form combustible dust concentrations in air. Possibility of dust explosion. it is recommended that all dust control equipment and material transport systems involved are engineered to prevent conditions contributing to dust explosions. Do not allow dust to accumulate on flat surfaces, on rafters or building structural components. Keep away from all ignition sources including heat, sparks and flame.

SECTION 3:COMPOSITION/INFORMATION OF INGREDIENTS

- Chemical name Citric acid - Food grade

Safety Data Sheet

CITRIC ACID FCC/USP PWD

- CAS number	77-92-9
- EINECS number	201-069-1
- Synonyms	2 - Hydroxy -1,2,3 propanetricarboxylic acid Acidulant - Citric acid - food additive E330.

SECTION 4:FIRST AID MEASURES

4.1 DESCRIPTION OF FIRST AID MEASURES

- General advise	Seek medical attention if irritation develops after first aid application
- Inhalation	Move people from the exposure to fresh air.
- Skin contact	Wash skin with soap and water.
- Eye contact	Remove particulates by irrigating with eye wash solution or clean water, holding eyelids apart.
- Ingestion	Wash mouth and flush throat upto the stomach.

4.2 MOST IMPORTANT SYMPTOMS AND EFFECTS, BOTH ACUTE AND DELAYED
ROUTE(S) OF ENTRY: Skin Contact; Eye Contact
HUMAN EFFECTS AND SYMPTOMS OF OVEREXPOSURE:
ACUTE SKIN CONTACT: This product is irritating to the skin resulting in reddening, stinging, and swelling.
ACUTE EYE CONTACT: This product is irritating to the eyes resulting in stinging, reddening, tearing, and swelling.
CHRONIC EFFECTS OF EXPOSURE: No applicable information was found concerning any adverse chronic health effects from overexposure to this product.
CARCINOGENICITY: The components of this product are not listed by NTP, IARC or regulated as a carcinogen by OSHA.
MEDICAL CONDITIONS
AGGRAVATED BY EXPOSURE: Persons with pre-existing eye or skin disorders may be more susceptible to the effects of this product.

4.3 INDICATION OF ANY IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED.
None Anticipated

SECTION 5: FIRE-FIGHTING MEASURES

5.1 EXTINGUISHING MEDIA
Water spray, dry powder, carbon dioxide or media appropriate for surrounding fire. Use of water jet may cause explosive dust conditions.

Safety Data Sheet

CITRIC ACID FCC/USP PWD

5.2 SPECIFIC HAZARDS
FIRE AND EXPLOSION HAZARD: Possibility of dust explosion. It is recommended that all dust control equipment and material transport systems involved are engineered to prevent conditions contributing to dust explosions. Do not allow dust to accumulate on flat surfaces, on rafters or building structural components. Use of water jet may cause explosive dust conditions.
SEE NFPA 61, Standard for the prevention of Fire and Dust Explosions in Agricultural and Food Processing Facilities, 2008 or later Edition, and other related standards.

5.3 SPECIFIC PROTECTIVE EQUIPMENT AND PRECAUTIONS FOR FIRE-FIGHTERS
Wear self-contained breathing apparatus and full protective gear. Use water spray to cool fire exposed containers.

FLAMMABILITY CLASS (OSHA)
Not applicable

HAZARDOUS COMBUSTION PRODUCTS
Carbon dioxide and carbon monoxide

SECTION 6:ACCIDENTAL RELEASE MEASURES

6.1 PERSONAL PRECAUTIONS
Use personal protective equipment. Wear eye protection. Avoid contact with skin and eyes.

6.2 ENVIRONMENTAL PRECAUTIONS
Prevent further leakage or spillage if safe to do so. No special environmental precautions required

6.3 METHODS FOR CLEANING UP
Vacuum or sweep spills. Minimize dust generation.
If washing down spilled area is necessary, use copious amounts of water and control runoff.
Follow local, state and federal regulations for product disposal

6.4 REFERENCE TO OTHER SECTIONS
See Section 7 for information on safe handling
See Section 8 for information on personal protection equipment
See Section 13 for disposal information

SECTION 7: HANDLING AND STORAGE

Safety Data Sheet

CITRIC ACID FCC/USP PWD

7.1 PRECAUTIONS FOR SAFE HANDLING
See NFPA 61, Standard for the Prevention of Fire and Dust Explosions in Agricultural and Food Processing Facilities, 2008 Edition, and other related standards. Use with adequate ventilation. Minimize dust generation and accumulation; dust deposits should not be allowed to accumulate on surfaces, as these may form an explosive mixture if they are disturbed.

All dust control equipment and material transport systems involved are engineered to prevent conditions contributing to dust explosions and may require explosion relief vents or an explosion suppression system or an oxygen-deficient environment. Bonding and grounding systems may be required.

Dust-handling systems (such as exhaust ducts, dust collectors, vessels, and processing equipment) should be designed to limit or prevent leakage of dust into the work area.

Do not allow dust to accumulate on flat surfaces, on rafters or building structural components. Routine housekeeping should be instituted to reduce dust accumulation. Use Avoid dispersal of dust in the air; use vacuum or wet sweeping methods. Do not use compressed air to clean surfaces.

Keep away from all ignition sources including heat, sparks, and flame. Where dust accumulations occur use non-sparking tools.

7.2 CONDITIONS OF SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES
Store in a cool dry place. Store in a tightly closed container/bag.
The packaging material should have reasonable moisture and air barriers and comply with food regulations.
7.3 SPECIFIC END USE(S)
See overview of the exposure scenario and summary of risk management measures in Appendix 1

SECTION 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 CONTROL PARAMETERS
Exposure limits: Nuisance dust (also called particulate not otherwise regulated (PNOR)).
OSHA PEL: 15 mg/ mg/m3 Total dust
5 mg/m3 Respirable dust
ACGIH TLV: 10 mg/m3 Inhalable dust
5 mg/m3 Respirable dust
15 mg/m3 Total dust

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CITRIC ACID FCC/USP PWD

8.2 EXPOSURE CONTROLS
APPROPRIATE ENGINEERING CONTROLS:
Ventilation: See NFPA 61, Standard for the Prevention of Fire and Dust Explosions in Agricultural and Food Processing Facilities, 2008 Edition, and National Fire Protection Association 650, Standard for Pneumatic Conveying Systems for Handling Combustible Materials, 1997 Edition and other related standards. Normal industrial hygiene measures should be sufficient for protection of employees from exposure to dusts. Local and mechanical exhaust is desirable when dumping bags.

APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT:
Eye protection: Safety glasses are recommended. Safety goggles are desirable when dumping bags.
Emergency wash facilities: Eye wash is recommended for conditions where dust generation is likely.
Special protective clothing: Not normally required.
Gloves: Not normally required. Use ordinary work gloves if dust dries skin.
Respirator: NIOSH approved N-95 dust respirator if working in situations that could generate large amounts of airborne dust.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:
See section 5.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1 INFORMATION ON BASIC PHYSICAL AND CHEMICAL PROPERTIES

- Physical form	Solid
- Color	White to off-white
- Odor	Essentially odorless to very slight sugar odor
- pH (concentration)	NA
- Boiling point	104°C (219 °F)
- Flash point	345°C
- Melting/freezing point	approx. 153°C at 1,013 hPa
- Decomposition temperature	NA
- Auto-ignition temperature	NA
- Explosion properties	NA
- Oxidising properties	NA
- Vapour pressure	2.21*10-6 Pa at 25°C
- Vapor density	0.62 (Air = 1)
- Relative density	1.665at 20°C

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CITRIC ACID FCC/USP PWD

- Bulk density	Not Established
- Specific gravity	15 °C (1.24 at 59 °F)
- Viscosity	Not Established
- Water solubility	590 g/L at 20°C
- Solubility (non aqueous)	Methyl alcohol: completely miscible
- Partition coefficient	In OCTANOL/ WATER (log value): Log Kow: -0.2 to -1.8
- Dissociation constant	pKa: 3.13, 4.76 and 6.4 at 25°
- Evaporation rate	Less than 1 (Butyl acetate =1)

9.2 OTHER INFORMATION

SECTION 10: STABILITY AND REACTIVITY

10.1 REACTIVITY
Stable

10.2 CHEMICAL STABILITY
Stable under normal conditions.
Polymerization will not occur.

10.3 POSSIBILITY OF HAZARDOUS REACTIONS
Not applicable

10.4 CONDITIONS TO AVOID
Practices which produce dust or disperse finely divided dust in air.
See NFPA 61. Standard for the Prevention of Fire and Dust Explosions in Agricultural and Food Processing Facilities, 2008 Edition, and other related standards.

10.5 INCOMPATIBLE MATERIALS
Oxidizing agents, strong acids

10.6 Hazardous decomposition products:
Nothing unusual

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 INFORMATION ON TOXICOLOGICAL EFFECTS

- Inhalation	ORAL: LD50: 5400 – 5790 mg/kg bw (mouse) / LD50: 11700 mg/kg bw (rat) DERMAL: LD50 >2000 mg/kg bw rat
- Ingestion	No effects known or anticipated.

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CITRIC ACID FCC/USP PWD

- Skin irritation / corrosion	Sustained exposure in a dusty manufacturing environment may result in mechanical irritation in the creases of the skin, particularly at the fingers, or other drying effects. no health effects known or anticipated.
- Eye irritation	Irritating to eyes.
- Skin sensitisation	Not sensitizing
- Chronic toxicity	Not known or anticipated
- Genetic toxicity	Not known or anticipated
- Carcinogenicity	Not classifiable as Carcinogen.
- Reprotoxicity	Not known or anticipated
- Specific effects	Not applicable

SECTION 12: ECOLOGICAL INFORMATION

12.1 TOXICITY
LC50 for freshwater fish: 440 mg/l
EC50/LC50 for freshwater invertebrates: 1535 mg/l.

12.2 PERSISTENCE/DEGRADABILITY
Ready biodegradable

12.3 BIOACCUMULATIVE POTENTIAL
Log Kow <3, not bioaccumulative

12.4 MOBILITY IN SOIL
Not applicable

12.5 BPT, vPvB
The substance does not meet the criteria for PBT or vPvB.

12.6 OTHER ADVERSE EFFECTS
None known

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 WASTE TREATMENT METHODS
Follow local, state and federal regulations for product disposal. Not a hazardous waste unless contaminated with hazardous products.

SECTION 14: TRANSPORTATION INFORMATION

Safety Data Sheet

CITRIC ACID FCC/USP PWD

International regulations (RID/ADR; RTMDR; IMDG; IATA/OACI): Not classified as dangerous for transport.
DOT shipping label: Non-hazardous

SECTION 15: REGULATORY INFORMATION

15.1 SAFETY, HEALTH AND ENVIRONMENTAL REGULATIONS
According with the version of the Globally Harmonized System of Classification and labeling adopted in the United States and Regulation 1272/2008/EC(CLP): Classified

15.2 CHEMICAL SAFETY ASSESSMENT
US FEDERAL REGULATIONS:
Clean Air Act:
ODS: Not applicable.
SARA (EPCRA) Section 313 (40 C.F.R. § 372.65): Not applicable.
TSCA Status: On TSCA inventory.

STATE REPORTING REQUIREMENTS:
California Proposition 65: Not applicable.

SECTION 16: OTHER INFORMATION

See Hazard Communication Guidance for Combustible Dusts, OSHA 3371-08 2009, U.S. Occupational Safety and Health Administration, https://www.osha.gov/Publications/3371combustible-dust.html (accessed 10/8/14)
And
NFPA 654, Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids, for general safe handling and design guidance.

Other classifications of the substance:
TSCA STATUS: On TSCA Inventory.
FDA STATUS: Citrus acid, Anhydrous complies with FDA Regulation 21 C.F.R. § 184.1033;
CALIFORNIA PROPOSITION 65: Not applicable.
HMIS rating:
Health: 1
Flammable: 0

Safety Data Sheet

CITRIC ACID FCC/USP PWD

Reactivity: 0
(0 = minimal ; 1 = slight ; 2 = moderate ; 3 = serious ; 4 = severe)

Safety Data Sheet according to Commission Regulation (EU) No 453/2010 of 20 May 2010 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)

DISCLAIMER OF LIABILITY

The information in this SDS is collected from reliable sources. However, the information is provided without any warranty, expressed or implied. The conditions or methods of handling, storage, use or disposal of the product might be beyond our control and knowledge. For the avoidance of doubt, we shall in no such circumstances be under any liability in respect of loss, damage or expenses arising from handling, storage, use or disposal of the product by your company and/or your subcontractors. This SDS is only applicable for the product mentioned in the identification chapter and title. If the product is used as a component in another product, this SDS may not be applicable on the composite material.

Annex I

SUMMARY OF RISK MANAGEMENT MEASURES
Safe use has been demonstrated by calculation of risk characterisation ratios where appropriate, while qualitative considerations were stipulated where quantification was not possible. The risk characterisation is based on the following risk management measures:
Exposure scenario ,,Description ,,General measures ,,Specific Human Health risk management measures ,,Specific Environment risk management measures ,,
ES1 ,,Production and intermediate use on production sites ,,Good working practices, containment and safe handling in line with industry best practice. ,,(i) Local Exhaust ventilation (LEV)
(ii) Personal Protective Equipment (PPE): Working clothing, protective gloves and safety glasses. Dust masks in areas where dust may be present. In case of open handling of larger quantities or accidental release, a particle mask or respirator with independent air supply is recommended. ,,(i) Treatment of effluent in waste water treatment plant. ,,
ES2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17 ,,Industrial use ,,
Good working practices, containment and safe handling in line with industry best practice. ,,(i) Local Exhaust ventilation (LEV) if
aerosol mists or dusts are present.
(ii) Personal Protective Equipment (PPE): Working clothing, protective gloves and safety glasses. Dust masks in areas where dust may be present. In case of open handling of larger quantities or accidental release, a particle mask or respirator with independent air supply is

Safety Data Sheet

CITRIC ACID FCC/USP PWD

recommended. ,,(i) Treatment of effluent in waste water treatment plant. ,,
ES10 ,,Textile industry ,,Good working practices, containment and safe handling in line with industry best practice. ,,(i) Local Exhaust ventilation (LEV) if aerosol mists or dusts are present.
(ii) Personal Protective Equipment (PPE): Working clothing, ,,(i) Treatment of effluent in waste water treatment plant.
(ii) No direct discharge into the marine environment ,,

Univar USA Inc Safety Data Sheet

For Additional Information contact SDS Coordinator during business hours, Pacific time: (425) 889-3400

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ATTACHMENT

DOWNHOLE TOOLS/REAMERS

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Reaming Tools/Equipment

The reamers utilized for hole-opening operations are custom fabricated by Michels Corporation, however equivalent or better tools may be substituted depending on availability of other suppliers' products, or, if changes in anticipated drilling conditions are encountered. Michels R&D program for downhole tools includes monitoring of performance & longevity of reaming equipment in differing soil conditions throughout North America as well as foreign destinations. Utilizing the latest technology, tooling and materials available to the industry is a continuing goal of Michels.

There is essentially no limit to the length of time these tools can be run since simple repairs can be made in the field to keep the reamers in good working condition. The condition of the reamers will depend on the type of ground encountered; typically these reamers are discarded when they are observed to be beyond field repair. Initial maximum run time for specific reamers recommended by Michels is 50-100 hours.

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ATTACHMENT

DRILL FLUID RECYCLING
MUD CLEANING EQUIPMENT

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Drill Mud Cleaning and Disposal

The first phase of the mud cleaning system is displacement of solid returns at the shakers. Heavy solids are sifted out by a shaker with screens and deposited into a pit. From here they will be transported by dump truck to a site for disposal.

Drill Mud Cleaning Equipment Specifications

Volume of Mixing/Scalper Tank	54.0-Bbls
Volume of Desander Tank	72.0-Bbls
Volume of Desilter Tank	72.0-Bbls
Quantity of Scalping Shakers	1.0-Shakers
Mesh Size of Scalping Shakers	10-20 Double Stacked
Desander Capability	2 @ 500-GPM (1,000 GPM Total)
Desander Cones	2.0-Cones
Desander Mesh Size	40 to 165
Quantity of Desilter Cones	10 Ea @ 100-GPM
Desilter Mesh Size	60 to 250
Steel Mud Circulating Tank Volume	160-Bbls
Returns Tank Volume (Mud Pit)	320-Bbls
Cuttings Tank Volume (20-yd Roll-off)	150-Bbls
Mud Screening, Max Pass Size	40 Mesh

Due to the quantity and types of mud pumps owned by Michels and located on multiple drill sites Michels utilizes one of the following pumps based on availability and geographic location:

Bentonite Pump Capabilities (ENTRY/EXIT)

Name Brand	Gardner Denver OPI-350
Liner Size	6-Inches
Maximum Pressure	1,469 PSI
Maximum Flow Rate	529 GPM
Gallons Per Stroke	2.94 Gallons Per Stroke

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Bentonite Pump Capabilities (ENTRY/EXIT SIDE)

Name Brand..... Ellis Williams W-446 Super Force Triplex Piston Model

Liner Size..... 6-Inches

Maximum Pressure..... 1,027 PSI

Maximum Flow Rate..... 661 GPM

Gallons Per Stroke..... 2.20 Gallons Per Stroke

Bentonite Pump Capabilities (ENTRY/EXIT SIDE)

Name Brand..... Gardner Denver OPI-700

Liner Size..... 7-Inches

Maximum Pressure..... 1,690 PSI

Maximum Flow Rate..... 599 GPM

Gallons Per Stroke..... 3.99 Gallons Per Stroke

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MICHELS ROLLERS

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Michels Directional Crossings Pipeline Rollers

General Description: Steel tubing welded frame supporting two urethane coated rollers. Pillow block bearings are used to mount the rollers. The rollers are opposed to each other and set @ 125° to accommodate various pipe sizes.

Size: Footprint of 50”x48” with overall height of 40”

Load Capacity: 167,000 Lbs per assembly

Shafts: Material is steel 4140, 2-15/16 Diameter.

Frame: Frame weldment made of steel ASTM A-500 Grade square tubing

Rollers: 11” O.D., 20” face width, 8-5/8” core size. Coating is urethane approximately 1” thick (95 Shore-A)

Bearings: 4-required per assembly, 2 on each coated roller. Manufacturer is Linkbelt, Part Number PB22447E w/ 2-15/16” spherical roller, self aligning, contact seal.

Load Capacity for Bearings;

Basic = 41,800 Lbs
Static = 71,500 Lbs,
L-10 Life = 9,410 Hours @ 300 RPM

ATTACHMENT

MICHELS CONTINGENCY PLANS

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DIRECTIONAL DRILL CONTINGENCY PLANS

WBI

Lake Sakakawea Crossing

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Horizontal Directional Drilling

CONTINGENCY PLANS

Michels believes contingency planning begins with the appointment of competent field personnel having the greatest amount of experience to complete a project. Michels' personnel are some of the most qualified drilling experts in the industry, as demonstrated by resumes and experience lists highlighting past projects completed. With the abundant resources at their disposal, Michels has overcome risks associated with some of the most difficult drilling projects ever attempted and has evolved into an industry leader. Michels Project Managers are some of the best in the industry utilizing the many resources available while coordinating the various facets of a productive drill site.

Michels' Drill Superintendents are highly experienced at utilizing drill rigs and ancillary equipment of every size. They have worked up though the ranks providing them a complete and comprehensive understanding of safety, environmental monitoring, manpower, equipment operations and repairs for each phase of the drilling operation. As noted on the attached resumes, each Superintendent has drilled throughout North America and has encountered varying soil conditions, from sands, gravels, clay and cobble to solid rock formation. They are well respected throughout the industry and have worked with a majority of the major Pipeline Construction Companies in North America. Michels' personnel maintain continuous certification through accredited schooling for all phases of the drilling operation.

Contingency planning is conducted in response to unforeseen events and conditions, which could occur during normal operating sequences. The following contingency plans are in place to ensure completion of the project in accordance with governing authorities. The Field Operations Superintendent oversees preventative measures before product line installation. This alleviates the probability for adverse conditions such as stuck pipe. The following are some of the more common variables, which we have developed contingency plans for. They include but are not limited to:

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Possible Condition: *Inadvertent Drill Fluid Release Response and Control*

Contingency:

A large reduction or sudden loss in drill fluid returns is a signal to the driller and monitoring personnel that monitoring for inadvertent returns should be intensified for possible surface release. Therefore, the proposed drill R.O.W. will be inspected for inadvertent returns at a minimum of twice per shift and becoming more frequent if there is a large reduction or sudden loss. The frequency and results of R.O.W. inspections will be documented and recorded on the daily reports. Early detection and quick response is the key to controlling and/or limiting surface release. Additional information regarding access to USACE-Owned Land is addressed later in this document.

The absence of an open bore-hole conduit or the presence of a major formation fracture can lead to partial and/or potentially total loss of drilling fluid circulation. While it is impossible to determine the precise nature of this type of fluid loss, it is possible to accurately monitor for it by watching for a significant difference between the rate fluid is being pumped down-hole and the rate it returns to the surface. The drilling fluid pumping rate and the rate of drilling fluid return to the surface is constantly monitored by the mud technician and relayed to the driller while the HDD operation is progressing. The driller will know immediately if an unusually high volume of drilling fluid is being lost down-hole, depending on the ground conditions encountered in the crossing and taking into account the volume used to fill the bore-hole. Should the driller believe that circulation is being completely lost he will implement the following procedures:

1) Temporarily cease drilling operations, including pump shut down;
2) Dispatch experienced observers as required to monitor the area in the vicinity of the crossing, for inadvertent returns of drilling fluid at the surface or in the river;
3) Identify the position of the drill head in relation to the point of entry
4) Re-start the pump and stroke the bore-hole up and down in stroke lengths up to 30 feet up to 6 times but no fewer than 2 in an effort to size the bore-hole annulus and re-open the circulation pathway.

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In addition, the thixotropic properties of the drilling fluid may be thickened within the guidelines set forth by the manufacturer to aid in re-establishing circulation as required depending on bore-hole conditions. Observers will regularly monitor for inadvertent fluid returns as long as the pump remains on. Occasionally, based on the driller's discretion, it may be useful to increase the stroke length up to 90 feet or past the point at which he believes circulation was lost.

If circulation is re-established, drilling will proceed as usual and monitoring for inadvertent fluid will take place once again if the rate of drilling returns progressively decreases at the fluid entry pit. If circulation is not re-established, monitoring for inadvertent fluid returns to the ground surface and river will continue and drilling will proceed.

If the amount of inadvertent returns is not great enough to allow practical collection, the affected area will be diluted with fresh water and allowed to dry and dissipate naturally back into the earth. If the amount of returns exceeds that which can be suitably contained with hand placed containment barriers, small collection sumps (less than 3.8 cubic meters) will be used to pump fluid back to the solids control system.

When drilling fluid returns are observed to be continuously surfacing above ground at an accessible location the following procedure will be followed:

1) Immediately cease pumping of drilling fluid;
2) Contain the location such that the drilling fluid cannot migrate across the ground surface;

On-Site Materials and equipment used for containment:

- Straw Bales, if available;
- Silt Fence;
- Check Dams;
- Backhoe for Accessible Areas;
- Shovels;

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- Portable Pumps;
- 100 feet of Hose.

3) Excavate a small sump pit at the location and provide a means for the fluid to be returned to either the drilling operations or a disposal site (i.e. pump through hose or into tanker);
4) Notify on-site contractor supervisor and Owner's representative as required by the communication plan;
5) Continue drilling operations, maintain the integrity of the containment measures, and monitor the fluid returns as required to ensure that no surface migration occurs;
6) Clean-up is carried out once inadvertent returns are contained/controlled;
7) Fluid pumped to a secure containment vessel;
8) Area is diluted with water;
9) Area is restored to original condition.

If inadvertent drilling fluid returns are observed to be surfacing above-ground at a location that is inaccessible, i.e. along the bed of a water body, or, into the water, the following procedures will be followed:

Ensure that all reasonable measures within the limitations of the technology have been taken to re-establish circulation;

Continue drilling with the minimum amount of drilling fluid required to penetrate the formation and successfully install the product line.

Typically lost circulation has the highest probability of occurring while the pilot hole is being drilled due to the smaller bore-hole annulus and the relatively large volume of solids being displaced and carried out in the drilling fluid. In the course of drilling the pilot hole, circulation will often be temporarily lost as the pilot bit is advanced through more permeable or less

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competent sections of the ground formation when fluid pressures are at a maximum. As the pilot bit advances beyond these sections of the bore-hole fluid pressure will fall and circulation within the bore-hole will naturally be re-established. Much of the fluid lost to the formation under the greater pressures will return back to the bore-hole as the pressures fall, in which case the drilling fluid is not likely to migrate to the surface or the river. It is also possible for the drilling fluid to leave the bore-hole and migrate in a direction other than the ground surface or the wetland, in which case it may never be observed even if circulation is lost for long periods of time.

It should be noted that frequently drill cuttings generated as a result of the drilling process will naturally bridge and subsequently seal fractures or voids as drilling progresses, thus providing another means of re-establishing circulation. This is especially likely during the reaming process as higher volumes of larger cuttings are typically generated. Therefore it is usually beneficial to proceed with the pilot hole even if circulation has not been re-established since it will likely be re-established at some point during the reaming process.

The use of an environmentally safe drilling fluid ensures that even in the unlikely event of fluid loss at sensitive areas, there will be no adverse environmental impact other than a temporary minor increase in turbidity until the drilling fluid dissipates. It is important to note that any temporary increase in turbidity as a result of inadvertent drilling fluid loss while directional drilling the crossing will be several orders of magnitude less than that of an open-cut crossing.

Contingency Access Plan for USACE-Owned Lands in Event of Unanticipated Return

In event of an unanticipated return of drilling fluid on U.S. Army Corps of Engineer (USACE) owned lands, WBI Energy, Inc. (WBI) and its contractors would mobilize clean-up crews as soon as practicable. Crews would utilize access points and routes identified on Figures 1 and 2 (North Side and South Side of the Lake Sakakawea horizontal directional drill). To the extent practicable WBI Energy will use publically available access roads to reach inadvertent return cleanup areas. WBI and its contractors will notify landowners prior to the commencement of HDD drilling activities and will work expediently to contact landowners in event of an inadvertent return.

If necessary, equipment used to access and clean-up inadvertent returns of drilling fluid on the ground surface of USACE owned property would include rubber tired vehicles, such as pick-ups

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and vacuum trucks (vac-trucks). It is anticipated that for an inadvertent return of drilling fluid to the ground surface, access to USACE owned property would follow the paths illustrated on Figures 1 and 2, the primary route on both sides of the Lake Sakakawea HDD would be along the permanent right-of-way leading from the drill box to the banks above the shoreline. From the permanent right-of-way, a direct perpendicular route would be taken to reach the site of the inadvertent return with the shortest path. To the maximum extent practicable, woody vegetation (trees and shrubs) will not be cleared; access paths would avoid trees and general vegetation disturbance to the maximum extent practicable. Where necessary crews will travel around persistent, live, woody vegetation.

If access is necessary along the beach on either the north side of Lake Sakakawea, as shown in Figure 1, or the south side of Lake Sakakawea, as shown in Figure 2, crews will either access the clean-up location by walking in, or utilizing small, low ground pressure equipment, such as UTVs or ATVs. A secondary option for beach access would be to mobilize a small boat from a public dock to bring personnel and cleanup equipment to the beach. Every effort will be made to access clean-up sites, if necessary, from the higher ground along the permanent right-of-way. After clean-up of drilling fluid is complete, crews will follow the same path out that was taken in to the inadvertent return, to minimize additional disturbance. Calls will be made to the appropriate USACE point of contact as soon as feasible, but not greater than 24 hours from the time crews are mobilized to clean-up the inadvertent return.

Attachment – Figure 1

Attachment – Figure 2

Possible Condition: *EQUIPMENT MALFUNCTION/FAILURE-SPARE PARTS*

Contingency: Based on past experience, Michels can reasonably estimate the average life expectancy of all major components of the drilling operation under normal operating conditions. The operating hours of the equipment are recorded prior to start of drilling operations and maintained throughout completion of the crossing. Documentation and maintenance records are maintained by the drilling superintendent so that replacement of key components can be routinely performed in a timely manner to prevent failure. Occasionally, a component of the drilling operation will fail unexpectedly even with the most stringent maintenance and replacement schedule. These types of failures have occurred in the past and

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Michels has established a spare parts inventory with each drill rig based on the most common failures of this type. Spare parts kept on site include hydraulic pumps, flendor motors, and drive gears. In addition, odd sized or extremely high pressure hydraulic hoses that are not readily available "off the shelf" are kept on site.

Major Spare Parts kept on-site

- 1,800-Mission pump
- 2,500-Halco pump
- Mud Rig – Clutch and Transmission
- 11 – Vise Blocks
- 4 - Vise Hydraulic Rams
- 2 - Rotary Motors
- 2 – Drive Motors
- 1 – Hydraulic Pump
- 2 – Vise Travel Motors
- 1 – Circulation Pump
- 2 – Mud Swivels
- 2 – Complete Rebuilds for OPI-350
- Rebuild Parts for EW-446
- Electric Motor for Halco
- Electric Motor for Cooling Fans
- 2 – Shaker Motors

It is not feasible to maintain a complete spare parts inventory with each drilling rig on site so Michels immediately identifies local sources for commonly available spare parts and equipment upon job start up. Spare parts not readily available locally are kept in one of four Michels' permanent warehouse locations in Bothell, Washington; Adrie, Alberta Canada; Harrisburg, Pennsylvania; or Brownsville, Wisconsin, where the parts can be shipped overnight to the job site to prevent extensive down time caused as a result of equipment failure if necessary.

Possible Condition: *STUCK PIPE*

Contingency: The following are some of the preventative measures invoked by the Drilling Foreman in order to reduce the chances for complications while pulling back product pipe.

1. Utilize drilling equipment capable of supplying enough power to remove seized pipe from either entry or exit location.

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2. Performing an extra reaming pass with the purpose of cleaning out the reamed hole (not a cutting pass) and adding proper lubrication with precise weight bentonite mixture.
3. Reduce torsional and axial loads through the use of properly spaced rollers, well maintained swivels and creating a smooth transition between downhole exit angle and pipe strung out on top of ground readied for pullback.
4. Utilize Ballasting to control the weight of the pipe by achieving negative or neutral buoyancy.

Contingencies for stuck pipe

If above preventative methods fail and the pipe become seized in the borehole we invoke Best Available Control Technology (BACT). One of the methods involves specific techniques in conjunction with ballasting, which is controlled loading with water. Past experience has shown us that if the leading end of the pipe remains too heavy during ballasting, air can be supplied to this area of pipe, displacing water back toward the middle, and in some circumstances freeing up the point of greatest friction.

If the drilling rig is unable to supply the initial thrust to release the seized pipe, side booms and or track-hoes can supply thrusting pressure from the exit side in order to start momentum. Michels drilling rigs have the potential to supply up to 1,200,000 pounds of thrust and pulling-force, add additional equipment and there is not much that cannot be dislodged.

Not only can force be applied from the drill-rig side but additional force can be applied from the pipe installation side for large diameter installations through the use of a Herrenknect pipe thruster for land to land crossings. This alternative source of power supplied from the opposite end can dramatically assist large diameter pipe pullback during significant changes in the effective weight of the pipe during pullback (buoyancy) caused by either losing circulation or re-establishing circulation unexpectedly therefore causing drastic changes in the buoyancy of the pipe. This method also reduces the risk for damage to pipe coating during pullback by reducing the tensile force needed to pull back the pipe. If the large diameter pipe becomes stuck additional control can be established to move pipe back and forth in the event gravel, cobble and/or boulder sized

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materials fall in the hole after swabbing. This can be used as an alternative to the percussion hammer which has been used as a contingency measure on previous past projects.

(See Attachment Herrenknect Pipe Thruster)

If percussion assistance is determined to be necessary to supply the energy required to complete the pullback operation, Michels is capable of performing this operation utilizing a GrundoRam percussion hammer supplied by TT-Technologies. The work area needed for invoking hammer assist procedures is located on the pipe pullback side of the crossing. This will encompass an area of 40-feet long x 20-feet wide for staging of the "Taurus" GrundoRam percussion hammer and assist equipment. This pipe-ramming machine has a thrust of up to 2,000 tones and a ramming speed of 180-strokes/minute. A GrundoRam and 1600 CFM air compressor will be made available by Michels on-site. Additional sources for spare parts and accessories should also be identified.

(See Attachment Grundo-Ram Percussion)

A specially manufactured reinforced push ring is positioned at the back end of the product line so that equal transmission of percussion energy can be transmitted down the product pipe, and to protect the steel pipe end while in contact with the GrundoRam "Taurus". The persistent exertion of energy along the descending steel pipeline aids in aggressively sliding the pipe through suspect areas of unconsolidated formation or through areas of cave-in. Although this is not a regular occurrence due to mitigative measures taken prior to installation, Michels has successfully completed this unique form of pipeline pullback assist periodically over the past 10-years and has built a solid reputation as an innovator in this field.

Possible Condition: *INCLEMENT WEATHER*

Contingency: Key personnel monitor long range forecasts for the project areas to be affected. Various weather services (i.e. NOAA, Weather Channel etc) are monitored by computer for bad weather and potential hurricanes. Regular updates are given to Michels' personnel to make them aware of approaching weather conditions. Evacuation routes will be identified and reviewed with all personnel for potential hurricanes prior to beginning work and responsibilities will

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be assigned. If electrical storms are projected to affect a drill site, approaching storms will be monitored by radar and radio and communication will be maintained between Project Manager and personnel. Electrical storms can potentially cause serious problems for a drilling operation. The Drill Superintendent must use his discretion as to the appropriate safe action to be taken for the safety of the crew and entire drilling operation. Proper grounding must be maintained throughout a drilling operation.

A safe area on the site will also be designated for response to an approaching tornado. Stream gages will also be identified and monitor for potential flooding conditions.

Possible Condition: *NOISE*

Contingency: Noise reduction can be accomplished using several methods. To begin with, a site reconnaissance or noise modeling must be completed by the Owner to determine what decibel (dB) level will be allowable at the affected locations. Some of the Noise Control Considerations include: Redirection of sound waves or deadening just by the simple positioning of drilling equipment and strategic location of frac-tanks. This option generally has little affect upon cost and may cause minor inconveniences for the drilling operation.

Another option is to utilize hospital/industrial grade mufflers to deaden sound as it leaves engines of motorized equipment. This could impede maximum operating output from equipment and also slow down the drilling operation.

More costly forms of Sound Control include; Building walls made of hay bales, sound curtain matting or plywood, or, building sound deadening enclosures constructed of wood.

Possible Condition: *DAMAGE TO EXISTING UTILITIES*

Contingency: Preventative measures include proper notification of local utilities through area one-call programs or site investigation and recording of area markers, manholes and valves. Pot-holing existing utilities is the most reliable method of exact utility location

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Damage to existing utilities or structures may occur during drilling or reaming operations. Occasionally unknown or unmarked utilities may be hit during drilling or reaming operations. If this circumstance does occur the type of utility is first identified so that severity of response can be identified. Emergency personnel for the identified utility are then notified. Pertinent personnel for the Owner and/or Owner Representatives are then notified, following the chain of command. Decisions are then made as to appropriate action to be taken.

Possible Condition: *ENCOUNTERING SUBSURFACE OBSTRUCTION*

Contingency: Occasionally an unknown subsurface obstruction is encountered during drilling operations such as; 1) buried tanks, 2) Building foundations/piers/pilings, 3) buried junk/cars. If this situation occurs, the location of the object is first identified in relation to the drill path. If the current R.O.W. is ample and soils provide adequate steering capabilities, the drill head is pulled back to a pre-calculated point along the previously drilled path and the drill bit is rotated and steered around the obstruction.

The chance of encountering an obstruction during reaming operations is highly unlikely. But, if this should occur, the magnitude of the obstruction must first be evaluated. If the obstruction is determined to be impassible, operations will be halted until an agreeable solution can be determined.

Possible Condition: *RUNNING SANDS*

Contingency: It is possible that loose cohesionless soils, such as running sands, may not support the drilled annular space over a long directional drill length. Although this circumstance sounds serious, it may not prevent the installation of a pipeline. Mechanical agitation of the formation by the downhole tool and trailing drill string, combined with the injection of bentonite drilling fluid causes the soils to experience a decrease in shear strength. When the resulting shear strength is low enough, the soil will react in a fluid-like manner thus, allowing the pipeline to be pulled through it.

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It would be highly unusual for soil strata to be of the same consistency from drill entry to drill exit, especially at the various depths encountered during pilot hole drilling. Prior to drilling, only general soil information is known for estimating and hypothesizing. The type of drilling fluid providing the best performance capabilities for the conditions is chosen based upon this information. Adjustments are then made in the field correlating to specific soil properties in order to improve performance.

Possible Condition: *PIPELINE MISALIGNMENT*

Contingency: Today's technology in the directional drilling industry provides state of the art instrumentation and tracking capabilities. The directional drill alignment is accurately known to within ± 0.01° or, ± 1.4 feet per 1,000 feet in both profile and plan view. The addition of Para Tracker as a secondary form of verification and validation for plan view orientation, left and right of center line, provides precise information which is updated regularly during drilling operations. The most frequent cause of misalignment is the inability to steer in transitional zones near the exit location. These soils may include varying degrees of overburden or formations allowing unpredictable degrees of penetration. The orientation or angle of these zones from horizontal may deflect the drill bit having a direct affect upon steering capabilities.

In any case, the steering probe maintains its tracking capabilities and allows the Survey Technician continuous feedback for locating the drill string in a three dimensional plane. Any deviation from the targeted exit is known and can be compensated for. If the target area is not large enough to accommodate the deviation, the drill string can be pulled back to a calculated point and be redirected toward the proposed exit location.

Possible Condition: *PRESSURE CONTROL*

Contingency: An important function of the drilling fluid is to prevent the uncontrolled entry into the hole of fluids from the formation penetrated by the bit. The pressure exerted by the column of drilling fluid (hydrostatic head) must be somewhat greater than the pressure exerted by the formation fluids to allow raising the drill string without any problems. Following are some mitigative measures taken to counteract pressures.

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1. Avoid swabbing drill string (plunging the drill string back and forth with great force)
2. Keep the hole full of drill mud while pulling the drill pipe, especially when hydrostatic head is not much greater than formation pressure.

At any given depth, the hydrostatic pressure (in psi) of the mud column is equal to mud density (in lb/gal) times depth (in feet) times 0.052

Psi (hydrostatic pressure)	=	lb/gal (density)	x	feet (depth)	x	0.052

Possible Condition: *HOLE COLLAPSE*

Contingency: Most drillable formations, whether consolidated or unconsolidated, have some form of cohesive properties allowing drilling fluid to interact and add to its bonding properties, thus avoiding hole collapse. Some soils, such as large gravel zones or cobble areas may not be capable of holding a hole. If this type of formation exists in the overburden soil (upper strata), a steel casing pipe may be washed over the drill stem into competent soil and left in place during operations. Drilling and reaming operations will then resume utilizing this conduit as a means of carrying drill cuttings back up-hole without obstruction. This reduces the chance for lost circulation. Under this circumstance, the integrity of the pipe coating **cannot** be guaranteed.

If this type of formation exists throughout the borehole, it should be known and researched prior to drilling so that an alternate route may be researched. The route that provides the best chance for success should be the route chosen. If a competent drilling contractor properly investigates a route, the chance for a hole collapse is greatly reduced.

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Possible Condition: *PIPELINE COLLAPSE*

Contingency: Pipeline collapse during pulling operations is a rare occurrence caused by certain factors, which must be considered before pullback begins. Some of the main factors, which must be considered during pre-planning stages or prior to pipeline pullback operations, include:

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1. Pre-engineered profile must reflect the minimum radius of curvature calculated for the given pipe (wall thickness, pipe size, tensile strength, X-rating)
2. Drilled profile should not exceed pipe tolerance throughout the drilled borehole.
3. Experienced directional drilling Survey Technician verifies three joint radii calculations for maximum degree of bend per 30-foot joint.
4. Industry standard safety factor should be included in the profile and calculations taking into account unknowns.
5. Exit and entry angles must be within specified tolerances so that support equipment capabilities are not exceeded in order to provide the pipeline a smooth, uninhibited transition into the opened hole.
6. Calculations performed for anticipated stresses the pipe will be subjected to during pullback (i.e. Pull loads, tensile, unconstrained buckle, hoop stress.) This way upper stress limits will be known.
7. Proper ballasting of product line through controlled loading of water to the leading end of pipeline. This procedure also provides internal pressure to the product line as a counter balance to external pressures. If water is added to the opened end of the product line and allowed to flow down toward the leading end during pullback, a vacuum may occur creating undue stress on the product line which would increase the possibility of implosion or collapse. Therefore, a conduit is positioned to carry water through the interior of the product pipe dispersing water at the leading end of the pipe filling it from the lowest portion (elevation) toward the highest elevation. Volume calculations are maintained to ensure only the lowest portion of the pipe is maintained full of water.

The appointment of highly competent personnel experienced in pipeline pullback procedures is a must. There is no substitute for experience. Experienced personnel should be placed at critical positions at both the drill entry and exit locations.

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ATTACHMENT

FIGURE 1

Proprietary to Michels

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Milepost
Workspace
Access Route
Low Impact Access Route
Surveyed Wetland
Surveyed Waterbody

N

125 62.5 0 125
Feet

Figure 1
North Bakken Expansion Project
Preliminary Access Plan in Event of Inadvertent Returns for Access to USACE Lands

WBI ENERGY TRANSMISSION

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Drawn By: RJC

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FIGURE 2

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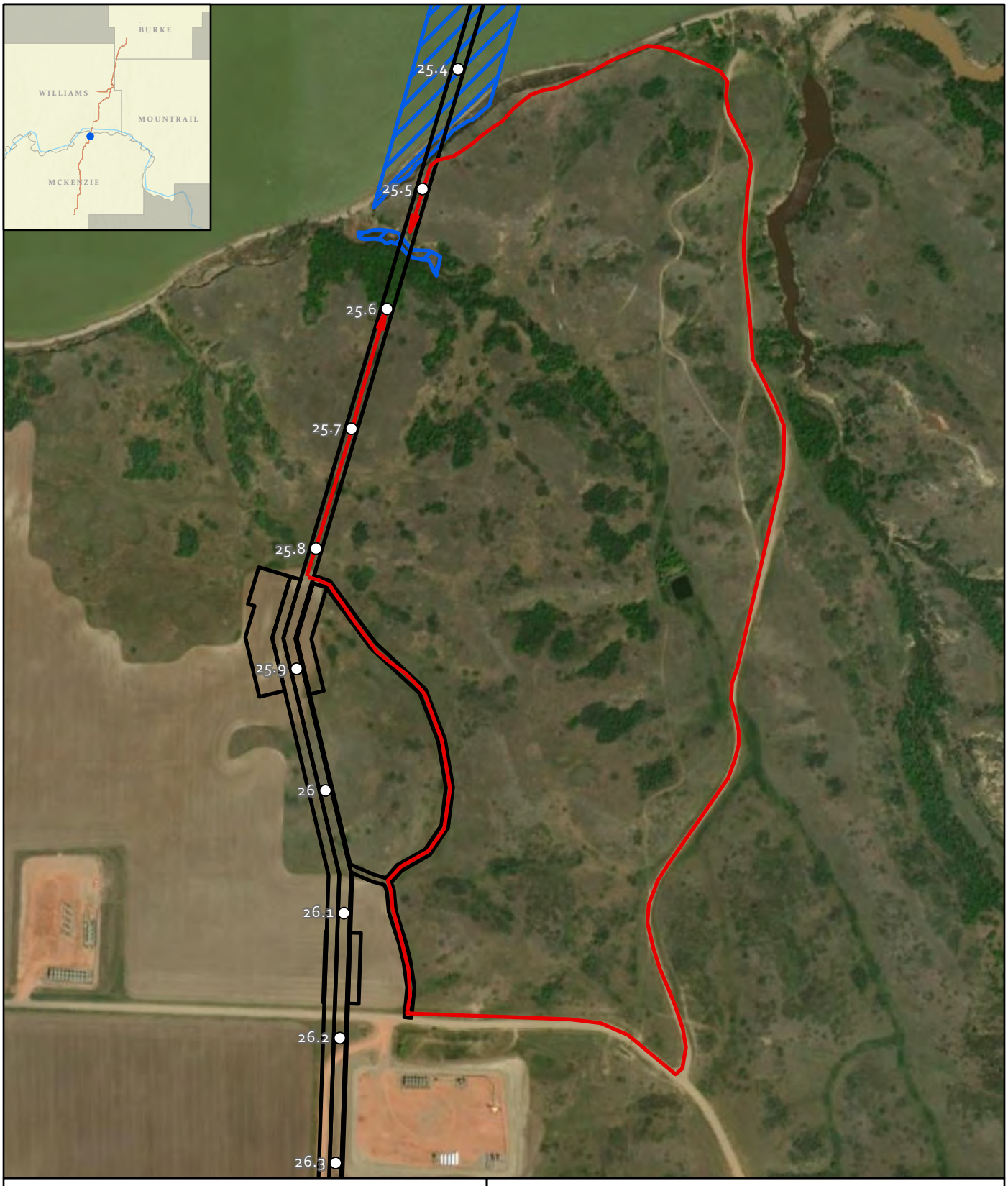

Figure 2
North Bakken Expansion Project
Preliminary Access Plan in Event of Inadvertent Returns for Access to USACE Lands

WBI ENERGY TRANSMISSION

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ATTACHMENT

GRUNDO RAM
PNEUMATIC PIPE RAMMER

Proprietary to Michels

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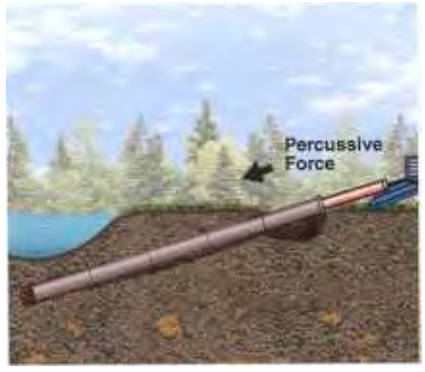
Percussive Power

for directional drilling assist

Conductor Barrel™

A sure start for your bore even in the worst soil.

- Ram casings through difficult soil conditions to more desirable drill starting points.
- Guide down-hole or mud motors to rocky soils through the conductor barrel.
- Provides friction-free section for product pullback.



Pullback Assist

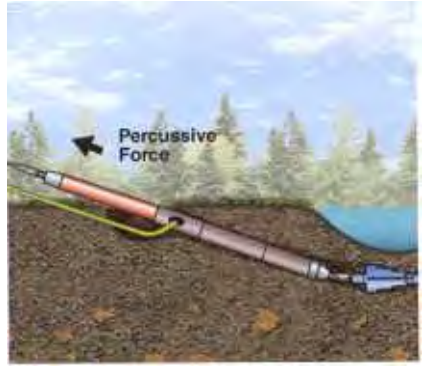
Overcome hydrolock with a pipe rammer.

- Rammer attached to product pipe during pullback.
- Percussive action keeps pipe moving and helps prevent high levels of pullback stress.
- Percussive power frees immobilized product pipes.

Pipe Removal

Remove stuck product pipe and bore again.

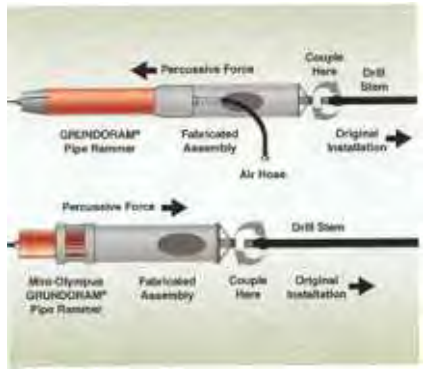
- Rammer attached to product pipe after pullback fails.
- Percussive action pulls product pipe, removing it from the bore.
- Salvage the job and bore again.



Drill Stem Recovery

Retrieve stuck drill stems.

- Pipe Rammer fitted with a special sleeve.
- Stuck drill stem welded to the back of the rammer sleeve.
- Percussive power frees drill stem, saving time and money.



"Power without limits!"

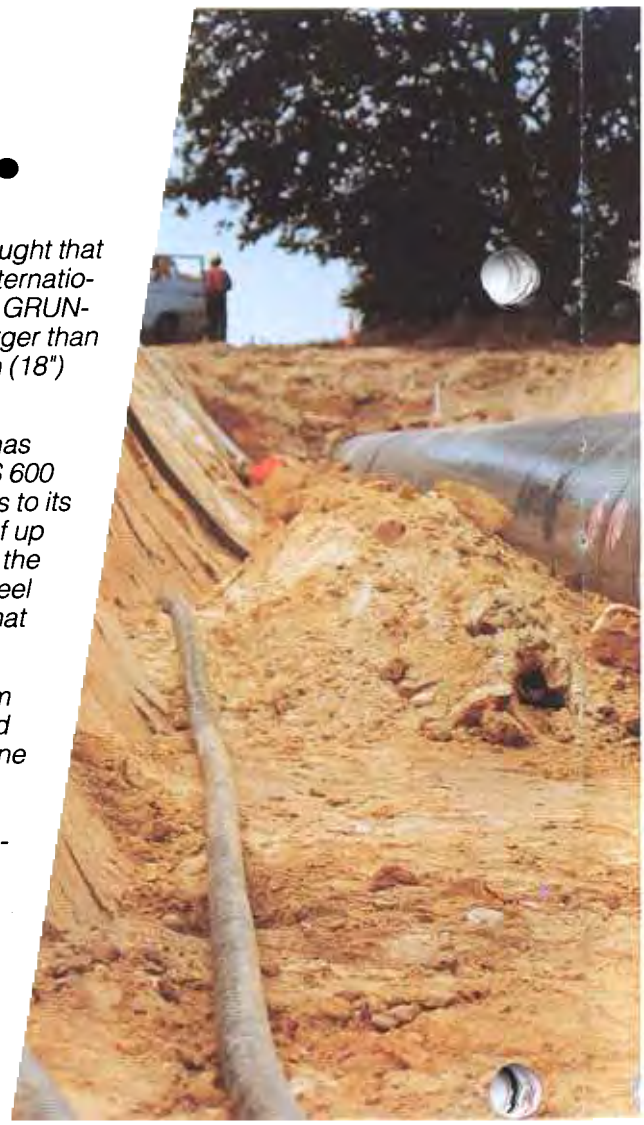
The strongest in existance ...

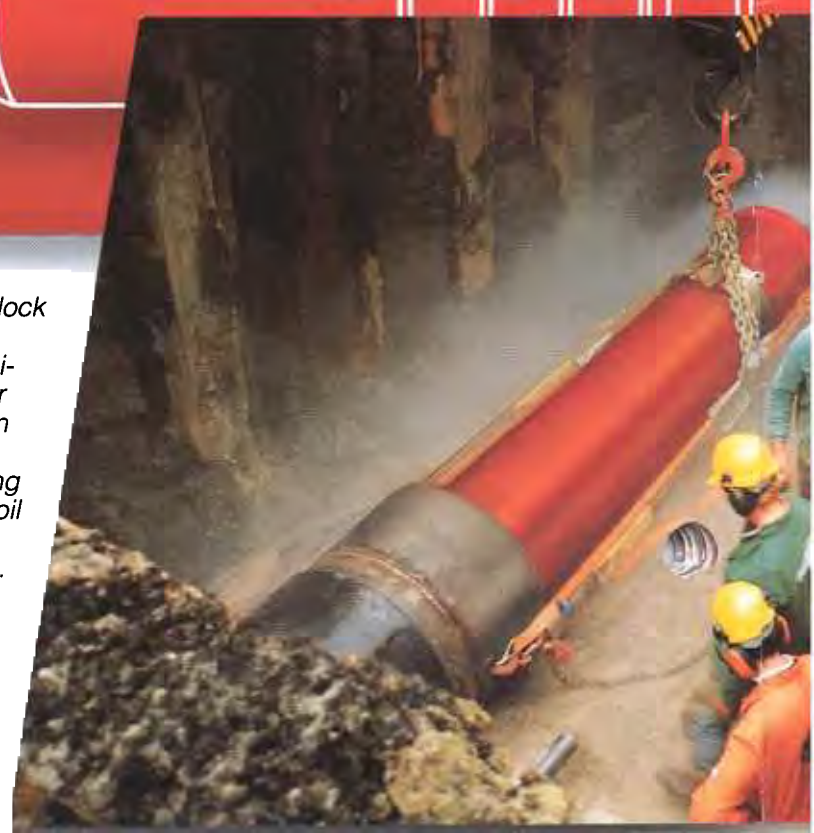
Who would have thought that there would be an international requirement for a GRUNDORAM hammer - larger than the GOLIATH 450 mm (18") machine?

International demand has made the new TAURUS 600 mm (24") a must. Thanks to its dimensions and thrust of up to 2,000 tons (4,480 lbs) the TAURUS is the largest steel pipe ramming machine that exists.

Steel pipes up to 2,000 mm (80") can now be installed with this powerful machine when installing casing or product pipes for the water, sewage, telephone, electricity and gas industries or railway authorities.

When other ramming equipment has reached its power limit the TAURUS offers that extra power to get that pipe into the ground.





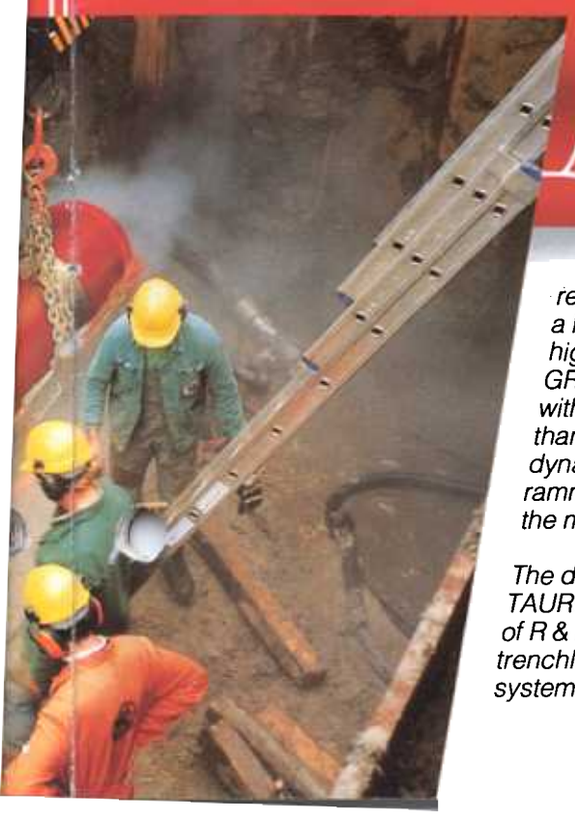
It is designed of a monoblock main casing made from a high quality alloy with a unique flexible control stud for perfect impact transmission onto the steel pipe. This makes it a reliable and lasting boring unit even in difficult soil conditions or over long stretches of steel pipe installation.

A GRUNDORAM's number of strokes has a direct influence on the forward ramming speed. However, high ground

TAURUS

Ø of rammer.....	.....24"
Length.....	.....12 ft
Weight.....	....10,580 lbs
Air consumption.	1.766 ft³/min
Strokes per min..	180
Thrust.....	....4,400 lbs
Suitable for pipes.	.....>380

A TAURUS used on a gas pipeline installation.



resistance and friction require a low stroke frequency with a higher single impact. The GRUNDORAM model TAURUS with 180 strokes/min and more than 2,000 tons (4,480 lbs) of dynamic thrust ensures high ramming speeds even under the most difficult conditions.

The development of the new TAURUS is the result of years of R & D in the field of trenchless pipe laying systems.

The GRUNDORAM is suitable to resist the highest stress in difficult soils thanks to its monoblock casing and flexible control stud.

GRUNDORAM

Good examples back up our claims

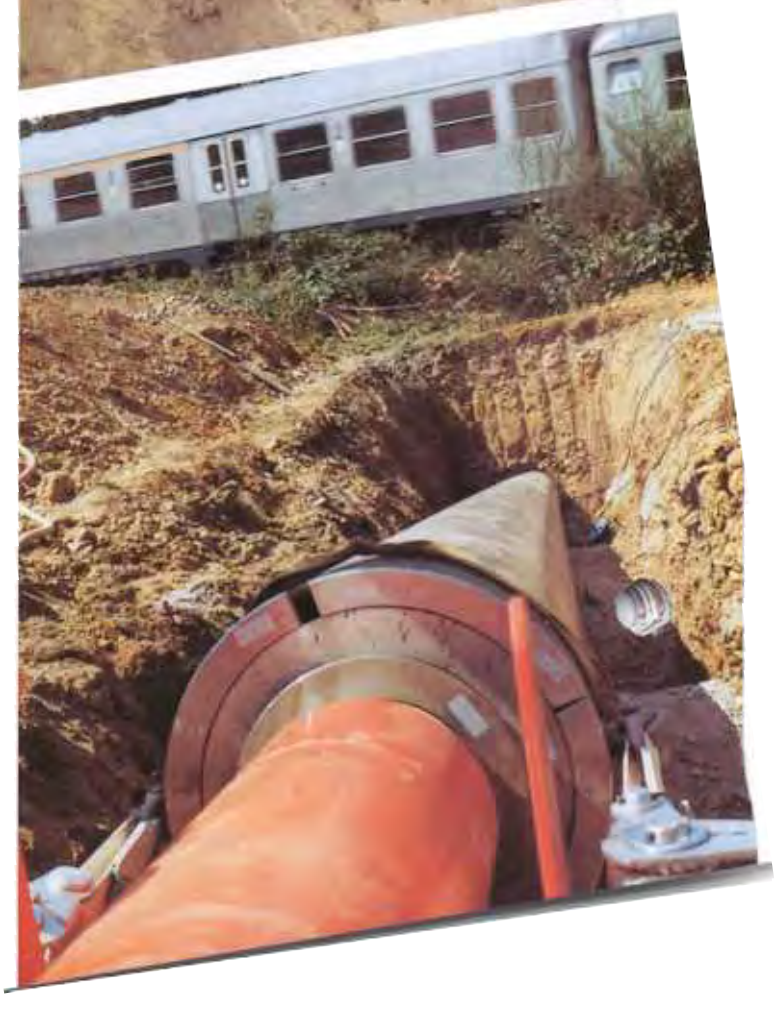
Global usage is quickly leading to the general acceptance of the robust GRUNDORAM system. Contractors value the ● simple operation and ● reliability the ● enormous impact power, the ● wide range of applications, the ● quick and easy preparation and the ● sturdy accessories.

● 220 ft of steel pipe, 14" diameter was rammed under a canal to accommodate 8 fibre-optic cables.

● 125 ft of 59" diameter pipe was laid under an embankment in Manchester, England, as a drainage system.

● 65 steel pipes of 28" diameter were installed parallel to each other under the main Seoul-Pusan railway line in South Korea.

● A 24" steel pipe was easily rammed along a 131 ft stretch under a railway embankment south of Cairo/Egypt.



"Typical" but also not everyday jobsite projects are excellent references, for example

● 115 ft of steel drainage pipe of 55" diameter was perfectly installed under the river Pader in the heart of the city of Paderborn/ Germany

● 200 ft of 30" steel casing for gas/telecom/mains supply was installed under the A 1 motorway without traffic disruption or diversions

● *90 steel pipes of 20" diameter were driven in vertically to provide solid foundations for a noise-protection barrier in Germany.*

There are many other typically good examples that could be listed. If you are interested in specific cases, contact us - we will supply you with detailed information.

GRUNDORAM

ATTACHMENT

HERRENKNECT
PIPE THRUSTER

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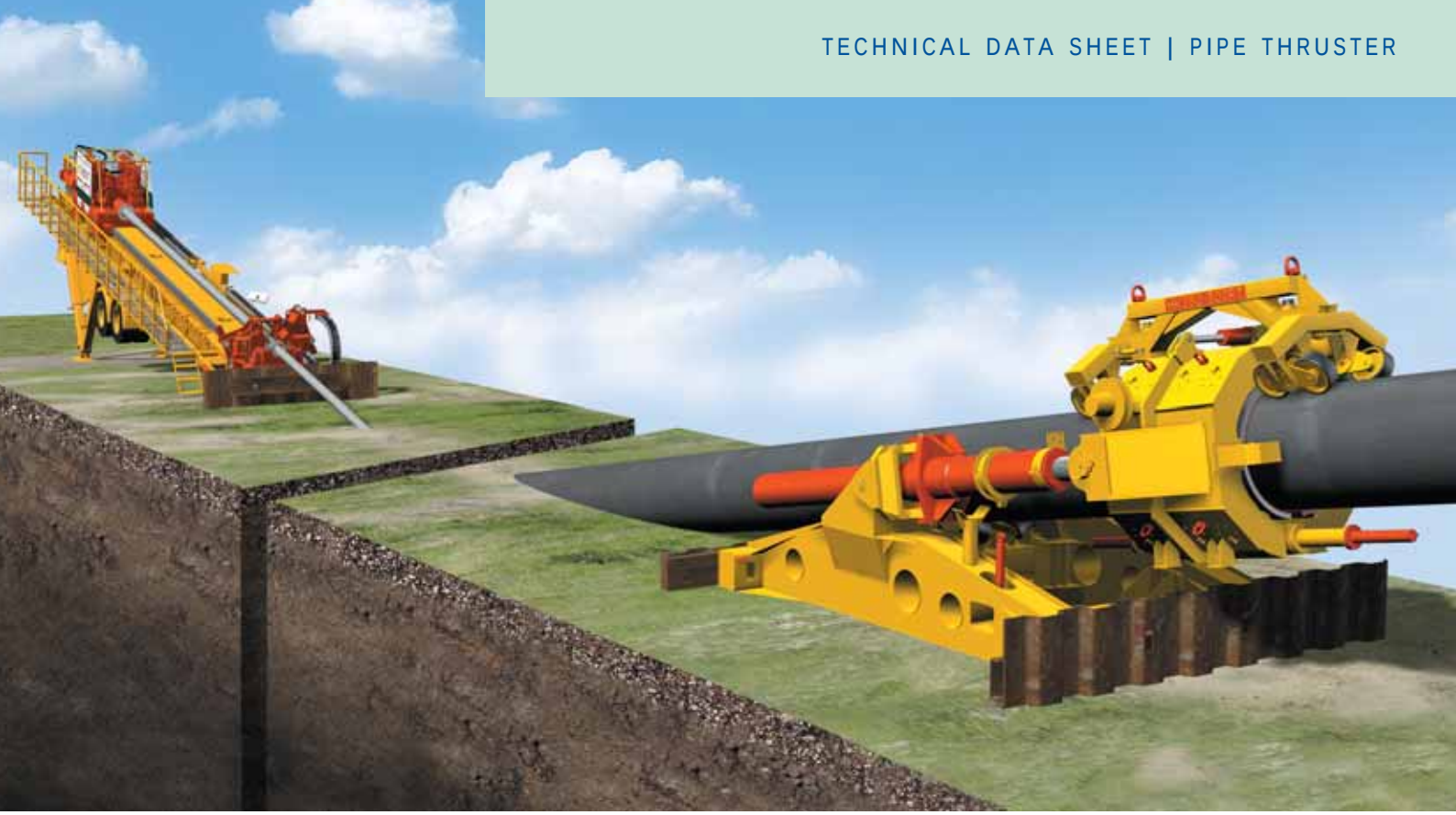

Additional Power for Pipe Pullback.

The newly developed Herrenknecht Pipe Thruster is an auxiliary device for Horizontal Directional Drilling Technology and extends its field of application. The Thruster is mounted at the exit point and helps to push the entire pipeline into the ground. It is particularly suited for extremely long pipelines, very large diameters or difficult geological conditions. Depending on the project the Pipe Thruster can be used as a support tool, a rescue tool or as a pipe installation tool.

After finishing the pilot hole and the reaming procedures using a HDD Rig the Pipe Thruster assists during the pipe pull. The Pipe Thruster is mounted at the exit point and pushs the product pipe into the enlarged hole while the Rig is pulling the pipe. This simultaneuos process will reduce the stresses on the drillpipe and the product pipe.

Beside improved safety the Pipe Thruster allows drill lengths of more than 3,000m and makes the use of big pipe diameters more common.

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utility@herrenknecht.com
www.herrenknecht.com

HERRENKNECHT
Tunnelling Systems

Innovative Solution: The Pipe Thruster

Range of Application

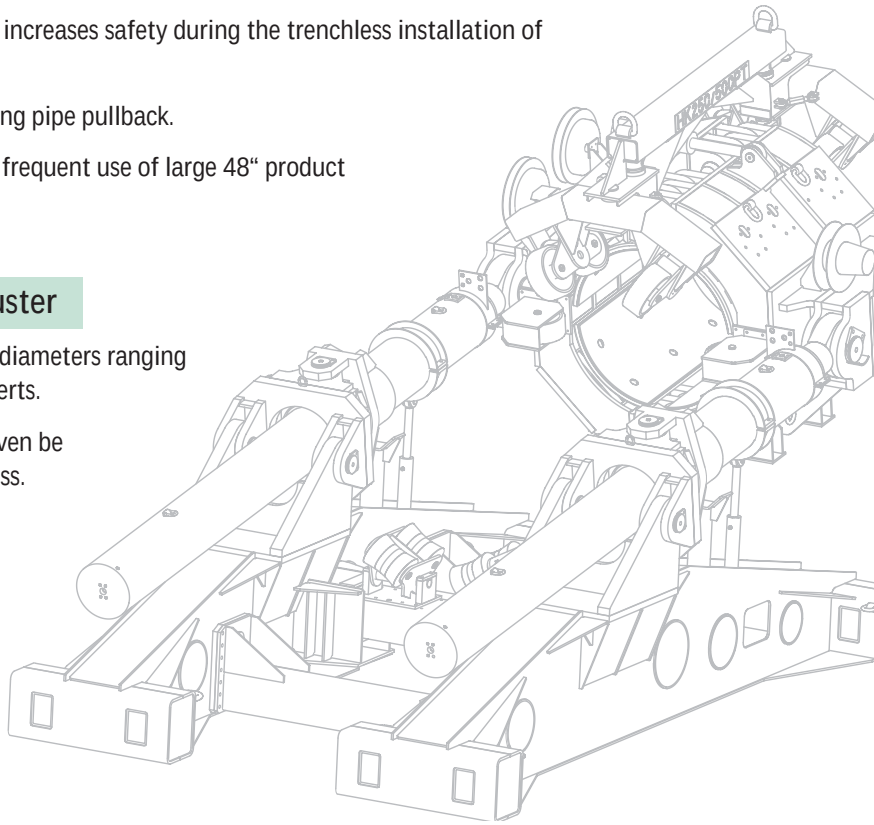
- Support of the HDD process during pipe pullback.
- Sea Outfall projects: ashore thrusting of the product pipeline.
- Rescue Tool for the recovery of stucked pipelines, e.g. in difficult geological conditions.

Advantages of the Method

- The deployment of the Pipe Thruster allows to add a push force from the exit point to the pull force of the HDD Rig.
- The flexible load distribution at the entry and exit point increases safety during the trenchless installation of pipelines considerably.
- Reduced stress for drill pipes and rigsite equipment during pipe pullback.
- Increase of drill lengths to more than 3,000m and more frequent use of large 48“ product pipe diameters.

Advantages of the Herrenknecht Pipe Thruster

- The Herrenknecht Pipe Thruster can be used for all pipe diameters ranging between 20“ and 48“ by just changing the clamping inserts.
- Due to a tilting clamping device the Pipe Thruster can even be installed when the pipeline pullback is already in progress.
- The clamping device is suitable for all types of pipelines and coatings.
- The modular design does not require special cargo transports.



Technical Data

Pipe Thruster

- Operating angle: 5° - 15°
- Push and pull force (normal): 250t (2,500kN)
- Push and pull force (maximum): 500t (5,000kN)
- Min. clamp diameter: 20“ (508mm)
- Max. clamp diameter: 48“ (1,219mm)
- Max. speed: 5m/min.
- Stroke of push/pull cylinder: 5,000mm
- Dimensions: 9 x 4.1 x 4.4m
- Weight: 45t

Power Unit

- Dimensions: 20ft container
- Installed power: 400kW
- Weight: 10t
- Remote control and hydraulic hoses to the Pipe Thruster are included.

MICHELS®

ATTACHMENT

DRILL FLUID RECYCLING FLOW CHART

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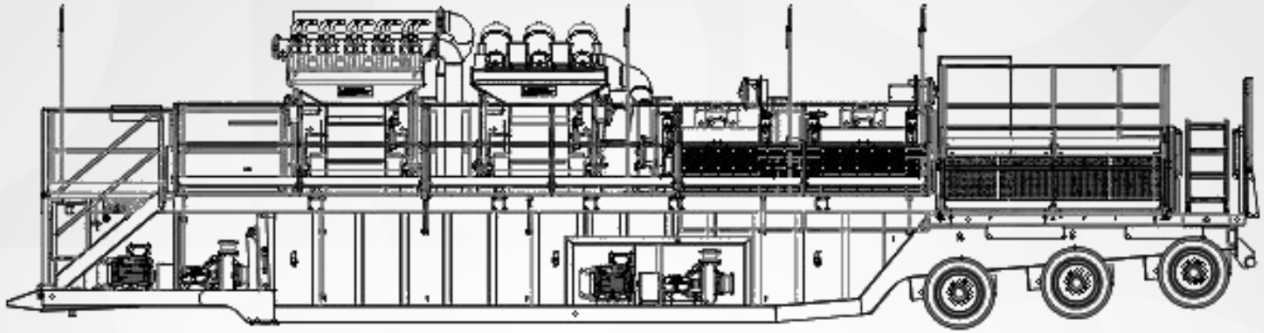
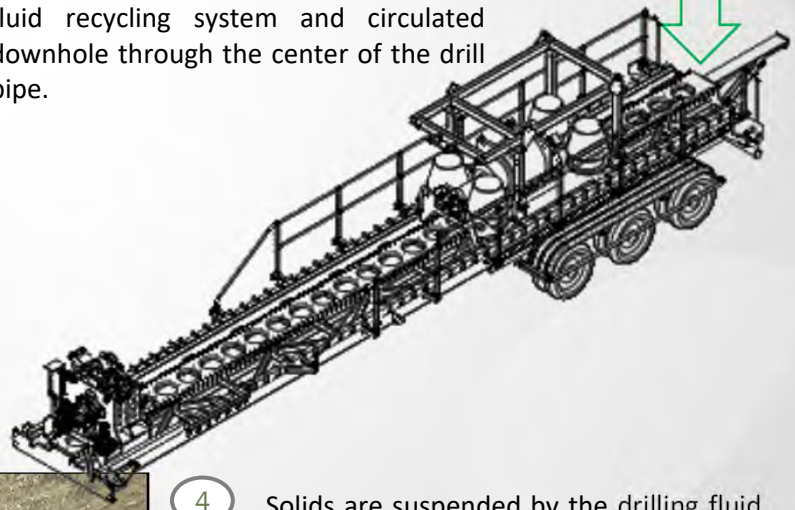
1 Drilling fluid volume is initially prepared consisting primarily of bentonite (NSF/ANSI-60 Drinking Water Additive Standard Certified) & water. Pumps are used to circulate the fluid downhole.



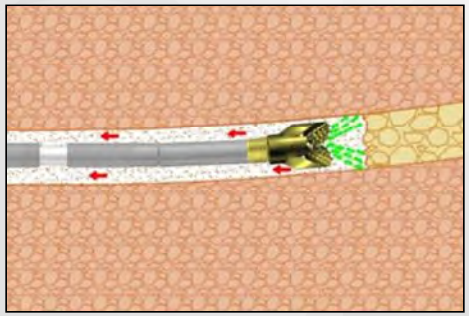
CLEAN FLUID

2 Drilling fluid is pumped from the drilling fluid recycling system and circulated downhole through the center of the drill pipe.



3 Once downhole, drilling fluid serves the following purposes;

- In alluvial formations, assists with jetting the hole
- Transports cuttings to the surface
- Aids in stabilizing formations
- Provides lubrication & tool cooling
- Provides hydrostatic fluid pressure to balance formation pressure.



SOLIDS LADEN FLUID

4 Solids are suspended by the drilling fluid downhole and transported throughout the annular space to the entry pit at surface.

5 Solid laden drilling fluid returns to the recycling system where it is processed by large particle shakers, de-sanders & de-silters. It is during this stage that the suspended cuttings are removed and the desired drilling fluid rheology is restored.

MICHELS®

WBI ENERGY TRANSMISSION, INC.
North Bakken Expansion Project
Section 408 Application

Attachment 2
Surface Use Plan of Operation

August 2020

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT
SURFACE USE PLAN OF OPERATION

1.0 PROJECT DESCRIPTION

WBI Energy Transmission, Inc. (WBI Energy) proposes to construct and operate the North Bakken Expansion Project (or Project), which consists of an approximately 62-mile-long, new 24-inch-diameter natural gas pipeline from new facilities at WBI Energy's Tioga Compressor Station near Tioga, North Dakota, to a new compressor station (Elkhorn Creek Compressor Station) southeast of Watford City, North Dakota.

The Project also involves construction of approximately 0.3 mile of new 24-inch-diameter natural gas pipeline between the proposed Elkhorn Creek Compressor Station to a new interconnect with Northern Border Pipeline Company, approximately 20.4 miles of new 12-inch-diameter natural gas pipeline looping along WBI Energy's Line Section 25, approximately 9.4 miles of new 12-inch-diameter natural gas pipeline looping along WBI Energy's Line Section 30, approximately 0.5 mile of new 20-inch-diameter receipt lateral to the Tioga Compressor Station, and uprating of WBI Energy's Line Section 25. The Project includes additional horsepower at the Tioga Compressor Station; the installation of new and modifications to existing delivery, receipt and transfer stations along WBI Energy's pipeline routes; the replacement of small segments of pipeline facilities; and the installation of block valves, pig launcher/receiver stations and other associated appurtenances.

The Project will require crossing of the Lake Sakakawea Reservoir, which is managed by the U.S. Army Corps of Engineers (USACE), along with USACE-owned lands adjacent to Lake Sakakawea. WBI Energy proposes to install the natural gas pipeline under Lake Sakakawea and USACE lands using the horizontal directional drill (HDD) construction method, a trenchless method designed to avoid direct impacts to sensitive features. The HDD workspaces will be located adjacent to USACE-owned lands on the north side of the lake, and approximately 800 feet from USACE-owned lands on the south side of Lake Sakakawea. No surface impact to USACE lands is anticipated for this Project during installation and operation of the pipeline; all temporary surface impacts will be located outside of USACE lands. Access in the area of the proposed HDD will be along public and private roads.

2.0 CONSTRUCTION TECHNIQUE

The proposed HDD will be approximately 2.9 miles (15,393 feet) in length and will cross 12,934 feet of USACE-owned lands. For the HDD crossing of Lake Sakakawea, WBI Energy anticipates using the intersect method, where a single alignment is achieved by drilling from both ends so as to connect the drills underground. Electromagnetic sensors located on the tip of the drill bit will allow the operator to follow the sensor grid along the prescribed path. Once the pilot hole is completed, the sensor grid will be removed and the hole will be enlarged through a process called reaming. A reaming tool will be installed at one end of the drill string on the exit side of the pilot hole, and then pushed or drawn back to the drill rig to enlarge the hole. Several passes with progressively larger reaming tools may be required to enlarge the hole to a sufficient diameter to accommodate the pipeline. During this process, drilling fluid, or mud, consisting of in-situ material and water (and possibly bentonite clay) will be circulated through the hole to remove drill cuttings and maintain the integrity of the hole. Once the reaming process is complete, a prefabricated segment of pipe will be attached to the drill string on the exit side of the crossing, and pulled back

through the hole toward the drill rig. The pipe segment will generally be hydrostatically tested prior to its installation, and once installed, connected on either side of the crossing to adjoining sections of pipe. The pipe segment will be hydrostatically tested a second time with the remainder of the pipeline system.

3.0 LAND REQUIREMENTS

WBI Energy has requested that the USACE issue a real estate easement across Lake Sakakawea and on adjacent USACE-owned lands. The requested easement would be 50-feet (25-feet either side of centerline) in width and 12,934 feet in length centered on the proposed pipeline. A legal description of the requested easement is provided in Appendix A – Easement Plats.

WBI Energy will maintain the easement according to easement provisions. No surface occupancy of USACE land is proposed as part of the Project. Additionally, WBI Energy does not propose to maintain vegetation (i.e., clear, mow, or apply herbicide) within the easement on USACE lands during operation of the pipeline. However, WBI Energy will conduct periodic inspections of the pipeline right-of-way as outlined in WBI Energy Transmission – Gas System Operation and Maintenance Manual (CUI/PRIV – DO NOT RELEASE included as Appendix A of Attachment 6 of the 408 Permit Application package). The proposed Project will be incorporated into WBI Energy's extensive Supervisory, Control, and Data Acquisition System (SCADA). The Gas Control Center is located at WBI Energy's headquarters in Bismarck, North Dakota, and is staffed 24 hours a day, 365 days a year. Gas controllers use SCADA to monitor the pipeline system, which includes a wide range of activities such as monitoring gas pressures and flows along the pipeline, physical startup and shutdown of compressor sites, and operating system valves along the pipeline.

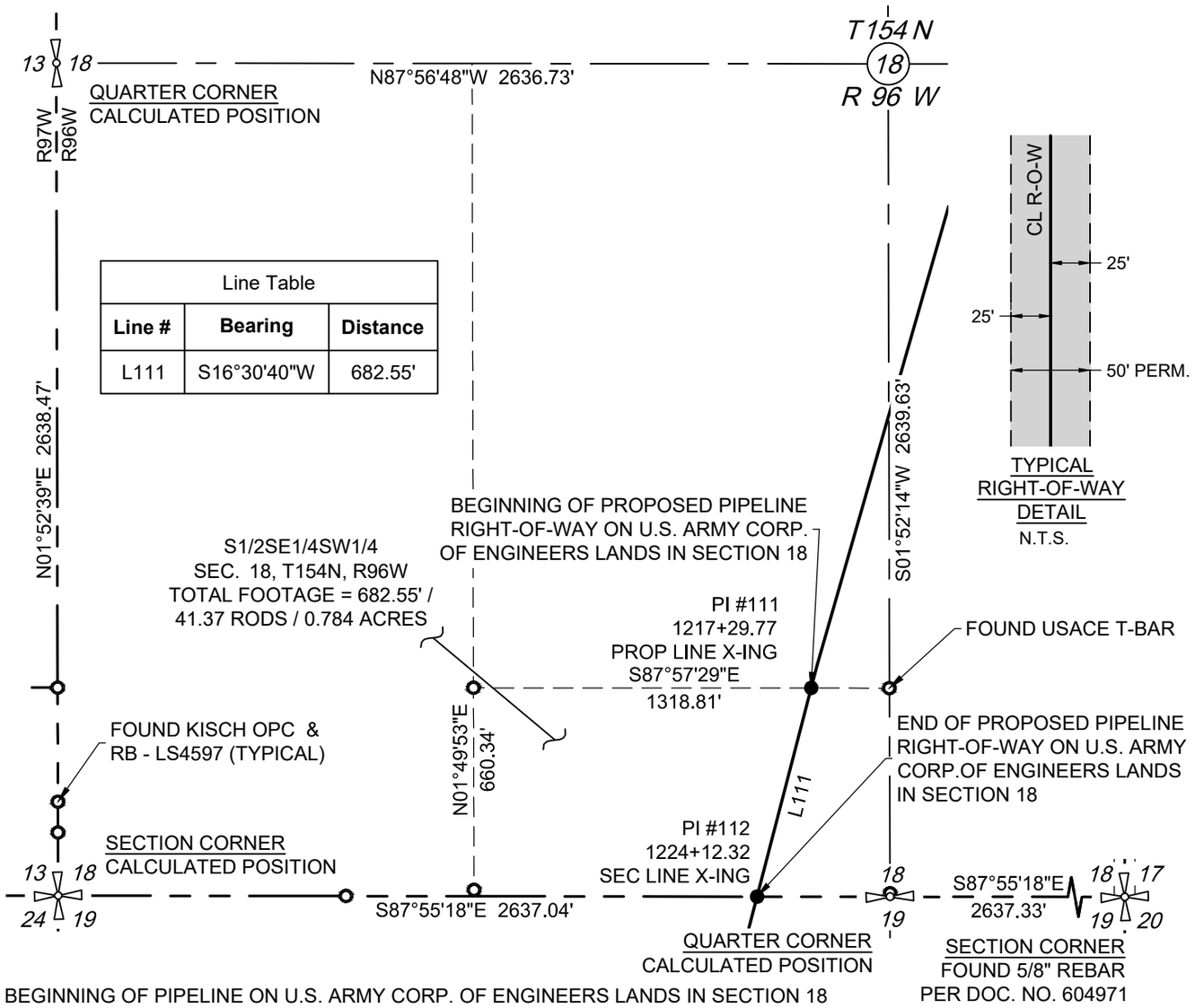
Data acquisition occurs at many locations along the mainline, such as compressor stations, and meter stations. This data is transmitted to Gas Control through SCADA. If system parameters fall outside a predetermined range, an alarm is activated at Gas Control and corrective action is taken by the gas controller as needed. Local WBI Energy personnel are dispatched in response to these alarms if intervention is required outside Gas Control. WBI Energy will also conduct a baseline assessment using in-line inspection of the proposed pipeline in accordance with U.S. Department of Transportation requirements to check for damage, deformities, or other factors that could affect the integrity of the pipelines. If potential problems are identified and maintenance or repair of the pipeline is required, WBI Energy would request separate authorization from the USACE and other applicable agencies to repair or maintain the pipeline.

NORTH BAKKEN EXPANSION PROJECT
Surface Use Plan of Operation

APPENDIX A
Easement Plats

WBI NORTH BAKKEN EXPANSION

TRACT NO. 154 -96-18-066
50' WIDE PIPELINE EASEMENT
S1/2SE1/4SW1/4 SEC. 18, T154N, R96W, 5TH P.M.,
WILLIAMS COUNTY, NORTH DAKOTA
EXHIBIT A



Line Table		
Line #	**Bearing**	**Distance**
L111	S16°30'40"W	682.55'

BEGINNING OF PIPELINE ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 18 BEARS N87°57'29"W, A DISTANCE OF 247.72' FROM THE NORTHEAST CORNER OF THE SOUTH HALF OF THE SOUTHEAST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 18, T154N, R96W, 5TH P.M.

END OF PIPELINE ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 18 BEARS N87°55'18"W, A DISTANCE OF 3058.32' FROM THE SOUTHEAST SECTION CORNER OF SECTION 18, T154N, R96W, 5TH P.M.

Notes:

1. This survey was prepared without the benefit of title research. Ownership information provided by client.

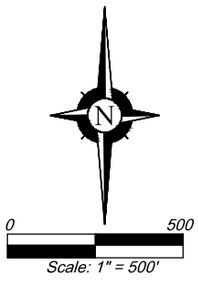
2. Date of Survey: February 2019

Survey Datum:

NORTH DAKOTA NORTH (NAD 83) - International Foot
**Distances are Grid Distances. Combined Scale Factor = 0.999846363*
Grid Distance x 1.000153661 = Ground Distance.

Certificate of Surveyor:

I, Lee S. Hurst, a Registered Professional Land Surveyor, North Dakota Registration No. LS-9208, hereby certify that the survey shown hereon represents a survey performed by me or under my direct supervision and is true and correct to the best of my knowledge and belief.



WBI ENERGY TRANSMISSION Tract No. 154-96-18-066 System Name: North Bakken Expansion Sheet 1 of 10 XX/XX	WBI ENERGY TRANSMISSION Tract No. 154-96-18-066 50' Wide Pipeline Easement Over, Under & Across S1/2SE1/4SW1/4 Sec. 18, T154N, R96W, 5TH P.M., Williams County, North Dakota	Project No.: 2018-23-0200.100 Dwg. Date: 2-11-20 Drawn By: H. Nickoloff Checked By: J. Reineking Rev. No: ___ Date: ___	Surveying & Drafting Services By: ECS INC. ERICKSON CONTRACT SURVEYING 333 10th AVE SE Sidney, Montana Office 406-482-6606 / Fax 406-482-6600

WBI NORTH BAKKEN EXPANSION

TRACT NO. 154 -96-18-066
50' WIDE PIPELINE EASEMENT
S1/2SE1/4SW1/4 SEC. 18, T154N, R96W, 5TH P.M.,
WILLIAMS COUNTY, NORTH DAKOTA
EXHIBIT A

PIPELINE RIGHT-OF-WAY DESCRIPTION ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 18

A 50' WIDE RIGHT-OF WAY 25' ON EACH SIDE OF THE FOLLOWING DESCRIBED CENTERLINE.

BEGINNING AT A POINT OF THE NORTH LINE OF THE SOUTH HALF OF THE SOUTHEAST QUARTER OF THE SOUTHWEST QUARTER (S1/2SE1/4SW1/4) OF SECTION 18, T154N, R96W, 5TH P.M. WHICH BEARS N87°57'29"W, A DISTANCE OF 247.72' FROM THE NORTHEAST CORNER OF SAID SOUTH HALF OF THE SOUTHEAST QUARTER OF THE SOUTHWEST QUARTER; THENCE S16°30'40"W, A DISTANCE OF 682.55' TO A POINT ON THE SOUTH SECTION LINE OF SAID SECTION 18, WHICH BEARS N87°55'18"W, A DISTANCE OF 3058.32' FROM THE SOUTHEAST SECTION CORNER OF SAID SECTION 18. THE SIDE LINES OF SAID DESCRIBE RIGHT-OF-WAY BEING SHORTENED OR ELONGATED TO MEET THE GRANTOR'S PROPERTY LINES. CONTAIN 0.784 ACRES MORE OR LESS.

Notes:

1. This survey was prepared without the benefit of title research. Ownership information provided by client.

2. Date of Survey: February 2019

Survey Datum:

NORTH DAKOTA NORTH (NAD 83) - International Foot
**Distances are Grid Distances. Combined Scale Factor = 0.999846363*
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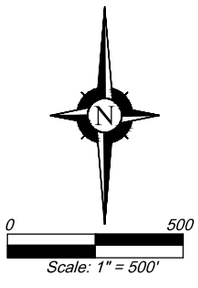

WBI ENERGY TRANSMISSION An MDU Resources Group company Tract No. 154-96-18-066 System Name: North Bakken Expansion Sheet 2 of 10 XX/XX	*WBI ENERGY TRANSMISSION* Tract No. 154-96-18-066 *50' Wide Pipeline Easement Over, Under & Across S1/2SE1/4SW1/4* *Sec. 18, T154N, R96W, 5TH P.M.,* *Williams County, North Dakota*	*Project No.: 2018-23-0200.100* *Dwg. Date: 2-11-20* *Drawn By: H. Nickoloff* *Checked By: J. Reineking* *Rev. No:___ Date:___*

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ERICKSON CONTRACT SURVEYING
333 10th AVE SE Sidney, Montana
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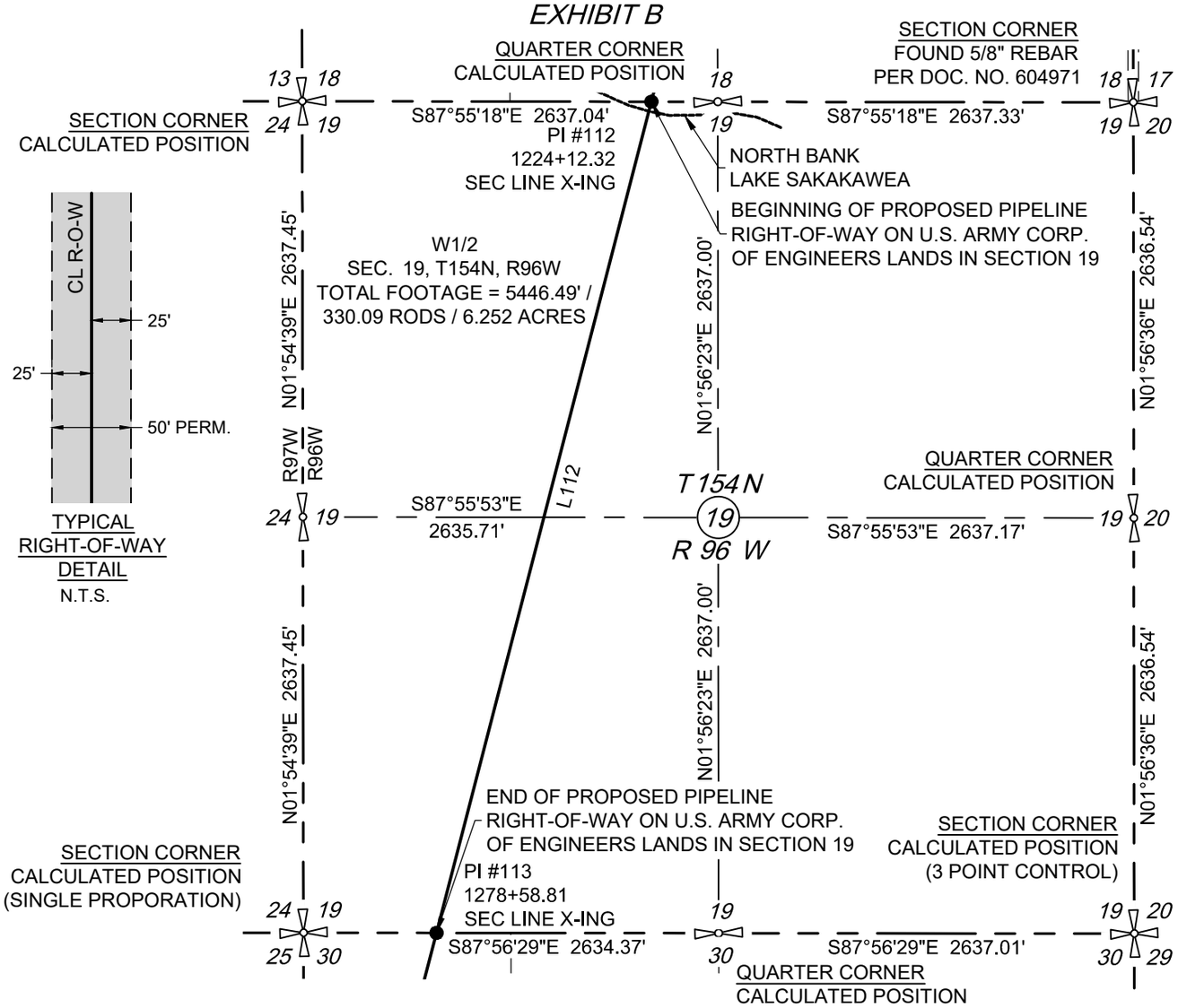
WBI NORTH BAKKEN EXPANSION

TRACT NO. 154-96-19-067 & 154-96-19-068
50' WIDE PIPELINE EASEMENT
W1/2 SEC. 19, T154N, R96W, 5TH P.M.,
McKENZIE COUNTY, NORTH DAKOTA
EXHIBIT B



BEGINNING OF PIPELINE ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 19 BEARS N87°55'18"W, A DISTANCE OF 3058.32' FROM THE NORTHEAST SECTION CORNER OF SECTION 19, T154N, R96W, 5TH P.M.

END OF PIPELINE ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 19 BEARS S87°56'29"E, A DISTANCE OF 843.16' FROM THE SOUTHWEST COMPUTED SECTION CORNER OF SECTION 19, T154N, R96W, 5TH P.M.

Line Table		
Line #	**Bearing**	**Distance**
L112	S16°30'40"W	5446.49'

Notes:

1. This survey was prepared without the benefit of title research. Ownership information provided by client.

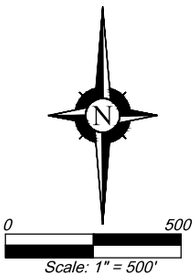
2. Date of Survey: February 2019

Survey Datum:

NORTH DAKOTA NORTH (NAD 83) - International Foot
**Distances are Grid Distances. Combined Scale Factor = 0.999846363*
Grid Distance x 1.000153661 = Ground Distance.

Certificate of Surveyor:

I, Lee S. Hurst, a Registered Professional Land Surveyor, North Dakota Registration No. LS-9208, hereby certify that the survey shown hereon represents a survey performed by me or under my direct supervision and is true and correct to the best of my knowledge and belief.



WBI ENERGY TRANSMISSION Tract No. 154-96-19-067 & 68 System Name: North Bakken Expansion Sheet 3 of 10 XX/XX	*WBI ENERGY TRANSMISSION* Tract No. 154-96-19-067 & 154-96-19-068 *50' Wide Pipeline Easement Over, Under & Across W1/2* *Sec. 19, T154N, R96W, 5TH P.M.,* *Williams County, North Dakota*	*Project No.: 2018-23-0200.100* *Dwg. Date: 2-11-20* *Drawn By: H. Nickoloff* *Checked By: J. Reineking* *Rev. No: ___ Date: ___*	*Surveying & Drafting Services By:* ECS INC. ERICKSON CONTRACT SURVEYING 333 10th AVE SE Sidney, Montana Office 406-482-6606 / Fax 406-482-6600

WBI NORTH BAKKEN EXPANSION

TRACT NO. 154-96-19-067 & 154-96-19-068
50' WIDE PIPELINE EASEMENT
W1/2 SEC. 19, T154N, R96W, 5TH P.M.,
McKENZIE COUNTY, NORTH DAKOTA
EXHIBIT B

PIPELINE RIGHT-OF-WAY DESCRIPTION ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 19

A 50' WIDE RIGHT-OF WAY 25' ON EACH SIDE OF THE FOLLOWING DESCRIBED CENTERLINE.

BEGINNING AT A POINT OF THE NORTH SECTION LINE OF SECTION 19, T154N, R96W, 5TH P.M. WHICH BEARS N87°55'18"W, A DISTANCE OF 3058.32' FROM THE NORTHEAST SECTION CORNER OF SAID SECTION 19; THENCE S16°30'40"W, A DISTANCE OF 5446.49' TO A POINT ON THE SOUTH SECTION LINE OF SAID SECTION 19, WHICH BEARS S87°56'29"E, A DISTANCE OF 843.16' FROM THE SOUTHWEST COMPUTED SECTION CORNER OF SAID SECTION 19. THE SIDE LINES OF SAID DESCRIBE RIGHT-OF-WAY BEING SHORTENED OR ELONGATED TO MEET THE GRANTOR'S PROPERTY LINES. CONTAIN 6.252 ACRES MORE OR LESS.

Notes:

1. This survey was prepared without the benefit of title research. Ownership information provided by client.

2. Date of Survey: February 2019

Survey Datum:

NORTH DAKOTA NORTH (NAD 83) - International Foot
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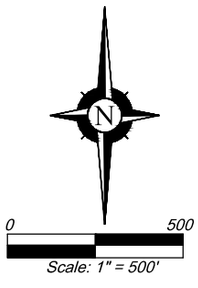
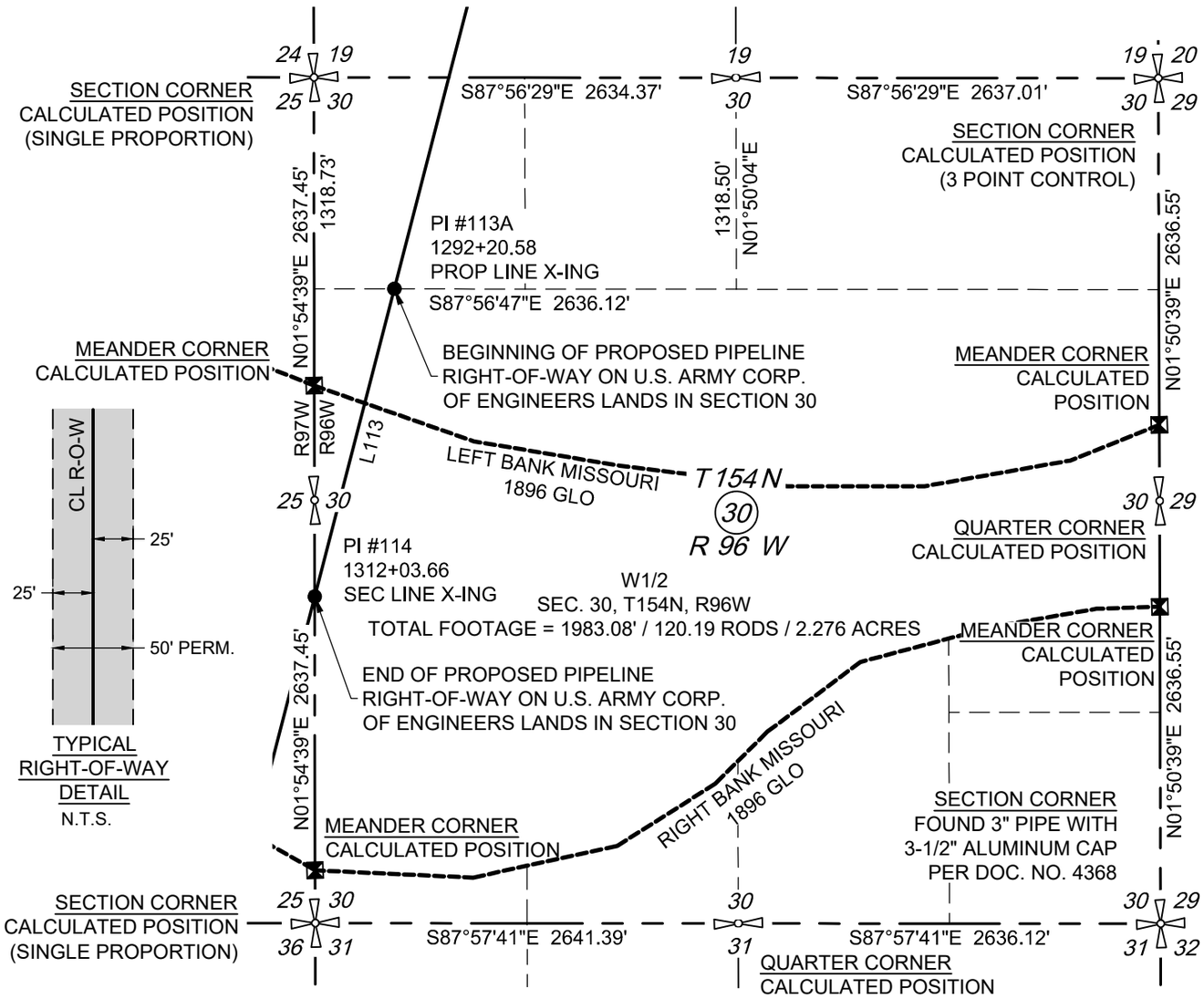


WBI ENERGY TRANSMISSION An MDU Resources Group company Tract No. 154-96-19-067 & 068 System Name: North Bakken Expansion Sheet 4 of 10 XX/XX	*WBI ENERGY TRANSMISSION* Tract No. 154-96-19-067 & 154-96-19-068 *50' Wide Pipeline Easement Over, Under & Across W1/2* *Sec. 19, T154N, R96W, 5TH P.M.,* *Williams County, North Dakota*	*Project No.: 2018-23-0200.100* *Dwg. Date: 2-11-20* *Drawn By: H. Nickoloff* *Checked By: J. Reineking* *Rev. No:___ Date:___*	*Surveying & Drafting Services By:* ECS INC. ERICKSON CONTRACT SURVEYING 333 10th AVE SE Sidney, Montana Office 406-482-6606 / Fax 406-482-6600

WBI NORTH BAKKEN EXPANSION

TRACT NO. 154-96-30-071
50' WIDE PIPELINE EASEMENT
W1/2 SEC. 30, T154N, R96W, 5TH P.M.,
WILLIAMS COUNTY, NORTH DAKOTA
EXHIBIT C



BEGINNING OF PIPELINE ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 30 BEARS S18°49'53"E, A DISTANCE OF 1411.46' FROM THE NORTHWEST COMPUTED SECTION CORNER OF SECTION 30, T154N, R96W, 5TH P.M.

END OF PIPELINE ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 30 BEARS N01°54'39"E, A DISTANCE OF 2035.89' FROM THE SOUTHWEST COMPUTED SECTION CORNER OF SECTION 30, T154N, R96W, 5TH P.M.

Line Table		
Line #	**Bearing**	**Distance**
L113	S16°30'40"W	1983.08'

Notes:

1. This survey was prepared without the benefit of title research. Ownership information provided by client.

2. Date of Survey: February 2019

Survey Datum:

NORTH DAKOTA NORTH (NAD 83) - International Foot
**Distances are Grid Distances. Combined Scale Factor = 0.999846363*
Grid Distance x 1.000153661 = Ground Distance.

Certificate of Surveyor:

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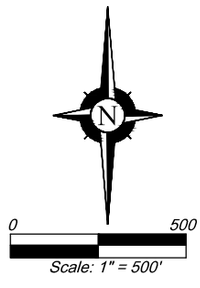

WBI ENERGY TRANSMISSION An MDU Resources Group company Tract No. 154-96-30-070 & 071 System Name: North Bakken Expansion Sheet 5 of 10 XX/XX	*WBI ENERGY TRANSMISSION* Tract No. 154-96-30-071 *50' Wide Pipeline Easement Over, Under & Across W1/2* *Sec. 30, T154N, R96W, 5TH P.M.,* *Williams County, North Dakota*	*Project No.: 2018-23-0200.100* *Dwg. Date: 2-11-20* *Drawn By: H. Nickoloff* *Checked By: J. Reineking* *Rev. No:___ Date:___*	*Surveying & Drafting Services By:* ECS INC. ERICKSON CONTRACT SURVEYING 333 10th AVE SE Sidney, Montana Office 406-482-6606 / Fax 406-482-6600

WBI NORTH BAKKEN EXPANSION

TRACT NO. 154-96-30-071
50' WIDE PIPELINE EASEMENT
W1/2 SEC. 30, T154N, R96W, 5TH P.M.,
WILLIAMS COUNTY, NORTH DAKOTA
EXHIBIT C

PIPELINE RIGHT-OF-WAY DESCRIPTION ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 30

A 50' WIDE RIGHT-OF WAY 25' ON EACH SIDE OF THE FOLLOWING DESCRIBED CENTERLINE.

BEGINNING AT A POINT OF THE NORTH LINE OF LOT 2 IN SECTION 30, T154N, R96W, 5TH P.M. WHICH BEARS S18°49'53"E, A DISTANCE OF 1411.46' FROM THE NORTHWEST COMPUTED SECTION CORNER OF SECTION 30; THENCE S16°30'40"W, A DISTANCE OF 1983.08' TO A POINT ON THE WEST SECTION LINE OF SAID SECTION 30, WHICH BEARS N01°54'39"E, A DISTANCE OF 2035.89' FROM THE SOUTHWEST COMPUTED SECTION CORNER OF SAID SECTION 30. THE SIDE LINES OF SAID DESCRIBE RIGHT-OF-WAY BEING SHORTENED OR ELONGATED TO MEET THE GRANTOR'S PROPERTY LINES. CONTAIN 2.276 ACRES MORE OR LESS.

Notes:

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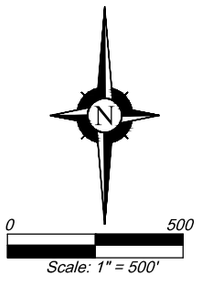
2. Date of Survey: February 2019

Survey Datum:

NORTH DAKOTA NORTH (NAD 83) - International Foot
**Distances are Grid Distances. Combined Scale Factor = 0.999846363*
Grid Distance x 1.000153661 = Ground Distance.

Certificate of Surveyor:

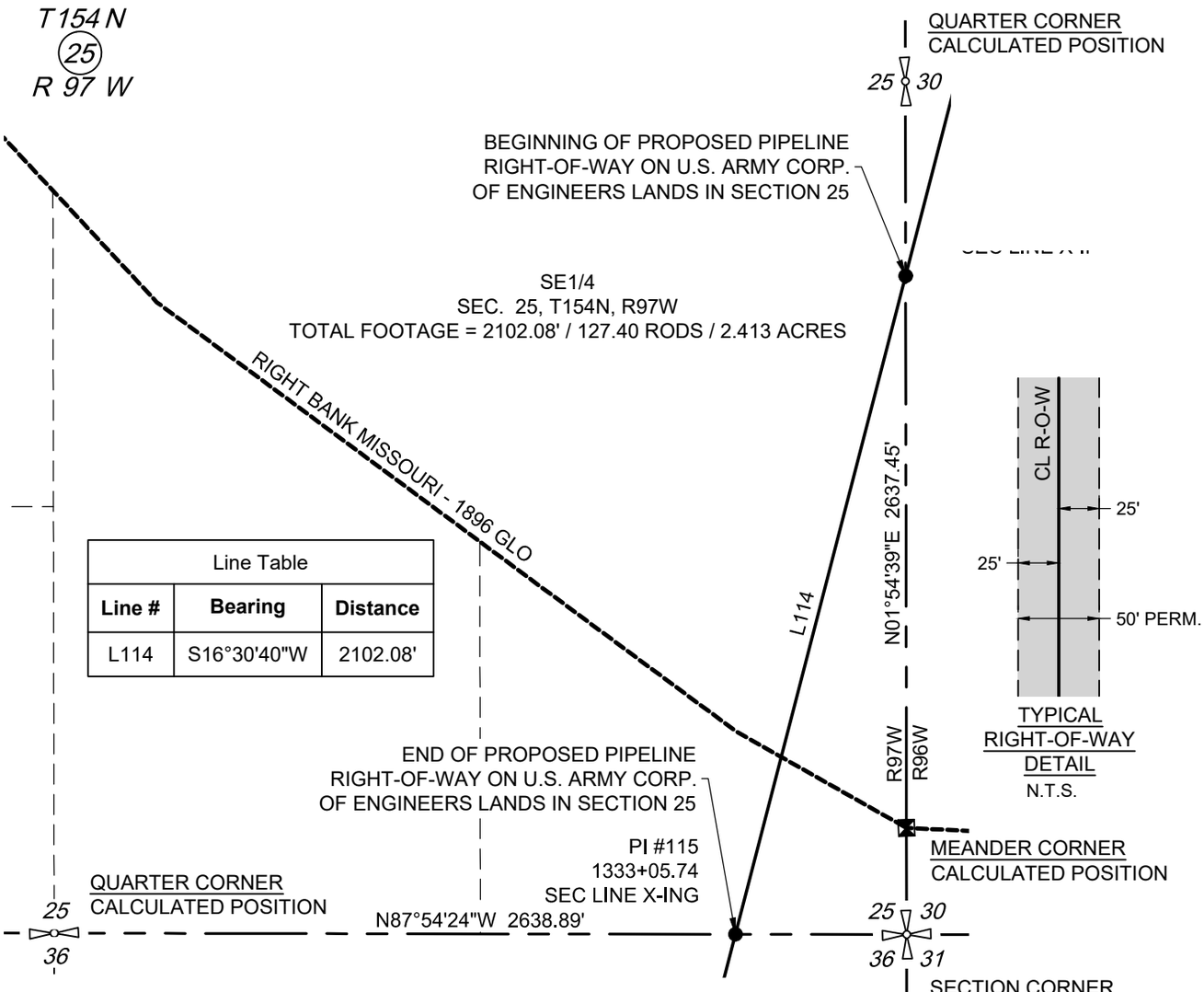
I, Lee S. Hurst, a Registered Professional Land Surveyor, North Dakota Registration No. LS-9208, hereby certify that the survey shown hereon represents a survey performed by me or under my direct supervision and is true and correct to the best of my knowledge and belief.



WBI ENERGY TRANSMISSION An MDU Resources Group company Tract No. 154-96-30-070 & 071 System Name: North Bakken Expansion Sheet 6 of 10 XX/XX	*WBI ENERGY TRANSMISSION* Tract No. 154-96-30-071 *50' Wide Pipeline Easement Over, Under & Across W1/2* *Sec. 30, T154N, R96W, 5TH P.M.,* *Williams County, North Dakota*	*Project No.: 2018-23-0200.100* *Dwg. Date: 2-11-20* *Drawn By: H. Nickoloff* *Checked By: J. Reineking* *Rev. No: ___ Date: ___*	*Surveying & Drafting Services By:* ECS INC. ERICKSON CONTRACT SURVEYING 333 10th AVE SE Sidney, Montana Office 406-482-6606 / Fax 406-482-6600

WBI NORTH BAKKEN EXPANSION

TRACT NO. 154-97-25-073a
50' WIDE PIPELINE EASEMENT
SE1/4 SEC. 25, T154N, R97W, 5TH P.M.,
WILLIAMS COUNTY, NORTH DAKOTA
EXHIBIT D



Line Table		
Line #	**Bearing**	**Distance**
L114	S16°30'40"W	2102.08'

BEGINNING OF PIPELINE ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 25 BEARS N01°54'39"E, A DISTANCE OF 2035.89' FROM THE SOUTHEAST COMPUTED SECTION CORNER OF SECTION 25, T154N, R97W, 5TH P.M.

END OF PIPELINE ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 25 BEARS N87°54'24"W, A DISTANCE OF 529.88' FROM THE SOUTHEAST COMPUTED SECTION CORNER OF SECTION 25, T154N, R97W, 5TH P.M.

Notes:

1. This survey was prepared without the benefit of title research. Ownership information provided by client.

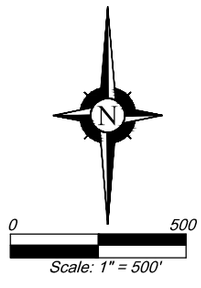
2. Date of Survey: February 2019

Survey Datum:

NORTH DAKOTA NORTH (NAD 83) - International Foot
**Distances are Grid Distances. Combined Scale Factor = 0.999846363*
Grid Distance x 1.000153661 = Ground Distance.

Certificate of Surveyor:

I, Lee S. Hurst, a Registered Professional Land Surveyor, North Dakota Registration No. LS-9208, hereby certify that the survey shown hereon represents a survey performed by me or under my direct supervision and is true and correct to the best of my knowledge and belief.



WBI ENERGY TRANSMISSION An MDU Resources Group company Tract No. 154-97-25-073 System Name: North Bakken Expansion Sheet 7 of 10 XX/XX	*WBI ENERGY TRANSMISSION* Tract No. 154-97-25-073a *50' Wide Pipeline Easement Over, Under & Across SE1/4* *Sec. 25, T154N, R97W, 5TH P.M.,* *Williams County, North Dakota*	*Project No.:* 2018-23-0200.100 *Dwg. Date:* 2-11-20 *Drawn By:* H. Nickoloff *Checked By:* J. Reineking *Rev. No:* ___ *Date:* ___	*Surveying & Drafting Services By:* ECS INC. ERICKSON CONTRACT SURVEYING 333 10th AVE SE Sidney, Montana Office 406-482-6606 / Fax 406-482-6600

WBI NORTH BAKKEN EXPANSION

TRACT NO. 154-97-25-073a
50' WIDE PIPELINE EASEMENT
SE1/4 SEC. 25, T154N, R97W, 5TH P.M.,
WILLIAMS COUNTY, NORTH DAKOTA
EXHIBIT D

PIPELINE RIGHT-OF-WAY DESCRIPTION ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 25

A 50' WIDE RIGHT-OF WAY 25' ON EACH SIDE OF THE FOLLOWING DESCRIBED CENTERLINE.

BEGINNING AT A POINT OF THE EAST SECTION LINE OF SECTION 25, T154N, R97W, 5TH P.M. WHICH BEARS N01°54'39"E, A DISTANCE OF 2035.89' FROM THE SOUTHEAST COMPUTED SECTION CORNER OF SAID SECTION 25; THENCE S16°30'40"W, A DISTANCE OF 2102.08' TO A POINT ON THE SOUTH SECTION LINE OF SAID SECTION 25, WHICH BEARS N87°54'24"W, A DISTANCE OF 529.88' FROM THE SOUTHEAST COMPUTED SECTION CORNER OF SAID SECTION 25. THE SIDE LINES OF SAID DESCRIBE RIGHT-OF-WAY BEING SHORTENED OR ELONGATED TO MEET THE GRANTOR'S PROPERTY LINES. CONTAIN 2.413 ACRES MORE OR LESS.

Notes:

1. This survey was prepared without the benefit of title research. Ownership information provided by client.

2. Date of Survey: February 2019

Survey Datum:

NORTH DAKOTA NORTH (NAD 83) - International Foot
**Distances are Grid Distances. Combined Scale Factor = 0.999846363*
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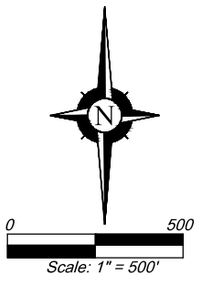
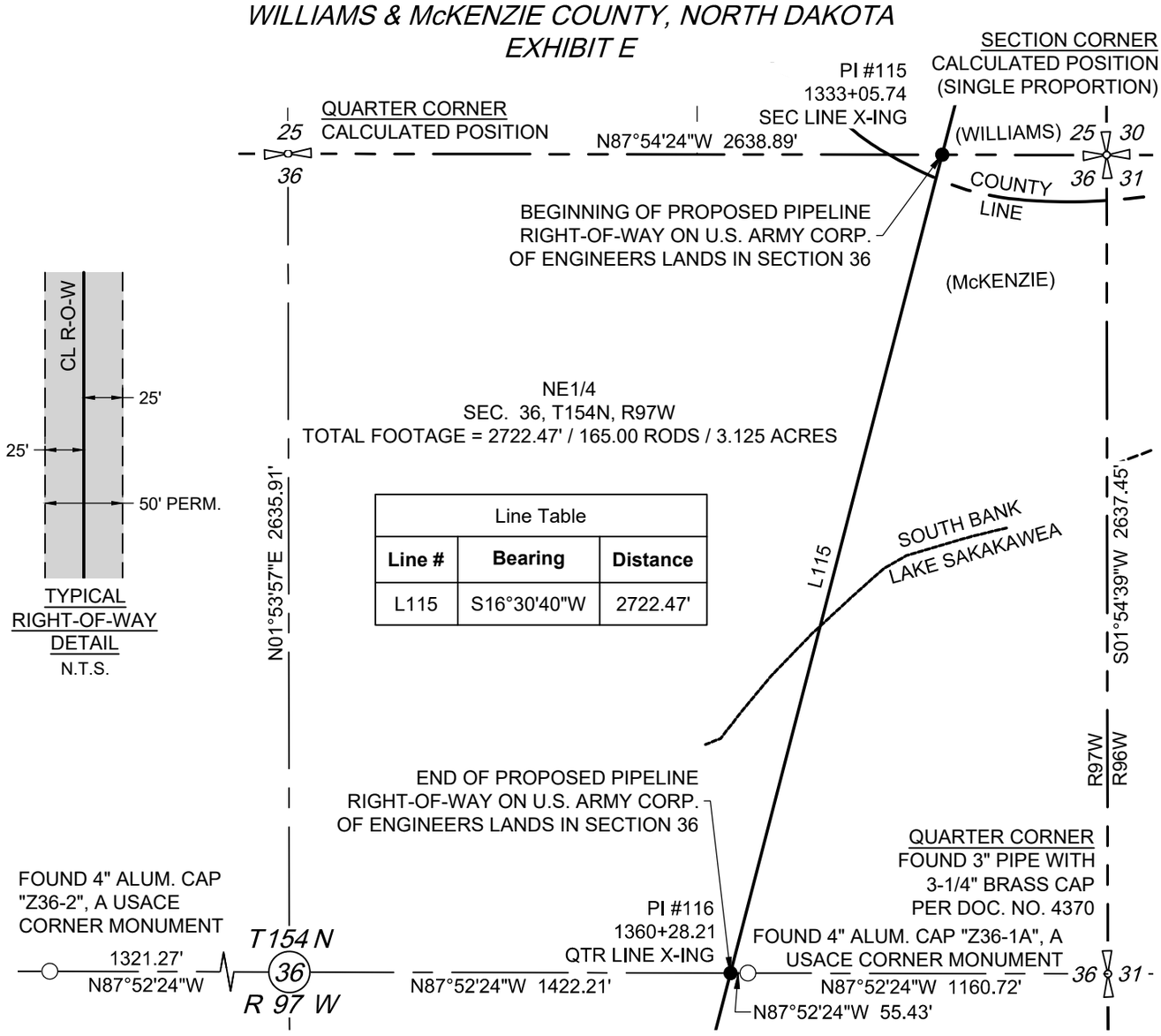


WBI ENERGY TRANSMISSION An MDU Resources Group company Tract No. 154-97-25-073 System Name: North Bakken Expansion Sheet 8 of 10 XX/XX	*WBI ENERGY TRANSMISSION* Tract No. 154-97-25-073a *50' Wide Pipeline Easement Over, Under & Across SE1/4* *Sec. 25, T154N, R97W, 5TH P.M.,* *Williams County, North Dakota*	*Project No.: 2018-23-0200.100* *Dwg. Date: 2-11-20* *Drawn By: H. Nickoloff* *Checked By: J. Reineking* *Rev. No: ___ Date: ___*	*Surveying & Drafting Services By:* ECS INC. ERICKSON CONTRACT SURVEYING 333 10th AVE SE Sidney, Montana Office 406-482-6606 / Fax 406-482-6600

WBI NORTH BAKKEN EXPANSION

TRACT NO. 154-97-36-074a
50' WIDE PIPELINE EASEMENT
NE1/4 SEC. 36, T154N, R97W, 5TH P.M.,
WILLIAMS & McKENZIE COUNTY, NORTH DAKOTA
EXHIBIT E



Line Table		
Line #	**Bearing**	**Distance**
L115	S16°30'40"W	2722.47'

BEGINNING OF PIPELINE ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 36 BEARS N87°54'24"W, A DISTANCE OF 529.88' FROM THE NORTHEAST COMPUTED SECTION CORNER OF SECTION 36, T154N, R97W, 5TH P.M.

END OF PIPELINE ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 36 BEARS N87°52'24"W, A DISTANCE OF 55.43' FROM THE USACE CORNER MONUMENT NUMBER Z36-1A, IN SECTION 36, T154N, R97W, 5TH P.M.

Notes:

1. This survey was prepared without the benefit of title research. Ownership information provided by client.

2. Date of Survey: February 2019

Survey Datum:

NORTH DAKOTA NORTH (NAD 83) - International Foot
**Distances are Grid Distances. Combined Scale Factor = 0.999846363*
Grid Distance x 1.000153661 = Ground Distance.

Certificate of Surveyor:

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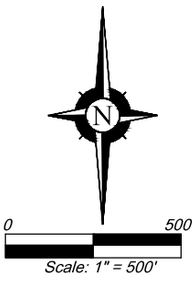

WBI ENERGY TRANSMISSION An MDU Resources Group company	WBI ENERGY TRANSMISSION	Project No.: 2018-23-0200.100	Surveying & Drafting Services By:
Tract No. 154-97-36-074	Tract No. 154-97-36-074a	Dwg. Date: 2-11-20	ECS INC.
System Name: North Bakken Expansion	50' Wide Pipeline Easement Over, Under & Across NE1/4	Drawn By: H. Nickoloff	ERICKSON CONTRACT SURVEYING
Sheet 9 of 10 XX/XX	Sec. 36, T154N, R97W, 5TH P.M., Williams & McKenzie County, North Dakota	Checked By: J. Reineking	333 10th AVE SE Sidney, Montana
		Rev. No: ___ Date: ___	Office 406-482-6606 / Fax 406-482-6600

WBI NORTH BAKKEN EXPANSION

TRACT NO. 154-97-36-074a
50' WIDE PIPELINE EASEMENT
NE1/4 SEC. 36, T154N, R97W, 5TH P.M.,
WILLIAMS & McKENZIE COUNTY, NORTH DAKOTA
EXHIBIT E

PIPELINE RIGHT-OF-WAY DESCRIPTION ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 36

A 50' WIDE RIGHT-OF WAY 25' ON EACH SIDE OF THE FOLLOWING DESCRIBED CENTERLINE.

BEGINNING AT A POINT OF THE NORTH SECTION LINE OF SECTION 36, T154N, R97W, 5TH P.M. WHICH BEARS N87°54'24"W, A DISTANCE OF 529.88' FROM THE NORTHEAST COMPUTED SECTION CORNER OF SAID SECTION 36; THENCE S16°30'40"W, A DISTANCE OF 2722.47' TO A POINT ON THE EAST-WEST QUARTER LINE OF SAID SECTION 36, WHICH BEARS N87°52'24"W, A DISTANCE OF 55.43' FROM THE USACE CORNER MONUMENT # Z36-1A, IN SAID SECTION 36. THE SIDE LINES OF SAID DESCRIBE RIGHT-OF-WAY BEING SHORTENED OR ELONGATED TO MEET THE GRANTOR'S PROPERTY LINES. CONTAIN 3.125 ACRES MORE OR LESS.

Notes:

1. This survey was prepared without the benefit of title research. Ownership information provided by client.

2. Date of Survey: February 2019

Survey Datum:

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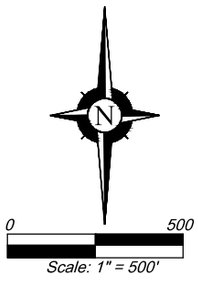

WBI ENERGY TRANSMISSION An MDU Resources Group company	*WBI ENERGY TRANSMISSION*	*Project No.: 2018-23-0200.100*	*Surveying & Drafting Services By:*
Tract No. 154-97-36-074	Tract No. 154-97-36-074a	*Dwg. Date: 2-11-20*	ECS INC.
System Name: North Bakken Expansion	*50' Wide Pipeline Easement Over, Under & Across NE1/4*	*Drawn By: H. Nickoloff*	*ERICKSON CONTRACT SURVEYING*
Sheet 10 of 10 *XX/XX*	*Sec. 36, T154N, R97W, 5TH P.M., Williams & McKenzie County, North Dakota*	*Checked By: J. Reineking* *Rev. No: ___ Date: ___*	*333 10th AVE SE Sidney, Montana* *Office 406-482-6606 / Fax 406-482-6600*

Attachment 3

Erosion Sedimentation Control Plan

WBI ENERGY TRANSMISSION, INC.
North Bakken Expansion Project
Section 408 Application

Attachment 3
Erosion and Sedimentation Control Plan

August 2020

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT
EROSION AND SEDIMENTATION CONTROL PLAN

WBI Energy Transmission, Inc. (WBI Energy) proposes to construct and operate the North Bakken Expansion Project (or Project), which consists of an approximately 61.9-mile-long, new 24-inch-diameter natural gas pipeline from new facilities at WBI Energy's Tioga Compressor Station near Tioga, North Dakota, to a new compressor station (Elkhorn Creek Compressor Station) southeast of Watford City, North Dakota.

The Project also involves construction of approximately 0.3 mile of new 24-inch-diameter natural gas pipeline between the proposed Elkhorn Creek Compressor Station to a new interconnect with Northern Border Pipeline Company, approximately 20.4 miles of new 12-inch-diameter natural gas pipeline looping along WBI Energy's Line Section 25, approximately 9.4 miles of new 12-inch-diameter natural gas pipeline looping along WBI Energy's Line Section 30, approximately 0.5 mile of new 20-inch-diameter receipt lateral to the Tioga Compressor Station, and uprating of WBI Energy's Line Section 25. The Project includes additional horsepower at the Tioga Compressor Station; the installation of new and modifications to existing delivery, receipt and transfer stations along WBI Energy's pipeline routes; the replacement of small segments of pipeline facilities; and the installation of block valves, pig launcher/receiver stations and other associated appurtenances.

The Project will require crossing of the Lake Sakakawea Reservoir, which is managed by the U.S. Army Corps of Engineers (USACE), along with USACE-owned lands adjacent to Lake Sakakawea. WBI Energy proposes to install the natural gas pipeline under Lake Sakakawea and USACE lands using the horizontal directional drill (HDD) construction method, a trenchless method designed to avoid direct impacts to sensitive features. The HDD workspaces will be located adjacent to USACE-owned lands on the north side of the lake, and approximately 800 feet from USACE-owned lands on the south side of Lake Sakakawea. No surface impact to USACE lands is anticipated for this Project during installation and operation of the pipeline; all known temporary surface impacts will be located outside of USACE lands.

Construction of the Project will be completed in adherence to the Federal Energy Regulatory Commission's *Upland Erosion Control, Revegetation, and Maintenance Plan* and *Wetland and Waterbody Construction and Mitigation Procedures*, which are attached for reference as Appendix A and B, respectively.

NORTH BAKKEN EXPANSION PROJECT

Erosion and Sediment Control Plan

APPENDIX A
Federal Energy Regulatory Commission's Upland Erosion Control, Revegetation, and Maintenance Plan

Federal Energy Regulatory Commission

Office of Energy Projects

May 2013

UPLAND EROSION CONTROL, REVEGETATION, AND MAINTENANCE PLAN

Washington, DC 20426

MAY 2013 VERSION

UPLAND EROSION CONTROL, REVEGETATION, AND MAINTENANCE PLAN

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- A. CONSTRUCTION WORK AREAS 4
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UPLAND EROSION CONTROL, REVEGETATION, AND MAINTENANCE PLAN (PLAN)

I. APPLICABILITY

A. The intent of this Plan is to assist project sponsors by identifying baseline mitigation measures for minimizing erosion and enhancing revegetation. Project sponsors shall specify in their applications for a new FERC authorization and in prior notice and advance notice filings, any individual measures in this Plan they consider unnecessary, technically infeasible, or unsuitable due to local conditions and fully describe any alternative measures they would use. Project sponsors shall also explain how those alternative measures would achieve a comparable level of mitigation.

Once a project is authorized, project sponsors can request further changes as variances to the measures in this Plan (or the applicant's approved plan). The Director of the Office of Energy Projects (Director) will consider approval of variances upon the project sponsor's written request, if the Director agrees that a variance:

1. provides equal or better environmental protection;

2. is necessary because a portion of this Plan is infeasible or unworkable based on project-specific conditions; or

3. is specifically required in writing by another federal, state, or Native American land management agency for the portion of the project on its land or under its jurisdiction.

Sponsors of projects planned for construction under the automatic authorization provisions in the FERC's regulations must receive written approval for any variances in advance of construction.

Project-related impacts on wetland and waterbody systems are addressed in the staff's Wetland and Waterbody Construction and Mitigation Procedures (Procedures).

II. SUPERVISION AND INSPECTION

A. ENVIRONMENTAL INSPECTION

1. At least one Environmental Inspector is required for each construction spread during construction and restoration (as defined by section V). The number and experience of Environmental Inspectors assigned to each construction spread shall be appropriate for the length of the construction spread and the number/significance of resources affected.

2. Environmental Inspectors shall have peer status with all other activity inspectors.

3. Environmental Inspectors shall have the authority to stop activities that violate the environmental conditions of the FERC's Orders, stipulations of other environmental permits or approvals, or landowner easement agreements; and to order appropriate corrective action.

B. RESPONSIBILITIES OF ENVIRONMENTAL INSPECTORS

At a minimum, the Environmental Inspector(s) shall be responsible for:

1. Inspecting construction activities for compliance with the requirements of this Plan, the Procedures, the environmental conditions of the FERC's Orders, the mitigation measures proposed by the project sponsor (as approved and/or modified by the Order), other environmental permits and approvals, and environmental requirements in landowner easement agreements.

2. Identifying, documenting, and overseeing corrective actions, as necessary to bring an activity back into compliance;

3. Verifying that the limits of authorized construction work areas and locations of access roads are visibly marked before clearing, and maintained throughout construction;

4. Verifying the location of signs and highly visible flagging marking the boundaries of sensitive resource areas, waterbodies, wetlands, or areas with special requirements along the construction work area;

5. Identifying erosion/sediment control and soil stabilization needs in all areas;

6. Ensuring that the design of slope breakers will not cause erosion or direct water into sensitive environmental resource areas, including cultural resource sites, wetlands, waterbodies, and sensitive species habitats;

7. Verifying that dewatering activities are properly monitored and do not result in the deposition of sand, silt, and/or sediment into sensitive environmental resource areas, including wetlands, waterbodies, cultural resource sites, and sensitive species habitats; stopping dewatering activities if such deposition is occurring and ensuring the design of the discharge is changed to prevent reoccurrence; and verifying that dewatering structures are removed after completion of dewatering activities;

8. Ensuring that subsoil and topsoil are tested in agricultural and residential areas to measure compaction and determine the need for corrective action;

9. Advising the Chief Construction Inspector when environmental conditions (such as wet weather or frozen soils) make it advisable to restrict or delay construction activities to avoid topsoil mixing or excessive compaction;

10. Ensuring restoration of contours and topsoil;

11. Verifying that the soils imported for agricultural or residential use are certified as free of noxious weeds and soil pests, unless otherwise approved by the landowner;

12. Ensuring that erosion control devices are properly installed to prevent sediment flow into sensitive environmental resource areas (e.g., wetlands, waterbodies, cultural resource sites, and sensitive species habitats) and onto roads, and determining the need for additional erosion control devices;

13. Inspecting and ensuring the maintenance of temporary erosion control measures at least:

    a. on a daily basis in areas of active construction or equipment operation;

    b. on a weekly basis in areas with no construction or equipment operation; and

    c. within 24 hours of each 0.5 inch of rainfall;

14. Ensuring the repair of all ineffective temporary erosion control measures within 24 hours of identification, or as soon as conditions allow if compliance with this time frame would result in greater environmental impacts;

15. Keeping records of compliance with the environmental conditions of the FERC's Orders, and the mitigation measures proposed by the project sponsor in the application submitted to the FERC, and other federal or state environmental permits during active construction and restoration;

16. Identifying areas that should be given special attention to ensure stabilization and restoration after the construction phase; and

17. Verifying that locations for any disposal of excess construction materials for beneficial reuse comply with section III.E.

III. PRECONSTRUCTION PLANNING

The project sponsor shall do the following before construction:

A. CONSTRUCTION WORK AREAS

1. Identify all construction work areas (e.g., construction right-of-way, extra work space areas, pipe storage and contractor yards, borrow and disposal areas, access roads) that would be needed for safe construction. The project sponsor must ensure that appropriate cultural resources and biological surveys are conducted, as determined necessary by the appropriate federal and state agencies.

2. Project sponsors are encouraged to consider expanding any required cultural resources and endangered species surveys in anticipation of the need for activities outside of authorized work areas.

3. Plan construction sequencing to limit the amount and duration of open trench sections, as necessary, to prevent excessive erosion or sediment flow into sensitive environmental resource areas.

B. DRAIN TILE AND IRRIGATION SYSTEMS

1. Attempt to locate existing drain tiles and irrigation systems.

2. Contact landowners and local soil conservation authorities to determine the locations of future drain tiles that are likely to be installed within 3 years of the authorized construction.

3. Develop procedures for constructing through drain-tiled areas, maintaining irrigation systems during construction, and repairing drain tiles and irrigation systems after construction.

4. Engage qualified drain tile specialists, as needed to conduct or monitor repairs to drain tile systems affected by construction. Use drain tile specialists from the project area, if available.

C. GRAZING DEFERMENT

Develop grazing deferment plans with willing landowners, grazing permittees, and land management agencies to minimize grazing disturbance of revegetation efforts.

D. ROAD CROSSINGS AND ACCESS POINTS

Plan for safe and accessible conditions at all roadway crossings and access points during construction and restoration.

E. DISPOSAL PLANNING

Determine methods and locations for the regular collection, containment, and disposal of excess construction materials and debris (e.g., timber, slash, mats, garbage, drill cuttings and fluids, excess rock) throughout the construction process. Disposal of materials for beneficial reuse must not result in adverse environmental impact and is subject to compliance with all applicable survey, landowner or land management agency approval, and permit requirements.

F. AGENCY COORDINATION

The project sponsor must coordinate with the appropriate local, state, and federal agencies as outlined in this Plan and/or required by the FERC's Orders.

1. Obtain written recommendations from the local soil conservation authorities or land management agencies regarding permanent erosion control and revegetation specifications.

2. Develop specific procedures in coordination with the appropriate agencies to prevent the introduction or spread of invasive species, noxious weeds, and soil pests resulting from construction and restoration activities.

3. Develop specific procedures in coordination with the appropriate agencies and landowners, as necessary, to allow for livestock and wildlife movement and protection during construction.

4. Develop specific blasting procedures in coordination with the appropriate agencies that address pre- and post-blast inspections; advanced public notification; and mitigation measures for building foundations, groundwater wells, and springs. Use appropriate methods (e.g., blasting mats) to prevent damage to nearby structures and to prevent debris from entering sensitive environmental resource areas.

G. SPILL PREVENTION AND RESPONSE PROCEDURES

The project sponsor shall develop project-specific Spill Prevention and Response Procedures, as specified in section IV of the staff's Procedures. A copy must be filed with the Secretary of the FERC (Secretary) prior to construction and made available in the field on each construction spread. The filing requirement does not apply to projects constructed under the automatic authorization provisions in the FERC's regulations.

H. RESIDENTIAL CONSTRUCTION

For all properties with residences located within 50 feet of construction work areas, project sponsors shall: avoid removal of mature trees and landscaping within the construction work area unless necessary for safe operation of construction equipment, or as specified in landowner agreements; fence the edge of the construction work area for a distance of 100 feet on either side of the residence; and restore all lawn areas and landscaping immediately following clean up operations, or as specified in landowner agreements. If seasonal or other weather conditions prevent compliance with these time frames, maintain and monitor temporary erosion controls (sediment barriers and mulch) until conditions allow completion of restoration.

I. WINTER CONSTRUCTION PLANS

If construction is planned to occur during winter weather conditions, project sponsors shall develop and file a project-specific winter construction plan with the FERC application. This filing requirement does not apply to projects constructed under the automatic authorization provisions of the FERC's regulations.

The plan shall address:

1. winter construction procedures (e.g., snow handling and removal, access road construction and maintenance, soil handling under saturated or frozen conditions, topsoil stripping);

2. stabilization and monitoring procedures if ground conditions will delay restoration until the following spring (e.g., mulching and erosion controls, inspection and reporting, stormwater control during spring thaw conditions); and

3. final restoration procedures (e.g., subsidence and compaction repair, topsoil replacement, seeding).

IV. INSTALLATION

A. APPROVED AREAS OF DISTURBANCE

1. Project-related ground disturbance shall be limited to the construction right-of-way, extra work space areas, pipe storage yards, borrow and disposal areas, access roads, and other areas approved in the FERC's Orders. Any project-related ground disturbing activities outside these areas will require prior Director approval. This requirement does not apply to activities needed to comply with the Plan and Procedures (i.e., slope breakers, energy-dissipating devices, dewatering structures, drain tile system repairs) or minor field realignments and workspace shifts per landowner needs and requirements that do not affect other landowners or sensitive environmental resource areas. All construction or restoration activities outside of authorized areas are subject to all applicable survey and permit requirements, and landowner easement agreements.

2. The construction right-of-way width for a project shall not exceed 75 feet or that described in the FERC application unless otherwise modified by a FERC Order. However, in limited, non-wetland areas, this construction right-of-way width may be expanded by up to 25 feet without Director approval to accommodate full construction right-of-way topsoil segregation and to ensure safe construction where topographic conditions (e.g., side-slopes) or soil limitations require it. Twenty-five feet of extra construction right-of-way width may also be used in limited, non-wetland or non-forested areas for truck turn-arounds where no reasonable alternative access exists.

   Project use of these additional limited areas is subject to landowner or land management agency approval and compliance with all applicable survey and permit requirements. When additional areas are used, each one shall be identified and the need explained in the weekly or biweekly construction reports to the FERC, if required. The following material shall be included in the reports:

   a. the location of each additional area by station number and reference to previously filed alignment sheets, or updated alignment sheets showing the additional areas;

   b. identification of the filing at FERC containing evidence that the additional areas were previously surveyed; and

c. a statement that landowner approval has been obtained and is available in project files.

Prior written approval of the Director is required when the authorized construction right-of-way width would be expanded by more than 25 feet.

B. TOPSOIL SEGREGATION

1. Unless the landowner or land management agency specifically approves otherwise, prevent the mixing of topsoil with subsoil by stripping topsoil from either the full work area or from the trench and subsoil storage area (ditch plus spoil side method) in:

   a. cultivated or rotated croplands, and managed pastures;

   b. residential areas;

   c. hayfields; and

   d. other areas at the landowner's or land managing agency's request.

2. In residential areas, importation of topsoil is an acceptable alternative to topsoil segregation.

3. Where topsoil segregation is required, the project sponsor must:

   a. segregate at least 12 inches of topsoil in deep soils (more than 12 inches of topsoil); and

   b. make every effort to segregate the entire topsoil layer in soils with less than 12 inches of topsoil.

4. Maintain separation of salvaged topsoil and subsoil throughout all construction activities.

5. Segregated topsoil may not be used for padding the pipe, constructing temporary slope breakers or trench plugs, improving or maintaining roads, or as a fill material.

6. Stabilize topsoil piles and minimize loss due to wind and water erosion with use of sediment barriers, mulch, temporary seeding, tackifiers, or functional equivalents, where necessary.

C. DRAIN TILES

1. Mark locations of drain tiles damaged during construction.

2. Probe all drainage tile systems within the area of disturbance to check for damage.

3. Repair damaged drain tiles to their original or better condition. Do not use filter-covered drain tiles unless the local soil conservation authorities and the landowner agree. Use qualified specialists for testing and repairs.

4. For new pipelines in areas where drain tiles exist or are planned, ensure that the depth of cover over the pipeline is sufficient to avoid interference with drain tile systems. For adjacent pipeline loops in agricultural areas, install the new pipeline with at least the same depth of cover as the existing pipeline(s).

D. IRRIGATION

Maintain water flow in crop irrigation systems, unless shutoff is coordinated with affected parties.

E. ROAD CROSSINGS AND ACCESS POINTS

1. Maintain safe and accessible conditions at all road crossings and access points during construction.

2. If crushed stone access pads are used in residential or agricultural areas, place the stone on synthetic fabric to facilitate removal.

3. Minimize the use of tracked equipment on public roadways. Remove any soil or gravel spilled or tracked onto roadways daily or more frequent as necessary to maintain safe road conditions. Repair any damages to roadway surfaces, shoulders, and bar ditches.

F. TEMPORARY EROSION CONTROL

Install temporary erosion controls immediately after initial disturbance of the soil. Temporary erosion controls must be properly maintained throughout construction (on a daily basis) and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls or restoration is complete.

1. Temporary Slope Breakers

   a. Temporary slope breakers are intended to reduce runoff velocity and divert water off the construction right-of-way. Temporary slope

breakers may be constructed of materials such as soil, silt fence, staked hay or straw bales, or sand bags.

b. Install temporary slope breakers on all disturbed areas, as necessary to avoid excessive erosion. Temporary slope breakers must be installed on slopes greater than 5 percent where the base of the slope is less than 50 feet from waterbody, wetland, and road crossings at the following spacing (closer spacing shall be used if necessary):

Slope (%)	Spacing (feet)
5 - 15	300
>15 - 30	200
>30	100

c. Direct the outfall of each temporary slope breaker to a stable, well vegetated area or construct an energy-dissipating device at the end of the slope breaker and off the construction right-of-way.

d. Position the outfall of each temporary slope breaker to prevent sediment discharge into wetlands, waterbodies, or other sensitive environmental resource areas.

2. Temporary Trench Plugs

Temporary trench plugs are intended to segment a continuous open trench prior to backfill.

a. Temporary trench plugs may consist of unexcavated portions of the trench, compacted subsoil, sandbags, or some functional equivalent.

b. Position temporary trench plugs, as necessary, to reduce trenchline erosion and minimize the volume and velocity of trench water flow at the base of slopes.

3. Sediment Barriers

Sediment barriers are intended to stop the flow of sediments and to prevent the deposition of sediments beyond approved workspaces or into sensitive resources.

a. Sediment barriers may be constructed of materials such as silt fence, staked hay or straw bales, compacted earth (e.g., driveable berms across travelways), sand bags, or other appropriate materials.

b. At a minimum, install and maintain temporary sediment barriers across the entire construction right-of-way at the base of slopes greater than 5 percent where the base of the slope is less than 50 feet from a waterbody, wetland, or road crossing until revegetation is successful as defined in this Plan. Leave adequate room between the base of the slope and the sediment barrier to accommodate ponding of water and sediment deposition.

c. Where wetlands or waterbodies are adjacent to and downslope of construction work areas, install sediment barriers along the edge of these areas, as necessary to prevent sediment flow into the wetland or waterbody.

4. Mulch

a. Apply mulch on all slopes (except in cultivated cropland) concurrent with or immediately after seeding, where necessary to stabilize the soil surface and to reduce wind and water erosion. Spread mulch uniformly over the area to cover at least 75 percent of the ground surface at a rate of 2 tons/acre of straw or its equivalent, unless the local soil conservation authority, landowner, or land managing agency approves otherwise in writing.

b. Mulch can consist of weed-free straw or hay, wood fiber hydromulch, erosion control fabric, or some functional equivalent.

c. Mulch all disturbed upland areas (except cultivated cropland) before seeding if:

(1) final grading and installation of permanent erosion control measures will not be completed in an area within 20 days after the trench in that area is backfilled (10 days in residential areas), as required in section V.A.1; or

(2) construction or restoration activity is interrupted for extended periods, such as when seeding cannot be completed due to seeding period restrictions.

d. If mulching before seeding, increase mulch application on all slopes within 100 feet of waterbodies and wetlands to a rate of 3 tons/acre of straw or equivalent.

e. If wood chips are used as mulch, do not use more than 1 ton/acre and add the equivalent of 11 lbs/acre available nitrogen (at least 50 percent of which is slow release).

f. Ensure that mulch is adequately anchored to minimize loss due to wind and water.

g. When anchoring with liquid mulch binders, use rates recommended by the manufacturer. Do not use liquid mulch binders within 100 feet of wetlands or waterbodies, except where the product is certified environmentally non-toxic by the appropriate state or federal agency or independent standards-setting organization.

h. Do not use synthetic monofilament mesh/netted erosion control materials in areas designated as sensitive wildlife habitat, unless the product is specifically designed to minimize harm to wildlife. Anchor erosion control fabric with staples or other appropriate devices.

V. RESTORATION

A. CLEANUP

1. Commence cleanup operations immediately following backfill operations. Complete final grading, topsoil replacement, and installation of permanent erosion control structures within 20 days after backfilling the trench (10 days in residential areas). If seasonal or other weather conditions prevent compliance with these time frames, maintain temporary erosion controls (i.e., temporary slope breakers, sediment barriers, and mulch) until conditions allow completion of cleanup.

   If construction or restoration unexpectedly continues into the winter season when conditions could delay successful decompaction, topsoil replacement, or seeding until the following spring, file with the Secretary for the review and written approval of the Director, a winter construction plan (as specified in section III.I). This filing requirement does not apply to projects constructed under the automatic authorization provisions of the FERC's regulations.

2. A travel lane may be left open temporarily to allow access by construction traffic if the temporary erosion control structures are installed as specified in section IV.F. and inspected and maintained as specified in sections II.B.12 through 14. When access is no longer required the travel lane must be removed and the right-of-way restored.

3. Rock excavated from the trench may be used to backfill the trench only to the top of the existing bedrock profile. Rock that is not returned to the trench shall be considered construction debris, unless approved for use as mulch or for some other use on the construction work areas by the landowner or land managing agency.

4. Remove excess rock from at least the top 12 inches of soil in all cultivated or rotated cropland, managed pastures, hayfields, and residential areas, as well as other areas at the landowner's request. The size, density, and distribution of rock on the construction work area shall be similar to adjacent areas not disturbed by construction. The landowner or land management agency may approve other provisions in writing.

5. Grade the construction right-of-way to restore pre-construction contours and leave the soil in the proper condition for planting.

6. Remove construction debris from all construction work areas unless the landowner or land managing agency approves leaving materials onsite for beneficial reuse, stabilization, or habitat restoration.

7. Remove temporary sediment barriers when replaced by permanent erosion control measures or when revegetation is successful.

B. PERMANENT EROSION CONTROL DEVICES

1. Trench Breakers

a. Trench breakers are intended to slow the flow of subsurface water along the trench. Trench breakers may be constructed of materials such as sand bags or polyurethane foam. Do not use topsoil in trench breakers.

b. An engineer or similarly qualified professional shall determine the need for and spacing of trench breakers. Otherwise, trench breakers shall be installed at the same spacing as and upslope of permanent slope breakers.

c. In agricultural fields and residential areas where slope breakers are not typically required, install trench breakers at the same spacing as if permanent slope breakers were required.

d. At a minimum, install a trench breaker at the base of slopes greater than 5 percent where the base of the slope is less than 50 feet from a waterbody or wetland and where needed to avoid draining a waterbody or wetland. Install trench breakers at wetland boundaries, as specified in the Procedures. Do not install trench breakers within a wetland.

2. Permanent Slope Breakers

a. Permanent slope breakers are intended to reduce runoff velocity, divert water off the construction right-of-way, and prevent sediment deposition into sensitive resources. Permanent slope breakers may be constructed of materials such as soil, stone, or some functional equivalent.

b. Construct and maintain permanent slope breakers in all areas, except cultivated areas and lawns, unless requested by the landowner, using spacing recommendations obtained from the local soil conservation authority or land managing agency.

In the absence of written recommendations, use the following spacing unless closer spacing is necessary to avoid excessive erosion on the construction right-of-way:

Slope (%)	Spacing (feet)
5 - 15	300
>15 - 30	200
>30	100

c. Construct slope breakers to divert surface flow to a stable area without causing water to pool or erode behind the breaker. In the absence of a stable area, construct appropriate energy-dissipating devices at the end of the breaker.

d. Slope breakers may extend slightly (about 4 feet) beyond the edge of the construction right-of-way to effectively drain water off the disturbed area. Where slope breakers extend beyond the edge of the construction right-of-way, they are subject to compliance with all applicable survey requirements.

C. SOIL COMPACTION MITIGATION

1. Test topsoil and subsoil for compaction at regular intervals in agricultural and residential areas disturbed by construction activities. Conduct tests on the same soil type under similar moisture conditions in undisturbed areas to approximate preconstruction conditions. Use penetrometers or other appropriate devices to conduct tests.

2. Plow severely compacted agricultural areas with a paraplow or other deep tillage implement. In areas where topsoil has been segregated, plow the subsoil before replacing the segregated topsoil.

If subsequent construction and cleanup activities result in further compaction, conduct additional tilling.

3. Perform appropriate soil compaction mitigation in severely compacted residential areas.

D. REVEGETATION

1. General

a. The project sponsor is responsible for ensuring successful revegetation of soils disturbed by project-related activities, except as noted in section V.D.1.b.

b. Restore all turf, ornamental shrubs, and specialized landscaping in accordance with the landowner's request, or compensate the landowner. Restoration work must be performed by personnel familiar with local horticultural and turf establishment practices.

2. Soil Additives

Fertilize and add soil pH modifiers in accordance with written recommendations obtained from the local soil conservation authority, land management agencies, or landowner. Incorporate recommended soil pH modifier and fertilizer into the top 2 inches of soil as soon as practicable after application.

3. Seeding Requirements

a. Prepare a seedbed in disturbed areas to a depth of 3 to 4 inches using appropriate equipment to provide a firm seedbed. When hydroseeding, scarify the seedbed to facilitate lodging and germination of seed.

b. Seed disturbed areas in accordance with written recommendations for seed mixes, rates, and dates obtained from the local soil conservation authority or the request of the landowner or land management agency. Seeding is not required in cultivated croplands unless requested by the landowner.

c. Perform seeding of permanent vegetation within the recommended seeding dates. If seeding cannot be done within those dates, use appropriate temporary erosion control measures discussed in section IV.F and perform seeding of permanent vegetation at the beginning of the next recommended seeding season. Dormant seeding or temporary

seeding of annual species may also be used, if necessary, to establish cover, as approved by the Environmental Inspector. Lawns may be seeded on a schedule established with the landowner.

d. In the absence of written recommendations from the local soil conservation authorities, seed all disturbed soils within 6 working days of final grading, weather and soil conditions permitting, subject to the specifications in section V.D.3.a through V.D.3.c.

e. Base seeding rates on Pure Live Seed. Use seed within 12 months of seed testing.

f. Treat legume seed with an inoculant specific to the species using the manufacturer's recommended rate of inoculant appropriate for the seeding method (broadcast, drill, or hydro).

g. In the absence of written recommendations from the local soil conservation authorities, landowner, or land managing agency to the contrary, a seed drill equipped with a cultipacker is preferred for seed application.

Broadcast or hydroseeding can be used in lieu of drilling at double the recommended seeding rates. Where seed is broadcast, firm the seedbed with a cultipacker or roller after seeding. In rocky soils or where site conditions may limit the effectiveness of this equipment, other alternatives may be appropriate (e.g., use of a chain drag) to lightly cover seed after application, as approved by the Environmental Inspector.

VI. OFF-ROAD VEHICLE CONTROL

To each owner or manager of forested lands, offer to install and maintain measures to control unauthorized vehicle access to the right-of-way. These measures may include:

A. signs;

B. fences with locking gates;

C. slash and timber barriers, pipe barriers, or a line of boulders across the right-of-way; and

D. conifers or other appropriate trees or shrubs across the right-of-way.

VII. POST-CONSTRUCTION ACTIVITIES AND REPORTING

A. MONITORING AND MAINTENANCE

1. Conduct follow-up inspections of all disturbed areas, as necessary, to determine the success of revegetation and address landowner concerns. At a minimum, conduct inspections after the first and second growing seasons.

2. Revegetation in non-agricultural areas shall be considered successful if upon visual survey the density and cover of non-nuisance vegetation are similar in density and cover to adjacent undisturbed lands. In agricultural areas, revegetation shall be considered successful when upon visual survey, crop growth and vigor are similar to adjacent undisturbed portions of the same field, unless the easement agreement specifies otherwise.

   Continue revegetation efforts until revegetation is successful.

3. Monitor and correct problems with drainage and irrigation systems resulting from pipeline construction in agricultural areas until restoration is successful.

4. Restoration shall be considered successful if the right-of-way surface condition is similar to adjacent undisturbed lands, construction debris is removed (unless otherwise approved by the landowner or land managing agency per section V.A.6), revegetation is successful, and proper drainage has been restored.

5. Routine vegetation mowing or clearing over the full width of the permanent right-of-way in uplands shall not be done more frequently than every 3 years. However, to facilitate periodic corrosion/leak surveys, a corridor not exceeding 10 feet in width centered on the pipeline may be cleared at a frequency necessary to maintain the 10-foot corridor in an herbaceous state. In no case shall routine vegetation mowing or clearing occur during the migratory bird nesting season between April 15 and August 1 of any year unless specifically approved in writing by the responsible land management agency or the U.S. Fish and Wildlife Service.

6. Efforts to control unauthorized off-road vehicle use, in cooperation with the landowner, shall continue throughout the life of the project. Maintain signs, gates, and permanent access roads as necessary.

B. REPORTING

1. The project sponsor shall maintain records that identify by milepost:

   a. method of application, application rate, and type of fertilizer, pH modifying agent, seed, and mulch used;

   b. acreage treated;

   c. dates of backfilling and seeding;

   d. names of landowners requesting special seeding treatment and a description of the follow-up actions;

   e. the location of any subsurface drainage repairs or improvements made during restoration; and

   f. any problem areas and how they were addressed.

2. The project sponsor shall file with the Secretary quarterly activity reports documenting the results of follow-up inspections required by section VII.A.1; any problem areas, including those identified by the landowner; and corrective actions taken for at least 2 years following construction.

   The requirement to file quarterly activity reports with the Secretary does not apply to projects constructed under the automatic authorization, prior notice, or advanced notice provisions in the FERC's regulations.

NORTH BAKKEN EXPANSION PROJECT

Erosion and Sediment Control Plan

APPENDIX B
Federal Energy Regulatory Commission's Wetland and Waterbody Construction and Mitigation Procedures

Federal Energy Regulatory Commission

Office of Energy Projects

May 2013

WETLAND AND WATERBODY CONSTRUCTION AND MITIGATION PROCEDURES

Washington, DC 20426

MAY 2013 VERSION

WETLAND AND WATERBODY CONSTRUCTION AND MITIGATION PROCEDURES

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WETLAND AND WATERBODY
CONSTRUCTION AND MITIGATION PROCEDURES (PROCEDURES)

I. APPLICABILITY

A. The intent of these Procedures is to assist project sponsors by identifying baseline mitigation measures for minimizing the extent and duration of project-related disturbance on wetlands and waterbodies. Project sponsors shall specify in their applications for a new FERC authorization, and in prior notice and advance notice filings, any individual measures in these Procedures they consider unnecessary, technically infeasible, or unsuitable due to local conditions and fully describe any alternative measures they would use. Project sponsors shall also explain how those alternative measures would achieve a comparable level of mitigation.

Once a project is authorized, project sponsors can request further changes as variances to the measures in these Procedures (or the applicant's approved procedures). The Director of the Office of Energy Projects (Director) will consider approval of variances upon the project sponsor's written request, if the Director agrees that a variance:

1. provides equal or better environmental protection;

2. is necessary because a portion of these Procedures is infeasible or unworkable based on project-specific conditions; or

3. is specifically required in writing by another federal, state, or Native American land management agency for the portion of the project on its land or under its jurisdiction.

Sponsors of projects planned for construction under the automatic authorization provisions in the FERC's regulations must receive written approval for any variances in advance of construction.

Project-related impacts on non-wetland areas are addressed in the staff's Upland Erosion Control, Revegetation, and Maintenance Plan (Plan).

B. DEFINITIONS

1. "Waterbody" includes any natural or artificial stream, river, or drainage with perceptible flow at the time of crossing, and other permanent waterbodies such as ponds and lakes:

   a. "minor waterbody" includes all waterbodies less than or equal to 10 feet wide at the water's edge at the time of crossing;

   b. "intermediate waterbody" includes all waterbodies greater than 10 feet wide but less than or equal to 100 feet wide at the water's edge at the time of crossing; and

   c. "major waterbody" includes all waterbodies greater than 100 feet wide at the water's edge at the time of crossing.

2. "Wetland" includes any area that is not in actively cultivated or rotated cropland and that satisfies the requirements of the current federal methodology for identifying and delineating wetlands.

II. PRECONSTRUCTION FILING

A. The following information must be filed with the Secretary of the FERC (Secretary) prior to the beginning of construction, for the review and written approval by the Director:

1. site-specific justifications for extra work areas that would be closer than 50 feet from a waterbody or wetland; and

2. site-specific justifications for the use of a construction right-of-way greater than 75-feet-wide in wetlands.

B. The following information must be filed with the Secretary prior to the beginning of construction. These filing requirements do not apply to projects constructed under the automatic authorization provisions in the FERC's regulations:

1. Spill Prevention and Response Procedures specified in section IV.A;

2. a schedule identifying when trenching or blasting will occur within each waterbody greater than 10 feet wide, within any designated coldwater fishery, and within any waterbody identified as habitat for federally-listed threatened or endangered species. The project sponsor will revise the schedule as necessary to provide FERC staff at least 14 days advance notice. Changes within this last 14-day period must provide for at least 48 hours advance notice;

3. plans for horizontal directional drills (HDD) under wetlands or waterbodies, specified in section V.B.6.d;

4. site-specific plans for major waterbody crossings, described in section V.B.9;

5. a wetland delineation report as described in section VI.A.1, if applicable; and

6. the hydrostatic testing information specified in section VII.B.3.

III. ENVIRONMENTAL INSPECTORS

A. At least one Environmental Inspector having knowledge of the wetland and waterbody conditions in the project area is required for each construction spread. The number and experience of Environmental Inspectors assigned to each construction spread shall be appropriate for the length of the construction spread and the number/significance of resources affected.

B. The Environmental Inspector's responsibilities are outlined in the Upland Erosion Control, Revegetation, and Maintenance Plan (Plan).

IV. PRECONSTRUCTION PLANNING

A. The project sponsor shall develop project-specific Spill Prevention and Response Procedures that meet applicable requirements of state and federal agencies. A copy must be filed with the Secretary prior to construction and made available in the field on each construction spread. This filing requirement does not apply to projects constructed under the automatic authorization provisions in the FERC's regulations.

1. It shall be the responsibility of the project sponsor and its contractors to structure their operations in a manner that reduces the risk of spills or the accidental exposure of fuels or hazardous materials to waterbodies or wetlands. The project sponsor and its contractors must, at a minimum, ensure that:

a. all employees handling fuels and other hazardous materials are properly trained;

b. all equipment is in good operating order and inspected on a regular basis;

c. fuel trucks transporting fuel to on-site equipment travel only on approved access roads;

d. all equipment is parked overnight and/or fueled at least 100 feet from a waterbody or in an upland area at least 100 feet from a wetland boundary. These activities can occur closer only if the Environmental Inspector determines that there is no reasonable alternative, and the

project sponsor and its contractors have taken appropriate steps (including secondary containment structures) to prevent spills and provide for prompt cleanup in the event of a spill;

e. hazardous materials, including chemicals, fuels, and lubricating oils, are not stored within 100 feet of a wetland, waterbody, or designated municipal watershed area, unless the location is designated for such use by an appropriate governmental authority. This applies to storage of these materials and does not apply to normal operation or use of equipment in these areas;

f. concrete coating activities are not performed within 100 feet of a wetland or waterbody boundary, unless the location is an existing industrial site designated for such use. These activities can occur closer only if the Environmental Inspector determines that there is no reasonable alternative, and the project sponsor and its contractors have taken appropriate steps (including secondary containment structures) to prevent spills and provide for prompt cleanup in the event of a spill;

g. pumps operating within 100 feet of a waterbody or wetland boundary utilize appropriate secondary containment systems to prevent spills; and

h. bulk storage of hazardous materials, including chemicals, fuels, and lubricating oils have appropriate secondary containment systems to prevent spills.

2. The project sponsor and its contractors must structure their operations in a manner that provides for the prompt and effective cleanup of spills of fuel and other hazardous materials. At a minimum, the project sponsor and its contractors must:

a. ensure that each construction crew (including cleanup crews) has on hand sufficient supplies of absorbent and barrier materials to allow the rapid containment and recovery of spilled materials and knows the procedure for reporting spills and unanticipated discoveries of contamination;

b. ensure that each construction crew has on hand sufficient tools and material to stop leaks;

c. know the contact names and telephone numbers for all local, state, and federal agencies (including, if necessary, the U. S. Coast Guard and the National Response Center) that must be notified of a spill; and

d. follow the requirements of those agencies in cleaning up the spill, in excavating and disposing of soils or other materials contaminated by a spill, and in collecting and disposing of waste generated during spill cleanup.

B. AGENCY COORDINATION

The project sponsor must coordinate with the appropriate local, state, and federal agencies as outlined in these Procedures and in the FERC's Orders.

V. WATERBODY CROSSINGS

A. NOTIFICATION PROCEDURES AND PERMITS

1. Apply to the U.S. Army Corps of Engineers (COE), or its delegated agency, for the appropriate wetland and waterbody crossing permits.

2. Provide written notification to authorities responsible for potable surface water supply intakes located within 3 miles downstream of the crossing at least 1 week before beginning work in the waterbody, or as otherwise specified by that authority.

3. Apply for state-issued waterbody crossing permits and obtain individual or generic section 401 water quality certification or waiver.

4. Notify appropriate federal and state authorities at least 48 hours before beginning trenching or blasting within the waterbody, or as specified in applicable permits.

B. INSTALLATION

1. Time Window for Construction

Unless expressly permitted or further restricted by the appropriate federal or state agency in writing on a site-specific basis, instream work, except that required to install or remove equipment bridges, must occur during the following time windows:

a. coldwater fisheries - June 1 through September 30; and

b. coolwater and warmwater fisheries - June 1 through November 30.

2. Extra Work Areas

a. Locate all extra work areas (such as staging areas and additional spoil storage areas) at least 50 feet away from water's edge, except where

the adjacent upland consists of cultivated or rotated cropland or other disturbed land.

b. The project sponsor shall file with the Secretary for review and written approval by the Director, site-specific justification for each extra work area with a less than 50-foot setback from the water's edge, except where the adjacent upland consists of cultivated or rotated cropland or other disturbed land. The justification must specify the conditions that will not permit a 50-foot setback and measures to ensure the waterbody is adequately protected.

c. Limit the size of extra work areas to the minimum needed to construct the waterbody crossing.

3. General Crossing Procedures

a. Comply with the COE, or its delegated agency, permit terms and conditions.

b. Construct crossings as close to perpendicular to the axis of the waterbody channel as engineering and routing conditions permit.

c. Where pipelines parallel a waterbody, maintain at least 15 feet of undisturbed vegetation between the waterbody (and any adjacent wetland) and the construction right-of-way, except where maintaining this offset will result in greater environmental impact.

d. Where waterbodies meander or have multiple channels, route the pipeline to minimize the number of waterbody crossings.

e. Maintain adequate waterbody flow rates to protect aquatic life, and prevent the interruption of existing downstream uses.

f. Waterbody buffers (e.g., extra work area setbacks, refueling restrictions) must be clearly marked in the field with signs and/or highly visible flagging until construction-related ground disturbing activities are complete.

g. Crossing of waterbodies when they are dry or frozen and not flowing may proceed using standard upland construction techniques in accordance with the Plan, provided that the Environmental Inspector verifies that water is unlikely to flow between initial disturbance and final stabilization of the feature. In the event of perceptible flow, the project sponsor must comply with all applicable Procedure requirements for "waterbodies" as defined in section I.B.1.

4. Spoil Pile Placement and Control

   a. All spoil from minor and intermediate waterbody crossings, and upland spoil from major waterbody crossings, must be placed in the construction right-of-way at least 10 feet from the water's edge or in additional extra work areas as described in section V.B.2.

   b. Use sediment barriers to prevent the flow of spoil or silt-laden water into any waterbody.

5. Equipment Bridges

   a. Only clearing equipment and equipment necessary for installation of equipment bridges may cross waterbodies prior to bridge installation. Limit the number of such crossings of each waterbody to one per piece of clearing equipment.

   b. Construct and maintain equipment bridges to allow unrestricted flow and to prevent soil from entering the waterbody. Examples of such bridges include:

      (1) equipment pads and culvert(s);
      (2) equipment pads or railroad car bridges without culverts;
      (3) clean rock fill and culvert(s); and
      (4) flexi-float or portable bridges.

      Additional options for equipment bridges may be utilized that achieve the performance objectives noted above. Do not use soil to construct or stabilize equipment bridges.

   c. Design and maintain each equipment bridge to withstand and pass the highest flow expected to occur while the bridge is in place. Align culverts to prevent bank erosion or streambed scour. If necessary, install energy dissipating devices downstream of the culverts.

   d. Design and maintain equipment bridges to prevent soil from entering the waterbody.

   e. Remove temporary equipment bridges as soon as practicable after permanent seeding.

   f. If there will be more than 1 month between final cleanup and the beginning of permanent seeding and reasonable alternative access to the right-of-way is available, remove temporary equipment bridges as soon as practicable after final cleanup.

g. Obtain any necessary approval from the COE, or the appropriate state agency for permanent bridges.

6. Dry-Ditch Crossing Methods

a. Unless approved otherwise by the appropriate federal or state agency, install the pipeline using one of the dry-ditch methods outlined below for crossings of waterbodies up to 30 feet wide (at the water's edge at the time of construction) that are state-designated as either coldwater or significant coolwater or warmwater fisheries, or federally-designated as critical habitat.

b. Dam and Pump

(1) The dam-and-pump method may be used without prior approval for crossings of waterbodies where pumps can adequately transfer streamflow volumes around the work area, and there are no concerns about sensitive species passage.

(2) Implementation of the dam-and-pump crossing method must meet the following performance criteria:

(i) use sufficient pumps, including on-site backup pumps, to maintain downstream flows;
(ii) construct dams with materials that prevent sediment and other pollutants from entering the waterbody (e.g., sandbags or clean gravel with plastic liner);
(iii) screen pump intakes to minimize entrainment of fish;
(iv) prevent streambed scour at pump discharge; and
(v) continuously monitor the dam and pumps to ensure proper operation throughout the waterbody crossing.

c. Flume Crossing

The flume crossing method requires implementation of the following steps:

(1) install flume pipe after blasting (if necessary), but before any trenching;

(2) use sand bag or sand bag and plastic sheeting diversion structure or equivalent to develop an effective seal and to divert stream flow through the flume pipe (some modifications to the stream bottom may be required to achieve an effective seal);

(3) properly align flume pipe(s) to prevent bank erosion and streambed scour;

(4) do not remove flume pipe during trenching, pipelaying, or backfilling activities, or initial streambed restoration efforts; and

(5) remove all flume pipes and dams that are not also part of the equipment bridge as soon as final cleanup of the stream bed and bank is complete.

d. Horizontal Directional Drill

For each waterbody or wetland that would be crossed using the HDD method, file with the Secretary for the review and written approval by the Director, a plan that includes:

(1) site-specific construction diagrams that show the location of mud pits, pipe assembly areas, and all areas to be disturbed or cleared for construction;

(2) justification that disturbed areas are limited to the minimum needed to construct the crossing;

(3) identification of any aboveground disturbance or clearing between the HDD entry and exit workspaces during construction;

(4) a description of how an inadvertent release of drilling mud would be contained and cleaned up; and

(5) a contingency plan for crossing the waterbody or wetland in the event the HDD is unsuccessful and how the abandoned drill hole would be sealed, if necessary.

The requirement to file HDD plans does not apply to projects constructed under the automatic authorization provisions in the FERC's regulations.

7. Crossings of Minor Waterbodies

Where a dry-ditch crossing is not required, minor waterbodies may be crossed using the open-cut crossing method, with the following restrictions:

a. except for blasting and other rock breaking measures, complete instream construction activities (including trenching, pipe installation, backfill, and restoration of the streambed contours) within 24 hours.

Streambanks and unconsolidated streambeds may require additional restoration after this period;

b. limit use of equipment operating in the waterbody to that needed to construct the crossing; and

c. equipment bridges are not required at minor waterbodies that do not have a state-designated fishery classification or protected status (e.g., agricultural or intermittent drainage ditches). However, if an equipment bridge is used it must be constructed as described in section V.B.5.

8. Crossings of Intermediate Waterbodies

Where a dry-ditch crossing is not required, intermediate waterbodies may be crossed using the open-cut crossing method, with the following restrictions:

a. complete instream construction activities (not including blasting and other rock breaking measures) within 48 hours, unless site-specific conditions make completion within 48 hours infeasible;

b. limit use of equipment operating in the waterbody to that needed to construct the crossing; and

c. all other construction equipment must cross on an equipment bridge as specified in section V.B.5.

9. Crossings of Major Waterbodies

Before construction, the project sponsor shall file with the Secretary for the review and written approval by the Director a detailed, site-specific construction plan and scaled drawings identifying all areas to be disturbed by construction for each major waterbody crossing (the scaled drawings are not required for any offshore portions of pipeline projects). This plan must be developed in consultation with the appropriate state and federal agencies and shall include extra work areas, spoil storage areas, sediment control structures, etc., as well as mitigation for navigational issues. The requirement to file major waterbody crossing plans does not apply to projects constructed under the automatic authorization provisions of the FERC's regulations.

The Environmental Inspector may adjust the final placement of the erosion and sediment control structures in the field to maximize effectiveness.

10. Temporary Erosion and Sediment Control

Install sediment barriers (as defined in section IV.F.3.a of the Plan) immediately after initial disturbance of the waterbody or adjacent upland.

Sediment barriers must be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls or restoration of adjacent upland areas is complete. Temporary erosion and sediment control measures are addressed in more detail in the Plan; however, the following specific measures must be implemented at stream crossings:

a. install sediment barriers across the entire construction right-of-way at all waterbody crossings, where necessary to prevent the flow of sediments into the waterbody. Removable sediment barriers (or driveable berms) must be installed across the travel lane. These removable sediment barriers can be removed during the construction day, but must be re-installed after construction has stopped for the day and/or when heavy precipitation is imminent;

b. where waterbodies are adjacent to the construction right-of-way and the right-of-way slopes toward the waterbody, install sediment barriers along the edge of the construction right-of-way as necessary to contain spoil within the construction right-of-way and prevent sediment flow into the waterbody; and

c. use temporary trench plugs at all waterbody crossings, as necessary, to prevent diversion of water into upland portions of the pipeline trench and to keep any accumulated trench water out of the waterbody.

11. Trench Dewatering

Dewater the trench (either on or off the construction right-of-way) in a manner that does not cause erosion and does not result in silt-laden water flowing into any waterbody. Remove the dewatering structures as soon as practicable after the completion of dewatering activities.

C. RESTORATION

1. Use clean gravel or native cobbles for the upper 1 foot of trench backfill in all waterbodies that contain coldwater fisheries.

2. For open-cut crossings, stabilize waterbody banks and install temporary sediment barriers within 24 hours of completing instream construction activities. For dry-ditch crossings, complete streambed and bank stabilization before returning flow to the waterbody channel.

3. Return all waterbody banks to preconstruction contours or to a stable angle of repose as approved by the Environmental Inspector.

4. Install erosion control fabric or a functional equivalent on waterbody banks at the time of final bank recontouring. Do not use synthetic monofilament

mesh/netted erosion control materials in areas designated as sensitive wildlife habitat unless the product is specifically designed to minimize harm to wildlife. Anchor erosion control fabric with staples or other appropriate devices.

5. Application of riprap for bank stabilization must comply with COE, or its delegated agency, permit terms and conditions.

6. Unless otherwise specified by state permit, limit the use of riprap to areas where flow conditions preclude effective vegetative stabilization techniques such as seeding and erosion control fabric.

7. Revegetate disturbed riparian areas with native species of conservation grasses, legumes, and woody species, similar in density to adjacent undisturbed lands.

8. Install a permanent slope breaker across the construction right-of-way at the base of slopes greater than 5 percent that are less than 50 feet from the waterbody, or as needed to prevent sediment transport into the waterbody. In addition, install sediment barriers as outlined in the Plan.

   In some areas, with the approval of the Environmental Inspector, an earthen berm may be suitable as a sediment barrier adjacent to the waterbody.

9. Sections V.C.3 through V.C.7 above also apply to those perennial or intermittent streams not flowing at the time of construction.

D. POST-CONSTRUCTION MAINTENANCE

1. Limit routine vegetation mowing or clearing adjacent to waterbodies to allow a riparian strip at least 25 feet wide, as measured from the waterbody's mean high water mark, to permanently revegetate with native plant species across the entire construction right-of-way. However, to facilitate periodic corrosion/leak surveys, a corridor centered on the pipeline and up to 10 feet wide may be cleared at a frequency necessary to maintain the 10-foot corridor in an herbaceous state. In addition, trees that are located within 15 feet of the pipeline that have roots that could compromise the integrity of the pipeline coating may be cut and removed from the permanent right-of-way. Do not conduct any routine vegetation mowing or clearing in riparian areas that are between HDD entry and exit points.

2. Do not use herbicides or pesticides in or within 100 feet of a waterbody except as allowed by the appropriate land management or state agency.

3. Time of year restrictions specified in section VII.A.5 of the Plan (April 15 – August 1 of any year) apply to routine mowing and clearing of riparian areas.

VI. WETLAND CROSSINGS

A. GENERAL

1. The project sponsor shall conduct a wetland delineation using the current federal methodology and file a wetland delineation report with the Secretary before construction. The requirement to file a wetland delineation report does not apply to projects constructed under the automatic authorization provisions in the FERC's regulations.

   This report shall identify:

   a. by milepost all wetlands that would be affected;

   b. the National Wetlands Inventory (NWI) classification for each wetland;

   c. the crossing length of each wetland in feet; and

   d. the area of permanent and temporary disturbance that would occur in each wetland by NWI classification type.

   The requirements outlined in this section do not apply to wetlands in actively cultivated or rotated cropland. Standard upland protective measures, including workspace and topsoiling requirements, apply to these agricultural wetlands.

2. Route the pipeline to avoid wetland areas to the maximum extent possible. If a wetland cannot be avoided or crossed by following an existing right-of-way, route the new pipeline in a manner that minimizes disturbance to wetlands. Where looping an existing pipeline, overlap the existing pipeline right-of-way with the new construction right-of-way. In addition, locate the loop line no more than 25 feet away from the existing pipeline unless site-specific constraints would adversely affect the stability of the existing pipeline.

3. Limit the width of the construction right-of-way to 75 feet or less. Prior written approval of the Director is required where topographic conditions or soil limitations require that the construction right-of-way width within the boundaries of a federally delineated wetland be expanded beyond 75 feet. Early in the planning process the project sponsor is encouraged to identify site-specific areas where excessively wide trenches could occur and/or where spoil piles could be difficult to maintain because existing soils lack adequate unconfined compressive strength.

4. Wetland boundaries and buffers must be clearly marked in the field with signs and/or highly visible flagging until construction-related ground disturbing activities are complete.

5. Implement the measures of sections V and VI in the event a waterbody crossing is located within or adjacent to a wetland crossing. If all measures of sections V and VI cannot be met, the project sponsor must file with the Secretary a site-specific crossing plan for review and written approval by the Director before construction. This crossing plan shall address at a minimum:

   a. spoil control;

   b. equipment bridges;

   c. restoration of waterbody banks and wetland hydrology;

   d. timing of the waterbody crossing;

   e. method of crossing; and

   f. size and location of all extra work areas.

6. Do not locate aboveground facilities in any wetland, except where the location of such facilities outside of wetlands would prohibit compliance with U.S. Department of Transportation regulations.

B. INSTALLATION

1. Extra Work Areas and Access Roads

   a. Locate all extra work areas (such as staging areas and additional spoil storage areas) at least 50 feet away from wetland boundaries, except where the adjacent upland consists of cultivated or rotated cropland or other disturbed land.

   b. The project sponsor shall file with the Secretary for review and written approval by the Director, site-specific justification for each extra work area with a less than 50-foot setback from wetland boundaries, except where adjacent upland consists of cultivated or rotated cropland or other disturbed land. The justification must specify the site-specific conditions that will not permit a 50-foot setback and measures to ensure the wetland is adequately protected.

   c. The construction right-of-way may be used for access when the wetland soil is firm enough to avoid rutting or the construction right-of-way has been appropriately stabilized to avoid rutting (e.g., with timber riprap, prefabricated equipment mats, or terra mats).

      In wetlands that cannot be appropriately stabilized, all construction equipment other than that needed to install the wetland crossing shall

use access roads located in upland areas. Where access roads in upland areas do not provide reasonable access, limit all other construction equipment to one pass through the wetland using the construction right-of-way.

d. The only access roads, other than the construction right-of-way, that can be used in wetlands are those existing roads that can be used with no modifications or improvements, other than routine repair, and no impact on the wetland.

2. Crossing Procedures

a. Comply with COE, or its delegated agency, permit terms and conditions.

b. Assemble the pipeline in an upland area unless the wetland is dry enough to adequately support skids and pipe.

c. Use "push-pull" or "float" techniques to place the pipe in the trench where water and other site conditions allow.

d. Minimize the length of time that topsoil is segregated and the trench is open. Do not trench the wetland until the pipeline is assembled and ready for lowering in.

e. Limit construction equipment operating in wetland areas to that needed to clear the construction right-of-way, dig the trench, fabricate and install the pipeline, backfill the trench, and restore the construction right-of-way.

f. Cut vegetation just above ground level, leaving existing root systems in place, and remove it from the wetland for disposal.

The project sponsor can burn woody debris in wetlands, if approved by the COE and in accordance with state and local regulations, ensuring that all remaining woody debris is removed for disposal.

g. Limit pulling of tree stumps and grading activities to directly over the trenchline. Do not grade or remove stumps or root systems from the rest of the construction right-of-way in wetlands unless the Chief Inspector and Environmental Inspector determine that safety-related construction constraints require grading or the removal of tree stumps from under the working side of the construction right-of-way.

h. Segregate the top 1 foot of topsoil from the area disturbed by trenching, except in areas where standing water is present or soils are

saturated. Immediately after backfilling is complete, restore the segregated topsoil to its original location.

i. Do not use rock, soil imported from outside the wetland, tree stumps, or brush riprap to support equipment on the construction right-of-way.

j. If standing water or saturated soils are present, or if construction equipment causes ruts or mixing of the topsoil and subsoil in wetlands, use low-ground-weight construction equipment, or operate normal equipment on timber riprap, prefabricated equipment mats, or terra mats.

k. Remove all project-related material used to support equipment on the construction right-of-way upon completion of construction.

3. Temporary Sediment Control

Install sediment barriers (as defined in section IV.F.3.a of the Plan) immediately after initial disturbance of the wetland or adjacent upland. Sediment barriers must be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench). Except as noted below in section VI.B.3.c, maintain sediment barriers until replaced by permanent erosion controls or restoration of adjacent upland areas is complete. Temporary erosion and sediment control measures are addressed in more detail in the Plan.

a. Install sediment barriers across the entire construction right-of-way immediately upslope of the wetland boundary at all wetland crossings where necessary to prevent sediment flow into the wetland.

b. Where wetlands are adjacent to the construction right-of-way and the right-of-way slopes toward the wetland, install sediment barriers along the edge of the construction right-of-way as necessary to contain spoil within the construction right-of-way and prevent sediment flow into the wetland.

c. Install sediment barriers along the edge of the construction right-of-way as necessary to contain spoil and sediment within the construction right-of-way through wetlands. Remove these sediment barriers during right-of-way cleanup.

4. Trench Dewatering

Dewater the trench (either on or off the construction right-of-way) in a manner that does not cause erosion and does not result in silt-laden water flowing into any wetland. Remove the dewatering structures as soon as practicable after the completion of dewatering activities.

C. RESTORATION

1. Where the pipeline trench may drain a wetland, construct trench breakers at the wetland boundaries and/or seal the trench bottom as necessary to maintain the original wetland hydrology.

2. Restore pre-construction wetland contours to maintain the original wetland hydrology.

3. For each wetland crossed, install a trench breaker at the base of slopes near the boundary between the wetland and adjacent upland areas. Install a permanent slope breaker across the construction right-of-way at the base of slopes greater than 5 percent where the base of the slope is less than 50 feet from the wetland, or as needed to prevent sediment transport into the wetland. In addition, install sediment barriers as outlined in the Plan. In some areas, with the approval of the Environmental Inspector, an earthen berm may be suitable as a sediment barrier adjacent to the wetland.

4. Do not use fertilizer, lime, or mulch unless required in writing by the appropriate federal or state agency.

5. Consult with the appropriate federal or state agencies to develop a project-specific wetland restoration plan. The restoration plan shall include measures for re-establishing herbaceous and/or woody species, controlling the invasion and spread of invasive species and noxious weeds (e.g., purple loosestrife and phragmites), and monitoring the success of the revegetation and weed control efforts. Provide this plan to the FERC staff upon request.

6. Until a project-specific wetland restoration plan is developed and/or implemented, temporarily revegetate the construction right-of-way with annual ryegrass at a rate of 40 pounds/acre (unless standing water is present).

7. Ensure that all disturbed areas successfully revegetate with wetland herbaceous and/or woody plant species.

8. Remove temporary sediment barriers located at the boundary between wetland and adjacent upland areas after revegetation and stabilization of adjacent upland areas are judged to be successful as specified in section VII.A.4 of the Plan.

D. POST-CONSTRUCTION MAINTENANCE AND REPORTING

1. Do not conduct routine vegetation mowing or clearing over the full width of the permanent right-of-way in wetlands. However, to facilitate periodic corrosion/leak surveys, a corridor centered on the pipeline and up to 10 feet wide may be cleared at a frequency necessary to maintain the 10-foot corridor in an herbaceous state. In addition, trees within 15 feet of the pipeline with roots that could compromise the integrity of pipeline coating may be selectively cut and removed from the permanent right-of-way. Do not conduct any routine vegetation mowing or clearing in wetlands that are between HDD entry and exit points.

2. Do not use herbicides or pesticides in or within 100 feet of a wetland, except as allowed by the appropriate federal or state agency.

3. Time of year restrictions specified in section VII.A.5 of the Plan (April 15 – August 1 of any year) apply to routine mowing and clearing of wetland areas.

4. Monitor and record the success of wetland revegetation annually until wetland revegetation is successful.

5. Wetland revegetation shall be considered successful if all of the following criteria are satisfied:

   a. the affected wetland satisfies the current federal definition for a wetland (i.e., soils, hydrology, and vegetation);

   b. vegetation is at least 80 percent of either the cover documented for the wetland prior to construction, or at least 80 percent of the cover in adjacent wetland areas that were not disturbed by construction;

   c. if natural rather than active revegetation was used, the plant species composition is consistent with early successional wetland plant communities in the affected ecoregion; and

   d. invasive species and noxious weeds are absent, unless they are abundant in adjacent areas that were not disturbed by construction.

6. Within 3 years after construction, file a report with the Secretary identifying the status of the wetland revegetation efforts and documenting success as defined in section VI.D.5, above. The requirement to file wetland restoration reports with the Secretary does not apply to projects constructed under the automatic authorization, prior notice, or advance notice provisions in the FERC's regulations.

   For any wetland where revegetation is not successful at the end of 3 years after construction, develop and implement (in consultation with a

professional wetland ecologist) a remedial revegetation plan to actively revegetate wetlands. Continue revegetation efforts and file a report annually documenting progress in these wetlands until wetland revegetation is successful.

VII. HYDROSTATIC TESTING

A. NOTIFICATION PROCEDURES AND PERMITS

1. Apply for state-issued water withdrawal permits, as required.

2. Apply for National Pollutant Discharge Elimination System (NPDES) or state-issued discharge permits, as required.

3. Notify appropriate state agencies of intent to use specific sources at least 48 hours before testing activities unless they waive this requirement in writing.

B. GENERAL

1. Perform 100 percent radiographic inspection of all pipeline section welds or hydrotest the pipeline sections, before installation under waterbodies or wetlands.

2. If pumps used for hydrostatic testing are within 100 feet of any waterbody or wetland, address secondary containment and refueling of these pumps in the project's Spill Prevention and Response Procedures.

3. The project sponsor shall file with the Secretary before construction a list identifying the location of all waterbodies proposed for use as a hydrostatic test water source or discharge location. This filing requirement does not apply to projects constructed under the automatic authorization provisions of the FERC's regulations.

C. INTAKE SOURCE AND RATE

1. Screen the intake hose to minimize the potential for entrainment of fish.

2. Do not use state-designated exceptional value waters, waterbodies which provide habitat for federally listed threatened or endangered species, or waterbodies designated as public water supplies, unless appropriate federal, state, and/or local permitting agencies grant written permission.

3. Maintain adequate flow rates to protect aquatic life, provide for all waterbody uses, and provide for downstream withdrawals of water by existing users.

4. Locate hydrostatic test manifolds outside wetlands and riparian areas to the maximum extent practicable.

D. DISCHARGE LOCATION, METHOD, AND RATE

1. Regulate discharge rate, use energy dissipation device(s), and install sediment barriers, as necessary, to prevent erosion, streambed scour, suspension of sediments, or excessive streamflow.

2. Do not discharge into state-designated exceptional value waters, waterbodies which provide habitat for federally listed threatened or endangered species, or waterbodies designated as public water supplies, unless appropriate federal, state, and local permitting agencies grant written permission.

Attachment 4

Spill Prevention Control Countermeasure Plan

WBI ENERGY TRANSMISSION, INC.
North Bakken Expansion Project
Section 408 Application

Attachment 4
Spill Prevention, Control, and Countermeasure Plan

August 2020

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT
SPILL PREVENTION, CONTROL, AND COUNTERMEASURE PLAN

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ACRONYMS AND ABBREVIATIONS

EI	Environmental Inspector
Project	North Bakken Expansion Project
SPCC Plan	Spill Prevention, Control, and Countermeasure Plan
WBI Energy	WBI Energy Transmission, Inc.

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT

1.0 INTRODUCTION

This Spill Prevention, Control, and Countermeasure Plan (SPCC Plan) was prepared for WBI Energy Transmission, Inc.'s (WBI Energy) proposed North Bakken Expansion Project (Project) to be implemented during construction of the Project. This SPCC Plan outlines specific preventive measures and practices to reduce the likelihood of an accidental release of a hazardous or regulated liquid and, in the event such a release occurs, to expedite the response to and remediation of the release.

This SPCC Plan restricts the location of fuel storage, fueling activities, and construction equipment maintenance along the construction right-of-way and provides procedures for these activities. Training and lines of communication to facilitate the prevention, response, containment, and cleanup of spills during construction activities are also described.

All contractor personnel working on the Project are responsible for implementation of the measures and procedures defined in this SPCC Plan. Contractors are expected to meet or exceed WBI Energy's standards for spill response, reporting, and cleanup. Contractors whose activities could result in a spill of fuel or other regulated or hazardous materials on the right-of-way will adopt the measures identified in this SPCC Plan. All measures outlined in this SPCC Plan are consistent with the applicable requirements of the Federal Energy Regulatory Commission's *Wetland and Waterbody Construction and Mitigation Procedures*.

This SPCC Plan will be updated to include information specific to the horizontal directional drill crossing of Lake Sakakawea once a contractor has been selected for the Project. A complete copy of the SPCC Plan shall be maintained on site. A copy of the SPCC Plan will be available for a review during normal working hours. *[Note: An updated version of this plan will be filed with the Federal Energy Regulatory Commission and the U.S. Army Corps of Engineers as more detailed information is finalized.]*

1.1 TRAINING

Experienced, well-trained staff are essential for the successful implementation of the SPCC Plan. Contractors will provide spill prevention training as well as safety training to their work crews. The training program will be designed to improve awareness of safety requirements, pollution control laws, and proper operation and maintenance of equipment. Contractors will train all employees who handle fuels and other regulated substances to prevent spills and to quickly and effectively contain and clean up spills in accordance with applicable regulations and the provisions of this plan.

1.2 ROLES AND RESPONSIBILITIES

1.2.1 Spill Coordinator

Contractors will appoint a Spill Coordinator who will be responsible for coordinating Contractor Work Crews for spill cleanup, conducting site investigations, and assisting with completing spill reports. The Spill Coordinator will report all spills to an Environmental Inspector

(EI). The Spill Coordinator will be responsible for completing WBI Energy's internal Spill Report Form as soon as possible but no later than the end of the work day that the spill occurred, regardless of the size of the spill. The Spill Report Form will be submitted to the WBI Energy Designated Representative.

Spill Coordinator:	[To Be Determined Prior to Construction]
Phone Number:	[To Be Determined Prior to Construction]

1.2.2 Contractor Work Crews

Contractor Work Crews will comply with this SPCC Plan and will notify the Spill Coordinator immediately of any spill of fuel or other regulated or hazardous material, regardless of the volume of the spill. Contractor Work Crews will assist with the cleanup of the spill as directed by the Spill Coordinator, if trained to do so.

1.2.3 Environmental Inspectors

The EIs will monitor the Contractors' compliance with the provisions of the SPCC Plan to ensure that spill resources are allocated and cleanup accomplished in accordance with this plan and any applicable regulatory requirements. The EIs will work in conjunction with WBI Energy's Designated Representative to promptly report spills to appropriate federal, state, and local agencies, as required, and to coordinate with these agencies regarding contacting additional parties or agencies.

Environmental Inspector:	[To Be Determined Prior to Construction]
Phone Number:	[To Be Determined Prior to Construction]

1.2.4 WBI Energy's Designated Representative

The Designated Representative has the authority to commit resources to implement this SPCC Plan. The Designated Representative will work in conjunction with the EIs to promptly report spills to appropriate federal, state, and local agencies.

ALL SPILLS, REGARDLESS OF SIZE, MUST BE REPORTED TO THE SPILL COORDINATOR AND ENVIRONMENTAL INSPECTORS

2.0 PREVENTATIVE MEASURES

Contractors will minimize the potential for a spill during construction activities at WBI Energy's facilities and on its right-of-way by implementing appropriate measures to prevent and contain spills. Equipment and materials will be located on site to meet the provisions of this SPCC Plan. The Contractor shall supply each construction crew with a quantity of absorbent and barrier materials sufficient to contain and recover spills that could potentially occur from the equipment with the largest on-board volume of fuel and lubricant. These materials may include, but are not limited to, drip pans, buckets, absorbent pads, containment booms, straw bales, absorbent clay, saw dust, floor drying agents, spill containment barriers, plastic sheeting, skimmer pumps, covered holding tanks, and fire extinguishers.

The Contractor shall make known to all construction personnel the locations of staging areas where spill response equipment and materials are stored, and have them readily accessible during construction. Contractors will comply with applicable environmental and safety laws and regulations and will ensure that a copy of this plan is available on site to all Construction Work Crew members.

In addition, periodic discussions between construction personnel and their supervisors must be held. These are conversations where problems in field operations are discussed and solved. This SPCC Plan, together with specific techniques, will be reviewed with the appropriate employees at a safety meeting before construction starts.

The contractor will provide, maintain, and make available the appropriate Safety Data Sheets for vehicle and equipment fuel, lubricating oil, and any other regulated or hazardous materials utilized for the Project.

The following sections describe spill prevention measures to be taken on Project locations.

2.1 PETROLEUM AND HAZARDOUS LIQUID STORAGE, REFUELING, AND EQUIPMENT MAINTENANCE

2.1.1 Staging Areas and Facility Sites:

- Contractors will construct temporary liners and seamless impermeable berms, or other appropriate containment, around aboveground storage containers so that liquids will be contained and collected in specified areas isolated from waterbodies in the event of a leak or spill. Storage containers will not be placed in areas subject to periodic flooding and washout.

- Contractors will visually inspect aboveground storage containers for leaks and spills frequently and whenever containers are refilled.

- Secondary containment structures must provide a containment volume equal to a minimum of 110 percent of the maximum storage volume of the largest storage container in the containment structure.

- Secondary containment structures must be constructed so that no outlet is provided and any spill will be contained within the containment structure. Accumulated rainwater may be removed if authorized by an EI. Accumulated water with a visible sheen will be collected for proper storage, transport and disposal.

- Contractors will remove all secondary containment structures at the conclusion of the Project. Contractors also will be responsible for returning any storage impoundment areas to original contours and appearance upon completion of the Project.

- Fuels and lubricants will be stored only at designated staging areas and in appropriate service vehicles. The storage areas will be located at least 100 feet away from edges of wetlands and waterbodies, at least 100 feet away from

designated municipal watershed areas, at least 200 feet away from private water supply wells, and at least 400 feet away from municipal water-supply wells unless a larger buffer is required by regulatory agencies.

- Storage containers will display labels that identify the contents of the container and whether the contents are hazardous. Contractors will maintain and provide to WBI Energy, when requested, copies of all Safety Data Sheets.

- Contractors will conduct routine equipment maintenance such as oil changes in staging areas, or as necessary in additional temporary workspace, and will dispose of waste oil in an appropriate manner (e.g. the Contractors will collect the waste oil in labeled, sealed containers and transport the waste oil to a recycling facility).

- Contractors will correct visible leaks in storage containers as soon as possible. Leaks outside of secondary containment, regardless of volume, will be reported to an EI.

- All fuel nozzles will be equipped with functional automatic shut-off valves.

- The drivers of tank trucks will be responsible for spill prevention and secondary containment during loading and unloading operations. Procedures for loading and unloading tank trucks will meet the minimum requirements established by applicable regulations. Drivers will observe and control the fueling operations at all times to prevent overfilling. Contractors will be responsible for training drivers of tank trucks to comply with these provisions.

- Prior to departure of any tank truck, all outlets of the vehicle will be closely examined by the driver for leakage and tightened, adjusted, or replaced, as necessary, to prevent liquid leakage while in transit. Contractors will be responsible for training drivers of tank trucks to comply with these provisions.

2.1.2 Project Right-of-Way

- All machinery will arrive on the right-of-way in a clean, washed condition, and free of fluid leaks.

- Contractors will wash, refuel, and service machinery at locations well away from any wetlands and waterbodies to prevent petroleum or chemical substances from entering surface waters.

- Overnight parking of equipment, as well as refueling and lubricating of construction equipment, will be restricted to upland areas at least 100 feet away from stream channels and wetlands, at least 200 feet from private water-supply wells, and at least 400 feet from municipal water-supply wells. Where this is not possible, and where an EI finds in advance no reasonable alternative, the equipment will be fueled by designated personnel with specific training in refueling, spill containment, and cleanup, under the supervision of an EI. Prior to refueling, appropriate steps will be taken (including deployment of secondary containment structures) to prevent spills and provide for prompt cleanup in the event of a spill.

- Fuel trucks transporting fuels to construction areas will only travel on approved access roads.

- Contractors will keep a spill kit on site in case of machinery leaks or spills.

2.1.3 Restricted Refueling Areas

Restricted refueling areas include areas where the appropriate buffer (e.g., 100 feet from a wetland or waterbody) cannot be maintained. All restricted refueling areas will be identified in the field with flagging or signs. A site-specific plan and written approval from an EI will be required to refuel in restricted areas.

- Approval must be received from an EI and, where necessary, appropriate regulatory permits must be obtained, prior to refueling in restricted refueling areas.

- In large wetlands where no upland site is available for refueling, auxiliary fuel tanks may be mounted to equipment to minimize the need for refueling.

- Trained personnel must be available for refueling, and an EI must be present unless a case-specific exemption is obtained in writing from WBI Energy's Designated Representative.

- Equipment such as large, stationary pumps will be fitted with auxiliary tanks as appropriate. The auxiliary tanks will be placed within secondary containment which provides for a containment volume equal to a minimum of 110 percent of the volume of the largest tank in the containment structure.

- Refueling within restricted refueling areas will take place only in areas designated by an EI. Fuel trucks with a capacity in excess of 300 gallons will not be allowed within a restricted refueling area unless adequate secondary containment is provided.

- Refueling of dewatering pumps, generators, and other small, portable equipment will be performed using approved containers with a maximum volume of 5 gallons.

- Fuel trucks will be prohibited from traveling on temporary equipment bridges at stream crossings. An EI may waive this restriction on a site-specific basis if a reasonable refueling option is not available. Such case-specific exemptions must be approved in writing by WBI Energy's Designated Representative.

2.2 SPILL RESPONSE EQUIPMENT

2.2.1 Staging Areas and Facility Sites

- Contractors will stock a sufficient supply of sorbent and barrier materials at construction staging areas to allow the rapid containment and recovery of spilled material. Sorbent and barrier materials will also be used to contain runoff from spill areas.

- Shovels and labeled drums will be kept at each of the individual staging areas. If small quantities of soil become contaminated within the staging area, they will be collected and placed in the drums. Large quantities of contaminated soil will be collected using heavy equipment and will be stored in drums, lined bermed areas, or other suitable containment, prior to disposal. The Contractors will dispose of all contaminated soil in accordance with applicable state and federal regulations.

2.2.2 Project Right-of-Way

- Each construction crew must have adequate absorbent materials and containment booms on hand to enable the rapid and complete cleanup of spills, as well as sufficient tools and materials to stop leaks.

- Contractors must maintain spill kits containing a sufficient quantity of absorbent and barrier materials to adequately contain and recover foreseeable spills. These kits may include, but are not limited to, absorbent pads, straw bales, absorbent clay, saw dust, floor drying agents, spill containment barriers, plastic sheeting, skimmer pumps, and drums. The equipment will be located near fuel storage areas and other locations as necessary to be readily available in the event of a spill.

- All fuel, and where possible, service trucks, will carry adequate spill response materials. Spill response materials present on trucks should consist of absorbent pads, absorbent material, plastic bags, and a shovel.

- The Spill Coordinator will inform an EI, and all Contractor personnel of the location of spill control equipment and materials, and have them readily accessible while construction activities are occurring.

2.3 CONCRETE COATING

Concrete coating activities will not be performed within 100 feet of a wetland or waterbody unless the location is an existing industrial site designated for such use.

3.0 STORAGE, CONTAINMENT AND FACILITY TRANSFER

All chemical storage containers, tanks, or barrels will be made of compatible materials with the appropriate temperature and pressure rating, overpressure protection, valving, and equalization lines necessary to comply with the appropriate state and federal regulations regarding storage of regulated substances. All chemicals, regardless of container size, will be stored in secondary containment or designated storage areas when not actively in use.

Fuel valves used for the final control of flow shall be of the self-closing type and shall be manually held open except were automatic means are provided for shutting off the flow when the vehicle is full.

Contaminated liquids inside containment areas will not be allowed to be drained outside the containment structures onto the ground or into any open water course. These liquids will be pumped or wiped out of containment structures and disposed of appropriately.

4.0 SPILL RESPONSE

Any employee who detects a spill incident while it is occurring should take the necessary measures to stop the flow but only if that employee has been trained to do so. If the employee is unprepared to effectively control the spill, caution and good judgment should be used as to personal safety until a cleanup crew arrives. Immediate containment by the discovering person can reduce the extent of the spill damage.

4.1 FIRST PRIORITIES

The first priorities after discovering a spill are to protect the safety of personnel and the public, minimize damage to the environment, and control costs associated with cleanup and reclamation. Actions to be taken immediately following a spill include the following:

1. Assess the safety of the situation (including the surrounding public).
2. Sources of ignition will be removed from the area, **if safe to do so**.
3. The source of the spill will be shut off, **if safe to do so**.
4. Efforts to contain the spill immediately will be initiated, **if safe to do so**.

Cleanup activities will be initiated as soon as possible after the spill is contained using properly trained and protected personnel with adequate spill cleanup materials and equipment.

5.0 SPILL REPORTING

All spills will be reported immediately to the Spill Coordinator who will in turn work with an EI and WBI Energy's Designated Representative to address and report the spill as necessary. The Spill Coordinator will record at a minimum the following information (found on the Spill Report Form in appendix A):

1. Date, time, and location of the spill.
2. Type of material spilled.
3. Amount of material spilled.
4. Extent of spill area.
5. Whether the material has reached or has the potential to reach a waterbody.
6. Status of spill containment and cleanup.
7. Circumstances leading up to the spill.

WBI Energy's Designated Representative will report the spill to the appropriate regulatory agencies if the spill meets or exceeds a reportable threshold. Appropriate agencies include, but may not be limited to, the following:

1. North Dakota Department of Health at 1-701-328-5210 for non-emergencies or North Dakota Department of Emergency Services at 1-800-472-2121 (24 hour hotline) for emergencies. The North Dakota Department of Health also requires completion of an online "General Environmental Incident" form available at http://www.ndhealth.gov/ehs/eir/eirform.htm for any spill of any volume.

2. National Spill Response Center (Washington D.C.) at 1-800-424-8802 (24 hours).

3. U.S. Army Corp of Engineers – Jeremy Thury (701-654-7761) and Reece Nelson (402-995-2505) for any spills occurring on U.S. Army Corp of Engineers owned land.

4. U.S. Forest Service Little Missouri National Grasslands– McKenzie Ranger District (701-842-8500) Cale Bickerdyke or Kim Grotte for any spills occurring on U.S Forest Service owned land.

Contractors are responsible for assisting WBI Energy with preparing follow-up written incident reports to regulatory agencies upon request and with accommodating any inspections performed by regulatory agencies.

WBI Energy's internal Spill Report Form will be completed by the Spill Coordinator and provided to WBI Energy's Designated Representative as soon as possible but no later than the end of the day on the day the spill event occurred so agencies can be notified in a timely manner and pertinent information is available for reporting. State and federal agencies must be notified within 24 hours of a reportable spill event. Field personnel will report the spill to the state and federal agencies only if the WBI Energy's Designated Representative is unavailable to do so. All Spill Report Forms and other reporting documentation will be kept on file by WBI Energy's Designated Representative.

6.0 SPILL CONTROL AND CLEANUP

Spill control should only be done by employees trained and prepared to effectively control the spill. Good judgment should be made by employees as to their personal role in the containment actions; however, prompt action can often prevent extensive spill damage. Employees engaged in spill control will use the proper precautions and safety equipment as specified in the Safety Data Sheet(s). The Designated Representative and EI will devise a cleanup plan, as necessary, based on location, quantity, and type of substance spilled.

Upon learning of the spill, the Spill Coordinator will implement the measures in the following sections.

6.1 LAND SPILL

- As necessary, berms will be constructed with available equipment to physically contain the spill and sorbent materials will be applied to the spill area. Traffic on contaminated soils will be minimized.

- Contaminated soils and vegetation will be removed and disposed of at a licensed waste disposal facility.

- Waste materials from the spill will be disposed of according to state and federal regulatory requirements.

- The following information will be provided to the EI and the WBI Energy Designated Representative:

    - The amount of spilled material that was recovered during cleanup.

- Proposed reclamation of remaining contaminated areas.
- Storage method for the contaminated waste material before transport and disposal.
- Transport and disposal documentation for the contaminated waste material.

6.2 WETLAND AND WATERBODY SPILL

Regardless of size, the following conditions apply if a spill occurs near or into a stream, wetland, or an open surface water source.

- For spills in standing water, floating booms, skimmer pumps, and holding tanks shall be used as appropriate by the contractor to recover and contain released materials on the surface of the water.
- For a spill threatening a waterbody, berms and/or trenches will be constructed to contain the spill before it reaches the waterbody. Deployment of booms, sorbent materials, and skimmers may be necessary if the spill reaches the water. The spilled product will be collected and the affected area cleaned up in accordance with appropriate state or federal regulations.
- Contaminated soils in wetlands must be excavated from the wetland. The soils must be placed on and covered by plastic sheeting in approved containment areas a minimum of 100 feet away from wetlands or waterbodies. Contaminated soil will be disposed of as soon as possible in accordance with appropriate state or federal regulations.

All cleanup activities will be conducted according to this SPCC Plan. Personnel involved in cleanup activities will meet the minimum requirements for hazardous materials training and will use approved Occupational Safety and Health Administration safety equipment.

WBI Energy's contractor responsible for the HDD has also developed an activity-specific SPCC plan for the HDD of Lake Sakakawea. In event of a spill or inadvertent release of drilling fluid during the HDD crossing of Lake Sakakawea, the SPCC plan included as Appendix B will be implemented.

NORTH BAKKEN EXPANSION PROJECT
Spill Prevention, Control, and Countermeasure Plan

APPENDIX A
Spill Report Form

WBI Energy Transmission, Inc. Spill Report Form		
Date of Spill:	Date of Spill Discovery:	
Time of Spill:	Time of Spill Discovery:	
Name and Title of Discoverer:		
Type of material spilled and manufacturer's name:		
Legal description of spill location to the quarter section:		
Directions to nearest community:		
Estimated volume of spill (gallons):		
Weather conditions:		
Topography and surface conditions of spill site:		
Spill medium (pavement, sandy soil, water, etc.)		
Proximity of spill to surface waters:		
Did the spill reach a waterbody?	Yes	No
If so, was a sheen present?	Yes	No
Describe the causes and circumstances of the spill:		
Describe the extent of observed contamination, both horizontal and vertical (i.e., spill-stained soil in a 5-foot radius to a depth of 1 inch):		
Describe immediate spill control and/or cleanup methods used and implementation schedule:		
Current status of cleanup actions:		
Name and Company of:		
Construction Superintendent:		
Spill Coordinator:		
Environmental Inspector:		
Person who reported spill:		
Form completed by:	Date:	

NORTH BAKKEN EXPANSION PROJECT
Spill Prevention, Control, and Countermeasure Plan

APPENDIX B
Michels SPCC Plan

SPILL PREVENTION/CONTROL/ COUNTERMEASURE PLAN (SPCC)

For HDD - Crossings

A DIVISION OF MICHELS CORPORATION

DIRECTIONAL DRILLED CROSSINGS

Revision 1
August 4, 2020

MICHELS DIRECTIONAL CROSSINGS
A DIVISION OF MICHELS CORPORATION

SPILL PREVENTION CONTROL AND COUNTERMEASURE PLAN (SPCC)

HORIZONTAL DIRECTIONAL DRILLING

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Attachment C Petroleum and Hazardous Material Spill Report

Attachment D Emergency Response/Hospital Location

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I. Introduction

This Spill Prevention Control and Countermeasure Plans (SPCC) have been developed by Michels Corporation (Michels) to serve as a guideline for horizontal directional drilling (HDD) operations. This plan is intended to ensure that the equipment utilized to perform the work and the fuel, oil, and lubricant products used in the day to day operation of the equipment will have no long-term adverse environmental impact on the staging areas required for construction. The guidelines contained in this plan will be implemented by field personnel to prevent accidental releases of hazardous material to the environment and to outline measures taken should an accidental release occur. The drilling project manager for the project is experienced in these matters and is typically the designated Spill Coordinator for Michels.

This SPCC plan was developed using Federal Energy Regulatory Commission (FERC) guidelines for construction activities along a pipeline right-of-way. This plan is intended to comply with all applicable requirements of FERC and local State and County authorities. Since HDD operations are generally confined to two distinct locations, the rig (entry) side and pipe (exit) side, this SPCC plan addresses construction operations at these specific locations only for hazardous materials. This SPCC plan consists of three sections:

- Preventative measures to be taken prior to initiating construction with hazardous materials;
- Preventative procedures to be followed while using hazardous materials during construction;
- Procedures to be implemented should an accidental spill of hazardous material occur;

II. Pre-Construction Hazardous Material Spill Prevention

Prior to construction, all Michels' personnel who will be performing work on site will have attended a FERC-approved environmental training program within the last year. This training program will serve to indoctrinate the personnel and make them aware of the pollution control laws, rules, and regulations applicable to the pipeline right-of-ways. Michels' personnel are highly experienced with the equipment to be used in HDD operations and have worked on numerous FERC governed projects in the past. However all personnel will be refreshed by the project manager and drill superintendent in the operation and maintenance of construction equipment to prevent the accidental discharge or spill of fuel, oil, or lubricants.

Through the environmental training program and the project manager's guidance along with knowledge obtained from past experience, all Michels' personnel will be thoroughly educated on the following topics:

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- Precautionary measures to prevent spills;
- Potential sources of spills, such as equipment failure or malfunction and re-fueling procedures;
- Standard operating procedures in case of a spill, including applicable notification requirements;
- Equipment, Materials, and Supplies available for clean-up of a spill;
- Review of known spill events, if any.

Prior to mobilizing equipment to the proposed alignment R.O.W., Michels will thoroughly inspect and if necessary repair or replace equipment components that could potentially leak hazardous material. The equipment will be cleaned of any debris or material observed to be hazardous. All hazardous material storage containers and secondary containment devices will be inspected and if necessary repaired or replaced.

The spill containment and clean-up materials used by Michels will be inventoried and if necessary re-stocked prior to initiating construction operations. At a minimum, the following spill containment and clean-up materials will be located in a central location at each side of the HDD crossings where equipment is in use or hazardous materials are stored in sufficient quantities to contain and clean-up a spill or release should one occur:

- Spill containment kits typically consisting of the following items
  - 1 x 55 gal poly drum
  - 50 x 18” x 18” absorbent pads
  - 8 x 3” x 4’ absorbent socks
  - 6 x 18” x 18” absorbent pillows
  - 3 x 5” x 10’ absorbent booms
  - 4 Disposable plastic bags with ties
  - 4 pair nitrile gloves
- Plastic sheeting
- Floor Dry absorbent material (50 pound bag-typical)
- Personal protective equipment (i.e. gloves and safety glasses)
- Replacement parts and equipment for repair of tanks, hoses, nozzles, etc.
- Equipment and tools to divert spilled fluids and create earthen barriers

III. HDD Construction Operations Hazardous Material Spill Prevention

Once construction activities for the HDD are underway, hazardous material spill prevention will be a continuous element of the operations. During equipment set up, potential sources of hazardous material releases, i.e. fuel tanks, hydraulic oil tanks and hoses, antifreeze tanks, and lubricant storage bins will be located as far away as practicably possible from streams, wetlands, and drainage ways. If necessary, and if practicable, temporary barriers may be constructed or placed between the potential sources of spills and areas identified as extremely sensitive to accidental

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spills. Spill containment and clean-up materials/kits will be located in a central location at each side of the drill site location where equipment is in operation or hazardous materials are stored and all personnel will be made aware of the location.

Secondary containment devices will be placed to enclose major sources of potential hazardous spill locations (i.e. fuel storage tanks and hazardous materials storage areas). A site layout drawing for entry locations and exit locations showing the placement of significant sources of hazardous material releases and secondary containment measures are attached in **Appendix A** of this plan. The exact location of the equipment will vary to address specific site conditions after the temporary work space has been prepared for equipment set-up. Access to the sites will be limited by the Project Manager to only authorized personnel and visitors.

During construction, spill refresher briefings will be scheduled quarterly and conducted by Michels. The briefings will refresh Michels' personnel on the topics covered during the pre-construction environmental training as well as review operations to date, including any accidental spills that may have occurred and measures taken for prevention of future spills.

Michels will store, handle and transfer hazardous materials used during HDD operations in a manner to prevent accidental releases or spills of these materials. **Table-1** attached in **Appendix-A** to this plan summarizes the hazardous materials, combined expected volumes, and storage methods for both the entry and exit locations. The Material Safety Data Sheets (MSDS) for every product used by Michels are maintained on file in the drilling survey trailer on site should they be required to assess the hazard potential of a spill. The list of primary hazardous materials (petroleum-based products) to be used by Michels over the course of each HDD crossing is as follows:

- Gasoline
- Diesel Fuel
- Hydraulic Oil
- Lubricants
- Penetrating Oils
- Antifreeze

Michels' personnel will follow specific guidelines set forth in this plan during operation and maintenance of equipment and vehicles used in support of the HDD operations. All waste oil or fuel collected during routine maintenance of the equipment will be contained and disposed of in accordance with state and federal requirements.

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IV. Potential Sources of Hazardous Spill-Preventative Measures to be Implemented

For day to day operations, Michels' personnel will follow these guidelines to prevent the accidental release or spill of hazardous materials:

Potential Source of Hazardous Spill	Preventative Measures To be Implemented
Fuel stored in a storage tank	• Except as specified in **Attachment-A** of Appendix-B, locate storage tank at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. • Install secondary containment devices around tank in excess of 150% of the maximum volume to be stored. • Inspect tank and secondary containment daily and before filling, implement corrective action upon discovery of deterioration that could cause a spill or result in a leak. Record inspection results weekly on log attached in the appendix to this plan. • Remove any precipitation found within the secondary containment. Prior to removing the precipitation, inspect for film, sheen, discoloration, sludge, emulsion or tarry residue, if present then collect the liquid for disposal. Do not discharge to land or surface waters. • Plug or close all tank openings when not in use. • Maintain sufficient quantities of spill control and clean-up materials in a central location near the storage tank, inspect supply daily. • Provide security measures to protect against vandalism of stored materials
Liquid material stored in a container	• Except as specified in **Attachment-A** of Appendix-B, store container at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. • If practicable and if room allows, store containers in a central location within a common secondary containment device. All significant container storage (i.e. greater than 5 gallon) will have secondary containment in excess of 150% of the maximum volume proposed to be stored. • Use small containers which are in good condition (maximum 55 gallon drum). • Take measures to protect the containers from the elements or physical damage. • Inspect containers daily, replace immediately if damaged or leaking. Record inspection results weekly on log attached in **Attachment-B** of Appendix-B to this plan • Close containers when not in use. • Maintain sufficient quantities of spill control and clean-up materials in a central location where the containers are regularly used, inspect supply daily. • Provide security measures to protect against vandalism of stored materials

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Liquid material transferred from a storage tank or container to vehicles or equipment	• Except as specified in **Attachment-A** of Appendix-B**,** transfer materials at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. Exercise extreme caution for transfers in areas where set-back distances from sensitive areas cannot be met such as placement of absorbent pads or drip pans beneath transfer points, creating temporary earthen berms, or other similar precautionary spill measures. • Transfer during daylight hours or where lighting is adequate to illuminate the area. • Monitor transfer operations at all times. • Maintain sufficient quantities of spill control and clean-up materials in a central location where transfers regularly occur, inspect supply daily. • Provide security measures to protect against vandalism of stored materials

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Liquid material used in vehicles and equipment	• Except as specified in **Attachment-A** of Appendix-B, park at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. • Inspect daily for leaks or signs of deterioration that could result in a leak. • Repair or replace defective tanks, hoses, fittings, etc. • Maintain sufficient quantities of spill control and clean-up materials in a central location where equipment or vehicles are in use, inspect supply daily. • Provide security measures to protect against vandalism of stored materials

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Liquid material transferred from tank vehicle to vehicles & equipment	• Except as specified in **Attachment A** of Appendix-B, tank vehicle used during re-fueling operations shall be specifically designed for supplying fuel to vehicle or equipment tanks and will comply with the requirements of NFPA 385 and other applicable state and federal requirements. • Tank vehicle and its equipment shall be maintained in good repair. • Drivers to be thoroughly trained in the proper method and operation of tank vehicles and in acceptable unloading procedures. • The driver or operator will not leave vehicle unattended during re-fueling operations • All engines to be shut off and operators not on the equipment during refueling operations. • Smoking is to be forbidden on or near any vehicle involved in re-fueling operations. Extreme precaution shall be exercised to prevent people in the vicinity from smoking, lighting matches, or carrying any flame or lighted device. Signs prohibiting smoking or open flames to be prominently displayed in open view on the tank vehicle. • Re-fueling procedures will not be initiated until precautions have been taken to prevent the motion of vehicles involved. Parking brakes to be utilized if available. • Length of refueling hose is typically limited to 50-feet from the hose reel. Tank vehicle to be positioned with respect to vehicles being fueled in order to prevent unwanted traffic between the tank vehicle and vehicle/equipment being fueled. • Each vehicle must contain one portable fire extinguisher that has a minimum rating of 4A, or 4-B,C. Ratings to be in accordance with NFPA-10. Signage on vehicles shall clearly indicate location of fire extinguisher. • Fueling/Re-fueling operations should typically take place during daylight hours. Nighttime fueling operations conducted in adequately lighted areas. • Documentation of training to be made available upon request. • Provide security measures to protect against vandalism of stored materials

Should these guidelines prove to be inadequate to prevent the accidental release or spill of hazardous material, they will be revised and implemented as required to ensure that every possible preventative effort is being taken. All personnel will be made aware of any such revisions at the time of the revision and at the environmental refresher meetings.

V. HDD Construction Operations Hazardous Material Spill Procedures

A spill is an unintentional release of hazardous material to the environment. In the unlikely event that an inadvertent spill of a hazardous material occurs the following steps will be followed at a minimum:

- Step 1 - Containment: Assess the situation prior to attempting to control the spill. Secure the spill scene and attempt to identify and stop the source of spill and

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contain at source. Limit access to the site in order to prevent/limit personal and/or property damage. Responders must have knowledge of the spilled material and immediately utilize all available resources (i.e. equipment, personnel, and materials), to contain spill. If adequate resources are not available, expedite mobilization of additional resources from other construction activities as required to fully contain the spill. If the spill cannot be adequately handled by additional resources, Michels will arrange for an approved spill response contractor to mobilize to the site and contain, clean up, and perform required sampling and disposal of spilled materials and residual contaminated debris.

- Step 2 - Remediation: Properly trained personnel shall clean up hazardous material immediately after spill is contained to prevent further migration of hazardous materials into the environment. Responders should consult with proper governmental resource agencies as required. In no case shall containment equipment be used to permanently store contaminated material. Containerize in DOT-approved containers, label, and remove all contaminated material from the construction area and dispose of material in accordance with applicable regulatory guidelines (i.e. transport to hazardous waste disposal facility by licensed waste hauler). The Owner will be provided with proper documentation showing that material was disposed of in a proper manner.

- Step 3 - Notification: Reporting requirements will depend on the quantity of spill. A spill constituting less than a significant spill event will be reported to Owner and/or Owner's representative Chief Inspector **(CI)-_____: ( ) - (office), or ( ) - (cell).**

  Significant spills are defined as: any amount of petroleum, oils, or lubricants discharged to a receiving stream that causes a film, sheen, or discoloration of surface water or adjoining shoreline; or any reportable quantity of hazardous material as defined by 40CFR320. If a significant spill should take place, Michels' Project Manager (PM), will notify the Prime Contractors' Project Manager and Owner's representative Chief Inspector **(CI)-_____( ) - (office), or ( ) - (cell)** of the spill as soon as he has confirmed that the spill has been completely contained. Michels' PM will assist the Owner's representative in submitting the regulatory-required information for hazardous spill notification in accordance with Governing Agency procedures. At the very minimum the project superintendent will provide the CI with the information required on the "Spill Report" included as **Attachment C** in Appendix C.

- Step 4 – Michels' Project Manager will be responsible for any applicable agency reporting requirements. The notification requirements for petroleum and hazardous materials spills are as follows:

  - Federal Contacts:
    National Spill Response Center 1-800-424-8802

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- State Contacts:
  State Department of Environmental
  Quality - Spill Notification ( ) - (Business Hours)
  ( ) - (After Hours)

- Local Contacts:
  Local Fire Department _____

- A completed Petroleum and Hazardous Materials Spill Report must be submitted to OWNER & Governmental Agencies within 48 hours.
- Prior to continuing work, Michels will determine the cause of the spill and implement measures to ensure that further spills will not occur.

A More detailed list of Local Emergency Response Personnel and Hospital Location will be attached and filled out as **Attachment D** in Appendix C.

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APPENDIX-A

TABLE I

HAZARDOUS SUBSTANCE INVENTORY

Material	Quantity (gallons)	Storage Location	Reportable Quantity (include reference)
Oil/Fuel:			
Unleaded Gasoline	**10 Gallons**	**5 Gallon DOT-Approved Re-fill able Cans - Storage Trailer**	
	80 Gallons	**Fuel Tank in Bed of Pick-Up Truck**	
Diesel Fuel	**120 Gallons**	**Fuel Tank in Bed of Pick-Up Truck**	
	500 Gallons	**Fuel Tank w/Secondary Containment on Site in excess of 150% of maximum volume**	
Motor Oil	**1 or 5 Gallons**	**Reinforced Plastic Container - Storage Trailer**	
Hydraulic Oil	**110-Gallons**	**Two 55-gallon drums w/Secondary Containment on Site in excess of 150% of maximum volume**	
Commercial Chemicals:			
Ethylene Glycol	**40-Gallons**	**1 or 5 Gallon Reinforced Plastic Containers - Storage Trailer**	
Hazardous Wastes:			

APPENDIX-B

Attachment A

The setbacks specified for refueling, fuel storage, and parking of equipment may not be practicable for certain construction activities, including horizontal directional drilling. Exceptions to the setback requirements may be allowed for:

- Areas where removing equipment from a wetland for servicing or overnight parking would increase adverse impacts to the wetland and/or result in significant construction delays;
- Construction sites where moving equipment to refueling stations from pre-fabricated equipment pads is impracticable or where there is a natural barrier from the water-body or wetland (i.e., dike, road or railroad);
- Locations where the water-body or wetland is located adjacent to a road crossing (from which the equipment can be serviced);
- Refueling and fuel storage for immobile equipment including, but not limited to, bending and boring machines, air compressors, padding machines, and hydro-test fill pumps.

ATTACHMENT B
WEEKLY HAZARDOUS MATERIALS/WASTE INSPECTION LOG

For each item listed below, Contractor will indicate whether existing conditions are acceptable (A) or unacceptable (U). Resolution of all unacceptable conditions must be documented. Contractor will inspect all storage facilities on a regular basis, but not less than weekly. Contractor will keep records of all inspections on file. Contractor will provide a coy of the completed form to the Chief Inspector and Environmental Inspector on a weekly basis.

I. STORAGE AREAS FOR FUELS, LUBRICANTS AND CHEMICALS

General

A/U

_____ Construction yard or storage areas secured

_____ National Fire Protection Association symbol posted in storage area or at yard entrance

_____ Storage areas properly prepared and signed

_____ Material Safety Data Sheets available

_____ Hazardous Materials Management Plan/Spill Prevention and Countermeasure Plan available

Hazardous Materials Management

A/U

_____ No evidence of spilled or leaking materials

_____ Incompatible materials separated

_____ All containers labeled properly

_____ All containers securely closed

_____ All containers upright

_____ No evidence of container bulging, damage, rust or corrosion

Secondary Containment Areas

A/U

_____ Containment berm intact and capable of holding 110% of material stored plus precipitation

_____ Lining intact

_____ No materials overhanging berms

_____ No materials stored on berms

_____ No flammable materials used for berms

Compressed Gases

A/U

_____ Cylinders labeled with contents

_____ Cylinders secured from falling

_____ Oxygen stored at least 25 feet away from fuel

_____ Cylinders in bulk storage are separated from incompatible materials by fire barriers or by appropriate distance

II. HAZARDOUS WASTE MANAGEMENT

Waste Container Storage

A/U

_____ No evidence of spilled or leaking wastes

_____ Adequate secondary containment for all wastes

_____ Separate containers for each waste stream—no piles

_____ Waste area not adjacent to combustibles or compressed gases

_____ All containers securely closed

_____ Bungs secured tightly

_____ Open-top drum hoops secured

_____ All containers upright

_____ No evidence of container bulging, corrosion

_____ No severe container damage or rust

_____ Containers are compatible with waste (e.g. plastic liner for corrosives, metal liner for solvents)

_____ No smoking and general danger/warning signs posted

Waste Container Labeling

A/U

_____ Containers properly labeled

_____ Name, address and EPA ID number or ID Number of generator listed (Not required if Contractor is an exempt small quantity generator.)

_____ Accumulation start date listed

_____ Storage start date listed

_____ Chemical and physical composition of waste listed

_____ Hazardous property listed

Nonhazardous Waste Areas

A/U

_____ No litter in yard

_____ No hazardous wastes or used oil mixed with trash (e.g., contaminated soil, oily rags, diapers, or other oily materials)

_____ Empty oil and aerosol containers for disposal are completely emptied

III. EMERGENCY RESPONSE EQUIPMENT

A/U

_____ Shovels

_____ Absorbent materials (booms, pads, pillows, socks, “Speedy Dry”

_____ Personal protective equipment (goggles, gloves)

_____ Fire-fighting equipment

_____ First aid supplies (e.g. medical supplies, squeeze bottle eye wash)

_____ DOT-approved containers

_____ Plastic sheeting, bags and ties

_____ Communication equipment

_____ Bung wrench (non-sparking)

(Required for all unacceptable conditions)

IV. CORRECTIVE ACTIONS TAKEN

_____

_____

_____

_____

_____

_____

_____

_____

_____

Date: _____ **Contractor Name :** _____

Inspected by (Contractor’s Inspector): _____

Signature: _____

APPENDIX-C

ATTACHMENT C

Petroleum and Hazardous Material Spill Report

Date of spill: _____ Incident No: _____ Date of spill discovery: _____

Time of spill: _____ Time of spill recovery: _____

Location Name: _____ Spread: _____ County: _____

Section: _____ Township: _____ Range: _____

Name and Title of Discoverer: _____

Type of material spilled and product name: _____

Manufacturer's Name: _____

Legal description of spill location: _____

Directions from nearest community: _____

_____

_____

Estimated volume of spill: _____ Estimated material recovered: _____

Weather Conditions: _____

Topography and surface conditions of spill site: _____

Spill medium (pavement, sandy soil, water, etc.): _____

Proximity of spill to surface waters or wetland: _____

Did the spill reach a water body? _____ Yes _____ No

If so, was a sheen present? _____ Yes _____ No

Direction and time of travel (if in stream): _____

Responsible party (name, phone number): _____

Describe the causes and circumstances resulting in the spill: _____

_____

_____

Describe the extent of observed contamination, both horizontal and vertical (i.e., spill-stained soil in a 5'' radius to a depth of 1"):

_____

_____

Resources and installations that may be affected: _____

_____

_____

Potential impact on human health: _____

Describe immediate spill control and/or cleanup methods used and implementation schedule: _____

Current status of cleanup actions: _____

Name/Company/Address/Phone Number for the following:

Construction Superintendent: _____

OWNER
Representative: _____

Environmental Director: _____

Person Who Reported the Spill: _____

Environmental Inspector: _____

On-Scene Agency Coordinator (where applicable): _____

Form completed by: _____ Date: _____

The Contractor must complete this for any petroleum or hazardous material spill regardless of size, and submit the form to OWNER or OWNER's designated representative for construction observation within 48 hours of the occurrence.

ATTACHMENT D
LOCAL Emergency RESPONSE PERSONNEL-HOSPITAL LOCATION

The contractor should provide a listing by municipality of the local emergency response organizations near the HDD project site, and the name and phone number of a contact person for each. For example, list fire and police departments, emergency management organizations, etc. The contractor should update and complete this information as required for his/her work locations. Additions will be made by the Project Manager once they become available prior to drilling operations.

Local Emergency Contacts

- Federal Contacts:

National Spill Response Center	1-800-424-8802
US Army Corps of Engineers	(402) 995-2505 office (785) 213-1507 cell

- State Contacts:

North Dakota Department of Emergency Services	(701) 328-8100 (24 hr.) (800) 773-3259 (toll free) (800) 472-2121 (Div. State Radio Notification)
North Dakota Department of Health	(701) 328-5210 (24 hr.)
North Dakota Oil & Gas Division	(701) 328-8020

- Local Contacts:

Emergency Response -	
Emergency Response -	
Local Fire Department	911
Local Police Department	911

- Nearest Hospital:

North Drill Site: **Tioga Medical Center** - Hospital
810 Welo St N
Tioga, ND 58852
(701) 664-3305

South Drill Site: **McKenzie County Healthcare Systems, Inc.** - Hospital
709 4th Ave NE
Watford City, ND 58854
(701) 842-3000

Other Phone Numbers to be added to this form if necessary.

Attachment 2

Surface Use Plan of Operation

Attachment 5

Emergency Response Plan, Facility Response Plan, Geographical Response Plan

WBI ENERGY TRANSMISSION, INC.
North Bakken Expansion Project
Section 408 Application

Attachment 5
Emergency Response Plan, Facility Response Plan, and Geographical Response Plan

August 2020

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT
EMERGENCY RESPONSE PLAN, FACILITY RESPONSE PLAN, AND GEOGRAPHICAL RESPONSE PLAN

1.0 PROJECT DESCRIPTION

WBI Energy Transmission, Inc. (WBI Energy) proposes to construct and operate the North Bakken Expansion Project (or Project), which consists of an approximately 61.9-mile-long, new 24-inch-diameter natural gas pipeline from new facilities at WBI Energy's Tioga Compressor Station near Tioga, North Dakota, to a new compressor station (Elkhorn Creek Compressor Station) southeast of Watford City, North Dakota.

The Project also involves construction of approximately 0.3 mile of new 24-inch-diameter natural gas pipeline between the proposed Elkhorn Creek Compressor Station to a new interconnect with Northern Border Pipeline Company, approximately 20.4 miles of new 12-inch-diameter natural gas pipeline looping along WBI Energy's Line Section 25, approximately 9.4 miles of new 12-inch-diameter natural gas pipeline looping along WBI Energy's Line Section 30, approximately 0.5 mile of new 20-inch-diameter receipt lateral to the Tioga Compressor Station, and uprating of WBI Energy's Line Section 25. The Project includes additional horsepower at the Tioga Compressor Station; the installation of new and modifications to existing delivery, receipt and transfer stations along WBI Energy's pipeline routes; the replacement of small segments of pipeline facilities; and the installation of block valves, pig launcher/receiver stations and other associated appurtenances.

2.0 EMERGENCY REPONSE PLAN

WBI Energy will manage potential sources of gas releases by implementing WBI Energy's Gas System Operations and Maintenance Manual and Control Room Management Manual (CUI/PRIV – DO NOT RELEASE). These are Pipeline Hazardous Materials Safety Administration (PHMSA) approved manuals for the entire WBI Energy system. Copies of these manuals are provided as Appendix A and B in Attachment 6 of the Section 408 application. Once the Project becomes operational, these manuals will be updated to include the required notification procedures and points of contact for the U.S. Army Corps of Engineers.

3.0 FACILITY RESPONSE PLAN

As noted in section 2.0, WBI Energy prepares Operation and Maintenance Plans that include emergency response procedures according to and approved by the U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration. In addition, Per 40 CFR 112.20, the EPA Facility Response Planning Compliance Assistance Guide, the North Bakken Expansion Project is not an oil pipeline and does not trigger the need for a Facility Response Plan. Furthermore, the portion of the Project that will be installed below U.S. Army Corps of Engineers owned property and below Lake Sakakawea is a natural gas pipeline, and will not require storage or transport of oil.

4.0 GEOGRAPHICAL RESPONSE PLAN

Most natural gas used in the United States is delivered to consumers through approximately 319,400 miles of gathering and transmission pipelines, providing about 25 percent of the total energy consumption in the United States. Because of the critical role transmission

pipelines play in supplying a large portion of the country's energy needs, it is imperative that they are safe and reliable. Pipelines and related facilities are designed and maintained with strict adherence to Pipeline and Hazardous Materials Safety Administration regulations, which are intended to provide public safety and reliability and minimize the risk of system failure.

The natural gas transmission industry has an excellent record of public safety and reliability. Nevertheless, the transportation of natural gas by pipeline involves some risk to the public in the event of an accidental release of natural gas. The Project will transport natural gas that contains primarily methane, but also smaller amounts of ethane, propane, and higher hydrocarbon gases such as butane. This product is a colorless, practically odorless gas. If natural gas is breathed in high concentrations, oxygen deficiency can occur, resulting in serious injury or suffocation. Natural gas has an auto-ignition temperature of approximately 1,000 degrees Fahrenheit and is flammable at methane concentrations between 5 and 15 percent in air. These concentrations can be reached when natural gas is in a confined space, and could result in a hazard in the presence of an ignition source. Unconfined mixtures of natural gas and air become highly diluted and are not usually explosive. Lighter components of natural gas such as methane are buoyant at atmospheric temperatures and, if released, rise and disperse rapidly in air. Higher hydrocarbon components of natural gas such as propane are heavier than air and, although unlikely, may form a potentially flammable cloud near the ground until sufficiently dispersed in air.

The Pipeline and Hazardous Materials Safety Administration administers the national regulatory program to provide for the safe transportation of natural gas and other hazardous materials by pipeline. Safety regulations and other approaches to risk management provide for safety in the design, construction, testing, operation, and maintenance of pipeline facilities. These standards are specified in Title 49 of the Code of Federal Regulations (CFR) Part 192 (49 CFR 192).

WBI Energy is committed to protecting the safety of those living or working near its pipeline system and working proactively to keep its system operating safely and effectively. Accordingly, the Project will be designed, constructed, tested, operated, inspected, and maintained to meet or exceed the DOT's Minimum Federal Safety Standards specified in 49 CFR 192. These regulations are intended to ensure adequate protection of the public from natural gas pipeline facility accidents and failures; in addition, 49 CFR 192 specifies the minimum material, design, welding, construction, testing, protection from corrosion, operations, maintenance, and personnel qualifications for pipelines. Further, Subpart O requires each pipeline operator to have a detailed integrity management program. As a part of the integrity management program, high-resolution in-line inspection tools (i.e., smart pigs), pressure tests, or direct assessments are periodically performed on the line to assess the pipe for any features requiring remediation (e.g., corrosion, dents, gouges).

As the Project is not an oil pipeline, WBI Energy is not required to develop a Facility Response Plan per 49 CFR 194.101 and 194.103.3. As noted in section 2.0 above, WBI Energy will implement the company-wide Gas System Operations and Maintenance Manual and the Control Room Management Manual (CUI/PRIV – DO NOT RELEASE), which are PHMSA approved documents. Appropriate points of contact and procedures for notifications to the U.S. Army Corps of Engineers will be included in these manuals once the Project becomes operational. Copies of these manuals are included with Attachment 6 of the Section 408 application.

Attachment 6

Operation and Maintenance Plan

(CUI/PRIV - DO NOT RELEASE - WBI Energy's Gas System Operation and Maintenance Manual and Control Room Management Manual**)**

Attachment 7

Reclamation and Monitoring Plan

WBI ENERGY TRANSMISSION, INC.
North Bakken Expansion Project
Section 408 Application

Attachment 7
Reclamation and Monitoring Plan

August 2020

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT
RECLAMATION AND MONITORING PLAN

WBI Energy Transmission, Inc. (WBI Energy) proposes to construct and operate the North Bakken Expansion Project (or Project), which consists of an approximately 61.9-mile-long, new 24-inch-diameter natural gas pipeline from new facilities at WBI Energy's Tioga Compressor Station near Tioga, North Dakota, to a new compressor station (Elkhorn Creek Compressor Station) southeast of Watford City, North Dakota.

The Project also involves construction of approximately 0.3 mile of new 24-inch-diameter natural gas pipeline between the proposed Elkhorn Creek Compressor Station to a new interconnect with Northern Border Pipeline Company, approximately 20.4 miles of new 12-inch-diameter natural gas pipeline looping along WBI Energy's Line Section 25, approximately 9.4 miles of new 12-inch-diameter natural gas pipeline looping along WBI Energy's Line Section 30, approximately 0.5 mile of new 20-inch-diameter receipt lateral to the Tioga Compressor Station, and uprating of WBI Energy's Line Section 25. The Project includes additional horsepower at the Tioga Compressor Station; the installation of new and modifications to existing delivery, receipt and transfer stations along WBI Energy's pipeline routes; the replacement of small segments of pipeline facilities; and the installation of block valves, pig launcher/receiver stations and other associated appurtenances.

The Project will require crossing of the Lake Sakakawea Reservoir, which is managed by the U.S. Army Corps of Engineers (USACE), along with USACE-owned lands adjacent to Lake Sakakawea. WBI Energy proposes to install the natural gas pipeline under Lake Sakakawea and USACE lands using the horizontal directional drill (HDD) construction method, a trenchless method designed to avoid direct impacts to sensitive features. The HDD workspaces will be located adjacent to USACE-owned lands on the north side of the lake, and approximately 800 feet from USACE-owned lands on the south side of Lake Sakakawea. No surface impact to USACE lands is anticipated for this Project during installation and operation of the pipeline; all temporary surface impacts will be located outside of USACE lands. Access in the area of the proposed HDD will be along public and private roads.

WBI Energy has acquired Michels Corporation (Michels) to perform the horizontal direction drilling operations for installation of the pipeline beneath Lake Sakakawea. Two drilling rigs will be used (both on private land), located on either side of Lake Sakakawea. The drilling rigs will be installed on matting and minimal surface disturbance outside of the proposed drill box locations is anticipated to occur.

No excavation will occur on USACE lands and no tracked equipment is anticipated to be used on USACE lands. Based on the technical analysis completed to date, WBI Energy does not anticipate an inadvertent return of drilling fluid into Lake Sakakawea. In the unlikely event of an inadvertent return of drilling fluid within Lake Sakakawea, WBI Energy would implement emergency procedures outlined in Michels' Horizontal Direction Drilling Installation Plan filed as Attachment 1 of the Section 408 Application. Notifications would be made to the appropriate federal and state contacts within one hour of identification. Specialized crews would mobilize utilizing agreed upon routes from the Project workspace if the return is located on USACE owned property and deploy turbidity curtains (as appropriate) to contain the release to the smallest impact.

WBI Energy is requesting that the post-construction monitoring requirement be waived on USACE lands, assuming no inadvertent return occurs on USACE property. No surface improvements (e.g., fencing, recreation facilities) will be impacted by the proposed Project. No land disturbance occurring on USACE land is anticipated to occur, however in the unlikely event of an inadvertent return, any land disturbance occurring on USACE land will be restored and revegetated according to the FERC Plan and Procedures and additional requests beyond those outlined in the Plan and Procedures would be address in coordination with the USACE Garrison Project Office.

On lands impacted by typical pipeline construction (outside of the HDD path) WBI Energy will restore Project work areas to pre-construction conditions as required in the Federal Energy Regulatory Commission's (FERC) *Upland Erosion Control, Revegetation, and Maintenance Plan* (Plan) and *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures), which have been provided for reference as attachments to the Erosion and Sediment Control Plan included for the Project.

Attachment 8

Risk Assessment Plan

WBI ENERGY TRANSMISSION, INC.
North Bakken Expansion Project
Section 408 Application

Attachment 8
Risk Assessment Plan

August 2020

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT
RISK ASSESSMENT PLAN

1.0 PROJECT DESCRIPTION

WBI Energy Transmission, Inc. (WBI Energy) proposes to construct and operate the North Bakken Expansion Project (or Project), which consists of an approximately 61.9-mile-long, new 24-inch-diameter natural gas pipeline from new facilities at WBI Energy's Tioga Compressor Station near Tioga, North Dakota, to a new compressor station (Elkhorn Creek Compressor Station) southeast of Watford City, North Dakota.

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The Project will require crossing of the Lake Sakakawea Reservoir, which is managed by the U.S. Army Corps of Engineers (USACE), along with USACE-owned lands adjacent to Lake Sakakawea. WBI Energy proposes to install the natural gas pipeline under Lake Sakakawea and USACE lands using the horizontal directional drill (HDD) construction method, a trenchless method designed to avoid direct impacts to sensitive features. The HDD workspaces will be located adjacent to USACE-owned lands on the north side of the lake, and approximately 800 feet from USACE-owned lands on the south side of Lake Sakakawea. No surface impact to USACE lands is anticipated for this Project during installation and operation of the pipeline; all temporary surface impacts will be located outside of USACE lands. Access in the area of the proposed HDD will be along public and private roads.

2.0 RISK ASSESSMENT OVERVIEW

WBI Energy and their contractors have prepared a HDD Design Report that addresses the engineering design for the HDD of Lake Sakakawea and evaluates the factor of safety for the HDD. The HDD Design Report is attached as Appendix A. The sections below provide additional information on the regulatory safety framework for natural gas pipelines and WBI Energy's operating and emergency response measures

2.1 NATURAL GAS TRANSMISSION PIPELINE SAFETY STANDARDS

Most natural gas used in the United States is delivered to consumers through approximately 319,400 miles of gathering and transmission pipelines, providing about 25 percent of the total energy consumption in the United States (U.S. Department of Transportation [DOT], Pipeline and Hazardous Materials Safety Administration [PHMSA], 2019a,b). Because of the critical role transmission pipelines play in supplying a large portion of the country's energy needs,

it is imperative that they are safe and reliable. Pipelines and related facilities are designed and maintained with strict adherence to PHMSA regulations, which are intended to provide public safety and reliability and minimize the risk of system failure.

The natural gas transmission industry has an excellent record of public safety and reliability. Nevertheless, the transportation of natural gas by pipeline involves some risk to the public in the event of an accidental release of natural gas. The Project will transport natural gas that contains primarily methane, but also smaller amounts of ethane, propane, and higher hydrocarbon gases such as butane. This product is a colorless, practically odorless gas. Project facilities will be odorized as appropriate per Title 49 of the CFR Part 192 (49 CFR 192) part 625. If natural gas is breathed in high concentrations, oxygen deficiency can occur, resulting in serious injury or suffocation. Natural gas has an auto-ignition temperature of approximately 1,000 degrees Fahrenheit and is flammable at methane concentrations between 5 and 15 percent in air. These concentrations can be reached when natural gas is in a confined space, and could result in a hazard in the presence of an ignition source. Unconfined mixtures of natural gas and air become highly diluted and are not usually explosive. Lighter components of natural gas such as methane are buoyant at atmospheric temperatures and, if released, rise and disperse rapidly in air. Higher hydrocarbon components of natural gas such as propane are heavier than air and, although unlikely, may form a potentially flammable cloud near the ground until sufficiently dispersed in air.

The PHMSA administers the national regulatory program to provide for the safe transportation of natural gas and other hazardous materials by pipeline. Safety regulations and other approaches to risk management provide for safety in the design, construction, testing, operation, and maintenance of pipeline facilities. These standards are specified in 49 CFR 192.

2.1.1 Pipeline Design, Construction, and Operating Standards

WBI Energy is committed to protecting the safety of those living or working near its pipeline system and working proactively to keep its system operating safely and effectively. Accordingly, the Project will be designed, constructed, tested, operated, inspected, and maintained to meet or exceed the DOT's Minimum Federal Safety Standards specified in 49 CFR 192. These regulations are intended to ensure adequate protection of the public from natural gas pipeline facility accidents and failures; in addition, 49 CFR 192 specifies the minimum material, design, welding, construction, testing, protection from corrosion, operations, maintenance, and personnel qualifications for pipelines. Further, Subpart O requires each pipeline operator to have a detailed integrity management program (IMP). As a part of the IMP, high-resolution in-line inspection tools (i.e., smart pigs), pressure tests, or direct assessments are periodically performed on the line to assess the pipe for any features requiring remediation (e.g., corrosion, dents, gouges).

DOT regulations in 49 CFR 192 define area classifications (called class location units) based on population density in the vicinity of a pipeline, and specify more rigorous safety requirements for populated areas. Each class location unit covers the area extending 220 yards on either side of the centerline of any continuous 1-mile length of pipeline. The proposed Project will fall under a Class 1 designation for its entire length, which is specified by any class location unit that has 10 or fewer buildings intended for human occupancy.

WBI Energy will monitor population changes in the vicinity of the pipeline over the life of the pipeline system. If an increase in population density adjacent to the right-of-way is detected,

WBI Energy will evaluate whether a change in class location is required and respond accordingly while meeting requirements of 49 CFR 192.

DOT regulations (49 CFR 192, Subpart O) additionally specify how pipeline operators must identify, prioritize, assess, evaluate, repair, and validate the integrity of natural gas transmission pipelines that could affect High Consequence Areas (HCAs) in the event of a leak or failure. The regulations require pipeline operators to develop and follow a written IMP that contains all the elements described in 49 CFR 192.911 and addresses the risks on each covered segment of the transmission pipeline. The criteria for an HCA in regards to a natural gas pipeline is the area within the potential impact circle containing 20 or more buildings intended for human occupancy, or any area within a potential impact circle that contains an identified site.[1]

No HCAs have been identified along the proposed Project route. However, the Project will be incorporated into WBI Energy's existing IMP and use the following criteria to determine HCA locations if conditions change along the pipeline system:

- identification of a site with 20 or more buildings intended for human occupancy; or
- location of an identified site.

On October 1, 2019, PHMSA issued a final rule amending the Federal Pipeline Safety Regulations in 49 CFR 191 and 192 to address integrity management requirements and improve the safety of onshore gas transmission lines (84 Federal Register 52180). The amendments, which will become effective July 1, 2020, focus on reconfirmation of MAOP for existing pipelines and the expansion of assessment requirements for pipelines in areas not designated as HCAs. The criteria for a moderate consequence area (MCA) as defined in the new amendments is an area that is within the potential impact circle of the pipeline that contains five or more buildings intended for human occupancy, or any portion of the paved surface including shoulders of a designated interstate, freeway, expressway, or any other principal arterial roadway with four or more lanes that lies within the potential impact circle. WBI Energy has identified one MCA that will exist where the new Tioga-Elkhorn Creek pipeline will cross 64th Street NW/Highway 2. WBI Energy will install additional launching and receiving facilities on both sides of this MCA that will allow for assessing the area.

2.2 OPERATING AND EMERGENCY RESPONSE MEASURES TO PROTECT THE PUBLIC

WBI Energy maintains operating policies and procedures that are periodically reviewed by the DOT. The policies provide specific directions in regular preventive maintenance and vigilant patrols of facilities, as well as procedures to follow in the event of an accident or natural catastrophe. All operating personnel are trained to perform operations and maintenance activities in accordance with these policies and procedures. Further, periodic training sessions are conducted for operations employees to review typical operating and emergency response procedures or to update employees on changes in procedures. This training includes safe operation of pipeline and aboveground facilities; hazardous material handling procedures;

[1] An identified site is defined as an outside area or open structure that is occupied by 20 or more persons on at least 50 days in any 12-month period; a building that is occupied by 20 or more persons on at least 5 days a week for any 10 weeks in any 12-month period; or a facility that is occupied by persons who are confined, are of impaired mobility, or would be difficult to evacuate.

firefighting; public liaison; and general operating procedures. The proposed Project will be operated and maintained in accordance with each of these policies and procedures.

2.2.1 Line Patrols

WBI Energy will inspect the pipelines periodically on foot, by all-terrain vehicle, or by other vehicle as required by applicable regulatory requirements to identify potential concerns that may affect the safety and operation of the pipelines. Pipeline markers and signs will be inspected and maintained or replaced, as necessary, to ensure that pipeline locations are clearly identified. Field personnel will advise the appropriate operations personnel of new construction along or near the pipeline system. Issues identified are investigated and appropriately remediated based on risk assessment.

2.2.2 Integrity Management

The proposed Project will be hydrostatically tested throughout its entire length before it is put into service. In this procedure, water or test media is introduced into the pipelines and pressurized to a specified level above the maximum allowable operating pressure for a specified amount of time. This test is used to confirm that the facility will operate safely at the designed pressure.

WBI Energy will also conduct a baseline assessment using in-line inspection of the proposed pipelines to check for damage, deformities, or other factors that could affect the integrity of the pipelines. If potential problems are identified, repairs will be made to the affected segment of pipe.

2.2.3 System Control

The proposed Project will be incorporated into WBI Energy's extensive Supervisory, Control, and Data Acquisition System (SCADA). The Gas Control Center is located at WBI Energy's headquarters in Bismarck, North Dakota, and is staffed 24 hours a day, 365 days a year. Gas controllers use SCADA to monitor the pipeline system, which includes a wide range of activities such as monitoring gas pressures and flows along the pipeline, physical startup and shutdown of compressor sites, and operating system valves along the pipeline.

Data acquisition occurs at many locations along the mainline, such as compressor stations, and meter stations. This data is transmitted to Gas Control through SCADA. If system parameters fall outside a predetermined range, an alarm is activated at Gas Control and corrective action is taken by the gas controller as needed. Local WBI Energy personnel are dispatched in response to these alarms if intervention is required outside Gas Control.

2.2.4 Corrosion and Cathodic Protection

49 CFR 192 Subpart I prescribes minimum requirements for the protection of metallic pipelines from external, internal, and atmospheric corrosion. Line pipe used to construct the Project will be externally coated at the pipe mill with fusion bond epoxy. A compatible coating will be applied in the field over circumferential welds and assembly piping will be coated with epoxy-based or tape style coatings.

In accordance with PHMSA requirements, WBI Energy will install cathodic protection systems at various points along the proposed pipelines to inhibit external corrosion of the

underground facilities. This cathodic protection system imparts a low-voltage current to the pipeline to offset natural soil corrosion potential should the coating become damaged over the life of the pipeline. WBI Energy will inspect the cathodic protection system at regular intervals to ensure proper operating conditions consistent with PHMSA requirements for corrosion mitigation.

2.2.5 Pipeline Markers

WBI Energy will install markers at road and railroad crossings, as well as other locations (e.g., fence lines and stream crossings) to indicate the pipeline location and convey emergency information in accordance with DOT safety requirements.

2.2.6 Emergency Preparedness and Procedures

DOT regulations prescribe minimum standards for operating and maintaining pipeline facilities, including a requirement to establish a written plan governing these activities. Additionally, pipeline operators are required to establish an emergency plan that identifies procedures to minimize hazards in a natural gas pipeline emergency to protect the public and the environment. Key elements of the plan include procedures for the following tasks:

- receiving, identifying, and classifying emergency events, gas leakage, fires, explosions, and natural disasters;
- establishing and maintaining communications with local fire, police, and public officials, and coordinating emergency response;
- emergency system shutdown and safe restoration of service;
- making personnel, equipment, tools, and materials available at the scene of an emergency; and
- protecting people first and then property, and making them safe from actual or potential hazards.

WBI Energy currently has an emergency response plan (ERP) for its existing pipeline system in accordance with DOT regulations. WBI Energy will update its ERP, as necessary, to incorporate the proposed Project. The ERP will be made available prior to and during construction and will contain the appropriate emergency contacts (e.g., names and telephone numbers).

2.2.7 Liaison with Local Authorities

The DOT requires that pipeline operators establish and maintain liaison with local fire, police, and other emergency responders to plan for and coordinate emergency response efforts in the event of an incident during construction or operation of the proposed facilities. Each operator must also establish a continuing education program to enable customers, the public, government officials, and those engaged in excavation activities to recognize a gas pipeline emergency and report it to the appropriate public officials. The proposed Project is located within WBI Energy's existing operating counties. As such, WBI Energy will continue to work with the local public officials and emergency responders, and provide appropriate training to responders.

2.2.8 Public Awareness

WBI Energy's public awareness program for its existing pipeline system provides information to the affected public, emergency officials, and public officials, as well as excavators. The messaging includes but is not limited to:

- pipeline purpose and reliability;
- awareness of hazards and prevention measures undertaken;
- emergency preparedness communications;
- damage prevention awareness;
- one-call requirements;
- leak recognition and response;
- pipeline location and operator information;
- National Pipeline Mapping System information; and
- how to get additional information.

WBI Energy will incorporate the Project into its public awareness program.

2.2.9 Damage Prevention

WBI Energy is a member of "One Call" and related pre-excavation notification organizations in the states where it operates, including North Dakota. Through "One Call," contractors or private individuals provide notification of proposed excavations to a central agency that, in turn, will notify WBI Energy of the excavation locations. If WBI Energy facilities are located in the area of proposed excavation, company representatives will mark the pipeline location, consult with the excavator as needed, and observe the excavation as necessary to prevent damage to the pipeline. WBI Energy supports enforceable one-call legislation in all of the states crossed by its pipeline facilities.

3.0 REFERENCES

U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration. 2019a. Pipeline Mileage and Facilities. Available online at https://www.phmsa.dot.gov/data-and-statistics/pipeline/pipeline-mileage-and-facilities. Accessed July 2019.

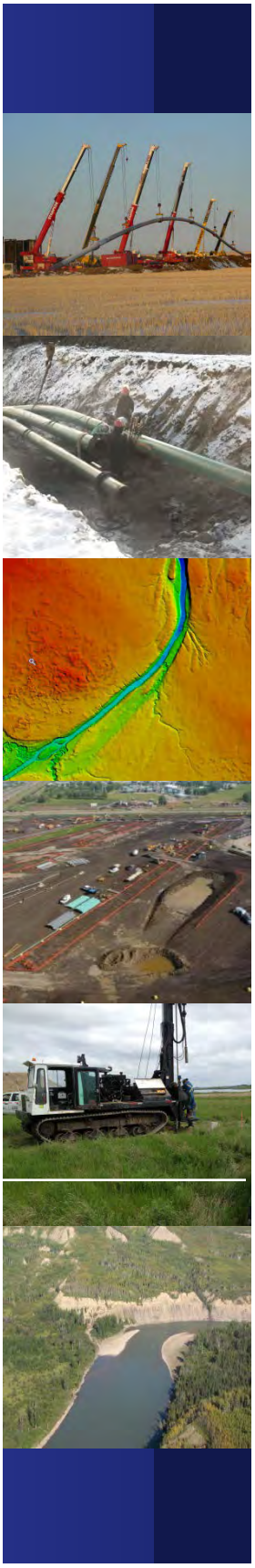
U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration. 2019b. General Pipeline FAQs. Available online at https://www.phmsa.dot.gov/faqs/general-pipeline-faqs. Accessed July 2019.

NORTH BAKKEN EXPANSION PROJECT

Risk Assessment Plan

Appendix A
HDD Design Report

CCI & Associates Inc.



North Bakken Expansion

HDD Design Report

Missouri River NPS 24 HDD Crossing

Prepared for:

WBI Energy Transmission

Project No.: 2386

Document No.: 2386-01-DESIGN REPORT-00

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North Bakken Expansion

HDD Design Report - Missouri River NPS 24 HDD Crossing

CCI & Associates Inc. – North Dakota CoCP # 27692PE

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1 INTRODUCTION

WBI Energy Transmission, Inc. (WBI) is planning to construct a pipeline crossing of the Missouri River (Lake Sakakawea) within North Dakota, between the cities of Tioga and Watford City as part of the North Bakken Expansion Project. The project involves approximately 60 miles of new NPS 24 (24" O.D.) natural gas pipeline that will connect WBI Energy's Tioga Compressor Station near Tioga, North Dakota, with Northern Border Pipeline Company's mainline at a new interconnection point south of Watford City, North Dakota. The pipeline is for natural gas takeaway to help reduce natural gas flaring in the area. The pipeline alignment crosses the Missouri River approximately 24 miles north of Watford City and 23 miles east of Williston, ND. At the crossing location, the Missouri River forms Lake Sakakawea, which contains a historic channel traversing the lake, and is a United States Army Corps of Engineers (USACE) monitored navigable waterway. This report will focus on the feasibility of the North Bakken Missouri River crossing utilizing the Horizontal Directional Drill (HDD) trenchless construction method. The proposed HDD crossing will cross beneath the entire width of the lake, measuring 15,393 ft in length from entry to exit.

This report is provided as a feasibility assessment of site conditions, incorporating the available geotechnical information and a geometric review of the proposed HDD alignment and design along with annular pressure analysis and pipe stress analysis. Also included are some challenges the contractor may face and some mitigation strategies that may be implemented to minimize the project risks. This assessment is also intended to provide verification that the HDD design meets USACE requirements.

2 DESIGN PARAMETERS

The parameters utilized in the design of the crossing are as follows:

a) The Pipeline Research Council International (PRCI) design guidelines (PR-277-144507-R01) and ASME B31.8 requirements, as applicable, were utilized to model the bending, external hoop, tensile, and combined stress cases for the installation and operating conditions imposed on the pipe.
b) The calculations consider the pipe material, diameter, wall thickness, grade, depth, and the geometric design of the crossing.
c) The geotechnical conditions at the site were analyzed to design the drill for progression through formations that are favorable for horizontal directional drills, where possible, with consideration given to potential borehole instability and surficial casing installation.
d) The HDD crossing was designed by completing an assessment of the annular pressure to minimize the risk of hydraulic fracture to the surface or water body during drilling of the pilot hole. The HDD crossing was designed to have a factor of safety against hydraulic fracture beneath the Missouri River (Lake Sakakawea) of greater than 2.0, as per USACE calculations. The annular pressure calculation models the potential fracture pressure of the overburden formation versus the downhole pressures created during the pilot hole phase of the construction.
e) Space limitations associated with points of inflection (PI), topographical features, and achievable temporary workspace (TWS) were considered. Temporary workspace has been selected to ensure that the required equipment can be set up on site to complete the work and to minimize grading requirements and disturbance.
f) The entry and exit positions have been identified based on the location of the pipe section lay out for installation, generally at the exit location. The drill is designed as an intersect and will have a drill rig set up at both the entry and exit locations.
g) The crossing has been designed with consideration of the pullback section and available layout. These plans will be updated (if required) to allow for multiple sections and/or contractor input.

h) All elevations and topographic survey data utilized are based off North American Vertical Datum 88 (NAVD 88) and State Plane North Dakota North coordinate system.

3 MISSOURI RIVER CROSSING LOCATION

3.1 SITE DESCRIPTION

The proposed HDD crosses the Missouri River (Lake Sakakawea) within McKenzie and Williams County, North Dakota. The proposed pipeline alignment is located approximately 24 miles north of Watford City and 23 miles east of Williston, ND, and is shown in Figure 1, below. The length of the proposed HDD measures approximately 15,393 ft.

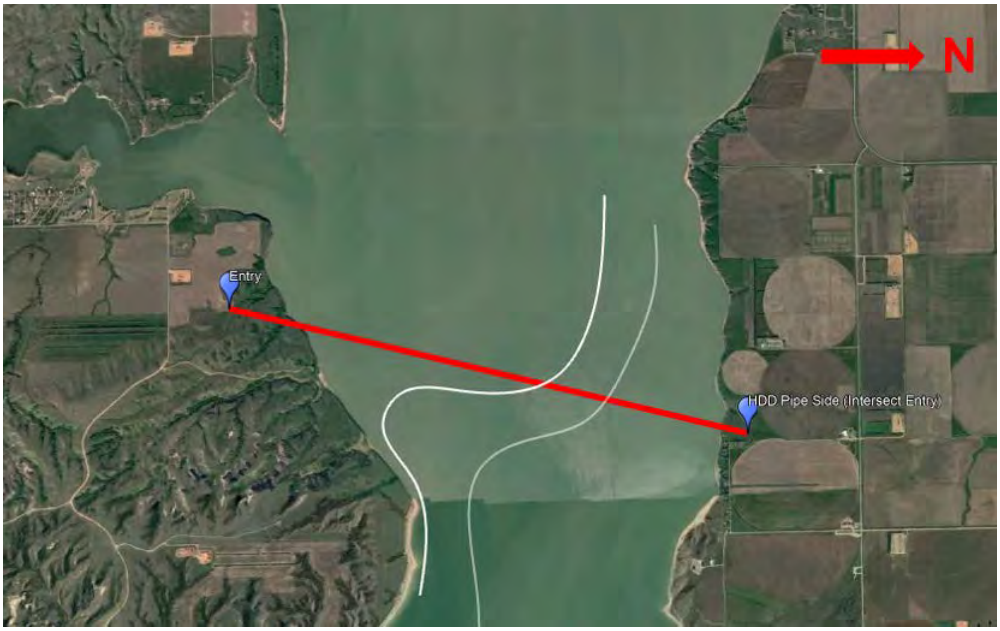


Figure 1. Proposed HDD Alignment Location

The proposed HDD entry location is situated in a relatively level, cultivated grass field, southwest of rugged terrain along the edge of the Missouri River and east of Tobacco Garden Bay. From entry, the HDD alignment follows the proposed pipeline right-of-way down rolling, sloped terrain towards the south bank, crosses the Missouri River (Lake Sakakawea) and climbs the north bank to the location of the HDD exit. The exit location is situated within a maintained grass field, west of several houses along the lake. The pipe string staging and preparation area, shown in Figure 2, is located to the north of the exit point (pipe side) within a proposed temporary workspace area. The planned pipe string and pullback alignment continues to the north, crossing 52nd Street NW and a cultivated field before roping to parallel Highway 17A, ending at Highway 1804 (54th Street NW).

The land near the proposed HDD consists of primarily agricultural fields and grassed areas with several residential buildings in proximity of the northern work site.

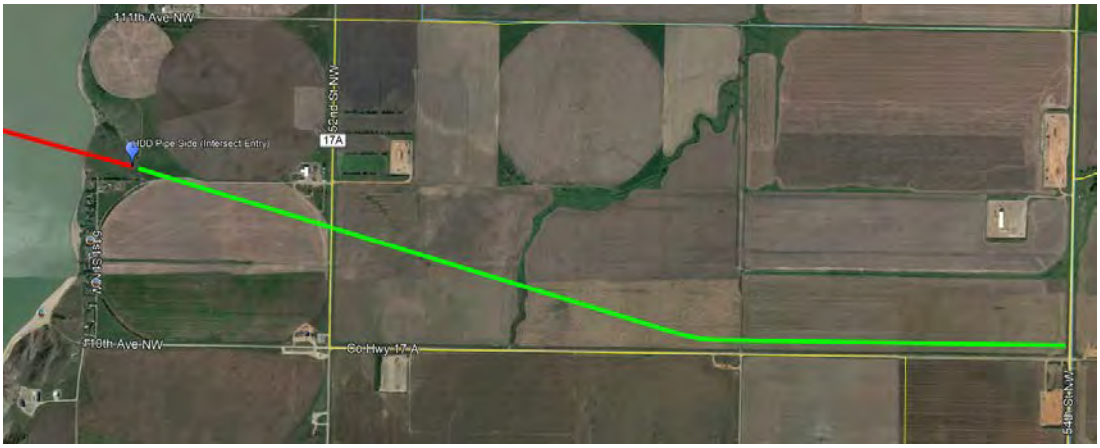


Figure 2. Proposed HDD Pipe Stringing Location

3.2 GEOLOGICAL SETTING

The geology in the area consists of glacial deposits overlying the Sentinel Butte Formation followed by the Bullion Creek Formation, both of the Paleocene Age. The Sentinel Butte Formation consists of layers of silt, clay, sand, lignite, carbonaceous shale, and mudstone. The Bullion Creek Formation comprises primarily silt, clay, sand with interbedded sandstone, lignite, baked clay, and limestone. Both formations are poorly lithified and form rolling topography over areas of Western North Dakota. It is expected that the proposed HDD bore path will be encompassed within the Sentinel Butte Formation and not encounter the Bullion Creek Formation.

3.3 GEOTECHNICAL REVIEW

To form a basis on evaluating the site specific subsurface conditions, CCI sub-contracted Groundwater & Environmental Services, Inc. (GES) to perform a subsurface exploration and laboratory testing program at the proposed HDD site to support the feasibility evaluation and design of the Lake Sakakawea crossing. As part of the geotechnical program, two investigations were completed: one (1) land-based investigation and one (1) water-based investigation. Associated subsequent geotechnical reports entitled "Geotechnical Investigation Report – WBI North Bakken Expansion Project", dated June 14, 2019 and "Geotechnical Investigation Report, Water-Based Borings – WBI North Bakken Expansion Project", dated July 9, 2020 were completed. As part of the land-based investigation, three (3) exploratory land borings, LB-1 to LB-3, were drilled/sampled to depths between 372 and 403 ft below ground surface. As part of the water-based investigation, six (6) additional water-based borings, WB-1 to WB-6, were drilled/sampled to depths between 300 and 315 ft below the Lake Sakakawea thalweg.

The locations of the nine (9) geotechnical borings relative to the HDD alignment are shown in Figure 2, below, and depicted in the design drawing attached in Appendix A.

Figure 3. Borings Location Plan

The borehole coordinates were obtained during the geotechnical investigation by GES using a handheld GPS. The borehole depths and coordinates are shown below in Table 1.

Table 1. Geotechnical Boring Locations and Depths

Borehole	Depth (ft)	Latitude	Longitude
LB -1	403	48.115647°	-103.092842°
LB-2	400	48.117656°	-103.092611°
LB-3	372	48.156139°	-103.077672°
WB-4	300	48.123139°	-103.090536°
WB-5	300	48.128400°	-103.087644°
WB-6	300	48.133994°	-103.086317°
WB-7	315	48.138314°	-103.083792°
WB-8	300	48.146003°	-103.081647°
WB-9	310	48.150150°	-103.079189°

A summary of the encountered subsurface conditions encountered during the geotechnical program, as well as some concerns regarding the geotechnical conditions as they relate to HDD construction operations is listed below in Table 2 and 3. A copy of the detailed geotechnical boring logs from GES' geotechnical investigation is located within the Geotechnical Reports provided in Appendix E.

Table 1. Generalized Summary of the Boring Logs for Missouri River

Borehole	Location	Geologic Description[1, 2]	Primary Geotechnical Concerns
LB -1	Approx. 130 ft NE of entry point, near NE corner of entry pad TWS	0 – 25 ft: Med. Dense Sand 25 – 110 ft: V. Stiff to Hard Lean/Fat Clay and Silt 110 – 211 ft: Hard Fat/Lean Clay 211 – 233 ft: Coal 233 – 288 ft: Highly Weathered, Hard Shale 288 – 403 ft: Hard Silt	Thick coal layer encountered from 211 to 233 ft. Intermittent coal layers/lenses frequently encountered below 233 ft. Fat clays/shale could contain high swell potential.
LB-2	Approx. 930 ft NE of entry point, west side of HDD CL	0 –35 ft: Loose to Med. Dense Silt/Silty Sand. 35-55 ft: V. Stiff Fat Clay 55 – 120 ft: Loose to Dense Sand 120 – 153 ft: Hard Silt and Lean Clay 153 – 215 ft: Highly Weathered Shale and Siltstone	Loose granular materials encountered poses slough risk. Thick coal layer encountered from 215 to 238 ft. Intermittent coal layers/lenses frequently

Borehole	Location	Geologic Description[1, 2]	Primary Geotechnical Concerns
		215 – 238: Coal 238 – 350 ft: Hard Silt 350 – 380 ft: Dense Sand 380 – 400 ft: Highly Weathered Shale	encountered below 238 ft. Fat clays/shale could contain high swell potential.
LB-3	Approx. 100 ft from exit point, along southern edge of exit pad TWS	0 – 115 ft: V. Loose to V. Dense Sand and Silty Sand 115 – 140 ft: Coal 140 – 202 ft: V Dense/Hard Sand, Silt and Lean Clay 202 – 252 ft: Hard Silt with coal lenses 252 – 290 ft: V. Dense Sand 290 – 336 ft: Highly Weathered, Hard Shale 347 – 372 ft: V. Dense Silty Sand	Loose granular materials encountered poses slough risk. Thick coal layer encountered from 115 to 140 ft. Intermittent coal layers/lenses frequently encountered below 140 ft. Shale contains swell potential.
WB-4	Approx. 2,900 ft from entry point, west side of HDD CL	0 – 45 ft: Soft/Loose Lean Clay and Sand 45 – 53 ft: Loose Gravelly Sand 53 – 81 ft: Hard Lean Clay 81 – 102 ft: Highly Weathered, Hard Shale 102 – 127 ft: Coal 127 – 277 ft: Highly Weathered, Hard Shale and Weakly Cemented, V. Dense Sandstone 287 – 300 ft: Highly Weathere, Hard Shale	Granular (alluvial) materials encountered poses slough risk. Thick coal layer encountered from 102 to 127 ft. Intermittent coal layers/lenses frequently encountered below 127 ft. Shale could contain high swell potential.
WB-5	Approx. 4,950 ft from entry point, east side of HDD CL	0 – 35 ft: Med. Stiff/Loose Silt and Sand 35 – 85 ft: Med. to V. Dense Sand and Gravel 85 – 140 ft: Hard/Dense Lean Clay and Sand 140 – 245 ft: Highly Weathered, Hard Shale 245 – 267 ft: Weakly Cemented, V. Dense Sand 267 – 280 ft: Coal 280 – 300 ft: Hard Lean Clay	Thick coal layer encountered from 267 to 280 ft. Intermittent coal layers/lenses frequently encountered below 140 ft. Shale could contain high swell potential.
WB-6	Approx. 7,000 ft from entry point, west side of HDD CL	0 – 70 ft: V. Loose to Med. Dense Sand 70 – 115 ft: V. Stiff Lean/Fat Clay and Silt 115 – 220 ft: Dense to V. Dense Sand 220 – 300 ft: Highly Weathered, Hard Shale	Frequent coal layers/lenses encountered below 220 ft. Fat clays/shale could contain high swell potential.
WB-7	Approx. 8,690 ft from entry point, east side of HDD CL	0 – 56 ft: V. Loose to Med. Dense Sand 56 – 120 ft: Med. Dense/V. Stiff Sand and Lean Clay 120 – 210 ft: Dense to V. Dense Sand 210 – 235 ft: Highly Weathered, Hard Shale 235 – 253 ft: Coal 253 – 315 ft: Highly Weathered, Hard Shale	Thick coal layer encountered from 235 to 253 ft. Intermittent coal layers/lenses frequently encountered below 253 ft. Shale could contain high swell potential.
WB-8	Approx. 3,840 ft from exit point, west side of HDD CL	0 – 35 ft: V. Soft to Med. Stff Lean Clay and Silt 35 – 150 ft: V. Loose to V. Dense Sand 150 – 230 ft: Highly Weathered, Hard Shale 230 – 240 ft: Coal 240 – 290 ft: Highly Weathered, Hard Shale 290 – 300 ft: Coal	Thick coal layers encountered in the bedrock. As well, thinner intermittent coal layers/lenses frequently encountered. Shale could contain high swell potential.
WB-9	Approx. 2,230 ft from exit point, west side of HDD CL	0 – 140 ft: V. Loose to V. Dense Sand and Gravelly Sand 140 – 225 ft: Highly Weathered, Hard, Shale 225 – 235 ft: Coal 235 – 290 ft: Highly Weathered, Hard, Shale 290 – 305 ft: Coal 305 – 310 : Highly Weathered, Hard, Shale	Thick coal layers encountered in the bedrock. As well, thinner intermittent coal layers/lenses frequently encountered. Shale could contain high swell potential.

Note 1: Soil descriptions as per United Soil Classification System (USCS)
Note 2: Soil Consistency and Relative Density determined as per in-situ SPT N-Value

Although variations exist, the subsurface conditions were similar in the nine (9) borings. In general, the subsurface conditions comprised overburden glacial and alluvial deposits to depths between 127 and 290 ft below the surface/thalweg overlying the Sentinel Butte Formation to the depth of the investgation. The glacial and alluvial deposits predominantly consisted of variable deposits of fat/lean clay, sand and silt with thin, frequent interbedded layers of gravel and coal. The consistency of the overburden material increased with depth, starting as soft/loose and becoming hard/very dense. As noted, the bedrock of the Sentinel Butte Formation consisted of primarily poorly lithified shale and sand. Within the formation, two

(2) relatively continuous coal layers were identified along the length of the drill. The coal layers varied in thickness from approximately 5 to 30 ft, with frequently encountered thinner layers/lenses.

Although not encountered in the geotechnical investigation, there is potential to encounter cobbles and/or boulders along the drill path. By definition, glacial deposits consists of a variations of all soil types, including a random distribution of cobble and boulder sized materials, and granular layers/lenses.

No standpipes were installed. Rather, groundwater conditions were inferred from seepages noted and measurements taken during drilling. For the land-based borings, water was observed at 24 ft in LB-3 whereas LB-1 and LB-2 remained dry; however, in each of these borings mud-rotary drilling commenced at a depth of 25 ft, precluding deeper measurements. No groundwater measurements were obtainable in the water-based borings since a perfect seal was not feasible on the casing through the lake. It is expected that the groundwater is situated at an elevation equivalent to the elevation of Lake Sakakawea.

The proposed HDD is anticipated to be within shale of the Sentinel Butte Formation for most of its length, passing through overburden/alluvial deposits as it nears surface at the entry and exit locations. As noted, the overburden/alluvial deposits consist of variations of fat/lean clay, sand and silt. Two relatively continuous coal layers, approximately 5 to 30 ft thick, are proximate to the bottom tangent of the bore path.

4 HDD CROSSING CONSIDERATIONS

4.1 PIPE SPECIFICATIONS

The pipeline specifications provided by WBI are summarized in Table 3. These parameters were used in the engineering design of the Missouri River HDD crossing.

Table 3. Pipe Specifications for the Missouri River HDD Crossing

Parameter	NPS 24 HDD
Outside Diameter (inch)	24
Wall Thickness (inch)	0.99
Pipe Material	Steel
Carried Product	Natural Gas
Specification	API 5L
Grade	X60
Specified Minimum Yield Strength (SMYS) (psi)	60,000
Chosen Design Radius (ft)	5,000
Minimum Allowable Design Radius (MADR) (ft)	1,500
Entry Angle	15°
Exit Angle	14°
Borehole Diameter (inch)	36
Maximum Operating Temperature (°F)	100
Minimum Installation Temperature (°F)	60
Maximum Operating Pressure (psi)	1,480

4.2 HDD ALIGNMENT

The proposed crossing follows a southwest to northeast alignment with the proposed entry and exit (pipe layout) points located approximately 2,100 ft south and 850 ft north of the Missouri River edge of water, respectively. The crossing passes beneath the lake for approximately 12,300 ft. Temporary workspace (TWS) is required at both ends of the crossing to facilitate entry and exit-side construction spreads, which are planned to have workspace dimensions of 300 ft x 300 ft (on the south) and 270 ft x 300 ft (on the north).

The proposed crossing is planned to be completed by intersect methodology, approximately 6000-9000 ft will be competed from either direction, the drill paths will intersect within a 3200 ft "intersect zone". The details of the design are shown on the Issued for Permit (IFP) HDD design drawing [2386-EG-0101, Rev G, dated July 31, 2020] provided in Appendix A.

4.3 BOREHOLE SIZE

The final borehole diameter must be larger than pipe outer diameter to facilitate pipeline installation and reduce the drag forces acting on the pipe while allowing for proper drilling fluid circulation within the annulus. The general industry standard for pipes with diameter more than 20 inches is a final borehole diameter 12 inches larger than the pipe outer diameter. For the proposed NPS 24 HDD crossing, the minimum final borehole diameter is expected to be 36 inches.

4.4 ENTRY AND EXIT ANGLES

The entry and exit angles have been selected based on expected geologic formations and casing requirements, bending restrictions, topography and the support of the pullback section. The entry angle (south) has both been selected to be 15° for this crossing to minimize casing requirements while adhering to geometric constraints and depth. The exit angle was selected to minimize casing requirements on exit while considering the overbend support height and support equipment requirements. The exit angle has been designed to be 14° for the proposed crossing. Due to the pipe size and specification, significant equipment is still required to lift and safely support the pipe above ground during installation. The risks associated with above-ground pipe support equipment requirements on site will be discussed further in the construction risk assessment.

4.5 HDD DEPTH OF COVER

Selection of an HDD depth is based on several parameters including geological formation, casing requirements, required overburden pressure to overcome the drilling fluid annular pressure (while maintaining an adequate factor of safety), and watercourse geometric parameters. The proposed installation depth considered should maximize the length of drill advancing through favorable materials for directional drilling to maximizing borehole stability during hole opening and pipe installation. The drill path is designed to avoid the coal layers identified in the geotechnical investigation for as much of the drill path as possible.

The bottom tangent depth for the proposed NPS 24 HDD is around 250 ft below the bottom of the lake. It is expected that the majority of the drill path will be within shale of the Sentinel Butte Formation based on the 9 geotechnical borings described above. The design depth for the proposed crossing is expected to provide adequate overburden pressure to counteract the expected drilling fluid pressures while utilizing the HDD pilot hole intersect method. Further details about annular pressure modeling are discussed in Section 5.1.

4.6 DESIGN RADIUS

The standard practice in the HDD industry is to utilize 1,200 times the nominal pipe diameter (in ft) as the design radius of curvature (ROC). For example, an NPS 24 (2 ft O.D.) pipe would utilize a 2,400 ft ROC. This is a general "Rule of Thumb" for quick calculations which has been developed over the years based on constructability as opposed to pipe stress limitations. The minimum vertical curve chosen for the proposed HDD is 5,000 ft, which is much larger than the minimum based on the above criteria. This increased design radius has been chosen to assist in ease of steering for the contractor during construction. Applying the design radius, the bending stress and operational shear stress have been calculated to be 13.1% and 48.1%, of allowable, respectively.

An essential part of the design of HDD crossings is providing the contractor with minimum steering tolerances during pilot-hole based on an acceptable level of stress on the pipe. These tolerances are designed to allow the contractor to follow the designated drill path as closely as possible while avoiding any variation that may result in overstressing the product pipe. CCI has calculated the minimum allowable design radius (MADR) for the pipe based on limiting the bending stress to less than 45% of allowable (as per PRCI). For this crossing, an additional design factor has been added to this typical MADR calculation, in order to ensure major variations from the design radius which may negatively affect installation pull-forces are avoided. In addition to the calculated 3-joint minimum allowable design radius (MADR), CCI recommends the additional minimum 1-joint radius specification as shown in Table 4.

Table 4. Minimum Radius Allowances

	Radius Specification
30ft (single-joint)	Minimum ROC – 1,100 ft
100ft Average (3-joint) / MADR	Minimum ROC – 2,000 ft
Design Radius	5,000 ft

If the contractor adheres to these minimum radius specifications, the product pipe will be within allowable stress limits during installation and operation. It should be noted that a recommended single-joint minimum radius has been included, which is sometimes not specified within HDD designs. Without a single-joint radius specification, it is possible that the contractor may be able to include an excessive steer within a single joint, yet still adhere to the provided 3-joint minimum radius average. In order to avoid overstressing of the pipe that may occur in such an instance, adherence to the single-joint radius specification is recommended.

4.7 LAYDOWN AREA

The design proposes that the product pipe be laid out in one (1) continuous section. The proposed pullback workspace is 100 ft wide and crosses an unnamed road and 52nd Street NW (Highway 17A). The proposed pullback alignment also crosses an un-named creek which would likely require two (2) additional side booms to support the pipe from either side of the creek bed. The creek may need to be diverted, bridged, or infilled within the temporary workspace to support machinery traffic and equipment. From an initial desktop study, most of the designated workspace that is planned to be used during pullback will travel through cleared land, so minimal clearing will be required. Near the end of the pullback section, the workspace turns and parallels Co Highway 17A. To accommodate this curve, the pullback includes a 4000 ft radius horizontal curve.

Due to the usage of 52nd Street, it is expected that it will not be possible to close for pullback and it is expected the pipe will be lifted and supported over the road during pullback operations after final welds.

Due to the pipe size, a significant excavation length would be required if the pipe were to be strung under the road in a culvert. The culvert option could be investigated if permission to support the pipe over the road are not granted.

Based on CCI's stress analysis, the minimum allowable overbend radius of the pullback section is roughly 1,600 ft for the NPS 24 pipe. The stress analysis also yielded a maximum crane/side boom support spacing of 80 ft (based on typical roller-cradle capacities) and roller spacing of 40 ft, assuming adequately sized supports will be used. It is also recommended the maximum unsupported overhang not exceed 60 ft. The overbend radius and maximum support spacing was selected to maintain the imposed stress on the product pipe below 80% of allowable stress as per PRCI and with consideration of roller-cradle capacities.

The pullback alignment described above encounters a relatively level topography, with one geographically noticeable hill approximately 2,800 ft north along the pipe stringing alignment. The hill is gradual and should not affect pullback operations. Given the 14° exit angle, the height of the pullback overbend will reach approximately 35 ft above ground surface. This overbend results in approximately 6 cranes and 3 side booms to support the pipe within the overbend.

At the end of the existing 100 ft wide workspace, CCI has proposed an additional 40' of workspace, ending at the road surface of 54th Street NW. This additional workspace is to allow the pipe to be laid out in one section. Due to the topographical elevation changes within the layout, it is expected the pipe will not be as close to the road as is conservatively shown on the Issued for Permit (IFP) HDD design drawing [2386-EG-0102, Rev D, dated July 31, 2020] provided in Appendix A.

5 HDD ENGINEERING ANALYSES

The proposed HDD design has incorporated supplied topographical information, geotechnical information, and ROW alignment. In addition to these considerations, detailed annular pressure analysis and pipe stress analysis calculations have been completed as outlined below.

5.1 ANNULAR PRESSURE MODELING

The annular pressure (AP) was modeled to simulate the downhole pressure during the pilot hole phase of construction and compare it with the limiting pressure of the substrata above the drill path. The AP simulation was conducted with CCI's analysis tools, which have been developed with industry standard calculation models (Bingham Plastic, General Overburden, and USACE/Delft model) and additional modified safety factors based on our experience from over 15,000 completed HDD crossings. CCI developed geotechnical parameters for the crossing that are closely representative of the soil formations observed in the land boring logs and water boring logs completed by GES at the crossing.

Drilling fluid properties, used to model the downhole pressure during drilling, are dependent on construction practices of the HDD contractor, field conditions, and interpretations of the drilling fluid technician. Annular drilling fluid pressures can significantly change with changes in drilling fluid properties. Therefore, it is important to re-evaluate drilling fluid pressures based on fluid properties during HDD operations and compare them with estimated limiting pressures of the formation. Additionally, annular pressure measurement tools should be used to monitor annular pressure during the HDD installation.

The drilling parameters utilized by CCI for this analysis are based on tooling specifications provided by the drilling contractor and are as follows:

- 13 1/2" drill bit (pilot)
- 7 5/8" drill pipe

- 650 gpm (2.5 m^3/min) fluid pump rate
- 9.6 lb/gal fluid density
- 25 lb/100ft^2 yield point of fluid
- 20 cP plastic viscosity of fluid

Calculated expected annular pressure graphs for each drill direction were produced with the above drilling parameters and are modeled in Figure 3 and Figure 4. These annular pressure graphs form the basis for establishing whether a proposed HDD crossing is at risk for hydraulic fracture during the pilot hole phase. This graph shows a calculated expected downhole pressure, as well as an *Operating Zone* above the expected downhole pressure, shown as 125% of the calculated pressure. According to this model, drilling pressures that exceed the overburden fracture pressure do not necessarily indicate a fracture will occur, but rather a higher risk that hydraulic fracture may occur in those areas.

CCI has reviewed and incorporated the geotechnical program laboratory testing results from the geotechnical investigation and developed three geotechnical parameter sets for this crossing. These geotechnical parameter sets represent a “Firm CL-CI Clay” layer at surface, a variable thickness “Compact Sand” layer, and a “Shale Bedrock” layer in which the drill progresses for the majority of the crossing. The Parameters utilized by CCI are listed below.

Firm CL-CI:

- 26° Internal Angle of Friction
- 200 psf Cohesion Coefficient
- 120 pcf Unit weight of Soil
- 0.4 ksi Shear Modulus of the Soil
- Variable Radius of Plastic Zone based on soil parameters

Compact Sand:

- 32° Internal Angle of Friction
- 0 psf Cohesion Coefficient
- 125 pcf Unit weight of Soil
- 2.2 ksi Shear Modulus of the Soil
- Variable Radius of Plastic Zone based on soil parameters

Shale Bedrock:

- 26° Internal Angle of Friction
- 902 psf Cohesion Coefficient
- 131 pcf Unit weight of Bedrock
- 6.7 ksi Shear Modulus of the Bedrock
- Variable Radius of Plastic Zone based on soil parameters

Due to the length of the Missouri River HDD crossing, the crossing will be completed by intersect methodology. Figure 3 and 4 represent the annular pressure curves for the north and south portions of the HDD pilot hole. The Intersect Zone is shown on both drills, and represents the maximum length drilled from either side. The graphs shown are based on a modified CCI Delft equation. The modified Delft equation used here utilizes a smaller Radius of Plastic Zone than the standard Delft equation which results in much lower limiting pressure outputs, equating to more conservative allowable pressures in the curves shown below than would be shown in typical Delft model outputs.

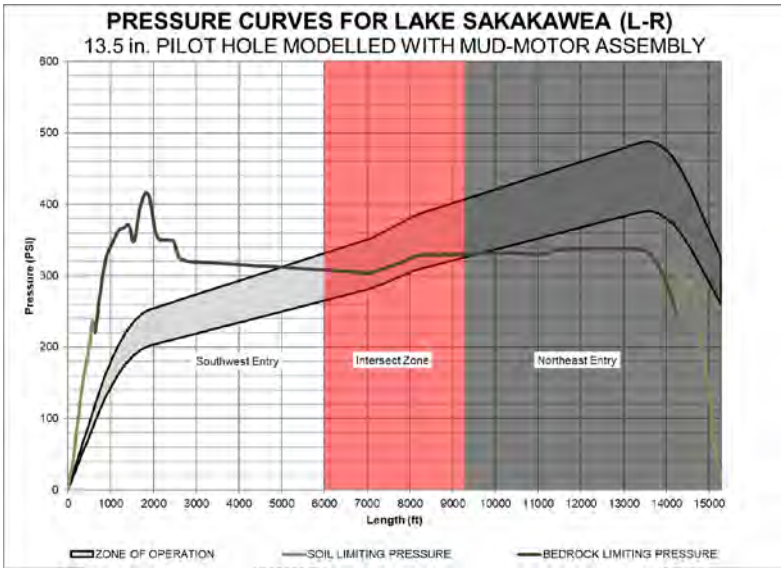


Figure 3. Modeled Annular Pressure During South Pilot Hole

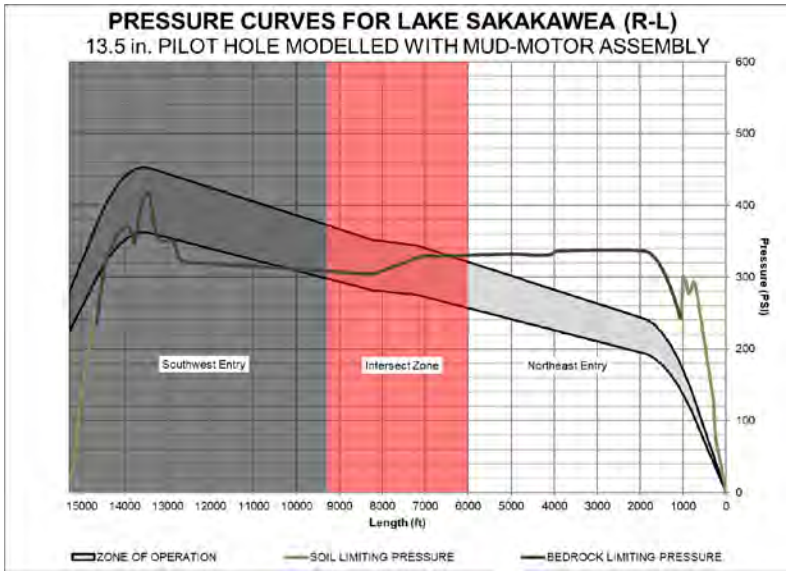


Figure 4. Modeled Annular Pressure During North Pilot Hole

The modified CCI annular pressure graphs above suggest that the drilling pressures remain below the limiting pressures of the overburden along the first 5000-6000 ft of the drill from either side. Within the 5000-8000 ft measured depth range, the lower operating pressures are below or slightly over the limiting over burden pressures. Once past the planned intersect zones, the drilling pressures greatly exceed the overburden pressure, illustrating the need for an intersect based on annular pressure considerations. Within the middle section of the drill, near the intersect zone, the risk of hydraulic fracture for the HDD is moderate.

The annular pressure graphs in Figures 5 and 6, below, have been run using the standard USACE Delft equation. These annular pressure graphs correspond to the factor of safety graphs seen in Figures 7 and 8.

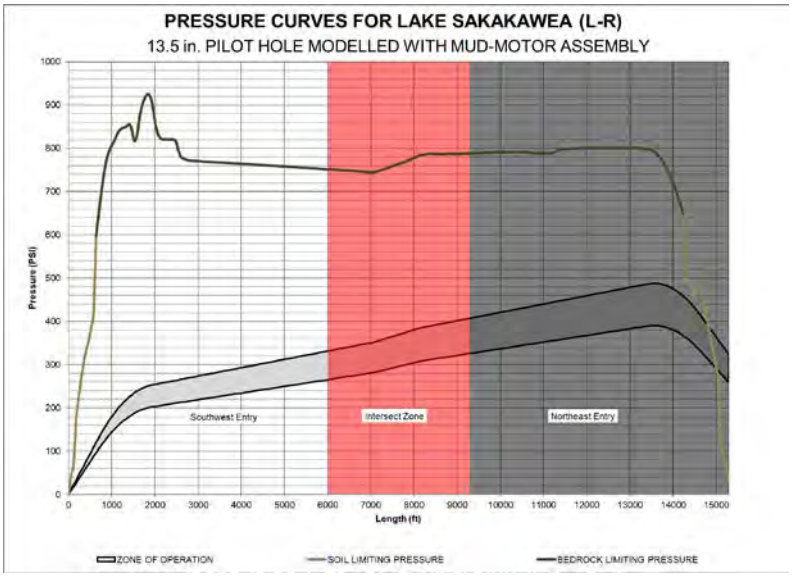


Figure 5. USACE Modeled Annular Pressure During South Pilot Hole

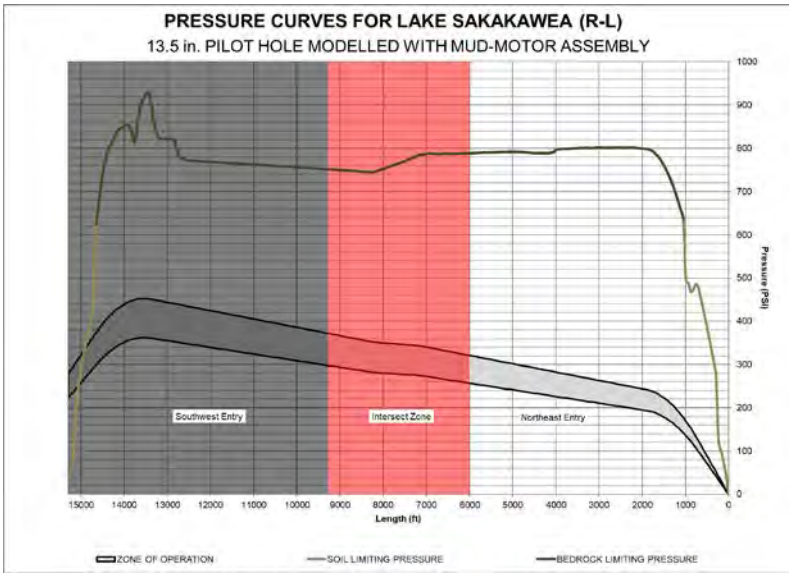


Figure 6. USACE Modeled Annular Pressure During North Pilot Hole

USACE requires a factor of safety against hydraulic fracturing, generally in the 2.0 range, for the portion of the drill passing beneath a regulated waterbody. The factor of safety is calculated by dividing the calculated limiting pressure of the formation by the expected annular pressure along the length of the drill path. Figure 7 and 8 shows the factor of safety against hydraulically fracturing the formation during pilot hole installations utilizing the standard USACE calculation models without any additional factor of safety applied to the equations at the design depth.

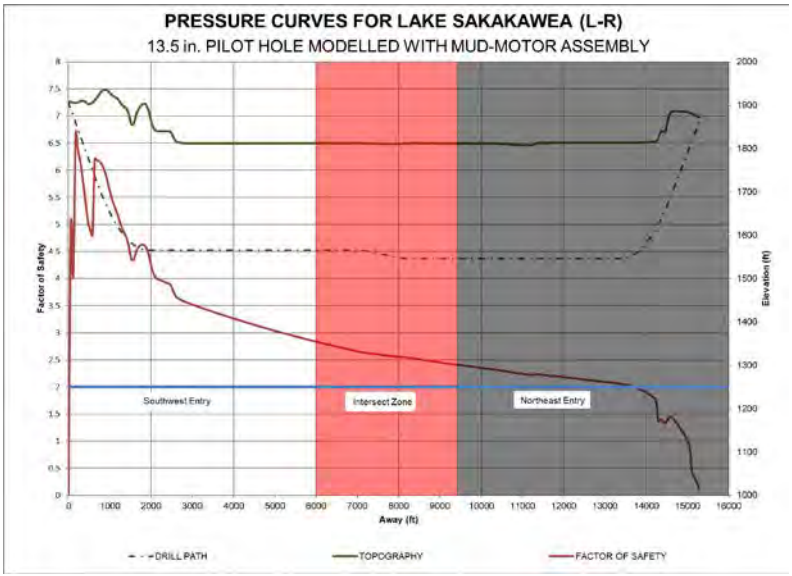


Figure 7. Factor of Safety Against Hydraulic Fracture South Pilot Hole

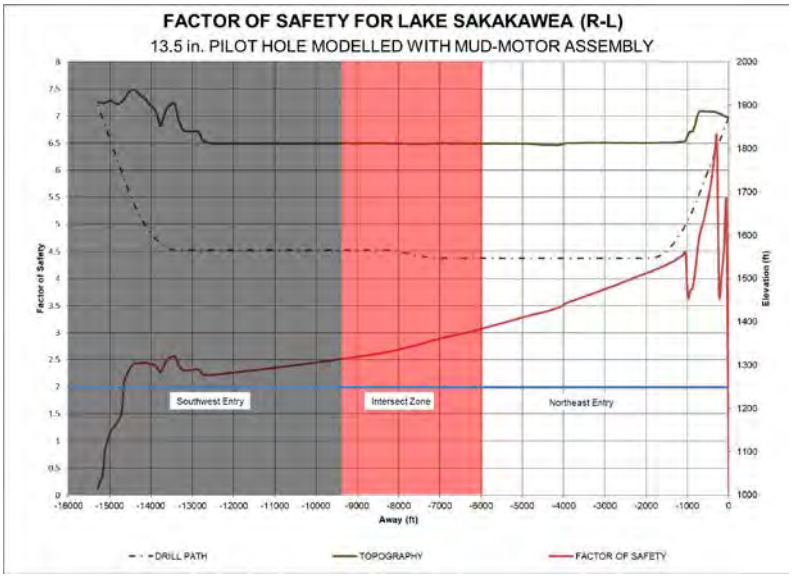


Figure 8. Factor of Safety Against Hydraulic Fracture North Pilot Hole

Figure 7 and 8 indicate that the Factor of Safety (FOS) against hydraulic fracture is above 2.0 for the entire planned pilot hole from the south and north sides. Utilizing USACE calculations, the FOS is roughly 2.5-4 below the Missouri River. Based on the results of the analysis, the HDD design meets the USACE minimum requirements for factor of safety against hydraulic fracture.

During construction, the risk and impact of hydraulic fracture and inadvertent returns (IR) to surface can be reduced by implementing preventative measures during pilot hole. It is recommended that the contractor reduce pump rates as the drills approach the intersect location. It is also recommended that contractor maintain drilling fluid densities at the low end of what is industry standard. An annular pressure

tool should be used during construction to monitor pressures as the drill progresses, avoiding exceeding containment pressures under any critical locations, as required by the USACE. The contractor should review the drilling fluid parameters and tooling and ensure the proposed equipment is in alignment. It may be preferential to utilize a larger drill bit to increase the annular space and decrease the expected pressures.

5.2 HDD STRESS ANALYSIS

The installation and operating conditions imposed on the product pipe during and after installation have been modelled against the respective code requirements as laid out in Section 2. The HDD stress modeling determines if given pipe specifications are adequate for the design.

5.2.1 Pulling Load

To pull the product line inside the borehole, the pull force must overcome several resisting forces including effective weight of the pipe, fluidic drag, frictional drag between the pipe and the borehole walls and between the pipe and the rollers, drag due to length of drill string in the hole, and the reamer assembly in front of the pull section.

The pull force has been calculated with the assumption that the pipe will be installed in one continuous section with no mid-welds as it is suspected there will be sufficient, or nearly sufficient, workspace. It is expected a small section of pipe may need to be pulled into the borehole prior to a single, final weld. This portion of the pipe would be expected to be in the surface casing, and it is not anticipated increased pull forces will be experienced due to this stop near the beginning of pull. If the pipeline installation requires multiple sections beyond this short initial section, the pull forces should be reevaluated to account for the effects of downtime due to intermittent welds during pullback. The soil around the borehole could slough or swell while the pipe remains stationary downhole during the welding process which would result in increased friction on the pipe during pulling.

The calculated expected installation pull force is dependent on the geometry of the HDD, geologic formations present along the drill path, drilling mud properties, and pipe size and weight. CCI has calculated the expected range of pull forces for the product pipe installation, accounting for typical ranges of downhole mud densities. In this analysis, 9.5 ppg (pounds per gallon) drilling fluid is applicable for relatively clean drilling fluid with minimal suspended cuttings, while 12 ppg fluid would be applicable for relatively “dirty” drilling fluid containing significant suspended solids and cuttings. CCI utilizes a safety factor of 1.5 when calculating pull force to account for variations in drilling practices, geology, etc. and addition of the reamer and swivel in the pullback bottom hole assembly. CCI has calculated pull forces for the proposed HDD crossings with and without the additional factor of safety. The calculated pull forces are shown in Table 5. Due to the wall thickness of the product pipe and its associated weight, the pipe is relatively close to neutrally buoyant and therefore buoyancy control is not required for this installation.

Table 5. Pullforce Calculation Analysis

	Drilling Fluid (9.5 ppg)	Drilling Fluid (12 ppg)
Pull force	502,000 lbs	640,000 lbs
Pull force incl. 1.5 x S.F.	752,000 lbs	960,000 lbs

5.2.2 Installation & Operating Stresses

As the pipeline is installed through the final borehole, it is subjected to three primary loading conditions: tension, bending, and external (hoop) pressure. As part of the design process, the individual stresses and their combined effect on the pipe were evaluated to check the pipeline potential for failure.

During operation, the stress imposed on a pipeline installed by HDD is similar to a conventionally installed pipe with the exception of the elastic bending resulting from a continually welded pipeline pulled through a curved borehole. The operating loads including bending, net hoop stress (difference between external and internal pressures), thermal expansion, and combined stresses were checked to evaluate the risk of failure for the NPS 24 product pipe.

The stress analysis completed by CCI based on the design geometry, pipe specifications, and operating conditions for the proposed HDD installation is summarized in Table 6.

A summary of the maximum expected installation and operating stresses and their allowable limits are presented in Appendix B.

Table 6. Installation & Operating Stresses

	Missouri River HDD Crossing	
	Installation Stresses	**% of Allowable (PRCI)**
Maximum Tensile Stress (PRCI 5.1.1, 5.5)	8,935 psi	16.5%
Maximum Bending Stress (PRCI 5.2.2)	5,900 psi	13.1%
Maximum Hoop Stress (PRCI 5.2.3)	2,642 psi	11.3%
Maximum Operating Stress (PRCI 5.4.4.2)	13,000 psi	48.1%
Maximum Combined Installation Stress (tensile and bending) (PRCI 5.2.4)	0.29	29%
Maximum Combined Installation Stress (tensile, bending, and hoop) (PRCI 5.2.4)	0.10	10%

5.2.3 Pipe Lifting Stress Modeling

An analysis was completed to evaluate stresses and imposed loading on the product pipe and supporting equipment during lifting and pullback operations. Minimum support spacing was determined based on pipe specifications and capacity of expected equipment. Summaries of the maximum expected support loading and stresses on the pipe and supports are presented in Appendix B.

The lifting plan requirements including minimum allowable overbend radii, maximum support spacing and maximum allowable overhang to not overstress the pipe or supporting equipment are shown in Table 7. The stresses imposed on the pipeline and loadings on supporting equipment during pullback are also shown. The stress analysis assumes that the pipe is installed empty without buoyancy control.

Table 7. Pullback Support Stresses & Loading

Parameter	
Tensile Stress / % SMYS	10,412 psi / 20%
Bending Stress / % SMYS	18,718 psi / 36%
Combined Tensile & Bending Stress / % SMYS	28,400 psi / 55%
Vertical Load at Support	55,400 lbs
Longitudinal Load At Support	5,540 lbs

Parameter	
Vertical Load at Roller Support	9,700 lbs
Support Spacing	80 ft
Roller Spacing	40 ft
Maximum Unsupported Overhang	60 ft
Overbend Radius	1,600 ft

CCI recommends that designed stresses imposed on the product pipe during pullback are limited to 80% SMYS to account for mishandling in the field during maneuvering and installation. The results from the stress analysis completed for the pullback show that the pipe will be subjected to stresses that are below the recommended limit and are therefore considered acceptable.

CCI recommends that the contractor selects adequately sized lifting equipment and rollers that can handle the expected loadings while providing an adequate factor of safety as per OSHA requirements. CCI recommends that the selected contractor independently evaluate the pullback and pipe lifting plan and account for weather conditions such as snow, rain, and winds to ensure that the equipment and product pipe do not become overloaded or overstressed during pipe handling and pullback.

5.2.4 Design Summary

For this crossing, the operating stresses govern the design of the pipe, and not the installation stresses. Calculations carried out by CCI indicate that the provided pipe specifications are suitable for the HDD installation, based upon the installation and operating conditions supplied.

5.3 HDD CONSTRUCTION RISK ASSESSMENT

The main construction risks and challenges for the Missouri River HDD crossing were identified in the risk assessment conducted by CCI, based on available data and previous experience. The risk items are ranked into the risk categories ranging from low risk to very high risk based on the probability and the consequence of each risk factor.

The descriptions of risk items and a summary of the risk assessment for the crossing detailing the risks prior to any mitigation and after mitigation is presented in Appendix C. The following are major risks and the main mitigation strategies developed.

Casing Installation / Removal:

Casing not Being Installed to Depth

Risk: Geotechnical conditions near surface can pose a problem when driving casing to a designed depth. It is expected both the entry and exit locations will require casing. The entry (south) is expected to be cased to the shale/siltstone bedrock, and the exit location will be cased past the coal layer. The proposed lengths of casing install, although expected to be achievable, are quite considerable.

Mitigation: Achievable casing installation lengths should be investigated prior to construction. The casing should be installed in 160-200ft lengths of telescoped casing. The final casing size shall be 48" and the initial casing should be sized to ensure the final casing will reach the required depth for seating.

Casing Not Being Fully Removed Upon Completion

Risk: Due to the proposed lengths of casing install, the makeup of the subsurface material traversed by the casing, and the expected length of time the casing will remain stationary, there is a risk that the full lengths of casing on either end may not be easily or successfully removed after completion of the product pipe installation.

Mitigation: Contractor shall submit casing plan that includes proper welding specifications to ensure integrity of the casing. Contractor shall also have a mitigation plan for grouting off any portions of casing left below-ground. Owner's integrity management personnel shall evaluate impact of casing left downhole and have a suitable cathodic protection mitigation plan prepared to address any possible related concerns.

Pilot Hole Operations:

Fracture to Water Body

Risk: Fractured formations (including coal seams as identified within the bedrock formation) or high annular pressures could result in release of fluid to surface. The length of the Missouri River crossing results in high pressures due to the building friction forces. The bedrock layer is inconsistent and dips significantly in the middle of the Missouri River, reducing the expected strength of the overburden formation.

Mitigation: The crossing is designed to be completed as an intersect which will limit the expected drilling pressures. The crossing has been designed with significant depth to limit the potential for fracture. Casing will also help with circulation back to entry/exit locations, which should reduce the potential for climbing annular pressures. Contractor shall utilize an Annular Pressure Tool to measure actual downhole pressures during drilling of the pilot hole to ensure any significant increases in pressure beyond planned ranges can be addressed and reduced to within expected ranges with mechanical tripping or additional circulation as applicable.

Large Fluid Loss to the Formation

Risk: Drilling fluid has the potential to migrate outside of the designed drill path in fractures. The crossing location is characterized by several coal seams, including two thick coal seams above and below the bottom tangent of the drill path, which may act as preferential path for drilling fluid.

Mitigation: The drill depth has been chosen to limit the risk of fracture to surface. Casing is included in the design to minimize the amount of coal seams the drill path will encounter. The contractor shall develop a mitigation plan for reducing significant losses where possible, including the use of Loss Circulation Material (LCM) pills to try to plug off any encountered zones of significant fluid loss.

Steering Control Issues

Risk: The crossing is 15,393ft long and each rig will need to drill approximately 7,000 – 8,000 ft. Maintaining weight on bit in order to be able to steer at this length is expected to be difficult, complicating the intersect operations.

Mitigation: The crossing is designed with a large radius which will reduce the steering requirements. The Contractor is utilizing 7 5/8" drill string and gyro steering systems to ensure accuracy and a successful intersect. The bottom tangent is very long and will allow the drills

sufficient time to align for intersect operations. Casing at the entry and exit locations may help to maintain weight on bit.

Annular Pressure Issues

Risk: Drilling operations require soil cuttings to be cleaned out of the bore and hydro-transported back to the rig by the drilling fluid. This process requires large volumes of pressurized drilling fluid to be pumped downhole. The length of the crossing will increase the risk of annular pressure issues.

Mitigation: The Contractor shall maintain returns to both entry pits and monitor annular pressures. A mud engineer shall be on site to monitor adherence to the crossing specific Engineered Drilling Fluid Plan (EDFP). A bottoms up procedure (circulating the calculated amount of fluid that it takes to flow from the bit downhole back up to the entry pit) should be in place and followed when necessary to clean the hole.

Over Schedule Risk

Risk: Geotechnical conditions, permitting, and environmental issues can all contribute to delays in the schedule. The crossing is long with a large borehole size. Over schedule could significantly increase costs. Significant delays could have a large financial impact due to delay to in-service date.

Mitigation: All requirements of the permits should be strictly followed. The Contractor shall ensure proper drilling procedures are in place. Encountered geotechnical conditions should be monitored and reported during drilling so modifications can be made to execution strategy, as required, to ensure no negative impacts. It is recommended construction proceed 24/7 with 2 12hr rotational shifts per day.

Disposal of Drilling Fluid

Risk: Drilling fluid needs to be stored and disposed of. Running out of temporary storage can lead to schedule delays and environmental concerns. The length and large borehole size will result in significant volumes of drilling fluid. Drilling fluid may be contaminated due to coal seams.

Mitigation: Adequate storage should be on site. An EDFP should be followed and an adequate recycling system will be on site. An approved disposal plan should be developed prior to construction. Facility disposal should be expected.

Reaming Operations:

Over Schedule Risk

Risk: Geotechnical conditions, permitting, and environmental issues can all contribute to delays in the schedule. The crossing is long with a large borehole size. Over schedule could significantly increase costs. Significant delays could have a large financial impact due to delay to in-service date.

Mitigation: All requirements of the permits should be strictly followed. The Contractor shall ensure proper drilling procedures are in place. Encountered geotechnical conditions should be monitored and reported during drilling so modifications can be made to execution strategy, as required, to ensure no negative impacts. Using two rigs will split the workload which would be normally be placed upon a single rig.

Loss of Equipment in the Borehole

Risk: Reaming or enlarging the bore to the desired diameter may cause instability areas. These areas may cause downhole tooling to get stuck or lost. Loss of equipment within the borehole is a larger risk than with a shorter crossing.

Mitigation: The utilization of intersect methodology will mitigate the risk of losing equipment within the borehole. Using two rigs will split the workload which would be normally be placed upon a single rig. If problems arise on one side of the reamer, the opposite rig will maintain contact with the downhole tooling and be able to trip to surface. Drill string management plan should be provided by the contractor, which should include regularly switching out drill stem on either side of the reamers.

Poor Removal of Cuttings

Risk: Due to the large ream pass and length a large volume of cuttings will be created and therefore will have to be removed from the borehole.

Mitigation: Drilling fluid parameters will be optimized for maximum cutting transportation, through adherence to the EDFP. High pump rates throughout the ream passes of the HDD will increase the annular velocity and therefore carrying capacity. Additional trips will be necessary to mechanically remove cuttings from the borehole. The number of trips required will be based on the borehole conditions. The cut size should ensure that cuttings can be removed.

Drilling Fluid Control

Risk: As the volume of drilling fluid within the borehole increases, it becomes more difficult to change its properties with drilling fluid additives. The large diameter borehole combined with the length will impact the quality and makeup of the drilling fluid. Coal seams may contaminate drilling fluid. Contractor will be hauling in water.

Mitigation: The Contractor should prepare and adhere to an approved EDFP which will outline the steps required to ensure the highest quality of drilling fluid is used for the crossing. A premix tank should be made available in addition to the mud tank. Contractor should continue to adhere to the EDFP throughout reaming operations even if they are experiencing fluid losses.

Pullback Operations:

Stuck Pipe

Risk: There is a risk that the pipe section becomes stuck in the borehole due to borehole length, instability, blockages, or irregularities. The pullforce for this length is between approximately 502,000 and 960,000lbs.

Mitigation: One or more wiper trips shall be completed to ensure a clean hole. Required force should be monitored during the wiper passes. It is recommended that a Pipe Thruster (with custom inserts for NPS 24) be available on exit side to assist the rig with pullback in the event pullforces start to become exceedingly high.

Pull Forces Exceeding Theoretical Model

Risk: There is a risk that pull forces exceed the theoretical model, especially with the length of the drill. Contributing factors can include cuttings in the borehole, having to temporarily halt line pull, borehole instability, and heavy drilling fluid.

Mitigation: A swab pass should be completed and downtime during installation should be minimized. It is expected pipe pull will continue overnight as required. This should be planned for with crews in advance, lighting shall be sufficient to allow overnight operations for pull. Pipe thruster should be available on exit side to assist the rig will pullback.

Coating Damage

Risk: Gravel, cobbles, boulders, and bedrock interfaces within the bore path pose a risk that the pipe coating is damaged during line pull.

Mitigation: Wiper passes shall be completed to gauge any possible areas of issue, and additional passes may be used to ensure minimized risk prior to pullback. FBE and ARO coated pipe shall be used.

Pipe Handling

Risk: The exit angle, wall thickness, and size of the pipe result in a large radius overbend that reaches a height of 35 ft. The pipe section requires significant support equipment.

Mitigation: A pullback lift plan should be created prior to construction for review and approval. The equipment capacities should be sufficient for the anticipated loads. Spreader bars may reduce crane requirements. A traffic plan should be created for Highway 17A (52nd Street NW) and 54th Street NW (if required).

Pipe Preparation:

Over Schedule Risk

Risk: There is significant support equipment required for pullback. If pullback is delayed this could be a large cost to keep the equipment on site. If the pipe section is not ready for pull the hole could tighten.

Mitigation: A pullback lift plan should be created prior to construction for review and approval. The equipment capacities should be sufficient for the anticipated loads. Spreader bars may reduce crane requirements. A traffic plan should be created for Highway 17A (52nd Street NW) and 54th Street NW (if required). Progress of the HDD should be tracked closely.

Other Risks:

Crossing Length

Risk: The crossing is 15,393ft long, approaching record lengths for an HDD crossing. There is a risk that the crossing could encounter compounding issues that lead to the crossing not being completed successfully.

Mitigation: A competent contractor with adequate tooling and relevant experience with similarly large installations has been selected. The risks should be highlighted to all stakeholders.

Access to Water

Risk: Water sources should be investigated/confirmed. Water transport should be a major consideration.

Mitigation: Additional transport and water sources should be investigated prior to construction. Transport should include contingency to ensure a lack of water does not lead to any delays with progress of the drill, particularly in the event of significant fluid losses during drilling, where large volumes of make-up water may be required.

Public Attention

Risk: Scrutiny is possible in the area. There is a risk of negative public perception issues. The summer season will see high levels of lake use.

Mitigation: The contractor shall ensure all procedures are being followed and their impact is minimized. The contractor shall ensure all correspondence with the public is completed by WBI representation.

6 RECOMMENDATIONS

The following recommendations outline the main action items that should be completed in order to ensure smooth progression of the project into the construction phase:

a) Review of information by all stakeholders and issuance of the Issued for Construction (IFC) drawings incorporating any changes from the Owner, environment, or other consultants.

b) Ensure that all the requirements of the USACE Omaha district are met, and an open line of communication is maintained throughout design and construction.

c) Ensure all required ROW and TWS, environmental notifications and permits, and water withdrawal and disposal sites are acquired.

d) Review the Construction Execution Plan, including but not limited to Pullback Plan, Water Management and Drilling Fluid Disposal Plan, Drilling Rig Anchoring Plan, Casing Plan, and Site-Specific Environmental Plan.

e) Scope of construction inspection, turbidity monitoring and fluid disposal management services should be identified.

f) Review any new environmental concerns with respect to the crossings and develop contingency plans if required.

g) Select an appropriate level of qualified supervision on site for all stages of the drill to ensure that the drill profile is adhered to within the radius limits set forth on the IFC drawing, the proper drilling techniques and equipment are utilized, and schedule and costs are controlled.

h) Select a qualified drilling contractor with experience completing HDD installations of similar size and scope in the area who is familiar with the local geologic formations and associated risks.

7 CONCLUSIONS

This assessment shows the risks identified on the Missouri River NPS 24 HDD crossing and if adequately mitigated, reduces the overall impact on the project. Based on the available data, it is deemed feasible to construct the Missouri River HDD crossing along the proposed North Bakken Expansion Pipeline project

successfully. The crossing is one of the longest HDD crossings completed, and there is potential for an unsuccessful HDD installation, however, this risk will be minimized if the recommendations included within this report are followed.

8 LIMITATIONS

This report has been prepared based on the available site-specific information for the exclusive use of WBI in the construction of the proposed Missouri River HDD crossing. No other warranty is expressed or implied and the information presented within this report shall not be applied to other projects.

Although subsurface conditions are not expected to vary significantly from those shown on the drawings, it should be appreciated that extrapolation of subsurface conditions between boreholes and to depths below the depth of exploration is subject to interpretation and could be at variance with actual field conditions.

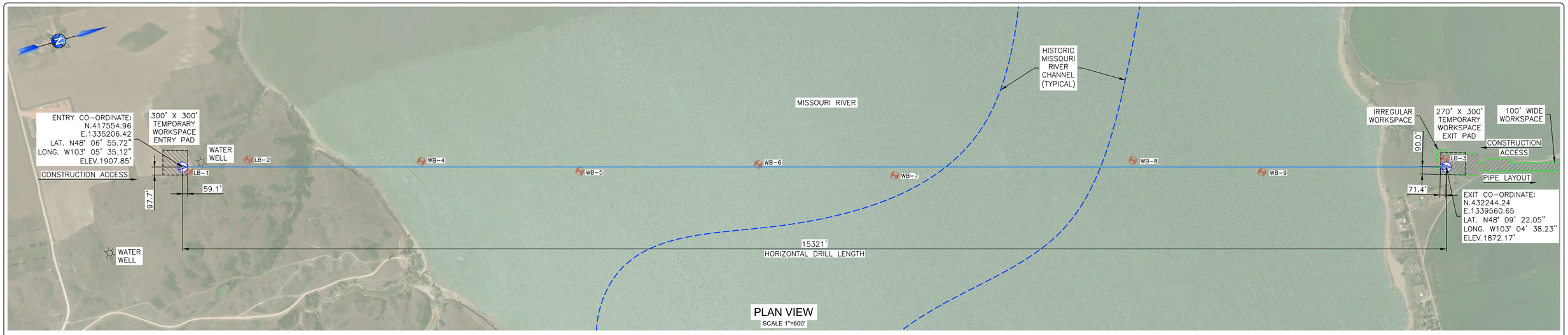
9 REFERENCE DOCUMENTS – HDD DESIGN DRAWINGS

Drawing Name	Drawing Number	Revision	Sheet
Missouri River HDD Crossing Plan and Profile	2386-EG-0101	G	1 of 3
Missouri River HDD Pullback Plan and Detail	2386-EG-0102	D	2 of 3
Missouri River HDD Construction Notes	2386-EG-0103	A	3 of 3

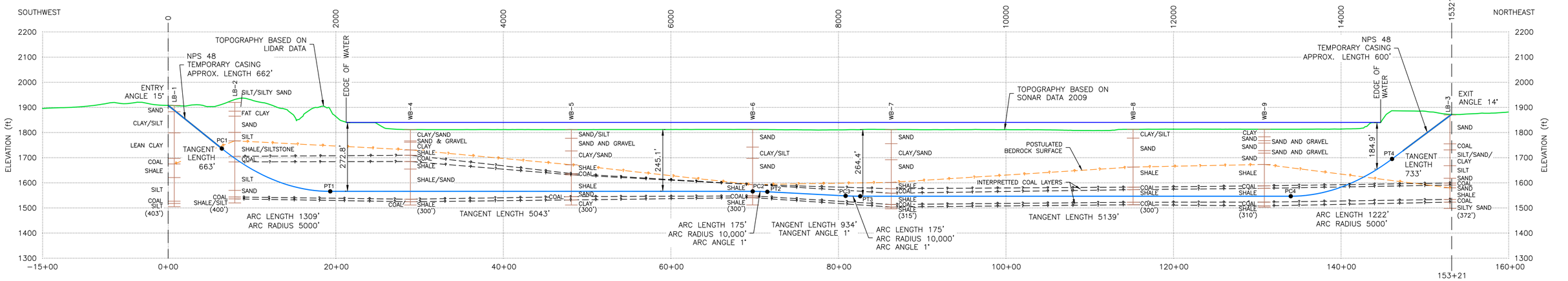
Geotechnical Report: WBI North Bakken Land-based Geotech Report

Geotechnical Report: WBI North Bakken Water-based Geotech Report

APPENDIX A – HDD DESIGN DRAWINGS



PLAN VIEW
SCALE 1"=600'



PROFILE ALONG PROPOSED PIPELINE
SCALE 1"=600' HORIZONTAL
SCALE 1"=200' VERTICAL

TOTAL DRILL LENGTH 15393'

HORIZONTAL DIRECTIONAL DRILL DATA MISSOURI RIVER HDD		
DESCRIPTION	STATION (ft)	ELEVATION (ft)
ENTRY @ 15°	0+00.00	1907.85
PC1 = 5000' RADIUS	6+40.51	1736.23
PT1	19+34.61	1565.86
PC2 = 10,000' RADIUS	69+78.43	1565.86
PT2	71+52.95	1564.33
PC3 = 10,000' RADIUS	80+87.31	1548.02
PT3	82+61.83	1546.50
PC4 = 5000' RADIUS	134+00.95	1546.50
PT4	146+10.56	1695.02
EXIT @ 14°	153+21.04	1872.17
HORIZONTAL DISTANCE (ft) = 15321.04		
DIRECTIONAL DRILL PIPE LENGTH (ft) = 15392.57		

Pilot Hole Tolerances	
Item	Tolerance
Pilot Entry Angle	Increase in angle up to 1° (deeper), but no decrease in angle allowed as long as minimum 3-joint bending radius is not compromised.
Pilot Entry Location	As staked by COMPANY. No change without COMPANY approval.
Pilot Exit Angle	Change in angle up to +/-1° allowed as long as minimum 3-joint bending radius is not compromised.
Pilot Exit Location	Up to 40 feet longer or 10 feet shorter than exit stake. Between 10 feet left and 10 feet right of COMPANY survey centerline.
Pilot Depth	Up to 5 feet decrease in design depth (shallower) allowed except under critical areas such as roads, utilities, levees etc. near the entry and exit points. Up to 10 feet increase in depth (deeper) allowed. Best efforts shall be made to stay at or below pipe design profile depth.
Pilot Alignment	Shall remain within 10 feet left or right of COMPANY centerline survey.

GEOTECHNICAL BORE HOLE INFORMATION			
BOREHOLE	LATITUDE	LONGITUDE	DEPTH (ft)
LB-1	48° 6' 56.33"	-103° 5' 34.23"	403
LB-2	48° 7' 3.56"	-103° 5' 33.40"	400
LB-3	48° 9' 22.10"	-103° 4'39.62"	372
WB-4	48° 7' 23.30"	-103° 5'25.93"	300
WB-5	48° 7' 42.24"	-103° 5' 15.52"	300
WB-6	48° 8' 2.38"	-103° 5' 10.74"	300
WB-7	48° 8' 17.93"	-103° 5' 1.65"	315
WB-8	48° 8' 45.61"	-103° 4' 53.93"	300
WB-9	48° 9' 0.54"	-103° 4' 45.08"	310

REFERENCE DOCUMENT NO.	DATE
1. NBE_PL-PROPOSED_ROUTES 190824	2019-08-24
2. 2386-01-IMP STEEL STRESS-24-inch-02	2020-07-30

ENGINEER AND PERMIT STAMPS

PIPELINE SPECIFICATIONS	NPS 24
OUTSIDE DIAMETER (OD)(in)	24
WALL THICKNESS (WT)(in)	0.99
GRADE (psi)	60,000
PRODUCT	NATURAL GAS
MATERIAL	STEEL
SPECIFICATIONS	API 5L
INTERNAL COATING	N/A
OUTER COATING	DUAL FBE
MAX. OPER. PRESSURE (psi)	1,480
MIN. TEST PRESSURE (psi)	1,850
MAX. OPER. TEMP (°F)	100
MIN. INSTALLATION TEMP (°F)	60

STEERING TOLERANCES	30ft	100ft	DESIGN
MINIMUM RADIUS (ft)	1100	2000	5000

PULL FORCE / RIG SIZE / STRESS	
PULL FORCE (w/o BUOYANCY CONTROL):	752,000 lbs (w/sf)
MINIMUM RECOMMENDED RIG SIZE:	1,000,000 lbs
COMBINED STRESS UNITY CHECK:	0.29
OPERATING STRESS	48.1%

DRAWING STATUS	DATE	DRN	CHK	DES	GEO	APR	CR
ISSUED FOR PERMIT	2020-07-31	MS	EY	CG	LC	KP	NM

LOCATION PLAN (1"=7000')

NAD83.ND-Nft

WBI ENERGY TRANSMISSION
An MDU Resources Group company

WBI NORTH BAKKEN EXPANSION PROJECT
MISSOURI RIVER HDD CROSSING
PLAN AND PROFILE
WATFORD CITY / TIOGA, MCKENZIE COUNTY, NORTH DAKOTA

SCALE	DWG. #	REVISION	SHEET
AS SHOWN	2386-EG-0101	G	1 OF 3

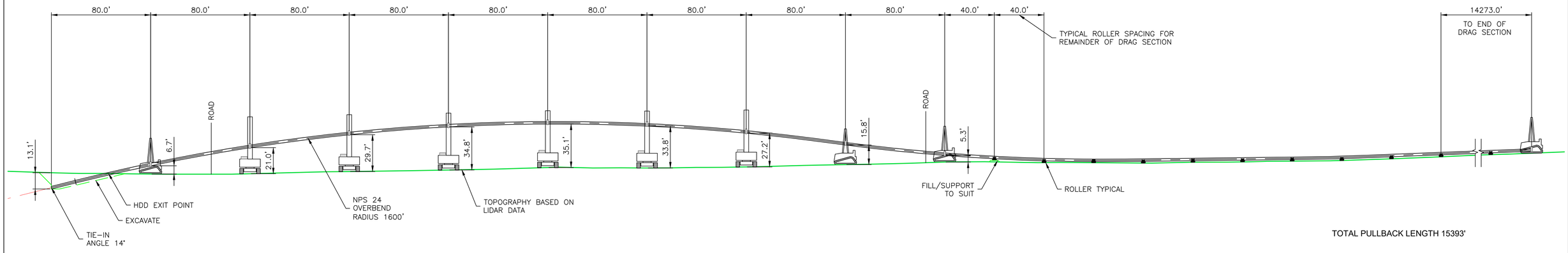
CCI & Associates Inc.
20445 State Highway 249, Suite 250
Houston, TX 77070
COCP 27692PE

1"=600'
FT 0 600 1200 2400

1"=200'
FT 0 200 400 800

PULLBACK PLAN VIEW

SCALE 1"=600'



TOTAL PULLBACK LENGTH 15393'

PULLBACK DETAIL

SCALE 1"=40' HORIZONTAL
SCALE 1"=40' VERTICAL

REFERENCE DOCUMENT NO.	DATE
1. NBE_PL-PROPOSED_ROUTES 190824	2019-08-24
2. 2386-01-IMP STEEL STRESS-24-inch-02	2020-07-30

CCI & Associates Inc.
20445 State Highway 249, Suite 250
Houston, TX 77070
COCP 27692PE

ENGINEER AND PERMIT STAMPS

1"=600'
FT 0 600 1200 2400

1"=40'
FT 0 40 80 160

PIPELINE SPECIFICATIONS

	NPS 24
OUTSIDE DIAMETER (OD)(in)	24
WALL THICKNESS (WT)(in)	0.99
GRADE (psi)	60,000
PRODUCT	NATURAL GAS
MATERIAL	STEEL
SPECIFICATIONS	API 5L
INTERNAL COATING	N/A
OUTER COATING	DUAL FBE
MAX. OPER. PRESSURE (psi)	1,480
MIN. TEST PRESSURE (psi)	1,850
MAX. OPER. TEMP (°F)	100
MIN. INSTALLATION TEMP (°F)	60

PULL FORCE / RIG SIZE / STRESS

PULL FORCE (w/o BUOYANCY CONTROL):	752,000 lbs (w/sf)
MINIMUM RECOMMENDED RIG SIZE:	1,000,000 lbs

DRAWING STATUS	DATE	DRN	CHK	DES	GEO	APR	CR
ISSUED FOR PERMIT	2020-07-31	MH	EY	CG	N/A	KP	NM

LOCATION PLAN (1"=7000')

NAD83.ND-Nft

WBI ENERGY TRANSMISSION
An MDU Resources Group company

WBI NORTH BAKKEN EXPANSION PROJECT
MISSOURI RIVER HDD CROSSING
PULLBACK PLAN AND DETAIL
TIOGA, MCKENZIE COUNTY, NORTH DAKOTA

SCALE	DWG. #	REVISION	SHEET
AS SHOWN	2386-EG-0102	D	2 OF 3

NOTES

1. All dimensions are in feet unless otherwise specified. All dimensions are to the centerline of borehole unless otherwise specified.
2. All drill path lengths are rounded to the nearest foot and angles are rounded to the nearest degree, unless otherwise specified.
3. This drawing is based on information provided from various sources. Consulting company does not take responsibility for the accuracy of information provided by others.
4. The crossing shall be constructed in accordance with ASME B31.8 2018.

CONSTRUCTION

5. The estimated theoretical pull force (including safety factor) for this HDD crossing has been calculated to be 752,000 lbs without the consideration of pipeline buoyancy control.
6. Assumed final borehole size is 36".
7. The Contractor shall submit a Drilling Execution Plan for Company approval (prior to start of drilling operations) meeting the minimum requirements of the Contract Documents. Any deviation from the Execution Plan shall only be allowed with Company approval.
8. The Contractor shall verify topographical survey information represented on this drawing in the field prior to construction. Contractor shall inform the Owner of any topographical discrepancies identified.
9. The design drill path and existing utilities being crossed shall have a minimum separation of 10ft.
10. Contractor shall supply and use an approved annular pressure tool capable of operating within the expected pressure range. Annular pressure information provided is based on a mud motor assembly for a 13 1/2" pilot hole.
11. The locations of existing utilities, pipelines and structures shown on the drawing are approximate and shall be verified in the field by the Contractor prior to start of any excavation or pilot hole operations. Verification shall be in accordance with Company specifications and procedures. The Contractor shall ensure any utilities, pipelines and structures in the area are protected and not damaged by the construction.
12. The Contractor shall take specific precautions in protecting existing utilities, pipelines and structures at the entry and exit sites. Such precautions may include: entry/exit pits excavated below existing utilities, casing or sheet piling used to protect pipelines, ramping/matting and special drilling precautions employed during drilling. These precautions shall be used to ensure the drilling tools, pipe and product pipe maintain a safe distance from the existing pipelines, utilities and structures.
13. The Contractor shall assess the need for temporary casing, including both small diameter "wash-over" type casing during pilot hole, and large diameter hammered-in place casing. If large diameter casing is utilized, casing shall be sized to accommodate the final ream pass and shall utilize centralizer casing within the temporary conductor casing. Casing diameter, wall thickness, grade, and drive shoe design shall be determined by the Contractor. A Contractor's Casing Plan shall be submitted and approved by Company prior to casing installation. All temporary casings shall be removed at completion unless otherwise noted.
14. The pilot hole shall be drilled along the design drill path with the designated design radius of curvature shown in the drawing. The pilot hole shall be within the pilot hole tolerances noted on the drawing.
15. The design radius for this crossing is 5000 ft. The pilot hole drilling shall adhere to the following tolerances:
    30ft (single joint) radius shall not be less than 1100 ft
    100ft (3-joint) average radius shall not be less than 2000 ft
16. Crossing to be completed using an intersect methodology utilizing an HDD rig on either side of the crossing. Intersect shall be planned for near the mid-point of the drill geometry in order to ensure minimized risk of drilling fluid release throughout the drill.
17. This engineered design is based on the following minimum equipment requirements that the Contractor shall have onsite:
    a. Drilling Equipment:
    - Drilling Rig with a minimum pull force of 1,000,000 lbs;
    - Drill Pipe 7 5/8" (inspected as per the HDD specification);
    - Drill Bit – 13 1/2" in diameter or larger (provide details, condition, and supplier);
    - 8" Mud Motor or larger capable of running within its specified maximum load range (provide details, condition, and supplier);
    - Annular Pressure Tool (0 to 510 psi range);
    - Reamers designed for the formation (provide manufacturer's operating specifications, condition, and supplier);
    - Gyroscopic steering system;
    - Casing (specifications and details to be provided for approval).

    b. Drilling Fluid Recycling Equipment:
    - Pump Capacity (Operable Rate – 1050 gpm);
    - Shakers (Operable Rate – 1050 gpm);
    - Centrifuge/Desander/Desilter (Minimum Capacity of 1050 gpm);
    - Engineered Drilling Fluid Plan must be able to be implemented in the field with the proposed equipment.

    c. This is a minimum list of equipment and should not be considered a directive on how to complete the work. The Contractor is responsible for the execution of the work under its Approved Execution Plan and shall supply all necessary equipment to complete its plan at its own cost. All equipment shall be supplied in good working order, maintained, fueled and serviced.
18. Drilling Fluid is assumed to have a maximum density of 10 lbs/gallon and 1.0% sand content.

ENVIRONMENTAL

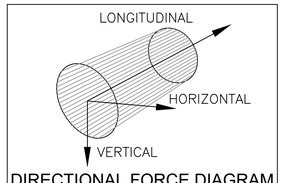
19. Emergency response spill kits must be on-site and available for use for the duration of the project.
20. Terrestrial "inadvertent return walks" shall be initiated every 4hrs. (at a minimum), or immediately following a loss of fluid event.
21. Contractor's proposed drilling fluid composition, including all expected additives, shall be reviewed and approved by the Owner's representative prior to construction.
22. The watercourse must be monitored for a potential release of drilling fluid and to assess the immediate effects of the works on the aquatic environment in accordance with applicable Federal and State regulations.
23. The Contractor shall ensure that the following documentation is on-site and readily available at all times (at a minimum):
    a. Emergency Response Procedure (ERP);
    b. Environmental Protection Plan (EPP);
    c. MSDS for all on-site material;
    d. Copies of Land Use Agreements.

GEOTECHNICAL

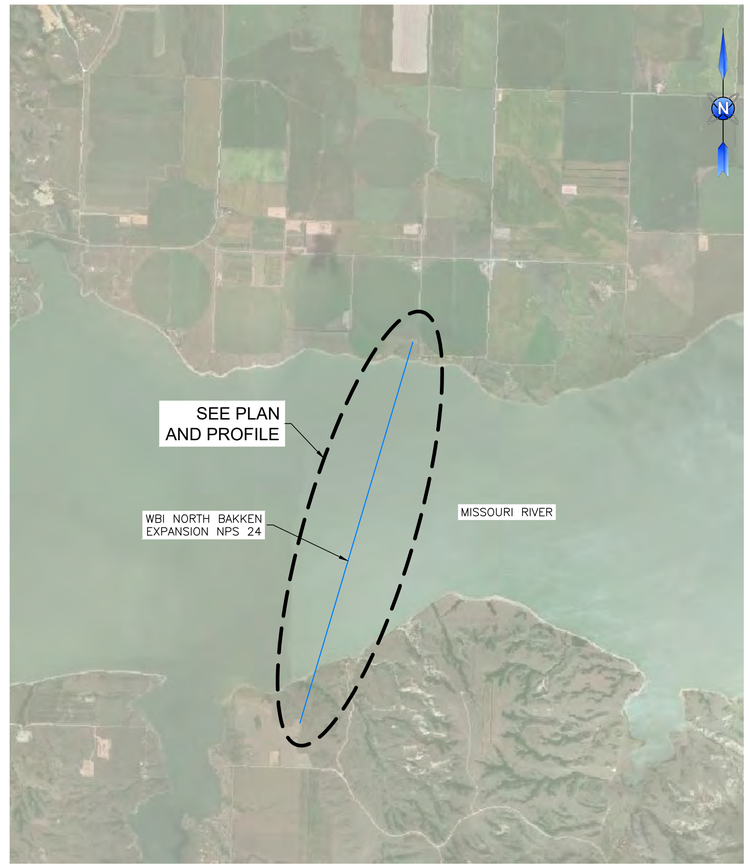
24. A land-based geotechnical investigation was completed at this site by Groundwater and Environmental Services, Inc (GES), and can be referenced from the report titled "Geotechnical Investigation Report WBI North Bakken Expansion Project", dated June 14, 2019. A supplemental water-based geotechnical investigation was also completed and can be referenced from the report titled "Geotechnical Investigation Report Water Based Borings", dated July 9, 2020.
25. The soil and bedrock stratigraphy shown is based on interpretation of data from three (3) land-based boreholes, and six (6) water-based boreholes, drilled at the locations shown and the designer's understanding of the local geology. Due to natural variations in subsurface conditions and inherent uncertainties associated with the interpretation of subsurface data, some variation in stratigraphy between boreholes and along the length of the bore should be expected.
26. The Contractor should independently evaluate the crossing with due consideration given to the suitability of its proposed equipment and construction procedures. Proposed construction means and methods shall be submitted to Company for approval but remain the sole responsibility of the Contractor.

PULLBACK NOTES

1. This drawing is engineered and designed to ensure the pipe section is not overstressed during the installation process.
2. This drawing is developed to inform the Contractor of the maximum spacing, anticipated lifting heights, minimum loading requirements and the minimum amount of support equipment to be provided by the Contractor. It is expected that the Pipeline Contractor will choose the type and size of equipment to manage the minimum loads provided.
3. The shown spacing and heights of supports represent a modeled maximum total stress on the pipe (including tension, bending and shear stress at the supports) of 80% of SMYS.
4. The support placement and spacing shown is based on provided topographical survey data. The Contractor shall field fit equipment according to the terrain or other on-site requirements adhering to a maximum spacing provided of 80ft between any two supports.
5. This drawing is based on information provided from various sources. Contractor shall confirm the accuracy of information prior to construction.
6. All loads shown assume that no buoyancy control will be utilized for this pullback.
7. All dimensions are to the bottom of pipe.
8. It is anticipated that all support equipment will utilize roller cradles during the pullback operation. Load capacity of each roller cradle is 56,500lbs (24"-36" roller cradle model). The load capacity shall be confirmed prior to use.
9. Equipment shall be sized with an adequate safety factor (2.0x or greater) to safely handle expected loads and to suit the heights recommended to facilitate the proper radius of curvature. It is expected that extended boom lengths or ramping under the side-booms may be necessary.
10. Shown pipe roller spacing based on roller load capacity of 12,000lbs. Roller spacing shall be adjusted to suit model of roller used.
11. It is the Contractor's responsibility to ensure they have crossing agreements from all utility and pipeline companies in the area where work will be performed overtop or in the vicinity of high pressure pipelines or utilities.
12. Proper padding/ramping above existing lines is required for all areas in which heavy equipment is moved or placed where the equipment may impact these lines.
13. Contractor shall ensure that there is minimal public disturbance and disruption during all parts of the work.
14. Contractor shall be prepared to work with other Contractors in the area.
15. Care shall be taken in manipulating the first and last section of pipe throughout the pullback. The maximum unsupported length at the leading and trailing ends of the pull section shall not exceed 60ft in order to prevent overstressing of the pipe.
16. Contractor shall implement an adequately sized catch off tractor as an anchor when the pipe section involves a slope, horizontal curve and/or a high to low installation. The tractor must be secured to the pipe section in an acceptable manner such as a pull head.
17. Contractor shall consider other factors such as weather conditions (wind, rain, snow, etc.) and site conditions on the pullback operations to ensure a safe lift and installation.
18. Contractor shall secure the load lines on cranes (if required) to the ground to minimize movement of the cradles along the pipe.
19. Contractor to take all precautions to minimize damage to pipe coating during pullback. Any damage to coating shall be repaired as specified in contract documents.
20. Contractor shall modify this plan (as required) to ensure the pipe pull section is sufficiently supported at all times during pullback. Contractor must provide a Pullback Plan for approval by the owner's representative two weeks in advance of commencing the work.
21. For the support design shown, the largest expected forces are:
    Single Cradle Support
    a. Vertical 55,400lbs
    b. Horizontal 95lbs
    c. Longitudinal 5,540lbs
22. The loads on the supports during pullback resolve to three directions; vertical, horizontal and longitudinal. The vertical direction is the weight of the pipe, the horizontal direction results from horizontal curves and the longitudinal direction results from the pipe being pulled through the cradles. A diagram can be seen in the detail to the right.

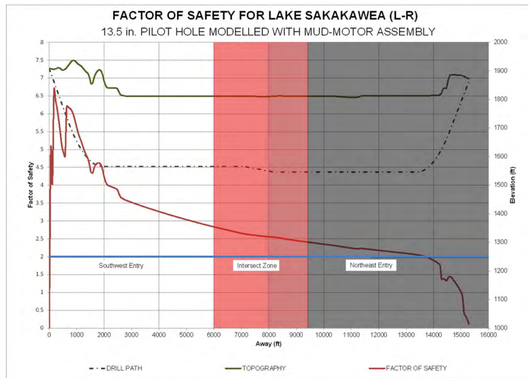


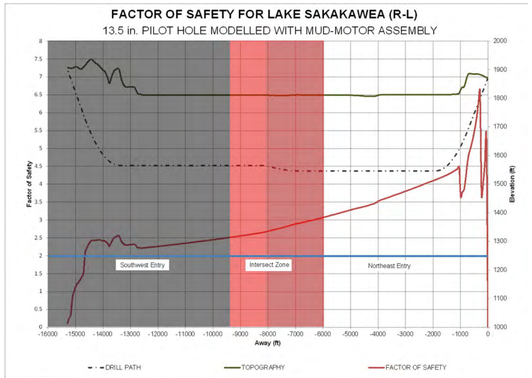
DIRECTIONAL FORCE DIAGRAM
N.T.S.



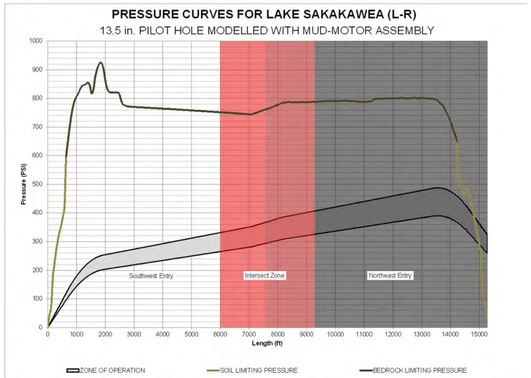
LOCATION PLAN
SCALE 1"=3000'

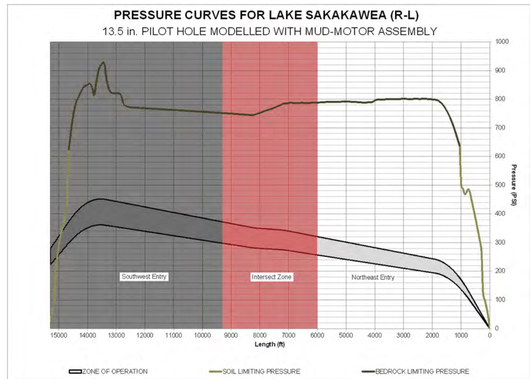
FACTOR OF SAFETY GRAPHS





ANNULAR PRESSURE CHART





REFERENCE DOCUMENT NO.	DATE
1. NBE_PL-PROPOSED_ROUTES 190824	2019-08-24
2. 2386-01-IMP STEEL STRESS-24-inch-02	2020-07-30
3. 2386-01-L2R-AP-02	2020-07-23
4. 2386-01-R2L-AP-02	2020-07-23
5. 2386-01-L2R-AP-02 (USACE FS)	2020-07-23
6. 2386-01-R2L-AP-02 (USACE FS)	2020-07-23

CCI & Associates Inc.
20445 State Highway 249, Suite 250
Houston, TX 77070
COCP 27692PE

ENGINEER AND PERMIT STAMPS

PIPELINE SPECIFICATIONS

	NPS 24
OUTSIDE DIAMETER (OD)(in)	24
WALL THICKNESS (WT)(in)	0.99
GRADE (psi)	60,000
PRODUCT	NATURAL GAS
MATERIAL	STEEL
SPECIFICATIONS	API 5L
INTERNAL COATING	N/A
OUTER COATING	DUAL FBE
MAX. OPER. PRESSURE (psi)	1,480
MIN. TEST PRESSURE (psi)	1,850
MAX. OPER. TEMP (°F)	100
MIN. INSTALLATION TEMP (°F)	60

STEERING TOLERANCES

	30ft	100ft	DESIGN
MINIMUM RADIUS (ft)	1100	2000	5000

PULL FORCE / RIG SIZE / STRESS

PULL FORCE (w/o BUOYANCY CONTROL):	752,000 lbs (w/sf)
MINIMUM RECOMMENDED RIG SIZE:	1,000,000 lbs
COMBINED STRESS UNITY CHECK:	0.29
OPERATING STRESS	48.1

DRAWING STATUS	DATE	DRN	CHK	DES	GEO	APR	CR
ISSUED FOR PERMIT	2020-07-31	MH	EY	CG	LC	KP	NM

NAD83.ND-Nft

WBI ENERGY TRANSMISSION
An MDU Resources Group company

WBI NORTH BAKKEN EXPANSION PROJECT

MISSOURI RIVER HDD CROSSING
CONSTRUCTION NOTES AND PIPELINE INFORMATION

WATFORD CITY / TIOGA, MCKENZIE COUNTY, NORTH DAKOTA

SCALE	DWG. #	REVISION	SHEET
AS SHOWN	2386-EG-0103	A	3 OF 3

APPENDIX B – HDD STRESS SUMMARY

Owner:	WBI Energy Transmission
Project:	North Bakken Expansion
Date:	2020-07-29
Calculation Description:	Stress Assessment NPS 24 HDD
Applicable Crossings:	Lake Sakakawea - 9.5 lb/gal Fluid

CCI & Associates Inc.

Completed By:	KP	Reviewed By:	JT	Sheet Revision:	R19.1

Pipe Information			Design Criteria				Crossing Characteristics	
Pipe Diameter (in)	Pipe W.T. (in)	Pipe Grade (psi)	MOP (psi)	Max. Operating Temperature (°F)	Installation Temperature (°F)	Design Radius (ft)	Maximum Depth From Entry Location (ft)	HDD Length (ft)
24	0.990	60000	1,480	100	60	5000	361	15393

The pipe section installated stresses are modelled in 5 sections (exit tangent (5), exit arc (4), bottom tangent (3), entry arc (2), entry tangent (1)) incorporating effects of buoyancy, soil friction, curvature, fluidic drag and pipe weight. The calculated stresses are evaluated using the AGA method (PRCI). Operating stresses incorporate hoop, bending, tensile, and thermal expansion.

Variable Definitions:

F_y - Specified Minimum Yield Strength
D - Outer Diameter of Product Pipe
E - Young's Modulus (Steel)
t - Wall Thickness of Product Pipe

Tensile Stress:

			% of Allowable
5	6761.2 psi	**PRCI 5.1.1, 5.5**	12.5%
4	7007.0 psi		**13.0%**
3	6434.7 psi	**Allowable Tensile Stress**	11.9%
2	6758.5 psi	$F_t = (0.9) * F_y$	12.5%
1	6961.7 psi	= 54000 psi	12.9%

Bending Stress:

			% of Allowable
5	295.0 psi	**PRCI 5.2.2**	0.7%
4	5900.0 psi	$f_b = (E/D)/(2R)$	**13.1%**
3	295.0 psi	**Allowable Bending Stress**	0.7%
2	5900.0 psi	$F_b = \{0.72 - (0.58\ F_y\ D / (E\ t)\}\ F_y$	**13.1%**
1	295.0 psi	= 45000 psi	0.7%

Hoop Stress:

			% of Allowable
5	1242.0 psi	**PRCI 5.2.3**	5.3%
4	2130.2 psi	$f_h = P_{ext}D/2t$	**9.1%**
3	2130.2 psi	**Allowable Hoop Stress**	**9.1%**
2	2130.2 psi	$F_{hc} = [0.88 \times E \times (t/D)^2] / 1.5$	**9.1%**
1	1111.3 psi	= 23300.7 psi	4.8%

Operating Stresses:

			% of Allowable
5	10197.0 psi	**PRCI 5.4.4.2:**	37.8%
4	12999.5 psi	**Allowable Shear Stress**	**48.1%**
3	10197.0 psi	$F(v) = 45\%$ of F_y	37.8%
2	12999.5 psi	$F(v) = 27000$ psi	**48.1%**
1	10197.0 psi		37.8%

Combined Stress (Tensile and Bending)

			% of Allowable
5	0.13	**PRCI 5.2.4**	13%
4	0.26	$f_t/0.9F_y+f_b/F_b \le 1$	**26%**
3	0.13		13%
2	0.26		26%
1	0.14		14%

Combined Stress (Tensile, Bending, and Hoop)

			% of Allowable
5	0.02	**PRCI 5.2.4**	2%
4	0.08	$A^2+B^2+2v\lvert A\rvert B \le 1$	**8%**
3	0.02	$A = ((f_t+f_b-0.5f_h)1.25)/F_y$	2%
2	0.07	$B = 1.5f_h/F_{hc}$	7%
1	0.02		2%

Estimated PullForce (without Buoyancy Control)

501,204 lbs 751,805 lbs (including 1.5x Safety Factor)

Owner:	WBI Energy Transmission
Project:	North Bakken Expansion
Date:	2020-07-29
Calculation Description:	Stress Assessment NPS 24 HDD
Applicable Crossings:	Lake Sakakawea - 10.5 lb/gal Fluid

CCI & Associates Inc.

Completed By:	KP	Reviewed By:	JT	Sheet Revision:	R19.1

Pipe Information			Design Criteria				Crossing Characteristics	
Pipe Diameter (in)	Pipe W.T. (in)	Pipe Grade (psi)	MOP (psi)	Max. Operating Temperature (°F)	Installation Temperature (°F)	Design Radius (ft)	Maximum Depth From Entry Location (ft)	HDD Length (ft)
24	0.990	60000	1,480	100	60	5000	361	15393

The pipe section installated stresses are modelled in 5 sections (exit tangent (5), exit arc (4), bottom tangent (3), entry arc (2), entry tangent (1)) incorporating effects of buoyancy, soil friction, curvature, fluidic drag and pipe weight. The calculated stresses are evaluated using the AGA method (PRCI). Operating stresses incorporate hoop, bending, tensile, and thermal expansion.

Variable Definitions:

F_y - Specified Minimum Yield Strength
D - Outer Diameter of Product Pipe
E - Young's Modulus (Steel)
t - Wall Thickness of Product Pipe

Tensile Stress:

			% of Allowable
5	6777.8 psi	**PRCI 5.1.1, 5.5**	12.6%
4	7208.1 psi		**13.3%**
3	5968.7 psi	**Allowable Tensile Stress**	11.1%
2	6336.4 psi	$F_t = (0.9) * F_y$	11.7%
1	6454.9 psi	= 54000 psi	12.0%

Bending Stress:

			% of Allowable
5	295.0 psi	**PRCI 5.2.2**	0.7%
4	5900.0 psi	$f_b = (E/D)/(2R)$	**13.1%**
3	295.0 psi	**Allowable Bending Stress**	0.7%
2	5900.0 psi	$F_b = \{0.72 - (0.58\ F_y\ D / (E\ t)\}\ F_y$	**13.1%**
1	295.0 psi	= 45000 psi	0.7%

Hoop Stress:

			% of Allowable
5	1353.3 psi	**PRCI 5.2.3**	5.8%
4	2335.1 psi	$f_h = P_{ext}D/2t$	**10.0%**
3	2335.1 psi	**Allowable Hoop Stress**	**10.0%**
2	2335.1 psi	$F_{hc} = [0.88 \times E \times (t/D)^2] / 1.5$	**10.0%**
1	1208.9 psi	= 23300.7 psi	5.2%

Operating Stresses:

			% of Allowable
5	10197.0 psi	**PRCI 5.4.4.2:**	37.8%
4	12999.5 psi	**Allowable Shear Stress**	**48.1%**
3	10197.0 psi	F(v) = 45% of F_y	37.8%
2	12999.5 psi	F(v) = 27000 psi	**48.1%**
1	10197.0 psi		37.8%

Combined Stress (Tensile and Bending)

			% of Allowable
5	0.13	**PRCI 5.2.4**	13%
4	0.26	$f_t/0.9F_y+f_b/F_b \le 1$	**26%**
3	0.12		12%
2	0.25		25%
1	0.13		13%

Combined Stress (Tensile, Bending, and Hoop)

			% of Allowable
5	0.02	**PRCI 5.2.4**	2%
4	0.08	$A^2+B^2+2v\lvert A\rvert B \le 1$	**8%**
3	0.02	$A = ((f_t+f_b-0.5f_h)1.25)/F_y$	2%
2	0.07	$B = 1.5f_h/F_{hc}$	7%
1	0.02		2%

Estimated PullForce (without Buoyancy Control)

515,588 lbs 773,382 lbs (including 1.5x Safety Factor)

Owner:	WBI Energy Transmission
Project:	North Bakken Expansion
Date:	2020-07-29
Calculation Description:	Stress Assessment NPS 24 HDD
Applicable Crossings:	Lake Sakakawea - 12 lb/gal Fluid

CCI & Associates Inc.

Completed By: KP | Reviewed By: JT | Sheet Revision: R19.1

Pipe Information			Design Criteria				Crossing Characteristics	
Pipe Diameter (in)	Pipe W.T. (in)	Pipe Grade (psi)	MOP (psi)	Max. Operating Temperature (°F)	Installation Temperature (°F)	Design Radius (ft)	Maximum Depth From Entry Location (ft)	HDD Length (ft)
24	0.990	60000	1,480	100	60	5000	361	15393

The pipe section installated stresses are modelled in 5 sections (exit tangent (5), exit arc (4), bottom tangent (3), entry arc (2), entry tangent (1)) incorporating effects of buoyancy, soil friction, curvature, fluidic drag and pipe weight. The calculated stresses are evaluated using the AGA method (PRCI). Operating stresses incorporate hoop, bending, tensile, and thermal expansion.

Variable Definitions:

F_y - Specified Minimum Yield Strength
D - Outer Diameter of Product Pipe
E - Young's Modulus (Steel)
t - Wall Thickness of Product Pipe

Tensile Stress:

			% of Allowable
5	6969.8 psi	**PRCI 5.1.1, 5.5**	12.9%
4	7689.7 psi		14.2%
3	8133.7 psi	**Allowable Tensile Stress**	15.1%
2	8807.5 psi	$F_t = (0.9) * F_y$	16.3%
1	8935.1 psi	= 54000 psi	**16.5%**

Bending Stress:

			% of Allowable
5	295.0 psi	**PRCI 5.2.2**	0.7%
4	5900.0 psi	$f_b = (E/D)/(2R)$	**13.1%**
3	295.0 psi	**Allowable Bending Stress**	0.7%
2	5900.0 psi	$F_b = \{0.72 - (0.58\ F_y\ D / (E\ t)\}\ F_y$	**13.1%**
1	295.0 psi	= 45000 psi	0.7%

Hoop Stress:

			% of Allowable
5	1520.4 psi	**PRCI 5.2.3**	6.5%
4	2642.4 psi	$f_h = P_{ext}D/2t$	**11.3%**
3	2642.4 psi	**Allowable Hoop Stress**	**11.3%**
2	2642.4 psi	$F_{hc} = [0.88 \times E \times (t/D)^2] / 1.5$	**11.3%**
1	1355.4 psi	= 23300.7 psi	5.8%

Operating Stresses:

			% of Allowable
5	10197.0 psi	**PRCI 5.4.4.2:**	37.8%
4	12999.5 psi	**Allowable Shear Stress**	**48.1%**
3	10197.0 psi	F(v) = 45% of F_y	37.8%
2	12999.5 psi	F(v) = 27000 psi	**48.1%**
1	10197.0 psi		37.8%

Combined Stress (Tensile and Bending)

			% of Allowable
5	0.14	**PRCI 5.2.4**	14%
4	0.27	$f_t/0.9F_y+f_b/F_b \le 1$	27%
3	0.16		16%
2	0.29		**29%**
1	0.17		17%

Combined Stress (Tensile, Bending, and Hoop)

			% of Allowable
5	0.03	**PRCI 5.2.4**	3%
4	0.09	$A^2+B^2+2\nu\lvert A\rvert B \le 1$	9%
3	0.04	$A = ((f_t+f_b-0.5f_h)1.25)/F_y$	4%
2	0.10	$B = 1.5f_h/F_{hc}$	**10%**
1	0.04		4%

Estimated PullForce (without Buoyancy Control)

639,119 lbs 958,679 lbs (including 1.5x Safety Factor)

Owner:	WBI Energy Transmission
Project:	North Bakken Expansion
Date:	08/01/2019
Calculation Description:	HDD Pipe Pullback Analysis NPS 24
Applicable Crossings:	Lake Sakakawea - 12 lb/gal Fluid

CCI & Associates Inc.

Completed By:	KP	Reviewed By:	JT	Sheet Revision: R19.1

Pipe Information			Design Criteria					
Pipe Diameter (in)	**Pipe W.T. (in)**	**Pipe Grade (psi)**	**Overbend Radius (ft)**	**Total Supported Weight (lbs/ft)**	**Maximum Support Spacing (ft)**	**Roller Spacing (ft)**	**Maximum Unsupported Overhang (ft)**	**Estimated Pullforce (lbs)**
24.00	0.990	60000	1,600	242.0	80	40	60	958,679

The pipe pullback is modelled such that the pipe is not over-stressed due to the combination of bending, tensile, and shear stresses throughout the pullback section, both in the spans between supports and at the support locations.
The pullback is also modelled such that the supports are not overloaded with the weight of the pipe at any point during the pipe installation, including as the tailing end passes from support to support.

Definitions:

SMYS - Specified Minimum Yield Strength
Overhang - Where Unsupported Tail End of Pipe Extends Beyond Support
Full Span - Where Pipe Is Supported Between 2 Supports at Maximum Support Spacing Shown Above

SUPPORT LOADING

Vertical Load at Each Boom/Crane Support — **% of Support Capacity ***

At Support With Full Span:
25,100 kg 55,400 lbs — **97.9%**
At Support With Overhang:
15,400 kg 33,900 lbs — 60.1%

Longitudinal Load at Each Boom/Crane Support
2510.0 kg 5,540 lbs

* based on load capacity of Darby 24"-36" Rolli-Cradle

Horizontal Load at Each Boom/Crane Support
43 kg 95 lbs

Horizontal Load at Each Roller Support
43 kg 95 lbs

PIPE STRESS

Bending Stress	**% SMYS**	**% of Allowable (PRCI)**
At Support With Full Span:		
22355.6 psi	37.3%	53.9%
At Support with Overhanging Pipe:		
26363.1 psi	43.9%	**63.5%**

Tensile Stress

10411.5 psi	17.4%	**19.3%**

Combined Stress (Tensile and Bending)

32767.1 psi	54.6%	**73%**

APPENDIX C – RISK ASSESSMENT SUMMARY

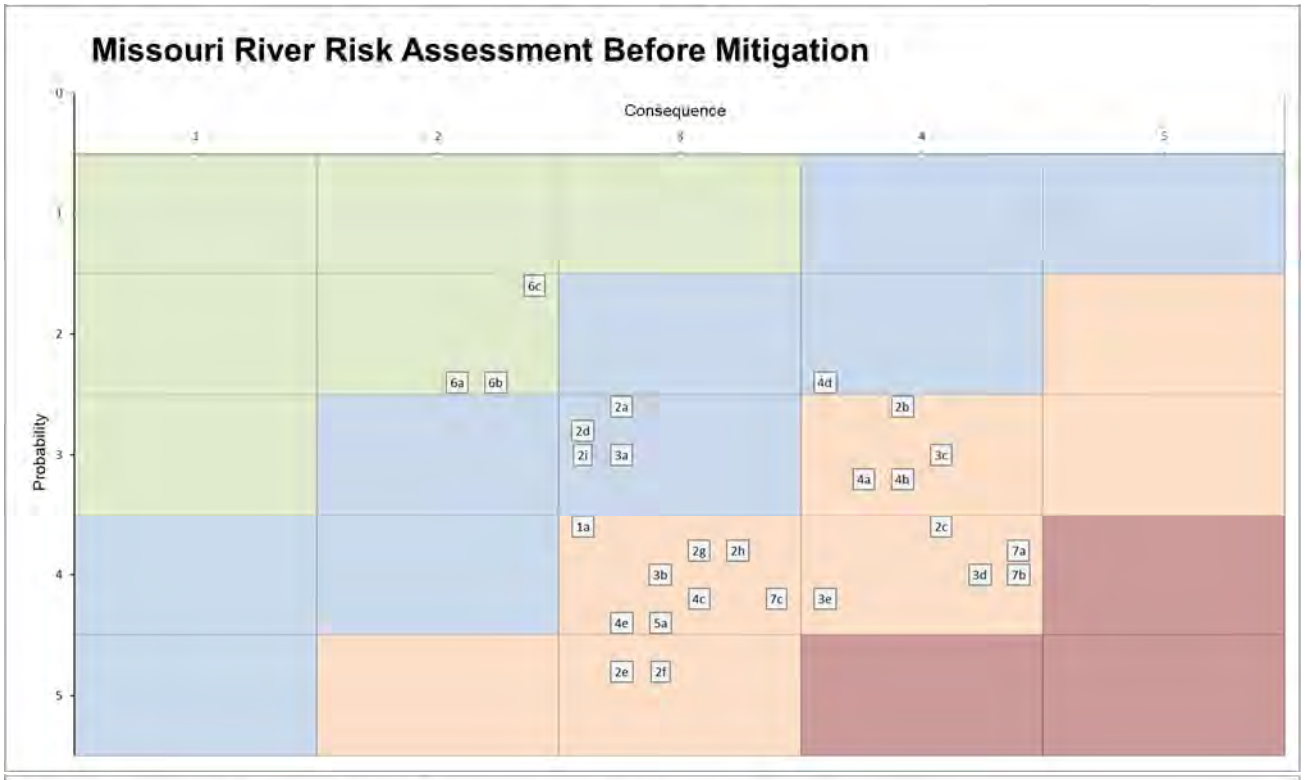
Missouri River Risk Assessment Summary

Phase	#	Description	Safety and Health Risk	Environmental Risk	Financial Risk	Production/Schedule Risk	Reputation Risk	Business Impact Risk	Risk Before Mitigation	Risk After Mitigation
Installation of Casing (Entry and Exit Points)	1a	Casing not Being Installed to Depth							High Risk	Medium Risk
Pilot Hole	2a	Fracture to Surface (Entry or exit, whichever poses as the greatest risk)		✓	✓	✓			Medium Risk	Medium Risk
	2b	Fracture to Water Body		✓	✓	✓	✓	✓	High Risk	Medium Risk
	2c	Large Fluid Loss to the Formation (>25% of total volume)		✓	✓	✓			High Risk	Medium Risk
	2d	Unstable Borehole (swelling, broken up, etc.)			✓	✓			Medium Risk	Medium Risk
	2e	Steering Control Issues			✓	✓			High Risk	High Risk
	2f	Annular Pressure Issues		✓	✓	✓			High Risk	High Risk
	2g	Over-Schedule Risk			✓	✓			High Risk	Medium Risk
	2h	Disposal of Drilling Fluid		✓	✓	✓			High Risk	Medium Risk
	2i	Water Ingress to Borehole			✓	✓			Medium Risk	Low Risk
Reaming Operations	3a	Unstable Borehole			✓	✓			Medium Risk	Medium Risk
	3b	Over-Schedule Risk			✓	✓			High Risk	Medium Risk
	3c	Loss of Equipment in Borehole			✓	✓	✓		High Risk	Medium Risk
	3d	Poor Removal of Cuttings			✓	✓			High Risk	High Risk
	3e	Drilling Fluid Control			✓	✓			High Risk	Medium Risk
Pullback Operations	4a	Pipe Section Gets Stuck in Borehole			✓	✓			High Risk	Medium Risk
	4b	Pull Forces Exceed Theoretical Model							High Risk	Medium Risk
	4c	Coating Damaged during Installation			✓	✓			High Risk	Medium Risk
	4d	Product Pipe is Damaged during Installation			✓	✓	✓		Medium Risk	Medium Risk
	4e	Pipe Handling on Exit	✓		✓	✓			High Risk	Medium Risk
Pipeline Contractor - Pipe Preparation and Support	5a	HDD Takes Longer than Scheduled to Complete			✓	✓			High Risk	Medium Risk
Construction Access and Pad Preparation	6a	Construction Access			✓	✓			Low Risk	Low Risk
	6b	Pad Layout & Construction			✓	✓			Low Risk	Low Risk
	6c	Travel Safety	✓				✓		Low Risk	Low Risk
Other Risks	7a	Crossing Length			✓	✓	✓	✓	High Risk	High Risk
	7b	Access to Water			✓	✓			High Risk	Medium Risk
	7c	Public Attention			✓		✓	✓	High Risk	Medium Risk
	7d				✓	✓	✓	✓		

Probability		
Value	Description	Chance
1	Rare	≤ 5%
2	Unlikely	~ 25%
3	Possible	~ 50%
4	Likely	~ 75%
5	Almost Certain	≥ 95%

Consequence	
Value	Description
1	Insignificant
2	Minor
3	Moderate
4	Major
5	Catastrophic

L	Low Risk - Managed by routine procedures
M	Medium Risk - Planned Mitigation Strategy Required
H	High Risk - Prioritized Mitigation Strategy Required
VH	Very High Risk - Immediate Mitigation Strategy Required


Missouri River Risk Assessment Before Mitigation
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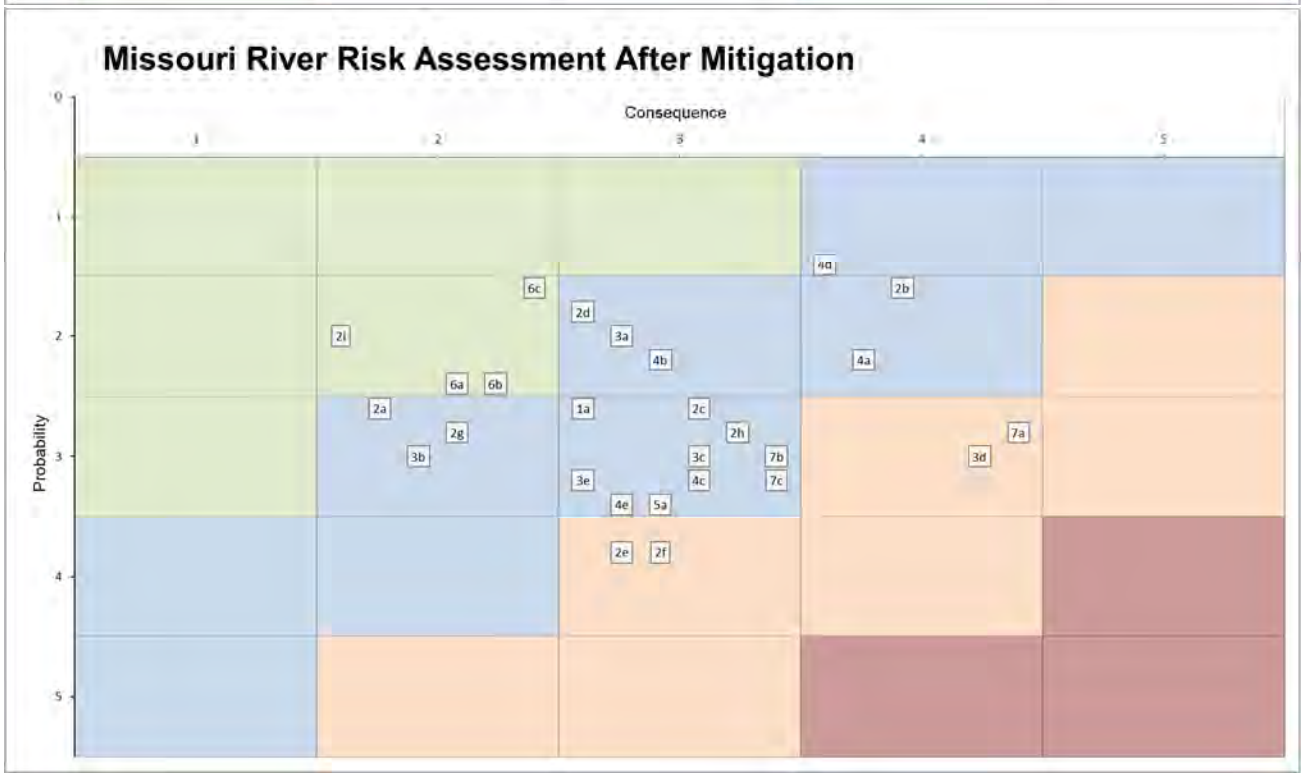
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Attendance: Kerby, Chelsea, Justin, Landon, Stefan, Steve, Neil

Missouri River

Date: July 31, 2020
Rev: 0

Mud Motor HDD Risk Assessment

No.	Risk/Issue	Type of Risk/Issue		Pre-Mitigation Probability	Pre-Mitigation Consequence	Post-Mitigation Probability	Post-Mitigation Consequence	Review Cost Needed?
Installation of Casing (Entry and Exit Points)								
1a	Casing not Being Installed to Depth	Safety and Health	-	4	3	3	3	Select
		Environment	-	High Risk		Medium Risk		
		Financial	-	**Description**		**Mitigation Strategy**		
		Production/Schedule	-	Geotechnical conditions near surface can pose a problem when driving casing to a designed depth. It is expected both the entry and exit locations will require casing. The entry (south) is expected to be cased to the shale/siltstone bedrock, and the exit location will be cased past the coal layer. The proposed lengths of casing install, although expected to be achievable, are quite considerable.		Achievable casing installation lengths should be investigated prior to construction. The casing should be installed in 160-200ft lengths of telescoped casing. The final casing size shall be 48" and the initial casing should be sized to ensure the final casing will reach the required depth for seating.		
		Reputation	-					
		Business Impact	-					
Pilot Hole								
2a	Fracture to Surface (Entry or exit, whichever poses as the greatest risk)	Safety and Health	-	3	3	3	2	Select
		Environment	Yes	Medium Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Granular material near surface can pose a potential risk for drilling fluid to fracture to surface. The crossing is characterized by well graded to poorly graded sand to depths of 20-120ft.		The sand is expected to be stable enough to maintain an open borehole, or cased. The topography near entry and exit is relatively flat and allows the drill to obtain sufficient depth to effectively mitigate the risk of fracture.		
		Reputation	-					
		Business Impact	-					
2b	Fracture to Water Body	Safety and Health	-	3	4	2	4	Select
		Environment	Yes	High Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Fractured formations (including coal seams as identified within the bedrock formation) or high annular pressures could result in release of fluid to surface. The length of the Missouri River crossing results in high pressures due to the building friction forces. The bedrock layer is inconsistent and dips fairly significantly in the middle of the Missouri River, reducing the expected strength of the overburden formation.		The crossing is designed to be completed as an intersect which will limit the expected drilling pressures. The crossing has been designed with significant depth to limit the potential for fracture. Casing will also help with circulation back to entry/exit locations, which should reduce the potential for climbing annular pressures. Contractor shall utilize an Annular Pressure Tool to measure actual downhole pressures during drilling of the pilot hole to ensure any significant increases in pressure beyond planned ranges can be addressed and reduced to within expected ranges with mechanical tripping or additional circulation as applicable.		
		Reputation	Yes					
		Business Impact	Yes					
2c	Large Fluid Loss to the Formation (>25% of total volume)	Safety and Health	-	4	3	3	3	Select
		Environment	Yes	High Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Drilling fluid has the potential to migrate outside of the designed drill path in fractures. The crossing location is characterized by several coal seams, including two thick coal seams above and below the bottom tangent of the drill path, which may act as preferential path for drilling fluid.		The drill depth has been chosen to limit the risk of fracture to surface. Casing is included in the design to minimize the amount of coal seams the drill path will encounter. The contractor shall develop a mitigation plan for reducing significant losses where possible, including the use of Loss Circulation Material (LCM) pills to try to plug off any encountered zones of significant fluid loss.		
		Reputation	-					
		Business Impact	-					
2d	Unstable Borehole (swelling, broken up, etc.)	Safety and Health	-	3	3	2	3	Select
		Environment	-	Medium Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Site conditions have identified granular materials at both entry and exit locations. During drilling operations this material can become unstable and collapse, which may cause reduced returns. Casing has been specified on entry and exit.		The Contractor should monitoring annular pressure and returns to ensure the borehole remains clear of obstructions, if returns slow the Contractor should mechanically clean the hole.		
		Reputation	-					
		Business Impact	-					
2e	Steering Control Issues	Safety and Health	-	5	3	4	3	Select
		Environment	-	High Risk		High Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	The crossing is 15,393ft long and each rig will need to drill 7000ft-8000ft. Maintaining weight on bit in order to be able to steer at this length is expected to be difficult, complicating the intersect.		The crossing is designed with a large radius which will reduce the steering requirements. The Contractor is utilizing 7 5/8" drill string and gyro steering systems to ensure accuracy and a successful intersect. The bottom tangent is very long and will allow the drills sufficient time to align for intersect operations. Casing may help to maintain weight on bit.		
		Reputation	-					
		Business Impact	-					
2f	Annular Pressure Issues	Safety and Health	-	5	3	4	3	Select
		Environment	Yes	High Risk		High Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Drilling operations require soil cuttings to be cleaned out of the bore and hydro-transported back to the rig by the drilling fluid. This process requires large volumes of pressurized drilling fluid to be pumped downhole. The length of the crossing will increase the risk of annular pressure issues.		The Contractor shall maintain returns to both entry pits and monitor annular pressures. A mud engineer shall be on site to monitor adherence to the crossing specific Engineered Drilling Fluid Plan (EDFP). A bottoms up procedure (circulating the calculated amount of fluid that it takes to flow from the bit downhole back up to the entry pit) should be in place and followed when necessary to clean the hole.		
		Reputation	-					
		Business Impact	-					
2g	Over-Schedule Risk	Safety and Health	-	4	3	3	2	Select
		Environment	-	High Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Geotechnical conditions, permitting, and environmental issues can all contribute to delays in the schedule. The crossing is long with a large borehole size. Over schedule could significantly increase costs. Significant delays could have a large financial impact due to delay to in-service date.		All requirements of the permits should be strictly followed. The Contractor shall ensure proper drilling procedures are in place. Encountered geotechnical conditions should be monitored and reported during drilling so modifications can be made to execution strategy, as required, to ensure no negative impacts. It is recommended construction proceed 24/7 with 2 12hr rotational shifts per day.		
		Reputation	-					
		Business Impact	-					
2h	Disposal of Drilling Fluid	Safety and Health	-	4	3	3	3	Select
		Environment	Yes	High Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Drilling fluid needs to be stored and disposed of. Running out of temporary storage can lead to schedule delays and environmental concerns. The length and large borehole size will result in significant volumes of drilling fluid. Drilling fluid may be contaminated due to coal seams.		Adequate storage should be on site. An EDFP should be followed and an adequate recycling system will be on site. An approved disposal plan should be developed prior to construction. Facility disposal should be expected.		
		Reputation	-					
		Business Impact	-					
2i	Water Ingress to Borehole	Safety and Health	-	3	3	2	2	Select
		Environment	-	Medium Risk		Low Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Ground water tends to migrate to where soil has been cut/ displaced. Coal seams may provide preferential paths for water ingress into the borehole. The ingress of water may dilute the bentonite drilling fluid and reduce the carrying capacity.		The crossing is level and the hole will be full of drilling fluid. Since the identified seams are below rig elevation, it is anticipated that the hydrostatic pressure of the drilling fluid will minimize water ingress to a manageable range.		
		Reputation	-					
		Business Impact	-					
Reaming Operations								
3a	Unstable Borehole	Safety and Health	-	3	3	2	3	Select
		Environment	-	Medium Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Site conditions have identified granular materials at both entry and exit locations. During drilling operations this material can become unstable and collapse, which may cause reduced returns.		The Contractor should monitoring annular pressure and returns to ensure the borehole remains clear of obstructions, if returns slow the Contractor should mechanically clean the hole. Adequate pumps for the ream size and length should be on site.		
		Reputation	-					
		Business Impact	-					
3b	Over-Schedule Risk	Safety and Health	-	4	3	3	2	Select
		Environment	-	High Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Geotechnical conditions, permitting, and environmental issues can all contribute to delays in the schedule. The crossing is long with a large borehole size.		All requirements of the permits should be strictly followed. The Contractor shall ensure proper drilling procedures are in place. Geotechnical conditions should be monitored and reported during drilling so modifications can be made to execution strategy, as required, to ensure no negative impacts. Using two rigs will split the workload which would be normally be placed upon a single rig.		
		Reputation	-					
		Business Impact	-					
		Safety and Health	-	3	4	3	3	Select
		Environment	-	High Risk		Medium Risk		

3c	Loss of Equipment in Borehole	Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	Reaming or enlarging the bore to the desired diameter may cause instability areas. These areas may cause downhole tooling to get stuck or lost. Loss of equipment within the borehole is a larger risk than with a shorter crossing.			The utilization of intersect methodology will mitigate the risk of losing equipment within the borehole. Using two rigs will split the workload which would be normally be placed upon a single rig. If problems arise on one side of the reamer, the opposite rig will maintain contact with the downhole tooling and be able to trip to surface. Drill string management plan should be provided by the contractor, which should include regularly switching out drill stem on either side of the reamers.		
		Reputation	Yes						
		Business Impact	-						
3d	Poor Removal of Cuttings	Safety and Health	-	4	4		3	4	Select
		Environment	-	High Risk			High Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	Due to the large ream pass and length a large amount of cuttings will be created and therefore will have to be removed from the borehole.			Drilling fluid parameters will be optimized for maximum cutting transportation, through adherence to the EDFP. High pump rates throughout the ream passes of the HDD will increase the annular velocity and therefore carrying capacity. Additional trips will be necessary to mechanically remove cuttings from the borehole. The number of trips required will be based on the borehole conditions. The cut size should ensure that cuttings can be removed.		
		Reputation	-						
		Business Impact	-						
3e	Drilling Fluid Control	Safety and Health	-	4	4		3	3	Select
		Environment	-	High Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	As the volume of drilling fluid within the borehole increases, it becomes more difficult to change its properties with drilling fluid additives. The large diameter borehole combined with the length will impact the quality and makeup of the drilling fluid. Coal seams may contaminate drilling fluid. Contractor will be hauling in water.			The Contractor should prepare and adhere to an approved EDFP which will outline the steps required to ensure the highest quality of drilling fluid is used for the crossing. A premix tank should be made available in addition to the mud tank. Contractor should continue to adhere to the EDFP throughout reaming operations even if they are experiencing fluid losses.		
		Reputation	-						
		Business Impact	-						
Pullback Operations									
4a	Pipe Section Gets Stuck in Borehole	Safety and Health	-	3	4		2	4	Select
		Environment	-	High Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	There is a risk that the pipe section becomes stuck in the borehole due to borehole length, instability, blockages, or irregularities. The pullforce for this length is between approximately 502,000 and 960,000lbs.			One or more wiper trips shall be completed to ensure a clean hole. Required force should be monitored during the wiper passes. It is recommended that a Pipe Thruster (with custom inserts for NPS 24) be available on exit side to assist the rig with pullback in the event pullforces start to become exceedingly high.		
		Reputation	-						
		Business Impact	-						
4b	Pull Forces Exceed Theoretical Model	Safety and Health	-	3	4		2	3	Select
		Environment	-	High Risk			Medium Risk		
		Financial	-	Description			Mitigation Strategy		
		Production/Schedule	-	There is a risk that pull forces exceed the theoretical model, especially with the length of the drill. Contributing factors can include cuttings in the borehole, having to temporarily halt line pull, borehole instability, and heavy drilling fluid.			A swab pass should be completed and downtime during installation should be minimized. It is expected pipe pull will continue overnight as required. This should be planned for with crews in advance, lighting shall be sufficient to allow overnight operations for pull. Pipe thruster should be available on exit side to assist the rig will pullback.		
		Reputation	-						
		Business Impact	-						
4c	Coating Damaged during Installation	Safety and Health	-	4	3		3	3	Select
		Environment	-	High Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	Gravel, cobbles, boulders, and bedrock interfaces within the bore path pose a risk that the pipe coating is damaged during line pull.			Wiper passes shall be completed to gauge any possible areas of issue, and additional passes may be used to ensure minimized risk prior to pullback. FBE and ARO coated pipe shall be used.		
		Reputation	-						
		Business Impact	-						
4d	Product Pipe is Damaged during Installation	Safety and Health	-	2	4		1	4	Select
		Environment	-	Medium Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	If the borehole has any ledges (intersect location or bedrock interface), the pipe could get hung up or scratched on these ledges resulting in pipe damage.			Ledges shall be reamed/smoothed out prior to product pipe installation. The intersect should be completed as straight as possible to reduce the potential for a ledges where the bits meet.		
		Reputation	Yes						
		Business Impact	-						
4e	Pipe Handling on Exit	Safety and Health	Yes	4	3		3	3	Select
		Environment	-	High Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	The exit angle, wall thickness, and size of the pipe result in a large radius overbend that reaches a height of 35 ft. The pipe section requires significant support equipment.			A pullback lift plan should be created prior to construction for review and approval. The equipment capacities should be sufficient for the anticipated loads. Spreader bars may reduce crane requirements. A traffic plan should be created for Highway 17A (52nd Street NW) and 54th Street NW (if required).		
		Reputation	-						
		Business Impact	-						
Pipeline Contractor - Pipe Preparation and Support									
5a	HDD Takes Longer than Scheduled to Complete	Safety and Health	-	4	3		3	3	Select
		Environment	-	High Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	There is significant support equipment required for pullback. If pullback is delayed this could be a large cost to keep the equipment on site. If the pipe section is not ready for pull the hole could tighten.			The pullback section should be completed significantly before pull is expected to ensure no unneccesary delays. Coordination of all contractors. Traffic plan for Highway 17A.		
		Reputation	-						
		Business Impact	-						
Construction Access and Pad Preparation									
6a	Construction Access	Safety and Health	-	2	2		2	2	Select
		Environment	-	Low Risk			Low Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	Access is assumed to be along ROW, through agricutural fields.			All agreements should be in place prior to mobilization. All workspace should be cleared as required. Access should be prepared.		
		Reputation	-						
		Business Impact	-						
6b	Pad Layout & Construction	Safety and Health	-	2	2		2	2	Select
		Environment	-	Low Risk			Low Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	The workspace are within grassy fields, clearing and grading are expected to be minimal.			All agreements should be in place prior to mobilization. All workspace should be cleared as required.		
		Reputation	-						
		Business Impact	-						
6c	Travel Safety	Safety and Health	Yes	2	2		2	2	Select
		Environment	-	Low Risk			Low Risk		
		Financial	-	Description			Mitigation Strategy		
		Production/Schedule	-	Contractor will have to travel to site from a off project location. Could continue into winter.			A travel plan should be in place.		
		Reputation	Yes						
Other Risks									
7a	Crossing Length	Safety and Health	-	4	4		3	4	Select
		Environment	-	High Risk			High Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	The crossing is 15,393ft long, approaching record lengths for an HDD crossing. There is a risk that the crossing could encounter compounding issues that lead to the crossing not being completed successfully.			A competent contractor with adequate tooling and relevant experience with similarly large installations has been selected. The risks should be highlighted to all stakeholders.		
		Reputation	Yes						
		Business Impact	Yes						
7b	Access to Water	Safety and Health	-	4	4		3	3	Select
		Environment	-	High Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	Water sources should be investigated/confirmed. Water transport should be a major consideration.			Additional transport and water sources should be investigated prior to construction. Transport should include contingency to ensure a lack of water does not lead to any delays with progress of the drill, particularly in the event of significant fluid losses during drilling, where large volumes of make-up water may be required.		
		Reputation	-						
		Business Impact	-						
7c	Public Attention	Safety and Health	-	4	3		3	3	Select
		Environment	-	High Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	-	Scrutiny is possible in the area. There is a risk of negative public perception issues. The summer season will see high levels of lake use.			The contractor shall ensure all procedures are being followed and their impact is minimized. The contractor shall ensure all correspondence with the public is completed by WBI representation.		
		Reputation	Yes						
		Business Impact	Yes						

APPENDIX D – GEOTECHNICAL REPORTS

CCI and Associates, Inc.

Geotechnical Investigation Report

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Date:
June 14, 2019

Geotechnical Investigation Report

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

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6/14/2019

Anthony Frances, PE
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Appendices

Appendix A - Boring Logs
Appendix B - Photographic Documentation
Appendix C - Laboratory Reports

Acronyms

ASTM	American Society for Testing and Materials
CCI	CCI and Associates, Inc.
GES	Groundwater & Environmental Services, Inc.
HDD	horizontal directional drilling
HSA	Hollow-stem auger
IDS	Interstate Drilling Services, LLP
MTS	Material Testing Services, LLC
TGCBA	Tobacco Garden Creek Bay Area
USACE	US Army Corp of Engineers

1 Introduction

This report presents the results of the geotechnical investigation that was performed by Groundwater and Environmental Services, Inc. (GES) for the project known as the WBI North Bakken Expansion Project in western North Dakota. Specifically, this report covers the geotechnical exploration at 3 land-based soil borings located along the proposed horizontal directional drilling (HDD) pipeline project under Lake Sakakawea/Missouri River (**Figure 1**). The proposed pipeline alignment under Lake Sakakawea is located approximately 1 mile northeast of the Tobacco Garden Creek Bay Area (TGCBA). The TGCBA is located approximately 23 miles northeast of Watford City, North Dakota.

Services for this investigation were performed in general accordance with the April 1, 2019 Services Contract by and between CCI and Associates, Inc. (CCI) and GES.

1.1 Project Location and Scope

The objective of this phase of the geotechnical investigation is to assist CCI with evaluating the subsurface conditions at 3 land-based boring locations (LB-1 through LB-3) located along the proposed HDD pipeline alignment on the north and south sides of Lake Sakakawea.

The scope of work included the following:

- Prepare a site-specific health and safety plan for GES employees and subcontractors for the proposed geotechnical investigation activities.
- Coordinate field activities and communication with project team and CCI.
- Arrange for utility clearance through North Dakota One Call.
- Mobilize our drilling project team to the project including Interstate Drilling Services, LLP (IDS) and GES personnel.
- Advance 3 land-based soil borings and collect samples at designated locations surveyed by a CCI subcontractor.
- Contract laboratory tests on soil samples obtained from the 3 land-based soil borings to evaluate physical properties.
- Provide a written geotechnical report.

2 Methods

2.1 Soil Borings

As part of the geotechnical investigation, GES contracted with IDS of Grand Forks, North Dakota, to advance the 3 land-based soil borings (**Figure 1**). IDS used a Diedrich D-50 track-mounted drill rig to advance the borings and collect soil samples.

The drilling rig, equipment and supplies mobilized to the project location on April 23, 2019. Advancement of soil boring LB-1 began on April 24 and the last soil boring LB-3 was completed on May 5, 2019. The drilling operation consisted of one crew working 12-hour shifts. Borehole locations for LB-1 through LB-3 were provided by CCI and are provided in **Table 1**.

Soil borings LB-1, LB-2, and LB-3 were completed to depths of 403 feet, 400 feet, and 370 feet below grade, respectively. Hollow-stem auger (HSA) boring methodology was used to collect soil samples while boring through unconsolidated sediment in the upper portion of each soil boring. Once competent sediment was encountered, a closed loop, fluid rotary drilling methodology was used to advance the borings. Rock coring drilling methodology was used at each boring for the last, approximately 200+ feet (to boring terminus). Upon completion, each boring was sealed from the boring terminus to ground surface with a concrete/bentonite slurry through a tremie rod. Drilling cuttings and sediment were thin spread at each boring location.

During HSA and fluid rotary drilling methodology, 1.5-foot samples were collected at 5 foot intervals using a split-spoon sampler in accordance with American Society for Testing and Materials (ASTM) D1586 (*Standard Test Method for Standard Penetration Test [SPT] and Split-Barrel Sampling of Soils*) using a 2-inch diameter split-spoon sampler. During rock coring drilling methodology, samples were generally collected at 5-foot sample intervals continuously in accordance with ASTM D2113 (*Standard Practice for Rock Core Drilling and Sampling of Rock for Site Exploration*) using a using a NQ3 size, triple-tube core barrel with a diamond bit.

Soils were classified in the field by a GES field geologist using ASTM Visual-Manual procedures (ASTM D2488, *Standard Practice for Description and Identification of Soils [Visual-Manual Procedure]*). The field geologist also collected samples from the split-spoon sampler and rock core sampler for geotechnical laboratory testing.

The boring logs and standard boring classification guidelines are contained in **Appendix A**. Photographic documentation of the project is provided in **Appendix B.**

2.2 Laboratory Testing

GES contracted with Material Testing Services, LLC (MTS) of Minot, North Dakota to provide geotechnical laboratory testing and evaluation services to aid in classifying and evaluating the physical properties of the soil/rock samples. Soil/rock sample selection and laboratory test parameters were determined by CCI.

The laboratory testing included the following:

- Moisture Content (ASTM D4959 - Standard Test Method for Determination of Water Content of Soil by Direct Heating and D4643 - Standard Test Method for Determination of Water Content of Soil and Rock by Microwave Oven Heating).
- Sieve Analysis (ASTM D422 – Test Method for Particle-size Analysis of Soils).
- Atterberg Limits (ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils).
- Unconfined Compression Testing (ASTM D2166 – Standard Test Method for Unconfined Compressive Strength of Cohesive Soils).

Test results are summarized in **Table 2** with the exception of the unconfined compression test results, which are provided with the laboratory reports in **Appendix C.**

3 Site Conditions

The proposed HDD pipeline crossing traverses southwest to northeast across Lake Sakakawea approximately 1 mile northeast of the TGCBA. The physiographic regions where the proposed HDD pipeline crossing is located consist of the McKenzie Upland Unit, located southwest of the Missouri River and the Coteau Slope Unit, located northeast of the Missouri River. These units are part of the Great Plains and are characterized by rolling to hilly plains with both erosional and glacial landforms. The proposed HDD crossing is located within the historic Missouri River floodplain that was flooded with the construction of the Garrison Dam in 1956 to form Lake Sakakawea. This area is located in the central portion of the Williston Basin.

The surface geology in the area consists of thin layers of glacial deposits underlain by the Tertiary-Aged Sentinel Butte Formation and Bullion Creek Formation. The Sentinel Butte Formation consists of layers of silt, clay, sand, lignite, carbonaceous shale, and mudstone (Carlson, 1985). The Bullion Creek Formation underlies the Sentinel Butte Formation and consists of yellowish layers of silt, clay, and sand with interbedded sandstone, lignite, baked clay, and limestone (Bluemle, 1977). Both formations form rolling topography over broad areas and has been eroded to badlands near rivers.

Soil borings LB-1 through LB-3 generally consisted of well graded to poorly graded sand in the upper portion of the borings. The well graded to poorly graded sand was logged from the ground surface to a depth of approximately 25 feet below grade at LB-1 and from the ground surface to approximately 120 feet below grade at LB-2 and LB-3. Underlying the sand, silt, clay (lean and fat), weathered shale, and silty sand were logged. Underlying the sand, lignite (laminations to layers >20 feet thick) were logged throughout each boring to boring terminus. Saturated conditions were only encountered at boring LB-3, at 24.5 feet below grade.

4 Limitations

The data generated and conclusions and opinions provided are based on the scope of work performed. All work was conducted in a manner consistent with currently accepted geotechnical

engineering practices exercised by members of the profession practicing under similar conditions. No other warranty, expressed or implied, is made.

The samples collected and described in this report are representative of the subsurface conditions at the sampled locations and intervals, and therefore, do not necessarily reflect strata variations that may exist between sampled intervals and locations. If variations from the subsurface conditions described in this study are noted during additional investigations and/or construction, recommendations in this report must be re-evaluated.

GES is not responsible for the independent conclusions, opinions, or recommendations made by others based on the data presented in this report. Nor can GES warrant that this report will satisfy the dictates of or provide a legal defense in connection with an environmental law or regulation.

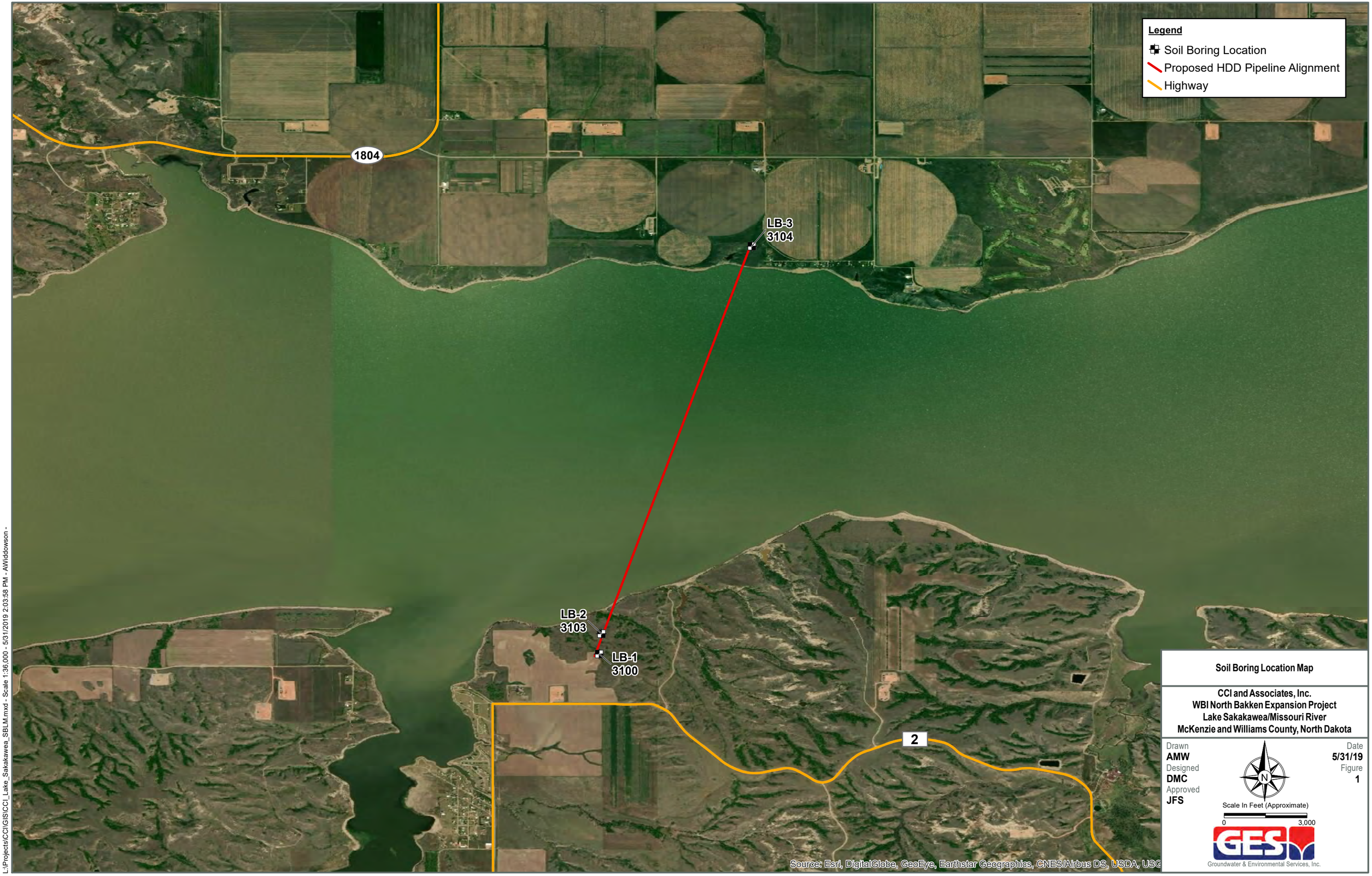
The results reported and any opinions reached by GES are for the benefit of the CCI & Associates and their client and unless agreed to by GES in writing, are not to be disclosed to or relied upon by any third party. The results and opinions set forth by GES in this report will be valid as of the date of the report.

References

Bluemle, J.P. 1977. *Geologic Highway Map of North Dakota*. North Dakota Geological Survey Educational Series 11, Miscellaneous Map 19.

Carlson, Clarence G. 1985. *Geology of McKenzie County, North Dakota.* North Dakota Geological Survey, Bulletin 80 – Part 1 and North Dakota State Water Commission, County Groundwater Studies 37 – Part 1.

Figure



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Soil Boring Location Map

CCI and Associates, Inc.
WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Drawn **AMW**
Designed **DMC**
Approved **JFS**

Date **5/31/19**
Figure **1**

Scale In Feet (Approximate)
0 3,000

Groundwater & Environmental Services, Inc.

Tables

Table 1

Soil Boring Locations

HDD Crossing	Boring ID	Boring Depth (ft)	Sample Interval (ft)	Boring Coordinates	
				Northing	Easting
Lake Sakakawea/Missouri River	LB-1	403	5	417613.836	1335268.645
	LB-2	400	5	418344.342	1335349.645
	LB-3	372	5	432251.954	1339466.302

Table 2

Laboratory Soil Test Data

Boring No.	Sample Depth (ft)	Sample Type	Moisture Content	Grain Size Distribution				Atterberg Limits		
				% Gravel	% Sand	% Silt	% Clay	LL	PL	PI
LB-1	4.5 - 6	SS	9.5							
LB-1	9.5 - 11	SS	13.2							
LB-1	14.5 - 16	SS	32.4							
LB-1	19.5 - 21	SS	4.4							
LB-1	24.5 - 26	SS	19.2							
LB-1	29.5 - 31	SS	24.3							
LB-1	34.5 -36	SS	25.8					50	19	30
LB-1	39.5 - 41	SS	23.8							
LB-1	44.5 - 46	SS	22							
LB-1	49.5 - 51	SS								
LB-1	54.5 - 56	SS	20.7							
LB-1	59.5 - 61	SS	22.2							
LB-1	64.5 - 66	SS	25.8							
LB-1	69.5 - 70	SS								
LB-1	74.5 - 76	SS	26.3							
LB-1	79.5 - 81	SS	24.8							
LB-1	84.5 - 86	SS	22.9							
LB-1	89.5 - 91	SS						57	21	36
LB-1	94.5 - 95	SS								
LB-1	99.5 - 101	SS	23.2							
LB-1	104.5 - 106	SS	24.6							
LB-1	109.5 - 111	SS	23.9							
LB-1	114.5 - 116	SS	22							
LB-1	119.5 - 121	SS	24.4							
LB-1	124.5 - 126	SS	19.1							
LB-1	129.5 - 131	SS						36	20	16
LB-1	134.5 - 136	SS	21.2							
LB-1	139.5 - 141	SS	21.1							
LB-1	144.5 - 146	SS	21.9							
LB-1	149.5 - 151	SS	28.5							
LB-1	154.5 - 156	SS	19.4							
LB-1	159.5 - 161	SS	21							
LB-1	164.5 - 165.5	SS	24.9							
LB-1	169.5 - 171	SS						48	19	28
LB-1	174.5 - 175.5	SS	19.9							
LB-1	179.5 - 180.5	SS	22.6							

Table 2

Laboratory Soil Test Data

Boring No.	Sample Depth (ft)	Sample Type	Moisture Content	Grain Size Distribution				Atterberg Limits		
				% Gravel	% Sand	% Silt	% Clay	LL	PL	PI
LB-1	185 - 189	RC	8.5							
LB-1	189 - 193	RC	13.8							
LB-1	193 - 198	RC	15.4							
LB-1	198 - 203	RC	16							
LB-1	203 - 208	RC								
LB-1	208 -213	RC	16							
LB-1	213 - 218	RC								
LB-1	218 - 223	RC								
LB-1	223 - 228	RC	54.1							
LB-1	228 - 233	RC	60.4							
LB-1	233 - 238	RC	15.4							
LB-1	238 -243	RC								
LB-1	243 - 248	RC	11.6							
LB-1	248 - 253	RC	11							
LB-1	253 - 258	RC	17.9							
LB-1	258 - 263	RC						41	18	23
LB-1	263 - 268	RC	21.2							
LB-1	268 - 273	RC	12.2							
LB-1	273 - 278	RC	11.8							
LB-1	278 - 283	RC	13.8							
LB-1	283 - 288	RC	15.5							
LB-1	288 - 293	RC	15.3							
LB-1	293 -298	RC	14.1							
LB-1	298 - 203	RC	14.2							
LB-1	303 - 308	RC								
LB-1	308 - 313	RC	15.3							
LB-1	313 - 318	RC	21.3							
LB-1	318 - 323	RC	16.9							
LB-1	323 - 328	RC	16.3							
LB-1	328 - 333	RC	13.1							
LB-1	333 - 338	RC	14.3							
LB-1	338 - 343	RC	15.5							
LB-1	343 - 348	RC	15.5							
LB-1	348 - 353	RC	17.6							
LB-1	353 - 358	RC	16.9							
LB-1	358 - 363	RC	16							
LB-1	363 - 368	RC	18.9							
LB-1	368 - 373	RC	16.2							
LB-1	373 - 378	RC	20.2							

Table 2

Laboratory Soil Test Data

Boring No.	Sample Depth (ft)	Sample Type	Moisture Content	Grain Size Distribution				Atterberg Limits		
				% Gravel	% Sand	% Silt	% Clay	LL	PL	PI
LB-1	378 -383	RC	19.8							
LB-1	383 - 388	RC								
LB-1	388 - 393	RC	18.9							
LB-1	393 - 398	RC								
LB-1	398 - 403	RC	19.9							
LB-2	4.5 - 6	SS	20.5							
LB-2	9.5 - 11	SS	17.3							
LB-2	14.5 - 16	SS	25.5							
LB-2	19.5 - 21	SS	22.6							
LB-2	24.5 - 26	SS	10.4							
LB-2	29.5 - 31	SS	27.5							
LB-2	34.5 - 36	SS								
LB-2	39.5 - 41	SS	32.9							
LB-2	44.5 - 46	SS						73	26	46
LB-2	49.5 - 51	SS	33							
LB-2	54.5 - 56	SS	19.9							
LB-2	59.5 - 61	SS	12.5							
LB-2	64.5 - 66	SS	14.1							
LB-2	69.5 - 71	SS	18.8							
LB-2	74.5 - 76	SS	14.3							
LB-2	79.5 - 81	SS	22	0.0	82.0	11.5	6.5			
LB-2	84.5 - 86	SS	17.3							
LB-2	89.5 - 91	SS	16							
LB-2	94.5 - 96	SS	18.2							
LB-2	99.5 - 101	SS	17.5							
LB-2	104.5 - 106	SS	14.8							
LB-2	109.5 - 111	SS	18.6							
LB-2	114.5 - 116	SS	21.7							
LB-2	119.5 - 121	SS	19							
LB-2	124.5 - 126	SS	21.9							
LB-2	129.5 - 131	SS	23.4							
LB-2	134.5 - 136	SS						NP	NP	NP
LB-2	139.5 - 140.5	SS	20.6							
LB-2	144.5 - 145.5	SS	25.8							
LB-2	149.5 - 150.5	SS	23.6							
LB-2	153 - 158	RC						33	17	16
LB-2	158 - 160	RC	15.6							
LB-2	160 - 165	RC								
LB-2	165 - 170	RC	16.1							
LB-2	170 - 175	RC	17.4							
LB-2	175 - 180	RC	19.1							
LB-2	180 - 185	RC	57.2							
LB-2	185 - 190	RC	12.3							
LB-2	190 - 195	RC	11.8							

Table 2

Laboratory Soil Test Data

Boring No.	Sample Depth (ft)	Sample Type	Moisture Content	Grain Size Distribution				Atterberg Limits		
				% Gravel	% Sand	% Silt	% Clay	LL	PL	PI
LB-2	195 - 200	RC	15.5							
LB-2	200 - 205	RC	16.3							
LB-2	205 - 210	RC								
LB-2	210 - 215	RC	15.5							
LB-2	215 - 220	RC								
LB-2	220 - 225	RC	61.2							
LB-2	225 - 230	RC	53.5							
LB-2	230 - 235	RC	65.6							
LB-2	235 - 240	RC	17.4							
LB-2	240 - 245	RC	15.5							
LB-2	245 - 250	RC	11.7							
LB-2	250 - 255	RC	15.6							
LB-2	255 - 260	RC	21.5							
LB-2	260 - 265	RC						26	23	3
LB-2	265 - 270	RC	14.1							
LB-2	270 - 275	RC	16.3							
LB-2	275 - 280	RC	16							
LB-2	280 - 285	RC	15.4							
LB-2	285 - 290	RC								
LB-2	290 - 295	RC	14.9							
LB-2	295 - 300	RC	16							
LB-2	300 - 305	RC	17.8							
LB-2	305 - 310	RC	23.1							
LB-2	310 - 315	RC	20.7							
LB-2	315 - 320	RC	13.6							
LB-2	320 - 325	RC	11.2							
LB-2	325 - 330	RC	17.9							
LB-2	330 - 335	RC						53	24	29
LB-2	335 - 340	RC	16.9							
LB-2	340 - 345	RC	16.3							
LB-2	345 - 350	RC	17.5							
LB-2	350 - 355	RC	16.3							
LB-2	355 - 360	RC	18	0.0	57.7	24.7	17.6			
LB-2	360 - 365	RC								
LB-2	365 - 370	RC	14.2							
LB-2	370 - 375	RC	15.3							
LB-2	375 - 380	RC	17.2							
LB-2	380 - 385	RC	15.3							
LB-2	385 - 390	RC	17.2							
LB-2	390 - 395	RC	16.2							
LB-2	395 - 400	RC								
LB-3	4.5 - 6	SS	4.3							
LB-3	9.5 - 11	SS	3.7							
LB-3	14.5 - 16	SS	2.4							

Table 2

Laboratory Soil Test Data

Boring No.	Sample Depth (ft)	Sample Type	Moisture Content	Grain Size Distribution				Atterberg Limits		
				% Gravel	% Sand	% Silt	% Clay	LL	PL	PI
LB-3	19.5 - 21	SS	3							
LB-3	24.5 - 26	SS	24.3							
LB-3	29.5 - 31	SS	25							
LB-3	34.5 - 36	SS	22	0.0	96.0	0.0	0.0			
LB-3	39.5 - 41	SS	22.2							
LB-3	44.5 - 46	SS	18.5							
LB-3	49.5 - 51	SS	14.1							
LB-3	54.5 - 56	SS	21							
LB-3	59.5 - 61	SS	20.9							
LB-3	64.5 - 66	SS	11	19.5	72.6	5.9	1.9			
LB-3	69.5 - 71	SS	23.8							
LB-3	74.5 - 76	SS	21							
LB-3	79.5 - 81	SS	18.2							
LB-3	84.5 - 86	SS	17.7							
LB-3	89.5 - 91	SS	12							
LB-3	94.5 - 96	SS	20.8							
LB-3	99.5 - 101.5	SS	12.5							
LB-3	104.5 - 105.5	SS	21.9							
LB-3	109.5 - 111	SS	16	0.0	59.1	29.2	11.2			
LB-3	114.5 - 115.5	SS								
LB-3	119.5 - 120	SS								
LB-3	124.5 - 125	SS								
LB-3	129.5 - 130	SS								
LB-3	134.5 - 135	SS								
LB-3	139.5 - 141	SS	17.1							
LB-3	144.5 - 146	SS	22.3							
LB-3	149.5 - 151	SS	20.2							
LB-3	154.5 - 156	SS	21.4							
LB-3	159.5 - 161	SS	20.4							
LB-3	164.5 - 166	SS						24	18	6
LB-3	169.5 - 171	SS	19.2							
LB-3	175 - 180	RC	32.5							
LB-3	180 - 185	RC	28.4							
LB-3	185 - 187	RC	51							
LB-3	187 - 192	RC	60.3							
LB-3	192 - 197	RC								
LB-3	197 - 202	RC	20.3							
LB-3	202 - 207	RC	18.9							
LB-3	207 - 212	RC	15.1							
LB-3	212 - 217	RC	15.4							
LB-3	217 - 222	RC	13.3							
LB-3	222 - 227	RC	15.9							
LB-3	227 - 232	RC						24	23	1
LB-3	232 - 237	RC	11.1							

Table 2

Laboratory Soil Test Data

Boring No.	Sample Depth (ft)	Sample Type	Moisture Content	Grain Size Distribution				Atterberg Limits		
				% Gravel	% Sand	% Silt	% Clay	LL	PL	PI
LB-3	237 - 242	RC	18.5							
LB-3	242 - 247	RC	15.6							
LB-3	247 - 252	RC	17							
LB-3	252 - 257	RC	20.2							
LB-3	257 - 262	RC								
LB-3	262 - 267	RC	19.4							
LB-3	267 - 272	RC	16.9							
LB-3	272 - 277	RC								
LB-3	277 - 282	RC	18							
LB-3	282 - 287	RC	23.8							
LB-3	287 - 292	RC	17.1							
LB-3	292 - 297	RC	19.2							
LB-3	297 - 302	RC								
LB-3	302 - 307	RC	14.8							
LB-3	307 - 312	RC	15.9							
LB-3	312 - 317	RC	17.4							
LB-3	317 - 322	RC	16.3							
LB-3	322 - 327	RC	15.8							
LB-3	327 - 332	RC								
LB-3	332 - 337	RC	19.2							
LB-3	337 - 342	RC	17.9							
LB-3	342 - 347	RC								
LB-3	347 - 352	RC	15.8							
LB-3	352 - 357	RC								
LB-3	357 - 362	RC	16.2							
LB-3	362 - 367	RC	22.3							
LB-3	367 - 372	RC	18.7							

Notes:
SS = Split Spoon
RC = Rock Core
Per MTS, some moisture content tests were not conducted because of lignite or moisture was done with the Atterberg Limit Testing.

Appendix A – Boring Logs

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-1**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
0				SW: WELL GRADED SAND, fine to medium grained, with trace silt, pale brown (10YR 6/3), moist, medium dense.							
5	1	11 in.	7-7-6		-						
10	2	12 in.	8-5-4	Color changes to light yellowish brown (10YR 6/4) and loose at 9.5 ft.	-						
15	3	18 in.	5-3-4	CL: LEAN CLAY, with trace silt, brownish yellow (10YR 6/6), moist, medium stiff.	0.5						
20	4	13 in.	7-5-8	SW: WELL GRADED SAND, fine to medium grained, pale brown (10YR 6/3), moist, medium dense.	-						
25	5	17 in.	5-10-13	ML: SILT, light yellowish brown (2.5Y 6/3), moist, medium dense.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 6' 56.33"

Lon: 103° 5' 34.23"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-1**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	6		18 in.	9-10-13	CL: LEAN CLAY, with trace silt, light olive brown (2.5Y 5/3) with gray (2.5Y 5/1) mottling, moist, very stiff to hard.	4.25						
35	7		18 in.	9-13-20		4.5	19	50	30			
40	8		14 in.	10-16-27	CL: LEAN CLAY, light brownish gray (2.5Y 6/2), moist, hard.	1.0						
45	9		17 in.	8-10-18	ML: SILT, light olive brown (2.5Y 5/3), moist, medium dense.	4.5						
50	10		18 in.	13-33-50/6"	CL: LEAN CLAY, gray (2.5Y 5/1), moist, hard. Lignite seam at least 12 in. thick at 50 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

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Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
55	11	18 in.	9-16-26		4.5						
60	12	13 in.	18-20-33	CL: LEAN CLAY, with trace silt, dark gray (2.5Y 4/1), moist, hard.	4.5						
65	13	18 in.	9-13-16	CL-ML: SILTY CLAY, gray (2.5Y 5/1), moist, very stiff.	3.25						
70	14	4 in.	50/4"	Lignite seam at least 4 in. thick at 69.5 ft.	-						
75	15	18 in.	15-21-32	ML: SILT, with trace clay, gray (2.5Y 5/1), moist, very dense. Lignite seam 1 in. thick at 75 ft.	4.5						
80	16	18 in.	10-14-16	CL: LEAN CLAY, with trace silt, gray (2.5Y 5/1), moist, hard.	4.5						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

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Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
85	17		18 in.	10-13-15	With trace lignite and very stiff at 84.5 ft.	3.75						
90	18		18 in.	23-30-41	CH: FAT CLAY, consolidated, possibly highly weathered shale, gray (2.5Y 5/1) moist, hard.	4.5	21	57	36			
95	19		5 in.	50/5"	Lignite seam at least 5 in. thick at 94.5 ft.	-						
100	20		18 in.	17-27-40	ML: SILT, with trace clay, gray (2.5Y 6/1), moist, very dense.	4.5						
105	21		18 in.	19-28-45		4.5						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

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M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

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Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
110	22		18 in.	11-28-48	CH: FAT CLAY, with trace silt and trace coal, consolidated, possibly highly weathered shale, gray (2.5Y 5/1) moist, hard.	4.5						
115	23		18 in.	17-33-50/6"	Lignite seam at least 1 in. thick at 116 ft.	4.5						
120	24		18 in.	21-28-41	CL: LEAN CALY, with some silt, gray (2.5Y 5/1), moist, very dense.	4.5						
125	25		18 in.	21-36-50/6"	With trace lignite at 124.5 ft.	4.5						
130	26		18 in.	16-25-36		4.5	20	36	16			

Notes:

Soil Lithologies based on field observations and laboratory analysis.

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Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	27		15 in.	21-36-50/3"		4.5						
140	28		18 in.	22-35-43	Lignite seam at least 2 in. thick at 139.5 ft.	4.5						
145	29		17 in.	24-36-50/5"		4.5						
150	30		18 in.	24-36-50/6"	Consolidated, weakly cemented, with lignite seam at least 1 in. thick at 151 ft.	4.5						
155	31		17 in.	27-43-50/5"	CL: LEAN CLAY, with some silt, consolidated, highly weathered shale, gray (2.5Y 5/1), moist, hard.	4.5						
160	32		12 in.	27-33-50/6"		4.5						

Notes:

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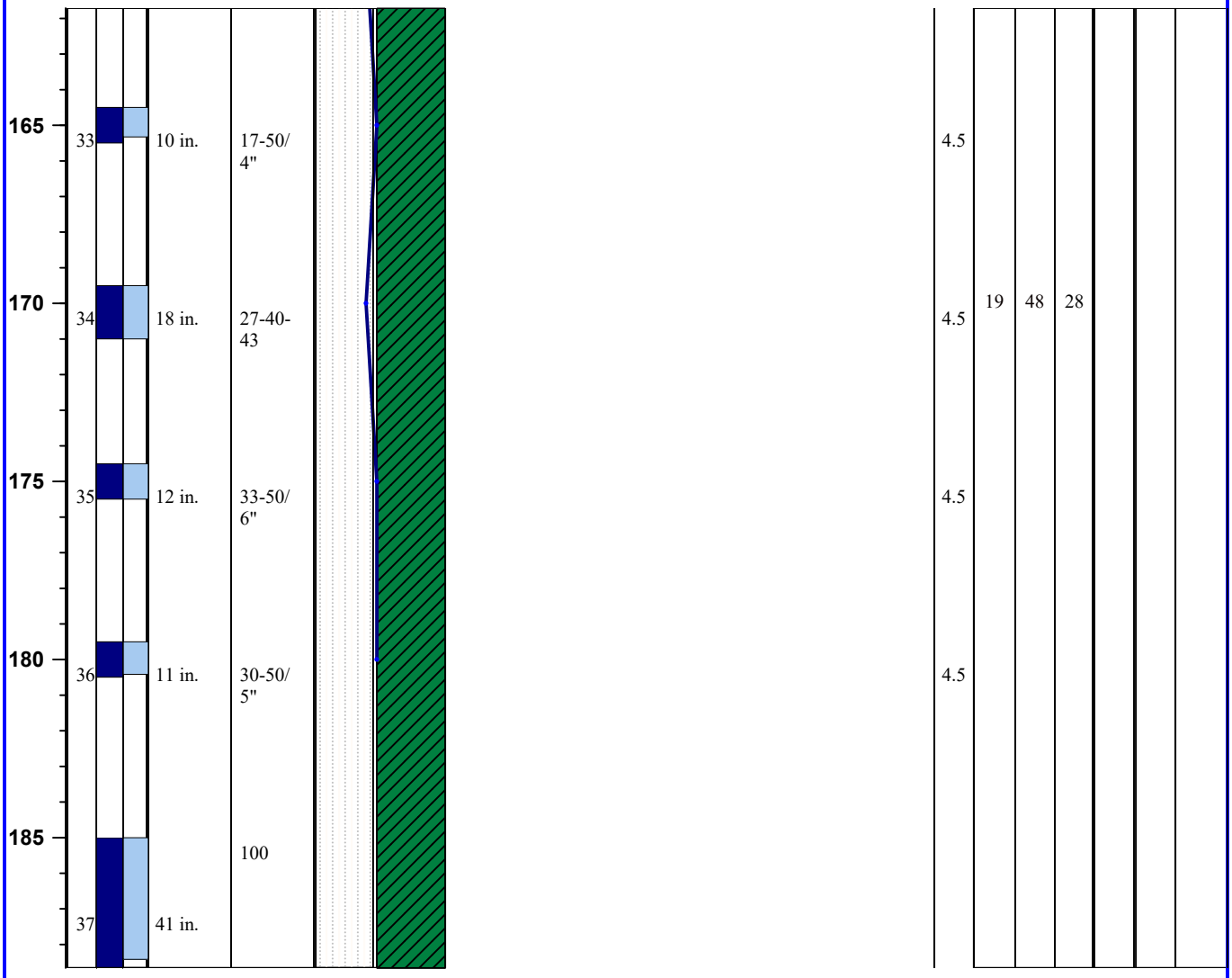

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Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
190			100								
	38	36 in.	83								
195											
	39	54 in.	63								
200				Silt seam 4 in. thick at 200 ft.							
	40	60 in.	95								
205											
	41	60 in.	81								
210				Lignite seam 1 in. thick at 210 ft.							
	42	60 in.		Coal: Lignite coal, black (2.5Y 2.5/1).							
			83								
215	43										

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 6' 56.33"

Lon: 103° 5' 34.23"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-1**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
220	44	60 in.	87								
			68								
225	45	60 in.									
			53								
230	46	60 in.									
			100	Shale: SHALE, highly weathered, gray (2.5Y 5/1), moist, hard.							
235	47	48 in.		ML: SILT, gray (2.5Y 5/1), moist, very dense.							
				Shale: SHALE, highly weathered, gray (2.5Y 5/1), moist, hard.							
			97	Trace Lignite less than 1 in. thick at 238 ft.							
240	48	60 in.		Lignite seam 6 in. thick at 242 ft.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 6' 56.33"

Lon: 103° 5' 34.23"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-1**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
245	49	50 in.	81	ML: SANDY SILT, fine grained, gray (2.5Y 5/1), moist, very dense.							
				Shale: SHALE, highly weathered, gray (2.5Y 5/1), moist, hard.							
			85	Trace Lignite 1 in. thick at 248 ft.							
				ML: SANDY SILT, fine grained, gray (2.5Y 5/1), moist, very dense.							
250	50	60 in.		Shale: SHALE, highly weathered, gray (2.5Y 5/1), moist, hard.							
				Calcified layer, light gray (2.5Y 7/1), harder than surrounding shale, 6 in. thick at 251.5 ft.							
			43	CL: LEAN CLAY with fine grained sand and silt, gray (2.5Y 5/1), moist, very dense.							
255	51	42 in.									
			100			18	41	23			
260	52	60 in.									
			100	Shale: SHALE, highly weathered, gray (2.5Y 5/1), moist, hard.							
265	53	55 in.									
			95	Lignite seam 2 in. thick at 269 ft.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 6' 56.33"

Lon: 103° 5' 34.23"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-1**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
270	54	60 in.		Color turns greenish gray (GLEY1 6/1) at 272 ft.							
			97	Shale: SHALE, highly weathered, with trace lignite, dark gray (2.5Y 4/1), moist, hard.							
275	55	60 in.		Lignite seam 5 in. thick at 276 ft.							
			93	Color turns to gray (2.5Y 5/1) and lignite seam 4 in. thick at 278 ft.							
280	56	60 in.		ML: SANDY SILT, fine grained, gray (2.5Y 5/1), moist, very dense.							
			100	Shale: SHALE, highly weathered, with trace lignite, greenish gray (GLEY1 6/1), moist, hard.							
285	57	60 in.		Color turns to gray (2.5Y 5/1) and lignite seam 1 in. thick at 285.5 ft.							
			97	ML: SILT, with trace clay, consolidated, weakly cemented, greenish gray (GLEY1 6/1) moist, very dense.							
290	58	60 in.		Lignite seam 1 in. thick at 288.5 ft.							
			100	Color turns to gray (2.5Y 5/1) at 293 ft.							
295	59	54 in.									

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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Lon: 103° 5' 34.23"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-1**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

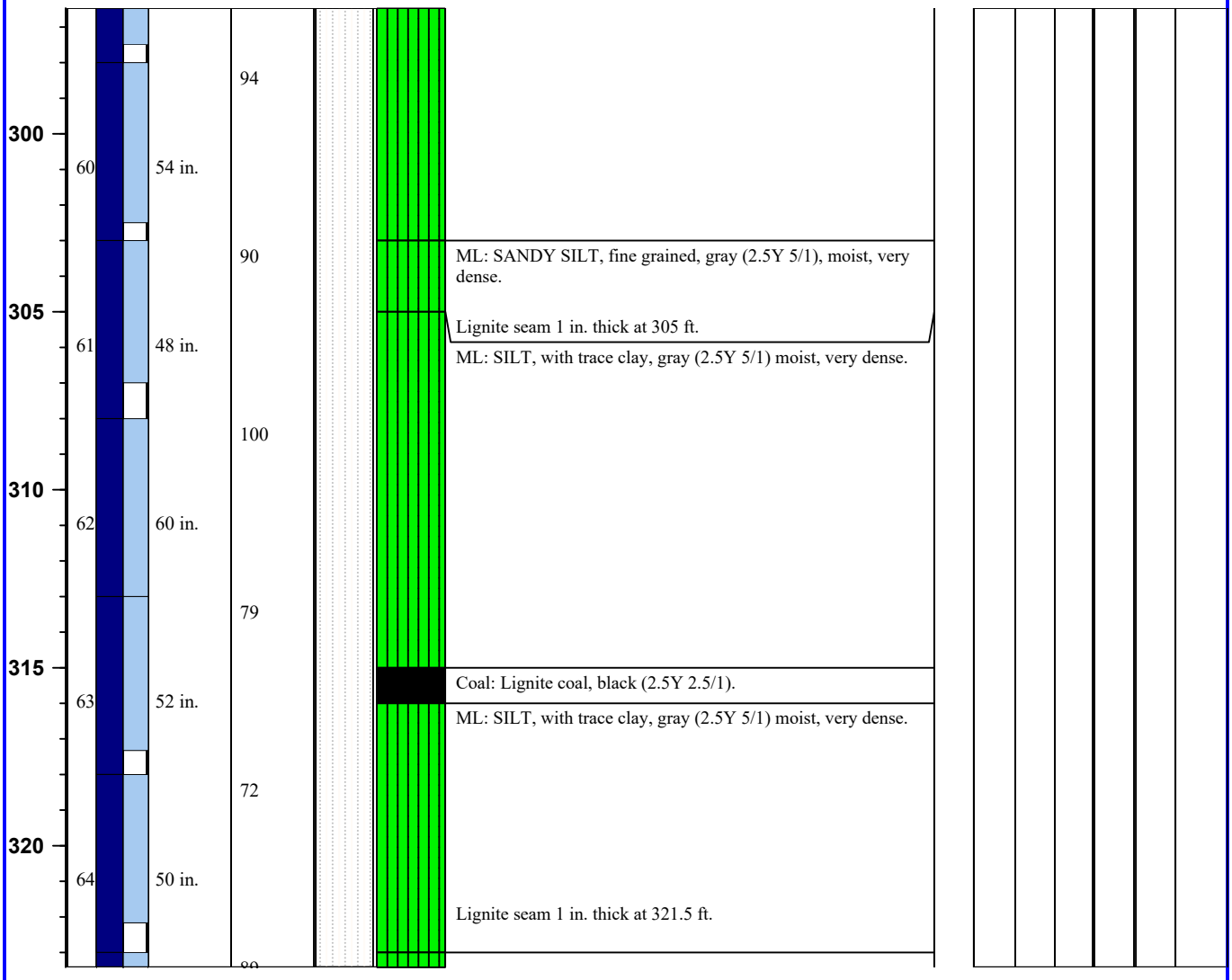
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**



Notes:

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Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 6' 56.33"

Lon: 103° 5' 34.23"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-1**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

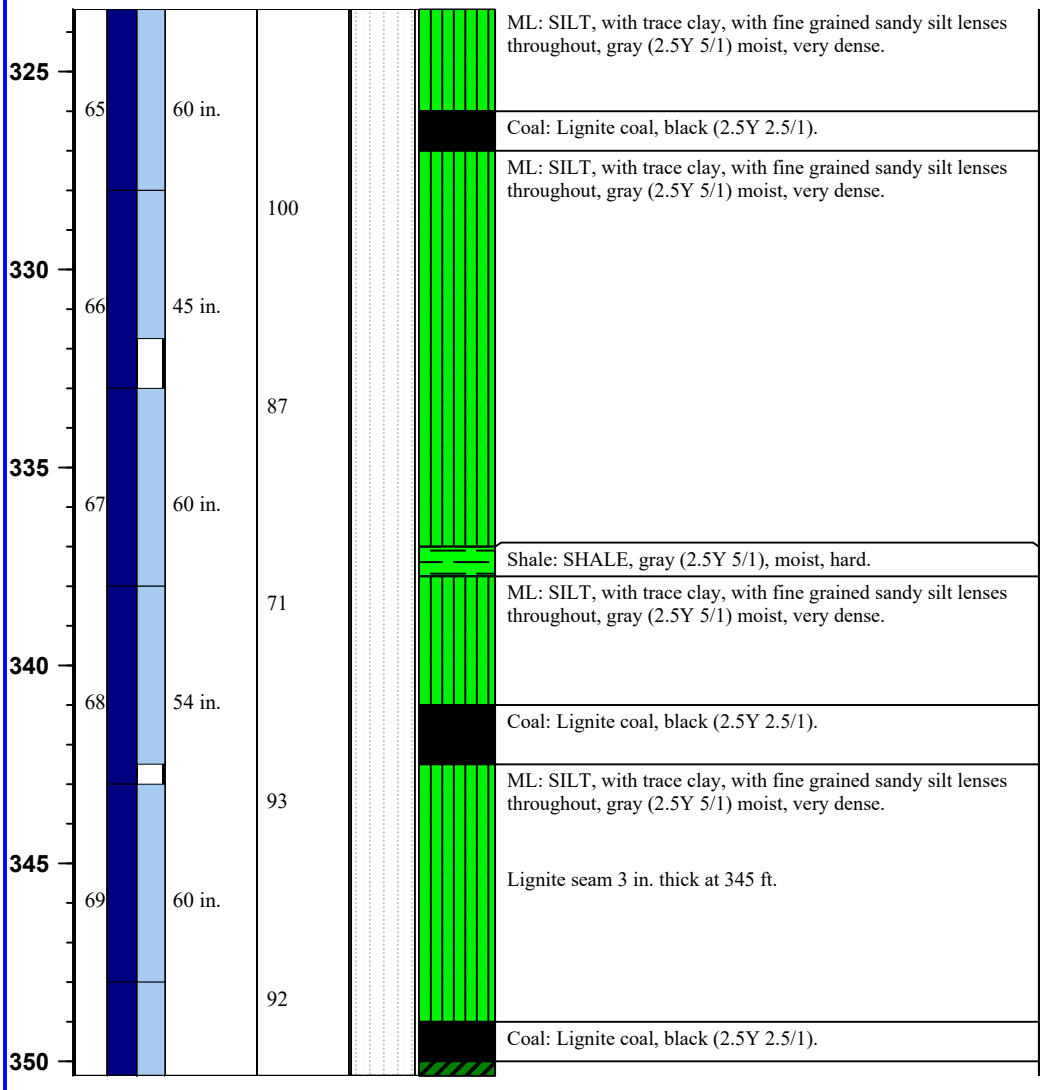
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**



Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 6' 56.33"

Lon: 103° 5' 34.23"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-1**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
355	70	32 in.	100	CH: FAT CLAY, with silt, with fine grained sandy silt lenses throughout, gray (2.5Y 5/1) moist, very dense.		23	196	173			
	71	60 in.									
360			92	ML: SILT, with trace fine grained sand, weakly cemented, gray (2.5Y 6/1) moist, very dense.							
	72	60 in.									
365			100								
	73	50 in.									
370			98								
	74	60 in.									
375			100								
	75	60 in.									

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 6' 56.33"

Lon: 103° 5' 34.23"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-1**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
380	76	60 in.	83	Coal: Lignite coal, black (2.5Y 2.5/1).							
385	77	58 in.	74								
390	78	60 in.	94	ML: SILT, with trace clay, weakly cemented, gray (2.5Y 6/1) moist, very dense.							
395	79	60 in.	100								
400	80	58 in.	74	Coal: Lignite coal, black (2.5Y 2.5/1).							
				ML: SILT, with trace clay, weakly cemented, gray (2.5Y 6/1) moist, very dense.							
				EOB at 403 ft. Target depth reached.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 6' 56.33"

Lon: 103° 5' 34.23"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
0				ML: SILT, with trace clay, light brownish gray (2.5Y 6/2), moist, medium dense.							
5	1	6 in.	7-8-9		-						
10	2	11 in.	6-6-11	SM: SILTY SAND, fine grained, light olive brown (2.5Y 5/3), moist, medium dense.	-						
15	3	13 in.	7-9-9	ML: SILT, with trace clay, light olive brown (2.5Y 5/3), moist, medium dense.	-						
20	4	16 in.	6-7-10	Color turns to dark grayish brown (2.5Y 4/2) at 19.5 ft.	-						
25	5	16 in.	4-4-4	SM: SILTY SAND, fine grained, light olive brown (2.5Y 5/3), moist, loose.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

Lon: 103° 5' 33.40"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	6		15 in.	5-5-6	ML: SANDY SILT, fine grained, grayish brown (2.5Y 5/2), moist, medium dense.	-						
35	7		18 in.	4-4-8	CH: FAT CLAY, with trace silt, gray (2.5Y 5/1), moist, very stiff.	2.25						
40	8		18 in.	4-5-8		2.75						
45	9		18 in.	4-6-7		2.75	26	73	46			
50	10		18 in.	5-7-8		3.0						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
55	11		12 in.	10-13-13	SP: POORLY GRADED SAND, fine grained, with trace silt, grayish brown (2.5Y 5/2) moist, medium dense.	-						
60	12		16 in.	8-10-10	SP: POORLY GRADED SAND, fine grained, grayish brown (2.5Y 5/2) moist, medium dense.	-						
65	13		18 in.	7-8-12		-						
70	14		12 in.	7-4-6	SP: POORLY GRADED SAND, fine grained with trace medium grained, with trace silt, grayish brown (2.5Y 5/2) moist, loose.	-						
75	15		14 in.	11-14-16	SP: POORLY GRADED SAND, fine to medium grained, grayish brown (2.5Y 5/2) moist, medium dense.	-						
80	16		12 in.	13-11-12	With some silt and clay at 79.5 ft.	-					82.0	18.0

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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GPS Coordinates

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
85	17	12 in.	13-17-19	Fine grained and dense at 84.5 ft.	-						
90	18	14 in.	6-7-9	With trace silt and medium dense at 89.5 ft.	-						
95	19	13 in.	10-14-14	Mostly fine grained with some medium grained at 94.5 ft.	-						
100	20	12 in.	9-17-17	Fine grained and dense at 99.5 ft.	-						
105	21	13 in.	8-9-9	Medium dense at 104.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

Lon: 103° 5' 33.40"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
110	22	13 in.	10-8-8	Trace lignite at 110 ft.	-						
115	23	16 in.	7-10-11	With trace silt and trace clay at 114.5 ft.	-						
120	24	15 in.	10-15-18	ML: SANDY SILT, fine grained, with trace clay, gray (2.5Y 5/1), moist, dense.	0.5						
125	25	18 in.	8-11-21	CL-ML: SILTY CLAY, gray (2.5Y 5/1), moist, hard.	3.0						
130	26	18 in.	15-25-36		4.5						

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M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

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SOIL BORING LOG

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Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	27		18 in.	17-24-34	ML: SILT, with trace fine grained sand, gray (2.5Y 5/1), moist, very dense.	-						
140	28		12 in.	20-50/6"	ML: SILT, with trace clay, weakly cemented, gray (2.5Y 5/1), moist, very dense. Lignite seam at least 1 in. thick at 140.5 ft.	4.5						
145	29		12 in.	20-50/6"	With trace lignite at 144.5 ft.	4.5						
150	30		12 in.	18-50/6"		4.5						
				100	Shale: SHALE, highly weathered, consolidated lean clay, gray (2.5Y 5/1), moist, hard.		17	33	16			
155	31		48 in.									
				97								
160	32		24 in.	83	Lignite seam at least 4 in. thick at 160 ft.							

Notes:

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Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
165	33	60 in.	83	Poor recovery, suspect non-cohesive sand was washed out and not collected in the core barrel from 165 to 170 ft.							
	34	15 in.									
170			81	Poor recovery, suspect non-cohesive sand was washed out and not collected in the core barrel from 170 to 175 ft.							
	35	11 in.									
175			0	No Recovery 175 to 180 ft.							
	36	0 in.									
180			35	Shale: SHALE, highly weathered, consolidated silty clay, gray (2.5Y 5/1), moist, hard. Poor recovery, suspect non-cohesive sand was washed out and not collected in the core barrel from 180 to 185 ft.							
	37	20 in.		Fine grained silty sand seam 3 in. thick at 183 ft.							
185			100								
	38	41 in.									

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Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

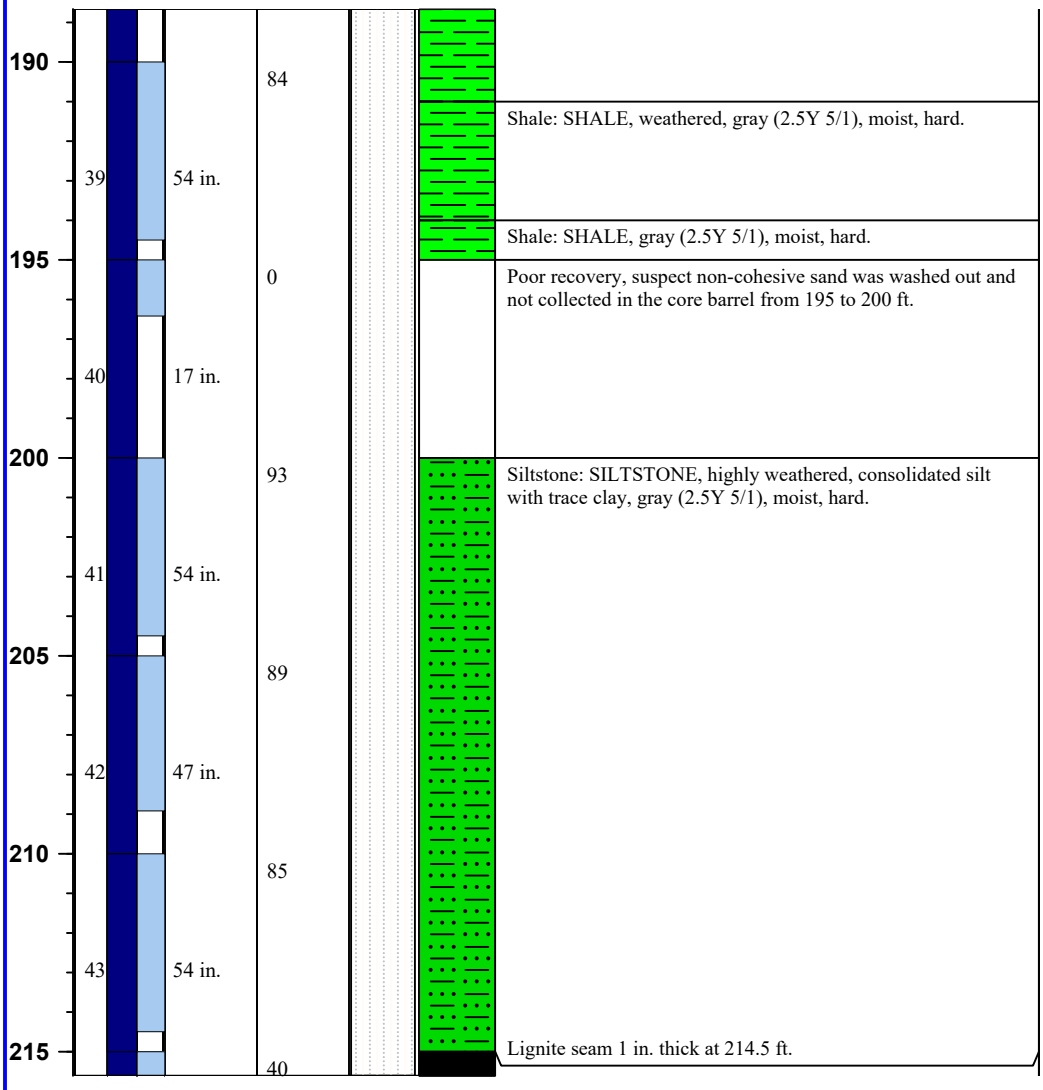
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**



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County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
220	44	48 in.	33	Coal: Lignite coal, black (2.5Y 2.5/1).							
225	45	60 in.	9								
	46	58 in.									
230			33								
	47	60 in.									
235			50								
	48	48 in.		ML: SILT, with trace lignite, gray (2.5Y 5/1), moist, very dense.							
240			100	With trace fine grained sand at 240 ft. Lignite seam less than 1 in. thick at 240.5 ft.							
	49										

Notes:

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NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
245	49		100	Lignite seam less than 1 in. thick at 243.5 and 244 ft.							
				Poor recovery, suspect non-cohesive sand was washed out and not collected in the core barrel from 245 to 250 ft.							
	50	33 in.									
250			0	Poor recovery, suspect non-cohesive sand was washed out and not collected in the core barrel from 250 to 255 ft.							
	51	0 in.									
255			56	ML: SANDY SILT, fine grained, with trace clay, gray (2.5Y 5/1), moist, dense.							
				ML: SILT, gray (2.5Y 5/1), moist, very dense.							
	52	48 in.									
260			95	With trace clay at 260 ft.		23	26	3			
	53	60 in.									
265			95	Weakly cemented at 265 ft.							
	54	60 in.									

Notes:

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Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
270			75	ML: SANDY SILT, fine grained, weakly cemented, gray (2.5Y 5/1), moist, dense.							
	55	57 in.									
275			69	ML: SILT, with trace clay, weakly cemented, gray (2.5Y 5/1), moist, very dense.							
	56	48 in.		Lignite seam 3 in. thick at 276 ft. Lignite seam 6 in. thick at 277.5 ft.							
280			100	With trace lignite seams throughout at 280 ft.							
	57	60 in.									
285			85								
	58	45 in.		Lignite seam 4 in. thick at 286 ft.							
				Lignite seam 4 in. thick at 288.5 ft.							
290			100	ML: SILT, with trace clay, weakly cemented, with trace lignite throughout, gray (2.5Y 5/1), moist, very dense.							
	59	54 in.									
295			95								

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Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
	60	60 in.		Lignite seam 1 in. thick at 297.5 ft.							
300			97	Sandy silt seam 4 in. thick at 299 ft.							
	61	48 in.		SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.							
305			30	Silt seam with trace clay 6 in. thick at 304 ft.							
				SP-SM: SAND WITH SILT, fine grained, gray (2.5Y 5/1), moist, very dense.							
	62	43 in.		ML: SILT, gray (2.5Y 5/1), moist, very dense.							
				Fine grained sand with silt seam 4 in. thick at 309 ft.							
310			80	Lignite seam 2 in. thick at 310 ft.							
				ML: SILT, with trace clay, gray (2.5Y 5/1) moist, very dense.							
	63	60 in.		Coal: Lignite coal, black (2.5Y 2.5/1).							
315			95	ML: SILT, with trace fine grained sand, with trace lignite throughout, gray (2.5Y 5/1) moist, very dense.							
	64	57 in.									
320			93	Coal: Lignite coal, black (2.5Y 2.5/1).							
				ML: SILT, with trace clay, gray (2.5Y 5/1) moist, very dense.							
	65	60 in.									

Notes:

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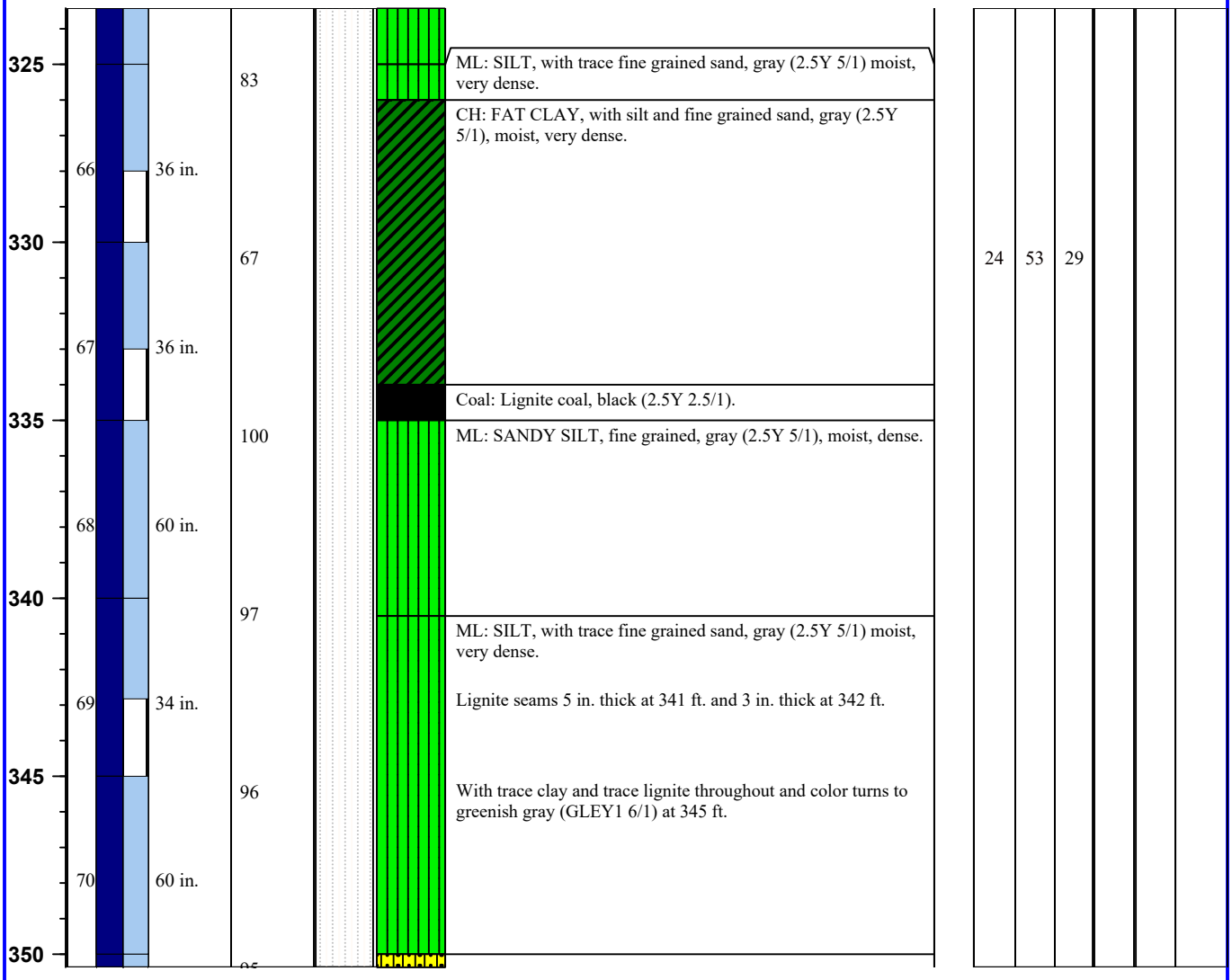
Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**



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Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
355	71	42 in.	100	SM: SILTY SAND, fine grained, with little clay, weakly cemented, greenish gray (GLEY1 6/1), moist, very dense.						57.7	42.3
360	72	59 in.	95								
	73	60 in.									
365			100								
	74	55 in.									
370			88								
	75	60 in.									
375			78	Coal: Lignite coal, black (2.5Y 2.5/1).							

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NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

Lon: 103° 5' 33.40"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

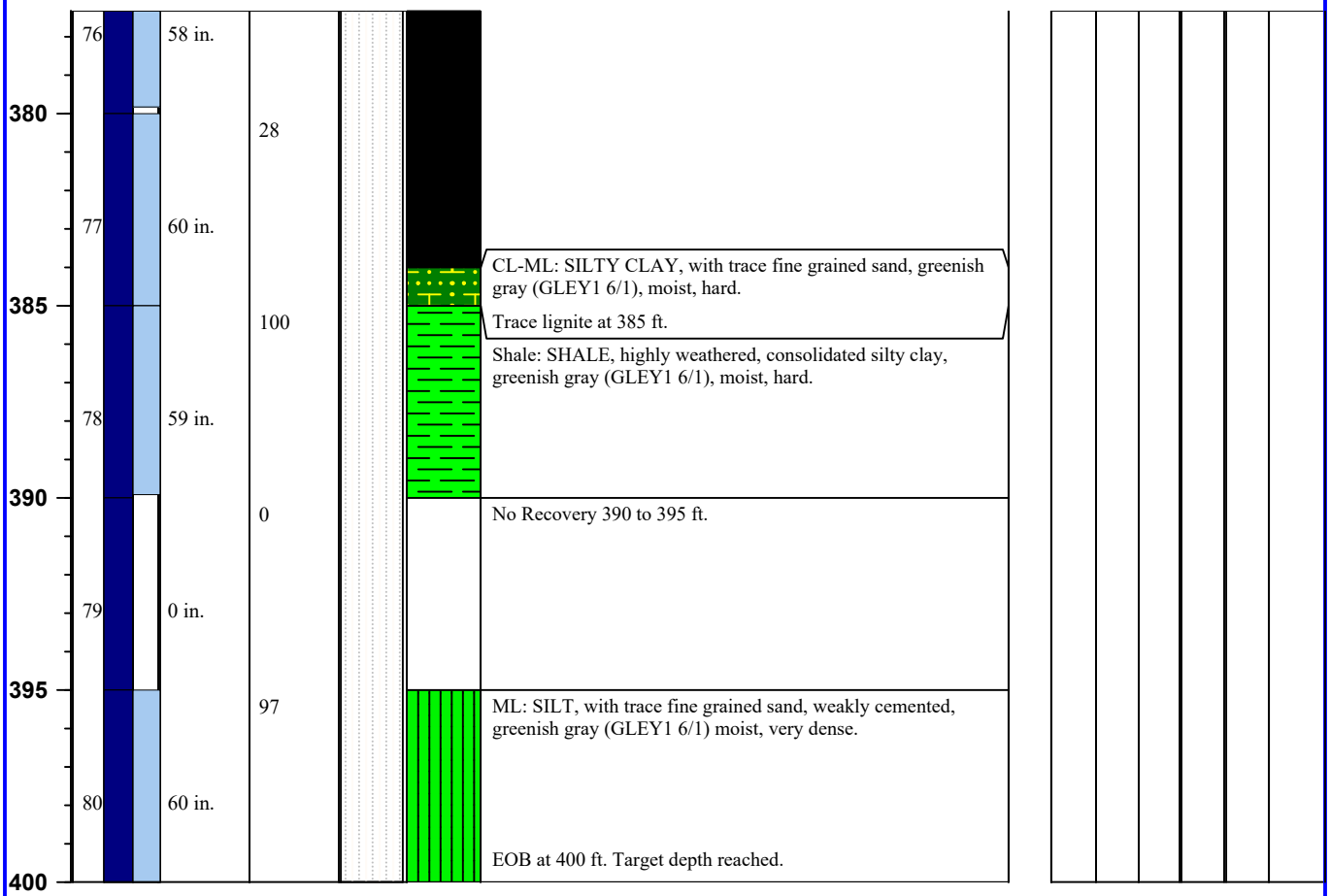
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**



Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

Lon: 103° 5' 33.40"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
0				SP: POORLY GRADED SAND, fine to medium grained, brown (7.5YR 4/3) moist, loose.							
5	1	15 in.	3-3-2		-						
10	2	13 in.	4-3-3		-						
15	3	13 in.	3-2-2	Color turns to brown (7.5YR 5/4) and trace coarse grained sand, very loose at 14.5 ft. Trace lignite at 16 ft.	-						
20	4	16 in.	5-3-3	Trace lignite at 21 ft.	-						
25	5	18 in.	2-4-5	Color turns to brown (7.5YR 4/3) and wet at 24.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 22.10"

Lon: 103° 4' 39.62"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	6		18 in.	2-3-3	Color turns to brown (7.5YR 5/3) at 29.5 ft.	-						
35	7		18 in.	4-7-8	Color turns to brown (7.5YR 4/3) at 34.5 ft.	-					96.0	
40	8		18 in.	4-6-11		-						
45	9		18 in.	6-10-12	Lignite seam less than 1 in. thick at 46 ft.	-						
50	10		18 in.	3-3-5	SW: WELL GRADED SAND, fine to medium grained, dark brown (7.5YR 3/3) wet, loose. Gravel and sand seam, coarse grained, 4 in. thick at 50.5 ft. Trace lignite at 51 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 22.10"

Lon: 103° 4' 39.62"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
55	11		18 in.	3-4-7	SW: WELL GRADED SAND, fine to medium grained, brown (7.5YR 4/3) wet, medium dense.	-						
60	12		18 in.	7-5-6	Gravel and sand seam, coarse grained, 6 in. thick at 60.5 ft.	-						
65	13		12 in.	6-10-10	SPG: POORLY GRADED SAND WITH GRAVEL, coarse grained, dark brown (7.5YR 3/2), wet, medium dense.	-				19.5	72.6	7.8
70	14		18 in.	5-8-9	CL: LEAN CLAY WITH SAND, fine grained, with silt, dark grayish brown (10YR 4/2), wet, very stiff.	2.0						
75	15		18 in.	17-24-25	SM: SILTY SAND, fine grained, grayish brown (2.5Y 5/2), wet, dense.	-						
80	16		18 in.	15-21-21		-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 22.10"

Lon: 103° 4' 39.62"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
85	17	8 in.	12-10-16	SW: WELL GRADED SAND, fine to medium grained, gray (2.5Y 5/1) wet, medium dense.	-						
90	18	14 in.	24-33-25	SW: WELL GRADED SAND, fine to coarse grained, gray (2.5Y 5/1) wet, very dense.	-						
95	19	18 in.	33-36-50/6"	SP: POORLY GRADED SAND, fine grained, with trace silt, dark gray (2.5Y 4/1) wet, very dense.	-						
100	20	12 in.	23-50/6"	With trace lignite at 99.5 ft. Trace silty clay at 101.5 ft.	-						
105	21	11 in.	34-50/6"	SP: POORLY GRADED SAND, fine grained, dark gray (2.5Y 4/1) moist, very dense.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 22.10"

Lon: 103° 4' 39.62"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

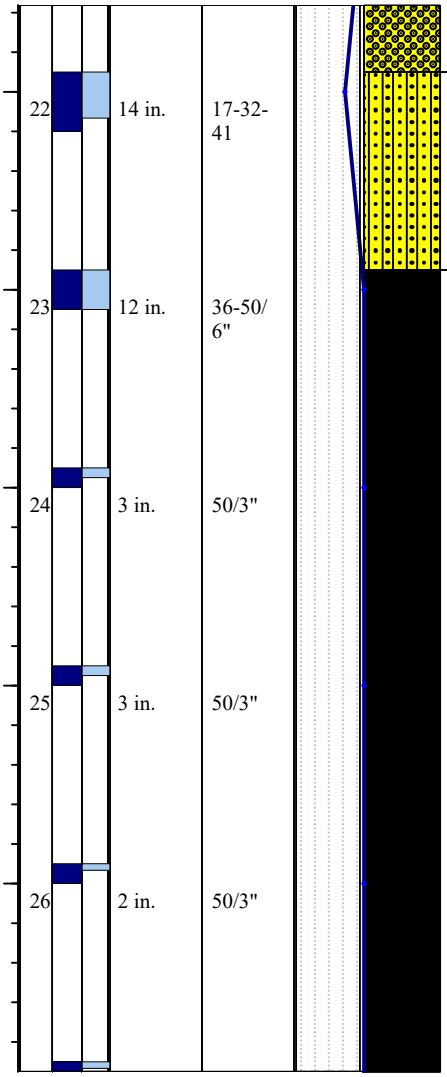
Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
110	22	14 in.	17-32-41	SM: SILTY SAND, fine grained, with trace clay, dark gray (2.5Y 4/1) moist, very dense.	-					59.1	40.4
115	23	12 in.	36-50/6"	Coal: Lignite coal, black (2.5Y 2.5/1), moist, very dense.	-						
120	24	3 in.	50/3"		-						
125	25	3 in.	50/3"		-						
130	26	2 in.	50/3"		-						



Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 22.10"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	27	2 in.	50/2"		-						
140	28	18 in.	17-33-43	ML: SILT, with trace clay, gray (2.5Y 5/1), moist, very dense.	-						
145	29	18 in.	18-26-36	CL-ML: SILTY CLAY, dark gray (2.5Y 4/1), moist, hard.	4.5						
150	30	18 in.	15-20-30	SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.	4.5						
155	31	18 in.	17-33-50/6"		-						
160	32	18 in.	16-23-28		-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 22.10"

Lon: 103° 4' 39.62"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
165	33	18 in.	17-24-27	CL-ML: SILTY CLAY, gray (2.5Y 5/1), moist, hard.	4.5	18	24	6			
170	34	18 in.	24-25-48	ML: SILT, with trace fine grained sand and trace clay, gray (2.5Y 5/1), moist, very dense.	3.5						
175	35	8.5 in.	59	Coal: Lignite coal, black (2.5Y 2.5/1).							
180	36	24 in.	75	CL: LEAN CLAY, with trace silt, gray (2.5Y 5/1). Lignite seam 2 in. thick at 182 ft. Lignite seam 2 in. thick at 184 ft.							
185	37	18 in.	89 40	SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 22.10"

Lon: 103° 4' 39.62"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

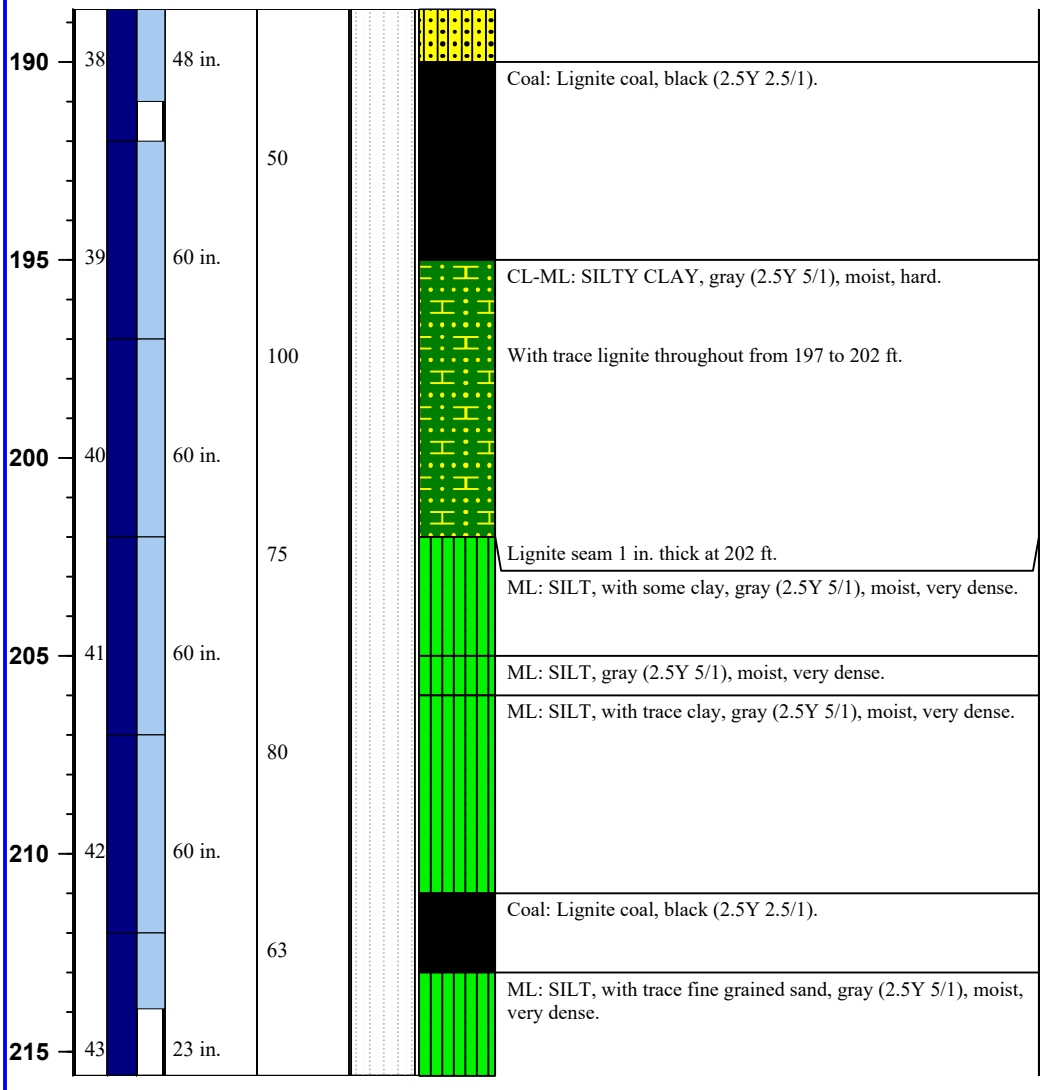
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**



Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

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M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 22.10"

Lon: 103° 4' 39.62"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
220	44	54 in.	98	Lignite seam 1 in. thick at 219.5 ft. ML: SILT, gray (2.5Y 5/1), moist, very dense.							
			90	CL-ML: SILTY CLAY, gray (2.5Y 5/1), moist, hard.							
225	45	60 in.									
			100	ML: SILT, with trace fine grained sand, gray (2.5Y 5/1), moist, very dense.		23	24	1			
230	46	57 in.									
			84	ML: SILT, with trace clay, gray (2.5Y 5/1), moist, very dense. Shale layer 6 in. thick at 234 ft.							
235	47	56 in.									
			85	Coal: Lignite coal, black (2.5Y 2.5/1).							
240	48	54 in.		ML: SILT, with trace clay and with trace lignite, gray (2.5Y 5/1), moist, very dense.							
			100								

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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GPS Coordinates

Lat: 48° 9' 22.10"

Lon: 103° 4' 39.62"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
245	49	60 in.	100	ML: SANDY SILT, fine grained, weakly cemented, greenish gray (GLEY1 6/1), moist, very dense.							
250	50	60 in.	100								
255	51	60 in.	100	SM: SILTY SAND, fine grained, weakly cemented, greenish gray (GLEY1 6/1), moist, very dense.							
260	52	60 in.	100								
265	53	60 in.	70	Shale seam 1 in. thick at 267 ft.							
	54	60 in.									

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 22.10"

Lon: 103° 4' 39.62"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
270											
			10	Coal: Lignite coal, black (2.5Y 2.5/1).							
	55	60 in.									
275				Silty clay layer 6 in. thick at 275 ft.							
			58								
				ML: SILT, with trace fine grained sand, gray (2.5Y 5/1), moist, very dense.							
280	56	48 in.									
			100	SM: SILTY SAND, fine grained, weakly cemented, greenish gray (GLEY1 6/1), moist, very dense.							
285	57	60 in.									
			95	Trace lignite less than 1 in. thick at 287 ft.							
				Trace lignite less than 1 in. thick at 289 ft.							
290	58	60 in.		Shale: SHALE, highly weathered, with trace coal, greenish gray (GLEY1 6/1), moist, hard.							
			91	Shale: SHALE, highly weathered, gray (2.5Y 5/1), moist, hard.							
295	59	60 in.									

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 22.10"

Lon: 103° 4' 39.62"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
300	60	60 in.	97	Shale layer, not weathered, 2 in. thick and color turns to dark gray (2.5Y 4/1) at 297 ft.							
				Sandstone layer 8 in. thick at 301 ft.							
			83	Color turns to gray (2.5Y 5/1) at 302 ft.							
305	61	60 in.									
			100	Silty sand layer, fine grained, 6 in. thick at 307 ft.							
				Shale layer, not weathered, less than1 in. thick at 307.5 ft.							
310	62	60 in.									
			80								
315	63	60 in.									
				Lignite seam 3 in. thick at 316 ft.							
			100	SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.							
				Shale: SHALE, highly weathered, gray (2.5Y 5/1), moist, hard.							
320	64	60 in.									
				SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.							
			100	Shale: SHALE, highly weathered, with trace lignite throughout, gray (2.5Y 5/1), moist, hard.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 22.10"

Lon: 103° 4' 39.62"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
325	65	60 in.	100			25	105	81			
330	66	60 in.	95								
335	67	60 in.	70	SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.							
340	68	60 in.	10	Coal: Lignite coal, black (2.5Y 2.5/1). Silty clay layer 6 in. thick at 339 ft.							
345	69	60 in.	100	Silty clay layer 6 in. thick at 344 ft.							
350	70	46 in.		SM: SILTY SAND, fine grained, weakly cemented, gray (2.5Y 5/1), moist, very dense.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 22.10"

Lon: 103° 4' 39.62"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
355	71	58 in.	57	Shale: SHALE, highly weathered, with trace lignite, gray (2.5Y 5/1), moist, hard.							
				Coal: Lignite coal, black (2.5Y 2.5/1).							
			62	SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.							
360	72	50 in.		CL-ML: SILTY CLAY, gray (2.5Y 5/1), moist, hard.							
			94	SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.							
365	73	54 in.									
			67								
370	74	58 in.		EOB at 372 ft. Target depth reached.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 22.10"

Lon: 103° 4' 39.62"

Appendix B – Photographic Documentation

Site Photographs

Geotechnical Investigation Report
CCI and Associates, Inc.
WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River, North Dakota

Description:
Soil Boring LB-1

Direction of View:
Looking North-northwest

Date Taken:
4/28/2019

Site Photographs

Geotechnical Investigation Report
CCI and Associates, Inc.
WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River, North Dakota

Description:
Soil Boring LB-2

Direction of View:
Looking North-northwest

Date Taken:
4/29/2019

Site Photographs

Geotechnical Investigation Report
CCI and Associates, Inc.
WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River, North Dakota

Description:
Soil Boring LB-3

Direction of View:
Looking South

Date Taken:
5/2/2019

Appendix C - Laboratory Reports

Project: **WBI N Bakken Expansion** Job Number: **G19-025** Sheet **1** of **10**

Manager: _____ Client: _____ Project Description: _____

Location: **Missouri River HDD Crossing**

Elevation Datum: _____

Borehole / Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-1 4.5							9.5						
LB-1 9.5							13.2						
LB-1 14.5							32.4						
LB-1 19.5							4.4						
LB-1 24.5							19.2						
LB-1 29.5							24.3						
LB-1 34.5	49.6	19.2	31.0				21.0						
LB-1 39.5							23.8						
LB-1 44.5							22.0						
LB-1 54.5							20.7						
LB-1 59.5							22.2						
LB-1 64.5							25.8						
LB-1 74.5							26.3						
LB-1 79.5							24.8						
LB-1 84.5							22.9						
LB-1 89.5	56.7	20.8	36.0				22.4						
LB-1 99.5							23.2						
LB-1 104.5							24.6						
LB-1 109.5							23.9						

Material Testing Services, LLC	**Summary of Material Properties**	June 6, 2019

Project: **WBI N Bakken Expansion** Job Number: **G19-025** Sheet **2** of **10**

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-1 114.5							22.0						
LB-1 119.5							24.4						
LB-1 124.5							19.1						
LB-1 129.5	36.4	20.3	16.0				20.4						
LB-1 134.5							21.2						
LB-1 139.5							21.1						
LB-1 144.5							21.9						
LB-1 149.5							28.5						
LB-1 154.5							19.4						
LB-1 159.5							21.0						
LB-1 164.5							24.9						
LB-1 169.5	47.7	19.4	29.0				19.3						
LB-1 174.5							19.5						
LB-1 179.5							22.6						
LB-1 185.0							8.5						
LB-1 189.0							13.8						
LB-1 193.0							15.4						
LB-1 198.0							16.0						
LB-1 203.0					137.7	118.7	16.0						
LB-1 208.0							16.0						
LB-1 223.0							54.1						
LB-1 228.0							60.4						

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-1 233.0							15.4						
LB-1 238.0					129.4	110.4	17.2						
LB-1 243.0							11.6						
LB-1 248.0							11.0						
LB-1 253.0							17.9						
LB-1 258.0	40.8	18.1	23.0				15.5						
LB-1 263.0							21.2						
LB-1 268.0							12.2						
LB-1 273.0							11.8						
LB-1 278.0							13.8						
LB-1 283.0							15.5						
LB-1 288.0							15.3						
LB-1 293.0							14.1						
LB-1 298.0							14.2						
LB-1 303.0					142.5	122.0	16.8						
LB-1 308.0							15.3						
LB-1 313.0							21.3						
LB-1 318.0							16.9						
LB-1 323.0							16.3						
LB-1 328.0							13.1						
LB-1 333.0							14.3						
LB-1 338.0							15.5						

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-1 343.0							15.5						
LB-1 348.0							17.6						
LB-1 353.0	196.0	23.0	173.0				18.4						
LB-1 358.0							16.0						
LB-1 363.0							18.9						
LB-1 368.0							16.2						
LB-1 373.0							20.2						
LB-1 378.0							19.8						
LB-1 388.0							18.9						
LB-1 393.0					131.4	112.1	17.2						
LB-1 398.0							19.9						
LB-2 4.5							20.5						
LB-2 9.5							17.3						
LB-2 14.5							25.5						
LB-2 19.5							22.6						
LB-2 24.5							10.4						
LB-2 29.5							27.5						
LB-2 34.5							25.8						
LB-2 39.5							32.9						
LB-2 44.5	72.9	26.4	47.0				31.4						
LB-2 49.5							33.0						
LB-2 54.5							19.5						

Project: **WBI N Bakken Expansion** Job Number: **G19-025** Sheet **5** of **10**

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-2 59.5							12.5						
LB-2 64.5							14.1						
LB-2 69.5							18.8						
LB-2 74.5							14.3						
LB-2 79.5				18.0			21.9						
LB-2 84.5							17.3						
LB-2 89.5							16.0						
LB-2 94.5							18.2						
LB-2 99.5							17.5						
LB-2 104.5							14.8						
LB-2 109.5							18.6						
LB-2 114.5							21.7						
LB-2 119.5							19.0						
LB-2 124.5							21.9						
LB-2 129.5							23.4						
LB-2 134.5	NP	NP	NP				23.9						
LB-2 139.5							20.6						
LB-2 144.5							25.8						
LB-2 149.5							23.6						
LB-2 153.0	33.5	17.1	16.0				15.4						
LB-2 158.0							15.6						
LB-2 165.0							16.1						

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-2 170.0							17.4						
LB-2 175.0							19.1						
LB-2 180.0							57.2						
LB-2 185.0							12.3						
LB-2 190.0							11.8						
LB-2 195.0							15.5						
LB-2 200.0							16.3						
LB-2 205.0					130.0	111.2	16.9						
LB-2 210.0							15.5						
LB-2 220.0							61.2						
LB-2 225.0							53.5						
LB-2 230.0							65.6						
LB-2 235.0							17.4						
LB-2 240.0							15.5						
LB-2 245.0							11.7						
LB-2 255.0							21.5						
LB-2 260.0	26.3	23.3	3.0				19.5						
LB-2 265.0					137.1	119.6	14.6						
LB-2 270.0							16.3						
LB-2 275.0							16.0						
LB-2 280.0							15.4						
LB-2 290.0							14.9						

Project: **WBI N Bakken Expansion** Job Number: **G19-025** Sheet **7** of **10**

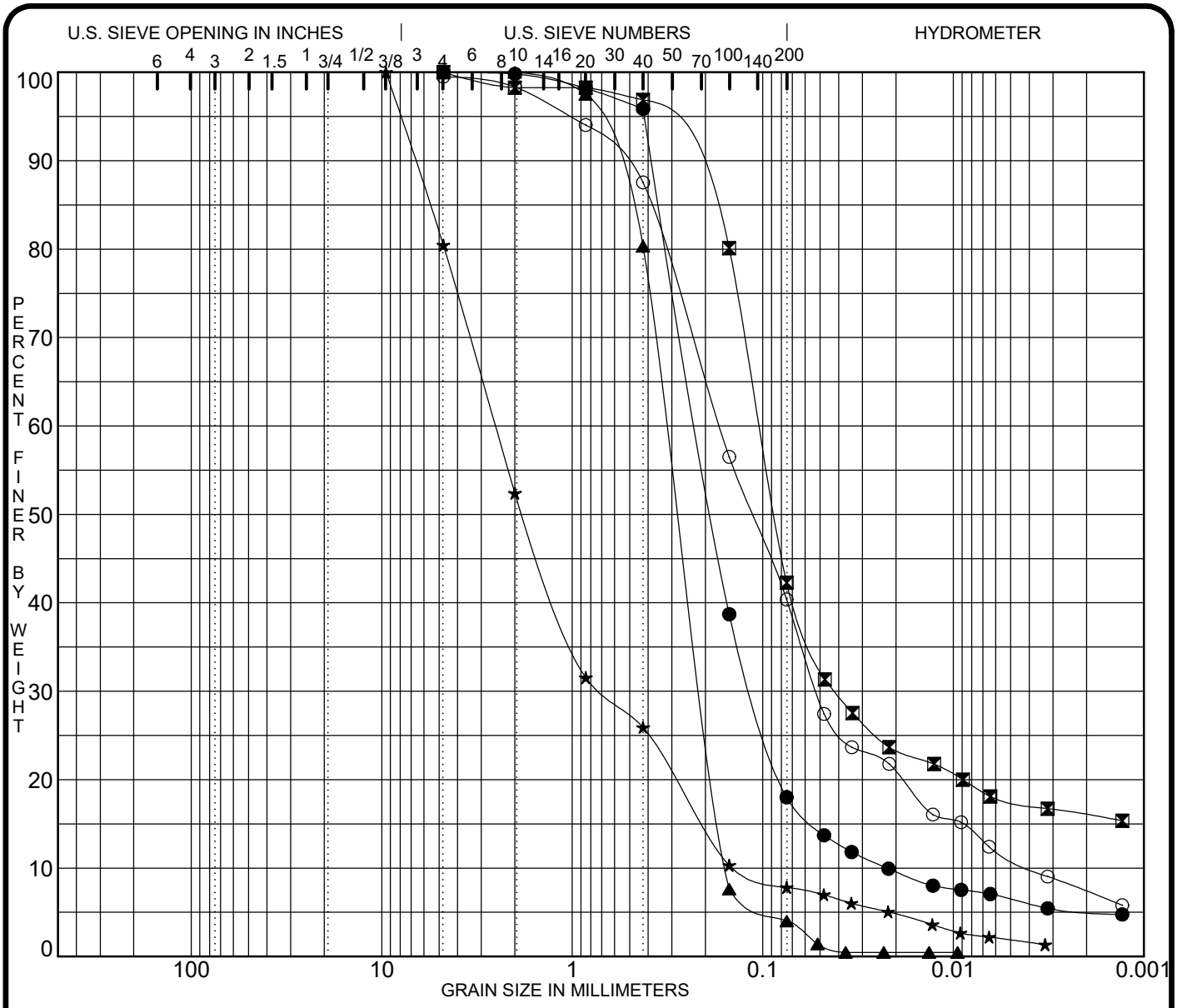
Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-2 295.0							16.0						
LB-2 300.0							17.8						
LB-2 305.0							23.1						
LB-2 310.0							20.7						
LB-2 315.0							13.6						
LB-2 320.0							11.2						
LB-2 325.0							17.9						
LB-2 330.0	52.8	23.9	29.0				18.2						
LB-2 335.0							16.9						
LB-2 340.0							16.3						
LB-2 345.0							17.5						
LB-2 350.0							16.3						
LB-2 355.0				42.3			17.9						
LB-2 360.0					135.7	114.6	18.4						
LB-2 365.0							14.2						
LB-2 370.0							15.3						
LB-2 375.0							17.2						
LB-2 380.0							15.3						
LB-2 385.0							17.2						
LB-2 390.0							16.2						
LB-2 395.0					129.3	109.5	18.1						
LB-3 4.5							4.3						

Borehole Depth / Elev.	Specimen Description	LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data: Top	Bottom	Type	Rec	'N'
LB-3 9.5								3.7						
LB-3 14.5								2.4						
LB-3 19.5								3.0						
LB-3 24.5								24.3						
LB-3 29.5								25.0						
LB-3 34.5	POORLY GRADED SAND				4.0			22.4						
LB-3 39.5								22.2						
LB-3 44.5								18.5						
LB-3 49.5								14.1						
LB-3 54.5								21.0						
LB-3 59.5								20.9						
LB-3 64.5					7.8			10.8						
LB-3 69.5								23.8						
LB-3 74.5								21.0						
LB-3 79.5								18.2						
LB-3 84.5								17.7						
LB-3 89.5								12.0						
LB-3 94.5								20.8						
LB-3 99.5								12.5						
LB-3 104.5								21.9						
LB-3 109.5					40.4			15.8						
LB-3 139.5								17.1						

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-3 144.5							22.3						
LB-3 149.5							20.2						
LB-3 154.5							21.4						
LB-3 159.5							20.4						
LB-3 164.5	23.9	18.1	6.0				20.3						
LB-3 169.5							19.5						
LB-3 175.0							32.5						
LB-3 180.0							28.4						
LB-3 185.0							51.0						
LB-3 187.0							60.3						
LB-3 197.0							20.3						
LB-3 202.0							18.9						
LB-3 207.0							15.1						
LB-3 212.0							15.4						
LB-3 217.0							13.3						
LB-3 222.0							15.9						
LB-3 227.0	24.3	23.1	1.0				13.5						
LB-3 232.0							11.1						
LB-3 237.0							18.5						
LB-3 242.0							15.6						
LB-3 247.0							17.0						
LB-3 252.0							20.2						

Project: **WBI N Bakken Expansion** Job Number: **G19-025** Sheet **10** of **10**

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-3 257.0					128.2	108.8	17.8						
LB-3 262.0							19.4						
LB-3 267.0							16.9						
LB-3 277.0							18.0						
LB-3 282.0							23.8						
LB-3 287.0							17.1						
LB-3 292.0							19.2						
LB-3 297.0					134.6	113.8	18.3						
LB-3 302.0							14.8						
LB-3 307.0							15.9						
LB-3 312.0							17.4						
LB-3 317.0							16.3						
LB-3 322.0							15.8						
LB-3 327.0	105.3	24.7	80.0				23.2						
LB-3 332.0							19.5						
LB-3 337.0							17.9						
LB-3 347.0							15.8						
LB-3 357.0							16.2						
LB-3 362.0					136.1	116.1	17.2						
LB-3 367.0							18.7						



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Classification	MC%	LL	PL	PI	Cc	Cu
●	**LB-2**	**79.5**		**22**				**2.55**	**9.9**
⊠	**LB-2**	**355.0**		**18**					
▲	**LB-3**	**34.5**	**POORLY GRADED SAND SP**	**22**				**0.87**	**2.0**
★	**LB-3**	**64.5**		**11**				**1.42**	**18.4**
⊙	**LB-3**	**109.5**		**16**				**4.12**	**43.1**

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**LB-2**	**79.5**	**4.75**	**0.22**	**0.112**	**0.0223**	**0.0**	**82.0**	**11.5**	**6.5**
⊠	**LB-2**	**355.0**	**4.75**	**0.10**	**0.042**		**0.0**	**57.7**	**24.7**	**17.6**
▲	**LB-3**	**34.5**	**2.00**	**0.32**	**0.207**	**0.1552**	**0.0**	**96.0**		
★	**LB-3**	**64.5**	**9.50**	**2.53**	**0.703**	**0.1375**	**19.5**	**72.6**	**5.9**	**1.9**
⊙	**LB-3**	**109.5**	**4.75**	**0.17**	**0.052**	**0.0039**	**0.0**	**59.1**	**29.2**	**11.2**

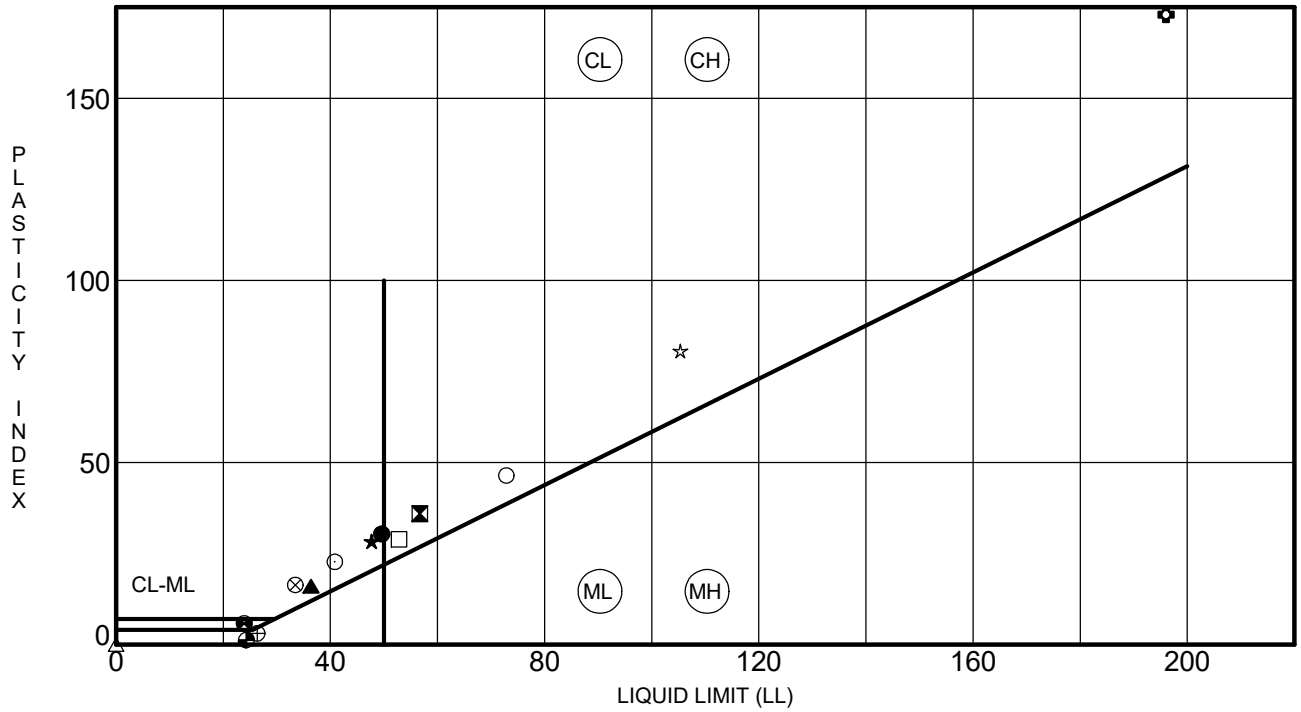
PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G19-025**

DATE **6/6/19**

PARTICLE SIZE ANALYSIS

Material Testing Services, LLC



Specimen Identification			LL	PL	PI	Fines	Classification
●	LB-1	34.5	50	19	30		
⊠	LB-1	89.5	57	21	36		
▲	LB-1	129.5	36	20	16		
★	LB-1	169.5	48	19	28		
⊙	LB-1	258.0	41	18	23		
✿	LB-1	353.0	196	23	173		
○	LB-2	44.5	73	26	46		
△	LB-2	134.5	NP	NP	NP		
⊗	LB-2	153.0	33	17	16		
⊕	LB-2	260.0	26	23	3		
□	LB-2	330.0	53	24	29		
⊛	LB-3	164.5	24	18	6		
◕	LB-3	227.0	24	23	1		
☆	LB-3	327.0	105	25	81		

PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G19-025**

DATE **6/6/19**

ATTERBERG LIMITS' RESULTS

Material Testing Services, LLC

MATERIAL TESTING SERVICES, LLC

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UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING
ZGE 15-102

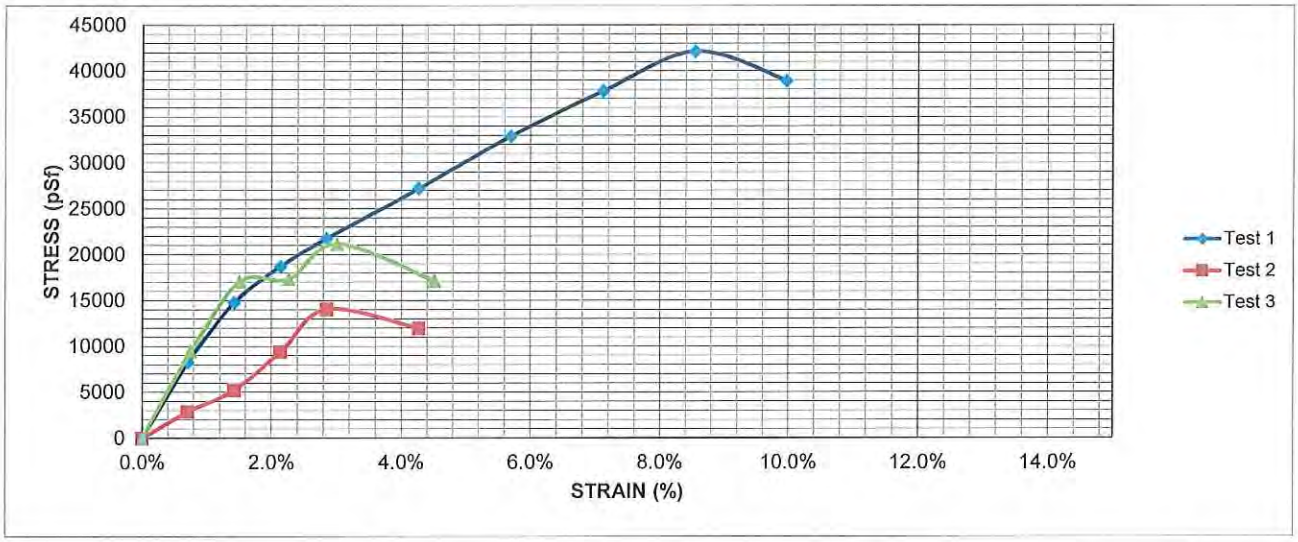
DATE: 6-Jun-19

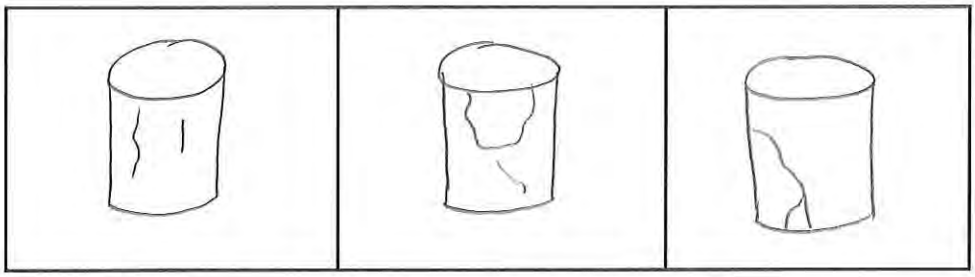
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G19-025

Specimen ID:	Test 1	Test 2	Test 3
	LB-1	LB-1	LB-1
	RC - 203-208 feet	RC - 238-243 feet	RC - 303-308 feet
Soil Class:			
Dry Density (pcf):	118.7	110.4	122.0
Water Content:	16.0%	17.2%	16.8%
Sample Dia. (mm):	42.3	45.3	42.9
Sample Ht (mm):	89.2	89.0	84.3
Height/Diameter:	2.11	1.97	1.97
Unc. Strength (psf):	**42174**	**14087**	**21196**
Strain at Failure (%):	8.5	2.9	3.0





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Material Testing Services, LLC

by

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UNCONFINED COMPRESSIVE STRENGTH
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PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING
ZGE 15-102

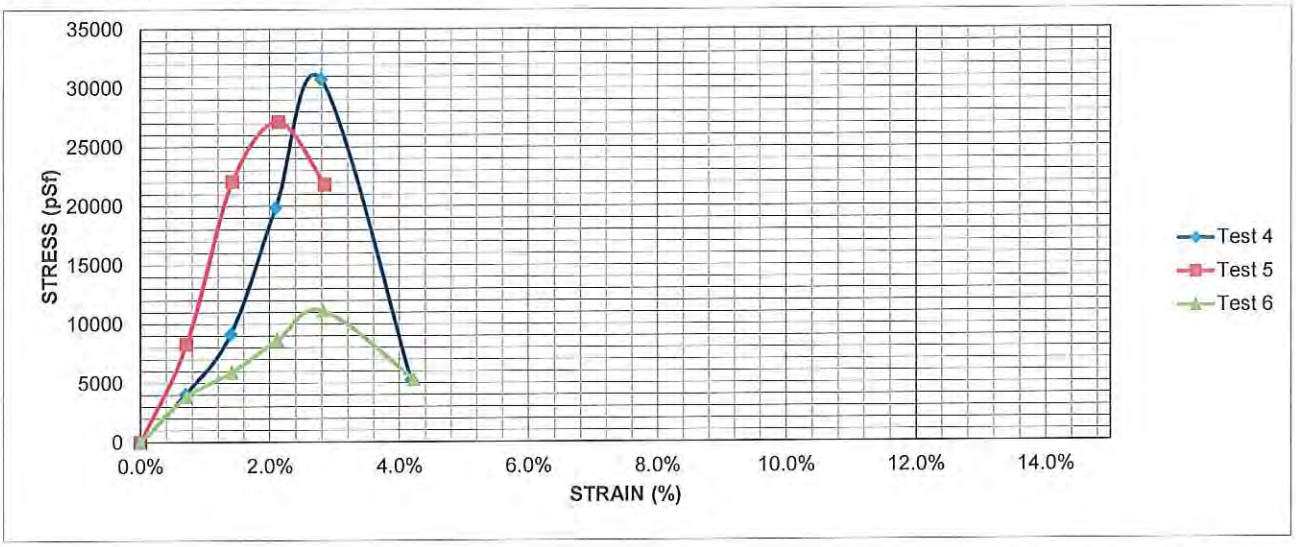
DATE: 6-Jun-19

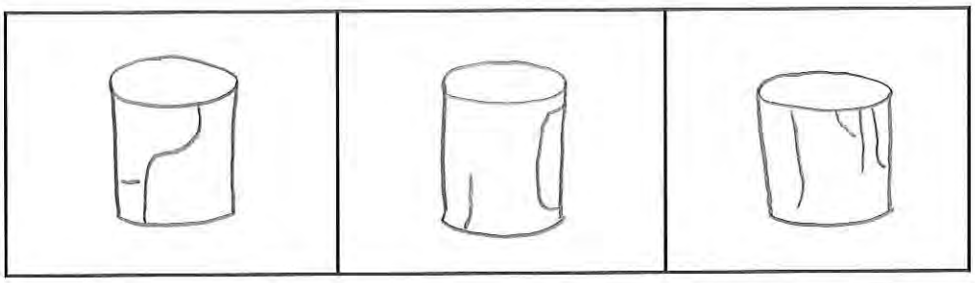
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G19-025

Specimen ID:	Test 4	Test 5	Test 6
	LB-1 RC - 393-398 feet	LB-2 RC - 160-165 feet	LB-2 RC - 205-210 feet
Soil Class:			
Dry Density (pcf):	112.1	115.1	111.2
Water Content:	17.2%	15.1%	16.9%
Sample Dia. (mm):	44.7	44.5	44.9
Sample Ht (mm):	91.2	89.4	90.2
Height/Diameter:	2.04	2.01	2.01
Unc. Strength (psf):	**30776**	**27159**	**11160**
Strain at Failure (%):	2.8	2.1	2.8





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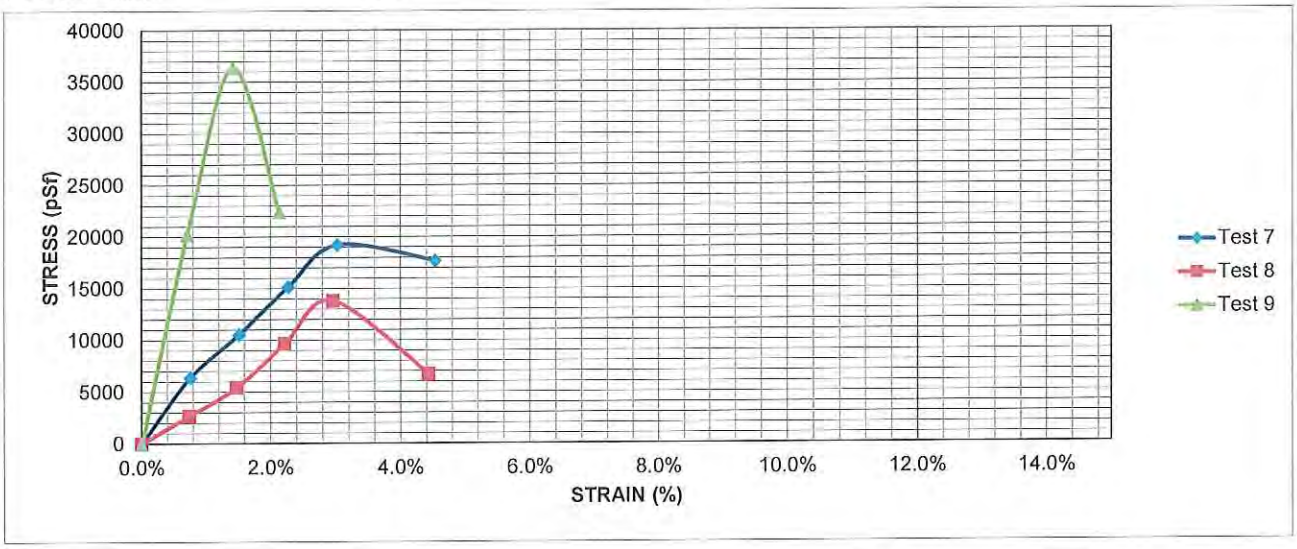
DATE: 6-Jun-19

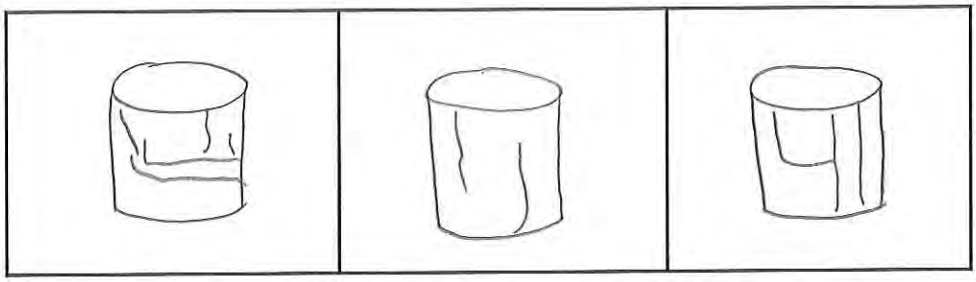
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G19-025

Specimen ID:	Test 7	Test 8	Test 9
	LB-2 RC - 265-270 feet	LB-2 RC - 360-365 feet	LB-2 RC - 395-400 feet
Soil Class:			
Dry Density (pcf):	119.6	114.6	109.5
Water Content:	14.6%	18.4%	18.1%
Sample Dia. (mm):	43.9	45.1	44.7
Sample Ht (mm):	84.1	86.0	89.5
Height/Diameter:	1.91	1.91	2.00
Unc. Strength (psf):	**19238**	**13841**	**36379**
Strain at Failure (%):	3.0	3.0	1.4





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Material Testing Services, LLC

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ZGE 15-102

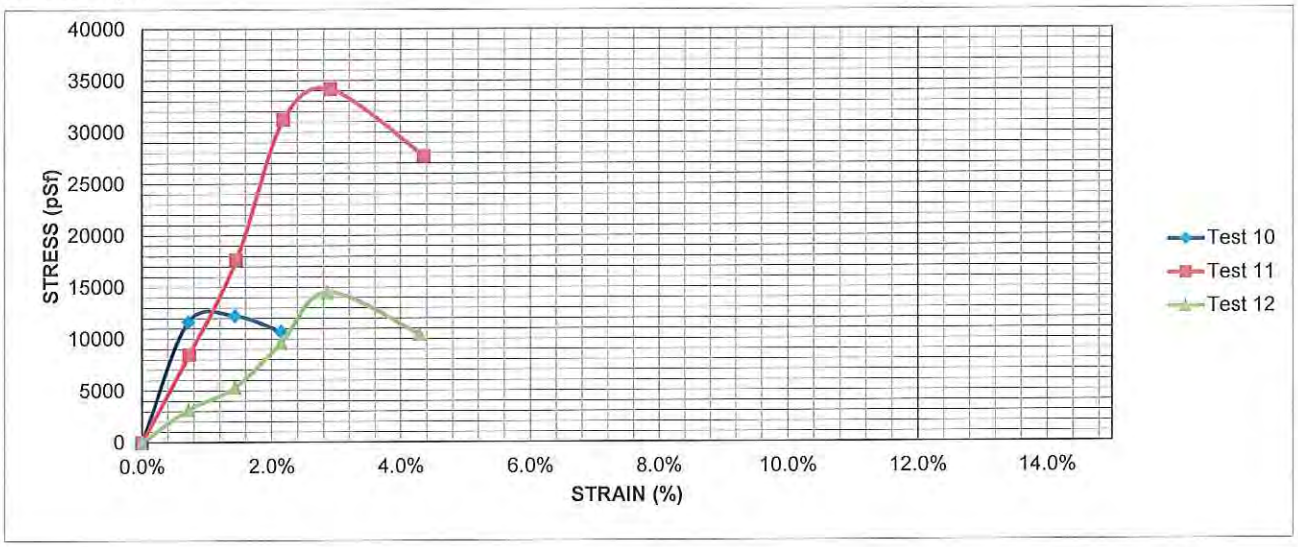
DATE: 6-Jun-19

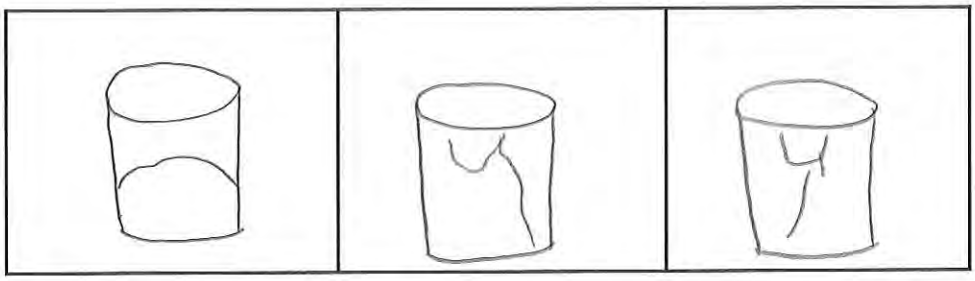
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G19-025

Specimen ID:	Test 10	Test 11	Test 12
	LB-3 RC -257-262 feet	LB-3 RC - 297-302 feet	LB-3 RC - 362-367 feet
Soil Class:			
Dry Density (pcf):	108.8	113.8	116.1
Water Content:	17.8%	18.3%	17.2%
Sample Dia. (mm):	45.1	43.7	45.1
Sample Ht (mm):	88.9	87.3	88.9
Height/Diameter:	1.97	2.00	1.97
Unc. Strength (psf):	**12245**	**34215**	**14547**
Strain at Failure (%):	1.4	2.9	2.9





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Material Testing Services, LLC

by

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%		ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

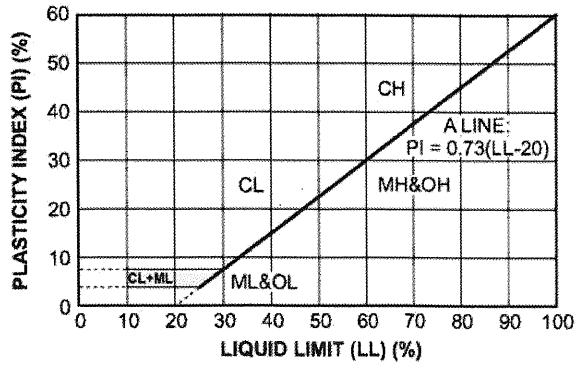
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent ..... GW, GP, SW, SP
More than 12 percent ..... GM, GC, SM, SC
5 to 12 percent ..... Borderline cases requiring dual symbols

PLASTICITY CHART



LABORATORY TEST RESULTS

Testing Scope

Laboratory testing was proposed to characterize soils index properties including Atterberg limits (liquid and plastic limits) and moisture content. Strength testing included unconfined compression testing.

Index Properties

Testing and classification of soils was performed in accordance with the Unified Soil Classification System as described in ASTM D 2487. Atterberg limits were performed according to ASTM D 4318. Moisture content was determined in accordance with ASTM D 4959 and D 4643. The dry density was determined with direct measurement procedures. Mechanical sieve analysis was done in accordance with ASTM D 422.

Strength Testing

The strength tests consisted of unconfined compression (QU) testing. The QU tests were conducted in accordance with ASTM D 2166.

CCI and Associates, Inc.

Geotechnical Investigation Report – Water-Based Borings

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Date:
July 9, 2020

Geotechnical Investigation Report – Water Based Borings

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

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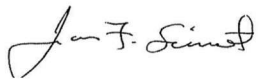

James F. Simonet
Senior Project Hydrogeologist

Robert E. Jenson, CHMM
Principal Scientist/Operations Manager

Anthony Frances, PE
Geotechnical Engineering
Material Testing Services, LLC.

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2 Methods 2
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2.2 Laboratory Testing 4
3 Site Conditions 4
4 Limitations 5

References

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Figure 1 – Soil Boring Location Map
Figure 2 – Barge Assembly and Crane Location Map

Tables

Table 1 – Soil Boring Locations

Appendices

Appendix A – Photographic Documentation Boring Logs
Appendix B – Aquatic Nuisance Species Inspection
Appendix C – Boring Logs
Appendix D – Laboratory Reports

Acronyms

ASTM	American Society for Testing and Materials
CCI	CCI and Associates, Inc.
ESC	Erickson Contract Surveying, Inc.
GES	Groundwater & Environmental Services, Inc.
HDD	horizontal directional drilling
HAS	hollow-stem auger
IDS	Interstate Drilling Services, LLP
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NDGFD	North Dakota Game and Fish Department
MTS	Material Testing Services, LLC
TGCRA	Tobacco Garden Creek Recreation Area
USACE	US Army Corp of Engineers

1 Introduction

This report presents the results of the geotechnical investigation that was performed by Groundwater and Environmental Services, Inc. (GES) for the project known as the WBI North Bakken Expansion Project in western North Dakota. Specifically, this report covers the geotechnical exploration at 6 water-based soil borings located along the proposed horizontal directional drilling (HDD) pipeline project under Lake Sakakawea/Missouri River (**Figure 1**). The proposed pipeline alignment under Lake Sakakawea is located approximately 1 mile northeast of the Tobacco Garden Creek Recreation Area (TGCRA). The TGCRA is located approximately 23 miles northeast of Watford City, North Dakota.

Services for this investigation were performed in general accordance with the April 1, 2019 Services Contract by and between CCI and Associates, Inc. (CCI) and GES.

1.1 Project Location and Scope

The objective of this phase of the geotechnical investigation is to assist CCI with evaluating the subsurface conditions at 6 water-based boring locations (WB-4 through WB-9) located along the proposed HDD pipeline alignment in Lake Sakakawea.

The scope of work included the following:

- Prepare a site-specific health and safety plan for GES employees and subcontractors for the proposed geotechnical investigation activities.
- Coordinate field activities and communication with project team and CCI.
- Participate in a pre-construction meeting with the Garrison Project Natural Resource Office of the US Army Corp of Engineers (USACE), TGCRA stakeholders, GES project team and WBI Energy representatives.
- Arrange for an inspection of all equipment entering the Lake by the North Dakota Game and Fish Department (NDGFD). Provide proof that equipment has been cleaned of aquatic nuisance species, mud, standing water and aquatic vegetation.
- Arrange for utility clearance through North Dakota One Call.
- Install crane mat protection along shoreline at barge assembly area located within the TGCRA.
- Mobilize the drilling team (Interstate Drilling Services, LLP (IDS)) and assembly and deploy the barge.
- Advance 6 water-based soil borings and collect samples at designated locations
- Clean barge sections and boats during final demobilization.

- Contract laboratory tests on soil samples obtained from the 6 water-based soil borings to evaluate physical properties.
- Provide a written geotechnical report.

Photographs taking during the project are provided in **Appendix A.**

2 Methods

2.1 Soil Borings

GES contracted with IDS of Grand Forks, North Dakota, to assemble the barge and advance the 6 water-based soil borings (**Figure 1**). IDS used a Diedrich D-50 track-mounted drill rig to advance the borings and collect soil samples.

The barge was deployed at the TGCRA at a location adjacent to the north side of the low-water boat ramp. Prior to deployment, crane mats, consisting of wood timbers were placed on the beach from the gravel driveway to approximately 5 feet from the water line in order to allow the crane to drive down to the water's edge while protecting the beach area and bank from damage. A 6" wattle was placed along the lake shore between the crane pad and water for erosion protection. The crane pad location is provided on **Figure 2**.

The crane pad was installed on May 4, 2020 and the crane, barge sections, push boat, drilling rig, equipment and supplies were mobilized to the TGCRA on May 5th.

Prior to placing into the lake, the barge sections and push-boat were power-washed and inspected for aquatic nuisance species by the NDGFD, per the USACE Permit DACW45-3-17-8010. A copy of the inspection is provided in **Appendix B**. Once approved by the NDGFD, the barge sections were placed into the lake and assembled. The barge consisted of six 10'x40' sections. Loading of the drilling rig, equipment and supplies onto the barge was completed on May 6th.

The barge was directed over the boring locations with assistance from Erickson Contract Surveying, Inc. (ECS) of Sidney, Montana. The boring locations were located via boat using a handheld GPS system and then demarcated with a 14" diameter red buoy. The buoys were deployed approximately 50 feet from the proposed pipeline alignment. Once the barge reached the buoy, ECS personnel collected a second measurement of the actual boring location. The borehole locations and mudline elevations using North Dakota – North, State Plane datum (NAD 83, 2011) are provided in **Table 1**. The water elevation for Lake Sakakawea during the project was generally stable at approximately 1,841 feet (NAVD88).

Table 1 - Borehole Locations					
Bore Hole	Easting	Northing	Mudline Elevation (feet)	Latitude	Longitude
WB-4	1335963.13	420346.33	1,811.7	N48°07'23.30"	W103°05'25.93
WB-5	1336623.75	422154.16	1,811.7	N48°07'42.24"	W103°05'15.52
WB-6	1337159.16	424253.25	1,811.9	N48°08'02.38"	W103°05'10.74
WB-7	1337758.65	425801.28	1,811.7	N48°08'17.93"	W103°05'01.65
WB-8	1338402.89	428621.66	1,812.7	N48°08'45.61"	W103°04'53.93
WB-9	1338983.19	430083.96	1,813.0	N48°09'00.54"	W103°04'45.07

Borehole advancement began on May 6, 2020 and the last boring was completed on the evening of May 16, 2020. The drilling operation consisted of 2 crews each working 12-hour shifts on the 24-hour operation. Work stoppages, due to high wind conditions occurred on May 8th, May 9th, May 12th and May 13th.

A hollow-stem auger (HSA) was used to collect soil samples while boring through soft lake sediment. Once competent sediment was encountered; a closed loop, fluid rotary drilling method was used to advance the borings through the sediments. Rock coring drilling methodology was then used to reach each boring terminus.

All borings were advanced to a total depth of 300 feet below the lake mudline except for WB-7 which was advanced to 315 feet and WB-9 which was advanced to 310 feet below the mudline. Upon completion, each boring was sealed from the boring terminus to the lake mudline with a concrete/bentonite slurry through a tremie rod.

During the fluid rotary drilling process, the spent drilling fluid was captured and run through a Mud Puppy 255 that removed drill cutting sand and grit from the drilling fluid, allowing the drilling fluid to be returned to the drilling operation. This process greatly reduced overall waste generation during the drilling process. Drilling cuttings and sediment were containerized for disposal and transported to the Grand Forks Landfill (Permit IT-202) located at 2701 North 69th Street, Grand Forks, North Dakota.

During HSA and fluid rotary methodologies, 1.5-foot samples were collected at 5 foot intervals using a split-spoon sampler in accordance with American Society for Testing and Materials (ASTM) D1586 (*Standard Test Method for Standard Penetration Test [SPT] and Split-Barrel Sampling of Soils*) using a 2-inch diameter split-spoon sampler. During rock coring drilling methodology, samples were generally collected at 5-foot sample intervals continuously in accordance with ASTM D2113 (*Standard Practice for Rock Core Drilling and Sampling of Rock for Site Exploration*) using a using a NQ3 size, triple-tube core barrel with a diamond bit.

Soils were classified in the field by a GES field geologist using ASTM Visual-Manual procedures (ASTM D2488, *Standard Practice for Description and Identification of Soils [Visual-Manual Procedure]*). The field geologist also collected samples from the split-spoon sampler and rock core sampler for geotechnical laboratory testing.

The boring logs and standard boring classification guidelines are contained in **Appendix C**.

2.2 Laboratory Testing

GES contracted with Material Testing Services, LLC (MTS) of Minot, North Dakota to provide geotechnical laboratory testing and evaluation services to aid in classifying and evaluating the physical properties of the soil/rock samples. Soil/rock sample selection and laboratory test parameters were determined by CCI.

The laboratory testing included the following:

- Moisture Content (ASTM D4959 - Standard Test Method for Determination of Water Content of Soil by Direct Heating and D4643 - Standard Test Method for Determination of Water Content of Soil and Rock by Microwave Oven Heating).
- Sieve Analysis (ASTM D422 – Test Method for Particle-size Analysis of Soils).
- Atterberg Limits (ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils).
- Unconfined Compression Testing (ASTM D2166 – Standard Test Method for Unconfined Compressive Strength of Cohesive Soils).

The laboratory data and reports are provided in **Appendix D.**

3 Site Conditions

The proposed HDD pipeline crossing traverses southwest to northeast across Lake Sakakawea approximately 1 mile northeast of the TGCRA. The physiographic regions where the proposed HDD pipeline crossing is located consist of the McKenzie Upland Unit, located south of the Missouri River and the Coteau Slope Unit, located north of the Missouri River. These units are part of the Great Plains and characterized by rolling to hilly plains with both erosional and glacial landforms. The proposed HDD crossing is located within the historic Missouri River floodplain that was flooded with the construction of the Garrison Dam in 1956 to form Lake Sakakawea. This area is located in the central portion of the Williston Basin.

The surface geology in the area consists of thin layers of glacial deposits underlain by the Paleocene-Aged Sentinel Butte Formation and the Bullion Creek Formation. The Sentinel Butte Formation consists of layers of silt, clay, sand, lignite, carbonaceous shale, and mudstone (Carlson, 1985). The Bullion Creek Formation underlies the Sentinel Butte Formation and consists of yellowish layers of silt, clay, and sand with interbedded sandstone, lignite, baked clay, and

limestone (Bluemle, 1977). Both formations are poorly lithified and form rolling topography over broad areas of Western North Dakota. The Sentinel Butte Formation outcrops along the north south shoreline of the Missouri River near WB-4 and both the Sentinel Butte and Bullion Creek Formations outcrop along the north shoreline of the Missouri River near WB-9 (Bluemle, 1977).

Soil borings WB-4 through WB-9 generally consist of silts and poorly graded sands and gravels in the upper portions of the borings, consistent with more recent alluvial deposits originating from the Missouri River. These alluvial deposits extend to approximately 45 feet below the mudline in borings WB-4 and WB-9, and to approximately 220 below the mudline at boring WB-7. Underlying the more recent alluvial deposits are deposits of the Sentinel Butte and Bullion Creek Formations.

4 Limitations

The data generated and conclusions and opinions provided are based on the scope of work performed. All work was conducted in a manner consistent with currently accepted geotechnical engineering practices exercised by members of the profession practicing under similar conditions. No other warranty, expressed or implied, is made.

The samples collected and described in this report are representative of the subsurface conditions at the sampled locations and intervals, and therefore, do not necessarily reflect strata variations that may exist between sampled intervals and locations. If variations from the subsurface conditions described in this study are noted during additional investigations and/or construction, recommendations in this report must be re-evaluated.

GES is not responsible for the independent conclusions, opinions, or recommendations made by others based on the data presented in this report. Nor can GES warrant that this report will satisfy the dictates of or provide a legal defense in connection with an environmental law or regulation.

The results reported and any opinions reached by GES are for the benefit of the CCI & Associates and their client and unless agreed to by GES in writing, are not to be disclosed to or relied upon by any third party. The results and opinions set forth by GES in this report will be valid as of the date of the report.

References

Bluemle, J.P. 1977. *Geologic Highway Map of North Dakota*. North Dakota Geological Survey Educational Series 11, Miscellaneous Map 19.

Carlson, Clarence G. 1985. *Geology of McKenzie County, North Dakota.* North Dakota Geological Survey, Bulletin 80 – Part 1 and North Dakota State Water Commission, County Groundwater Studies 37 – Part 1.

Figures

L:\Projects\CCI\GIS\CCI_Lake_Sakakawea_SBLM.mxd - Scale 1:36,000 - 7/1/2020 3:53:16 PM - dcleland - NAD 1983 StatePlane North Dakota North FIPS 3301 Feet

Water Boring Location Map

CCI and Associates, Inc.
WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Drawn **AMW**
Designed **DMC**
Approved **-**

Date **7/1/20**
Figure **1**

Scale In Feet (Approximate)
0 3,000

Groundwater & Environmental Services, Inc.

L:\Projects\CCI\GIS\CCI_Lake_Sakakawea_Barge Area.mxd - Scale 1:1,774 - 7/1/2020 5:04:52 PM - dcleland - NAD 1983 StatePlane North Dakota North FIPS 3301 Feet

Barge Assembly and Crane Location Area

CCI and Associates, Inc.
WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Drawn **AMW**
Designed **DMC**
Approved **-**

Date **7/1/20**
Figure **2**

Scale In Feet (Approximate)
0 150

Groundwater & Environmental Services, Inc.

Appendix A – Photographic Documentation Boring Logs

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
View of low-water boat ramp and location of crane mat area before mobilization

Direction of View:
Southeast

Date Taken:
04/29/2020

Description:
View of low-water boat ramp location of crane mat area before mobilization

Direction of View:
Westward

Date Taken:
04/29/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Placing crane mats in preparation of mobilizing barge

Direction of View:
Westward

Date Taken:
05/04/2020

Description:
Completion of crane pad area

Direction of View:
Southeast

Date Taken:
05/04/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Positioning of crane in preparation of barge mobilization

Direction of View:
Westward

Date Taken:
05/05/2020

Description:
Lifting first barge section to the water

Direction of View:
Westward

Date Taken:
05/05/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Placing the barge winch on the barge

Direction of View:
Northwest

Date Taken:
05/05/2020

Description:
Placement of drilling rig on barge

Direction of View:
Northwest

Date Taken:
05/05/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Placement of push boat in Lake

Direction of View:
Northeast

Date Taken:
05/05/2020

Description:
Placement of Spud on Barge

Direction of View:
Northward

Date Taken:
05/05/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
View of drilling rig and barge deck

Date Taken:
05/06/2020

Description:
Overhead view of barge

Date Taken:
05/06/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
View of barge deck and two spill kit barrels

Direction of View:
Port side of barge

Date Taken:
05/06/2020

Description:
Photo of Mud Puppy mud recycling unit and secondary containment

Direction of View:
Starboard side of barge

Date Taken:
05/06/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Barge deck and portable light towers in secondary containment

Direction of View:
At bow of barge

Date Taken:
05/07/2020

Description:
Drilling Rig preparing to begin at WB-5

Date Taken:
05/07/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Completing boring WB-9

Date Taken:
05/15/2020

Description:
Demobilization of equipment

Direction of View:
Northwest

Date Taken:
05/19/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Demobilization of drilling rig

Direction of View:
Northwest

Date Taken:
05/19/2020

Description:
Demobilization of equipment

Direction of View:
Northwest

Date Taken:
05/19/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Removal of push boat from water

Direction of View:
Northwest

Date Taken:
05/19/2020

Description:
Removal of barge sections during demobilization

Direction of View:
Eastward

Date Taken:
05/19/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Pressure washing barge sections during demobilization

Direction of View:
Eastward

Date Taken:
05/19/2020

Description:
Preparing to remove crane from crane pad during demobilization

Direction of View:
Southeast

Date Taken:
05/19/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Low water boat ramp and crane pad area after completion of demobilization

Direction of View:
Northwest

Date Taken:
05/19/2020

Description:
Low water boat ramp and crane pad area after completion of demobilization

Direction of View:
Southeast

Date Taken:
05/19/2020

Appendix B – Aquatic Nuisance Species Inspection

ANS INSPECTION REPORT - For equipment brought into or to be used in North Dakota
NORTH DAKOTA GAME AND FISH DEPARTMENT
FISHERIES DIVISION

Company name: Interstate Drilling **Contact:** Mike Zak	**E-mail address:** mikez@interstatedrilling.com	**Phone number:** (701) 741-9951

Water body: Lake Sakakawea **Location:** Tobacco Gardens
Equipment inspected: 6 barge sections, 1 tugboat, various aquatic equipment

Where equipment was last used

Tugboat and four sections of barge last used on Missouri River near Boonville, Mo (taken out 4/20/20)
One barge section has been sitting since December of 2019 – Rock River, Rock Island, IL (taken out DEC 2019)
One barge section has been sitting since August of 2019 – Missouri River, Nebraska City, NE (take out AUG 2019)

ANS Precautions used prior to equipment entering North Dakota

All barge sections were pressure washed with hot water prior to entering North Dakota. Additionally, barge sections and tugboat were dried for 2 weeks to 8 months.

Actual physical and visual ANS inspection

Barge section 1 – few very dry byssal threads found. No limpets or ZM. Cleared for launch.
Barge section 2 – numerous dried byssal threads and 2 dead zebra mussels found, all very dry. Required additional cleaning and inspection.
Barge section 3 – some byssal threads. No mussels or limpets. Cleared for launch.
Barge section 4 slanted – very few byssal threads. Cleared for launch.
Barge section 5 – no attached organism and very few dry byssal threads. Cleared for launch.
Barge section 6 – no attached organic material. Cleared for launch.
Tugboat – no byssal threads or mussels found on the outside of the boat. Required additional cleaning because it was not washed before entering North Dakota. Inside of tugboat does not take on water. No standing water or organics found inside, so did not require additional cleaning or disinfection inside.

Additional comments or notes:

One section of barge and the tugboat were power washed under supervision and were re-inspected. These were cleared to be put into Sakakawea.
Zebra mussels observed had desiccated organs, indicating that they were not alive. It is likely that the pressure washing in Missouri utilized hot water or the two week plus drying period allowed the mussels to die.
Crane did not get put in water – no inspection required.

Status:	**NDGF representative:**	**Date:**
Approved	Ben Holen, ANS Coordinator	5/5/2020

Barge section 2 and zebra mussel that was discovered on it.

Left: Pressure washing the tugboat. Right: Inside of tugboat. No standing water was present.

Line of barges.

Appendix C – Boring Logs

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
0				CL-ML: SILTY CLAY, with trace fine grained sand, very dark gray (5Y 3/1), very moist, soft.							
15	1	6 in.	2-2-2		0.25						
20	2	8 in.	1-12	SP: POORLY GRADED SAND, fine grained, dark gray (5Y 4/1), wet, very loose.	-						
25	3	15 in.	1-1-1		-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	4	10 in.	4-6-4	With trace medium grained sand and loose at 29.5 ft.	-						
35	5	10 in.	2-2-1		-						
40	6	10 in.	7-5-6	SP: POORLY GRADED SAND, medium to coarse grained, with little fine gravel, with trace small lignite pieces, olive (5Y 4/3), wet, medium dense.	-						
45	7	7 in.	4-4-6	SPG: POORLY GRADED SAND WITH GRAVEL, coarse grained with fine gravel, olive (5Y 4/3), wet, loose.	-						5.4
50	8	6 in.	6-9-11	SP: POORLY GRADED SAND, fine to medium grained, dark gray (5Y 4/1), wet, medium dense.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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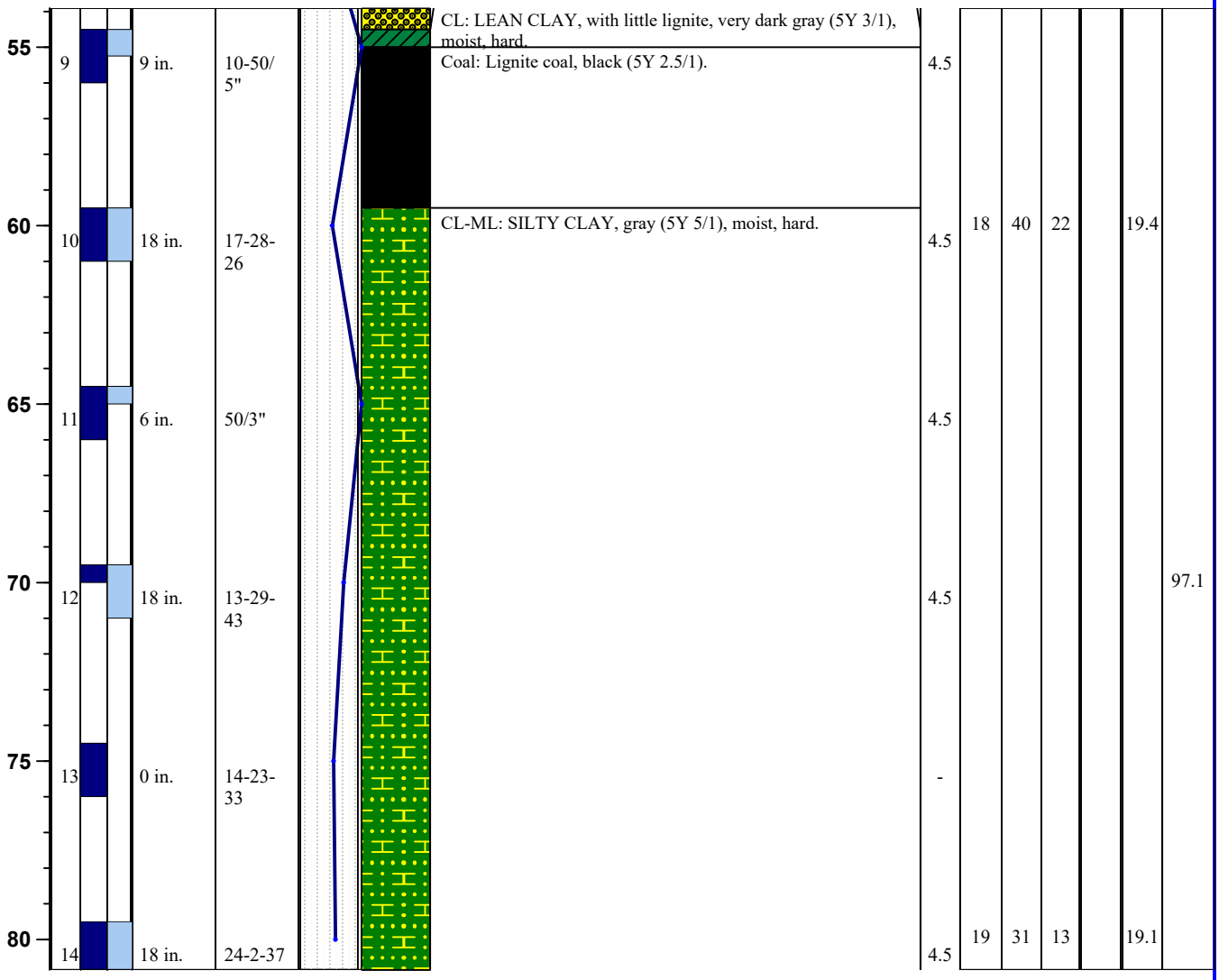
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**



Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
	9	9 in.	10-50/ 5"	CL: LEAN CLAY, with little lignite, very dark gray (5Y 3/1), moist, hard.							
				Coal: Lignite coal, black (5Y 2.5/1).	4.5						
	10	18 in.	17-28-26	CL-ML: SILTY CLAY, gray (5Y 5/1), moist, hard.	4.5	18	40	22		19.4	
	11	6 in.	50/3"		4.5						
	12	18 in.	13-29-43		4.5						97.1
	13	0 in.	14-23-33		-						
	14	18 in.	24-2-37		4.5	19	31	13		19.1	

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

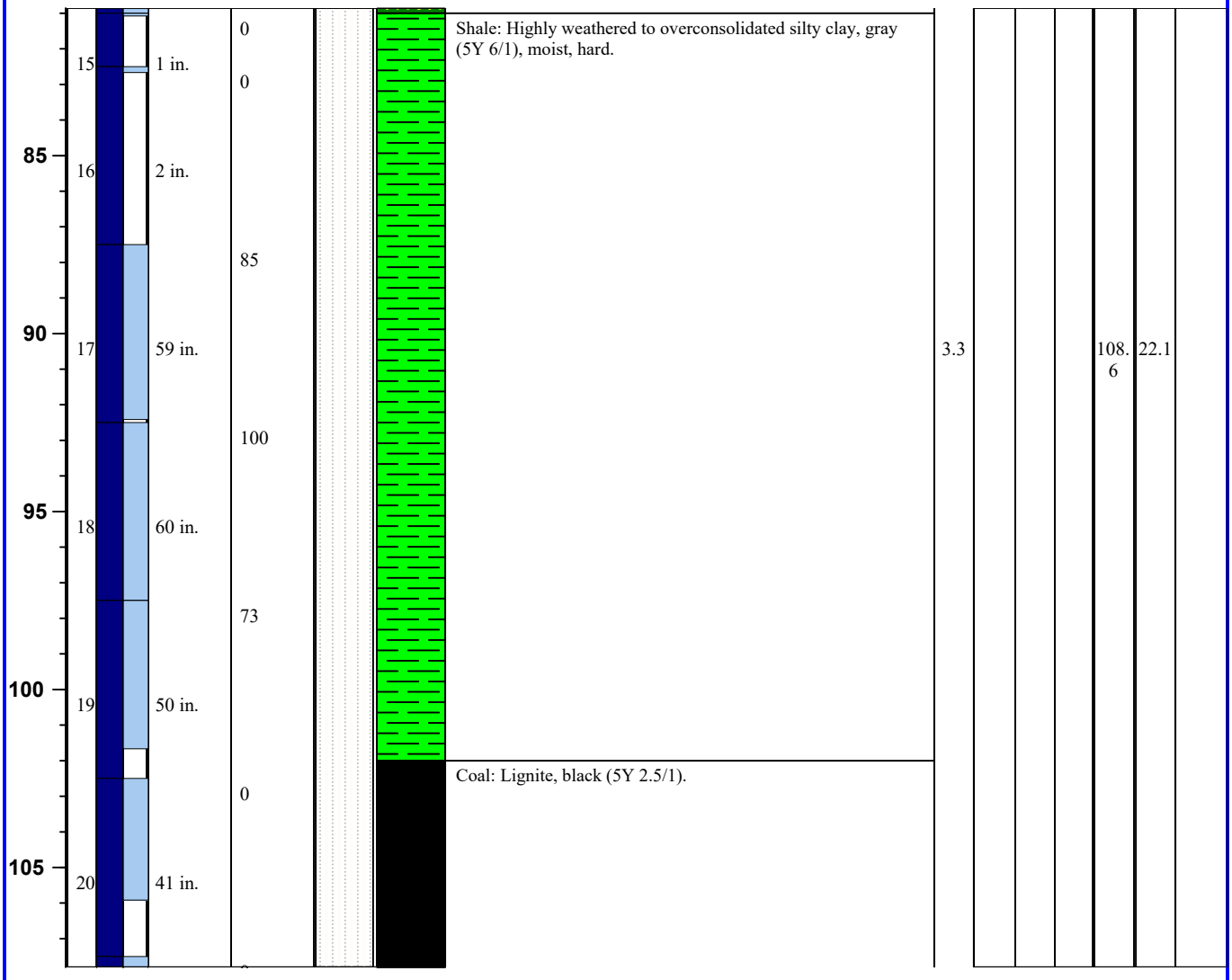
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**



Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
85	15	1 in.	0	Shale: Highly weathered to overconsolidated silty clay, gray (5Y 6/1), moist, hard.	3.3				108.6	22.1	
	16	2 in.	0								
			85								
90	17	59 in.									
			100								
95	18	60 in.									
			73								
100	19	50 in.									
			0	Coal: Lignite, black (5Y 2.5/1).							
105	20	41 in.									

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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Groundwater & Environmental Services, Inc.

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Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
110	21	60 in.	0	With some coarse sand from 110.5 to 112.5 ft.							
115	22	51 in.	0								
120	23	60 in.	0								
125	24	60 in.	78	Shale: Highly weathered to overconsolidated silty clay, gray (5Y 6/1), moist, hard.							
130	25	57 in.	83		11.3				113.7	15.2	

Notes:

Soil Lithologies based on field observations and laboratory analysis.

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Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

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Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

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Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	26	50 in.	93								
140	27	58 in.	85	Lignite seam 3 in. thick at 143 ft.							
145	28	55 in.	87	Lignite seam 2 in. thick at 145 ft.							
150	29	60 in.	95		17.6				118.9	15.5	
155	30	60 in.	0	SP: POORLY GRADED SAND, fine grained, gray (5Y 5/1).							
160	31	0 in.									

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
165	32	0 in.	0								
			0								
170	33	0 in.									
			0								
175	34	0 in.									
			7								
180	35	38 in.		Coal: Lignite, black (5Y 2.5/1).							
			85	Shale: Highly weathered to overconsolidated clay, gray (5Y 5/1), moist, hard.							
185	36	60 in.			23.8				115.1	19.1	
				Coal: Lignite, black (5Y 2.5/1).							
			87	Shale: Highly weathered to overconsolidated clay, gray (5Y							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
190	37	60 in.	85	5/1), moist, hard. Lignite seam 6 in. thick at 192 ft.							
195	38	58 in.	83	CL: LEAN CALY, with fine grained sand, gray (5Y 5/1), moist, hard. Coal: Lignite, black (5Y 2.5/1). SM: SILTY SAND, fine grained, gray (5Y 5/1), moist, very dense. Shale: Highly weathered to overconsolidated clay, gray (5Y 5/1), moist, hard.							
200	39	57 in.	100	Coal: Lignite, black (5Y 2.5/1). CL: LEAN CLAY, with trace fine grained sand, consolidated, to highly weathered shale, gray (5Y 5/1), moist, hard.							
205	40	60 in.	27	SP: POORLY GRADED SAND, fine grained, with trace silt, gray (5Y 5/1) moist, very dense.							
210	41	24 in.	10	Seam of consolidated clay 6 in. thick at 210 ft.							
215	42	44 in.									

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
220	43	45 in.	50	Coal: Lignite, black (5Y 2.5/1).							
			93	CL: LEAN CLAY, consolidated, to highly weathered shale, gray (5Y 5/1), moist, hard.							
225	44	60 in.	97	Sandstone: Fine grained, weakly cemented, with some silt, gray (5Y 5/1), moist, very dense.							
230	45	60 in.	88								
235	46	54 in.	100	Shale: Highly weathered, gray (5Y 5/1), moist, hard. Trace lignite less than 1 in. thick at 234 ft. Color turns to dark gray (5Y 5/1) at 237.5 ft.							
240	47	60 in.		Siltstone: With trace fine grained sand, weakly cemented, dark gray (5Y 4/1), moist, very dense.	5.7				113.9	15.2	

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
245	48	60 in.	100	Sandstone: Fine grained, weakly cemented, with some silt, dark gray (5Y 4/1), moist, very dense.							
250	49	60 in.	100		4.9				107.5	19.1	
255	50	60 in.	100								
260	51	60 in.	92								
265	52	57 in.	75								

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
270	53	45 in.	100	Seam of trace thin lignite laminations less than 1 in. thick from 269.5 to 270 ft.	4.5				109.4	18.6	
275	54	60 in.	0	Coal: Lignite, black (5Y 2.5/1).							
280	55	60 in.	0								
285	56	24 in.	93	Shale: Highly weathered, dark gray (5Y 4/1), moist, hard.							
290	57	60 in.	78		12.4				107.6	20.0	
				Coal: Lignite, black (5Y 2.5/1).							
295	58	60 in.		Shale: Highly weathered, dark gray (5Y 4/1), moist, hard.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
300	59	30 in.	100	EOB at 300 ft. Target depth reached.	11.1				105.9	21.1	

Notes:

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NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-5**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/7/20 through 5/8/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/8/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 66 ft.), Fluid Rotary (74 to 160 ft.), NQ Rock Core (66 to 74 and 160 to 300 ft.)**

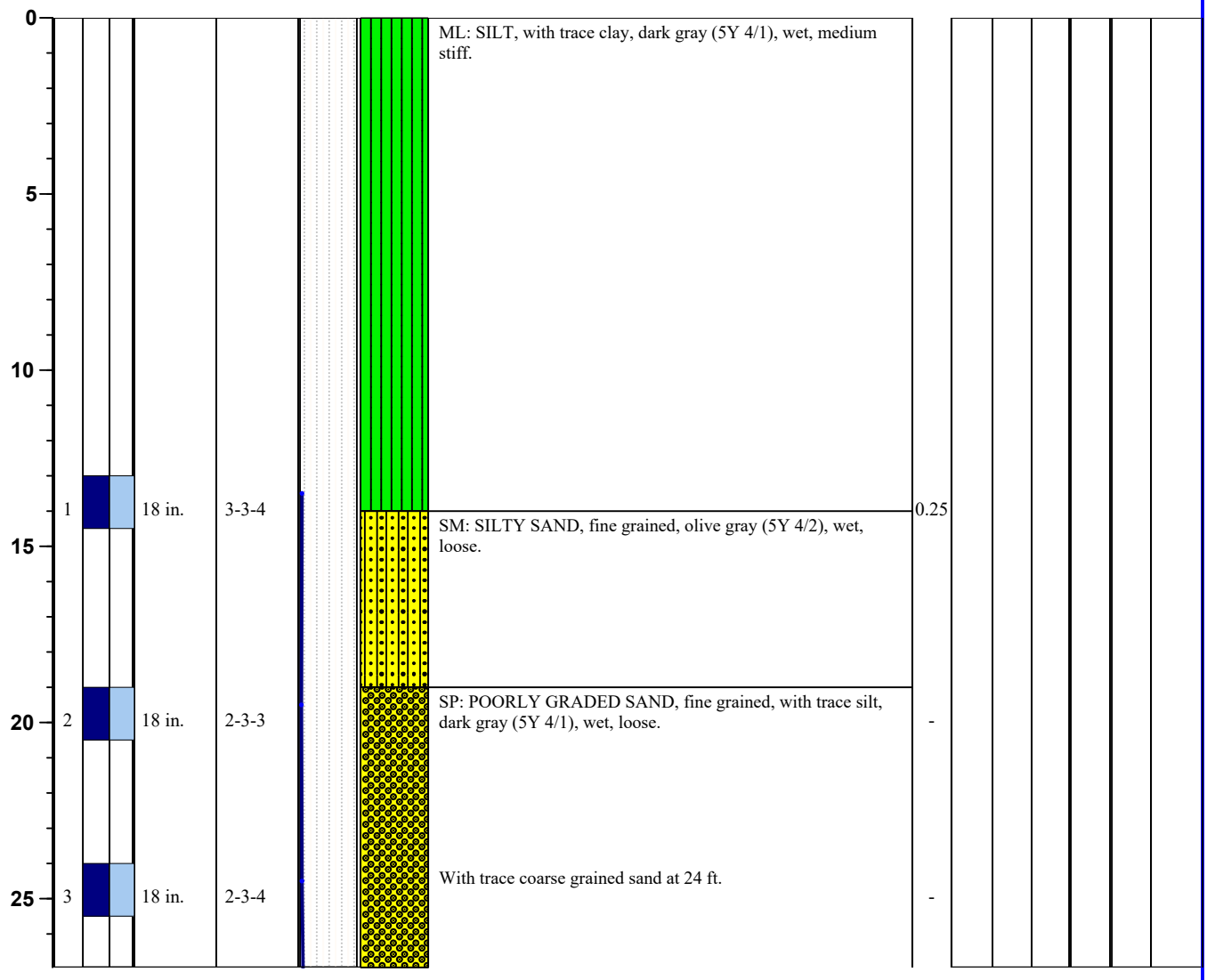
Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
0				ML: SILT, with trace clay, dark gray (5Y 4/1), wet, medium stiff.							
15	1	18 in.	3-3-4	SM: SILTY SAND, fine grained, olive gray (5Y 4/2), wet, loose.	0.25						
20	2	18 in.	2-3-3	SP: POORLY GRADED SAND, fine grained, with trace silt, dark gray (5Y 4/1), wet, loose.	-						
25	3	18 in.	2-3-4	With trace coarse grained sand at 24 ft.	-						



Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 42.24"

Lon: 103° 5' 15.52"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-5**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/7/20 through 5/8/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/8/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 66 ft.), Fluid Rotary (74 to 160 ft.), NQ Rock Core (66 to 74 and 160 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	4	18 in.	2-4-6	Fine to medium grained with trace coarse gained at 29 ft.	-						
35	5	0 in.	2-2-3	SPG: POORLY GRADED SAND WITH GRAVEL, coarse grained with fine gravel, dark gray (5Y 4/1), wet, loose.	-						
40	6	1 in.	4-4-4		-						
45	7	6 in.	10-7-6	With medium to coarse graind sand and medium dense at 44 ft.	-						7.7
50	8	4 in.	4-4-4	With trace medium to coarse graind sand and loose at 49 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 42.24"

Lon: 103° 5' 15.52"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-5**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/7/20 through 5/8/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/8/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 66 ft.), Fluid Rotary (74 to 160 ft.), NQ Rock Core (66 to 74 and 160 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
55	9		6 in.	9-14-14	With few medium to coarse graind sand and medium dense at 54 ft.	-						
60	10		16 in.	10-6-40	SPG: POORLY GRADED GRAVELLLY SAND, medium to coarse grained, dark gray (5Y 4/1), moist, dense.	-						
65	11		18 in.	10-13-17	CL: LEAN CLAY, consolidated, with trace silt, very dark gray (5Y 3/1), moist, very stiff.	3.75	22	47	25		28.0	
	12		16 in.	10								
70	13		24 in.	28	Coal: Lignite, black (2.5Y 2.5/1).							
75	14		0 in.	0	NO RECOVERY (suspect same noncohesive material as below) from 74 to 79 ft.							
80					SPG: POORLY GRADED GRAVELLLY SAND, fine grained, dark gray (5Y 4/1), moist, very dense.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 42.24"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-5**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/7/20 through 5/8/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/8/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 66 ft.), Fluid Rotary (74 to 160 ft.), NQ Rock Core (66 to 74 and 160 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
85	15	12 in.	12-24-36	CL-ML: SILTY CLAY, dark gray (5Y 4/1), moist, hard.	4.5						
90	16	18 in.	20-28-33		3.0						
95	17	18 in.	15-18-13	SPG: POORLY GRADED GRAVELLLY SAND, fine grained, dark gray (5Y 4/1), moist, dense.	-						
				CL-ML: SILTY CLAY, with 2 in. thick coal seam at 95.5 ft., dark gray (5Y 4/1), moist, hard.							
100	18	18 in.	16-17-18	SC: CLAYEY SAND, fine grained, dark gray (5Y 4/1), moist, dense.	-						
				ML: SILT, with trace clay, dark gray (5Y 4/1), moist, hard.							
105	19	18 in.	13-16-26	SC: CLAYEY SAND, fine grained, with trace silt, dark gray (5Y 4/1), moist, dense.	-						

Notes:

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NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-5**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/7/20 through 5/8/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/8/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 66 ft.), Fluid Rotary (74 to 160 ft.), NQ Rock Core (66 to 74 and 160 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample	Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
110	20		18 in.	16-17-10		-						46.6
115	21		18 in.	9-13-14	CL-ML: SILTY CLAY, dark gray (5Y 4/1), moist, very stiff.	4.25						
120	22		11 in.	13-14-16	SP: POORLY GRADED SAND, fine to coarse grained, with trace silt, dark gray (5Y 4/1), wet, medium dense.	-						
125	23		18 in.	10-16-23	CL-ML: SILTY CLAY, dark gray (5Y 4/1), moist, hard.	4.25						
130	24		11 in.	43-50/3"	SP: POORLY GRADED SAND, fine grained, with trace silt, dark gray (5Y 4/1), wet, very dense.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

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Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

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Groundwater & Environmental Services, Inc.

ID NO. **WB-5**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/7/20 through 5/8/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/8/20**

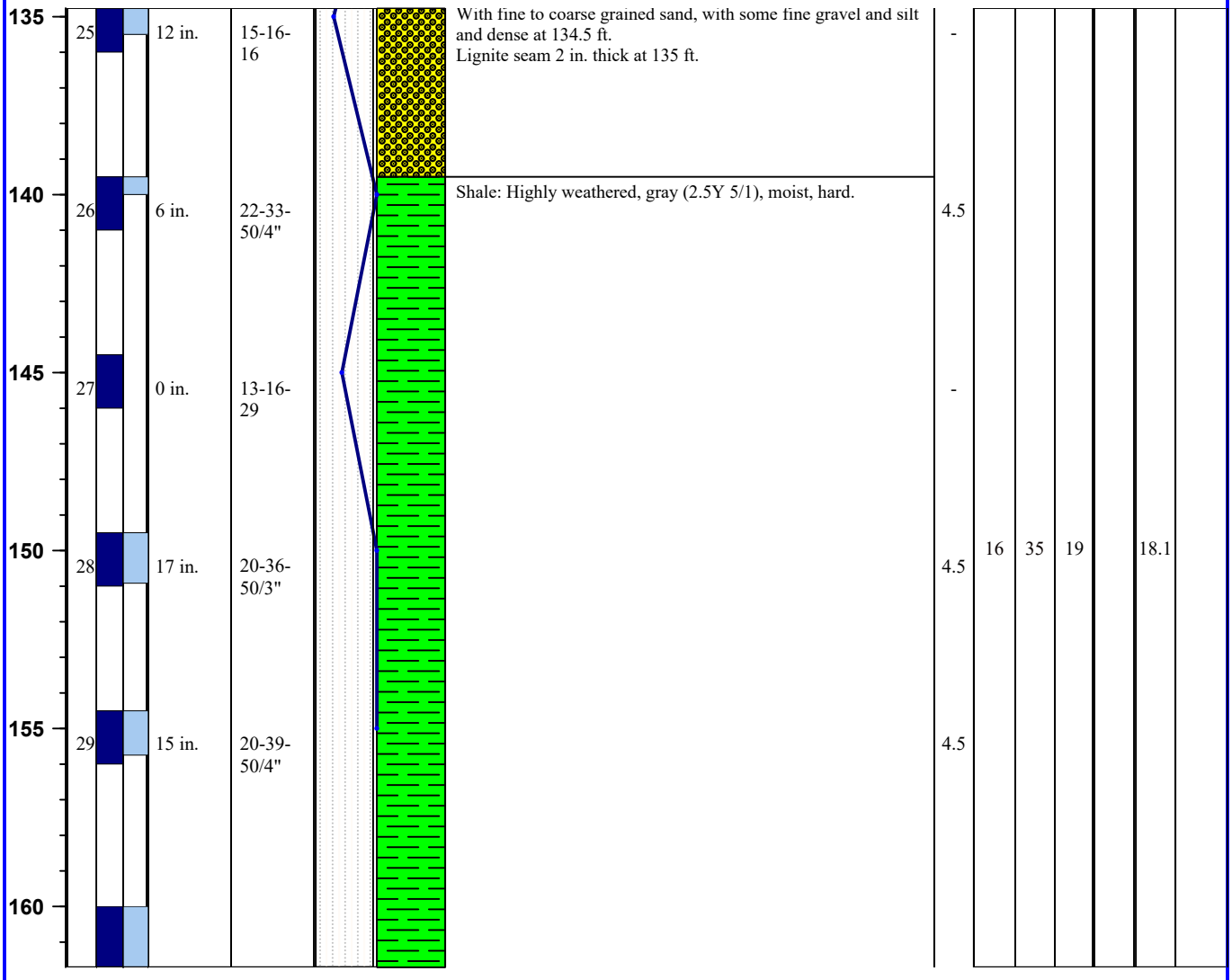
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 66 ft.), Fluid Rotary (74 to 160 ft.), NQ Rock Core (66 to 74 and 160 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**



Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	25	12 in.	15-16-16	With fine to coarse grained sand, with some fine gravel and silt and dense at 134.5 ft. Lignite seam 2 in. thick at 135 ft.	-						
140	26	6 in.	22-33-50/4"	Shale: Highly weathered, gray (2.5Y 5/1), moist, hard.	4.5						
145	27	0 in.	13-16-29		-						
150	28	17 in.	20-36-50/3"		4.5	16	35	19		18.1	
155	29	15 in.	20-39-50/4"		4.5						
160											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 42.24"

Lon: 103° 5' 15.52"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-5**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/7/20 through 5/8/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/8/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 66 ft.), Fluid Rotary (74 to 160 ft.), NQ Rock Core (66 to 74 and 160 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample	Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
165	30		41 in.	53		2.5				108.2	66.2	
	31		43 in.	38								
170	32		13 in.	13	ML: SILT, gray (2.5Y 5/1), moist, very dense.							
	33		30 in.	18	Coal: Lignite, black (5Y 2.5/1).							
180	34		58 in.	85	Shale: Highly weathered, gray (2.5Y 5/1), moist, hard. Lignite seam 2 in. thick at 184 ft. Lignite seam 5 in. thick at 184.5 ft.	12.1				117.5	16.6	
185	35		60 in.	93								

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-5**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/7/20 through 5/8/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/8/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 66 ft.), Fluid Rotary (74 to 160 ft.), NQ Rock Core (66 to 74 and 160 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
190				Color tunrs to gray (5Y 5/1) at 190 ft. Lignite seam 2 in. thick at 190.5 ft.							
	36	60 in.	97								
195				With small fine to medium grained sand seams at 195 ft.							
	37	47 in.	75								
200				Coal: Lignite, black (5Y 2.5/1).							
				Shale: Highly weathered, gray (5Y 5/1), moist, hard.							
	38	59 in.	83	Coal: Lignite, black (5Y 2.5/1).	9.6				116.3	14.2	
205				Shale: Highly weathered, gray (5Y 5/1), moist, hard.							
	39	56 in.	88								
210											
	40	60 in.	100								
215											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 42.24"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-5**

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Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/7/20 through 5/8/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/8/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 66 ft.), Fluid Rotary (74 to 160 ft.), NQ Rock Core (66 to 74 and 160 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
	41	50 in.	75								
220				Lignite seam 6 in. thick at 219.5 ft.							
	42	60 in.	90		4.1				105.8	19.2	
				Fine grained sand seam 2 in. think at 223.3 ft. Trace lignite at 224 ft.							
225				Color tunrs to dark gray (5Y 4/1) at 225 ft.							
	43	55 in.	87								
230											
	44	60 in.	100								
235											
	45	60 in.	100	With some fine grained sand from 237 ft. to 240 ft.							
240											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-5**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/7/20 through 5/8/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/8/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 66 ft.), Fluid Rotary (74 to 160 ft.), NQ Rock Core (66 to 74 and 160 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
245				SP: POORLY GRADED SAND, fine grained, with trace silt and trace clay, dark gray (5Y 4/1), moist, very dense.							
	47	58 in.	92		3.3				107.9	17.0	
250				Slightly cohesive to weakly cemented at 250 ft. and below.							
	48	59 in.	98								
255											
	49	58 in.	97								
260											
	50	58 in.	97								
265											
	51	60 in.	97	Coal: Lignite, black (5Y 2.5/1).	2.0				108.8	20.5	

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-5**

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Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/7/20 through 5/8/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/8/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 66 ft.), Fluid Rotary (74 to 160 ft.), NQ Rock Core (66 to 74 and 160 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
270											
	52	60 in.	20								
275											
	53	30 in.	37	SP: POORLY GRADED SAND, fine grained, with trace silt and trace clay, slighly cohesive to weakly cemented, dark gray (5Y 4/1), moist, very dense.	8.7				106.5	20.2	
				Coal: Lignite, black (5Y 2.5/1).							
280				SP: POORLY GRADED SAND, fine grained, with trace silt and trace clay, slighly cohesive to weakly cemented, dark gray (5Y 4/1), moist, very dense.							
	54	60 in.	88								
285				CL: LEAN CLAY, with trace fine grained sand, consolidated, dark gray (5Y 4/1), moist, hard.							
	55	53 in.	78								
				Coal: Lignite, black (5Y 2.5/1).							
290				CL: LEAN CLAY, with trace fine grained sand, consolidated, dark gray (5Y 4/1), moist, hard.							
	56	60 in.	100								
295											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/7/20 through 5/8/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/8/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 66 ft.), Fluid Rotary (74 to 160 ft.), NQ Rock Core (66 to 74 and 160 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
300	57	37 in.	62	EOB at 300 ft. Target depth reached.	6.4				106.7	21.6	

Notes:

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NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 42.24"

Lon: 103° 5' 15.52"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
0				SM: SILTY SAND, fine grained, very dark gray (2.5Y 3/1), wet, very loose.							
15	1	14 in.	1-2-1		-						
20	2	16 in.	3-9-9	Color turns to very dark grayish brown (2.5Y 3/2) and medium dense at 19.5 ft.	-						
25	3	4 in.	0-0-2	Very loose at 24.5 ft.	-						

Notes:

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NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	4		5 in.	1-1-1		-						
35	5		6 in.	2-3-5	Loose at 34.5 ft.	-						
40	6		6 in.	4-11-5	Medium dense at 39.5 ft.	-						
45	7		10 in.	2-3-3	Loose with coarse grained sand and fine gravel seam 5 in. thick at 45 ft.	-						
50	8		13 in.	8-32-24	Very dense with angular coarse sand and gravel seam 7 in. thick at 50 ft.	-						10

Notes:

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Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

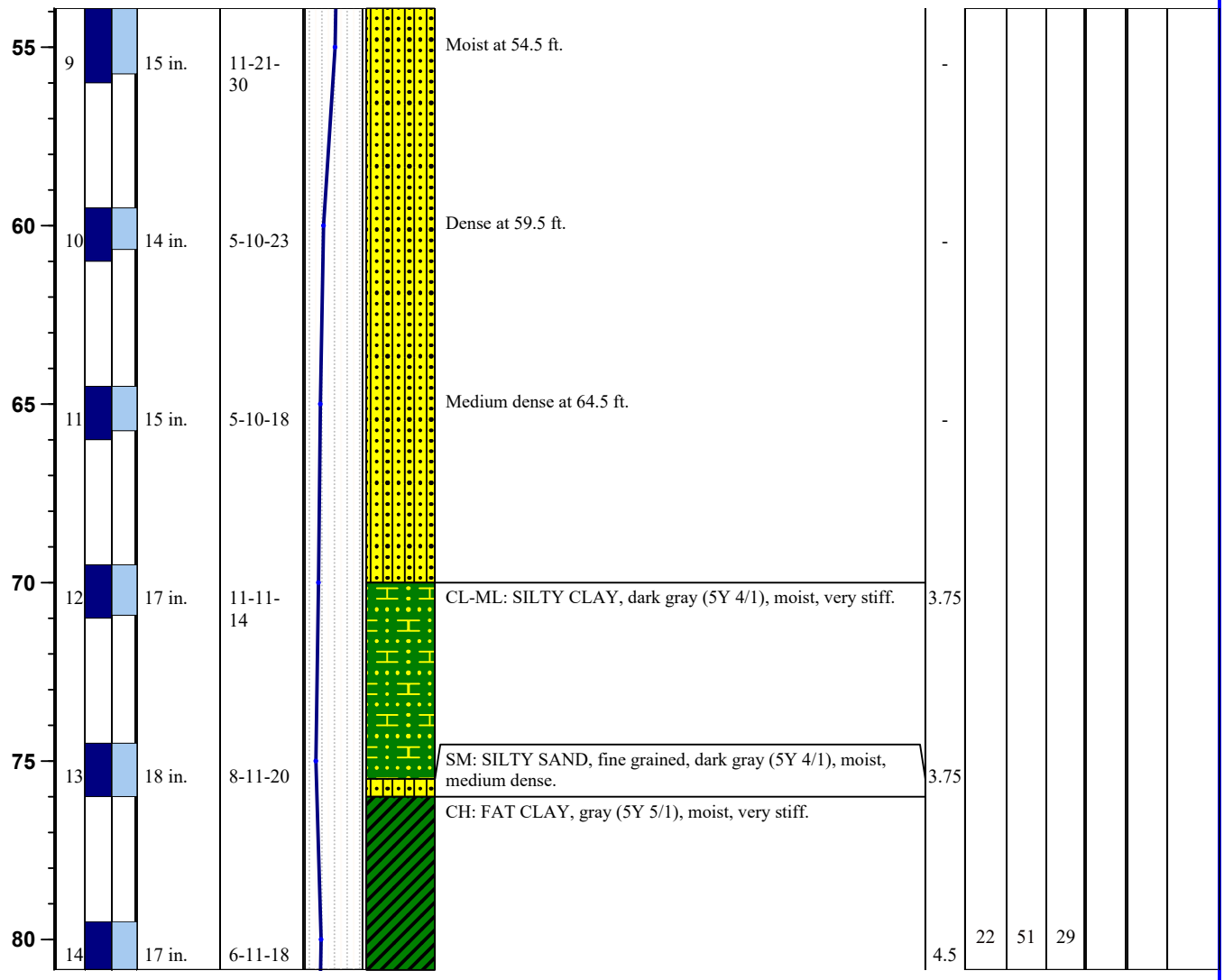
Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
55	9		15 in.	11-21-30	Moist at 54.5 ft.	-						
60	10		14 in.	5-10-23	Dense at 59.5 ft.	-						
65	11		15 in.	5-10-18	Medium dense at 64.5 ft.	-						
70	12		17 in.	11-11-14	CL-ML: SILTY CLAY, dark gray (5Y 4/1), moist, very stiff.	3.75						
75	13		18 in.	8-11-20	SM: SILTY SAND, fine grained, dark gray (5Y 4/1), moist, medium dense.	3.75						
					CH: FAT CLAY, gray (5Y 5/1), moist, very stiff.							
80	14		17 in.	6-11-18		4.5	22	51	29			



Notes:

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NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

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M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
85	15	18 in.	8-11-13		4.5						
90	16	18 in.	11-14-16		4.5						
95	17	18 in.	8-12-17	Color turns to dark gray (5Y 4/1) at 94.5 ft.	3.5						
100	18	18 in.	9-14-19	ML: SILT with some clay, gray (5Y 5/1), moist, dense.	3.5						
105	19	18 in.	13-18-26	SC: CLAYEY SAND, fine grained, with trace silt, dark gray (5Y 4/1), moist, dense.	1.5						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
110	20		18 in.	9-13-19	ML: SILT with trace clay, dark gray (5Y 4/1), moist, dense.	2.0	18	35	17		24.5	
115	21		14 in.	17-38-40	CL-ML: SILTY CLAY, gray (5Y 5/1), moist, hard.	4.5						
					SP: POORLY GRADED SAND, fine grained, gray (5Y 5/1), moist, very dense.							
120	22		18 in.	4-9-22	Fine to coarse grained, color turns to very dark grayish brown (2.5Y 3/2) and medium dense at 119.5 ft. Seam of lignite fragments 6 in. thick at 120.5 ft.	-						
125	23		10 in.	19-23-25	Dense at 124.5 ft.	-						
130	24		12 in.	16-24-25	With few gravel and color turns to dark olive brown (2.5Y 3/3) at 129.5 ft. and below.	-						6.4

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	25	13 in.	5-12-22	Wet at 134.5 ft. and below. Seam of lignite fragments 6 in. thick at 135.5 ft.	-						
140	26	13 in.	6-15-21		-						
145	27	18 in.	8-16-27		-						
150	28	12 in.	19-25-30	With lignite fragments and color turns to olive brown (5Y 4/2) at 149.5 ft.	-						
155	29	14 in.	23-24-28	Very dense at 154.5 ft.	-						
160	30	13 in.	29-38-38	Fine grained, color turns to gray (5Y 5/1) and very dense at 159.5 ft.	-						13.2

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
165	31	13 in.	29-31-41	With trace medium to coarse grained sand at 164.5 ft.	-						
170	32	13 in.	22-29-28		-						
175	33	12 in.	22-26-36	Fine to medium grained with trace coarse grains at 174.5 ft.	-						
180	34	8 in.	18-20-27	Medium to coarse grained with trace fine grains, color turns to olive brown (2.5Y 4/3) and dense at 179.5 ft.	-						
185	35	12 in.	22-29-37	Fine to medium grained, color turns to dark grayish brown (2.5Y 4/2) and very dense at 184.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
190	36		18 in.	22-31-29	Fine grained with trace medium grains, trace lignite fragments and color changes to dark olive gray (5Y 3/2) at 189.5 ft.	-						
195	37		9 in.	22-29-28	Fine to coarse grained with trace fine gravel and color turns to olive gray (5Y 4/2) at 194.5 ft.	-						6.7
200	38		17 in.	23-42-41	Fine to medium grained with fine grain sized lignite fragments and color turns to very dark gray (5y 3/1) at 199.5 ft. Coarse grained at 200.5 ft.	-						
205	39		10 in.	26-32-30	Fine to medium grained sand with trace fine gravel and color turns to olive (5Y 4/3) at 204.5 ft.	-						
210	40		10 in.	14-25-33	Color turns to olive gray (5Y 4/2) at 209.5 ft.	-						
215	41		14 in.	30-32-36	Fine to coarse grained with trace fine gravel and trace lignite fragments at 214.5 ft.	-						9.2

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample	Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
220	42		18 in.	16-24-30	Shale: Highly weathered, olive gray (2.5Y 4/2), moist, hard.	4.5						
225	43		18 in.	18-28-37	Color turns to dark gray (5Y 4/1) at 226 ft.	4.5					25.2	
	44		29 in.	60								
230	45		59 in.	78		8.0				102.7	23.1	
235	46		48 in.	62								
240												

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
245											
	48	58 in.	77		4.6				110.8	18.2	
250											
	49	60 in.	87								
255											
	50	58 in.	40								
260											
	51	60 in.	85								
265				Coal: Lignite, black (2.5Y 2.5/1).							
	52	56 in.	10	Highly weathered shale seam 6 in. thick at 268.5 ft.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
270											
	53	52 in.	70	Shale: Highly weathered, dark gray (5Y 4/1), moist, hard.							
275				Color turns to gray (5Y 5/1) at 275 ft.							
	54	60 in.	95								
280											
	55	60 in.	70								
				Coal: Lignite, black (5Y 2.5/1).							
285				Shale: Highly weathered, gray (5Y 5/1), moist, hard.							
	56	57 in.	95								
290											
	57	57 in.	95								
295											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
300	58	59 in.	98	EOB at 300 ft. Target depth reached.	23.4				110.6	17.1	

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
0				SP: POORLY GRADED SAND, fine grained, with trace silt, very dark gray (2.5Y 3/1), wet, very loose.							
10	1	3 in.	0-0-1		-						
15	2	0 in.	WOH		-						
20	3	12 in.	2-1-1	Color turns to olive gray (5Y 4/2) at 19.5 ft.	-						
25	4	0 in.	WOH		-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	5	18 in.	22-14-17	Medium dense at 29.5 ft.	-						
35	6	10 in.	1-2-1	Fine to medium grained with trace coarse grains, trace fine gravel and trace lignite fragments, very loose at 34.5 ft.	-						
40	7	9 in.	2-2-3	Loose at 39.5 ft.	-						
45	8	1 in.	7-8-11	GP: POORLY GRADED GRAVEL, coarse, olive gray (5Y 4/2), wet, medium dense.	-						
50	9	11 in.	8-9-10	SP: POORLY GRADED SAND, fine to medium grained, with trace lignite fragments, olive gray (5Y 4/2), wet, medium dense.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample	Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
55	10		14 in.	13-15-12	Fine grained with thin lignite laminations, color turns to dark gray (5Y 4/1) at 54.5 ft.	3.0						
					CL: LEAN CLAY, dark gray (5Y 4/1), moist, very stiff.							
60	11		18 in.	8-10-16	SM: SILTY SAND, fine grained, with trace clay, dark gray (5Y 4/1), wet, medium dense.	-					30.3	43.2
65	12		18 in.	1-5-8	SP: POORLY GRADED SAND, fine to medium grained, dark gray (5Y 4/1), wet, medium dense.	-						
70	13		18 in.	7-10-14	CL: LEAN CLAY, dark gray (5Y 4/1), moist, very stiff.	3.5						
75	14		18 in.	8-10-13		3.75	19	35	16		21.3	
80	15		18 in.	16-20-15	Hard at 79.5 ft.	3.5						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample	Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
85	16		18 in.	8-13-15	Very stiff at 84.5 ft.	4.0						
90	17		18 in.	8-19-22	Hard at 89.5 ft. SP: POORLY GRADED SAND, fine grained, dark gray (5Y 4/1), wet, dense.	3.5						
95	18		18 in.	3-10-28	Fine to medium grained at 94.5 ft.	-					27.0	8.0
100	19		17 in.	14-15-22	With trace lignite fragments and color turns to olive gray (5Y 4/2) at 99.5 ft. CL-ML: SILTY CLAY, with trace fine grained sand, olive gray (5Y 4/2), moist, hard.	-						
105	20		18 in.	9-13-20		2.5						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
110	21		18 in.	10-16-19		3.5						
115	22		18 in.	10-14-18		2.75	23	36	12		24.9	
120	23		12 in.	12-20-20	SP: POORLY GRADED SAND, fine to coarse grained, trace to few fine to medium gravel, trace silt and trace lignite fragments, olive gray (5Y 4/2), wet, dense.	-						
125	24		8 in.	12-20-18		-						
130	25		10 in.	16-22-22		-					13.3	6.5

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc. ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	26	11 in.	17-24-26		-						
140	27	13 in.	21-44-50/5"	Very dense at 139.5 ft.	-						
145	28	13 in.	25-31-34	Fine to medium grained with trace silt at 144.5 ft.	-					18.6	13.3
150	29	11 in.	20-35-50/4"	Fine grained with trace silt, trace lignite fragments and color changes to black (2.5Y 2.5/1) at 149.5 ft.	-						
155	30	14 in.	25-48-41	Fine grained with trace silt and color turns to olive gray (5Y 4/2) at 154.5 ft.	-						
160	31	15 in.	17-22-22	Fine to medium grained with trace silt and trace lignite fragments and dense at 159.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
165	32	16 in.	25-33-34	Fine grained with trace silt and very dense at 164.5 ft.	-					18.2	11.0
170	33	14 in.	21-32-38		-						
175	34	14 in.	19-23-36	Fine to coarse grained with trace silt and little lignite fragments at 174.5 ft.	-						
180	35	14 in.	26-30-30	Fine grained with trace silt at 179.5 ft.	-						
185	36	8 in.	30-50/6"	Fine to coarse grained with trace clay at 184.5 ft. Lignite lens 4 in. thick at 185 ft.	17.4				110.8	23.7	12.1

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
190	37		5 in.	20-25-34	Fine grained with trace silt and color changes to very dark gray (5Y 3/1) at 189.5 ft.	-						
195	38		6 in.	21-30-46		-						
200	39		14 in.	21-34-41	With trace lignite fragments at 199.5 ft.	-	23	37	14		13.1	
205	40		9 in.	49-50/6"		-						14.8
210	41		4 in.	50/4"	Shale: Highly weathered fragments, gray (2.5Y 6/1), moist, hard.	-						
215	42		0 in.	-	GP: NO RECOVERY, but drill cuttings appear to be angular	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
				fine gravel.							
220	43	8 in.	15-20-26	CH: FAT CLAY, with trace fine grained sand, gray (2.5Y 6/1), moist, hard.	4.5	17	57	40		21.6	
225	44	6 in.	18-23-27		4.5						
	45	12 in.	0	ML: SILT, with fine grained sand, non-cohesive, dark gray (5Y 4/1), moist.							
230	46	0 in.	-	NO RECOVERY, suspect same material as above.							
235	47	0 in.	-								
240											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
245	49	18 in.	0	Coal: Lignite, black (5Y 2.5/1). Trace large gravel at 245 ft.							
250	50	22 in.	32	Shale: Highly weathered, dark gray (5Y 4/1), moist, hard.	0.8				102.0	21.4	
255	51	60 in.	100	Siltstone to weathered shale with trace lignite at 255 ft.							
260	52	59 in.	93	With some siltstone layers and a lignite lens 1 in. thick at 260 ft.							
265	53	60 in.	100								

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
270											
	54	53 in.	67								
275				Lignite lens 8 in. thick at 274.5 ft.							
	55	60 in.	100		9.3				104.2	22.3	
280											
	56	48 in.	77								
285											
	57	55 in.	92								
290											
	58	60 in.	100								
295											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
300	59	60 in.	60	Coal: Lignite, black (5Y 2.5/1).	7.3				103.8	27.3	
	60	45 in.	0								
305	61	60 in.	38	Shale: Highly weathered, dark gray (5Y 4/1), moist, hard. Lignite lens 1 in. thick at 309 ft.							
310	62	60 in.	100							19.5	
315				EOB at 315 ft. Target depth reached.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
0				CL: LEAN CLAY, dark grayish brown (2.5Y 4/2), moist, medium stiff.							
5	1	8 in.	2-3-4		0.5						
10	2	18 in.	2-2-3		0.5						
15	3	10 in.	1-1-1	CL-ML: SILTY CLAY, olive brown (2.5Y 4/3), very moist, very soft.	0.25						
20	4	14 in.	1-1-1	ML: SILT, with trace clay, dark gray (5Y 4/1), moist, very loose.	0.25						
25	5	18 in.	1-1-1	CL-ML: SILTY CLAY, dark gray (5Y 4/1), moist, very soft.	0.25						
				ML: SILT, dark gray (5Y 4/1), moist, very loose.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

Lon: 103° 4' 53.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	6		15 in.	1-2-7	SP: POORLY GRADED SAND, fine grained, with trace silt, dark gray (5Y 4/1), wet, loose.	-						
35	7		18 in.	1-5-8	CL-ML: SILTY CLAY, very dark gray (5Y 3/1), very moist, stiff.	0.25						
40	8		11 in.	2-1-0	SM: SILTY SAND, fine grained, with trace clay, very dark gray (5Y 3/1), wet, very loose. Trace lignite fragments 1 in. thick at 40 ft.	-						
45	9		12 in.	3-5-5	SP: POORLY GRADED SAND, fine grained, with trace fine gravel, dark gray (5Y 4/1), wet, loose.	-					20.4	6.6
50	10		9 in.	7-9-6	Medium dense at 49.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

Lon: 103° 4' 53.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
55	11	12 in.	4-6-6	Fine to medium grained with trace coarse grains at 54.5 ft.	-						
60	12	15 in.	4-9-12	Clay lens 6 in. thick at 60 ft. With thin lignite laminations at 60.5 ft.	-						
65	13	8 in.	4-7-5	SPG: POORLY GRADED SAND WITH GRAVEL, fine to medium grained with fine gravel, dark gray (5Y 4/1), wet, medium dense.	-					14.7	10.0
70	14	10 in.	3-5-5	SP: POORLY GRADED SAND, fine grained, with trace medium grains, dark gray (5Y 4/1), wet, loose.	-						
75	15	10 in.	5-9-17	Fine grained and medium dense at 74.5 ft. With a few thin lignite laminations at 75.5 ft.	-						
80	16	9 in.	15-16-18	Fine to medium grained with trace coarse grains and dense at 79.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

Lon: 103° 4' 53.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
85	17	9 in.	11-11-13	Fine grained and medium dense at 84.5 ft.	-						
90	18	9 in.	13-12-15		-					27.7	10.1
95	19	9 in.	11-12-15		-						
100	20	10 in.	6-5-7		-						
105	21	12 in.	8-10-17	With trace lignite laminations throughout at 104.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

Lon: 103° 4' 53.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
110	22	15 in.	23-28-37	Fine grained with trace medium grains and very dense at 109.5 ft.	-					23.7	7.0
115	23	5 in.	17-19-17	Fine to medium grained with trace coarse grains, trace fine gravel and trace lignite fragments at 114.5 ft.	-						
				GP: POORLY GRADED GRAVEL, with some fine to coarse sand, trace lignite fragments, dark gray (5Y 4/1), wet, very dense.							
120	24	12 in.	26-47-50/4"	ML: SILT, cohesive, with little fine grained sand, dark gray (5Y 4/1), wet, very dense.	0.5						
125	25	15 in.	24-47-51	SP: POORLY GRADED SAND, fine grained, with trace silt, dark gray (5Y 4/1), wet, very dense.	-						
130	26	16 in.	20-27-40		-						26.0

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

Lon: 103° 4' 53.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	27	0 in.	17-25-36		-						
140	28	18 in.	20-25-39		-						
145	29	2 in.	50/3"	Lignite lens at least 2 in. thick at 144.5 ft.	-						
150	30	18 in.	20-25-49	Shale: Highly weathered to consolidated silty clay, gray (5Y 5/1), moist, hard.	4.5	17	46	29		21.0	
155	31	18 in.	24-31-50/3"	Lignite lens 2 in. thick at 155.75 ft.	4.5						
	32	42 in.	29	Coal: Lignite, black (2.5Y 2.5/1).							
160				Shale: Highly weathered to consolidated silty clay, gray (5Y 5/1), moist, hard.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

Lon: 103° 4' 53.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
165	33	60 in.	92		12.3				115.0	16.1	
170	34	45 in.	70								
175	35	60 in.	98	Lignite lens 1 in. thick at 174 ft.							
180	36	44 in.	63								
185	37	60 in.	93		3.5				106.9	20.1	
	38	59 in.	77	Lignite lens 6 in. thick at 188 ft.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

Lon: 103° 4' 53.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
190				Color turns to dark gray (5Y 4/1) and lignite lens 2 in. thick at 190 ft.							
	39	56 in.	93								
195											
	40	60 in.	100								
200											
	41	55 in.	92		10.5				107.0	21.3	
205											
	42	60 in.	97								
210											
	43	59 in.	98								
215											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

Lon: 103° 4' 53.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
220	44	60 in.	100								
225	45	58 in.	97		7.7				108.9	20.3	
	46	60 in.	95								
230				Coal: Lignite, black (2.5Y 2.5/1).							
	47	60 in.	0								
235				Highly weathered shale lens 4 in. thick at 236 ft.							
	48	28 in.	7								
240				Shale: Highly weathered to consolidated silty clay, dark gray (5Y 4/1), moist, hard.							
		60 in.	85								

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

Lon: 103° 4' 53.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
245											
	50	34 in.	53		10.0				108.8	20.1	
250											
	51	27 in.	37								
255											
	52	60 in.	95								
260				Less weathered, fractured shale 1 in. thick at 260 ft.							
	53	0 in.	0								
265											
	54	60 in.	98		13.0				105.8	23.1	

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

Lon: 103° 4' 53.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
270											
	55	33 in.	38								
275											
	56	60 in.	100		23.9				107.2	20.8	
280											
	57	60 in.	100								
285											
	58	60 in.	88		6.5				106.1	24.0	
290				Coal: Lignite, black (5Y 2.5/1).							
	59	60 in.	0								
295											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

Lon: 103° 4' 53.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
	60	60 in.	0	EOB at 300 ft. Target depth reached.							
300											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

Lon: 103° 4' 53.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
0				CL-ML: SILTY CLAY, olive (5Y 4/4), very moist, very soft.							
15	1	15 in.	WOH		0						
20	2	13 in.	1-2-2	SM: SILTY SAND, fine grained with trace clay, olive gray (5Y 4/2), wet, very loose.	-						
25	3	10 in.	1-1-1	CL-ML: SILTY CLAY, with trace fine grained sand, olive gray (5Y 4/2), wet, very soft.	0						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 0.54"

Lon: 103° 4' 45.08"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	4	18 in.	2-2-4	SP-SC: POORLY GRADED SAND WITH CLAY, fine grained with little silt, very dark gray (5Y 3/1), wet, loose.	0						
35	5	6 in.	3-7-3	Fine to medium gravel lens 2 in. thick at 35 ft.	0						
				SM: SILTY SAND, fine to coarse grained with trace fine to medium gravel, dark olive gray (5Y 3/2), wet, medium dense.							
40	6	6 in.	4-5-7		-						
45	7	6 in.	3-3-7	SWG: WELL GRADED SAND WITH GRAVEL, fine to coarse grained with fine to medium gravel and trace silt, dark olive gray (5Y 3/2), wet, loose.	-						4.7
50	8	9 in.	11-24-18	Dense at 44.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

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SOIL BORING LOG

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ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
55	9		12 in.	2-3-4	SM: SILTY SAND, fine grained, dark olive gray (5Y 3/2), wet, loose.	-						
60	10		5 in.	20-34-34	Fine to coarse grained and very dense at 59.5 ft.	-						
65	11		15 in.	6-9-10	Fine grained and medium dense at 64.5 ft.	-					29.1	29.1
70	12		12 in.	12-16-10		-						
75	13		14 in.	13-14-12		-						
80	14		12 in.	10-13-15		-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

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Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
85	15	12 in.	12-13-14	Fine to medium gravel lens 4 in. thick at 84.5 ft. SPG: POORLY GRADED SAND WITH GRAVEL , fine to coarse grained with fine gravel and trace silt, dark olive gray (5Y 3/2), wet, medium dense.	-						7.6
90	16	0 in.	3-4-12		-						
95	17	6 in.	8-12-12	SM: SILTY SAND, fine grained, dark olive gray (5Y 3/2), wet, medium dense.	-						
100	18	5 in.	7-7-8	Fine to coarse grained at 99.5 ft.	-						
105	19	6 in.	6-10-10	Fine grained and color turns to very dark gray (5Y 3/1) at 104.5 ft.	-						20.2

Notes:

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Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
110	20		10 in.	7-10-10		-						
115	21		12 in.	13-13-33	Dense at 114.5 ft.	-						
120	22		14 in.	23-30-37	SP-SC: POORLY GRADED SAND WITH CLAY, fine grained with some silt, gray (2.5Y 5/1), moist, very dense.	-						
125	23		16 in.	23-30-39	SM: SILTY SAND, fine grained with trace clay, gray (2.5Y 5/1), moist, very dense.	-					23.2	21.0
130	24		15 in.	22-28-42		-						

Notes:

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M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	25	9 in.	32-50/3"	Lens of lignite fragments 1 in. thick at 135 ft.	-						
				Trace clay at 139.5 ft.							
140	26	12 in.	30-32-50/4"	Shale: SHALE, highly weathered to consolidated silty clay, gray (2.5Y 5/1), moist, hard.	-						
145	27	18 in.	24-28-36	Color turns to gray (5Y 6/1) at 146 ft.	4.5	17	27	10		20.5	
	28	35 in.	68								
150	29	48 in.	63	Lignite lens 1 in. thick at 152 ft.							
155				Siltstone: Gray (5Y 6/1), moist, very dense.							
	30	55 in.	80	Shale: Highly weathered to consolidated silty clay, gray (5Y 6/1), moist, hard.							
160				Lignite lens 1 in. thick at 159.5 ft.							

Notes:

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Address: **NA** GES Job #: **3502056**

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Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
	31	58 in.	42	With trace lignite from 162 to 164 ft.							
165				Lignite lens 3 in. thick at 165.5 ft. Lignite lens 3 in. thick at 166 ft.							
	32	60 in.	95								
170						19	37	18			
	33	60 in.	95		12.7				108.6	20.4	
175				Lignite lens 1 in. thick at 174.5 ft.							
	34	48 in.	70								
180				Color turns to dark gray (5Y 4/1) at 180 ft.							
	35	48 in.	73								
185				Lignite lens 2 in. thick at 185 ft. Lignite lens 6 in. thick at 186 ft.							
	36	60 in.	86								

Notes:

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Address: **NA** GES Job #: **3502056**

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Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
190											
	37	51 in.	85		11.1				116.3	14.2	
195											
	38	60 in.	58								
200											
	39	60 in.	100								
205											
	40	48 in.	77								
210											
	41	60 in.	100		7.2				104.4	23.0	
215											

Notes:

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Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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SOIL BORING LOG

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Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
220	42	56 in.	93								
225	43	60 in.	100								
				Coal: Lignite, black (5Y 2.5/1).							
230	44	60 in.	0								
235	45	30 in.	8								
				Shale: Highly weathered to consolidated silty clay, dark gray (5Y 4/1), moist, hard.							
240	46	60 in.	98		16.6				108.5	19.7	
				Coal: Lignite, black (5Y 2.5/1).							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

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Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
245				Shale: Highly weathered to consolidated silty clay, dark gray (5Y 4/1), moist, hard.							
	48	60 in.	80								
250				Siltstone lens 1 in. thick at 251 ft.							
	49	29 in.	48								
255				Silt lens 2 in. thick at 256 ft.							
	50	32 in.	28		44.3				106.3	20.2	
260				NO RECOVERY, suspect more highly weathered shale material with trace lignite seams.							
	51	0 in.	0								
265											
	52	0 in.	0		5.0				112.7	15.3	

Notes:

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Address: **NA** GES Job #: **3502056**

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Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
270											
	53	0 in.	0								
275											
	54	0 in.	0								
280				Shale: Highly weathered to consolidated silty clay, with trace fine grained sand, light gray (5Y 7/1), moist, hard.							
	55	18 in.	30								
285											
	56	41 in.	55								
290				Coal: Lignite, black (5Y 2.5/1).							
	57	43 in.	0								
295											

Notes:

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
300	58	60 in.	15	Shale: Highly weathered to consolidated silty clay, dark gray (5Y 4/1), moist, hard.							
				Coal: Lignite with few shale lenses, black (5Y 2.5/1).							
				Shale: Highly weathered to consolidated silty clay, dark gray (5Y 4/1), moist, hard.							
	59	60 in.	25	Coal: Lignite, black (5Y 2.5/1).							
305				Shale: Highly weathered to consolidated silty clay, dark gray (5Y 4/1), moist, hard.							
	60	55 in.	65	Lignite lens 1 in. thick at 308.25 ft.	15.2				117.6	14.2	
310				Sand with clay lens 9 in. thick at 309 ft.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 0.54"

Lon: 103° 4' 45.08"

Appendix D – Laboratory Reports

Project: **WBI N Bakken Expansion** Job Number: **G20-045** Sheet **1** of **4**

Manager: _____ Client: _____ Project Description: _____

Location: **Missouri River HDD Crossing** _____

_____ _____

Elevation Datum: _____

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
WB4 44.5				5.4									
WB4 59.5	40.3	18.3	22.0				19.4						
WB4 69.5				97.2									
WB4 79.5	31.3	18.7	12.0				19.1						
WB4 87.5							22.1						
WB4 132.5							15.2						
WB4 147.5							15.6						
WB4 182.5							19.1						
WB4 237.5							15.2						
WB4 247.5							19.1						
WB4 262.5							18.6						
WB4 287.5	103.4	31.1	72.0				20.0						
WB4 297.5							21.1						
WB5 44.0				7.7									
WB5 64.0	46.8	22.2	25.0				28.0						
WB5 109.5				46.6									
WB5 149.5	35.5	16.1	19.0				18.1						
WB5 180.0							16.6						
WB5 200.0							14.2						

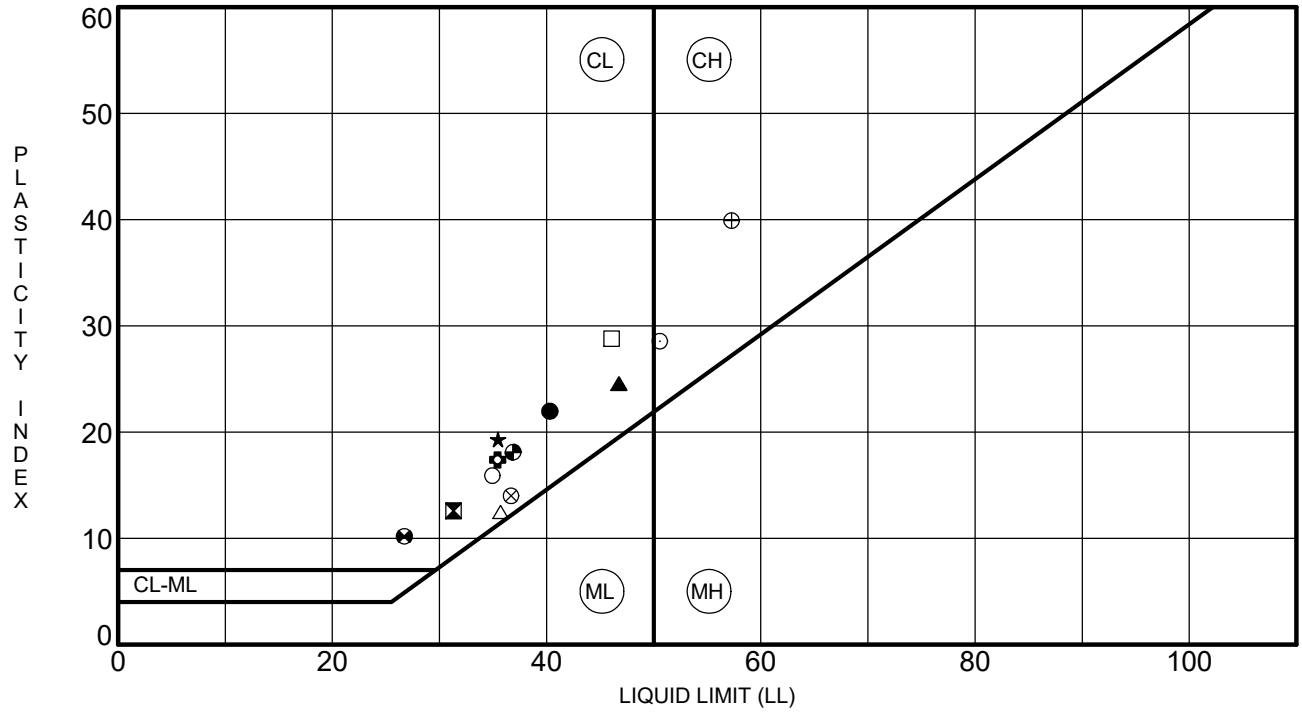
Material Testing Services, LLC	**Summary of Material Properties**	June 30, 2020

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
WB5 220.0							19.2						
WB5 245.0	90.5	26.3	65.0				17.0						
WB5 265.0							20.5						
WB5 275.0	149.2	22.3	127.0				20.2						
WB5 295.0							21.6						
WB6 49.5				10.0									
WB6 79.5	50.6	22.0	29.0										
WB6 109.5	35.4	18.0	17.0				24.5						
WB6 129.5				6.4									
WB6 159.5				13.2									
WB6 194.5				6.7									
WB6 214.5				9.2									
WB6 224.5	127.4	20.0	107.0				25.2						
WB6 230.0							23.1						
WB6 245.0							18.2						
WB6 275.0	162.4	20.6	141.0										
WB6 295.0							17.1						
WB7 59.5				43.2			30.3						
WB7 74.5	34.9	19.0	16.0				21.3						
WB7 94.5				8.0			27.0						
WB7 114.5	35.7	23.2	13.0				24.9						
WB7 129.5				6.5			13.3						

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
WB7 144.5				13.3			18.6						
WB7 164.5				11.0			18.2						
WB7 184.5				12.1			23.7						
WB7 202.5	36.7	22.7	14.0				13.1						
WB7 204.5				14.8									
WB7 219.5	57.3	17.3	40.0				21.6						
WB7 250.0							21.4						
WB7 275.0	203.2	23.7	179.0				22.3						
WB7 295.0							27.3						
WB7 310.0							19.5						
WB8 44.5				6.6			20.4						
WB8 64.5				10.0			14.7						
WB8 89.5				10.1			27.7						
WB8 109.5				6.9			23.7						
WB8 129.5				26.0									
WB8 149.5	46.1	17.3	29.0				21.0						
WB8 160.0							16.1						
WB8 180.0							20.1						
WB8 200.0							21.3						
WB8 220.0							20.3						
WB8 245.0							20.1						
WB8 265.0							23.1						

Project: **WBI N Bakken Expansion** Job Number: **G20-045** Sheet **4** of **4**

Borehole Depth / Elev.	Specimen Description	LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
WB8 275.0		169.4	22.6	146.0				20.8						
WB8 280.0								24.0						
WB9 44.5	WELL-GRADED SAND with GRAVEL				4.7									
WB9 64.5					29.2			29.1						
WB9 84.5					7.6									
WB9 104.5					20.2									
WB9 124.5					21.0			23.2						
WB9 144.5		26.7	16.5	10.0				20.5						
WB9 170.0		36.9	18.8	18.0				13.3						
WB9 190.0								20.4						
WB9 205.0								23.0						
WB9 235.0								19.7						
WB9 245.0		158.1	22.5	136.0				20.2						
WB9 255.0								15.3						
WB9 305.0								14.2						



Specimen Identification			LL	PL	PI	Fines	Classification
●	**WB4**	**59.5**	**40**	**18**	**22**		
⊠	**WB4**	**79.5**	**31**	**19**	**13**		
▲	**WB5**	**64.0**	**47**	**22**	**25**		
★	**WB5**	**149.5**	**35**	**16**	**19**		
⊙	**WB6**	**79.5**	**51**	**22**	**29**		
✿	**WB6**	**109.5**	**35**	**18**	**17**		
○	**WB7**	**74.5**	**35**	**19**	**16**		
△	**WB7**	**114.5**	**36**	**23**	**12**		
⊗	**WB7**	**202.5**	**37**	**23**	**14**		
⊕	**WB7**	**219.5**	**57**	**17**	**40**		
□	**WB8**	**149.5**	**46**	**17**	**29**		
⊛	**WB9**	**144.5**	**27**	**17**	**10**		
◕	**WB9**	**170.0**	**37**	**19**	**18**		

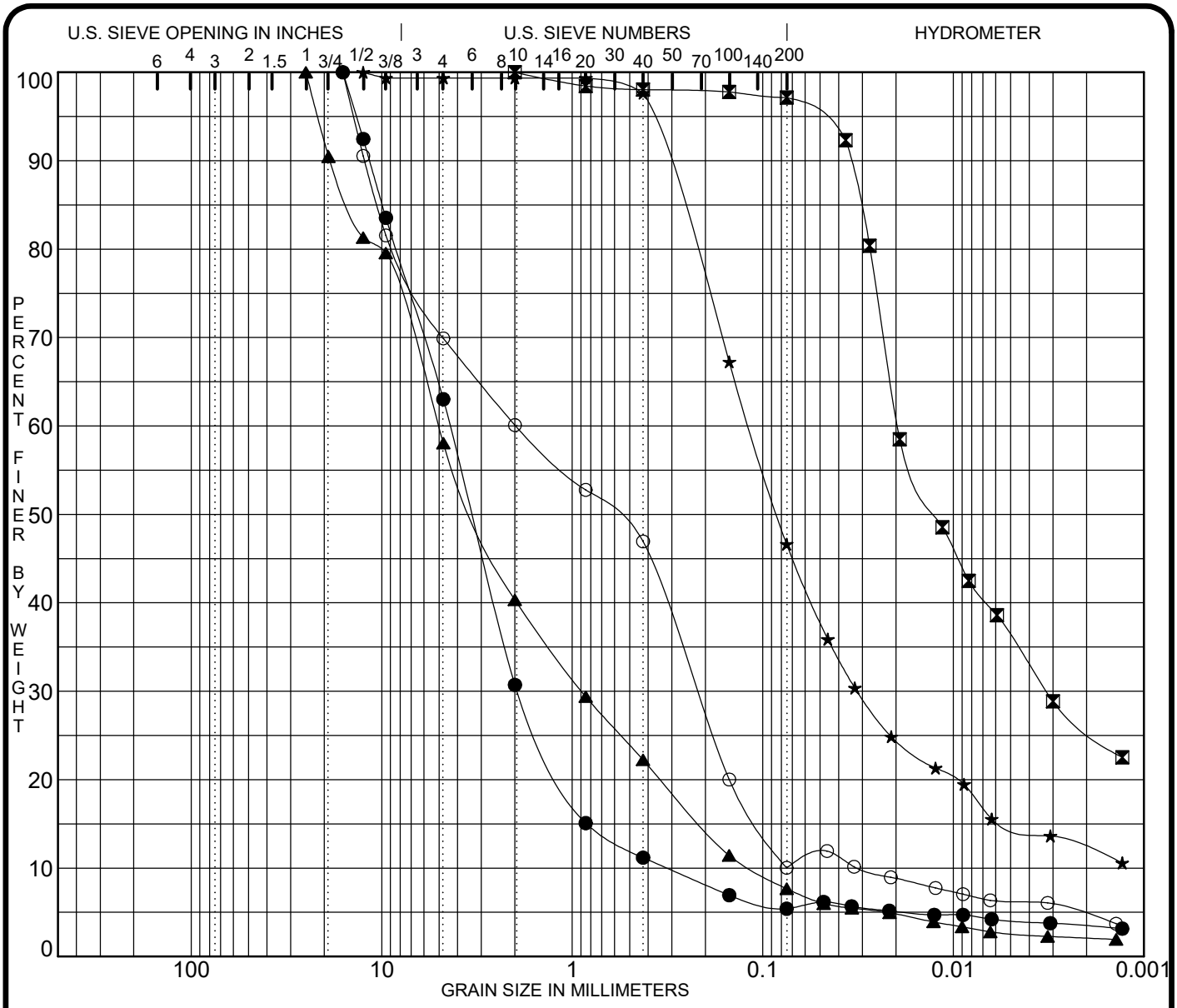
PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G20-045**

DATE **6/15/20**

ATTERBERG LIMITS' RESULTS

Material Testing Services, LLC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Classification	MC%	LL	PL	PI	Cc	Cu
●	**WB4**	**44.5**						**2.65**	**13.8**
⊠	**WB4**	**69.5**							
▲	**WB5**	**44.0**						**1.36**	**43.8**
★	**WB5**	**109.5**							
⊙	**WB6**	**49.5**						**0.34**	**27.3**

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**WB4**	**44.5**	**16.00**	**4.38**	**1.923**	**0.3184**	**37.0**	**57.6**	**1.3**	**4.1**
⊠	**WB4**	**69.5**	**2.00**	**0.02**	**0.003**		**0.0**	**2.8**	**60.9**	**36.2**
▲	**WB5**	**44.0**	**25.00**	**5.06**	**0.892**	**0.1154**	**41.9**	**50.4**	**5.1**	**2.6**
★	**WB5**	**109.5**	**12.50**	**0.12**	**0.032**		**0.6**	**52.7**	**31.7**	**14.9**
⊙	**WB6**	**49.5**	**16.00**	**1.98**	**0.221**	**0.0724**	**30.1**	**59.9**	**3.8**	**6.2**

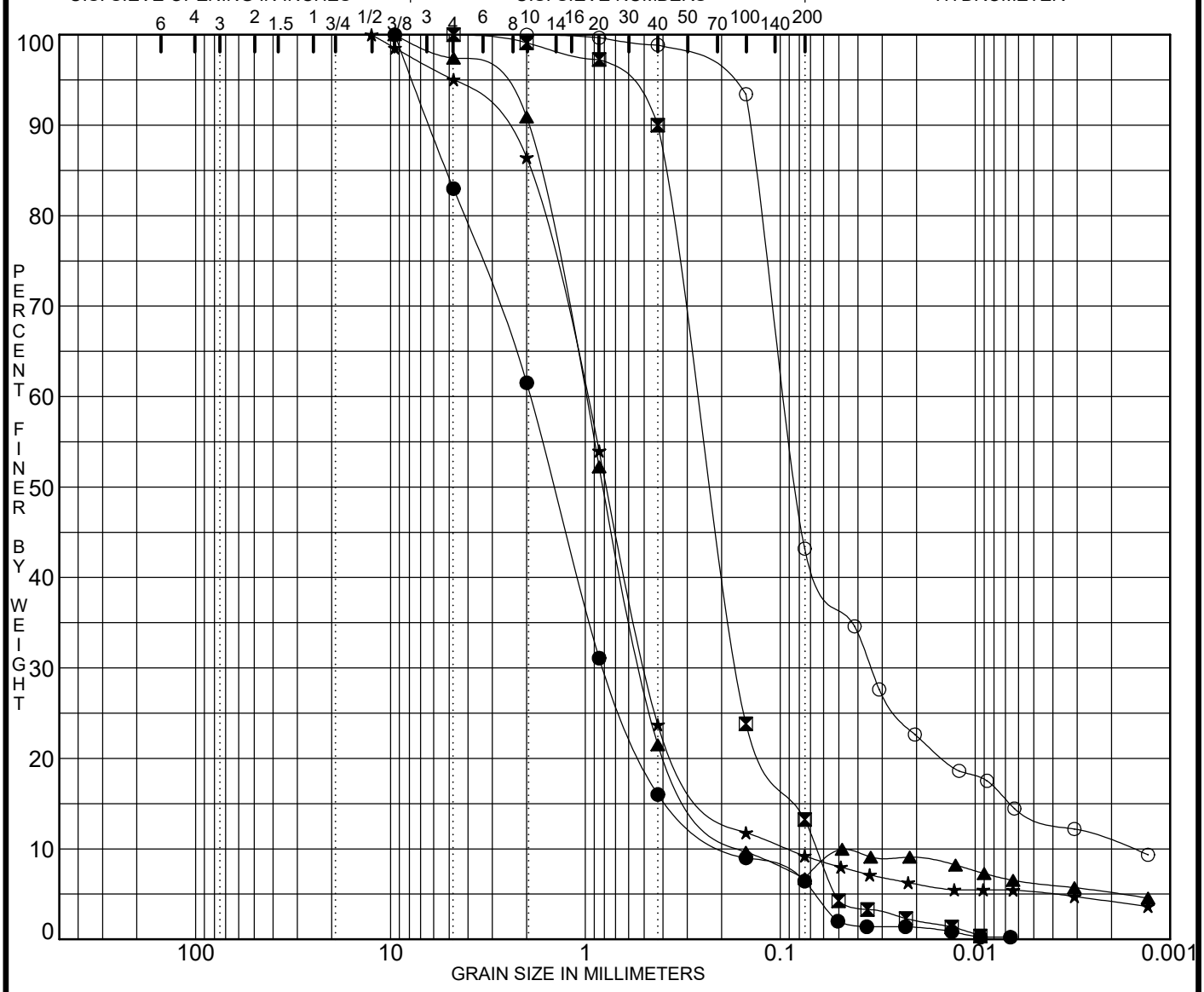
PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G20-045**

DATE **6/29/20**

PARTICLE SIZE ANALYSIS

Material Testing Services, LLC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Classification	MC%	LL	PL	PI	Cc	Cu
●	**WB6**	**129.5**						**1.96**	**11.0**
⊠	**WB6**	**159.5**						**1.59**	**4.1**
▲	**WB6**	**194.5**						**5.41**	**20.8**
★	**WB6**	**214.5**						**2.61**	**10.7**
⊙	**WB7**	**59.5**		**30**				**7.85**	**59.5**

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**WB6**	**129.5**	**9.50**	**1.92**	**0.809**	**0.1740**	**17.0**	**76.6**		
⊠	**WB6**	**159.5**	**4.75**	**0.27**	**0.165**	**0.0649**	**0.0**	**86.8**		
▲	**WB6**	**194.5**	**9.50**	**1.01**	**0.515**	**0.0486**	**2.6**	**90.7**	**0.5**	**6.2**
★	**WB6**	**214.5**	**12.50**	**1.00**	**0.491**	**0.0927**	**5.0**	**85.8**	**4.0**	**5.2**
⊙	**WB7**	**59.5**	**2.00**	**0.09**	**0.034**	**0.0016**	**0.0**	**56.8**	**29.5**	**13.7**

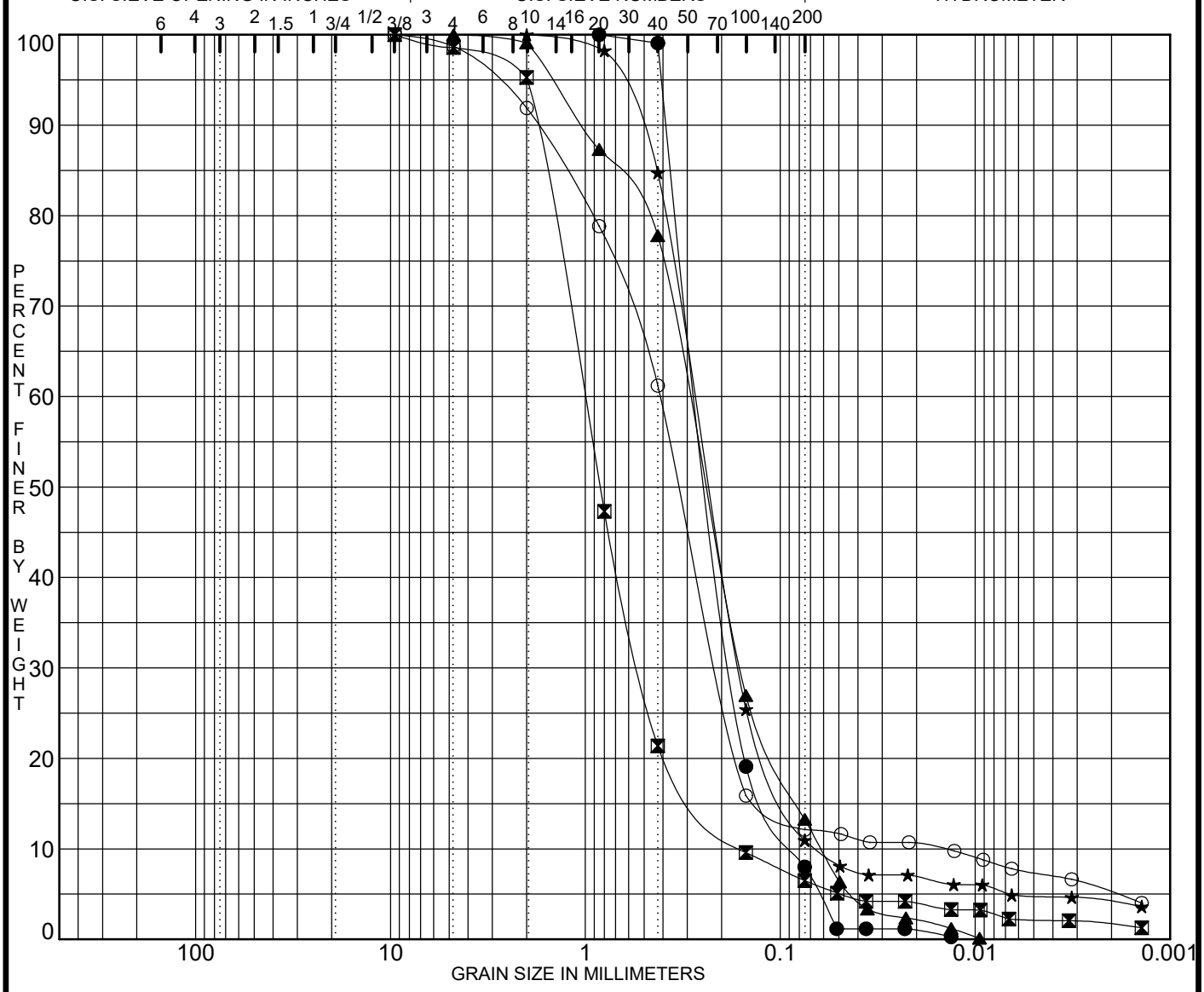
PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G20-045**

DATE **6/29/20**

PARTICLE SIZE ANALYSIS

Material Testing Services, LLC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Classification	MC%	LL	PL	PI	Cc	Cu
●	**WB7**	**94.5**		**27**				**1.38**	**3.0**
⊠	**WB7**	**129.5**		**13**				**1.73**	**6.5**
▲	**WB7**	**144.5**		**19**				**1.40**	**4.8**
★	**WB7**	**164.5**		**18**				**1.47**	**4.2**
⊙	**WB7**	**184.5**		**24**				**7.14**	**28.3**

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**WB7**	**94.5**	**0.85**	**0.26**	**0.173**	**0.0850**	**0.0**	**92.0**		
⊠	**WB7**	**129.5**	**9.50**	**1.02**	**0.524**	**0.1556**	**1.4**	**92.1**	**4.3**	**2.2**
▲	**WB7**	**144.5**	**4.75**	**0.30**	**0.160**	**0.0617**	**0.0**	**86.7**		
★	**WB7**	**164.5**	**2.00**	**0.28**	**0.163**	**0.0652**	**0.0**	**89.0**	**6.2**	**4.8**
⊙	**WB7**	**184.5**	**9.50**	**0.41**	**0.207**	**0.0146**	**1.3**	**86.6**	**4.7**	**7.4**

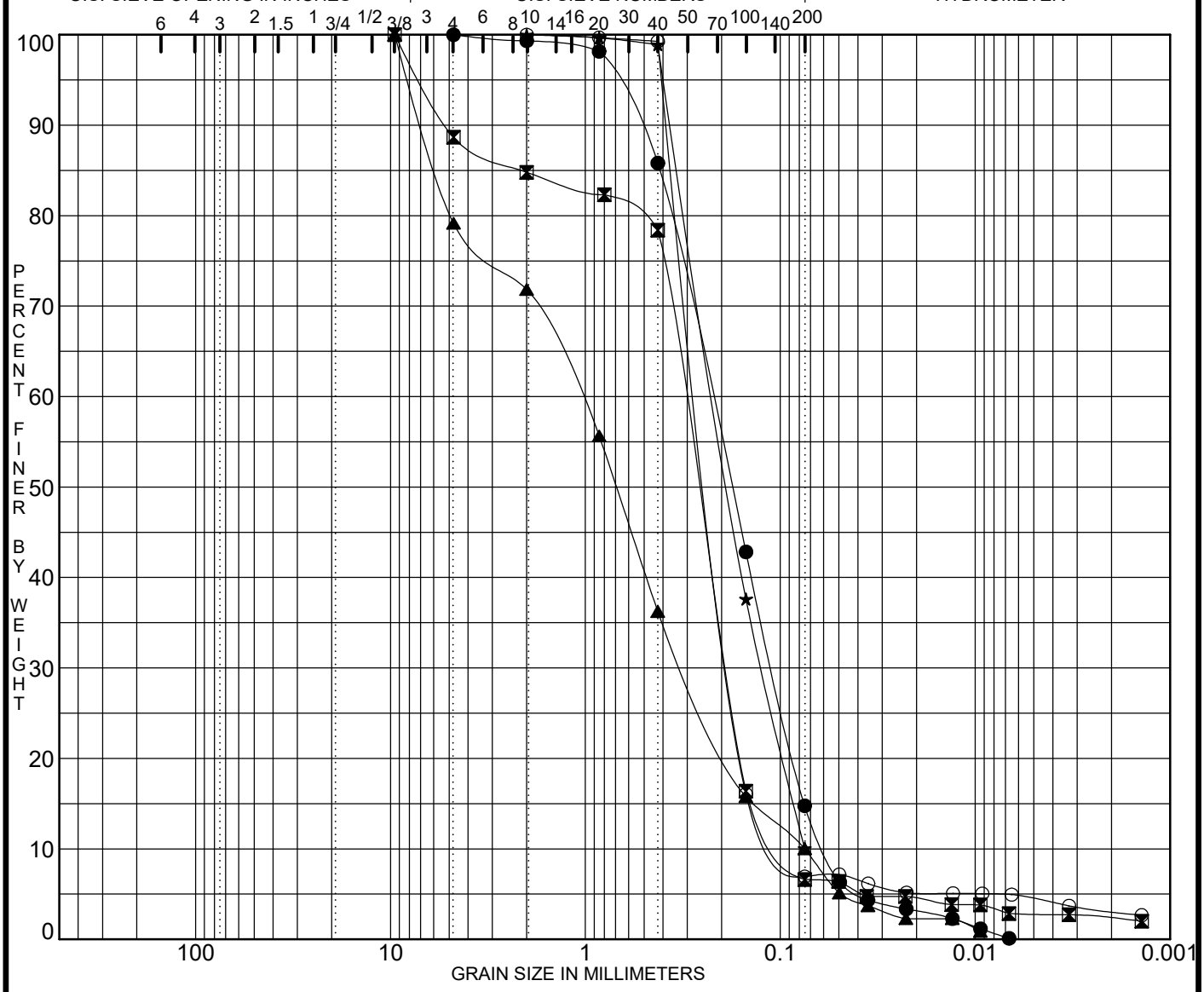
PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G20-045**

DATE **6/29/20**

PARTICLE SIZE ANALYSIS

Material Testing Services, LLC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Classification	MC%	LL	PL	PI	Cc	Cu
●	**WB7**	**204.5**						**0.88**	**3.8**
⊠	**WB8**	**44.5**		**20**				**1.19**	**3.3**
▲	**WB8**	**64.5**		**15**				**1.19**	**14.3**
★	**WB8**	**89.5**		**28**				**0.93**	**2.9**
⊙	**WB8**	**109.5**		**24**				**1.73**	**3.7**

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**WB7**	**204.5**	**4.75**	**0.23**	**0.109**	**0.0594**	**0.0**	**85.2**		
⊠	**WB8**	**44.5**	**9.50**	**0.31**	**0.189**	**0.0954**	**11.3**	**82.1**	**3.8**	**2.8**
▲	**WB8**	**64.5**	**9.50**	**1.07**	**0.309**	**0.0750**	**20.8**	**69.2**		
★	**WB8**	**89.5**	**2.00**	**0.22**	**0.124**		**0.0**	**89.9**	**10.1**	
⊙	**WB8**	**109.5**	**2.00**	**0.26**	**0.179**	**0.0709**	**0.0**	**93.1**	**2.5**	**4.5**

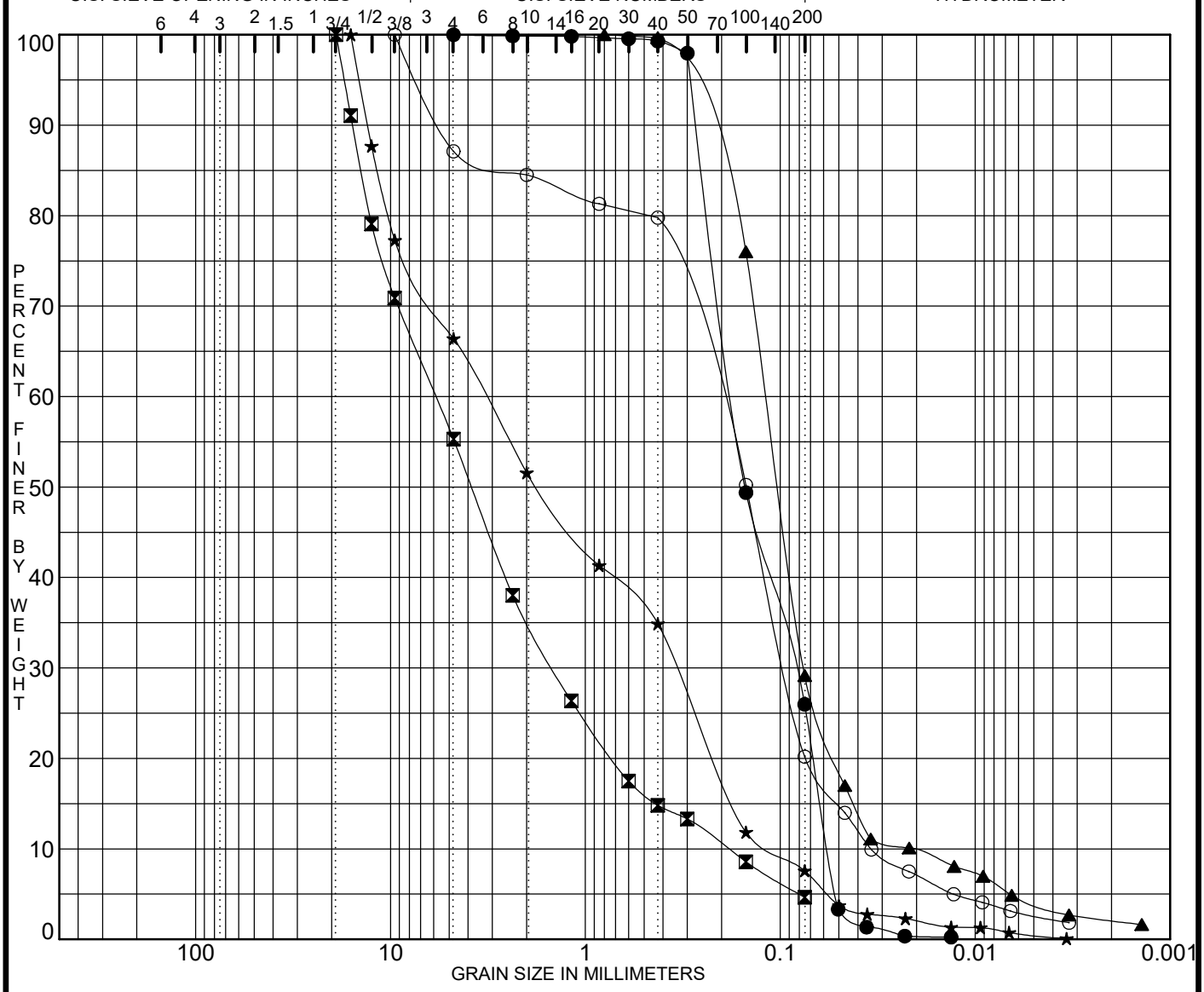
PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G20-045**

DATE **6/29/20**

PARTICLE SIZE ANALYSIS

Material Testing Services, LLC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Classification	MC%	LL	PL	PI	Cc	Cu
●	**WB8**	**129.5**						**0.72**	**3.1**
⊠	**WB9**	**44.5**	**WELL-GRADED SAND with GRAVEL SW**					**1.98**	**31.7**
▲	**WB9**	**64.5**		**29**				**2.29**	**5.6**
★	**WB9**	**84.5**						**0.32**	**29.4**
⊙	**WB9**	**104.5**						**1.22**	**6.2**

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**WB8**	**129.5**	**4.75**	**0.17**	**0.084**	**0.0567**	**0.0**	**74.0**		
⊠	**WB9**	**44.5**	**19.00**	**5.86**	**1.465**	**0.1848**	**44.7**	**50.6**	**4.7**	
▲	**WB9**	**64.5**	**0.80**	**0.12**	**0.076**	**0.0213**	**0.0**	**70.8**	**25.1**	**4.0**
★	**WB9**	**84.5**	**16.00**	**3.27**	**0.341**	**0.1112**	**33.6**	**58.8**	**7.1**	**0.5**
⊙	**WB9**	**104.5**	**9.50**	**0.21**	**0.094**	**0.0343**	**12.9**	**66.9**	**17.6**	**2.6**

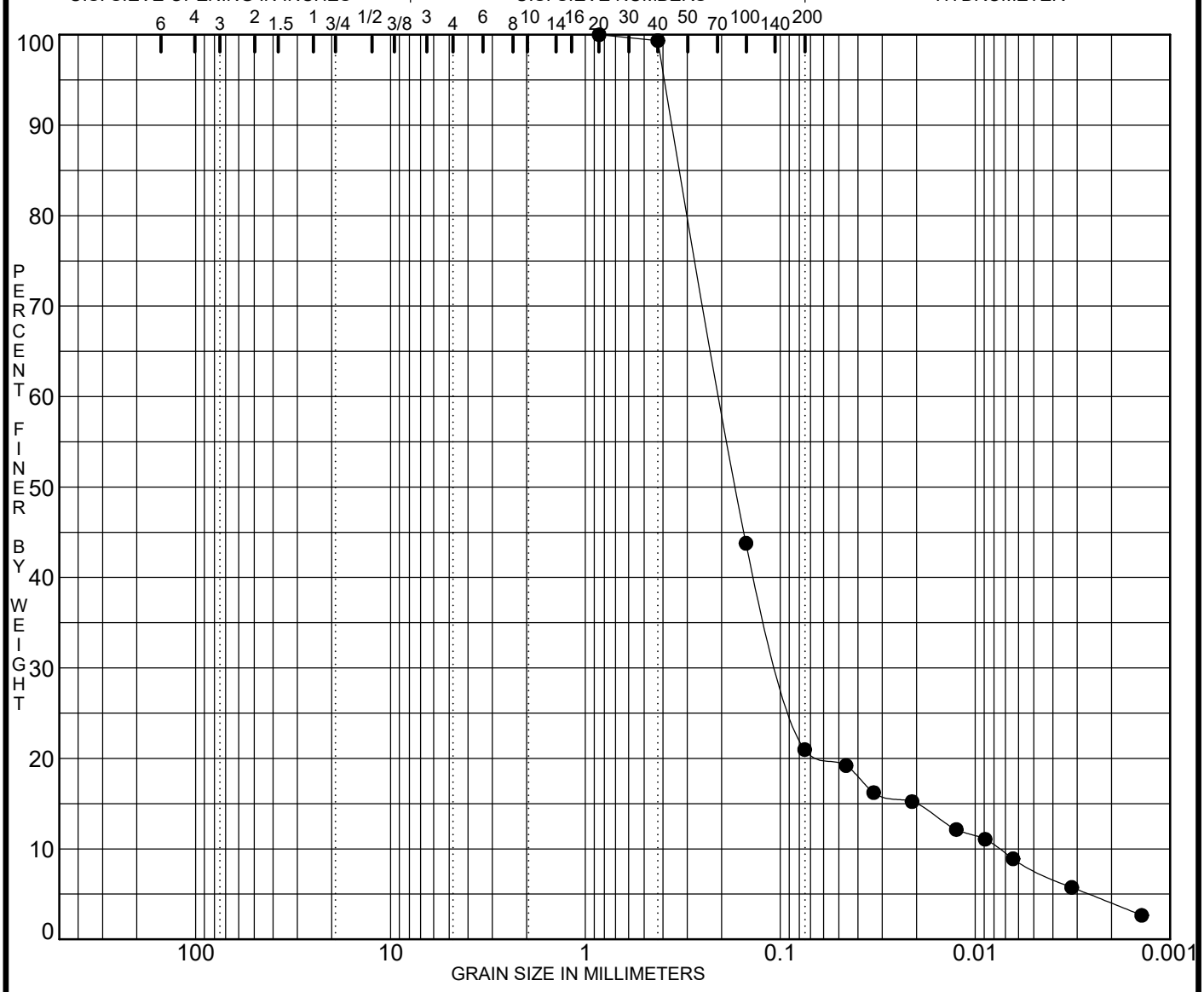
PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G20-045**

DATE **6/29/20**

PARTICLE SIZE ANALYSIS

Material Testing Services, LLC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Classification	MC%	LL	PL	PI	Cc	Cu
●	**WB9**	**124.5**		**23**				**6.33**	**26.9**

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**WB9**	**124.5**	**0.85**	**0.20**	**0.099**	**0.0076**	**0.0**	**79.0**	**13.2**	**7.8**

PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G20-045**

DATE **6/29/20**

PARTICLE SIZE ANALYSIS

Material Testing Services, LLC

MATERIAL TESTING SERVICES, LLC

P.O. Box 634
Minot, ND 58702
(701) 852-5553

P.O. Box 1093
Williston, ND 58802
(701) 572-4226

UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

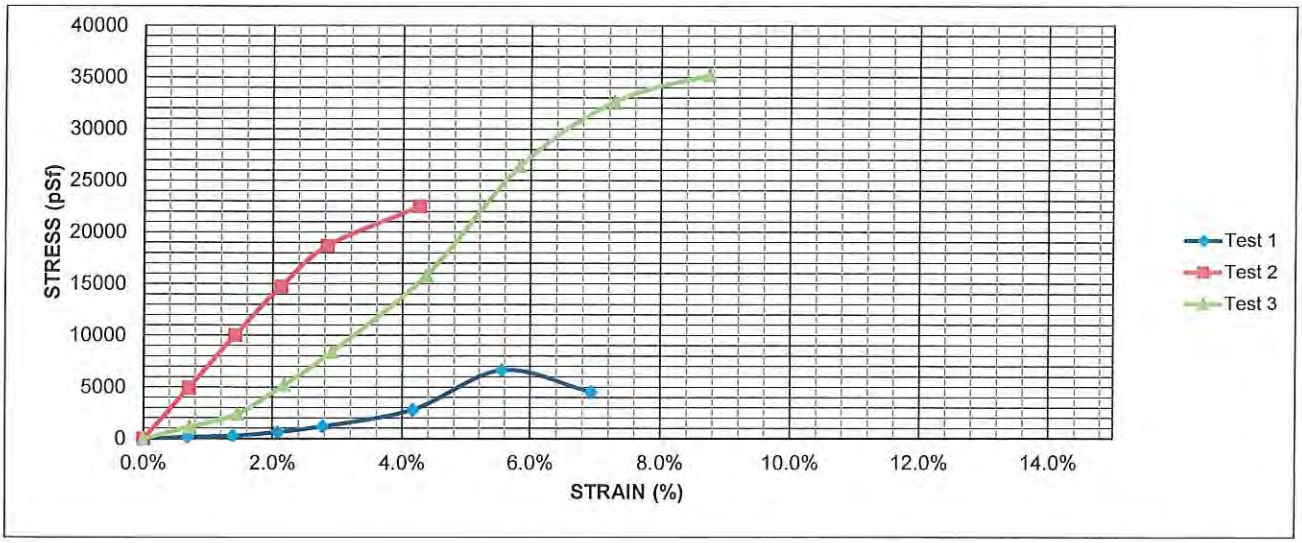
DATE: 4-Jun-20

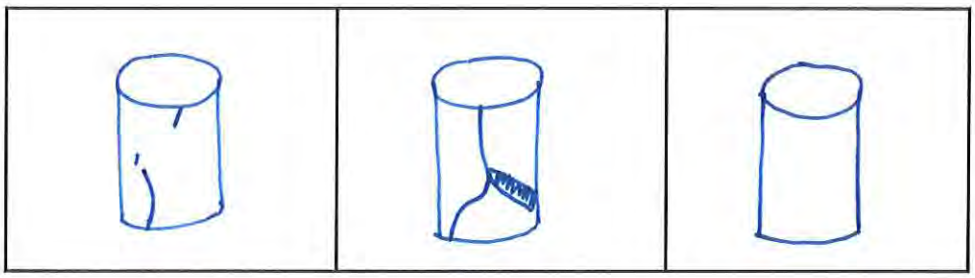
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 1	Test 2	Test 3
	WB-4 RC - 87.5-92.5 feet	WB-4 RC - 127.5-132.5 feet	WB-4 RC - 147.5-152.5 feet
Soil Class:			
Dry Density (pcf):	108.6	113.7	118.9
Water Content:	22.1%	15.2%	15.5%
Sample Dia. (mm):	45.1	44.8	44.4
Sample Ht (mm):	91.5	89.4	87.2
Height/Diameter:	2.03	2.00	1.96
Unc. Strength (psf):	**6646**	**22535**	**35246**
Strain at Failure (%):	5.6	4.3	7.3





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Material Testing Services, LLC

by

MATERIAL TESTING SERVICES, LLC

P.O. Box 634
Minot, ND 58702
(701) 852-5553

P.O. Box 1093
Williston, ND 58802
(701) 572-4226

UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

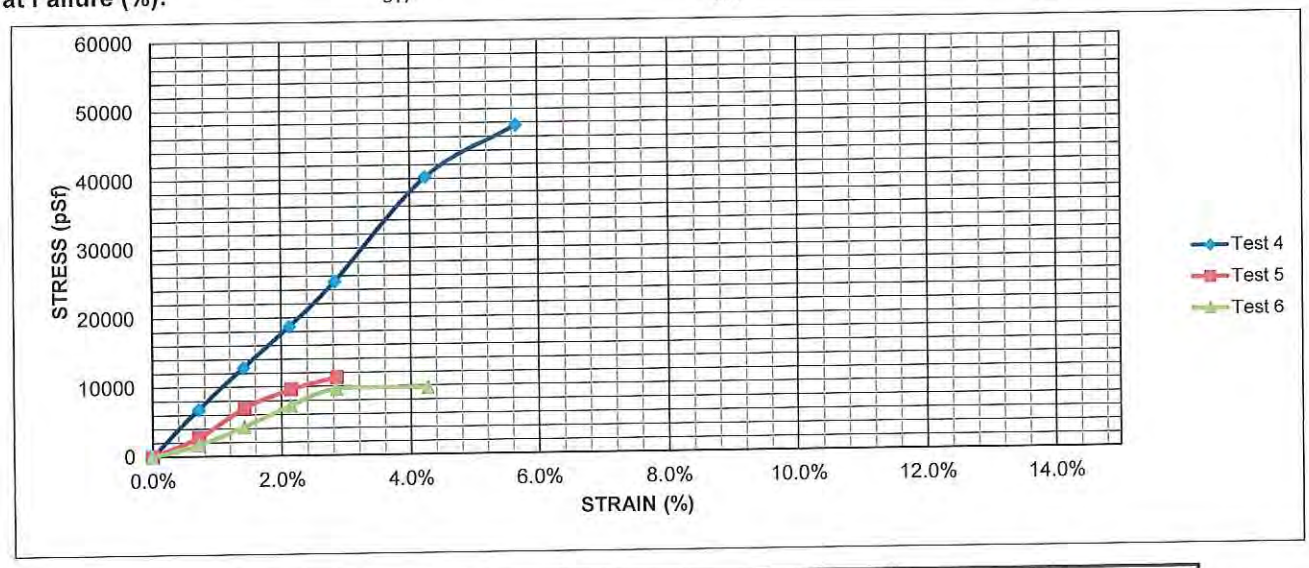
DATE: 4-Jun-20

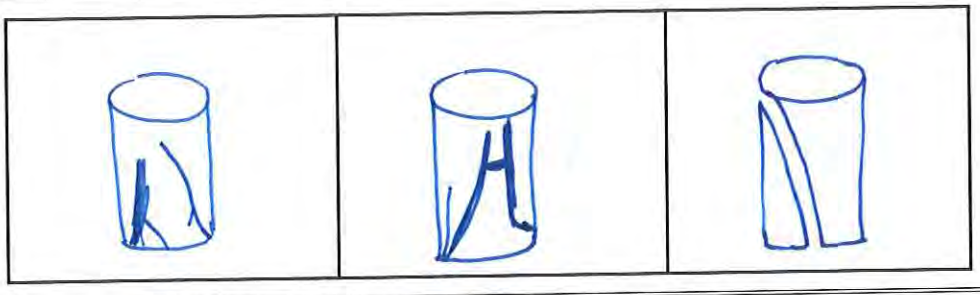
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 4 WB-4 RC - 182.5-187.5 feet	Test 5 WB-4 RC - 237.5-242.5 feet	Test 6 WB-4 RC - 247.5-252.5 feet
Soil Class:			
Dry Density (pcf):	115.1	113.9	107.5
Water Content:	19.1%	15.2%	19.1%
Sample Dia. (mm):	44.6	45.3	45.7
Sample Ht (mm):	89.7	88.9	89.2
Height/Diameter:	2.01	1.96	1.95
Unc. Strength (psf):	**47624**	**11336**	**9726**
Strain at Failure (%):	5.7	2.9	4.3





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Material Testing Services, LLC

by

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P.O. Box 634
Minot, ND 58702
(701) 852-5553

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Williston, ND 58802
(701) 572-4226

UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

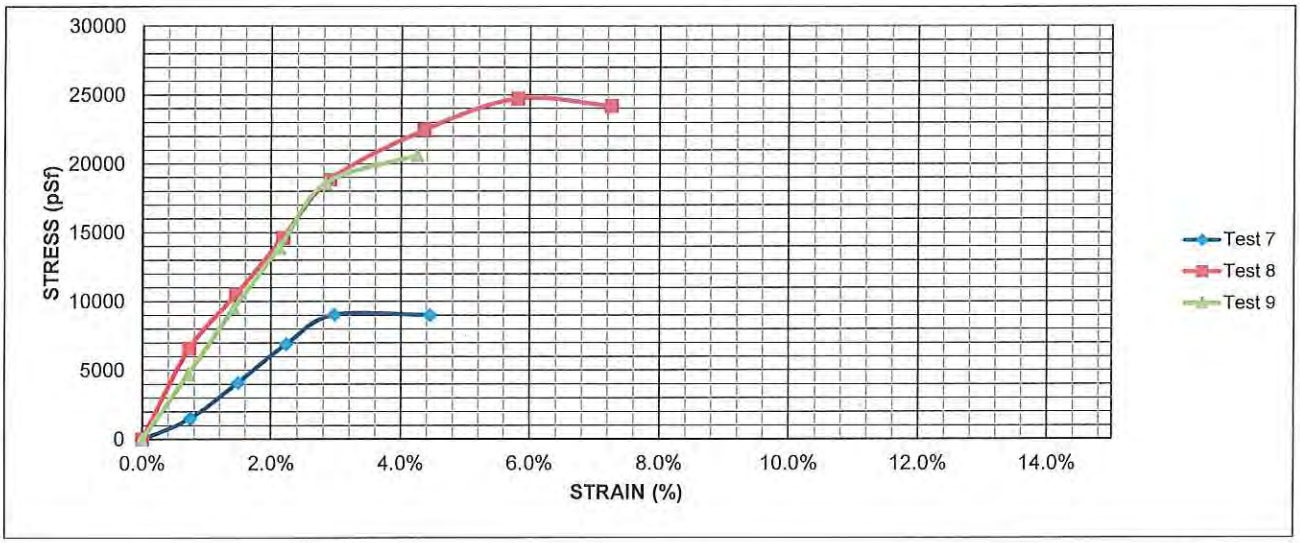
DATE: 4-Jun-20

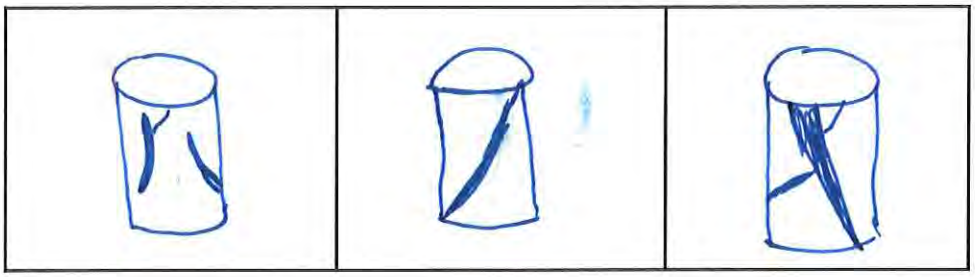
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 7	Test 8	Test 9
	WB-4 RC - 262.5-272.5 feet	WB-4 RC - 287.5-292.5 feet	WB-4 RC - 297.5-300 feet
Soil Class:			
Dry Density (pcf):	109.4	107.6	105.9
Water Content:	18.6%	20.0%	21.1%
Sample Dia. (mm):	45.7	44.4	44.6
Sample Ht (mm):	85.5	87.4	89.7
Height/Diameter:	1.87	1.97	2.01
Unc. Strength (psf):	**9054**	**24774**	**22188**
Strain at Failure (%):	3.0	5.8	4.2





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UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

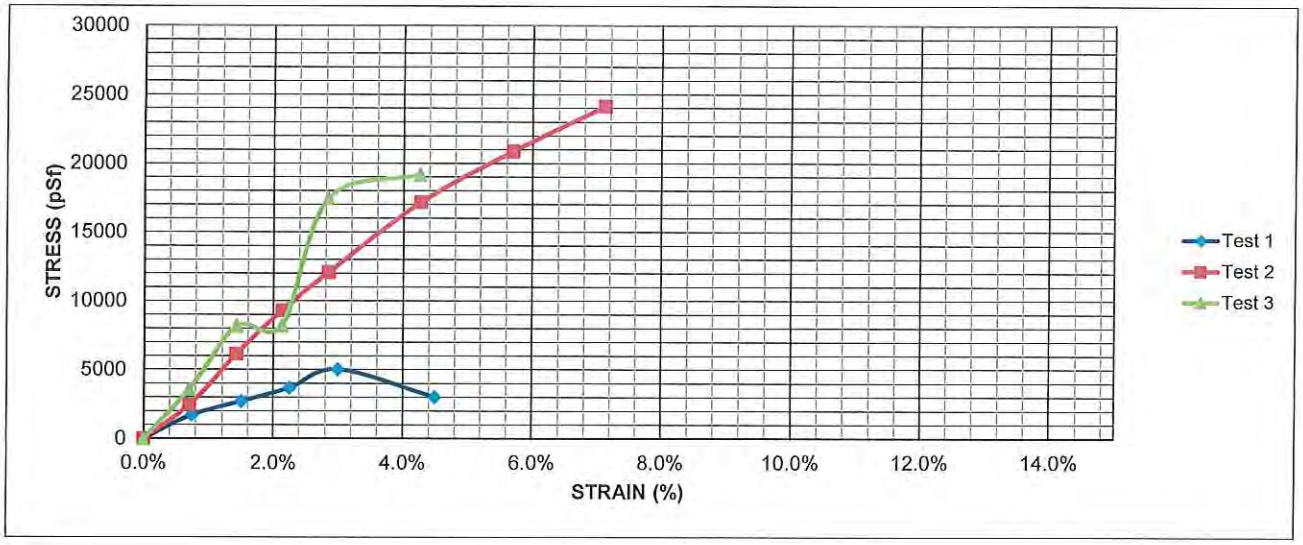
DATE: 5-Jun-20

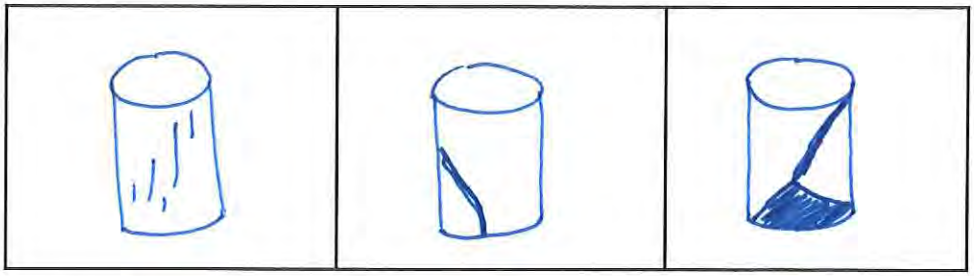
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 1	Test 2	Test 3
	WB-5	WB-5	WB-5
	RC - 160-165 feet	RC - 180-185 feet	RC - 200-205 feet
Soil Class:			
Dry Density (pcf):	108.2	117.5	116.3
Water Content:	66.2%	16.6%	14.2%
Sample Dia. (mm):	42.9	44.2	44.6
Sample Ht (mm):	84.8	89.2	89.5
Height/Diameter:	1.98	2.02	2.01
Unc. Strength (psf):	**5047**	**24258**	**19234**
Strain at Failure (%):	3.0	7.1	4.3





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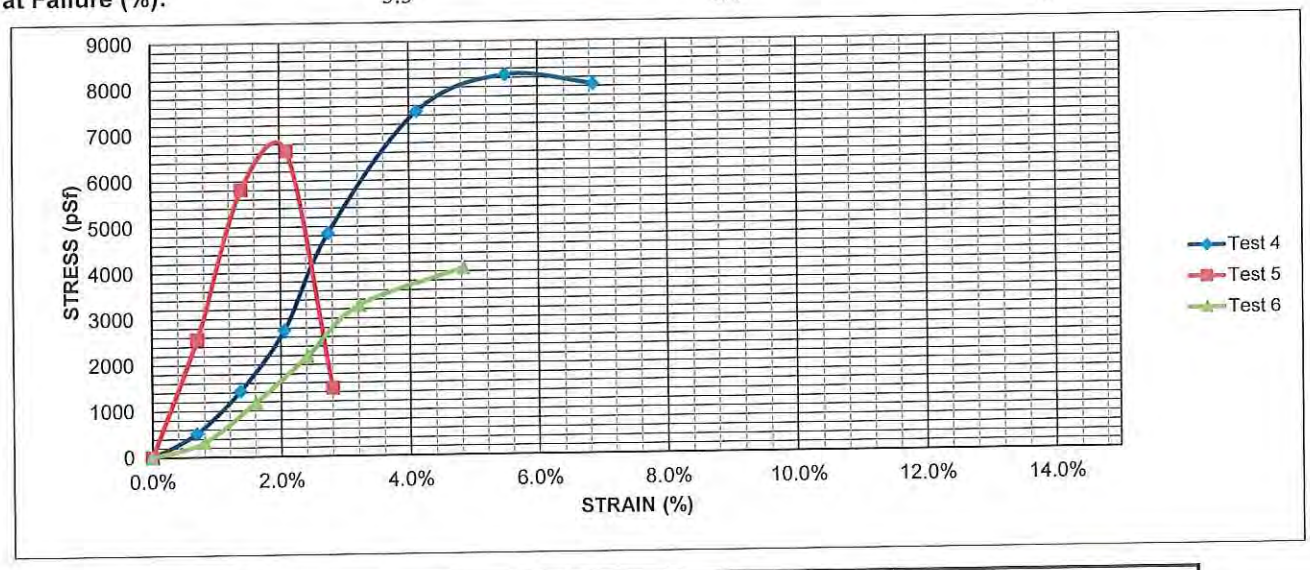
DATE: 5-Jun-20

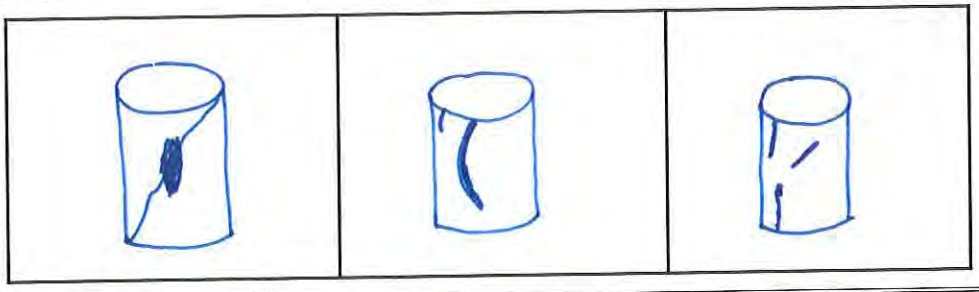
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 4 WB-5 RC - 220-225 feet	Test 5 WB-5 RC - 245-250 feet	Test 6 WB-5 RC - 265-270 feet
Soil Class:			
Dry Density (pcf):	105.8	107.9	108.8
Water Content:	19.2%	17.0%	20.5%
Sample Dia. (mm):	46.0	45.7	44.9
Sample Ht (mm):	92.5	90.5	78.9
Height/Diameter:	2.01	1.98	1.75
Unc. Strength (psf):	**8272**	**6658**	**4075**
Strain at Failure (%):	5.5	2.1	4.8





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UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

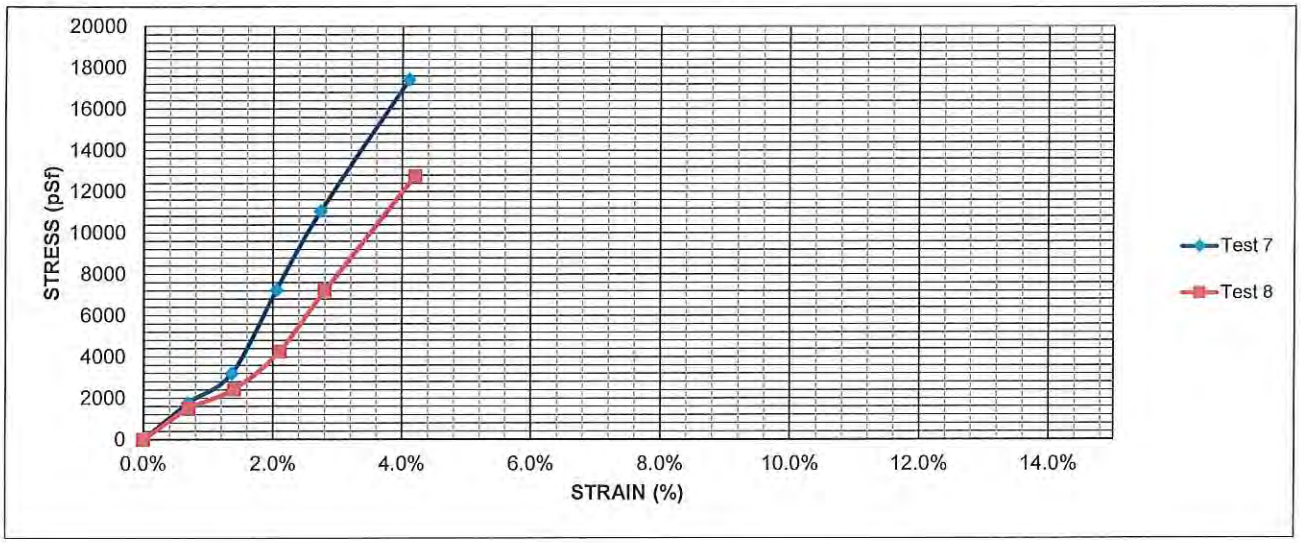
DATE: 7-Jun-20

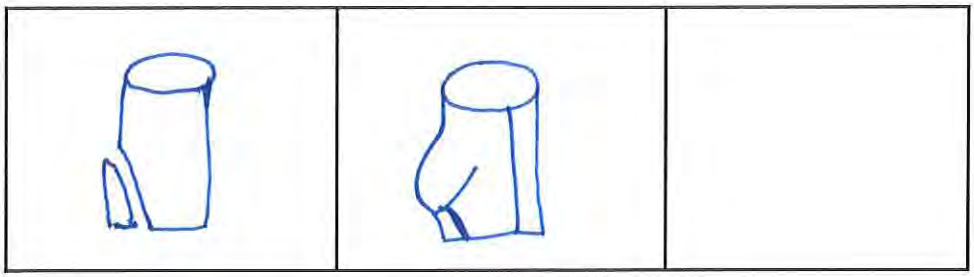
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 7	Test 8
	WB-5	WB-5
	RC - 275-280 feet	RC - 295-300 feet
Soil Class:		
Dry Density (pcf):	106.5	106.7
Water Content:	20.2%	21.6%
Sample Dia. (mm):	44.6	45.7
Sample Ht (mm):	92.9	90.7
Height/Diameter:	2.08	1.98
Unc. Strength (psf):	**17425**	**12763**
Strain at Failure (%):	4.1	4.2





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UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

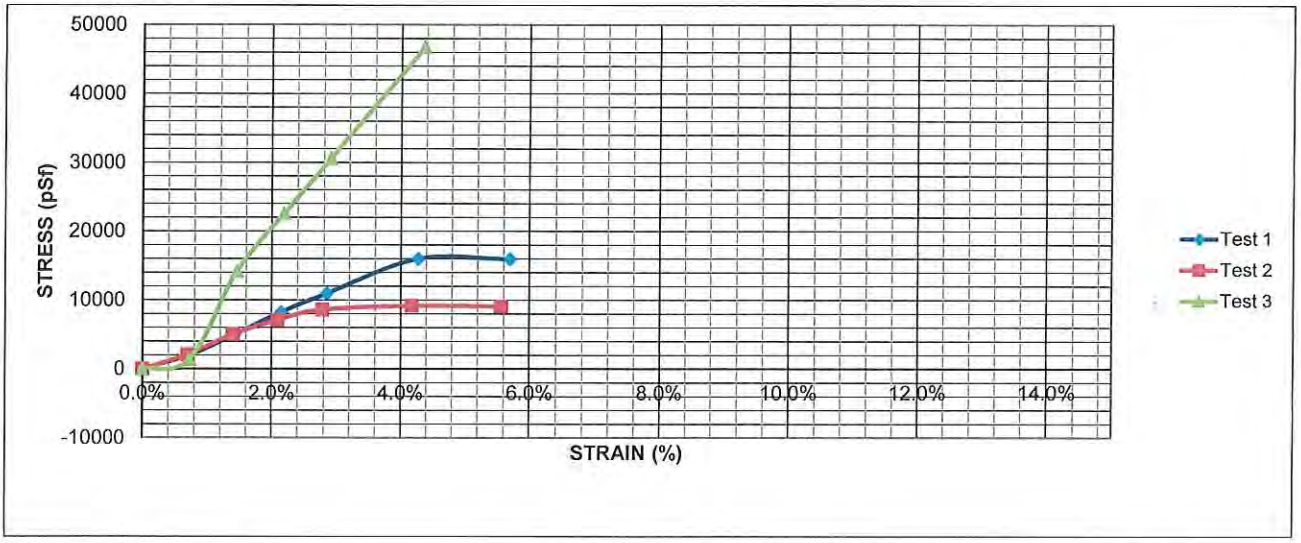
DATE: 10-Jun-20

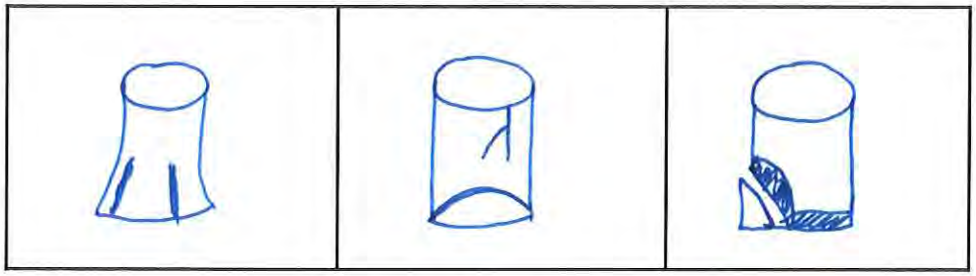
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 1	Test 2	Test 3
	WB-6 RC - 230-2355 feet	WB-6 RC - 245-250 feet	WB-6 RC - 295-300 feet
Soil Class:			
Dry Density (pcf):	102.7	110.8	110.6
Water Content:	23.1%	18.2%	17.1%
Sample Dia. (mm):	44.7	45.2	44.8
Sample Ht (mm):	89.2	91.4	87.3
Height/Diameter:	2.00	2.02	1.95
Unc. Strength (psf):	**16058**	**9230**	**46813**
Strain at Failure (%):	3.0	4.2	4.4





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UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

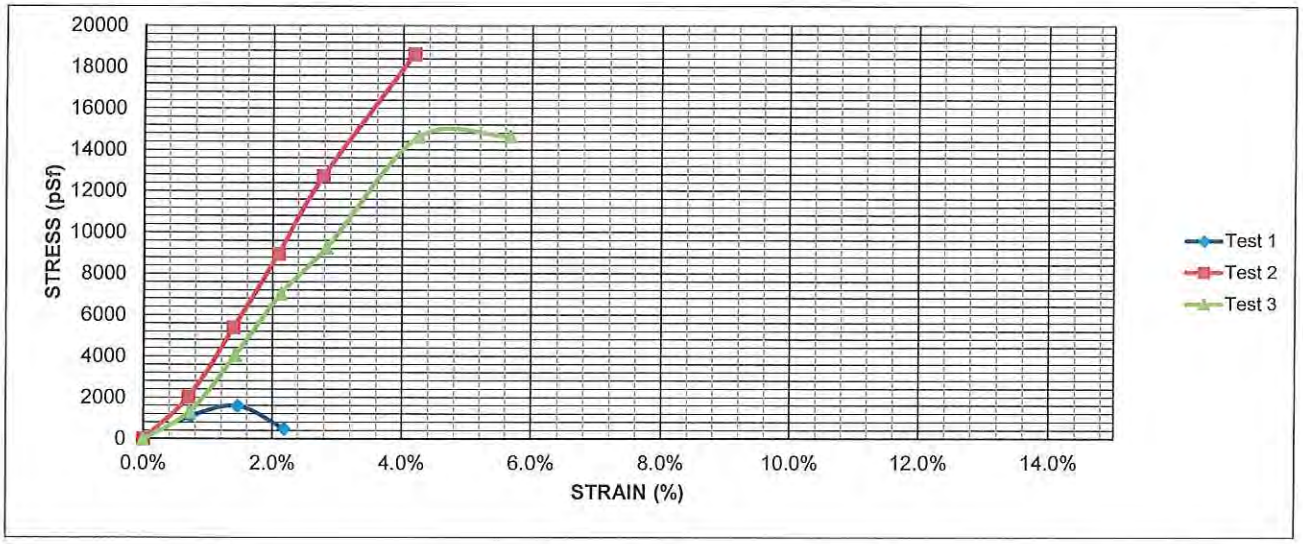
DATE: 4-Jun-20

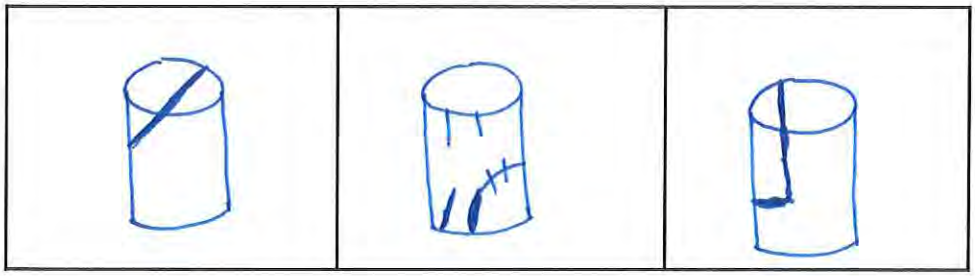
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 1	Test 2	Test 3
	WB-7	WB-7	WB-7
	RC - 250-255 feet	RC - 275-280 feet	RC - 295-300 feet
Soil Class:			
Dry Density (pcf):	102.0	104.2	103.8
Water Content:	21.4%	22.3%	27.3%
Sample Dia. (mm):	44.3	45.7	44.8
Sample Ht (mm):	87.2	91.1	89.6
Height/Diameter:	1.97	1.99	2.00
Unc. Strength (psf):	**1599**	**18637**	**14666**
Strain at Failure (%):	1.5	4.2	5.7





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UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

DATE: 4-Jun-20

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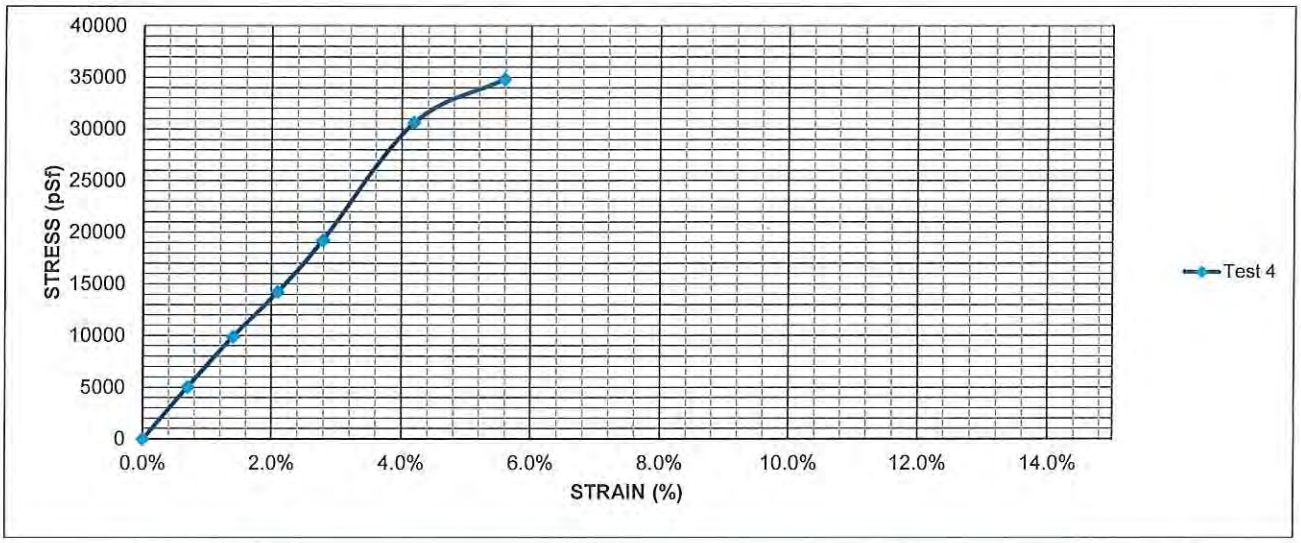
Eagan, MN 55121

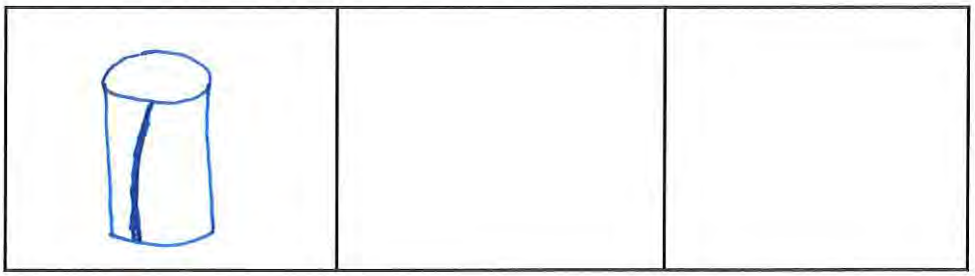
Laboratory Number G20-046

Specimen ID: **Test 4**
WB-7
RC - 182.5-187.5 feet

Soil Class:

Dry Density (pcf):	110.8
Water Content:	19.1%
Sample Dia. (mm):	45.1
Sample Ht (mm):	91.0
Height/Diameter:	2.02
Unc. Strength (psf):	**34830**
Strain at Failure (%):	5.6





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UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

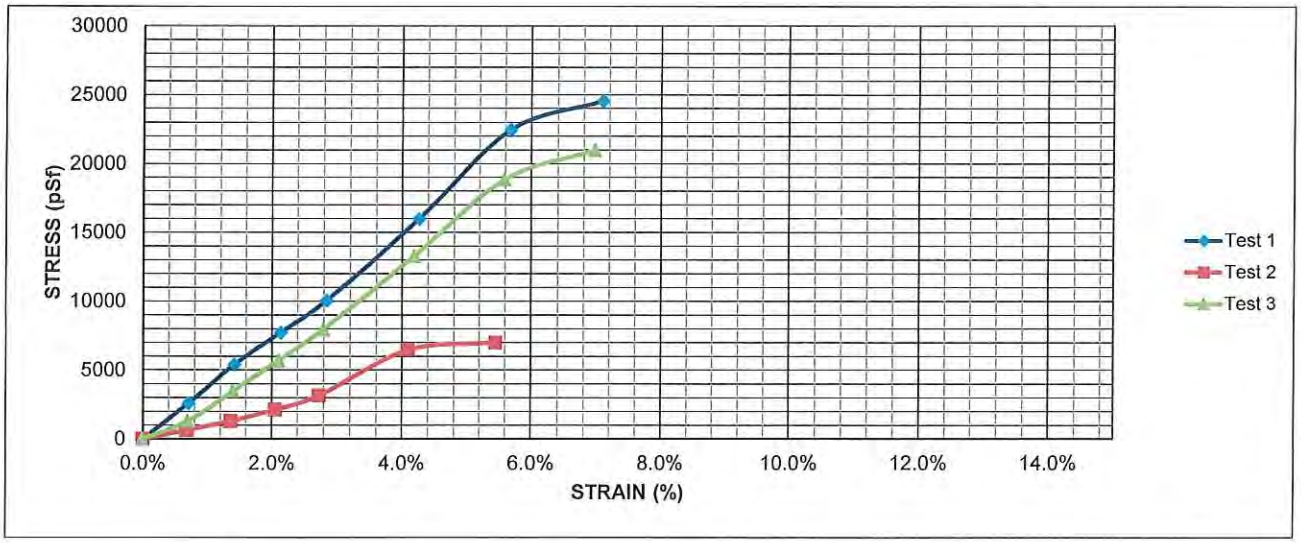
DATE: 5-Jun-20

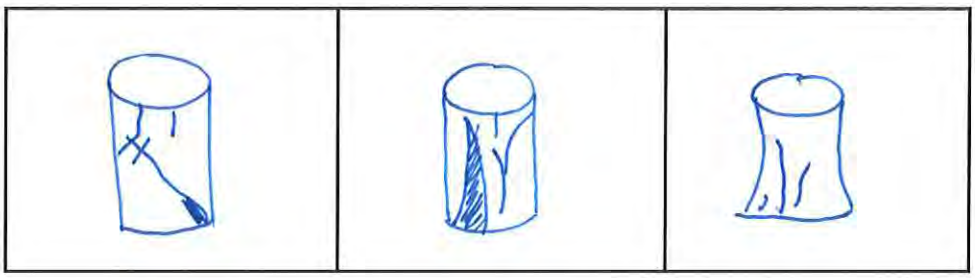
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 1	Test 2	Test 3
	WB-8 RC -160-165 feet	WB-8 RC - 180-185 feet	WB-8 RC - 200-205 feet
Soil Class:			
Dry Density (pcf):	115.0	106.9	107.0
Water Content:	16.1%	20.1%	21.3%
Sample Dia. (mm):	45.4	46.5	45.7
Sample Ht (mm):	89.4	93.2	91.0
Height/Diameter:	1.97	2.00	1.99
Unc. Strength (psf):	**24564**	**7009**	**21013**
Strain at Failure (%):	7.1	5.5	7.0





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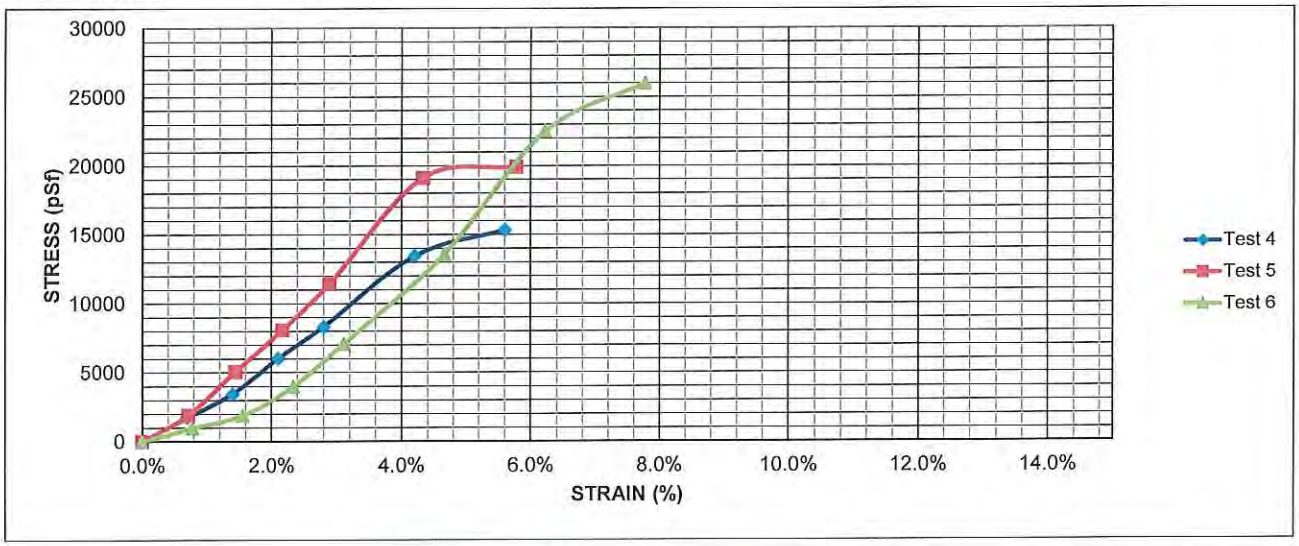
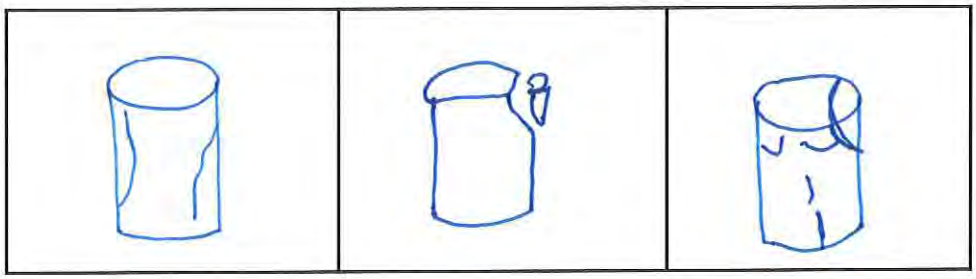
Laboratory Number G20-046

Specimen ID:	Test 4	Test 5	Test 6
	WB-8 RC - 220-225 feet	WB-8 RC - 245-250 feet	WB-8 RC - 265-270 feet
Soil Class:			
Dry Density (pcf):	108.9	108.8	105.8
Water Content:	20.3%	20.1%	23.1%
Sample Dia. (mm):	45.4	45.3	44.7
Sample Ht (mm):	90.6	87.9	81.6
Height/Diameter:	1.99	1.94	1.83
Unc. Strength (psf):	**15346**	**19931**	**26024**
Strain at Failure (%):	5.6	5.8	7.8





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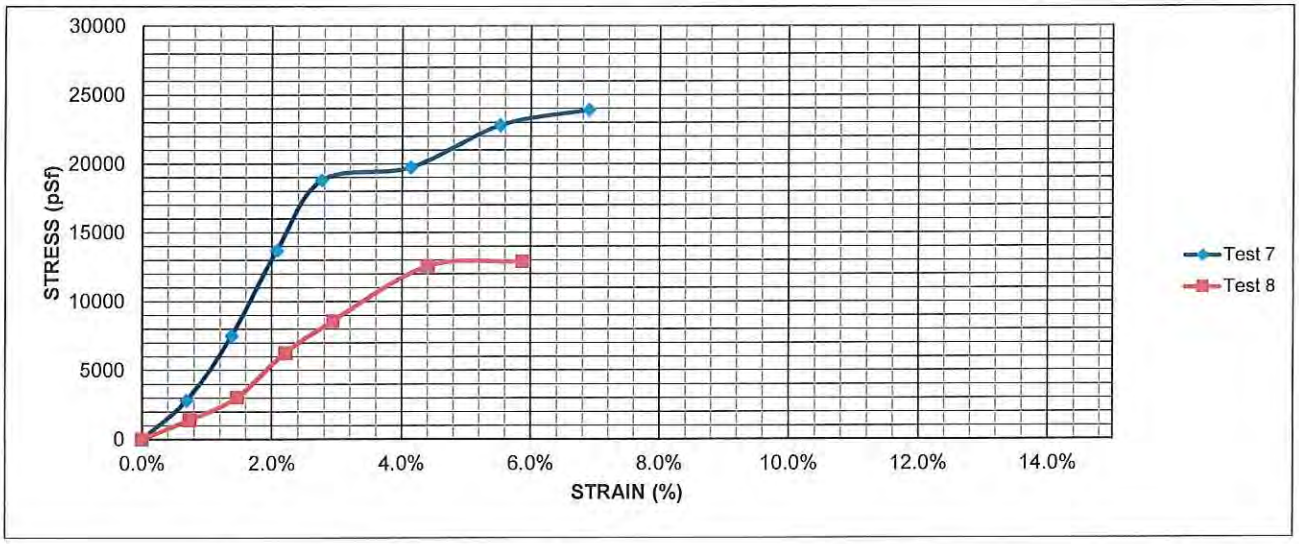
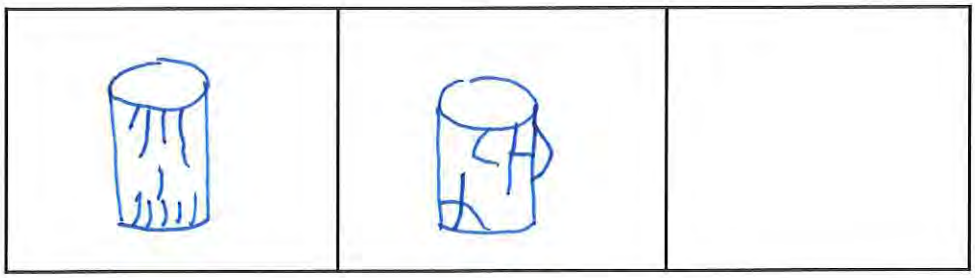
Laboratory Number G20-046

Specimen ID:	**Test 7**	**Test 8**
	WB-8	WB-4
	RC - 275-280 feet	RC - 287.5-292.5 feet
Soil Class:		
Dry Density (pcf):	107.2	106.1
Water Content:	20.8%	24.0%
Sample Dia. (mm):	45.3	45.0
Sample Ht (mm):	92.0	86.5
Height/Diameter:	2.03	1.92
Unc. Strength (psf):	**23927**	**12917**
Strain at Failure (%):	6.9	5.9





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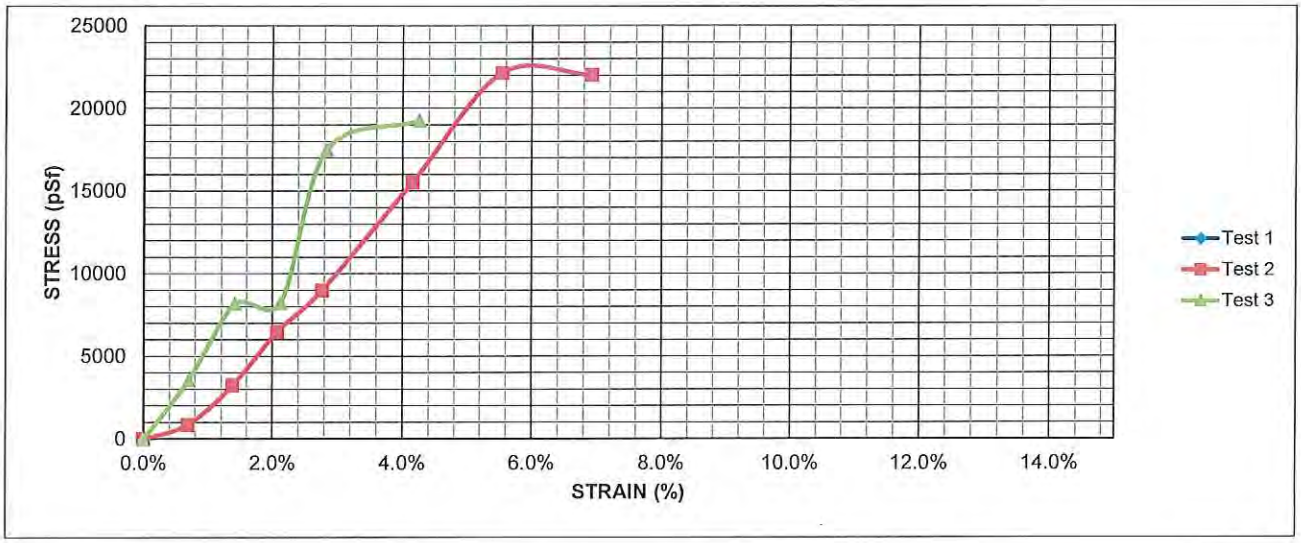
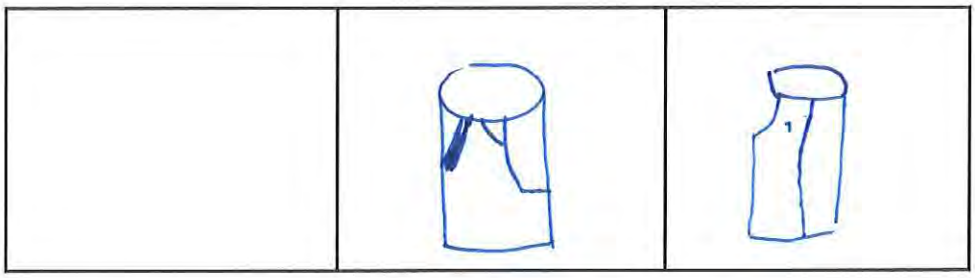
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 1	Test 2	Test 3
	WB-5	WB-9	WB-9
	RC - 87.5-92.5 feet	RC - 170-175 feet	RC - 190-195 feet
Soil Class:			
Dry Density (pcf):	Unable to Run	108.6	116.3
Water Content:		20.4%	14.2%
Sample Dia. (mm):		45.2	44.6
Sample Ht (mm):		91.7	89.5
Height/Diameter:		2.03	2.01
Unc. Strength (psf):		**25355**	**22155**
Strain at Failure (%):		4.1	5.3





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Material Testing Services, LLC

by

MATERIAL TESTING SERVICES, LLC

P.O. Box 634
Minot, ND 58702
(701) 852-5553

P.O. Box 1093
Williston, ND 58802
(701) 572-4226

UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

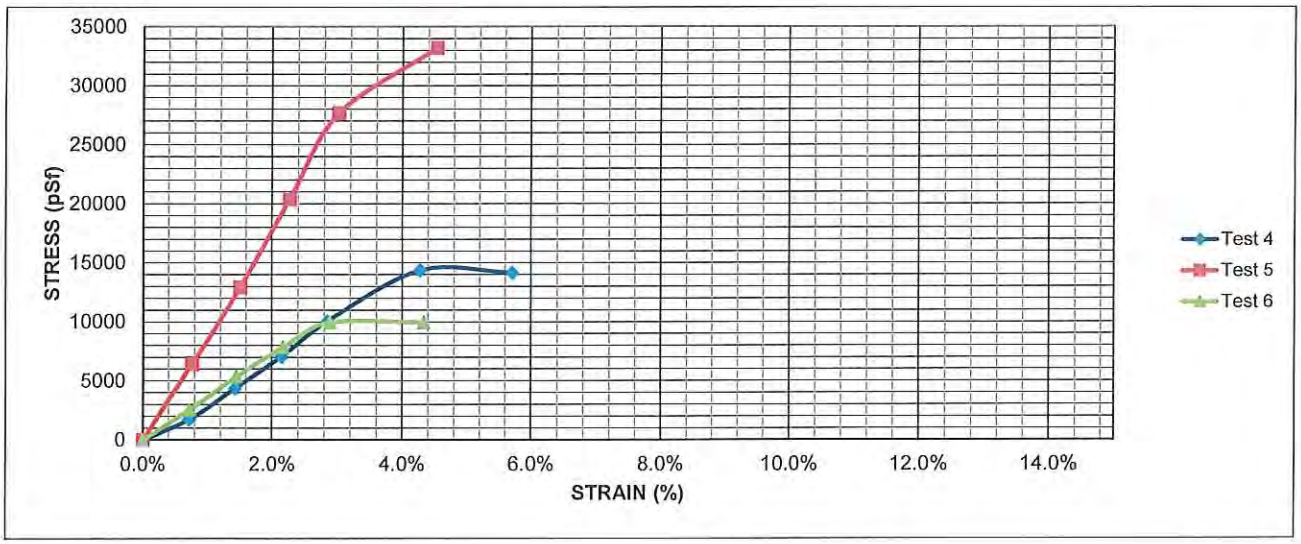
DATE: 7-Jun-20

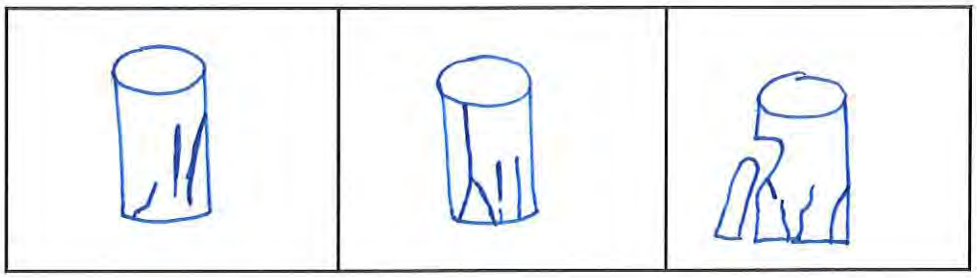
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 4	Test 5	Test 6
	WB-9	WB-5	WB-5
	RC - 210-215 feet	RC - 235-240 feet	RC - 265-270 feet
Soil Class:			
Dry Density (pcf):	104.4	108.5	106.3
Water Content:	23.0%	19.7%	20.2%
Sample Dia. (mm):	45.6	44.5	44.5
Sample Ht (mm):	88.9	83.9	87.8
Height/Diameter:	1.95	1.89	1.97
Unc. Strength (psf):	**14375**	**33239**	**9965**
Strain at Failure (%):	4.3	4.5	4.3





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UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

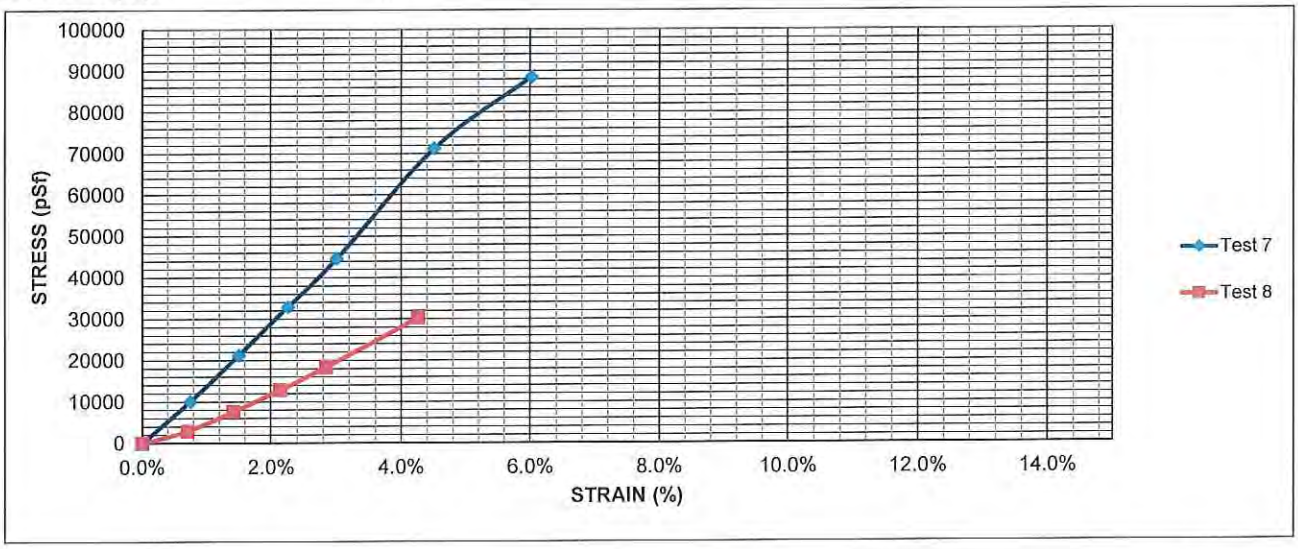
DATE: 7-Jun-20

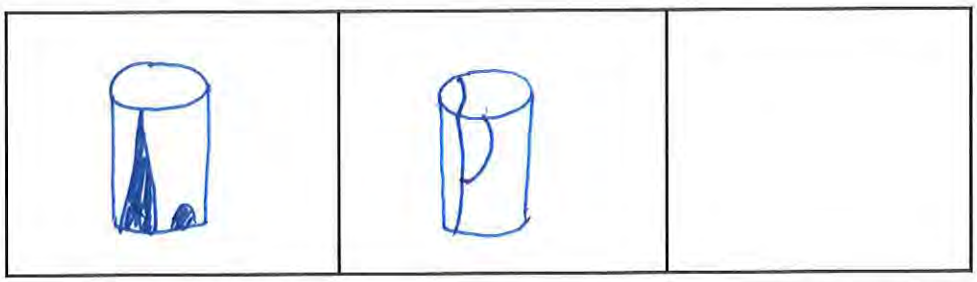
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 7	Test 8
	WB-9 RC - 255-260 feet	WB-9 RC - 305-310 feet
Soil Class:		
Dry Density (pcf):	112.7	117.6
Water Content:	15.3%	14.2%
Sample Dia. (mm):	42.2	44.9
Sample Ht (mm):	84.3	89.2
Height/Diameter:	2.00	1.99
Unc. Strength (psf):	**88505**	**30377**
Strain at Failure (%):	6.0	4.3





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Material Testing Services, LLC

by

LABORATORY TEST RESULTS

Testing Scope

Laboratory testing was proposed to characterize soils index properties including Atterberg limits (liquid and plastic limits) and moisture content. Strength testing included unconfined compression testing.

Index Properties

Testing and classification of soils was performed in accordance with the Unified Soil Classification System as described in ASTM D 2487. Atterberg limits were performed according to ASTM D 4318. Moisture content was determined in accordance with ASTM D 4959 and D 4643. The dry density was determined with direct measurement procedures. Mechanical sieve analysis was done in accordance with ASTM D 422.

Strength Testing

The strength tests consisted of unconfined compression (QU) testing. The QU tests were conducted in accordance with ASTM D 2166.

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%		ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

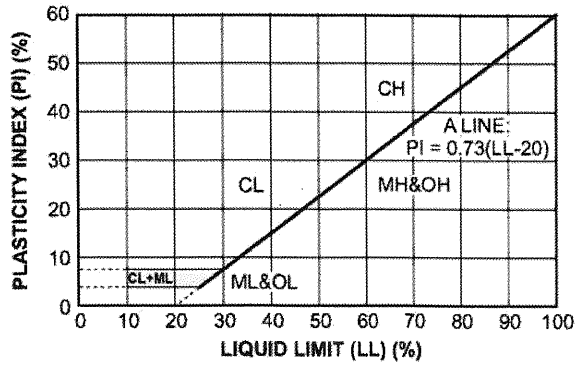
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent ..... GW, GP, SW, SP
More than 12 percent ..... GM, GC, SM, SC
5 to 12 percent ..... Borderline cases requiring dual symbols

PLASTICITY CHART



ERM

1000 IDS Center
80 South Eighth Street
Minneapolis, MN 55402

Telephone: +1 612 347 6789
Fax: +1 612 347 6780

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Call Log

Log of Telephone Conversation

Call To/From Whom	Rick Rogers
Phone number	701-654-7744
Company	USACE
ERM Contact	Pat Robblee
Phone number	612-840-8976
Date	8-17-20
Time of Conversation	2:30 p.m. est
Reference	North Bakken Expansion Project

LOG OF CONVERSATION

I called Mr. Rogers to discuss the schedule for completing site testing at 32WI976. I advised him that ERM is tentatively planning to re-mobilize after Labor Day to complete additional survey and hopefully the testing at 32WI976. I asked Mr. Rogers if his review of the testing plan for the site would be complete prior to Labor Day. Mr. Rogers said he expected review of the testing plan to be complete prior to that date.

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Andrea Thornton

From: Nelson, Reece E CIV USARMY CENWO (USA) <Reece.E.Nelson@usace.army.mil>
Sent: Tuesday, August 18, 2020 7:32 PM
To: Andrea Thornton
Cc: Thury, Jeremy J CIV USARMY CENWO (USA); Kruger, Heath Robert CIV USARMY CENWO (USA)
Subject: RE: ProjNet Access (UNCLASSIFIED)
Attachments: WBI Schedule.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

CLASSIFICATION: UNCLASSIFIED

Hey Andrea,

If you could get to the login screen, you are doing better than me the last two days! I will figure out what's wrong and get back to you, hopefully before Fri.

As for the schedule, see attached. I'll caveat that on the EA timeline I made some broad assumptions about new timelines, as I haven't gotten anything from FERC about WBI's planned timeline for submission, FERC incorporating, and we'll have another agency review prior to public comment period. But, we can't finalize the 408 permission and get it routed over to RE without the EA being completed by FERC and USACE adopting. So we can definitely discuss on Fri if you think anywhere I am way off base.

-Reece

-----Original Message-----
From: Andrea Thornton [mailto:Andrea.Thornton@erm.com]
Sent: Tuesday, August 18, 2020 1:49 PM
To: Nelson, Reece E CIV USARMY CENWO (USA) <Reece.E.Nelson@usace.army.mil>
Subject: [Non-DoD Source] FW: ProjNet Access (UNCLASSIFIED)

Hi Reece -

My ProjNet login appears to no longer be working. Are you able to check with the admin to see if there is something I need to do for access?

Additionally, WBI is asking about the review schedule again and if you are able to upload that file to ProjNet (or share via email) so we have that information and are all on the same page. We have out monthly call scheduled for Thursday where I'd like to see if there are immediate questions from the group on the revised application.

Thanks!
Andrea

Andrea Thornton
Principal Consultant

Pronouns: she/her/hers

Environmental Resources Management (ERM)
1050 SW 6th Avenue, Suite 1650 | Portland, Oregon | 97204 M 503-459-6864 E andrea.thornton@erm.com | W Blockedhttps://eur01.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.erm.com%2F&data=02%7C01%7C%7Caaf105bb25ff4ebc2b2908d843e855f7%7Cf2fe6bd39c4a485bae69e18820a88130%7C0%7C0%7C637334012464262074&sdata=v998yUHbCewGzY0ugZSV7Tuk6oHbk%2B9v3xad1CREpmc%3D&reserved=0

-----Original Message-----
From: Nelson, Reece E CIV USARMY CENWO (USA) <Reece.E.Nelson@usace.army.mil>
Sent: Tuesday, February 25, 2020 7:16 PM
To: Andrea Thornton <Andrea.Thornton@erm.com>; Atwell, Patrick C CIV USARMY CENWO (USA) <Patrick.C.Atwell@usace.army.mil>
Subject: RE: ProjNet Access (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Great, will forward on. You are already in the system though correct? I will make sure our Projnet admin checks your assignment.

-Reece

-----Original Message-----
From: Andrea Thornton [mailto:Andrea.Thornton@erm.com]
Sent: Tuesday, February 25, 2020 2:34 PM
To: Nelson, Reece E CIV USARMY CENWO (USA) <Reece.E.Nelson@usace.army.mil>; Atwell, Patrick C CIV USARMY CENWO (USA) <Patrick.C.Atwell@usace.army.mil>
Subject: [Non-DoD Source] RE: ProjNet Access (UNCLASSIFIED)

Thank you Reece. Below is the information that you asked for. We have one lead from WBI and one from ERM.

1. Company Name: WBI Energy
2. City: Glendive
3. State: Montana
4. Point of Contact (first and last name): Dave Linn
5. POC email address: dave.linn@wbienergy.com
6. POC phone number: 406-359-7333

1. Company Name: ERM (Environmental Resources Management)
2. City: Portland
3. State: Oregon
4. Point of Contact (first and last name): Andrea Thornton
5. POC email address: andrea.thornton@erm.com
6. POC phone number: 503-459-6864

Andrea Thornton
Principal Consultant

Environmental Resources Management (ERM)
1050 SW 6th Avenue, Suite 1650 | Portland, Oregon | 97204 M 503-459-6864 E andrea.thornton@erm.com | W
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-----Original Message-----
From: Nelson, Reece E CIV USARMY CENWO (USA) <Reece.E.Nelson@usace.army.mil>
Sent: Friday, February 21, 2020 9:56 AM
To: Andrea Thornton <Andrea.Thornton@erm.com>; Atwell, Patrick C CIV USARMY CENWO (USA) <Patrick.C.Atwell@usace.army.mil>
Subject: RE: ProjNet Access (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Hey Andrea,

Following info is needed for the company:

1. Company Name:
2. City:
3. State:
4. Point of Contact (first and last name):
5. POC email address:
6. POC phone number:

-Reece

-----Original Message-----
From: Andrea Thornton [mailto:Andrea.Thornton@erm.com]
Sent: Friday, February 21, 2020 10:03 AM
To: Nelson, Reece E CIV USARMY CENWO (USA) <Reece.E.Nelson@usace.army.mil>; Atwell, Patrick C CIV USARMY CENWO (USA) <Patrick.C.Atwell@usace.army.mil>
Subject: [Non-DoD Source] ProjNet Access

Hi Reece and Patrick -

Please let us know what information you need from WBI to get ProjNet access in place for the 408 permit documents.

Thanks,

Andrea

Andrea Thornton

Principal Consultant

Environmental Resources Management (ERM)

1050 SW 6th Avenue, Suite 1650 | Portland, Oregon | 97204

M 503-459-6864

E andrea.thornton@erm.com <mailto:andrea.thornton@erm.com> | W BlockedBlockedBlockedhttps://eur01.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.erm.com%2F&data=02%7C01%7C%7Caaf105bb25ff4ebc2b2908d843e855f7%7Cf2fe6bd39c4a485bae69e18820a88130%7C0%7C0%7C637334012464262074&sdata=v998yUHbCewGzY0ugZSV7Tuk6oHbk%2B9v3xad1CREpmc%3D&reserved=0 <BlockedBlockedBlockedhttps://eur01.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.erm.com%2F&data=02%7C01%7C%7Caaf105bb25ff4ebc2b2908d843e855f7%7Cf2fe6bd39c4a485bae69e18820a88130%7C0%7C0%7C637334012464262074&sdata=v998yUHbCewGzY0ugZSV7Tuk6oHbk%2B9v3xad1CREpmc%3D&reserved=0>

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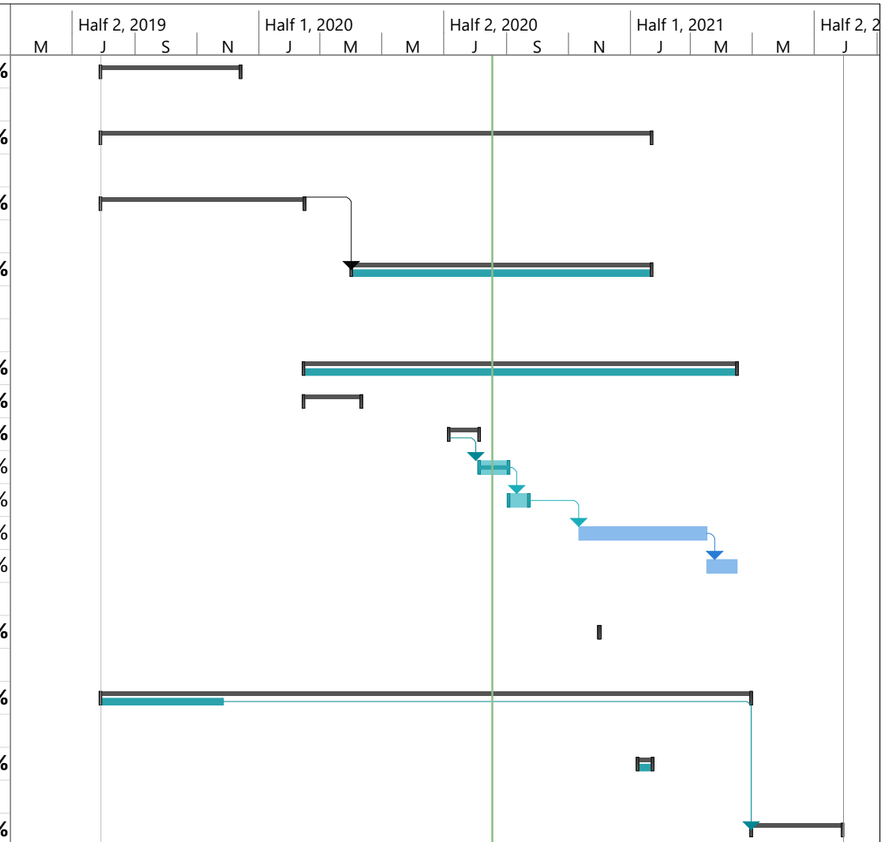
CLASSIFICATION: UNCLASSIFIED

ID	Task Mode	Task Name	Duration	Start	Finish	% Complete
1		**Project Initiation & Kickoff**	**100 days?**	**Mon 7/29/19**	**Fri 12/13/19**	**100%**
35						
36		**Design Review and Technical Analysis**	**389 days**	**Mon 7/29/19**	**Thu 1/21/21**	**61%**
37						
38		**Temp Construction License - Geotechnical Analysis**	**145 days**	**Mon 7/29/19**	**Fri 2/14/20**	**100%**
56						
57		**Design Review**	**212 days**	**Wed 4/1/20**	**Thu 1/21/21**	**25%**
93						
110						
111		**NEPA - Environmental Assessment**	**305 days**	**Fri 2/14/20**	**Thu 4/15/21**	**47%**
112		**NEPA - External Scoping**	**41 days?**	**Fri 2/14/20**	**Fri 4/10/20**	**100%**
128		**NEPA - USACE Approved Draft**	**22 days**	**Mon 7/6/20**	**Tue 8/4/20**	**50%**
134		Request of Information to FERC	21 days	Wed 8/5/20	Wed 9/2/20	100%
135		2nd Agency review of EA	20 edays	Wed 9/2/20	Tue 9/22/20	0%
136		Federal 90 day authorization period	90 days	Wed 11/11/20	Tue 3/16/21	0%
137		NEPA - EA Finalization	30 edays	Tue 3/16/21	Thu 4/15/21	0%
138						
139		**Section 106 Determination**	**1 day**	**Tue 12/1/20**	**Tue 12/1/20**	**0%**
147						
148		**Section 408 Permission / Determination**	**459 days**	**Mon 7/29/19**	**Thu 4/29/21**	**0%**
173						
174		**Regulatory - Section 404 and/or Section 10**	**11 days**	**Fri 1/8/21**	**Fri 1/22/21**	**0%**
177						
178		**USACE Real Estate Instrument(s)**	**90 edays**	**Fri 4/30/21**	**Thu 7/29/21**	**0%**



Project: WBI Schedule
Date: Tue 8/18/20

Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress
Summary	Inactive Summary	Manual Summary	External Milestone	

Andrea Thornton

From: Andrea Thornton
Sent: Wednesday, August 19, 2020 7:13 AM
To: 'Nelson, Reece E CIV USARMY CENWO (USA)'
Cc: Thury, Jeremy J CIV USARMY CENWO (USA); Kruger, Heath Robert CIV USARMY CENWO (USA)
Subject: RE: ProjNet Access (UNCLASSIFIED)

Thanks for passing this along Reece. If you are able, it may be worth giving Dawn a call at FERC regarding the EA schedule. I do not know exactly how far out the EA is getting pushed, but I don't believe it is going to be pushed as far out as you are showing it. Once FERC issues the EA (which would be the final EA) the federal 90 day authorization period would start. Any public comments that are received on the EA, FERC would then address in their Order.

Look forward to speaking with the group on Thursday, our call is scheduled for 10:30 central time.

Thanks,
Andrea

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

Environmental Resources Management (ERM)
1050 SW 6th Avenue, Suite 1650 | Portland, Oregon | 97204 M 503-459-6864 E andrea.thornton@erm.com | W www.erm.com

-----Original Message-----
From: Nelson, Reece E CIV USARMY CENWO (USA) <Reece.E.Nelson@usace.army.mil>
Sent: Tuesday, August 18, 2020 7:32 PM
To: Andrea Thornton <Andrea.Thornton@erm.com>
Cc: Thury, Jeremy J CIV USARMY CENWO (USA) <Jeremy.J.Thury@usace.army.mil>; Kruger, Heath Robert CIV USARMY CENWO (USA) <Heath.R.Kruger@usace.army.mil>
Subject: RE: ProjNet Access (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Hey Andrea,

If you could get to the login screen, you are doing better than me the last two days! I will figure out what's wrong and get back to you, hopefully before Fri.

As for the schedule, see attached. I'll caveat that on the EA timeline I made some broad assumptions about new timelines, as I haven't gotten anything from FERC about WBI's planned timeline for submission, FERC incorporating, and we'll have another agency review prior to public comment period. But, we can't finalize the 408 permission and get it routed over to RE without the EA being completed by FERC and USACE adopting. So we can definitely discuss on Fri if you think anywhere I am way off base.

-Reece

-----Original Message-----
From: Andrea Thornton [mailto:Andrea.Thornton@erm.com]
Sent: Tuesday, August 18, 2020 1:49 PM
To: Nelson, Reece E CIV USARMY CENWO (USA) <Reece.E.Nelson@usace.army.mil>
Subject: [Non-DoD Source] FW: ProjNet Access (UNCLASSIFIED)

Hi Reece -

My ProjNet login appears to no longer be working. Are you able to check with the admin to see if there is something I need to do for access?

Additionally, WBI is asking about the review schedule again and if you are able to upload that file to ProjNet (or share via email) so we have that information and are all on the same page. We have out monthly call scheduled for Thursday where I'd like to see if there are immediate questions from the group on the revised application.

Thanks!
Andrea

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

Environmental Resources Management (ERM)
1050 SW 6th Avenue, Suite 1650 | Portland, Oregon | 97204 M 503-459-6864 E andrea.thornton@erm.com | W Blockedhttps://eur01.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.erm.com%2F&data=02%7C01%7C%7Caaf105bb25ff4ebc2b2908d843e855f7%7Cf2fe6bd39c4a485bae69e18820a88130%7C0%7C0%7C637334012464262074&sdata=v998yUHbCewGzY0ugZSV7Tuk6oHbk%2B9v3xad1CREpmc%3D&reserved=0

-----Original Message-----
From: Nelson, Reece E CIV USARMY CENWO (USA) <Reece.E.Nelson@usace.army.mil>
Sent: Tuesday, February 25, 2020 7:16 PM
To: Andrea Thornton <Andrea.Thornton@erm.com>; Atwell, Patrick C CIV USARMY CENWO (USA) <Patrick.C.Atwell@usace.army.mil>
Subject: RE: ProjNet Access (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Great, will forward on. You are already in the system though correct? I will make sure our Projnet admin checks your assignment.

-Reece

-----Original Message-----
From: Andrea Thornton [mailto:Andrea.Thornton@erm.com]

Sent: Tuesday, February 25, 2020 2:34 PM
To: Nelson, Reece E CIV USARMY CENWO (USA) <Reece.E.Nelson@usace.army.mil>; Atwell, Patrick C CIV USARMY CENWO (USA) <Patrick.C.Atwell@usace.army.mil>
Subject: [Non-DoD Source] RE: ProjNet Access (UNCLASSIFIED)

Thank you Reece. Below is the information that you asked for. We have one lead from WBI and one from ERM.

1. Company Name: WBI Energy
2. City: Glendive
3. State: Montana
4. Point of Contact (first and last name): Dave Linn
5. POC email address: dave.linn@wbienergy.com
6. POC phone number: 406-359-7333

1. Company Name: ERM (Environmental Resources Management)
2. City: Portland
3. State: Oregon
4. Point of Contact (first and last name): Andrea Thornton
5. POC email address: andrea.thornton@erm.com
6. POC phone number: 503-459-6864

Andrea Thornton
Principal Consultant

Environmental Resources Management (ERM)
1050 SW 6th Avenue, Suite 1650 | Portland, Oregon | 97204 M 503-459-6864 E andrea.thornton@erm.com | W BlockedBlockedhttps://eur01.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.erm.com%2F&data=02%7C01%7C%7Caaf105bb25ff4ebc2b2908d843e855f7%7Cf2fe6bd39c4a485bae69e18820a88130%7C0%7C0%7C637334012464262074&sdata=v998yUHbCewGzY0ugZSV7Tuk6oHbk%2B9v3xad1CREpmc%3D&reserved=0

-----Original Message-----
From: Nelson, Reece E CIV USARMY CENWO (USA) <Reece.E.Nelson@usace.army.mil>
Sent: Friday, February 21, 2020 9:56 AM
To: Andrea Thornton <Andrea.Thornton@erm.com>; Atwell, Patrick C CIV USARMY CENWO (USA) <Patrick.C.Atwell@usace.army.mil>
Subject: RE: ProjNet Access (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Hey Andrea,

Following info is needed for the company:

1. Company Name:
2. City:
3. State:
4. Point of Contact (first and last name):

5. POC email address:
6. POC phone number:

-Reece

-----Original Message-----
From: Andrea Thornton [mailto:Andrea.Thornton@erm.com]
Sent: Friday, February 21, 2020 10:03 AM
To: Nelson, Reece E CIV USARMY CENWO (USA) <Reece.E.Nelson@usace.army.mil>; Atwell, Patrick C CIV USARMY CENWO (USA) <Patrick.C.Atwell@usace.army.mil>
Subject: [Non-DoD Source] ProjNet Access

Hi Reece and Patrick -

Please let us know what information you need from WBI to get ProjNet access in place for the 408 permit documents.

Thanks,

Andrea

Andrea Thornton

Principal Consultant

Environmental Resources Management (ERM)

1050 SW 6th Avenue, Suite 1650 | Portland, Oregon | 97204

M 503-459-6864

E andrea.thornton@erm.com <mailto:andrea.thornton@erm.com> | W BlockedBlockedBlockedhttps://eur01.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.erm.com%2F&data=02%7C01%7C%7Caaf105bb25ff4ebc2b2908d843e855f7%7Cf2fe6bd39c4a485bae69e18820a88130%7C0%7C0%7C637334012464262074&sdata=v998yUHbCewGzY0ugZSV7Tuk6oHbk%2B9v3xad1CREpmc%3D&reserved=0 <BlockedBlockedBlockedhttps://eur01.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.erm.com%2F&data=02%7C01%7C%7Caaf105bb25ff4ebc2b2908d843e855f7%7Cf2fe6bd39c4a485bae69e18820a88130%7C0%7C0%7C637334012464262074&sdata=v998yUHbCewGzY0ugZSV7Tuk6oHbk%2B9v3xad1CREpmc%3D&reserved=0>

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CLASSIFICATION: UNCLASSIFIED

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NORTH BAKKEN EXPANSION PROJECT
CONFERENCE CALL NOTES

MEETING TOPIC:
Status update on Filing of Final Section 408 Application Materials, and General Coordination

DATE OF MEETING:
August 20, 2020 at 10:30 a.m. CST (8:30 a.m. PST) – Project Conference Call

ATTENDEES:

WBI Energy Transmission, Inc. (WBI)
Jill Linn
Kyle Stefka
Greg Huncovsky
Alex Palmer
General Robert Crear (The CREAR Group, LLC)

Environmental Resources Management (ERM)
Andrea Thornton
Wade Hammer

U.S. Army Corps of Engineers (USACE)
Reece Nelson
Jeremy Thury
Jason Renschler
Kody Green
Shenille Lillejord

MEETING NOTES:

- Reece Nelson took role call and started can call commenting that the updated draft Section 408 permit application for the North Bakken Expansion Project (Project) had been received and he had just recently been able to get into the U.S. Army Corps of Engineers (USACE) network sharing site called ProjNet. Later in the call Reece acknowledged that he would start the USACE staff review in the next couple of days which would allow the internal team 30 days to review, comment, and request additional needs, targeting a completion around September 18, 2020. Andrea Thornton noted she had been having problems gaining access to the ProjNet site, and Reece noted he would look into the issue and coordinate with Andrea to gain access.
- Reece noted that he had on-going conversations with the Federal Energy Regulatory Commission (FERC) project manager, but that the FERC team had not provided an update to the FERC schedule for the Project.
- Reece then addressed the USACE project review schedule that he had recently shared with WBI. Reece noted that there were a number of assumptions he made to develop the schedule and that based on all of the assumptions the schedule for complete Section 408 review and real estate authorization from the USACE would likely be mid to late July 2021, based on his schedule. Andrea then requested clarification regarding the initiation of the federal 90 day review that would start once the Environmental Assessment (EA) was authorized.

Andrea noted that in the USACE schedule this would not start until April 2021. Andrea stated that while FERC had not provided an update to the EA schedule, she understood that FERC would be changing the schedule, but this would not go out as far as April 2021. Reece noted that he would connect with the FERC project manager and discuss the schedule.

- Andrea requested clarification that the USACE team would be reviewing the Section 408 materials in an on-going manner, and that there would be no delay in receiving initial comments or feedback due to the FERC schedule. Reece acknowledged, as noted in the first bullet point in these notes, that the USACE would initiate their review in the next couple of days.
- Reece noted that the Section 408 authorization would typically come very quickly after the FERC EA finalization. Reece noted that finalization of the 408 would then be routed internally at the USACE. This would trigger the start of the real estate review process, which was noted in the USACE draft schedule as taking up to 90 days. Andrea asked if this timeline was typical. Shenille Lillejord, the USACE real estate specialist on the call, noted that this timeline is typical, although it is possible it could go more quickly.
- Andrea asked for clarification regarding if construction could start once the Section 408 authorization was final, while the real estate review process is on-going. Reece noted that he would look back at a recent project to determine the steps that were taken and he would get back to Andrea. Both Reece and Shenille noted they did not think it would be likely that construction could be started without the real estate approval.
- Reece summarized that the 408 authorization cannot occur until after the National Environmental Policy Act (NEPA) review was completed, and further the real estate review could not start until the Section 408, Section 10, and Section 404 permits are issued.
- The meeting was adjourned at approximately 11 a.m. Central.

NORTH BAKKEN EXPANSION PROJECT
CONFERENCE CALL NOTES

MEETING TOPIC:
Section 404 Permitting Approach – Project Updates and U.S. Army Corps of Engineers Updates Regarding Nationwide Permit 12

DATE OF MEETING:
August 24, 2020 at noon CST (10:00 a.m. PST) – Project Conference Call

ATTENDEES:

WBI Energy Transmission, Inc. (WBI)
Jill Linn
Greg Huncovsky
Dave Linn

Environmental Resources Management (ERM)
Andrea Thornton
Wade Hammer

U.S. Army Corps of Engineers (USACE)
Jason Renschler

MEETING NOTES:

- Andrea Thornton opened the call by informing Jason Renschler that WBI Energy Transmission, Inc. (WBI) had determined that the best path forward for the Section 404 permitting, based on careful consideration, would be to continue with the Nationwide Permit 12 (NWP 12). Andrea asked if Jason had any thoughts regarding this strategy.
- Jason noted that the new Nationwide Permits that had recently been posted as draft by the U.S. Army Corps would likely be ready by the first part of 2021. Jason further noted that after further evaluating the potential for using an Individual Permit for the Project, he thought that would be a more difficult approach as it would require the USACE to utilize discretional authority, which would need to be run all the way up to the Division commander for approval. Therefore, Jason noted that NWP 12 would be the best approach. The group agreed that this would be the path forward.
- Wade Hammer asked Jason if there would be subsequent review after the Nationwide Permits are re-authorized to complete the review for regional conditions, and for the state of North Dakota to review the revised permits for compliance with Section 401 Water Quality Certification, which is delegated to the state. Jason stated that the USACE and the state of North Dakota would be completing parallel review with the Nationwide Permits, and so additional timing should not be expected.
- The call ended at approximately 12:15 p.m. Central.

ERM

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Call Log

Log of Telephone Conversation

Call To/From Whom	Rick Rogers
Phone number	701-301-0018
Company	USACE
ERM Contact	Kevin Malloy
Phone number	906-285-0361
Date	September 1, 2020
Time of Conversation	2:10; 4:25 pm
Reference	North Bakken Expansion Project (Project)
Signature	

LOG OF CONVERSATION

Rick Rogers from the USACE called me to discuss the archaeological testing of site 32WI976. We discussed methodology and finalized our approach. We also determined the date that we would be starting. We confirmed who would be on the archaeological crew and that at least one individual is listed on the ARPA permit. Rick asked that I make a small update to the work plan and resubmit it to him.

Update 4:25 pm.

I called Rick Rodgers back to confirm he understand one aspect of our planned methodology with regard to unit excavation so that we are on there wasn't any confusion.

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Andrea Thornton

From: Thury, Jeremy J CIV USARMY CENWO (USA) <Jeremy.J.Thury@usace.army.mil>
Sent: Wednesday, September 2, 2020 10:46 AM
To: Linn, Dave; Andrea Thornton; Linn, Jill
Cc: Tietz, Michael A CIV USARMY CENWO (USA); Nelson, Reece E CIV USARMY CENWO (USA); Nielsen, Wade; Stefka, Kyle
Subject: RE: WBI - Environmental Conditions of Property.

Thank you Dave, and yes both sides will need to be visited. I appreciate your help.

-----Original Message-----
From: Linn, Dave [mailto:Dave.Linn@WBIEnergy.com]
Sent: Wednesday, September 2, 2020 12:42 PM
To: Thury, Jeremy J CIV USARMY CENWO (USA) <Jeremy.J.Thury@usace.army.mil>; Andrea Thornton <Andrea.Thornton@erm.com>; Linn, Jill <Jill.Linn@wbienergy.com>
Cc: Tietz, Michael A CIV USARMY CENWO (USA) <Michael.A.Tietz@usace.army.mil>; Nelson, Reece E CIV USARMY CENWO (USA) <Reece.E.Nelson@usace.army.mil>; Nielsen, Wade <Wade.Nielsen@WBIEnergy.com>; Stefka, Kyle <Kyle.Stefka@WBIEnergy.com>
Subject: [Non-DoD Source] RE: WBI - Environmental Conditions of Property.

Jeremy, Yes we should be able to make a date in early October work. I will visit with Andrea/Jill about us getting together the right folks to address all the questions on the pre-assessment document and get back to you next week with some dates/times for the meeting. Assuming that we need to visit both sides, it will take a good share of a day with the travel and we may need to notify the adjacent private landowners regarding access for the site visit.

David Linn PE PMP
Senior Engineering and Projects Manager WBI Energy
2010 Montana Ave
Glendive Montana 59330
Cell 406.989.1022
Ph (406) 359-7333
e-mail dave.linn@wbienergy.com

-----Original Message-----
From: Thury, Jeremy J CIV USARMY CENWO (USA) <Jeremy.J.Thury@usace.army.mil>
Sent: Wednesday, September 2, 2020 10:57 AM
To: Andrea Thornton <Andrea.Thornton@erm.com>; Linn, Jill <Jill.Linn@wbienergy.com>; Linn, Dave <Dave.Linn@WBIEnergy.com>
Cc: Tietz, Michael A CIV USARMY CENWO (USA) <Michael.A.Tietz@usace.army.mil>; Nelson, Reece E CIV USARMY CENWO (USA) <Reece.E.Nelson@usace.army.mil>
Subject: WBI - Environmental Conditions of Property.

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Good Morning,

Part of the outgrant process for the Corps of Engineers is to assess, determine and document the environmental conditions of property (ECP) in and ECP Report. This report summarized the historical, cultural, and environmental conditions of the property subject to the real estate transaction. Completion of this report requires a site visit and completion of the attached "Previsit questionnaire"(PVQ) to gather information to better understand the environmental concerns for the site. The PVQ should be completed for the property proposed for easement only (not the company as a whole). The Corp would also like to request a representative of WBI to be present for the site visit to answer questions and provide access to the work site.

Please complete the attached questionnaire and let me know any availability WBI may have for a site visit in early October.

Thank you and please do not hesitate to contact me with any questions.

Jeremy J. Thury
Natural Resources Specialist
US Army Corps of Engineers
Garrison Dam/ Lake Sakakawea Project
Riverdale, North Dakota Office
O:(701) 654-7761
C:(701) 809-2571

Pat Robblee

From: Kevin Malloy
Sent: Thursday, September 3, 2020 9:26 PM
To: Rogers, Richard R II CIV USARMY CENWO (USA)
Cc: Pat Robblee
Subject: Updated work plan
Attachments: 32WI976 Site Testing Plan 20200109 Final.pdf

Good Evening Rick,

Hope you're doing well. Please find attached the updated work plan with the changes we discussed over the phone on Tuesday.

Please don't hesitate to reach out to me with questions.

Best,
Kevin

ERM

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80 South Eighth Street
Minneapolis, MN 55402

Telephone: +1 612 347 6789
Fax: +1 612 347 6780

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Call Log

Log of Telephone Conversation

Call To/From Whom	Rick Rogers
Phone number	701-301-0018
Company	USACE
ERM Contact	Kevin Malloy
Phone number	906-285-0361
Date	September 16, 2020
Time of Conversation	12:42; 1:42 pm
Reference	North Bakken Expansion Project (Project)
Signature	

LOG OF CONVERSATION

I called Rick Rogers, Archaeologist with the USACE, to check-in regarding progress for the archaeological testing taking place at site 32WI976. He did not answer, so I left a message.

Update 1:42 pm.

Rick returned my call and I provided him with an update of our ongoing work on site 32WI976.

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September 16, 2020

Richard R. Rogers, Archaeologist
U.S Army Corps of Engineers
201 1st Street, RM210
Riverdale, ND 58565

Subject: WBI Energy Transmission, Inc.
North Bakken Expansion Project – Class III Survey Reports 2020 Field Season
McKenzie, Williams, Burke, and Mountrail Counties, North Dakota
ND SHPO Ref.: 19-5593

Dear Mr. Rogers:

Please reference WBI Energy Transmission, Inc.'s (WBI Energy's) previous correspondence regarding the above referenced project. WBI Energy proposes to construct and operate the North Bakken Expansion Project (Project) in McKenzie, Williams, Burke, and Mountrail Counties, North Dakota.

The Project is regulated by the Federal Energy Regulatory Commission (FERC) under Section 7(c) of the Natural Gas Act. Under the Energy Policy Act of 2005, FERC is the lead agency for coordinating federal authorizations and complying with the National Environmental Policy Act on natural gas pipeline projects subject to its jurisdiction. FERC similarly is the lead federal agency for complying with Section 106 of the National Historic Preservation Act (NHPA) on natural gas pipeline projects under its jurisdiction. In accordance with 36 CFR 800.2(c)(4), WBI Energy is assisting the FERC in meeting its obligations under Section 106 of the NHPA by coordinating with agencies and tribes and conducting surveys to identify historic properties that may be affected by the Project.

Enclosed for your review please find Class III survey reports for the archaeological and historic structures surveys that were conducted during the 2019 and 2020 field seasons. The archaeological report includes the results provided in the original Class III report and addresses comments that were provided by the State Historical Society of North Dakota, Bureau of Land Management, U.S. Army Corps of Engineers, and the U.S. Forest Service. The attached table summarizes our response to those comments and provides the location of the relevant revisions or clarifications. A report on geomorphological investigations is also included in this submittal.

WBI Energy would appreciate your comments on the attached reports. If you have any questions or comments on the Project or the reports, please contact me at 612-840-8976 or pat.robblee@erm.com, or Dr. Kevin Malloy at 906-285-0361 or kevin.malloy@erm.com. Please direct written correspondence to Dr. Malloy's attention at:

Environmental Resources Management
1000 IDS Center
80 South 8th Street
Minneapolis, MN 55402

Sincerely,

Patrick Robblee
Program Director

Enclosures: Class III Archaeological Survey Report
Class III Historic Structures Addendum I Survey Report
Geomorphology Report

cc: Jill Linn, WBI Energy
Andrea Thornton, ERM
Kevin Malloy, ERM
Emily Laird, ERM
Andrew Clark, SHSND
Fern Swenson, SHSND
Liv Fetterman, USFS
Richard Rogers, USACE
Teanna Limpy, Northern Cheyenne Tribe
Pete Coffey, Three Affiliated Tribes of the Fort Berthold Reservation
Dyan Youpee, Assiniboine and Sioux Tribes of the Fort Peck Reservation
Ben Rhodd, Rosebud Sioux Tribe
Michael Black Wolf, Fort Belknap Indian Community
Tom Brings, Oglala Sioux Tribe
Jon Eagle, Standing Rock Sioux Tribe
Ben Ridgely, Northern Arapaho Tribe
Steven Vance, Cheyenne River Sioux
Erich Longie, Spirit Lake Tribe
Kip Spotted Eagle, Yankton Sioux Tribe
Jeff Desjarlais, Jr., Turtle Mountain Band of Chippewa
Dianne Desrosiers, Sisseton Wahpeton Oyate

Attachment: Table summarizing agency comments on the original Class III archaeology report

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Comments from the State Historical Society of North Dakota		
General comments:		
o Provide more background information on sites with previous work. Focus on methods and reasoning for previous eligibility recommendation.	Additional information on previous investigations has been added to site descriptions, as applicable.	Sections 5.3 through 5.7
o Map symbology has item named “Shovel test – No Dig”. Are these shovel probes that were planned, but not excavated for some reason? If so provide explanation.	These are planned but unexcavated shovel tests. Site descriptions have been updated, as applicable, to explain why some planned shovel tests were not excavated. Typical reasons for not excavating shovel tests include the presence of buried utilities (documented through One-Call markings) or slope.	Sections 5.3 through 5.5
Avoidance, 50 ft buffer minimum, fence, and monitor:		
o Private land: 32BK277, 32BK279, 32BK280, 32BK282, 32MZ3308, 32MZ3309, 32MZ3310, 32MZ3311, 32MZ3325, 32MZ3327, 32WI1494, 32WI1630, 32WI2144, 32WI2388, 32WI2389, 32WI2391, 32WI2392, 32WI2393, 32WI2394, 32WI2398, 32WI2406, 32WI2408.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.3
o US Forest Service Sites: 32MZ3301, 32MZ3314, 32MZ3315, 32MZ3319, 32MZ3320, 32MZ3322, 32MZ3324.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.5
Formally evaluate with site delineation and at least one 1x1 m TU. Submit evaluation plan prior to fieldwork:		
o Private Land: 32BK278, 32MZ3302, 32MZ3306, 32MZ3307, 32MZ3318, 32MZ3323, 32MZ3326, 32MZ3328, 32MZ3329, 32MZ3331, 32WI2390, 32WI2405, 32WI2407, 32WI2409, 32WI2410.	Additional testing (shovel testing and/or the excavation of at least one, 1 x 1 m test unit) was completed at each of these sites in accordance with a testing plan approved by the SHSND. Testing at sites 32WI2390 and 32MZ3328 was suspended following the identification of stone features at these sites; however, the pipeline route has been adjusted to avoid these sites with a minimum 50-ft buffer.	Section 5.3
o US Forest Service Site: 32MZ2346.	While ERM planned to conduct additional testing at this site, the pipeline route was modified prior to this work such that the site is now avoided by the Project with a buffer greater than 100 ft.	Section 5.5
Isolated finds:		
o Discuss subsurface potential on all IFs on a case-by-case basis. If the finds are in a good depositional context, STPs may be necessary to show that these are truly isolates. Minimal site recording may be enough to get a site number for database purposes, but more information is needed to verify that these are truly part of a category that can be written-off as not eligible.	Individual descriptions of isolated finds have been added to the text, including the results of shovel testing or an explanation for why shovel tests were not excavated.	Section 5.7

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Site-by-site comments, private land:		
o 32BK168 – Expand reasoning for Not Eligible Determination both previously and now. Newly recorded site boundary included previously unidentified features. Perhaps site should be unevaluated. Consider formal evaluation and provide updated management recommendations.	ERM conducted site testing at 32BK168 in 2020. Evidence of intact cultural deposits and features was identified during testing and the site is now recommended as eligible for listing in the NRHP. The pipeline route has been modified to avoid this site with a buffer of 57 ft.	Section 5.3
o 32MZ3323 – Discussion mentions "Better Examples" of homesteads. Provide examples.	The description for 32MZ3323 has been updated to incorporate the results of additional testing (shovel testing and the excavation of a 1 x 1 m test unit) in the updated Class III report.	Section 5.3
o 32WI1495 – Actual well shown in Figure 5.3-81 may be visible in figure 5.3-80. Is this location impacted by project? Consider site lead.	The location of the well (which is no longer extant) is discussed in the updated Class III report in conjunction with 32WI1495. ERM has submitted a site lead form for this resource. The suggested boundary of the site lead is 19 ft from Project workspace. The actual location of the well is about 235 ft from Project workspace.	Section 5.3
o 32WI2404 – How is this identified as prehistoric? Could it be a result of natural glacial and/or historic or modern field clearing? Provide evidence. Fence and monitor as necessary.	The interpretation of the feature at 32WI2404 as prehistoric is conservative and based on best professional judgement. Tribal cultural specialists who visited the site with ERM concurred with this interpretation.	Section 5.3
o 32WI2408 – Workspace is extremely close to possible graves. Is the planned route fixed?	The pipeline route has been modified to avoid this site with a buffer of 213 ft.	Section 5.3
Site-by-site comments, US Army Corps of Engineers land:		
o 32MZ976 – Drilling under site is not avoidance as leaks and emergency repairs do consider cultural resources. Formal testing or horizontal avoidance is necessary.	The trajectory of the HDD will be 160 to 180 ft below ground surface where it passes beneath 32WI976. The pipeline will carry gas, not a liquid; the gas would migrate to the surface and dissipate into the air in the event of a leak. Given the depth of the HDD installation, daylighting of the pipeline for repair would not be feasible. If repair is required in the future, the most likely course of action would be to re-install a new segment via HDD, which would require federal authorizations, thereby triggering review of the action under Section 106 of the NHPA. A description of the HDD method has been added to the description of 32WI976 in Section 5.4 of the report. Additional testing at the site is pending and scheduled to be completed this fall. The results will be discussed in an addendum report.	Section 5.4
o 32MZ976 – Show bore location and HDD line on map	A figure showing the HDD alignment with entry and exit points has been added to the description of this site as has a construction alignment sheet. The alignment sheet depicts the HDD in plan and profile.	Section 5.4

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o 32MZ976 – Clarify and provide more evidence for geomorphological hypothesis of A horizon being related to flood deposits. Typically, A horizons show stability rather than accretional or erosional events. Provide more information on why artifacts are interpreted as disturbed rather than in primary context.	The text in the updated Class III report has been updated to address this comment. As noted above, additional testing is planned to occur at 32WI976 this fall, which will provide additional information on the soils present at the site.	Section 5.4
o 32MZ976 – Did cut bank provide additional information on buried soils? Were artifacts identified in cut bank?	The cut bank was examined during the initial survey. As noted above, additional testing is planned to occur at the site this fall with results to be discussed in an addendum report.	Section 5.4
o 32WI976 – Given size and shape of site, additional TUs recommended.		
Comments from the Bureau of Land Management		
o The recommended protection/avoidance measures for unevaluated and eligible archaeological sites in the Class III report are inadequate, particularly regarding stone feature sites. The usual avoidance distance requested/required by the BLM is 100 feet. More than 100 feet is preferred for stone feature sites. Revise protection/avoidance measures buffers for archaeological sites.	WBI Energy has routed the pipeline to avoid unevaluated and eligible sites with a minimum buffer of 50 ft as directed by the SHSND.	Sections 5.3 through 5.5
o Why were indirect effects to archaeological sites not considered? Setting is an important aspect of integrity for stone feature sites. There are numerous archaeological sites within and near the survey corridor that should be analyzed for indirect effects. Revise the report to address indirect effects to archaeological sites.	The report has been updated to include an assessment of physical and non-physical impacts on unevaluated and eligible sites.	Sections 4 and 5.5 through 5.5
o WBI Energy needs to develop a cultural resource monitoring plan for construction.	WBI Energy commits to preparing a monitoring plan for construction.	Sections 5.3 through 5.5
o Update site form for all sites, site leads, and isolated finds regardless of whether they were relocated. Even if a cultural resource could not be relocated, that is still valuable information for the next project/site visit.	Site form updates have been submitted for all sites, isolated finds, and site leads discussed in the updated Class III report	N/A
o WBI Energy should make additional efforts to involve tribes in upcoming 2020 fieldwork and field reviews.	As discussed in more detail in Section 4 of the updated Class III report, WBI Energy retained Beaver Creek Archaeology to coordinate tribal participation in fieldwork in 2020. BCA worked with tribes to document sites as cultural heritage resources. The results of that work will be presented in a separate report. Information on tribal participation in the surveys also is provided in Sections 4 and 5.3 through 5.5 of ERM's updated Class III report	Sections 4 and 5.3 through 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Comments from U.S. Army Corps of Engineers		
o In section 5.4.2, remove figures for 32MZ0598 and move to the previous section.	This comment is addressed in the updated Class III report	Section 5.4
o Figure 5.4-5: Map of Site 32WI976, provide contour lines on this map to show the slope. This information would help to explain why the shovel testing pattern appears the way it does.	Contour lines are provided on Figure 5.4-9 in the updated Class III report.	Section 5.4
o ERM, on behalf of WBI [Energy], identified a second concentration of artifacts in the western side of site 32WI0976 after they started excavating the test unit. Some additional testing is needed here as USACE cannot agree with the recommended determination for this site given the data presented in this report.	Additional testing will be completed at this site in the fall of 2020 with the results presented in an addendum report.	Section 5.4
o USACE recommends that WBI [Energy] conduct a remote sensing evaluation (gradiometer or conductivity) at site 32WI0976. This would be the best way to produce measurable data regarding the presence/absence of subsurface features at the site.	A remote sensing survey of the site was completed in the summer of 2020. The results of the survey were used to prepare a testing plan for 32WI976. Additional testing at the site will occur this fall with the results presented in an addendum report.	Section 5.4
Comments from the U.S. Forest Service		
o The map showing previously recorded cultural resources within a one-mile radius is only included in the overall Class III and not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Figure 1.1-2 shows the Forest Service surface and differentiates between the survey corridor and the survey corridor on Forest Service surface; however, the survey corridor on Forest Service surface and the actual Forest Service surface displayed don't match.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Sites 32MZ2347 (Historical Archaeological) and 32MZ3278 (Cairn) are located immediately adjacent to the survey corridor but are not discussed. Please discuss.	Based on route modifications, 32MZ3278 was visited in 2020 and the site boundary expanded based on the findings. A discussion of the site is provided in the updated Class III report. 32MZ2347 is outside the inventory corridor for the Project; however, we have included a discussion of this site in the Class III inventory report.	Section 5.5
o Site 32MZ145 site form update does not appear to have been performed. Why? Was an attempt made to actually relocate the site? Also, according to the site form, a THPO representative requested avoidance in 2013. More work on this site is probably needed.	When 32MZ145 was first recorded in 1979, it was characterized as two stone cairns. Subsequent investigations described the site as consisting of a single historic rock clearing pile on the west side of Highway 1806, noting that the second pile was likely destroyed by construction of the highway. ERM's survey in 2019 was limited to the east side of Highway 1806, which explains why we did not relocate the site at that time. In 2020, ERM conducted additional survey on USFS lands, examining a corridor on the west side of Highway 1806. 32MZ145 was relocated as a result of this work. The site is discussed in the updated Class III report. Tribal cultural specialists who accompanied ERM during the 2020 field investigation concurred that 32MZ145 is historic rock clearing pile.	Section 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o Site 32MZ2346 and 32MZ144: it is very improbable and therefore suspicious that there are zero artifacts and one artifact respectively at sites with historic dumps.	Sites 32MZ2346 and 32MZ144 are both previously recorded historic sites which ERM revisited and recorded during the survey for the Project. Cultural material was observed at both sites as described in the updated Class III report. ERM expanded the boundaries of 32MZ2346 to encompass two previously unreported features at the site. One artifact–a commemorative coin–was collected from 32MZ2346 because of its uniqueness. No artifacts were collected from 32MZ144. Expanded descriptions of both sites are provided in the updated Class III report.	Section 5.5
o Additional survey is shown as needed near site 32MZ3278 on the maps in the overall Class III report but not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	Additional survey was completed in 2020 on USFS lands in the vicinity of 32MZ3278, which was relocated. A description of the site is provided in the updated Class III report.	Section 5.5
o The recommended avoidance and fencing measures are inadequate, especially for stone feature sites.	All stone feature sites have been avoided with a minimum buffet of 50 ft. Additionally, for sites between 50 and 100 ft of Project workspace WBI Energy commits to fencing and monitoring the sites during construction. WBI Energy will provide a monitoring plan for agency review.	Section 5.5
o A monitoring plan is needed.	WBI Energy commits to providing a construction monitoring plan as discussed in the updated Class III report.	
o Updates should have been conducted for all sites, site leads, and IFs [isolated finds] regardless of whether or not they were relocated.	Site form updates have been submitted for all applicable sites, isolated finds, and site leads discussed in the report	N/A
o The discussion of site leads during fieldwork is inadequate.	Site leads are discussed in Section 5.6 of the updated Class III report.	Section 5.6
o Provide specific distances between site boundaries and the edge of the workspace.	Distances between sites and Project workspaces have been added to summary tables and site descriptions throughout the updated Class III report.	Sections 5.3 through 5.5
o Provide a map of shovel testing performed outside of site boundaries. The report explains the testing strategy during survey but never discusses or shows specifics except within site boundaries.	The route maps provided as Appendix B depict survey methodology in addition to survey coverage and results.	Appendix B
o Identify the level of tribal involvement in the survey.	Tribal participation in field surveys is discussed in Sections 4 and 5.3 through 5.5 of the updated Class III report.	Sections 4 and 5.3 through 5.5
o Discuss whether indirect effects to archaeological sites were considered.	For unevaluated sites, we have added an assessment of non-physical impacts on setting.	Sections 5.3 through 5.5

Andrea Thornton

From: Nelson, Reece E CIV USARMY CENWO (USA) <Reece.E.Nelson@usace.army.mil>
Sent: Wednesday, September 16, 2020 7:16 AM
To: Andrea Thornton; Thury, Jeremy J CIV USARMY CENWO (USA)
Subject: RE: ProjNet Review - North Bakken Expansion

Hey Andrea,

I noticed that too, and sent a reminder to the team yesterday. I have a date of COB Sep 21 that comments are due.

Need to get an updated schedule to you as well, it's on my list to work this week/weekend.

-Reece

-----Original Message-----
From: Andrea Thornton [mailto:Andrea.Thornton@erm.com]
Sent: Wednesday, September 16, 2020 9:08 AM
To: Nelson, Reece E CIV USARMY CENWO (USA) <Reece.E.Nelson@usace.army.mil>; Thury, Jeremy J CIV USARMY CENWO (USA) <Jeremy.J.Thury@usace.army.mil>
Subject: [Non-DoD Source] ProjNet Review - North Bakken Expansion

Hi Reece and Jeremy -

I took a look at ProjNet this morning and noticed that there is only 1 outstanding comment which was a straggler from the first review back in April/May. On our call on August 20th it was discussed that the 30 day review period for the updated 408 permit package would be ending on September 18th. I wanted to check in to make sure that this was still the case.

Thanks,

Andrea

Andrea Thornton

Principal Consultant

Pronouns: she/her/hers

Environmental Resources Management (ERM)

1050 SW 6th Avenue, Suite 1650 | Portland, Oregon | 97204

M 503-459-6864

E andrea.thornton@erm.com <mailto:andrea.thornton@erm.com> | W Blockedhttps://eur01.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.erm.com%2F&data=02%7C01%7C%7C86b326b715b54a1f36cd08d85a4b0634%7Cf2fe6bd39c4a485bae69e18820a88130%7C0%7C0%7C637358625579183605&sdata=WSkSYUi0KqcF1qr6duXGpzliE4q8kCOv7OPiNCAPG4%3D&reserved=0 <Blockedhttps://eur01.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.erm.com%2F&data=02%7C01%7C%7C86b326b715b54a1f36cd08d85a4b0634%7Cf2fe6bd39c4a485bae69e18820a88130%7C0%7C0%7C637358625579183605&sdata=WSkSYUi0KqcF1qr6duXGpzliE4q8kCOv7OPiNCAPG4%3D&reserved=0>

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Andrea Thornton

From: Huncovsky, Greg <Greg.Huncovsky@WBIEnergy.com>
Sent: Wednesday, September 16, 2020 10:40 AM
To: Thury, Jeremy J CIV USARMY CENWO (USA)
Cc: Andrea Thornton; Linn, Dave; Linn, Jill
Subject: North Bakken Expansion Project Outgrant Pre-Visit Questionaire
Attachments: WBI NBE Outgrant Pre-Visit (PVQ).pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Jeremy I hope all is well with you.

Attached is WBI Energy's North Bakken Expansion Project outgrant pre-visit questionnaire. I have added some additional comments below for further clarification.

Natural Resource Management section, question #3:

- *While the project crosses the Missouri River floodplain, the proposed pipeline will be installed under the Missouri River floodplain using the HDD method. The entry side (northern drill location) will be about 800 feet from the shoreline at an elevation of about 1,850 feet. The exit site (southern drill location) will be approximately 2,150 feet from the shoreline at an elevation of about 1,925 feet. No aboveground structures will be installed within the floodplain. Project construction and operation will not affect floodplain elevations, river flows, or flood storage capacities. Additionally, project construction and operation will not affect the occupancy of the floodplain, nor will it result in modifications to the floodplain or promote floodplain development.*

Natural Resource Management section, question #5:

- *There is known piping plover and least tern habitat within the drill path. There are two reported piping plover nest sites (one from 2005 one from 2007) within the easement area along the north side of the lake. The operation of the Project would not impact available nesting habitat.*

- *One small area of Dakota skipper reproductive habitat was found on USACE land on the southern side of the lake and will be crossed by the HDD drill path with no surface impacts. The operation of the Project would not impact available Dakota skipper habitat.*

- *Pallid sturgeon may be present during portions of the year within the HDD path and easement. The operation of the Project would not impact available pallid sturgeon habitat.*

Please let me know a date/time that works for you to meet Dave Linn and myself at the project location.

Thanks Jeremy

GREG HUNCOVSKY
Environmental Affairs
Office - 406-359-7451

Cell - 406-989-1068

Outgrant Pre-visit Questionnaire (PVQ)

Name of Outgrant: WBI Energy Transmission, Inc.

Outgrant POC: Greg Huncovsky

Outgrant Telephone Number: 406-359-7451

Outgrant Email: greg.huncovsky@wbienergy.com

This questionnaire will provide background information necessary to plan and conduct an environmental compliance assessment. Additionally it provides insight for properly designing the composition of expertise on the assessment team.

Corps POC: Jeremy Thury

Corps Email: jeremy.j.thury@usace.army.mil Corps Tel #: 701-654-7761

General

1. Do you have any permits/licenses/letters or approval from the State, County, or municipality for your operations/activities? No

   If Yes, what types of permits/licenses/letters of approval?

   All permit approvals will be received prior to construction of the North Bakken Expansion Project including but not limited to: FERC, USACE, USFS, BLM, USFWS, SHPO, NDDEQ, and State Water Commission.

Air Emissions Management

1. Do you operate a fuel burner/steam generator/boiler? No

   If Yes, indicate the size and the type of fuel used:

2. Do you operate an incinerator (i.e. for classified documents, solid waste, etc) No

3. Do you operate fuel dispensing facilities for vehicles, watercraft, or heavy equipment (i.e., diesel, gasoline, biofuels, kerosene, etc) No

4. Do you strip paint from watercraft or other equipment for the purposes of re-painting? No

5. Do you repair any equipment containing refrigerant (e.g., motor vehicles, air conditioners, freezers, refrigerators, chillers)? No

Cultural Resources Management

1. Do you occupy any facility or site currently listed in the Federal or State list of historic places? No

2. Do you have any archeological artifacts in storage or on display? No

3. Do you know of any Native American burial sites, cemeteries, or possible locations of human remains on your site? No

Hazardous Materials Management

1. Have you conducted training for individuals working with hazardous materials such as paints, solvents, fuels (i.e., HAZCOM)? No

2. Do you have a written Hazard Communication (HAZCOM) Plan? No

3. Do you store any of the following extremely hazardous substances? No

Aldrin	No
Ammonia	No
Chlorine	No
Chloroform	No
Dinitrotoluene	No
Formaldehyde	No
Hydrocyanic Acid	No
Lindane	No
Nitric Acid	No
Potassium Cyanide	No
Sodium Cyanide	No

4. Do you store at any one time 10,000 lb or more of any hazardous substance which requires a Safety Data Sheet (SDS)? (NOTE: Fuel is a hazardous substance which requires an SDS) No

   Please list the materials. (NOTE: Using water as a basis of measurement, 10,000 lb is approx. 1250 gal.)

5. Do you store any compressed gases (i.e. acetylene cylinders, oxygen cylinders, propane)? No

Hazardous Waste Management

1. Do you generate hazardous waste (i.e., waste paint, paint stripper, battery acid, etc)? No
2. Do you typically generate less than 100 kg (229.46 lb; approx 28 gal) of hazardous waste in 1 month? No
3. Do you typically generate more than 100 kg (229.46 lb; approx 28 gal) of hazardous waste a month? No
4. Which of the following items do you handle as Universal Waste?

Fluorescent bulbs	☐
Alkaline Batteries	☐
Nickel-Cadmium Batteries	☐
Lithium Batteries	☐
Magnesium Batteries	☐
Lead-acid Batteries	☐
Mercury-containing equipment	☐
Waste Pesticides	☐

Natural Resources Management

1. List the recreational opportunities offered (i.e., athletic fields, walking/hiking tracks, off-road vehicle tracks, etc).

2. Do you have wetlands in your leased areas? No
3. Do you have floodplains in your leased areas? Yes

   If Yes, indicate the type:

25-yr	☐
50 – yr	☐
100-yr	☑

4. Do you conduct any dredging? No
5. Are you aware of any known threatened or endangered species on your leased areas? Yes

Outgrant Pre-visit Questionnaire (PVQ)

Pesticides Management

1. Do you use pesticides on your leased area? No

   If Yes, how are the pesticides applied?

   By a contractor ☐

   Self-application ☐

Petroleum, Oils, and Lubricants (POL) Management

1. If applicable, do you have a federally-required Spill Prevention Control and Countermeasure Plan? No
2. Do you have pipelines? No
3. Do you generate used oil/waste oil? No

Solid Waste Management

1. Who picks up your trash/garbage? Not Applicable
2. Do you have a recycling program? No

   If yes, which of the following do you recycle?

   Glass ☐

   Plastic Bottles ☐

   Beverage Cans ☐

   Paper ☐

   Cardboard ☐

   Printer cartridges ☐

3. Do you have a landfill or dumping area on your leased property? No

Storage Tank Management

1. Do you have aboveground storage tanks (ASTs) used for the storage of petroleum products, used oil, hazardous waste, or other potential contaminant? No

   If Yes, list the tanks individually

Tank Capacity	Contents

2. Do you have underground storage tanks (USTs) used for the storage of petroleum products, used oil, hazardous waste, or other potential contaminants? No

   If Yes, list the tanks individually

Tank Capacity	Contents

Toxic Substances Management

1. Do you have any of the following types of equipment contaminated with PCBs on your leased site? No

   If Yes, indicate which are known to be present:

Transformers	☐
Capacitors	☐
Ballasts	☐
Electromagnets	☐
Circuit Breakers	☐
Heat Transfer or Hydraulic Systems	☐
Other	

2. Do you have known asbestos on your leased site? No

3. Do you have any known facilities on your leased area with elevated radon levels? No

Wastewater Management

1. Does your wastewater go to a publically owned treatment works (POTW) (i.e., a municipal/county/Corps system not on the leased property? No

2. Does your wastewater go to any of the following? No

Sewage Lagoon	☐
Septic System	☐
Leach Field	☐
Package Plant	☐
Sedimentation Holding Ponds	☐

Water Quality Management

1. Do you provide drinking water to the public or employees (i.e., a water fountain, a faucet; NOT bottled water)? No

2. Do you maintain a drinking water well? No

3. Do you operate an underground injection control (UIC) well? No

   (NOTE: The most common type of UIC is a Class V motor vehicle waste disposal well that receives or has received fluids from vehicular repair or maintenance activities, such as an auto body repair shop, automotive repair shop, specialty repair shop (e.g., transmission and muffler repair shop), or any facility that does any vehicular repair work.)

4. Do you own/operate a public swimming area (i.e., a beach, a pool) No

Signature of Individual Completing This Form

Date Completed: 9-15-20

Andrea Thornton

From: Andrea Thornton
Sent: Friday, September 18, 2020 2:28 PM
To: Renschler, Jason J CIV USARMY CENWO (USA)
Cc: Wade Hammer; Linn, Dave; Linn, Jill; Huncovsky, Greg
Subject: WBI Energy North Bakken Expansion Project - Nationwide Permit 12 PCN Update
Attachments: USACE_WBI PCN Submittal Letter_091820.pdf

Hi Jason –

Attached is our transmittal letter for submitting the updated Nationwide Permit 12 – Pre-Construction Notification for the North Bakken Expansion Project. Due to the size of the files we have created a One Drive folder for you to access the document. Please note that the link to this page will only work for one week so please pull the document onto your computer and server for storage.

https://theermgroup-my.sharepoint.com/:f:/g/personal/andrea_thornton_erm_com/EocWy5dutA9HhZmAxEvkYFgBbXXpWhVFXavCZ7_VKpt_SQ?e=dKcliO

Please let me know if you have any questions or issues accessing the file.

Thank you,
Andrea

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

Environmental Resources Management (ERM)
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www.wbienergy.com

September 18, 2020

Jason Renschler
U.S. Army Corps of Engineers – Regulatory
3319 University Drive
Bismarck, ND 58504 (P: 701-255-0015)

Re: WBI Energy Transmission, Inc.
North Bakken Expansion Project
Nationwide Permit 12 – Pre-Construction Notification

Mr. Renschler,

WBI Energy Transmission, Inc. (WBI Energy) proposes to install approximately 94 miles of pipeline, including new pipeline, pipeline looping and upgrades to existing pipelines, as well as construction and upgrades to compressor stations and other appurtenances to transport natural gas from WBI Energy's existing Tioga Compressor Station near Tioga, Williams County, North Dakota, to a new interconnect with Northern Border's mainline southeast of Watford City, McKenzie County, North Dakota. The North Bakken Expansion Project (Project) would require crossing wetlands and waterbodies that would require Clean Water Act, Section 404, permits for dredge and fill, as well as a Section 10 of the Rivers and Harbors Act permit for a proposed crossing of Lake Sakakawea.

WBI Energy submitted a draft pre-construction notification (PCN) in February 2020, to coincide with the filing of the Project's Federal Energy Regulatory Commission application. WBI Energy is submitting a revised PCN that includes updated survey results due to additional land access and some minor route adjustments. The PCN includes the same project details and supporting materials that were submitted in February 2020, along with the updated project survey results, to provide the necessary information to facilitate U.S. Army Corps of Engineers (USACE) review in accordance with Nationwide Permit 12 (NWP 12) – Utility Lines. The PCN is required according to both NWP 12 and regional conditions that require a PCN for crossing of Lake Sakakawea (Section 10, navigable waterbody). According to NWP requirements, WBI Energy has included information for all Project crossings of water resources. WBI Energy requests use of the preliminary jurisdictional determination process for review of the Project. Given the Project crosses numerous landowners, access to the Project site would need to be coordinated with WBI Energy.

As noted in the enclosed PCN materials, the Project is under review by the Federal Energy Regulatory Commission (FERC) under section 7(c) of the Natural Gas Act. In coordination with the overall National Environmental Policy Act review that FERC is completing, WBI Energy is working closely with the U.S. Fish and Wildlife Service as they consult with FERC, as the lead federal agency for the Project, to complete consultation under Section 7 of the Endangered Species Act. Similarly, WBI Energy is coordinating with the North Dakota State Historic Preservation Office to facilitate review and consultation with FERC under Section 106 of the National Historic

Preservation Act. WBI Energy has also met and is coordinating with staff from the USACE – Omaha District office to coordinate Section 408 review of the Lake Sakakawea and adjacent USACE-owned land crossings proposed for the Project. WBI Energy anticipates keeping you appraised of developments related to these parallel review efforts to help facilitate your completion of review under NWP 12.

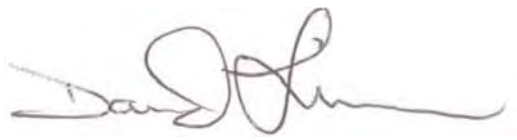
The materials included in the enclosed PCN conform to the general NWP requirements, as well as all regional conditions. The following attachments are included in this submittal:

ATTACHMENTS:

- U.S. Army Corps of Engineers Form ENG4345
- Supporting Information document, including appendices, as follows:
    - Appendix A – Aerial Route Maps
    - Appendix B – SPCC Plan
    - Appendix C – HDD Plan
    - Appendix D – Construction Typical Drawings
    - Appendix E – Wetland and Waterbody Delineation Report
    - Appendix F – Site-Specific Design Drawing for Lake Sakakawea HDD

WBI Energy appreciates your assistance and review of the enclosed materials and should you have questions or require additional information during your review, please contact Dave Linn (406) 359-7333.

Respectfully submitted,



Dave Linn
Senior Engineering and Projects Manager
WBI Energy Transmission, Inc.

Cc:

Greg Huncovsky, WBI

Andrea Thornton, ERM

ERM

1000 IDS Center
80 South Eighth Street
Minneapolis, MN 55402

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Fax: +1 612 347 6780

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Call Log

Log of Telephone Conversation

Call To/From Whom	Rick Rogers
Phone number	701-301-0018
Company	USACE
ERM Contact	Kevin Malloy
Phone number	906-285-0361
Date	September 18, 2020
Time of Conversation	8:20 am
Reference	North Bakken Expansion Project (Project)
Signature	

LOG OF CONVERSATION

Rick Rogers, archaeologist with the USACE, called to request a short summary of the progress on site 32WI976. I told him I would put one together and get it back to him. I followed up with him via email later in the morning.

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Pat Robblee

From: Kevin Malloy
Sent: Friday, September 18, 2020 11:25 AM
To: Rogers, Richard R II CIV USARMY CENWO (USA)
Subject: Progress Summary - 32WI976
Attachments: Summary for Rick Rogers_20200918.docx

Hey Rick

I pulled together the information Jayson has been providing on a nightly basis so you can see how things have progressed this week.

Please let me know if you have any questions.
Best,
Kevin

NORTH BAKKEN EXPANSION PROJECT

Agency Correspondence – U.S. Forest Service (USFS)

ERM

1050 SW 6th Ave
Suite 1650
Portland, OR 97204

Telephone: +1 603 488 5282

www.erm.com

Call Log

Log of Telephone Conversation

Call To/From Whom	To: Cale Bickerdyke
Phone number	701-842-8502
Company	U.S. Forest Service
ERM Contact	Andrea Thornton
Phone number	503-459-6864
Date	July 20, 2020
Time of Conversation	1:00 pm PST
Reference	North Bakken Expansion Project
Signature	

LOG OF CONVERSATION

Ms. Thornton called Mr. Bickerdyke to discuss the potential need for additional paleotological sueveys on U.S. Forest Service Land. Surveys were completed in 2019, however since that time the alignment on U.S. Forest Service lands has changed. Based on SWCA's (ERM's contractor) review of the current survey corridor, they did not believe that additional surveys would be warrented. Surveys in 2019 found a very limited number of exposures. Mr. Bickerdyke agreed that additional surveys are not needed and indicated that histrocially paleontological resources have not been found in this area of the grasslands. Ms. Thornton indicated that SWCA will update their report to note this conversation and thanked Mr. Bickerdyke for his time.

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Andrea Thornton

From: Andrea Thornton
Sent: Tuesday, July 21, 2020 1:12 PM
To: Bickerdyke, Cale E -FS
Subject: Availability for Call on Thursday

Hi Cale –

As a follow-up to our discussion yesterday, do you have availability on Thursday (7/23) for a call with WBI to run through the route constraints and ideas on routing through the cultural sites that have been identified?

Thanks,
Andrea

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

Environmental Resources Management (ERM)
1050 SW 6th Avenue, Suite 1650 | Portland, Oregon | 97204
M 503-459-6864
E andrea.thornton@erm.com | **W** www.erm.com

MEETING TOPIC:

North Bakken Expansion Project Introduction, Route Review USFS Land

DATE OF MEETING:

July 23, 2020 at 1:00 p.m. PST – TEAMS Meeting

ATTENDEES:

WBI Energy Transmission, Inc. (WBI)
Dave Linn
Greg Huncovsky
Kyle Stefka
Bob Stanhope
Jill Linn

Environmental Resources Management (ERM)
Andrea Thornton

U.S. Forest Service (USFS)
Kim Grotte
Cale Bickerdyke

MEETING NOTES:

Ms. Thornton started the meeting by thanking everyone for taking the time to meet again today to run through the route on USFS land. Mr. Stanhope from WBI Energy then shared his screen with the group and ran through the proposed alignment and constraints that have been identified in the field. The group discussed options including continuing to move east from the current alignment and moving west across Highway 1806. ERM and WBI Energy noted that they will send cultural and civil crews to the area west of Highway 1806 to see if that route would be feasible. Ms. Thornton indicated she would continue to keep Mr. Bickerdyke and Mr. Grotte updated as to what is found in the field.

Pat Robblee

From: Kevin Malloy
Sent: Friday, July 24, 2020 8:43 AM
To: Fetterman, Liv K -FS
Subject: Crews on the USFS land

Hi Liv,

I wanted to touch base with you about our crew's activities. Given the density of sites that we've identified, the civil surveyors are out on the USFS lands today looking for potential route options on the east side of HWY 1806. We were asked yesterday afternoon to send our archaeology crew out with them to help in process of identifying viable route that wouldn't disturb any archaeological sites. The plan is for them to only conduct pedestrian survey today and record any surface sites as they go. When a route is settled upon, the crews will return to conduct any necessary shovel testing, which will ensure that one-calls are in order.

Please let me know if you have any questions.

All the best,
Kevin

Andrea Thornton

From: Andrea Thornton
Sent: Tuesday, August 25, 2020 5:29 PM
To: Bickerdyke, Cale E -FS
Cc: Grotte, Kim -FS
Subject: RE: North Bakken Expansion FS Land Route

Thanks Cale –

My schedule is pretty open on Thursday so I will wait to hear back from Kim and then get a call scheduled.

-Andrea

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

Environmental Resources Management (ERM)
1050 SW 6th Avenue, Suite 1650 | Portland, Oregon | 97204
M 503-459-6864
E andrea.thornton@erm.com | **W** www.erm.com

From: Bickerdyke, Cale E -FS <cale.bickerdyke@usda.gov>
Sent: Tuesday, August 25, 2020 4:57 PM
To: Andrea Thornton <Andrea.Thornton@erm.com>
Cc: Grotte, Kim -FS <kim.grotte@usda.gov>
Subject: RE: North Bakken Expansion FS Land Route

Thursday morning before 11 AM or After 1PM. Kim needs to be involved so whatever of those times works for him

Cale Bickerdyke
Minerals and Lands Supervisor

Forest Service
Dakota Prairie Grassland, McKenzie Ranger District

p: 701-842-8502
f: 701-842-8544
cale.bickerdyke@usda.gov

1905 South Main Street
Watford City, ND 58854
www.fs.fed.us

Caring for the land and serving people

From: Andrea Thornton [mailto:Andrea.Thornton@erm.com]
Sent: Tuesday, August 25, 2020 6:16 PM
To: Bickerdyke, Cale E -FS <cale.bickerdyke@usda.gov>
Subject: North Bakken Expansion FS Land Route

Hi Cale –

I was hoping you might have a few minutes tomorrow or Thursday for a call to show you where WBI has landed with a route on FS land. Cultural crews continued to find some sites on the west side of the highway, but they were able to route around them. This route adjustment will be including in our upcoming supplemental filing to FERC.

-Andrea

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

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MEETING TOPIC:

North Bakken Expansion Project Introduction, Route Review USFS Land

DATE OF MEETING:

August 27, 2020 at 11:00 a.m. PST – TEAMS Meeting

ATTENDEES:

WBI Energy Transmission, Inc. (WBI)
Dave Linn
Greg Huncovsky
Kyle Stefka
Bob Stanhope
Jill Linn

Environmental Resources Management (ERM)
Andrea Thornton

U.S. Forest Service (USFS)
Cale Bickerdyke

MEETING NOTES:

Ms. Thornton started the meeting by thanking everyone for taking the time to meet again today to run through the route on USFS land. Ms. Thornton then shared her screen with the group and ran through the proposed alignment and constraints that have been identified in the field. The USFS did not have any questions on the proposed route, however Mr. Bickerdyke did request a figure showing the constraints that were run through on the call. Ms. Thornton thanked everyone for their time and noted she would follow-up with the requested figure.

From: Kevin Malloy [mailto:Kevin.Malloy@erm.com]
Sent: Wednesday, September 9, 2020 11:00 AM
To: Fetterman, Liv K -FS <liv.fetterman@usda.gov>
Cc: Pat Robblee <Pat.Robblee@erm.com>
Subject: Archaeological Site Visits

Hi Liv,

I hope this email finds you well. We have a crew that is going to be out in ND to do some additional fieldwork at the end of this week, none of which is located FS land. However, we received a request this morning to bring some Tribal members out to visit some of the sites identified on the FS land this year on Friday. No shovel testing or survey will be conducted. Our crew will simply bring the Tribal members to the site locations for them to see. This should still fall under our current permit.

Please let me know if you have any questions.
Kind regards,
Kevin

From: Fetterman, Liv K -FS <liv.fetterman@usda.gov>
Sent: Wednesday, September 9, 2020 11:04 AM
To: Kevin Malloy <Kevin.Malloy@erm.com>
Cc: Pat Robblee <Pat.Robblee@erm.com>; Bigelow, Elizabeth E -FS <elizabeth.e.bigelow@usda.gov>; Kruse, Andrea - FS <Andrea.Kruse@usda.gov>
Subject: Archaeological Site Visits

Good morning, Kevin,
Thank you for your message and the information. I'm including Beth Bigelow, the acting Heritage Program Manager while I'm on temporary assignment to another region. Please don't hesitate to contact Beth and or myself with any questions or concerns. Kindly include Beth in all correspondence you direct to me for the foreseeable future.
Best,
Liv

From: Kevin Malloy <Kevin.Malloy@erm.com>
Sent: Wednesday, September 9, 2020 11:06 AM
To: Fetterman, Liv K -FS <liv.fetterman@usda.gov>
Cc: Pat Robblee <Pat.Robblee@erm.com>; Bigelow, Elizabeth E -FS <elizabeth.e.bigelow@usda.gov>; Kruse, Andrea - FS <Andrea.Kruse@usda.gov>
Subject: RE: Archaeological Site Visits

Liv,
Thank you for your quick response. Not a problem. I will include Beth on any correspondence moving forward.

Kind regards,
Kevin

From: Kruse, Andrea - FS <Andrea.Kruse@usda.gov>
Sent: Thursday, September 10, 2020 10:21 AM
To: Kevin Malloy <Kevin.Malloy@erm.com>
Subject: RE: Archaeological Site Visits

Hi Kevin,
I will meet you at Tobacco Gardens tomorrow morning to go out with you all. I just wanted to give you a heads up.

Thanks!

Andrea Kruse, MA, RPA
Zone Archeologist, Little Missouri National Grassland
Forest Service
Dakota Prairie Grassland, McKenzie Ranger District
p: 701-842-8508
c: 701-641-6352
andrea.kruse@usda.gov
1905 S Main ST
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Andrea Thornton

From: Andrea Thornton
Sent: Friday, September 11, 2020 10:38 AM
To: Bickerdyke, Cale E -FS; Grotte, Kim -FS
Cc: Bickerdyke, Sarah - FS; Justin Moffett; Linn, Jill; Huncovsky, Greg; Linn, Dave
Subject: WBI Energy North Bakken Expansion Project - Revised Biological Evaluation Submittal
Attachments: WBI_USFS-BE_Submittal Letter_091120.pdf

Hi Cale and Kim –

Attached is our transmittal letter for submitting the revised Biological Evaluation for the North Bakken Expansion Project. Due to the size of the file we have created a One Drive folder for you to access the document. Please note that the link to this page will only work for one week so please pull the document onto your computer and server for storage. Please also note that the document is being submitted as CUI/PRIV and should not be shared with the public. I've also included the excel files of the DPG Plant Survey Field Form and shapefiles of the surveyed area which you request with our previous submittal.

https://theermgroup-my.sharepoint.com/:f:/g/personal/andrea_thornton_erm_com/Eqv0yh0MtgtBlXzmf0Pf9CwBc4k0r9f_my--CoytGc5niQ?e=TuEaaj

Please let me know if you have any questions or issues accessing the files.

Thank you,
Andrea

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

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WBI ENERGY TRANSMISSION, INC.
1250 West Century Ave.
P.O. Box 5601
Bismarck, ND 58506-5601
(701) 530-1600
www.wbienergy.com

September 11, 2020

Cale Bickerdyke
U.S. Department of Agriculture
Forest Service
Dakota Prairie, Grasslands, McKenzie Ranger District
1905 South Main Street
Watford City, ND 58854 (P: 701-842-8500)

Re: WBI Energy Transmission, Inc. – North Bakken Expansion Project
Biological Evaluation

Dear Mr. Bickerdyke,

WBI Energy Transmission, Inc. (WBI Energy) is seeking authorization from the Federal Energy Regulatory Commission (FERC) under Title 18 Code of Federal Regulations Sections 157.205 and 157.210 to construct, own, operate, and maintain the North Bakken Expansion Project (Project). The U.S. Forest Service (USFS) Manual Section 2672.41 requires a Biological Evaluation (BE) be conducted for all USFS planned, funded, executed, or permitted programs and activities. Environmental Resources Management (ERM) prepared this BE on behalf of WBI Energy at the request of the USFS to assist with the overall permitting requirements for the Project. The BE was prepared in accordance with legal requirements set forth under the National Forest Management Act, and the Dakota Prairie Grasslands Land and Resource Management Plan.

WBI Energy wishes to consult with your office concerning the impacts of the Project. WBI Energy requests your comments if you agree or disagree with WBI Energy's evaluation of the effects of the proposed action on the following:

- USFS sensitive and watch list animals and plants;
- Raptor species of concern; and
- Management Indicator Species

WBI Energy proposes to install approximately 93.5 miles of pipeline, including new pipeline, pipeline looping and upgrades to existing pipelines, as well as construction and upgrades to compressor stations and other appurtenances to transport natural gas from WBI Energy's existing Tioga Compressor Station near Tioga, Williams County, North Dakota, to a new interconnect with Northern Border's mainline southeast of Watford City, McKenzie County, North Dakota. Pipeline construction is currently planned to begin in May of 2021. The Project would include the crossing of approximately 2.1 miles of USFS-managed lands within the Little Missouri National Grassland.

The purpose of the Project is to provide additional capacity necessary for the transportation of incremental natural gas volumes from the Bakken region of northwest North Dakota to Northern Border's existing mainline for transit on that system. The Project would help to satisfy natural gas

demand in the midcontinent region of the United States, and the proposed transportation capacity of the Project is at least an additional 250 million cubic feet per day.

Within USFS-managed lands construction of the proposed pipeline would require a 50-foot wide construction right-of-way with an additional 25 feet of temporary workspace. Additionally, some temporary extra workspace will be required for certain road crossings, points of inflection along the route, and areas where special construction methods will be implemented (e.g., guided bore method). Approximately 23.1 acres of USFS land would be impacted by the Project, which includes the permanent right-of-way, temporary workspaces, and access roads.

On behalf of WBI Energy, ERM conducted a species determination based on the results of habitat surveys conducted by Western Ecosystems Technology, Inc. (WEST) and ERM. As a result of these surveys and subsequent reports, WBI Energy has reached the following determinations:

North Bakken Expansion Project
Summary of Determination for USFS Species of Concern

Species	Impact [a]	
	None [b]	May [c]
Sensitive Plants		
Alkali sacaton (*Sporobolus airoides*)	X	
Alyssum-leaved phlox (*Phlox alyssifolia*)	X	
Blue lips (*Collinsia parviflora*)	X	
Dakota buckwheat (*Eriogonum visheri*)	X	
Dwarf mentzelia (*Mentzelia pumila*)	X	
Easter daisy (*Townsendia exscapa*)		X
Hooker's Townsendia (*Townsendia hookeri*)		X
Lanceleaf cottonwood (*Populus x acuminata*)		X
Limber pine (*Pinus flexillis*)	X	
Nodding buckwheat (*Eriogonum cernuum*)	X	
Sand lily (*Leucocrinum montanum*)		X
Smooth goosefoot (*Chenopodium subglabrum*)	X	
Torrey's cryptantha (*Cryptantha torreyana*)	X	
Sensitive Animals		
Baird's sparrow (*Ammodramus bairdii*)		X
Bald eagle (*Haliaeetus leucocephalus*)	X	
Bighorn sheep (*Ovis canadensis*)	X	
Black-tailed prairie dog (*Cynomys ludovicianus*)	X	
Burrowing owl (*Athene cunicularia*)	X	
Greater sage-grouse (*Centrocercus urophasianus*)	X	
Loggerhead shrike (*Lanius ludovicianus*)		X
Long-billed curlew (*Numenius americanus*)		X
Ottoe skipper (*Hesperia ottoe*)		X
Red-bellied dace (*Chrosomus eos*)	X	
Regal fritillary (*Speyeria idalia*)		X
Sprague's pipit (*Anthus spragueii*)		X

North Bakken Expansion Project
Summary of Determination for USFS Species of Concern

Species	Impact [a] None [b]	Impact [a] May [c]
Tawny crescent (*Phyciodes batessii*)		X
Management Indicator Species		
Sharp-tailed grouse (*Tympanuchus phasianellus*)		X
Raptors		
Ferruginous hawk (*Buteo regalis*)		X
Golden eagle (*Aquila chrysaetos*)		X
Merlin (*Falco columbarius*)	X	
Prairie falcon (*Falco mexicanus*)		X
Peregrine falcon (*Falco peregrinus*)	X	
Watch List Species		
None observed		

[a] Effects determinations including Will Impact, defined as individuals with a consequence that the action may contribute to a trend towards elevated federal listing or cause a loss of viability to the population or species; or Beneficial Impact, defined as benefiting a species and/or habitat and requiring written concurrence from the FWS were not applicable in the analysis.
[b] No impact
[c] May impact individuals or habitat, but will not likely contribute to a trend towards elevated federal listing or cause a loss of viability to the population or species.

Additionally, no eagles or eagle nests were identified during Project surveys. If an eagle nest is identified near the Project during construction, WBI Energy would implement the measures described in sections 4.3.2 (bald eagle) and 4.5.2 (golden eagle) to avoid and minimize impacts on nesting eagles. The proposed Project is not expected to affect bald or golden eagles.

WBI Energy appreciates your assistance and review of the enclosed materials and should you have questions or require additional information during your review, please contact Jill Linn (406) 359-7332.

Respectfully submitted,

Jill Linn
Environmental Manager
WBI Energy Transmission, Inc.

Enclosure: Biological Evaluation

Cc: Greg Huncovsky, WBI Energy Transmission, Inc.
Andrea Thornton, Environmental Resources Management
Sarah Bickerdyke, U.S. Forest Service
Kim Grotte, U.S. Forest Service

ERM

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September 16, 2020

Liv Fetterman, Grasslands Archaeologist
Heritage Program Manager
Tribal Relations Program Manager
U.S Forest Service, Dakota Prairie Grasslands
2000 Miriam Circle,
Bismarck, ND 58501

Subject: WBI Energy Transmission, Inc.
North Bakken Expansion Project – Class III Survey Reports 2020 Field Season
McKenzie, Williams, Burke, and Mountrail Counties, North Dakota
ND SHPO Ref.: 19-5593

Dear Ms. Fetterman:

Please reference WBI Energy Transmission, Inc.'s (WBI Energy's) previous correspondence regarding the above referenced project. WBI Energy proposes to construct and operate the North Bakken Expansion Project (Project) in McKenzie, Williams, Burke, and Mountrail Counties, North Dakota.

The Project is regulated by the Federal Energy Regulatory Commission (FERC) under Section 7(c) of the Natural Gas Act. Under the Energy Policy Act of 2005, FERC is the lead agency for coordinating federal authorizations and complying with the National Environmental Policy Act on natural gas pipeline projects subject to its jurisdiction. FERC similarly is the lead federal agency for complying with Section 106 of the National Historic Preservation Act (NHPA) on natural gas pipeline projects under its jurisdiction. In accordance with 36 CFR 800.2(c)(4), WBI Energy is assisting the FERC in meeting its obligations under Section 106 of the NHPA by coordinating with agencies and tribes and conducting surveys to identify historic properties that may be affected by the Project. A report on geomorphological investigations is also included in this submittal.

Enclosed for your review please find Class III survey reports for the archaeological and historic structures surveys that were conducted during the 2019 and 2020 field seasons. The archaeological report includes the results provided in the original Class III report and addresses comments that were provided by the State Historical Society of North Dakota, Bureau of Land Management, U.S. Army Corps of Engineers, and the U.S. Forest Service. The attached table summarizes our response to those comments and provides the location of the relevant revisions or clarifications.

WBI Energy would appreciate your comments on the attached reports. If you have any questions or comments on the Project or the reports, please contact me at 612-840-8976 or pat.robblee@erm.com, or Dr. Kevin Malloy at 906-285-0361 or kevin.malloy@erm.com. Please direct written correspondence to Dr. Malloy's attention at:

Environmental Resources Management
1000 IDS Center
80 South 8th Street
Minneapolis, MN 55402

Sincerely,

Patrick Robblee
Program Director

Enclosures: Class III Archaeological Survey Report
Class III Historic Structures Addendum I Survey Report
Geomorphology Report

cc: Jill Linn, WBI Energy
Andrea Thornton, ERM
Kevin Malloy, ERM
Emily Laird, ERM
Andrew Clark, SHSND
Fern Swenson, SHSND
Liv Fetterman, USFS
Richard Rogers, USACE
Teanna Limpy, Northern Cheyenne Tribe
Pete Coffey, Three Affiliated Tribes of the Fort Berthold Reservation
Dyan Youpee, Assiniboine and Sioux Tribes of the Fort Peck Reservation
Ben Rhodd, Rosebud Sioux Tribe
Michael Black Wolf, Fort Belknap Indian Community
Tom Brings, Oglala Sioux Tribe
Jon Eagle, Standing Rock Sioux Tribe
Ben Ridgely, Northern Arapaho Tribe
Steven Vance, Cheyenne River Sioux
Erich Longie, Spirit Lake Tribe
Kip Spotted Eagle, Yankton Sioux Tribe
Jeff Desjarlais, Jr., Turtle Mountain Band of Chippewa
Dianne Desrosiers, Sisseton Wahpeton Oyate

Attachment: Table summarizing agency comments on the original Class III archaeology report

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Comments from the State Historical Society of North Dakota		
General comments:		
o Provide more background information on sites with previous work. Focus on methods and reasoning for previous eligibility recommendation.	Additional information on previous investigations has been added to site descriptions, as applicable.	Sections 5.3 through 5.7
o Map symbology has item named “Shovel test – No Dig”. Are these shovel probes that were planned, but not excavated for some reason? If so provide explanation.	These are planned but unexcavated shovel tests. Site descriptions have been updated, as applicable, to explain why some planned shovel tests were not excavated. Typical reasons for not excavating shovel tests include the presence of buried utilities (documented through One-Call markings) or slope.	Sections 5.3 through 5.5
Avoidance, 50 ft buffer minimum, fence, and monitor:		
o Private land: 32BK277, 32BK279, 32BK280, 32BK282, 32MZ3308, 32MZ3309, 32MZ3310, 32MZ3311, 32MZ3325, 32MZ3327, 32WI1494, 32WI1630, 32WI2144, 32WI2388, 32WI2389, 32WI2391, 32WI2392, 32WI2393, 32WI2394, 32WI2398, 32WI2406, 32WI2408.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.3
o US Forest Service Sites: 32MZ3301, 32MZ3314, 32MZ3315, 32MZ3319, 32MZ3320, 32MZ3322, 32MZ3324.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.5
Formally evaluate with site delineation and at least one 1x1 m TU. Submit evaluation plan prior to fieldwork:		
o Private Land: 32BK278, 32MZ3302, 32MZ3306, 32MZ3307, 32MZ3318, 32MZ3323, 32MZ3326, 32MZ3328, 32MZ3329, 32MZ3331, 32WI2390, 32WI2405, 32WI2407, 32WI2409, 32WI2410.	Additional testing (shovel testing and/or the excavation of at least one, 1 x 1 m test unit) was completed at each of these sites in accordance with a testing plan approved by the SHSND. Testing at sites 32WI2390 and 32MZ3328 was suspended following the identification of stone features at these sites; however, the pipeline route has been adjusted to avoid these sites with a minimum 50-ft buffer.	Section 5.3
o US Forest Service Site: 32MZ2346.	While ERM planned to conduct additional testing at this site, the pipeline route was modified prior to this work such that the site is now avoided by the Project with a buffer greater than 100 ft.	Section 5.5
Isolated finds:		
o Discuss subsurface potential on all IFs on a case-by-case basis. If the finds are in a good depositional context, STPs may be necessary to show that these are truly isolates. Minimal site recording may be enough to get a site number for database purposes, but more information is needed to verify that these are truly part of a category that can be written-off as not eligible.	Individual descriptions of isolated finds have been added to the text, including the results of shovel testing or an explanation for why shovel tests were not excavated.	Section 5.7

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Site-by-site comments, private land:		
o 32BK168 – Expand reasoning for Not Eligible Determination both previously and now. Newly recorded site boundary included previously unidentified features. Perhaps site should be unevaluated. Consider formal evaluation and provide updated management recommendations.	ERM conducted site testing at 32BK168 in 2020. Evidence of intact cultural deposits and features was identified during testing and the site is now recommended as eligible for listing in the NRHP. The pipeline route has been modified to avoid this site with a buffer of 57 ft.	Section 5.3
o 32MZ3323 – Discussion mentions "Better Examples" of homesteads. Provide examples.	The description for 32MZ3323 has been updated to incorporate the results of additional testing (shovel testing and the excavation of a 1 x 1 m test unit) in the updated Class III report.	Section 5.3
o 32WI1495 – Actual well shown in Figure 5.3-81 may be visible in figure 5.3-80. Is this location impacted by project? Consider site lead.	The location of the well (which is no longer extant) is discussed in the updated Class III report in conjunction with 32WI1495. ERM has submitted a site lead form for this resource. The suggested boundary of the site lead is 19 ft from Project workspace. The actual location of the well is about 235 ft from Project workspace.	Section 5.3
o 32WI2404 – How is this identified as prehistoric? Could it be a result of natural glacial and/or historic or modern field clearing? Provide evidence. Fence and monitor as necessary.	The interpretation of the feature at 32WI2404 as prehistoric is conservative and based on best professional judgement. Tribal cultural specialists who visited the site with ERM concurred with this interpretation.	Section 5.3
o 32WI2408 – Workspace is extremely close to possible graves. Is the planned route fixed?	The pipeline route has been modified to avoid this site with a buffer of 213 ft.	Section 5.3
Site-by-site comments, US Army Corps of Engineers land:		
o 32MZ976 – Drilling under site is not avoidance as leaks and emergency repairs do consider cultural resources. Formal testing or horizontal avoidance is necessary.	The trajectory of the HDD will be 160 to 180 ft below ground surface where it passes beneath 32WI976. The pipeline will carry gas, not a liquid; the gas would migrate to the surface and dissipate into the air in the event of a leak. Given the depth of the HDD installation, daylighting of the pipeline for repair would not be feasible. If repair is required in the future, the most likely course of action would be to re-install a new segment via HDD, which would require federal authorizations, thereby triggering review of the action under Section 106 of the NHPA. A description of the HDD method has been added to the description of 32WI976 in Section 5.4 of the report. Additional testing at the site is pending and scheduled to be completed this fall. The results will be discussed in an addendum report.	Section 5.4
o 32MZ976 – Show bore location and HDD line on map	A figure showing the HDD alignment with entry and exit points has been added to the description of this site as has a construction alignment sheet. The alignment sheet depicts the HDD in plan and profile.	Section 5.4

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o 32MZ976 – Clarify and provide more evidence for geomorphological hypothesis of A horizon being related to flood deposits. Typically, A horizons show stability rather than accretional or erosional events. Provide more information on why artifacts are interpreted as disturbed rather than in primary context.	The text in the updated Class III report has been updated to address this comment. As noted above, additional testing is planned to occur at 32WI976 this fall, which will provide additional information on the soils present at the site.	Section 5.4
o 32MZ976 – Did cut bank provide additional information on buried soils? Were artifacts identified in cut bank?	The cut bank was examined during the initial survey. As noted above, additional testing is planned to occur at the site this fall with results to be discussed in an addendum report.	Section 5.4
o 32WI976 – Given size and shape of site, additional TUs recommended.		
Comments from the Bureau of Land Management		
o The recommended protection/avoidance measures for unevaluated and eligible archaeological sites in the Class III report are inadequate, particularly regarding stone feature sites. The usual avoidance distance requested/required by the BLM is 100 feet. More than 100 feet is preferred for stone feature sites. Revise protection/avoidance measures buffers for archaeological sites.	WBI Energy has routed the pipeline to avoid unevaluated and eligible sites with a minimum buffer of 50 ft as directed by the SHSND.	Sections 5.3 through 5.5
o Why were indirect effects to archaeological sites not considered? Setting is an important aspect of integrity for stone feature sites. There are numerous archaeological sites within and near the survey corridor that should be analyzed for indirect effects. Revise the report to address indirect effects to archaeological sites.	The report has been updated to include an assessment of physical and non-physical impacts on unevaluated and eligible sites.	Sections 4 and 5.5 through 5.5
o WBI Energy needs to develop a cultural resource monitoring plan for construction.	WBI Energy commits to preparing a monitoring plan for construction.	Sections 5.3 through 5.5
o Update site form for all sites, site leads, and isolated finds regardless of whether they were relocated. Even if a cultural resource could not be relocated, that is still valuable information for the next project/site visit.	Site form updates have been submitted for all sites, isolated finds, and site leads discussed in the updated Class III report	N/A
o WBI Energy should make additional efforts to involve tribes in upcoming 2020 fieldwork and field reviews.	As discussed in more detail in Section 4 of the updated Class III report, WBI Energy retained Beaver Creek Archaeology to coordinate tribal participation in fieldwork in 2020. BCA worked with tribes to document sites as cultural heritage resources. The results of that work will be presented in a separate report. Information on tribal participation in the surveys also is provided in Sections 4 and 5.3 through 5.5 of ERM's updated Class III report	Sections 4 and 5.3 through 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Comments from U.S. Army Corps of Engineers		
o In section 5.4.2, remove figures for 32MZ0598 and move to the previous section.	This comment is addressed in the updated Class III report	Section 5.4
o Figure 5.4-5: Map of Site 32WI976, provide contour lines on this map to show the slope. This information would help to explain why the shovel testing pattern appears the way it does.	Contour lines are provided on Figure 5.4-9 in the updated Class III report.	Section 5.4
o ERM, on behalf of WBI [Energy], identified a second concentration of artifacts in the western side of site 32WI0976 after they started excavating the test unit. Some additional testing is needed here as USACE cannot agree with the recommended determination for this site given the data presented in this report.	Additional testing will be completed at this site in the fall of 2020 with the results presented in an addendum report.	Section 5.4
o USACE recommends that WBI [Energy] conduct a remote sensing evaluation (gradiometer or conductivity) at site 32WI0976. This would be the best way to produce measurable data regarding the presence/absence of subsurface features at the site.	A remote sensing survey of the site was completed in the summer of 2020. The results of the survey were used to prepare a testing plan for 32WI976. Additional testing at the site will occur this fall with the results presented in an addendum report.	Section 5.4
Comments from the U.S. Forest Service		
o The map showing previously recorded cultural resources within a one-mile radius is only included in the overall Class III and not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Figure 1.1-2 shows the Forest Service surface and differentiates between the survey corridor and the survey corridor on Forest Service surface; however, the survey corridor on Forest Service surface and the actual Forest Service surface displayed don't match.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Sites 32MZ2347 (Historical Archaeological) and 32MZ3278 (Cairn) are located immediately adjacent to the survey corridor but are not discussed. Please discuss.	Based on route modifications, 32MZ3278 was visited in 2020 and the site boundary expanded based on the findings. A discussion of the site is provided in the updated Class III report. 32MZ2347 is outside the inventory corridor for the Project; however, we have included a discussion of this site in the Class III inventory report.	Section 5.5
o Site 32MZ145 site form update does not appear to have been performed. Why? Was an attempt made to actually relocate the site? Also, according to the site form, a THPO representative requested avoidance in 2013. More work on this site is probably needed.	When 32MZ145 was first recorded in 1979, it was characterized as two stone cairns. Subsequent investigations described the site as consisting of a single historic rock clearing pile on the west side of Highway 1806, noting that the second pile was likely destroyed by construction of the highway. ERM's survey in 2019 was limited to the east side of Highway 1806, which explains why we did not relocate the site at that time. In 2020, ERM conducted additional survey on USFS lands, examining a corridor on the west side of Highway 1806. 32MZ145 was relocated as a result of this work. The site is discussed in the updated Class III report. Tribal cultural specialists who accompanied ERM during the 2020 field investigation concurred that 32MZ145 is historic rock clearing pile.	Section 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o Site 32MZ2346 and 32MZ144: it is very improbable and therefore suspicious that there are zero artifacts and one artifact respectively at sites with historic dumps.	Sites 32MZ2346 and 32MZ144 are both previously recorded historic sites which ERM revisited and recorded during the survey for the Project. Cultural material was observed at both sites as described in the updated Class III report. ERM expanded the boundaries of 32MZ2346 to encompass two previously unreported features at the site. One artifact–a commemorative coin–was collected from 32MZ2346 because of its uniqueness. No artifacts were collected from 32MZ144. Expanded descriptions of both sites are provided in the updated Class III report.	Section 5.5
o Additional survey is shown as needed near site 32MZ3278 on the maps in the overall Class III report but not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	Additional survey was completed in 2020 on USFS lands in the vicinity of 32MZ3278, which was relocated. A description of the site is provided in the updated Class III report.	Section 5.5
o The recommended avoidance and fencing measures are inadequate, especially for stone feature sites.	All stone feature sites have been avoided with a minimum buffet of 50 ft. Additionally, for sites between 50 and 100 ft of Project workspace WBI Energy commits to fencing and monitoring the sites during construction. WBI Energy will provide a monitoring plan for agency review.	Section 5.5
o A monitoring plan is needed.	WBI Energy commits to providing a construction monitoring plan as discussed in the updated Class III report.	
o Updates should have been conducted for all sites, site leads, and IFs [isolated finds] regardless of whether or not they were relocated.	Site form updates have been submitted for all applicable sites, isolated finds, and site leads discussed in the report	N/A
o The discussion of site leads during fieldwork is inadequate.	Site leads are discussed in Section 5.6 of the updated Class III report.	Section 5.6
o Provide specific distances between site boundaries and the edge of the workspace.	Distances between sites and Project workspaces have been added to summary tables and site descriptions throughout the updated Class III report.	Sections 5.3 through 5.5
o Provide a map of shovel testing performed outside of site boundaries. The report explains the testing strategy during survey but never discusses or shows specifics except within site boundaries.	The route maps provided as Appendix B depict survey methodology in addition to survey coverage and results.	Appendix B
o Identify the level of tribal involvement in the survey.	Tribal participation in field surveys is discussed in Sections 4 and 5.3 through 5.5 of the updated Class III report.	Sections 4 and 5.3 through 5.5
o Discuss whether indirect effects to archaeological sites were considered.	For unevaluated sites, we have added an assessment of non-physical impacts on setting.	Sections 5.3 through 5.5

NORTH BAKKEN EXPANSION PROJECT

Agency Correspondence – U.S. Fish and Wildlife Service (FWS)

Andrea Thornton

From: Justin Moffett
Sent: Tuesday, August 11, 2020 3:42 PM
To: Jerry D. Reinisch (jerry_reinisch@fws.gov)
Cc: Andrea Thornton
Subject: WBI Energy: North Bakken Expansion Project update

Jerry,
I spoke to Andrea Thornton (PM) regarding your question about anticipated changes to the North Bakken Expansion Project and if/how they would involve the U.S. Fish and Wildlife Service. She indicated there have been two recent developments with the project, only one of which (#2 below) would involve USFWS.

1. Last month WBI filed an amendment with FERC announcing they intend to decrease the design capacity of the North Bakken Expansion Project to 250 MMcf/d by reducing compression at the Tioga Compression station. This amendment would not result in any substantive change to the scope of the environmental review since the decreased capacity would not changing the pipeline diameter or project footprint. Therefore this change does not require any additional review or consultation from USFWS.
2. WBI intends to submit a supplemental filing to FERC in late August/early September which is needed to address numerous minor route adjustments WBI has incorporated into the project design to address landowner requests and avoid sensitive resources such as cultural sites and Dakota skipper habitat. The supplemental filing will include submitting updated versions of applicable sections of the Resource Reports, biological assessment, biological and cultural survey reports, and other documents related to the project's environmental review. Once WBI submits the supplemental filing, FERC will review and update the Environmental Assessment and USFWS will have an opportunity to review the updated biological assessment which will allow WBI/FERC and USFWS to complete the project's Section 7 ESA consultation.

Let me know if you have any additional questions.
Thanks.

Justin T. Moffett, PWS
Principal Consultant

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Read ERM's response to the COVID-19 pandemic

Andrea Thornton

From: Krebsbach, Jacob B <jacob_krebsbach@fws.gov>
Sent: Tuesday, September 1, 2020 2:08 PM
To: Andrea Thornton
Subject: Re: [EXTERNAL] WBI Energy North Bakken Expansion Project

No. We're not worried about the tiny one.

Jacob Krebsbach
NAWCA Technician
Crosby Wetland Management District
U.S. Fish & Wildlife Service
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From: Andrea Thornton <Andrea.Thornton@erm.com>
Sent: Tuesday, September 1, 2020 2:57 PM
To: Krebsbach, Jacob B <jacob_krebsbach@fws.gov>
Cc: Williams, Scott A <Scott_A_Williams@fws.gov>
Subject: RE: [EXTERNAL] WBI Energy North Bakken Expansion Project

Thank you for getting these back to me so quickly! I will share these with WBI. Based on your email below, would WBI need the compatibility determination if the route still crosses the tiny wetland? I'm confident that the larger wetland can be avoided, but the smaller one may be trickier.

-Andrea

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

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From: Krebsbach, Jacob B <jacob_krebsbach@fws.gov>
Sent: Tuesday, September 1, 2020 12:34 PM
To: Andrea Thornton <Andrea.Thornton@erm.com>
Cc: Williams, Scott A <Scott_A_Williams@fws.gov>
Subject: Re: [EXTERNAL] WBI Energy North Bakken Expansion Project

Andrea,

Here are shapefiles for the wetland basins in the area we've been discussing. These are just approximate boundaries for these basins but it should give you a pretty good idea of the basin sizes.

Also, the very tiny wetland that the line appears to cross isn't so much of a concern for us. The main concern is the bigger wetland that the line skirts along. It looks like a very slight shift to the west and then precautions to avoid driving machinery through the basin would be enough to avoid that wetland. Please let me know your thoughts after you've had time to look at the shapefiles.

Jacob

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From: Andrea Thornton <Andrea.Thornton@erm.com>
Sent: Tuesday, September 1, 2020 10:46 AM
To: Krebsbach, Jacob B <jacob_krebsbach@fws.gov>; Williams, Scott A <Scott_A_Williams@fws.gov>
Subject: RE: [EXTERNAL] WBI Energy North Bakken Expansion Project

Hi Jacob and Scott –

Scott had provided the attached shapefile to me back in September 2019 after I mentioned that our civil and environmental survey crews did not notice any wetland basins in certain areas during surveys and aerial photography that we have in our GIS database is not showing the basins like they are depicted on the maps you sent.

If my memory serves correctly he only digitized those that were in question as being crossed by the previous route. Would we be able to receive shapefiles of the basins you mentioned yesterday so they can be avoided?

Thanks again,
Andrea

Andrea Thornton
Principal Consultant
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From: Andrea Thornton
Sent: Monday, August 31, 2020 3:24 PM

To: Krebsbach, Jacob B <jacob_krebsbach@fws.gov>
Subject: RE: [EXTERNAL] WBI Energy North Bakken Expansion Project

Hi Jacob –

Thank you for sending the maps along to us again. I will work with WBI to see what can be done in this area to avoid the two basins that you marked on the maps so we can avoid the compatibility determination process. I'll keep you updated!

-Andrea

Andrea Thornton
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From: Krebsbach, Jacob B <jacob_krebsbach@fws.gov>
Sent: Monday, August 31, 2020 3:14 PM
To: Andrea Thornton <Andrea.Thornton@erm.com>
Subject: Re: [EXTERNAL] WBI Energy North Bakken Expansion Project

Andrea,

Attached are two maps that were sent to WBI in the past. The first map (15709523.jpg) shows the wetland I mentioned in my previous email, as an identified protected wetland basin. There's a call out box pointing to it with the bore/avoid suggestion. The map also shows a tiny wetland that is completely covered by the route and work area in the map I just sent you. You can see it just to the NW of the larger basin we've been discussing. It also has a call out box pointing to it. This map was sent in March of 2019.

The second map (15709523_2.jpg) shows a reroute where both of those wetlands appear to be avoided. That map was sent in August of 2019.

The reason for sending you those maps is to show you we had those identified as protected basins from the beginning. Certainly not trying to pull the rug out from under you here.
So with the reroute, if either of these two wetlands are going to be impacted, we'd have to go through the compatibility process prior to development. This process would decide whether or not the project would be allowed to proceed as planned. It is not a quick process and most companies choose to avoid it whenever possible. We don't have a choice in this matter unfortunately. Whenever our easement interests are projected to be impacted from some time of development (aside from mineral development) we have to go through this process. If you decide to pursue this route, I can give you further details, but basically the request has to go all the way through our regional office.

Boring under or avoiding the basins with the route and machinery would be the other options. Particularly the larger wetland. It appears it wouldn't take much shifting to avoid that wetland.

Let me know your thoughts when you get the chance.

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From: Andrea Thornton <Andrea.Thornton@erm.com>
Sent: Monday, August 31, 2020 11:12 AM
To: Krebsbach, Jacob B <jacob_krebsbach@fws.gov>
Subject: RE: [EXTERNAL] WBI Energy North Bakken Expansion Project

Hi Jacob –

Thanks for getting back to me so quickly. Our survey crews did not identify a wetland in the area you outlined in your attachment and that location is not proposed to be crossed with a bore. In the screenshot below the red outline is the edge of our survey corridor. The route shifted east here due to other routing constraints being identified to the west.

Let me know if you would like to have a call to discuss.

Andrea

Andrea Thornton
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From: Krebsbach, Jacob B <jacob_krebsbach@fws.gov>
Sent: Monday, August 31, 2020 8:57 AM
To: Andrea Thornton <Andrea.Thornton@erm.com>
Subject: Re: [EXTERNAL] WBI Energy North Bakken Expansion Project

Hello Andrea,

I'm attaching a map with the new shapefiles you've provide. The bore you're asking about looks good to me. As long as the basin is avoided with machinery, everything should be fine there. However with this section of the line being shifted slightly to the east, it does come within a very close proximity to a different wetland. I believe previous proposals for this line avoided this wetland but I'm not sure now. I've made a note of it on the map. Is this also a bore area? Thanks for your help.

Jacob Krebsbach
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From: Andrea Thornton <Andrea.Thornton@erm.com>
Sent: Friday, August 28, 2020 9:58 AM
To: Krebsbach, Jacob B <jacob_krebsbach@fws.gov>
Subject: [EXTERNAL] WBI Energy North Bakken Expansion Project

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Hi Jacob –

I hope that you are doing well. Since our last communication back in March there have been some route adjustments along the North Bakken Expansion Project. I've attached the current shapefiles. There is now one basin that will be crossed using the bore construction method (see screenshot below). I wanted to confirm if there are any additional measures that need to be taken into account by WBI during construction in this area. In the screenshot the green polygon is our field delineated wetland boundary. This wetland is on parcel 157-95-23-004.

Please let me know if there are any questions or concerns.

Thanks,
Andrea

Andrea Thornton
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From: Krebsbach, Jacob B <jacob_krebsbach@fws.gov>
Sent: Tuesday, March 17, 2020 10:04 AM
To: Andrea Thornton <Andrea.Thornton@erm.com>
Subject: Re: [EXTERNAL] RE: WBI Energy North Bakken Expansion Project Maps

Andrea,

I apologize. I didn't realize you were waiting on a response from me.

Everything looked good. Between the map and the shapefiles, I believe I understood everything and it appears any areas where the pipeline is to cross USFWS easements had been reviewed and addressed in previous communications. Thanks again for the shapefile and for working with us.

Jacob

Jacob Krebsbach
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From: Andrea Thornton <Andrea.Thornton@erm.com>
Sent: Tuesday, March 17, 2020 11:14 AM
To: Krebsbach, Jacob B <jacob_krebsbach@fws.gov>
Subject: [EXTERNAL] RE: WBI Energy North Bakken Expansion Project Maps

Hi Jacob –

I hope all is well with you and your family during this strange time. Please let me know if you have any questions on the shapefiles that I sent out a few weeks ago.

Thank you,
Andrea

Andrea Thornton
Principal Consultant

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From: Andrea Thornton
Sent: Monday, March 2, 2020 7:25 AM
To: Krebsbach, Jacob B <jacob_krebsbach@fws.gov>
Cc: Leslie Rodman-Jaramillo <leslie.rodmanjaramillo@erm.com>
Subject: RE: WBI Energy North Bakken Expansion Project Maps

Hi Jacob-

WBI Energy filed their FERC Application on February 14, 2020. Attached are the current shapefiles for the North Bakken Expansion Project. WBI has worked to avoid or bore under all of the basins within wetland easements per our previous communications. If you have any questions or if there are any areas of concern please let us know!

Thanks,
Andrea

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From: Krebsbach, Jacob B <jacob_krebsbach@fws.gov>
Sent: Monday, March 2, 2020 7:20 AM
To: Andrea Thornton <Andrea.Thornton@erm.com>
Cc: Leslie Rodman-Jaramillo <leslie.rodmanjaramillo@erm.com>
Subject: Re: WBI Energy North Bakken Expansion Project Maps

Andrea,

We received a packet in the mail from WBI Energy regarding the North Bakken Expansion project and we were wondering if anything had changed since our last communication? Also would it be possible to receive a final shapefile for the project for our review? Thanks.

Jacob

Jacob Krebsbach
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From: Andrea Thornton <Andrea.Thornton@erm.com>
Sent: Monday, September 9, 2019 3:52 PM

To: Krebsbach, Jacob B <jacob_krebsbach@fws.gov>
Cc: Williams, Scott A <Scott_A_Williams@fws.gov>
Subject: [EXTERNAL] RE: WBI Energy North Bakken Expansion Project Maps

Hi Jacob and Scott –

We have a couple of questions regarding some of the basins identified on the easements attached maps. Our civil and environmental survey crews did not notice any wetland basins in these areas during surveys this summer, and aerial photography that we have in our GIS database is not showing the basins like they are depicted on the maps you sent. Do you have shapefiles of the extend of the basins (rather than just point data) so we can design workspaces appropriately to avoid these areas?

Thanks,
Andrea

Andrea Thornton
Principal Consultant

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From: Krebsbach, Jacob <jacob_krebsbach@fws.gov>
Sent: Thursday, August 15, 2019 12:20 PM
To: Leslie Rodman-Jaramillo <leslie.rodmanjaramillo@erm.com>
Cc: Justin Moffett <Justin.Moffett@erm.com>; Andrea Thornton <Andrea.Thornton@erm.com>; Scott Williams <scott_a_williams@fws.gov>
Subject: WBI Energy North Bakken Expansion Project Maps

Leslie,

Scott asked if I could send you some avoidance maps for this pipeline project you're working on. You'll find them attached below. I think I got all of them. Let me know if you have any questions. Thanks.

Jacob

Jacob Krebsbach
NAWCA Technician
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Andrea Thornton

From: Andrea Thornton
Sent: Friday, September 11, 2020 10:31 AM
To: Jerry D. Reinisch (jerry_reinisch@fws.gov)
Cc: Justin Moffett; Linn, Jill; 'Huncovsky, Greg'; 'Linn, Dave'
Subject: WBI Energy North Bakken Expansion Project - Revised Biological Assessment Submittal
Attachments: USFWS_WBI-BA_Submittal Letter_091120.pdf

Hi Jerry –

Attached is our transmittal letter for submitted the revised Biological Assessment for the North Bakken Expansion Project. Due to the size of the file we have created a One Drive folder for you to access the document. Please note that the link to this page will only work for one week so please pull the document onto your computer and server for storage. Please also note that the document is being submitted as CUI/PRIV and should not be shared with the public.

https://theermgroup-my.sharepoint.com/:f:/g/personal/andrea_thornton_erm_com/Eodj9ch4gKFNuYIVGAa6ATABae4bG7b-vlWMw9g1VpsUqw?e=Jqk5Zp

Please let me know if you have any questions or issues accessing the file.

Thank you,
Andrea

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

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E andrea.thornton@erm.com | **W** www.erm.com

WBI ENERGY TRANSMISSION, INC.
1250 West Century Ave.
P.O. Box 5601
Bismarck, ND 58506-5601
(701) 530-1600
www.wbienergy.com

September 11, 2020

Field Supervisor
U.S. Fish and Wildlife Service
North Dakota Field Office
3425 Miriam Avenue
Bismarck, ND 58501-7926 (P: 701-250-4402)

Re: WBI Energy Transmission, Inc. – North Bakken Expansion Project
Biological Assessment

Dear Field Supervisor,

As required by Title 18 Code of Federal Regulations §380.12, WBI Energy Transmission Inc. (WBI Energy) has prepared Environmental Reports in support of its application to the Federal Energy Regulatory Commission (FERC or Commission) for a Certificate of Public Convenience and Necessity under section 7(c) of the Natural Gas Act to construct, modify, operate and maintain the proposed facilities. WBI Energy is the Project Applicant and is also acting as FERC's non-federal representative for the purpose of complying with Section 7(a) of the Endangered Species Act of 1973 (ESA). WBI Energy and WBI Transmission have retained Environmental Resources Management (ERM) to assist with aspects of the proposed Projects including consultations with the U.S. Fish and Wildlife Service (FWS) under the ESA.

WBI Energy wishes to informally consult with your office concerning the impacts of the Project. WBI Energy requests your comments if you agree or disagree with WBI Energy's evaluation of the effects of the proposed action on the following:

- Endangered, threatened, or candidate species, or their designated critical habitats as identified in the ESA;
- Bald and Golden Eagles; and
- Migratory Birds

WBI Energy proposes to install approximately 93.5 miles of pipeline, including new pipeline, pipeline looping and upgrades to existing pipelines, as well as construction and upgrades to compressor stations and other appurtenances to transport natural gas from WBI Energy's existing Tioga Compressor Station near Tioga, Williams County, North Dakota, to a new interconnect with Northern Border's mainline southeast of Watford City, McKenzie County, North Dakota. Pipeline construction is currently planned to begin in May of 2021. The Project would include the crossing of Lake Sakakawea and adjacent U.S. Army Corps of Engineers (USACE) land, as well as the crossing of approximately 2.1 miles of U.S. Forest Service (USFS)-managed lands within the Little Missouri National Grassland.

The purpose of the Project is to provide additional capacity necessary for the transportation of incremental natural gas volumes from the Bakken region of northwest North Dakota to Northern Border's existing mainline for transit on that system. The Project would help to satisfy natural gas demand in the midcontinent region of the United States, and the proposed transportation capacity of the Project is at least an additional 250 million cubic feet per day.

Construction of the proposed 12-inch-diameter Line Section 25 and Line Section 30 Loops and the 20-inch-diameter Tioga Compressor Lateral would require a standard 75-foot-wide construction right-of-way. Except across USFS lands, construction of the proposed Elkhorn Creek-Northern Border pipelines would require a 100-foot-wide construction right-of-way. The USFS land crossing would require a 50-foot wide construction right-of-way with an additional 25 feet of additional temporary workspace (ATWS). Construction of the Project would affect approximately 1,470.3 acres of land, including the pipeline construction rights-of-way, ATWS, staging areas, temporary and permanent access roads, and aboveground facilities. Following construction, approximately 875.4 acres, including the temporary construction right-of-way, ATWS, staging areas, temporary access roads, and temporary workspace at aboveground facility sites, will revert to preconstruction conditions and uses. The remaining approximately 594.9 acres, including the permanent pipeline easements, permanent aboveground facility sites, and permanent access roads, would be retained for operation of the Project facilities.

On behalf of WBI Energy, ERM conducted a species determination based on the results of habitat surveys conducted by Western Ecosystems Technology, Inc. (WEST) and Beaver Creek Archaeology (BCA). As a result of these surveys and subsequent reports, WBI Energy has reached the following determinations:

North Bakken Expansion Project
Summary of Determination for Threatened and Endangered Species and Designated Critical Habitat

		Effects Determinations		
			Action area within Federal Lands	
Species/Critical Habitat	Federal Status [a]	Entire Action area [b]	USACE Areas [b]	USFS Areas [b]
Gray wolf (*Canis lupus*)	E	NE	NE [c]	NE [c]
Interior least tern (*Sterna antillarum athalassos*)	E [d]	NLAA	NLAA	NE
Pallid sturgeon (*Scaphirhynchus albus)*	E	NLAA	NLAA	NE
Whooping crane (*Grus americana*)	E	NLAA	NE	NLAA
Dakota skipper (*Hesperia dacotae*)/DCH	T	NLAA/NE	NE/NE	NLAA/NE
Northern long-eared bat (*Myotis septentrionalis*)	T	NLAA	NLAA	NLAA
Piping plover (*Charadrius melodus*)/DCH	T	NLAA/NAM	NLAA/NAM	NE/NE
Rufa red knot (*Calidris canutus rufa*)	T	NE	NE	NE

[a] Federal Status Codes: E = federally listed endangered; T = federally listed threatened; DCH = designated critical habitat; NAM=Not adversely modify

[b] Effects Determination Codes: NE = No Effect; NLAA = Not Likely to Adversely Affect; LAA = Likely to Adversely Affect

[c] Species was not listed in FWS IPaC report, and is not considered to be present within the *action area* on USACE or USFS-managed lands.

[d] Proposed for delisting.

Additionally, no eagles or eagle nests were identified during Project surveys. If an eagle nest is identified near the Project during construction, WBI Energy would implement the measures described in the FWS' 2007 National Bald Eagle Management Guidelines to avoid and minimize impacts on nesting eagles. The proposed Project is not expected to affect bald or golden eagles.

The Biological Assessment also states that by implementing certain proposed mitigation and restoration measures, no substantial changes in migratory bird habitat availability or suitability are anticipated as a result of the Project. As such, the Project is not expected to result in adverse permanent or cumulative impacts on migratory birds; however, temporary impacts on migratory bird habitat could occur.

WBI Energy appreciates your assistance and review of the enclosed materials and should you have questions or require additional information during your review, please contact Jill Linn (406) 359-7332.

Respectfully submitted,

Jill Linn
Environmental Manager
WBI Energy Transmission, Inc.

Enclosure: Biological Assessment

Cc: Greg Huncovsky, WBI Energy Transmission, Inc.

Andrea Thornton, Environmental Resources Management

Andrea Thornton

From: Andrea Thornton
Sent: Friday, September 18, 2020 10:54 AM
To: 'Jerry D. Reinisch (jerry_reinisch@fws.gov)'
Cc: Justin Moffett
Subject: RE: WBI Energy North Bakken Expansion Project - Revised Biological Assessment Submittal

Hi Jerry –

I wanted to check in to make sure you were able to access the files that we submitted last Friday via the OneDrive folder. Please us know if you have any questions or if you need me to send again.

Thanks,
Andrea

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

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M 503-459-6864
E andrea.thornton@erm.com | **W** www.erm.com

From: Andrea Thornton
Sent: Friday, September 11, 2020 10:31 AM
To: Jerry D. Reinisch (jerry_reinisch@fws.gov) <jerry_reinisch@fws.gov>
Cc: Justin Moffett <Justin.Moffett@erm.com>; Linn, Jill <Jill.Linn@wbienergy.com>; 'Huncovsky, Greg' <Greg.Huncovsky@WBIEnergy.com>; 'Linn, Dave' <Dave.Linn@WBIEnergy.com>
Subject: WBI Energy North Bakken Expansion Project - Revised Biological Assessment Submittal

Hi Jerry –

Attached is our transmittal letter for submitted the revised Biological Assessment for the North Bakken Expansion Project. Due to the size of the file we have created a One Drive folder for you to access the document. Please note that the link to this page will only work for one week so please pull the document onto your computer and server for storage. Please also note that the document is being submitted as CUI/PRIV and should not be shared with the public.

https://theermgroup-my.sharepoint.com/:f:/g/personal/andrea_thornton_erm_com/Eodj9ch4gKFNuYIVGAa6ATABae4bG7b-vlWMw9g1VpsUqw?e=Jqk5Zp

Please let me know if you have any questions or issues accessing the file.

Thank you,

Andrea

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

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M 503-459-6864
E andrea.thornton@erm.com | **W** www.erm.com

NORTH BAKKEN EXPANSION PROJECT

Agency Correspondence – U.S. Department Of Agriculture, Natural Resource Conservation Service (NRCS)

Andrea Thornton

From: Mike Buckless
Sent: Tuesday, August 18, 2020 2:18 PM
To: Teets, Tighe - NRCS, Stanley, ND
Subject: RE: WBI Energy Seed Mix Review - Mountrail County

Good afternoon Tighe,

The WBI Energy project is currently under review by the Federal Energy Regulatory Commission (FERC) as part of the application process. We have a supplemental information report we were going to file with FERC soon; therefore, I am reaching out again to see if there is any update we could provide regarding NRCS consultation in that filing. Any additional information your office or the State Rangeland Supervisor could provide would be much appreciated.

Thank you in advance,

Mike Buckless

ERM
M +1 (401) 447-5391
E mike.buckless@erm.com | **W** www.erm.com

From: Teets, Tighe - NRCS, Stanley, ND <tighe.teets@usda.gov>
Sent: Tuesday, January 7, 2020 11:26 AM
To: Mike Buckless <Mike.Buckless@erm.com>
Subject: RE: WBI Energy Seed Mix Review - Mountrail County

Your request was so large (geography wise) and going through such a big area of the county with many soil types, I passed the request along to my supervisor and I know it went up to our State Rangeland Supervisor.

I know you sent it out to multiple counties at the same time, we wanted input from one source, instead of getting multiple opinions.

Standby, I will again forward this email and request up the chain of my supervisors.

Tighe
701-628-2151 x3

From: Mike Buckless <Mike.Buckless@erm.com>
Sent: Tuesday, January 7, 2020 10:02 AM
To: Teets, Tighe - NRCS, Stanley, ND <tighe.teets@usda.gov>
Subject: RE: WBI Energy Seed Mix Review - Mountrail County

Good morning,

Just following up on our previous correspondence to see if you had any additional input. We received some information back from another NRCS field office (Mr. Crosby of the Bowbells FO) that was very helpful. If you determine that this information is also applicable to your area, we can incorporate that information.

Thanks again, and happy new year.

Mike Buckless

ERM
15 Park Row West | Suite 104 | Providence, RI 02903
M +1 (401) 447-5391
E mike.buckless@erm.com | **W** www.erm.com

From: Mike Buckless
Sent: Wednesday, October 2, 2019 9:59 AM
To: Teets, Tighe - NRCS, Stanley, ND <tighe.teets@usda.gov>
Subject: RE: WBI Energy Seed Mix Review - Mountrail County

Thanks for the quick response Tighe,

We are still preparing our application to the Federal Energy Regulatory Commission (FERC), so we have a bit of time. If possible, we were hoping for a response sometime by the end of October. Please let me know if that is something you would be able to accommodate.

Mike Buckless

ERM
15 Park Row West | Suite 104 | Providence, RI 02903
M +1 (401) 447-5391
E mike.buckless@erm.com | **W** www.erm.com

From: Teets, Tighe - NRCS, Stanley, ND <tighe.teets@usda.gov>
Sent: Wednesday, October 02, 2019 9:42 AM
To: Mike Buckless <Mike.Buckless@erm.com>
Subject: RE: WBI Energy Seed Mix Review - Mountrail County

Mike

I received your email request. When I get time, I will look at your proposed mixes. I am the only one in my office currently for NRCS, so it's hard to find the time. I will do my best and get back to you. What is the time frame you need this. I'm assuming no restoration and grass seeding would happen until spring 2020.

Tighe
701-628-2151 x3

From: Mike Buckless <Mike.Buckless@erm.com>
Sent: Wednesday, October 2, 2019 8:01 AM
To: Teets, Tighe - NRCS, Stanley, ND <tighe.teets@usda.gov>
Cc: Andrea Thornton <Andrea.Thornton@erm.com>; Destiny Kerr <Destiny.Kerr@erm.com>
Subject: WBI Energy Seed Mix Review - Mountrail County

Good morning Mr. Teets,

ERM is preparing environmental review documents on behalf of WBI Energy Transmission, Inc. for a development project affecting land in Mountrail County, ND. We respectfully request your review and comments on the proposed

seed-mixes for use during restoration of the construction work area. Please see the attached document for the proposed seed-mixes and additional background information.

Your time and assistance is greatly appreciated. Please feel free to reach out to myself or Andrea Thornton (cc'd) if you have any questions.

Mike Buckless

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M +1 (401) 447-5391
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Andrea Thornton

From: Andrea Thornton
Sent: Friday, August 28, 2020 8:04 AM
To: Hagel, Todd - NRCS, Bismarck, ND
Subject: RE: North Bakken Expansion Project
Attachments: FERC_Data_20200825.gdb.zip

Hello Todd –

I hope you are doing well. Since we last communicated back in March there have been some route adjustments on the North Bakken Expansion Project. I do not believe any easements are impacted by these changes, but would your be able to review and confirm?

Please let me know if there are any questions.

Thanks,
Andrea

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

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1050 SW 6th Avenue, Suite 1650 | Portland, Oregon | 97204
M 503-459-6864
E andrea.thornton@erm.com | **W** www.erm.com

From: Hagel, Todd - NRCS, Bismarck, ND <todd.hagel@usda.gov>
Sent: Tuesday, March 17, 2020 9:27 AM
To: Andrea Thornton <Andrea.Thornton@erm.com>; Howard, Jill - NRCS, Bismarck, ND <jill.howard@usda.gov>
Subject: RE: North Bakken Expansion Project

Andrea. The project has been reviewed. No NRCS held easements will be impacted by this proposed project.

Todd Hagel
Assistant State Conservationist-Programs
USDA-NRCS
701-530-2004

From: Andrea Thornton <Andrea.Thornton@erm.com>
Sent: Tuesday, March 17, 2020 11:12 AM
To: Howard, Jill - NRCS, Bismarck, ND <jill.howard@usda.gov>; Hagel, Todd - NRCS, Bismarck, ND <todd.hagel@usda.gov>
Subject: RE: North Bakken Expansion Project

Hi Jill and Todd –

I hope all is well with you and your families during this strange time. I wanted to check in to see if the updated shapefiles for the North Bakken Expansion Project had been reviewed.
Any updates you would be able to provide would be greatly appreciated.

Thank you,
Andrea

Andrea Thornton
Principal Consultant

Environmental Resources Management (ERM)
1050 SW 6th Avenue, Suite 1650 | Portland, Oregon | 97204
M 503-459-6864
E andrea.thornton@erm.com | **W** www.erm.com

From: Howard, Jill - NRCS, Bismarck, ND <jill.howard@usda.gov>
Sent: Thursday, January 16, 2020 7:47 AM
To: Andrea Thornton <Andrea.Thornton@erm.com>
Subject: RE: North Bakken Expansion Project

Good morning,
Todd is planning to be back next Tuesday. I'll talk to him about it then. Thanks

Jill Howard | Assistant State Conservationist – Partnership Coordinator
Acting ASTC-Programs
Natural Resources Conservation Service | USDA
Jill.Howard@nd.usda.gov | 701.530.2073 office|701.214.8874 cell

---

From: Andrea Thornton <Andrea.Thornton@erm.com>
Sent: Thursday, January 16, 2020 9:39 AM
To: Howard, Jill - NRCS, Bismarck, ND <jill.howard@usda.gov>
Subject: FW: North Bakken Expansion Project

Good Morning –

My name is Andrea Thornton and I work for ERM, the environmental consultant working with WBI Energy on the North Bakken Expansion Project. I had been working on and off with Todd Hagel on his of review of NRCS easements. Yesterday I sent him the attached updated project shapefiles for review and received the automatic reply email below. Are you able to assist with this review, or let me know if there is someone else that I should be reaching out to? For your reference I've also attached an email chain between myself and Todd.

Please let me know if you have any questions.

Thanks,
Andrea

Andrea Thornton
Principal Consultant

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1050 SW 6th Avenue, Suite 1650 | Portland, Oregon | 97204
M 503-459-6864
E andrea.thornton@erm.com | **W** www.erm.com

From: Hagel, Todd - NRCS, Bismarck, ND <todd.hagel@usda.gov>
Sent: Wednesday, January 15, 2020 3:16 PM
To: Andrea Thornton <Andrea.Thornton@erm.com>
Subject: Automatic reply: North Bakken Expansion Project

Thank you for your message.

I am not in the office at this time. I am out of the office until February 3, 2020. Please direct all correspondence to JoDean Nichols (Easements) (701-530-2093) or Tracy Dove (Financial Assistance) (701-530-2002) from December 20 thru January 6.

Jill Howard, will serve as the Acting Assistant State Conservationist-Programs(Ph: 701-530-2073) for the period of January 6, 2020 to February 3, 2020. Thank you.

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Andrea Thornton

From: Andrea Thornton
Sent: Friday, September 18, 2020 10:59 AM
To: 'Hagel, Todd - NRCS, Bismarck, ND'
Subject: North Bakken Expansion Project Shapefile Review

Hi Todd –

I wanted to check in to see if the updated shapefiles for the North Bakken Expansion Project that I sent at the end of August had been reviewed. Please let me know if you need me to resend the files.

Any updates you would be able to provide would be greatly appreciated.

Thank you,
Andrea

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

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E andrea.thornton@erm.com | **W** www.erm.com

NORTH BAKKEN EXPANSION PROJECT

Agency Correspondence – North Dakota Department of Environmental Quality (NDDEQ)

Andrea Thornton

From: Wax, Peter N. <pwax@nd.gov>
Sent: Friday, August 14, 2020 6:37 AM
To: Hyatt, Chuck R.
Cc: Andrea Thornton
Subject: RE: North Bakken Expansion Project- HDD Drilling Fluid Disposal

Dear Chuck:

As discussed, the email and Andrea are attached. Everyone here is easy to get along with - If you have questions please call. 701-325-5268

Pete

From: Andrea Thornton
Sent: Thursday, August 13, 2020 2:50 PM
To: Wax, Peter N. <pwax@nd.gov>
Subject: North Bakken Expansion Project- HDD Drilling Fluid Disposal

CAUTION: This email originated from an outside source. Do not click links or open attachments unless you know they are safe.

Hi Pete –

Thanks for chatting earlier. As we discussed I'm looking to find information on the permitting requirements associated with the disposal of HDD drilling fluid. There are currently no additives proposed, however the HDD contractor notes that additives may be deemed necessary based on evaluations and recommendations made by the Mud Technician during drill and hole-opening operations to maintain adequate fluid rheology down-hole. WBI is hoping to find an landowner who would "land farm" the drilling fluid and I'm not sure if there are permit requirements for this activity.

Thanks again,
Andrea

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

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NORTH BAKKEN EXPANSION PROJECT
CONFERENCE CALL NOTES

MEETING TOPIC:
North Bakken Expansion Project – HDD Fluid Disposal

DATE OF MEETING:
August 14, 2020 at 1:30 p.m. PST– Project Call

ATTENDEES:

Environmental Resources Management (ERM)
Andrea Thornton

North Dakota Department of Environmental Quality (NDDEQ)
Brad Torgerson

MEETING NOTES:

Brad Torgerson called Andrea Thornton to discuss the disposal of HDD drilling fluid during construction. Mr. Torgerson noted that liquids are not allowed at landfills and in the past the NDDEQ has not required these drilling fluids to be disposed of at other disposal facilities. He noted that as long as WBI Energy has landowner approval, any drilling additives meet drinking water quality regulations, and best management practices are used to control runoff that no permits are required. Ms. Thornton thanked Mr. Torgerson for the information and indicated that she would follow-up with an email of potential additives.

Andrea Thornton

From: Andrea Thornton
Sent: Friday, August 14, 2020 10:40 AM
To: btorgers@nd.gov
Subject: HDD Drilling Fluid Disposal
Attachments: Potential Additives HDD Drilling Fuid.pdf

Hi Brad –

Thanks for chatting earlier today about requirements for the disposal of HDD drilling fluids. Attached is a list of the potential additives that the drilling contractor has come up with, along with their Material Safety Datasheets. If any of these additives are problematic please let us know and we can relay that information back to Michels (drilling contractor).

Thanks again,
Andrea

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

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M 503-459-6864
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ATTACHMENT

DRILLING ADDITIVES / LCMs FOR APPROVAL

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MICHELS®

Product Name	Manufacturer	Generic Name	Intended Use	NSF 60 APPROVED?
Platinum PAC	M I Swaco	PAC	Fluid Loss Inhibitor	YES
Platinum PAC UL	M I Swaco	PAC	Fluid Loss Inhibitor	YES
Ringfree	M I Swaco	Thinner	Drill Mud Thinner	YES
Torqmaster	WyoBen, Inc.	Surfactant	Torque reduction / reduce bit balling	NO
Plugz It	WyoBen, Inc.	Proprietary bentonite blend	Lost Circulation Material	YES
Clay Cutter	Cetco	Clay Inhibitor	Inhibit swelling of clay formations	NO
Clay Breaker	DCS Fluids	Clay Inhibitor	Inhibit swelling of clay formations	NO
Torque Breaker	DCS Fluids	Surfactant	Torque reduction / reduce bit balling	NO
Ball Buster	DCS Fluids	SAPP	Reduce bit / reamer balling	YES
Soda Ash	Various	pH Enhancement	Increase pH and reduce hardness of make up water	YES
Sodium Bicarbonate	Various	Calcium Control	Reduce calcium contamination of mud from drilling grout	YES
Citric Acid	Various	pH Reducer	Reduce pH when drilling grout	YES

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POTENTIAL ADDITIVIVE

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SDS no. 12391
Version 7
Revision date 21/Jul/2014
Supersedes date 20/Dec/2013

Safety Data Sheet
PLATINUM PAC†

1. Identification of the substance/preparation and of the Company/undertaking

1.1 Product identifier

Product name PLATINUM PAC†
Product code 12391

1.2 Relevant identified uses of the substance or mixture and uses advised against

Recommended Use Drilling fluid additive Fluid loss reducer.

Uses advised against Consumer use

1.3 Details of the supplier of the safety data sheet

Supplier
M-I L.L.C.
P.O.Box 42842
Houston, TX 77242
www.miswaco.slb.com

Prepared by
Global Chemical Regulatory Compliance (GCRC) , Bethicia Prasek

1.4 Emergency Telephone Number

Emergency telephone - (24 Hour) Australia +61 2801 44558, Asia Pacific +65 3158 1074, China +86 10 5100 3039, Europe +44 (0) 1235 239 670, Middle East and Africa +44 (0) 1235 239 671, New Zealand +64 9929 1483, USA 001 281 561 1600
Telephone Number - 281-561-1512

2. Hazards identification

2.1 Classification of the substance or mixture

GHS - Classification

Health hazards Not classified

Environmental hazards Not classified

Physical Hazards

Combustible dust	-

2.2 Label elements

Signal word
WARNING

May form combustible dust concentrations in air

Precautionary statements
P240 - Ground/bond container and receiving equipment
P243 - Take precautionary measures against static discharge

P241 - Use explosion-proof electrical/ ventilating/ lighting/ equipment

3. Composition/information on Ingredients

3.1 Substances

Component	CAS-No	Weight % - range
Carboxymethylcellulose sodium salt	9004-32-4	99

3.2 Mixtures

Not Applicable

4. First aid measures

4.1 Description of first-aid measures

Inhalation — If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Ingestion — Rinse mouth. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Seek medical attention if irritation occurs.

Skin contact — Wash off immediately with soap and plenty of water removing all contaminated clothes and shoes. Get medical attention immediately if symptoms occur.

Eye contact — Promptly wash eyes with lots of water while lifting eye lids. Remove contact lenses. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

4.2 Most important symptoms and effects, both acute and delayed

General advice — The severity of the symptoms described will vary dependant of the concentration and the length of exposure. If adverse symptoms develop, the casualty should be transferred to hospital as soon as possible.

Main symptoms

Inhalation	Please see Section 11. Toxicological Information for further information.
Ingestion	Please see Section 11. Toxicological Information for further information.
Skin contact	Please see Section 11. Toxicological Information for further information.
Eye contact	Please see Section 11. Toxicological Information for further information.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician Treat symptomatically.

5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Fog, Alcohol Foam, CO_2, Dry Chemical.

Extinguishing media which shall not be used for safety reasons
None known.

5.2 Special hazards arising from the substance or mixture

Unusual fire and explosion hazards
Suspended dust may present a dust explosion hazard.

Hazardous combustion products
Carbon oxides (COx).

5.3 Advice for firefighters

Special protective equipment for fire-fighters
As in any fire, wear self-contained breathing apparatus and full protective gear.

Special Fire-Fighting Procedures
Containers close to fire should be removed immediately or cooled with water.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Extinguish all ignition sources. Avoid sparks, flames, heat and smoking. Evacuate personnel to safe areas. Use personal protective equipment. See also section 8. If spilled, take caution, as material can cause surfaces to become very slippery.

6.2 Environmental precautions

The product should not be allowed to enter drains, water courses or the soil.

Environmental exposure controls
Avoid release to the environment.

6.3 Methods and materials for containment and cleaning up

Methods for containment
Prevent further leakage or spillage if safe to do so.

Methods for cleaning up
Sweep up and shovel into suitable containers for disposal. After cleaning, flush away traces with water. Material becomes slippery when wet. Use caution if wet.

6.4 Reference to other sections

See section 13 for more information.

7. Handling and storage

7.1 Precautions for safe handling

Handling
Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin and eyes. Avoid dust formation.

Hygiene measures
Use good work and personal hygiene practices to avoid exposure. Do not eat, drink or smoke when using this product.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/precautions Ensure adequate ventilation. Provide appropriate exhaust ventilation at places where dust is formed. Keep airborne concentrations below exposure limits.

Storage precautions Keep away from open flames, hot surfaces and sources of ignition. Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure controls/personal protection

8.1 Control parameters

Exposure limits Control as an ACGIH particulate not otherwise specified (PNOS): 10 mg/m^3 (Inhalable); 3 mg/m^3 (Respirable) and an OSHA particulate not otherwise regulated (PNOR): 15 mg/m^3 (Total); 5 mg/m^3 (Respirable).

Component	ACGIH TLV	OSHA PEL
Carboxymethylcellulose sodium salt 9004-32-4 (99)	Not Determined	Not Determined

8.2 Exposure controls

All chemical Personal Protective Equipment (PPE) should be selected based on an assessment of both the chemical hazard present and the risk of exposure to those hazards. The PPE recommendations below are based on an assessment of the chemical hazards associated with this product. Where this product is used in a mixture with other products or fluids, additional hazards may be created and as such further assessment of risk may be required. The risk of exposure and need of respiratory protection will vary from workplace to workplace and should be assessed by the user in each situation.

Engineering measures to reduce exposure
Ensure adequate ventilation.

Personal protective equipment

Eye protection It is good practice to wear goggles when handling any chemical. Tightly fitting safety goggles.

Hand protection Wear chemical resistant gloves such as nitrile or neoprene.

Respiratory protection	All respiratory protection equipment should be used within a comprehensive respiratory protection program that meets the requirements of 29 CFR 1910.134 (U.S. OSHA Respiratory Protection Standard) or local equivalent. If exposed to airborne mist/aerosol of this product, use at least a NIOSH-approved N95 half-mask disposable or re-usable particulate respirator. In work environments containing oil mist/aerosol, use at least a NIOSH-approved P95 half-mask disposable or reuseable particulate respirator. If exposed to vapors from this product use a NIOSH/MSHA-approved respirator with an Organic Vapor cartridge.
Skin and body protection	Wear suitable protective clothing.
Hygiene measures	Wash hands before eating, drinking or smoking, Remove and wash contaminated clothing before re-use.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

Physical state	Solid powder
Appearance	Opaque
Odor	Mild Odorless
Color	Off-white - Tan
Odor threshold	Not applicable

Property	**Values**	**Remarks**
pH	No information available	
pH @ dilution	6.5-8.0 @ 1% in H2O	
Melting/freezing point		
Boiling point/range	No information available	
Flash point	Does not flash	
Evaporation rate (BuAc =1)		
Flammability (solid, gas)	Not Applicable	
Flammability Limits in Air		
Upper flammability limit	Not applicable	
Lower flammability limit	Not applicable	
Vapor pressure	0 mmHg	
Vapor density	Not applicable	
Specific gravity	1.5 - 1.6	
Bulk density	No information available	
Relative density	No information available	
Water solubility	Gels on contact with water	
Solubility in other solvents	No information available	
Autoignition temperature	No information available	
Decomposition temperature	No information available	
Kinematic viscosity	No information available	
Dynamic viscosity	No information available	
Log Pow	Not determined	
Explosive properties	Not Applicable	
Oxidizing properties	None known.	

9.2 Other information

Pour point	No information available
Molecular weight	No information available
VOC content(%)	None
Density	No information available

10. Stability and reactivity

10.1 Reactivity

No specific reactivity hazards associated with this product.

10.2 Chemical stability

Stable under normal temperature conditions and recommended use.

10.3 Possibility of Hazardous Reactions

Hazardous polymerization
Hazardous polymerization does not occur.

Hazardous Reactions
None known.

10.4 Conditions to avoid

Heat, flames and sparks.

10.5 Incompatible materials

Strong oxidizing agents.

10.6 Hazardous decomposition products

Carbon oxides (COx).

11. Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Inhalation — Inhalation of dust may cause shortness of breath, tightness of the chest, a sore throat and cough.

Eye contact — Dust may cause mechanical irritation.

Skin contact — Repeated exposure may cause skin dryness or cracking.

Ingestion — Irritant; may cause pain or discomfort to mouth, throat and stomach.

Acute toxicity — 0% of the mixture consists of ingredient(s) of unknown toxicity.

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Carboxymethylcellulose sodium salt	= 27000 mg/kg (Rat)	> 2 g/kg (Rabbit)	> 5800 mg/m³ (Rat) 4 h

Sensitization — This product does not contain any components suspected to be sensitizing.

Mutagenic effects — This substance has no evidence of mutagenic properties.

Carcinogenicity — This substance has no evidence of carcinogenic properties.

Reproductive toxicity	None known.
Developmental toxicity	Not known to cause birth defects or have a deleterious effect on a developing fetus.
Routes of exposure	Inhalation. Skin contact. Eye contact.
Routes of entry	None known.
Specific target organ toxicity (single exposure)	Not classified
Specific target organ toxicity (repeated exposure)	Not classified.
Aspiration hazard	Not Applicable.

12. Ecological information

12.1 Toxicity

Toxicity to algae
See component information below.

Toxicity to fish
See component information below.

Toxicity to daphnia and other aquatic invertebrates
See component information below.

Component	Toxicity to fish	Toxicity to algae	Toxicity to daphnia and other aquatic invertebrates
Carboxymethylcellulose sodium salt	No information available	No information available	No information available

12.2 Persistence and degradability

No product level data available.

12.3 Bioaccumulative potential

No data available.

12.4 Mobility in soil

No information available.

12.5 Results of PBT and vPvB assessment

This substance is not considered to be persistent, bioaccumulating or toxic (PBT)
This substance is not considered to be very persistent nor very bioaccumulating (vPvB)

12.6 Other adverse effects.

None known. Check for additional information in sect. 7.

13. Disposal considerations

13.1 Waste treatment methods

Waste from residues / unused products	Dispose of in accordance with local regulations.
Contaminated packaging	Empty containers should be taken for local recycling, recovery or waste disposal.

14. Transport information

14.1 UN Number

UN/ID No. (ADR/RID/ADN/ADG)	Not regulated
UN No. (IMDG)	Not regulated
UN No. (ICAO)	Not regulated
UN No. (DOT)	Not regulated

14.2 Proper shipping name

Not regulated for transportation by DOT, TDG, IMDG and ICAO/IATA.

14.3 Hazard class(es)

ADR/RID/ADN Hazard class	Not regulated
IMDG Hazard class	Not regulated
ICAO Hazard class/division	Not regulated
DOT Hazard class	Not regulated

14.4 Packing group

ADR/RID/ADN Packing Group	Not regulated
IMDG Packing group	Not regulated
ICAO Packing group	Not regulated
DOT Packing group	Not regulated

14.5 Environmental hazard

No

14.6 Special precautions

Not Applicable

15. Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

International inventories

USA (TSCA)	Complies
European Union (EINECS and ELINCS)	Complies
Canada (DSL)	Complies
Philippines (PICCS)	Complies
Japan (ENCS)	Complies
China (IECSC)	Complies
Australia (AICS)	Complies
Korean (KECL)	Complies
New Zealand (NZIoC)	Complies

U.S. Federal and State Regulations

SARA 311/312 Hazard Catagories Not a SARA 311/312 hazard.

SARA 302/304, 313, CERCLA RQ, California Proposition 65
Note: If no components are listed below, this product is not subject to the referenced SARA and CERCLA regulations and is not known to contain a Proposition 65 listed chemical at a level that is expected to pose a significant risk under anticipated use conditions.

This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class Not a controlled product.

16. Other information

Supersedes date 20/Dec/2013

Revision date 21/Jul/2014

Version 7

The following sections have been revised All sections.

HMIS classification

Health	0
Flammability	1
Physical hazard	0
PPE	E

N/A - Not Applicable, N/D - Not Determined.

†A mark of M-I L.L.C.

Disclaimer
The information provided in this Material Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

POTENTIAL ADDITIVIVE

PLATINUM PAC UL

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SDS no. 12481
Version 4
Revision date 08/Jan/2015
Supersedes date 14/Feb/2012

Safety Data Sheet
PLATINUM PAC† UL

1. Identification

1.1 Product identifier

Product name PLATINUM PAC† UL

Product code 12481

1.2 Relevant identified uses of the substance or mixture and uses advised against

Recommended Use Drilling fluid additive.

Uses advised against Consumer use

1.3 Details of the supplier of the safety data sheet

Supplier
M-I L.L.C.
P.O.Box 42842
Houston, TX 77242
www.miswaco.slb.com

Prepared by
Global Chemical Regulatory Compliance (GCRC) , Bethicia Prasek

1.4 Emergency Telephone Number

Emergency telephone (24 Hour) Australia +61 2801 44558, Asia Pacific +65 3158 1074, China +86 10 5100 3039, Europe +44 (0) 1235 239 670, Middle East and Africa +44 (0) 1235 239 671, New Zealand +64 9929 1483, USA 001 281 561 1600
Telephone Number - 281-561-1511

2. Hazards identification

2.1 Classification of the substance or mixture

GHS - Classification

Health hazards Not classified

Environmental hazards Not classified

Physical Hazards

Combustible dust	-

2.2 Label elements

Signal word
WARNING

May form combustible dust concentrations in air

Precautionary statements
P240 - Ground/bond container and receiving equipment
P243 - Take precautionary measures against static discharge

P241 - Use explosion-proof electrical/ ventilating/ lighting/ equipment

Unknown acute toxicity 0% of the mixture consists of ingredient(s) of unknown toxicity.

3. Composition/information on Ingredients

3.1 Substances

Not Applicable

3.2 Mixtures

Component	CAS-No	Weight % - range
Carbohydrate	Proprietary	60 - 100

Comments
The exact percentage (concentration) of composition has been withheld as a trade secret

4. First aid measures

4.1 First-Aid Measures

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Ingestion Rinse mouth. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Seek medical attention if irritation occurs.

Skin contact Wash off immediately with soap and plenty of water removing all contaminated clothes and shoes. Get medical attention immediately if symptoms occur.

Eye contact Promptly wash eyes with lots of water while lifting eye lids. Remove contact lenses. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

4.2 Most important symptoms and effects, both acute and delayed

General advice	The severity of the symptoms described will vary dependant of the concentration and the length of exposure. If adverse symptoms develop, the casualty should be transferred to hospital as soon as possible.
Main symptoms	
Inhalation	Please see Section 11. Toxicological Information for further information.
Ingestion	Please see Section 11. Toxicological Information for further information.
Skin contact	Please see Section 11. Toxicological Information for further information.
Eye contact	Please see Section 11. Toxicological Information for further information.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician Treat symptomatically

5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Fog, Alcohol Foam, CO_2, Dry Chemical.

Extinguishing media which shall not be used for safety reasons
None known.

5.2 Special hazards arising from the substance or mixture

Unusual fire and explosion hazards
Suspended dust may present a dust explosion hazard.

Hazardous combustion products
Carbon oxides (COx).

5.3 Advice for firefighters

Special protective equipment for fire-fighters
As in any fire, wear self-contained breathing apparatus and full protective gear.

Special Fire-Fighting Procedures
Containers close to fire should be removed immediately or cooled with water.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Extinguish all ignition sources. Avoid sparks, flames, heat and smoking. Evacuate personnel to safe areas. Use personal protective equipment. See also section 8. If spilled, take caution, as material can cause surfaces to become very slippery.

6.2 Environmental precautions

As local regulations may vary; all waste must be disposed/recycled/reclaimed in accordance with federal, state, and local environmental control regulations.

Environmental exposure controls
Avoid dust formation.

6.3 Methods and materials for containment and cleaning up

Methods for containment
Prevent further leakage or spillage if safe to do so.

Methods for cleaning up
Sweep up and shovel into suitable containers for disposal. After cleaning, flush away traces with water. Material becomes slippery when wet. Use caution if wet.

6.4 Reference to other sections

See section 13 for more information.

7. Handling and storage

7.1 Precautions for safe handling

Handling
Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin and eyes. Avoid dust formation.

Hygiene measures
Use good work and personal hygiene practices to avoid exposure. Do not eat, drink or smoke when using this product.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/precautions Ensure adequate ventilation. Provide appropriate exhaust ventilation at places where dust is formed. Keep airborne concentrations below exposure limits.

Storage precautions Keep away from open flames, hot surfaces and sources of ignition. Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure controls/personal protection

8.1 Control parameters

Exposure limits **Control as an ACGIH particulate not otherwise specified (PNOS): 10 mg/m³ (Inhalable); 3 mg/m³ (Respirable) and an OSHA particulate not otherwise regulated (PNOR): 15 mg/m³ (Total); 5 mg/m³ (Respirable).**

Component	ACGIH TLV	OSHA PEL
Carbohydrate	Not Determined	Not Determined

8.2 Exposure controls

All chemical Personal Protective Equipment (PPE) should be selected based on an assessment of both the chemical hazard present and the risk of exposure to those hazards. The PPE recommendations below are based on an assessment of the chemical hazards associated with this product. Where this product is used in a mixture with other products or fluids, additional hazards may be created and as such further assessment of risk may be required. The risk of exposure and need of respiratory protection will vary from workplace to workplace and should be assessed by the user in each situation.

Engineering measures to reduce exposure
Ensure adequate ventilation.

Personal protective equipment

Eye protection	Tightly fitting safety goggles.
Hand protection	Wear chemical resistant gloves such as nitrile or neoprene.
Respiratory protection	All respiratory protection equipment should be used within a comprehensive respiratory protection program that meets the requirements of 29 CFR 1910.134 (U.S. OSHA Respiratory Protection Standard) or local equivalent. If exposed to airborne mist/aerosol of this product, use at least a NIOSH-approved N95 half-mask disposable or re-usable particulate respirator. In work environments containing oil mist/aerosol, use at least a NIOSH-approved P95 half-mask disposable or reuseable particulate respirator. If exposed to vapors from this product use a NIOSH/MSHA-approved respirator with an Organic Vapor cartridge.
Skin and body protection	Wear suitable protective clothing.
Hygiene measures	Wash hands before eating, drinking or smoking, Remove and wash contaminated clothing before re-use.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

Physical state	Solid powder
Appearance	Opaque
Odor	Mild Odorless
Color	White - Yellow
Odor threshold	Not applicable

Property	**Values**	**Remarks**
pH		
pH @ dilution	6.5-8.5 @ 1% in H2O	
Melting/freezing point		
Boiling point/range	No information available	
Flash point	Does not flash	
Evaporation rate (BuAc =1)	No information available	
Flammability (solid, gas)	Not Applicable	
Flammability Limits in Air		
Upper flammability limit	No information available	
Lower flammability limit	No information available	
Vapor pressure	0 mmHg	
Vapor density	Not applicable	
Specific gravity	0.3 - 0.5	
Bulk density	No information available	
Water solubility	Soluble in water	
Solubility in other solvents	No information available	
Autoignition temperature	No information available	
Decomposition temperature	No information available	
Kinematic viscosity	No information available	
Dynamic viscosity	No information available	
Log Pow	Not determined	
Explosive properties	Not Applicable	
Oxidizing properties	None known.	

9.2 Other information

Pour point	No information available
Molecular weight	No information available

VOC content(%) None
Density No information available

10. Stability and reactivity

10.1 Reactivity

No specific reactivity hazards associated with this product.

10.2 Chemical stability

Stable under normal temperature conditions and recommended use.

10.3 Possibility of Hazardous Reactions

Hazardous polymerization
Hazardous polymerization does not occur.

Hazardous Reactions
None known.

10.4 Conditions to avoid

Heat, flames and sparks.

10.5 Incompatible materials

Strong oxidizing agents.

10.6 Hazardous decomposition products

Carbon oxides (COx).

11. Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Inhalation Inhalation of dust may cause shortness of breath, tightness of the chest, a sore throat and cough.

Eye contact Dust may cause mechanical irritation.

Skin contact Repeated exposure may cause skin dryness or cracking.

Ingestion Irritant; may cause pain or discomfort to mouth, throat and stomach.

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Carbohydrate	= 27000 mg/kg (Rat)	> 2 g/kg (Rabbit)	> 5800 mg/m³ (Rat) 4 h

Component	IARC Group 1 or 2	ACGIH - Carcinogens	OSHA listed carcinogens	NTP
Carbohydrate	No data available	No data available	No data available	No data available

Sensitization This product does not contain any components suspected to be sensitizing.

Mutagenic effects This substance has no evidence of mutagenic properties.

Carcinogenicity	This substance has no evidence of carcinogenic properties.
Reproductive toxicity	None known.
Developmental toxicity	Not known to cause birth defects or have a deleterious effect on a developing fetus.
Routes of exposure	Inhalation. Skin contact. Eye contact.
Routes of entry	None known.
Specific target organ toxicity (single exposure)	Not classified
Specific target organ toxicity (repeated exposure)	Not classified.
Aspiration hazard	Not Applicable.

12. Ecological information

12.1 Toxicity

Toxicity to algae
See component information below.

Toxicity to fish
See component information below.

Toxicity to daphnia and other aquatic invertebrates
See component information below.

Component	Toxicity to fish	Toxicity to algae	Toxicity to daphnia and other aquatic invertebrates
Carbohydrate (60 - 100)	No information available	No information available	No information available

12.2 Persistence and degradability

No product level data available.

12.3 Bioaccumulative potential

No data available.

12.4 Mobility in soil

No information available.

12.5 Results of PBT and vPvB assessment

This substance is not considered to be persistent, bioaccumulating or toxic (PBT)
This substance is not considered to be very persistent nor very bioaccumulating (vPvB)

12.6 Other adverse effects.

None known.

13. Disposal considerations

13.1 Waste treatment methods

Disposal Method Disposal should be made in accordance with federal, state and local regulations.

Contaminated packaging Empty containers should be taken for local recycling, recovery or waste disposal.

14. Transport information

14.1 UN Number

UN/ID No. (ADR/RID/ADN/ADG)	Not regulated
UN No. (IMDG)	Not regulated
UN No. (ICAO)	Not regulated
UN No. (DOT)	Not regulated

14.2 Proper shipping name

Not regulated for transportation by DOT, TDG, IMDG and ICAO/IATA.

14.3 Hazard class(es)

ADR/RID/ADN Hazard class	Not regulated
IMDG Hazard class	Not regulated
ICAO Hazard class/division	Not regulated
DOT Hazard class	Not regulated

14.4 Packing group

ADR/RID/ADN Packing Group	Not regulated
IMDG Packing group	Not regulated
ICAO Packing group	Not regulated
DOT Packing group	Not regulated

Marine pollutant
No

14.6 Special precautions
Not Applicable

15. Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

International inventories

USA (TSCA)	Complies
European Union (EINECS and ELINCS)	Complies
Canada (DSL)	Complies
Philippines (PICCS)	Complies
Japan (ENCS)	Complies

China (IECSC)	Complies
Australia (AICS)	Complies
Korean (KECL)	Complies
New Zealand (NZIoC)	Complies

U.S. Federal and State Regulations

SARA 311/312 Hazard Categories
Not a SARA 311/312 hazard.

SARA 302/304, 313, CERCLA RQ, California Proposition 65
Note: If no components are listed below, this product is not subject to the referenced SARA and CERCLA regulations and is not known to contain a Proposition 65 listed chemical at a level that is expected to pose a significant risk under anticipated use conditions.

Component	SARA 302 / TPQs	SARA 313	CERCLA RQ
Carbohydrate	N/A	N/A	N/A

State Comments
Proposition 65: This product is not known to contain chemicals considered by the State of California's Safe Drinking Water and Toxic Enforcement Act of 1986 as causing cancer and/or reproductive toxicity at levels that are expected to pose a significant risk under anticipated use conditions.

Canadian Classification

This product has been classified in accordance with the hazard criteria of the CPR and the SDS contains all the information required by the CPR.

WHMIS Hazard Class Not a controlled product.

16. Other information

Supersedes date 14/Feb/2012

Revision date 08/Jan/2015

Version 4

The following sections have been revised All sections. Updated according to GHS/CLP.

HMIS classification

Health	0
Flammability	1
Physical hazard	0
PPE	E

N/A - Not Applicable, N/D - Not Determined.

†A mark of M-I L.L.C.

Disclaimer
The information contained herein is considered in good faith as reliable of the date issued and is based upon on measurements, tests or data derived from supplier's own study or furnished by others. In providing this SDS information, Supplier makes no express or implied warranties as to the information or product; merchantability or fitness of purpose; any express or implied warranty; or non-infringement of intellectual property rights; and supplier assumes no responsibility for any direct, special or consequential damages, results obtained, or the activities of others. To the maximum extent permitted by law, supplier's warranty obligations and buyer's sole remedies are as stated in separate agreement between the parties.

MICHELS®

POTENTIAL ADDITIVIVE

RING FREE

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SDS no. 12003
Version 3
Revision date 24/Jul/2014
Supersedes date 27/Dec/2013

Safety Data Sheet
RINGFREE†

1. Identification of the substance/preparation and of the Company/undertaking

1.1 Product identifier

Product name RINGFREE†
Product code 12003

1.2 Relevant identified uses of the substance or mixture and uses advised against

Recommended Use Drilling fluid additive

Uses advised against Consumer use

1.3 Details of the supplier of the safety data sheet

Supplier
M-I L.L.C.
P.O.Box 42842
Houston, TX 77242
www.miswaco.slb.com

Prepared by
Global Chemical Regulatory Compliance (GCRC) , Mike McDowell

1.4 Emergency Telephone Number

Emergency telephone - (24 Hour) Australia +61 2801 44558, Asia Pacific +65 3158 1074, China +86 10 5100 3039, Europe +44 (0) 1235 239 670, Middle East and Africa +44 (0) 1235 239 671, New Zealand +64 9929 1483, USA 001 281 561 1600
Telephone Number - 281-561-1512

2. Hazards identification

2.1 Classification of the substance or mixture

GHS - Classification

Not a dangerous substance or mixture according to the Globally Harmonized System (GHS)

Health hazards Not classified

Environmental hazards Not classified

Physical Hazards Not classified

2.2 Label elements

Not a dangerous substance or mixture according to the Globally Harmonized System (GHS)
Hazard statements
None

Precautionary statements
None

-

3. Composition/information on Ingredients

3.1 Substances

Not Applicable

3.2 Mixtures

Not Applicable

Comments
No classified ingredients, or those having occupational exposure limits, present above the level of disclosure.

4. First aid measures

4.1 Description of first-aid measures

Inhalation — If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Ingestion — Rinse mouth. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Get medical attention if symptoms occur.

Skin contact — Wash off immediately with soap and plenty of water removing all contaminated clothes and shoes. Get medical attention immediately if symptoms occur.

Eye contact — Remove contact lenses. Promptly wash eyes with lots of water while lifting eye lids. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

4.2 Most important symptoms and effects, both acute and delayed

General advice — The severity of the symptoms described will vary dependant of the concentration and the length of exposure. If adverse symptoms develop, the casualty should be transferred to hospital as soon as possible.

Main symptoms

Inhalation — Please see Section 11. Toxicological Information for further information.

Ingestion — Please see Section 11. Toxicological Information for further information.

Skin contact — Please see Section 11. Toxicological Information for further information.

Eye contact — Please see Section 11. Toxicological Information for further information.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician Treat symptomatically.

5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media
Use extinguishing media appropriate for surrounding material.

Extinguishing media which shall not be used for safety reasons
None known.

5.2 Special hazards arising from the substance or mixture

Unusual fire and explosion hazards
None known.

Hazardous combustion products
Carbon oxides (COx).

5.3 Advice for firefighters

Special protective equipment for fire-fighters
As in any fire, wear self-contained breathing apparatus and full protective gear.

Special Fire-Fighting Procedures
Containers close to fire should be removed immediately or cooled with water.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. See also section 8.

6.2 Environmental precautions

The product should not be allowed to enter drains, water courses or the soil.

Environmental exposure controls
Avoid release to the environment.

6.3 Methods and materials for containment and cleaning up

Methods for containment
Prevent further leakage or spillage if safe to do so. Dike far ahead of liquid spill for later disposal.

Methods for cleaning up
Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. After cleaning, flush away traces with water.

6.4 Reference to other sections

See section 13 for more information.

7. Handling and storage

7.1 Precautions for safe handling

Handling
Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin and eyes. Do not breathe vapors or spray mist. Avoid spills and splashing during use.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/precautions	Ensure adequate ventilation. Keep airborne concentrations below exposure limits.
Storage precautions	Keep containers tightly closed in a dry, cool and well-ventilated place.
Packaging material	Use specially constructed containers only

8. Exposure controls/personal protection

8.1 Control parameters

Exposure limits The product does not contain any hazardous materials with occupational exposure limits established.

8.2 Exposure controls

All chemical Personal Protective Equipment (PPE) should be selected based on an assessment of both the chemical hazard present and the risk of exposure to those hazards. The PPE recommendations below are based on an assessment of the chemical hazards associated with this product. Where this product is used in a mixture with other products or fluids, additional hazards may be created and as such further assessment of risk may be required. The risk of exposure and need of respiratory protection will vary from workplace to workplace and should be assessed by the user in each situation.

Engineering measures to reduce exposure
Ensure adequate ventilation.

Personal protective equipment

Eye protection	It is good practice to wear goggles when handling any chemical. Tightly fitting safety goggles.
Hand protection	Wear chemical resistant gloves such as nitrile or neoprene.
Respiratory protection	No personal respiratory protective equipment normally required, In case of insufficient ventilation wear suitable respiratory equipment.
Skin and body protection	Wear suitable protective clothing, Provide eyewash station.

Hygiene measures Wash hands before eating, drinking or smoking, Remove and wash contaminated clothing before re-use.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

Physical state	Liquid
Appearance	Transparent
Odor	Mild
Color	Light yellow
Odor threshold	Not applicable

Property	Values	Remarks
pH	6 - 8	

pH @ dilution	
Melting/freezing point	
Boiling point/range	90 °C / 194 °F
Flash point	No information available
Evaporation rate (BuAc =1)	
Flammability (solid, gas)	Not Applicable
Flammability Limits in Air	
Upper flammability limit	Not applicable
Lower flammability limit	Not applicable
Vapor pressure	No information available
Vapor density	No information available
Specific gravity	1.27
Bulk density	No information available
Relative density	No information available
Water solubility	Slightly soluble in water.
Solubility in other solvents	No information available
Autoignition temperature	No information available
Decomposition temperature	No information available
Kinematic viscosity	No information available
Dynamic viscosity	No information available
Log Pow	Does not bioaccumulate
Explosive properties	No information available
Oxidizing properties	No information available

9.2 Other information

Pour point	No information available
Molecular weight	No information available
VOC content(%)	No information available
Density	No information available

10. Stability and reactivity

10.1 Reactivity

No specific reactivity hazards associated with this product.

10.2 Chemical stability

Stable under normal temperature conditions and recommended use.

10.3 Possibility of Hazardous Reactions

Hazardous polymerization
Hazardous polymerization does not occur.

10.4 Conditions to avoid

None known.

10.5 Incompatible materials

Strong oxidizing agents.

10.6 Hazardous decomposition products

Carbon oxides (COx).

11. Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Inhalation	Inhalation of vapors in high concentration may cause irritation of respiratory system.
Eye contact	May cause slight irritation.
Skin contact	Prolonged contact may cause redness and irritation.
Ingestion	Ingestion may cause stomach discomfort.
Acute toxicity	0% of the mixture consists of ingredient(s) of unknown toxicity.

Sensitization	This product does not contain any components suspected to be sensitizing.
Mutagenic effects	No evidence of mutagenic properties.
Carcinogenicity	No evidence of carcinogenic properties.
Reproductive toxicity	No evidence of toxicity to reproduction.
Developmental toxicity	Not known to cause birth defects or have a deleterious effect on a developing fetus.
Routes of exposure	Eye contact. Skin contact. Inhalation.
Routes of entry	No route of entry noted.
Specific target organ toxicity (single exposure)	Not classified
Specific target organ toxicity (repeated exposure)	Not classified.
Aspiration hazard	Not Applicable.

12. Ecological information

12.1 Toxicity

Toxicity to algae
See component information below.

Toxicity to fish
See component information below.

Toxicity to daphnia and other aquatic invertebrates
See component information below.

12.2 Persistence and degradability

No product level data available.

12.3 Bioaccumulative potential

No data available.

12.4 Mobility in soil

No information available.

12.5 Results of PBT and vPvB assessment

This preparation contains no substance considered to be persistent, bioaccumulating nor toxic (PBT)
This preparation contains no substance considered to be very persistent nor very bioaccumulating (vPvB)

12.6 Other adverse effects.

None known.

13. Disposal considerations

13.1 Waste treatment methods

Waste from residues / unused products	Dispose of in accordance with local regulations.
Contaminated packaging	Empty containers should be taken for local recycling, recovery or waste disposal.

14. Transport information

14.1 UN Number

UN/ID No. (ADR/RID/ADN/ADG)	Not regulated
UN No. (IMDG)	Not regulated
UN No. (ICAO)	Not regulated
UN No. (DOT)	Not regulated

14.2 Proper shipping name

Not regulated for transportation by DOT, TDG, IMDG and ICAO/IATA.

14.3 Hazard class(es)

ADR/RID/ADN Hazard class	Not regulated
IMDG Hazard class	Not regulated
ICAO Hazard class/division	Not regulated
DOT Hazard class	Not regulated

14.4 Packing group

ADR/RID/ADN Packing Group	Not regulated
IMDG Packing group	Not regulated
ICAO Packing group	Not regulated
DOT Packing group	Not regulated

14.5 Environmental hazard

No

14.6 Special precautions
Not Applicable

15. Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

International inventories

USA (TSCA)	Complies
European Union (EINECS and ELINCS)	Does not Comply
Canada (DSL)	Complies
Philippines (PICCS)	Complies
Japan (ENCS)	Complies
China (IECSC)	Complies
Australia (AICS)	Complies
Korean (KECL)	Complies
New Zealand (NZIoC)	Complies

IMPORTS, Canada
No import volume restrictions.

U.S. Federal and State Regulations

SARA 311/312 Hazard Catagories Not a SARA 311/312 hazard.

State Comments
Proposition 65: This product is not known to contain chemicals considered by the State of California's Safe Drinking Water and Toxic Enforcement Act of 1986 as causing cancer and/or reproductive toxicity at levels that are expected to pose a significant risk under anticipated use conditions.

This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class Not a controlled product.

16. Other information

Supersedes date	27/Dec/2013
Revision date	24/Jul/2014
Version	3
The following sections have been revised	All sections. Updated according to GHS.

Health	0
Flammability	1
Physical hazard	0
PPE	E

Disclaimer
The information provided in this Material Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

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TORQMASTER

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WYO-BEN, INC.

SAFETY DATA SHEET

1. PRODUCT AND COMPANY IDENTIFICATION

Product identifier
Product Code 25392
Product Name **TORQMASTER®**

Other means of identification

Recommended use of the chemical and restrictions on use
Use only for the purpose on the product label.

Details of the supplier of the safety data sheet

Manufacturer / Manufactured For
WYO-BEN
1345 Discovery Dr
Billings, Montana 59102
Phone: 406-652-6351
Emergency telephone number
24 Hour Emergency Phone Number: 1-800-535-5053

2. HAZARDS IDENTIFICATION

This product is not classified according to paragraph (d) of 29 CFR 1910.1200 and does not require a hazard warning label.

Hazard Classification

Acute aquatic toxicity	Category 3
Chronic aquatic toxicity	Category 3

Signal Word
None

Hazard Statements
Harmful to aquatic life with long lasting effects

Hazard Symbol
None

Precautionary Statements - Prevention
Avoid release to the environment.

Precautionary Statements - Response
Specific Treatment (See Section 4 on the SDS).
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
IF ON SKIN: Wash with plenty of soap and water. Wash contaminated clothing before reuse.
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
IF SWALLOWED: Rinse mouth. DO NOT induce vomiting. Drink plenty of water.

Precautionary Statements – Storage
Keep out of reach of children.

Precautionary Statements - Disposal
Dispose of contents/container to an approved waste disposal plant.

Hazards not otherwise classified (HNOC)

Other Information

Unknown Acute Toxicity 0.06% of the mixture consists of ingredient(s) of unknown toxicity.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS No.	Weight-%	Trade Secret
PROPRIETARY	Proprietary	1-5	*
Sodium Carbonate	497-19-8	1-5	*

*The exact percentage (concentration) of composition has been withheld as a trade secret.

4. FIRST AID MEASURES

First aid measures

Skin Contact Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Wash contaminated clothing before reuse. If skin irritation persists, call a physician.

Eye contact Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. If irritation persists, call a physician.

Inhalation If mists/vapors are formed or irritation occurs, leave area and do not return until mists/vapors have dissipated. If irritation persists, see a physician.

Ingestion Rinse mouth. Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Drink plenty of water. If irritation persists, see a physician.

Most important symptoms and effects, both acute and delayed

Symptoms No Information available.

Indication of any immediate medical attention and special treatment needed

Note to physicians Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media

Caution: Use of water spray when fighting fire may be inefficient.

Specific hazards arising from the chemical

No Information available.

Explosion data

Sensitivity to Mechanical Impact None
Sensitivity to Static Discharge None

Protective equipment and precautions for firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA **Health Hazard 0** **Fire Hazard 0** **Reactivity 0**

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions Ensure adequate ventilation, especially in confined areas.

Environmental precautions

Environmental precautions See Section 12 for additional ecological information.

Methods and material for containment and cleaning up

Methods for containment Prevent further leakage or spillage if safe to do so.

Methods for cleaning up Soak up with inert absorbent material. Pick up and transfer to properly labeled containers.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage, including any incompatibilities

Storage Conditions Keep containers tightly closed in a dry, cool and well-ventilated place.

Incompatible materials None known based on information supplied.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Appropriate engineering controls

Engineering Controls Showers, Eyewash stations & Ventilation systems.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin and body protection Wear chemical resistant gloves.

Respiratory protection If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators or air purifying respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.

General Hygiene Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Viscous Liquid
Appearance	Pink, Dark
Odor	Mild
Odor threshold	No Information available

Property	Values
pH	9.5 - 11.5
Specific Gravity	1.01
Viscosity	No Information available
Melting point/freezing point	No Information available
Boiling point / boiling range	> 212 / ° F Degrees
Flash point	> 212 / ° F Degrees
Evaporation rate	No Information available
Flammability (solid, gas)	No Information available
Upper flammability limit:	No Information available
Lower flammability limit:	No Information available
Vapor pressure	No Information available
Vapor density	No Information available
Bulk Density Lbs/Gal	No Information available
Water solubility	Complete
Partition Coefficient (n-octanol/water)	No Information available
Autoignition temperature	No Information available
Decomposition temperature	No Information available
VOC Content (%)	No Information available

10. STABILITY AND REACTIVITY

Reactivity
No data available

Chemical stability
Stable under recommended storage conditions.

Possibility of Hazardous Reactions
None under normal processing.

Conditions to avoid
Extremes of temperature and direct sunlight.

Incompatible materials
None known based on information supplied.

Hazardous Decomposition Products
None known based on information supplied.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information No data available

Inhalation No data available.

Eye contact No data available.

Skin Contact No data available.

Ingestion No data available.

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50
Sodium Carbonate 497-19-8	= 4090 mg/kg (Rat)	-	= 2300 mg/m³ (Rat) 2 h

Information on toxicological effects

Symptoms No Information available.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Sensitization	No Information available.
Germ cell mutagenicity	No Information available.
Carcinogenicity	No Information available.
Reproductive toxicity	No Information available.
STOT - single exposure	No Information available.
STOT - repeated exposure	No Information available.
Aspiration hazard	No Information available.

Numerical measures of toxicity - Product Information

Unknown Acute Toxicity 0.05% of the mixture consists of ingredient(s) of unknown toxicity.
This is based upon values calculated per chapter 3.1 of the GHS document.

12. ECOLOGICAL INFORMATION

Ecotoxicity

0.05% of the mixture consists of components(s) of unknown hazards to the aquatic environment

Chemical Name	Algae/aquatic plants	Fish	Crustacea
PROPRIETARY	-	LC50 Oncorhynchus mykiss, 96 hr.,1.2 mg/L:	LC50 Daphnia sp., 48 hr., 5.3 mg/L
Sodium Carbonate 497-19-8	EC 50 Nitzschia sp.,120 hr.,242 mg/L	LC 50 Lepomis macrochirus, 96 hr., 300 mg/L static LC50 Pimephales promelas, 96 hr., 310 - 1220 mg/L., static	EC50 Daphnia magna, 48 hr., 265 mg/L

Persistence and degradability
No Information available.

Bioaccumulation
No Information available.

Other adverse effects No Information available.

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Disposal of wastes Disposal should be in accordance with applicable regional, national and local laws and regulations.

Contaminated packaging Do not reuse container.

This product contains one or more substances that are listed with the State of California as a hazardous waste.

Chemical Name	California Hazardous Waste Status
Sodium Carbonate 497-19-8	Corrosive

14. TRANSPORT INFORMATION

The shipping classification information in this section (Section 14) is meant as a guide to the overall classification of the product. However, transportation classifications may be subject to change with changes in package size. Consult shipper requirements under 49 CFR, IATA and IMDG to assure regulatory compliance.

DOT Not regulated

15. REGULATORY INFORMATION

International Inventories

TSCA	Complies
DSL/NDSL	Complies
EINECS/ELINCS	Does not comply
ENCS	Does not comply
IECSC	Does not comply
KECL	Does not comply
PICCS	Does not comply
AICS	Does not comply

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory.
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List.
EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances.
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
AICS - Australian Inventory of Chemical Substances

US Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311/312 Hazard Categories

Acute health hazard	No
Chronic Health Hazard	No
Fire hazard	No
Sudden release of pressure hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

US State Regulations

California Proposition 65

This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

This product does not contain chemicals subject to Right-To-Know regulations in other states.

U.S. EPA Label Information

EPA Pesticide Registration Number Not Applicable

16. OTHER INFORMATION

Prepared	12/17/2019
Last Revision	01/17/2020

DISCLAMER

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text. No warranty or guarantee, expressed or implied is made by WYO-BEN, INC. as to this information, or as to the safety, toxicity or effect of the use of this product.

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PLUGZ IT

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WYO-BEN, INC.

SAFETY DATA SHEET

SECTION 1 — CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Trade Name:	**PLUGZ-IT™ MAX**
Chemical Family:	Mineral
Application:	Sealing
Manufacturer/Supplier:	Wyo-Ben, Inc. 1345 Discovery Drive Billings, MT 59102 USA Telephone: 800.548.7055 Facsimile: 406.656.0748
Emergency Phone Number	CHEMTREC® 800.424.9300

SECTION 2 — HAZARD IDENTIFICATION

Hazard Symbol: Health Hazard

Signal Word: Warning

Hazard Overview:

ACUTE HEALTH HAZARD
May cause eye and respiratory irritation.

CHRONIC HEALTH HAZARD
Breathing crystalline silica can cause lung disease, including silicosis and lung cancer.

SECTION 3 — COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	Percent	ACGIH TLV-TWA	OSHA PEL-TWA*
Crystalline Silica, quartz	14808-60-7	1 – 6%	0.025 mg/m^3	$\frac{10\ mg/m^3}{\%SiO2 + 2}$

*More restrictive exposure limits may be enforced by some states, agencies, or other authorities.
Non-hazardous components > 94%

SECTION 4 — FIRST AID MEASURES

Inhalation:	If inhaled, remove to a dust free area. Get medical attention if respiratory irritation develops or if breathing becomes difficult. Inhalation may aggravate existing respiratory illness.
Skin:	Wash with soap and water until clear. Seek medical attention if irritation persists.
Eyes:	In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.
Ingestion:	No adverse effects.
Notes to Physician:	Treat Symptomatically.

SECTION 5 — FIRE FIGHTING MEASURES

Flash Point/Range (F):	Not applicable
Flash Point/Range (C):	Not applicable
Flash Point Method:	Not applicable
Autoignition Temperature (F):	Not applicable
Autoignition Temperature (C):	Not applicable
Flammability Limits in Air – Lower (%):	Not applicable
Flammability Limits in Air – Upper (%):	Not applicable
Fire Extinguishing Media:	All standard firefighting media. (Caution slippery when wet.)
Special Exposure Hazards:	Not applicable
Special Protective Equipment for Firefighters:	Not applicable
NFPA Ratings:	Health 0, Flammability 0, Reactivity 0

SECTION 6 — ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures:	Use appropriate protective equipment. Avoid creating and breathing dust.
Environmental Precautionary Measures:	None known.
Procedure for Cleaning/Absorption:	Collect using appropriate dustless method and hold for appropriate disposal.

SECTION 7 — HANDLING AND STORAGE

Handling Precautions:	This product contains quartz which may become airborne. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposure below recommended exposure limits. Wear a NIOSH/MSHA European Standard En 149, or equivalent certified for silica bearing dust, respirator when using this product. Material is slippery when wet. Promptly clean up spills to avoid breathing airborne dust.
Storage Information:	Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container.

SECTION 8 — EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls:	Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits.
Personal Protective Equipment:	If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.
Respiratory Protection:	Not normally needed. If significant exposures are possible use NIOSH/MSH respirator approved for silica bearing dust.
Hand Protection:	Normal work gloves.
Skin Protection:	Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.
Eye Protection:	Wear safety glasses or goggles to protect against exposure.
Other Precautions:	None known.

SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid
Color:	Light tan to gray as dry powder
Odor:	Odorless
pH:	8 – 10 (5% aqueous solution)
Specific Gravity @ 20 C (Water=1):	2.45 – 2.55
Density @ 20 C (lbs/gallon):	Not determined
Bulk Density @ 20 C (lbs/ft^3):	60 – 66
Boiling Point/Range (F):	Not applicable
Boiling Point/Range (C):	Not applicable
Freezing Point/Range (F):	Not applicable
Freezing Point/Range (C):	Not applicable
Vapor Pressure @ 20 C (mmHg):	Not applicable
Vapor Density (Air=1):	Not applicable
Percent Volatiles:	Not applicable
Evaporation Rate (Butyl Acetate=1):	Not applicable
Solubility in Water (g/100ml):	Insoluble, forms colloidal suspension
Solubility in Solvents (g/100ml):	Not applicable
VOCs (lbs/gallon):	Not applicable
Viscosity, Dynamic @ 20 C (centipoise):	240
Viscosity, Kinematic @ 20 C (centistrokes):	Not applicable
Partition Coefficient/n-Octanol/Water:	Not applicable
Molecular Weight (g/mole):	Not applicable

SECTION 10 — STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid:	None anticipated
Incompatibility (Materials to Avoid):	Hydrofluoric Acid
Hazardous Decomposition Products:	None
Additional Guidelines:	Not applicable

SECTION 11 — TOXICOLOGICAL INFORMATION

Principle Route of Exposure:	Eye or skin contact, inhalation.
Inhalation:	Inhaled crystalline silica in the form or quartz from occupational sources is carcinogenic to humans (IARC, Group 1).
Skin Contact:	May cause mechanical skin irritation.
Eye Contact:	May cause eye irritation.
Ingestion:	None known
Aggravated Medical Conditions:	Individuals with respiratory disease, including but not limited to asthma and bronchitis, or subject to eye irritation, should not be exposed to respirable quartz-bearing dust.
Chronic Effects/Carcinogenicity:	Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis. Cancer Status: The International Agency for Research on Cancer (IARC, 1997) concludes that there is sufficient evidence in humans for carcinogenicity of inhaled crystalline silica from occupational sources (IARC Group 1), that carcinogenicity was not detected in all industrial circumstances studied and that carcinogenicity may depend on characteristics of the crystalline silica or on external factors affecting its biological activity. See IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997). The National Toxicology Program (NTP) classifies respirable crystalline silica as "Known to be a human carcinogen" (NTP 9th Report on Carcinogens, 2000). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies crystalline silica, quartz, as a suspected human carcinogen (A2).
Other Information:	See "Adverse Effects of Crystalline Silica Exposure" published by the American Thoracic Society Medical Section of the American Lung Association, American Journal of Respiratory and Critical Care Medicine, Volume 155, pages 761-768 (1997).
Toxicity Tests	
Oral Toxicity:	Not determined (on FDA GRAS list; used as a food additive)
Dermal Toxicity:	Not determined (on FDA GRAS list; used in cosmetic preparations)
Inhalation Toxicity:	Not determined
Primary Irritation Effect:	Not determined
Carcinogenicity:	Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997).
Genotoxicity:	Not determined
Reproductive/Developmental Toxicity:	Not determined

SECTION 12 — ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air):	Not determined
Persistence/Degradability:	Not determined
Bio-accumulation:	Not determined

Ecotoxicological Information

Acute Fish Toxicity:	Not determined
Acute Crustaceans Toxicity:	Not determined
Acute Algae Toxicity:	Not determined

Chemical Fate Information:	Not determined
Other Information:	Not applicable

SECTION 13 — DISPOSAL CONSIDERATIONS

Disposal Method:	Bury in a licensed landfill according to federal, state and local regulations.
Contaminated Packaging:	Follow all applicable national or local regulations.

SECTION 14 — TRANSPORT INFORMATION

Land Transportation

DOT – Not Restricted
Canadian TDG – Not Restricted
ADR – Not Restricted

Air Transportation

ICAO/IATA – Not Restricted

Sea Transportation

IMDG – Not Restricted

Other Transportation Information

Labels: None

SECTION 15 — REGULATORY INFORMATION

US Regulations

US TSCA Inventory	All components listed on inventory or are exempt.
EPA SARA Title III Extremely Hazardous Substances	Not applicable
EPA SARA (311, 312) Hazard Class	Acute Health Hazard Chronic Health Hazard
EPA SARA (313) Chemicals	This product does not contain a toxic chemical for routine annual “Toxic Chemical Release Reporting” under Section 313 (40 CFR 372).

EPA CERCLA/Superfund Reportable Spill Quantity	Not applicable
EPA RCRA Hazardous Waste Classification	If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.
California Proposition 65	This product contains crystalline silica (respirable) which is a substance known to the State of California to cause cancer.

Canadian Regulations

Canadian DSL Inventory	All components listed on inventory are exempt.
WHMIS Hazard Class	This product contains crystalline silica (respirable) and is classified as a Class D, Division 2, Subdivision A substance.

SECTION 16 — OTHER INFORMATION

Prepared	03/18/2015
Last Revision	07/23/2015

DISCLAIMER

All information presented herein is believed to be accurate; however, it is the user's responsibility to determine in advance of need that the information is current and suitable for their circumstances. No warranty or guarantee, expressed or implied is made by WYO-BEN, INC. as to this information, or as to the safety, toxicity or effect of the use of this product.

POTENTIAL ADDITIVIVE

CLAY CUTTER

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MATERIAL SAFETY DATA SHEET

1. Product and Company Identification

Material name CLAY CUTTER™

Version # 05

Revision date 19-December-2008

Chemical name Formation Inhibitor

Chemical description Liquid

CAS # Mixture

Manufacturer

CETCO
Drilling Products Group
2870 Forbs Avenue
Hoffman Estates, IL 60192 US
safetydata@amcol.com
http://www.cetco.com/
General Information (800) 527-9948
CHEMTREC® (800) 424-9300

2. Hazards Identification

Emergency overview No hazards resulting from the material as supplied. Health injuries are not known or expected under normal use.

OSHA regulatory status While this material is not considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200), this MSDS contains valuable information critical to the safe handling and proper use of the product. This MSDS should be retained and available for employees and other users of this product.

Potential health effects

Eyes Contact with eyes may cause irritation.

Skin May cause skin irritation in susceptible persons.

Inhalation Health injuries are not known or expected under normal use.

Ingestion Ingestion of this product may cause nausea, vomiting and diarrhea.

3. Composition / Information on Ingredients

The manufacturer lists no ingredients as hazardous according to OSHA 29 CFR 1910.1200.

Composition comments This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

4. First Aid Measures

First aid procedures

Eye contact Immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation develops or persists.

Skin contact Wash off with soap and water. Remove contaminated clothing. Get medical attention if irritation develops or persists.

Inhalation Remove to fresh air. If the affected person is not breathing, apply artificial respiration. If breathing is difficult, give oxygen. Get medical attention, if needed.

Ingestion Give victim water or milk. If swallowed, do NOT induce vomiting. Never give anything by mouth to an unconscious person. Obtain medical attention.

General advice If you feel unwell, seek medical advice (show the label where possible).

5. Fire Fighting Measures

Flammable properties Not a fire hazard.

Extinguishing media

Suitable extinguishing media Use any media suitable for the surrounding fires.

Protection of firefighters

Protective equipment and precautions for firefighters	Move containers from fire area if you can do it without risk. Cool containers with flooding quantities of water until well after fire is out.
Hazardous combustion products	None known.

6. Accidental Release Measures

Environmental precautions	Prevent spreading over a wide area (e.g. by containment or oil barriers). Prevent further leakage or spillage if safe to do so. Do not flush into surface water or sanitary sewer system.
Methods for containment	Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible.
Methods for cleaning up	Absorb spill with inert material (e.g., dry sand or earth), then place in a chemical waste container. Do not allow the spilled product to enter public drainage system or open water courses. Wear appropriate protective equipment and clothing during clean-up.

7. Handling and Storage

Handling	Use only in well-ventilated areas. Provide sufficient air exchange and/or exhaust in work rooms. In case of insufficient ventilation, wear suitable respiratory equipment.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Store in original container.

8. Exposure Controls / Personal Protection

Engineering controls	Good general ventilation should be sufficient to control airborne levels. Local exhaust is suggested for use, where possible, in enclosed or confined spaces. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower.

Personal protective equipment

Eye / face protection	Wear safety glasses; chemical goggles (if splashing is possible).
Skin protection	Wear appropriate chemical resistant gloves. Use of an impervious apron is recommended.
Respiratory protection	None required where adequate ventilation conditions exist.
General hygeine considerations	Use good industrial hygiene practices in handling this material. Wash hands before breaks and immediately after handling the product.

9. Physical & Chemical Properties

Appearance	Not available.
Color	Not available.
Odor	Not available.
Odor threshold	Not available.
Physical state	Liquid.
Form	Liquid.
pH	Not available.
Melting point	Not available.
Freezing point	Not available.
Boiling point	Not available.
Flash point	Not available.
Evaporation rate	Not available.
Flammability	Not available.
Flammability limits in air, upper, % by volume	Not available.
Flammability limits in air, lower, % by volume	Not available.
Vapor pressure	Not available.
Vapor density	Not Determined
Specific gravity	Not available.
Relative density	Not available.
Solubility (water)	Not available.

Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Percent volatile	50 % v/v

10. Chemical Stability & Reactivity Information

Chemical stability	No hazards to be especially mentioned. Stable at normal conditions.
Conditions to avoid	None known.
Incompatible materials	None known.
Hazardous decomposition products	Upon decomposition, this product may yield gaseous nitrogen oxides, carbon monoxide, carbon dioxide and/or low molecular weight hydrocarbons.
Possibility of hazardous reactions	Will not occur.

11. Toxicological Information

Component analysis - LD50	This product is judged to have an acute oral LD50 (rat) greater than 5 g/kg of body weight, and ar acute dermal LD50 (rabbit) greater than 3.16 g/kg of body weight.
Further information	This product has no known adverse effect on human health.

12. Ecological Information

Ecotoxicity	This material is not expected to be harmful to aquatic life. This material has a biodegradatior percentage of 85.2% and is considered to have ready biodegradability. This material exceeds the OECD Guideline 301B for environmental friendliness
Environmental effects	Ecological injuries are not known or expected under normal use.
Persistence and degradability	Not available.

13. Disposal Considerations

Disposal instructions	Dispose in accordance with all applicable regulations.

14. Transport Information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory Information

US federal regulations	OSHA Process Safety Standard: This material is not known to be hazardous by the OSHA Highly Hazardous Process Safety Standard, 29 CFR 1910.119.

CERCLA (Superfund) reportable quantity

None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - No Delayed Hazard - No Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No
Section 302 extremely hazardous substance	No
Section 311 hazardous chemical	No

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	No

Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	No
Europe	European Inventory of New and Existing Chemicals (EINECS)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	No
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	No

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

State regulations This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

16. Other Information

Further information This safety datasheet only contains information relating to safety and does not replace any product information or product specification.

HMIS ratings

NFPA ratings Health: 0
Flammability: 0
Instability: 0

Disclaimer The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The manufacturer expressly does not make any representations, warranties, or guarantees as to its accuracy, reliability or completeness nor assumes any liability, for its use. It is the user's responsibility to verify the suitability and completeness of such information for each particular use.

Third party materials: Insofar as materials not manufactured or supplied by this manufacturer are used in conjunction with, or instead of this product, it is the responsibility of the customer to obtain, from the manufacturer or supplier, all technical data and other properties relating to these and other materials and to obtain all necessary information relating to them. No liability can be accepted in respect of the use of this product in conjunction with materials from another supplier.

Issue date 19-December-2008

This data sheet contains changes from the previous version in section(s): Composition / Information on Ingredients: Component information

MICHELS®

POTENTIAL ADDITIVIVE

CLAY BREAKER

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1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

TRADE NAME: ClayBreaker

24-HOUR EMERGENCY TELEPHONE: 1-800-535-5053 (Infotrac)

SUPPLIER: DCS Fluids Solutions LP
P.O. Box 1027
Graham, TX 76450
(940) 521-0400

Product Use: Well Stimulation Additive, Clay Stabilizer
CAS #: Mixture

2. COMPOSITION, INFORMATION ON INGREDIENTS

No hazardous ingredients as defined by OSHA 29 CFR 1910.1200

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Colorless to amber liquid with a strong odor. May be irritating to eyes, skin and respiratory tract. May be harmful if swallowed. Avoid contact with skin, eyes and clothing.

POTENTIAL HEALTH HAZARDS:

- **INHALATION:** May cause irritation of respiratory tract.
- **INGESTION:** May cause irritation of the gastrointestinal tract including nausea, vomiting and diarrhea.
- **SKIN:** May cause skin irritation.
- **EYES:** May cause eye irritation.

CHRONIC EFFECTS: None known

Ingredients found on one of the OSHA designated carcinogen lists are listed below.

No ingredients listed in this section.

4. FIRST AID MEASURES

INHALATION: If breathing is difficult, remove to fresh air and keep at rest in a comfortable position for breathing. Obtain immediate medical attention.

INGESTION: If swallowed, seek immediate medical attention and show this container or label. Do not induce vomiting without medical advice.

SKIN: Wash skin thoroughly with soap and water. Remove contaminated clothing. Get medical attention if any irritation continues.

EYES: Immediately flush eyes with large quantities of water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of all eye and lid tissue. Get medical attention if irritation develops.

ADVICE TO PHYSICIANS: No specific treatment. Treat according to symptoms present.

5. FIRE FIGHTING MEASURES

FLASH POINT: >200° F (>93.3° C)
FLAMMABLE LIMITS: LEL: N/A
UEL: N/A

EXTINGUISHING AGENTS:

Water, dry chemical, CO2, water spray or regular foam.
Do not use a solid water stream as it may scatter and spread fire.

SPECIAL FIRE FIGHTING PROCEDURES:

Wear positive-pressure, self-contained breathing apparatus (SCBA) and protective fire fighting clothing (including fire fighting helmet, coat, pants, boots, and gloves). If protective equipment is not available or not used, fight fire from a protected location or safe distance.

UNUSUAL FIRE & EXPLOSION HAZARDS:

Always stay away from tanks engulfed in flame. Withdraw immediately in case of rising sound from venting safety devices of any discoloration of tanks due to fire. Move containers from fire area if you can do it without risk. Do not scatter spilled material with high pressure water streams. Use water spray to cool unopened containers. Cool containers with flooding quantities of water until well after fire is out.

6. ACCIDENTAL RELEASE MEASURE

PERSONAL PROTECTION:

Don appropriate personal protective equipment prior to entering spill/leak area.
(See Section 8)

SPILL CLEAN-UP PROCEDURES:

Limit access to area, as necessary. Shut off leak if it can be done safely. Contain spill with dike. Prevent run-off into sewers or waterways. Pump large spills into salvage containers. Soak up residue and small spills with vermiculite, paper, clay or other absorbent material. Remove affected soils. Place in salvage containers. Continue to observe handling precautions.

WASTE DISPOSAL METHOD:

Follow approved local beneficial reuse guidelines for uncontaminated spent drilling fluids. If contaminated, dispose of in a licensed industrial landfill according to local, state and federal regulations. If released to the environment for other than its intended purpose, this product, in its current state, does not meet the definition of a hazardous waste under 40 CFR 261.

7. HANDLING AND STORAGE

HANDLING PRECAUTIONS:

Always wear recommended personal protection equipment. Do not get in eyes, on skin or clothing. Avoid breathing mist or vapor. Use only with adequate ventilation or wear respiratory protection.

STORAGE PRECAUTIONS:

Keep containers tightly closed and properly labeled. Store at moderate temperatures in dry, well-ventilated area. Keep container closed when not in use. Keep in original container. Store containers in upright position. Since emptied containers retain product residue, follow hazard precautions even when empty.

HYGIENIC WORK PRACTICES:

Use good personal hygiene practices. Wash hands and skin thoroughly after handling. Promptly remove contaminated clothing and wash before reuse. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

ENGINEERING CONTROLS:

There are no occupational exposure limits established at this time. Since this material may be irritating to skin and mucous membranes, general room ventilation plus local exhaust at points of emission should be used to maintain levels of airborne contaminants as low as feasibly possible.

PERSONAL PROTECTION EQUIPMENT

RESPIRATORY:

Respiratory protection is not required under normal use. Wear a NIOSH/MSHA approved respirator following manufacturer's recommendations where airborne contaminants may occur.

EYE / FACE PROTECTION:

Wear chemical safety goggles or face shield to protect against splashing.

SKIN PROTECTION:

Chemical resistant gloves and splash aprons made of impermeable material should be worn.

9. PHYSICAL AND CHEMICAL PROPERTIES

- **Appearance and Odor:** Colorless to amber liquid with strong odor.
- **Physical State:** Liquid
- **pH:** 6.5 – 9
- **Vapor Pressure:** Not determined
- **Vapor Density:** Not determined
- **Boiling Point:** Not determined
- **Melting Point:** 469.4° F estimated
- **Solubility in Water:** Complete
- **Specific Gravity:** 1.01 – 1.03

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable at normal conditions**.**

CONDITIONS TO AVOID: Heat, flames and sparks.

MATERIALS TO AVOID: Strong acids.

HAZARDOUS DECOMPOSITION PRODUCTS: None expected.

HAZARDOUS POLYMERIZATION: Does not occur.

11. TOXICOLOGICAL INFORMATION

ACUTE EFFECTS:

Acute LD50: 400 – 4000 mg/kg, Rat, Oral
Acute LC50: > 4000 mg/kg, Rat, Dermal

Not expected to be hazardous by OSHA criteria.

CHRONIC EFFECTS:

None known. Not expected to be hazardous by OSHA criteria.
This product has no known adverse effect on human health.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL INFORMATION:

ClayBreaker has a biodegradation percentage of 85.2% and is considered to have ready biodegradability. Test of ready biodegradability are stringent tests that provide limited opportunity for acclimation and biodegradation to occur. A positive result in a test of ready biodegradability is an indication that the test substance will undergo rapid and ultimate biodegradation in the environment. OECD Guideline 301B has set the standard for ready biodegradability at 60%. ClayBreaker exceeds this standard for environmental friendliness.

13. DISPOSAL CONSIDERATIONS

Follow approved local beneficial reuse guidelines for uncontaminated spent drilling fluids. If contaminated, dispose of in a licensed industrial landfill according to local, state and federal regulations. If released to the environment for other than its intended purpose, this product does not meet, in its present state, the definition of a hazardous waste under 40 CFR 261. Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for a hazardous waste. Dispose in accordance with all applicable regulations.

14. TRANSPORTATION INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION (DOT):

Not regulated as dangerous goods.

CANADIAN TRANSPORTATION OF DANGEROUS GOODS (TDG):

Not regulated as dangerous goods.

IMDG:

Not regulated as dangerous goods.

IATA:

Not regulated as dangerous goods.

15. REGULATORY INFORMATION

OSHA: This product is not a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200. We request that you make all information in the Material Safety Data Sheet available to your employees.

TSCA: Not on inventory.

SARA TITLE III/CERCLA:

To aid our customers in complying with regulatory requirements, SARA Title III Hazard Categories for this product are indicated below. If the word "YES" appears next to any category, this product may be reportable by you under the requirements of 40 CFR Part 370. Please consult those regulations for details.

Immediate (Acute) Health:	YES
Delayed (Chronic) Health:	NO
Fire Hazard:	NO
Reactive Hazard:	NO
Sudden Release of Pressure:	NO

Reportable Quantity: Not reportable

Spills/release resulting in the loss of any ingredient at or above its RQ requires immediate notification to the National Response Center (1-800-424-8802) and to your Local Emergency Planning Committee.

16. OTHER INFORMATION

HMIS RATINGS: HEALTH (1) FLAMMABILITY (0) PHYSICAL HAZARD (0)
Based on the NPCA HMIS III rating system.

CURRENT ISSUE DATE: August 1, 2014
Updated information on LD50 and LC50.

DCS Fluid Solutions LP believes the information contained in this material safety data sheet is accurate based on the information supplied by reputable suppliers of our raw materials. We cannot make any assertions as to its reliability or completeness; therefore, the user may rely on it only at user's risk. We have made no effort to censor or conceal deleterious aspects of this product. Since we cannot anticipate or control the conditions under which this information and product may be used, we make no guarantee that the precautions we have suggested will be adequate for all individuals and/or situations. It is the obligation of each user of this product to comply with the requirements of all applicable laws regarding use and disposal of this product. Neither warranty, either expressed or implied, nor liability of any nature with respect to this product or to the data herein is made or incurred hereunder.

MICHELS®

POTENTIAL ADDITIVIVE

TORQUE BREAKER

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MATERIAL SAFETY DATA SHEET

5/04/04

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: TorqBreaker™
Chemical Family: Surfactant
Supplier: DCS Fluid Solutions.
PO Box1027
Graham TX 76450
940-521-0500

2. COMPOSITION/INFORMATION ON INGREDIENTS

OSHA Regulated Components: None

3. HAZARDS IDENTIFICATION

Acute Health Effects: None
Chronic Health Effects: None
Carcinogen: No

PRIMARY ENTRY ROUTES:

1) Skin and Eyes: Repeated contact with the skin may be irritating. Eye contact may be irritating.
2) Ingestion: May be harmful.
3) Inhalation: Not considered a hazard.

4. FIRST AID MEASURES

SKIN CONTACT:	Remove contaminated clothing without delay. Wash skin thoroughly with water. If irritation persists, get medical attention.
EYE CONTACT:	Rinse thoroughly with plenty of water for 15 minutes. In case of persistent eye irritation, consult a physician.
INGESTION:	Give large volumes of water. Do not induce vomiting. Get medical attention.
INHALATION:	N/A

5. FIRE FIGHTING MEASURES

FLASH POINT: None (will not burn)
EXTINGUISHING MEDIA: N/A
FIRE FIGHTING PROCEDURES: N/A

UNUSUAL FIRE AND EXPLOSION HAZARD: Fire fighters should observe all precautions that apply to any fire where chemicals are stored.

6. ACCIDENTAL RELEASE MEASURES

If product leaks or spills, flood area with water. Mop up and dispose to sanitary sewer. Adhere to all Federal, State and Local Regulations.

7. HANDLING AND STORAGE

Store containers tightly closed and in an upright position.
Do not destroy or deface the label.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Food, beverages and tobacco products should not be carried, stored or consumed where this material is in use. Before eating, drinking or smoking, wash face and hands with soap and water. Avoid skin contact. Protective clothing such as impervious gloves are recommended to prevent skin contact. For operations where eye or face contact can occur, wear eye protection such as chemical splash proof goggles or face shield.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Viscous Liquid
Color:	Red
Odor:	Slight Citrus
Solubility:	Completely soluble in water
Specific Gravity:	1.035
pH	10.0
Freezing Point:	N/A
Flash Point:	None (will not burn)
Vapor Pressure	N/A

10. STABILITY AND REACTIVITY

STABILITY: Stable Conditions to Avoid: None known
POLYMERIZATION: Will not occur. Conditions to Avoid: None known

11. TOXICOLOGICAL INFORMATION

None Available

12. ECOLOGICAL INFORMATION

None Available

13. DISPOSAL INFORMATION

If released into the environment for other than its intended purpose, this product does not meet the definition of a hazardous waste under 40 CFR 261. Follow approved local beneficial reuse guidelines for uncontaminated spent drilling fluids. If contaminated, dispose of in a licensed industrial landfill according to local, state and federal regulations..Recover and reuse if possible.

14. TRANSPORT INFORMATION

SHIPPING NAME: Not applicable/Not Regulated
HAZARD CLASS: Not applicable
UN NUMBER: Not applicable
DOT HAZARDOUS SUBSTANCES: Not applicable
TRANSPORT LABEL: None Required

15. REGULATORY INFORMATION

US TSCA: All components of this product are included on the TSCA Inventory in compliance with the Toxic Substances Control Act, 15 U.S.C. 2601

SECTION 313 SUPPLIER NOTIFICATION (SARA): This product contains the following toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right to Know Act of 1986 and of 40 CFR 372: None.

16. OTHER INFORMATION – NFPA Hazard Rating

Fire
0
Health 0 0 Reactivity
2
PPE

Health: 0=minimal
1=slightly hazardous
2=hazardous
3=serious hazard
4=severe hazard

Fire: 0=will not burn
1=FP>141F
2=FP>73=<141F
3=FP<73F
4=BP<95F FP by Pensky Marten closed cup

Reactivity: 0=None

PPE 0=not necessary

1=mild	1=goggles
2=strong	2=goggles, gloves
	3=goggles, gloves, protective clothes
	4=goggles, gloves, respirator

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POTENTIAL ADDITIVIVE

BALL BUSTER

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BHS Marketing

Western Briquette

BALLBUSTER

MATERIAL SAFETY DATA SHEET

Sodium Acid Pyrophosphate

Date: June 20, 2001

I Company Identification

Company Name:	BHS Marketing / Western Briquette
Mailing Address:	P.O. Box 27955 SLC, UT 84127-0955
Physical Address:	2320 West Indiana Ave. SLC, UT 84104
Telephone:	(801) 973-8232
Fax:	(801) 973-8838
Emergency Number:	Chemtrec (800) 424-9300

II Product Identification

Product Name:	Sodium Acid Pyrophosphate, SAPP, Disodium pyrophosphate
Chemical Formula:	$Na_2H_2P_2O_7$
Molecular Weight:	221.96
CAS Number:	7758-16-9

III Typical Physical Properties

Physical Appearance:	White powder
Odor:	Odorless
Bulk Density:	0.9 kg/l approx.
pH (1% aqueous solution):	3.7-4.4
Melting Point:	Decomposes at 220°C
Solubility in Water:	approx. 13g in 100g water, room temperature
Vapor Pressure:	Negligible

IV Reactivity Data

Chemical Stability:	Stable
Materials to Avoid:	Avoid contact with strong bases

V Toxicological Information

Toxicity:	Oral-rat LD-50: > 1000 mg/kg

VI Hazard Data

Acute	
Eye Contact:	Causes irritation
Skin Contact:	Causes irritation
Ingestion:	Causes irritation
Inhalation:	Causes irritation
Symptoms of Overexposure:	Irritant to eyes, skin and respiratory systems. Ingestion can cause vomiting and diarrhea

VII Recommended First Aid Measures

General First Aid:	Remove the person from source of exposure. Wash with plenty of water. Upon ingestion, if the person is conscious, cause him/her to vomit. Get medical attention

VIII Fire Fighting Measures

Flash Point:	Not flammable
Extinguishing Media:	Not combustible
Special Firefighting Procedures:	Protective clothing and self contained breathing apparatus

IX Accidental Release Measures

Clean up & Disposal of Spills:	Spillage or leakages are cleaned up by mechanical removal, if possible. Flushing with plenty of water

X Handling & Storage

Handling:	Avoid inhalation, contact with eyes, skin or clothing. Do not ingest
Storage:	Store in a cool, well ventilated, dry place, in tightly closed containers

XI Exposure Controls/ Personal Protection

Appropriate Hygienic Practices:	As part of good industrial, personal hygiene and safety procedure, avoid all unnecessary exposure to the product and ensure prompt removal from eyes, skin and clothing. Maintain good housekeeping to control dust accumulations.

Personal Protection Equipment

Eye Protection:	Use safety glasses
Skin Protection:	Wear protective clothing, gloves and dust respirator if necessary
Ventilation Protection:	Adequate ventilation

XII Additional Information

The information in this MSDS was obtained from sources, which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness.

The conditions or methods of handling, storage, use and disposal are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use or disposal of the product.

*n/a= Not Applicable

MICHELS®

POTENTIAL ADDITIVIVE

SODA ASH

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Soda Ash / Sodium Carbonate

Revision Date: 1/18/2016

SAFETY DATA SHEET

1 PRODUCT AND COMPANY IDENTIFICATION

1.1 PRODUCT IDENTIFIERS

Product Name:	Soda Ash or Sodium Carbonate
Chemical Name:	Sodium Carbonate
Synonyms / Common Names:	Carbonic Acid Sodium Salt
Registration Number REACH:	01-2119485498-19-0011
Product Type REACH:	Substance/mono-constituent
CAS Number:	497-19-8
EC Index Number:	011-005-00-2
EC Number:	207-838-8
RTECS Number:	VZ4050000

1.2 RELEVANT IDENTIFIED USES

Glass production	Paper production	Manufacture of substances
Detergent component	Laboratory chemicals	Acidity regulator

1.3 MANUFACTURER

Ciner Wyoming LLC
254 County Road 4-6
Green River, Wyoming 82935
United States
Telephone Number: (307) 875-2600
www.ciner.us.com

1.4 EMERGENCY TELEPHONE NUMBER

Emergency Response Information Provider: CHEMTREC

Within the United States Emergency Telephone Number: 1-800-424-9300

Outside the United States / International Emergency Telephone Number: +1-703-527-3887

2 HAZARD(S) IDENTIFICATION

2.1 CLASSIFICATION OF THE SUBSTANCE OR MIXTURE

GHS Classification in accordance with 29 CFR 1910 (OSHA HazCom Standard):

Eye Irritation (Category 2A), H319

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS LABEL ELEMENTS, INCLUDING PRECAUTIONARY STATEMENTS

Pictograms:

Irritant

Signal Word: Warning

Hazard Statement(s):

H319 Causes serious eye irritation.

Precautionary Statement(s):

P264 Wash skin thoroughly after handling.

P280 Wear eye protection / face protection.

P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P337 + P313 If eye irritation persists: Get medical advice / attention.

2.3 HAZARDS NOT OTHERWISE CLASSIFIED OR NOT COVERED BY GHS

None

3 COMPOSITION / INFORMATION ON INGREDIENTS

3.1 SUBSTANCES

Synonyms:	Soda Ash, Sodium Carbonate, Carbonic Acid Sodium Salt
Formula:	Na_2CO_3

Molecular Weight: 105.99 g/mol

Component (REACH Registration)	CAS # / EC #	Concentration	Classifications	Remark
Sodium carbonate (01-2119485498-19-0011)	CAS #: 497-19-8 EC #: 207-838-8	≥ 99%	Eye Irrit. 2A, H319	Mono-constituent

* For the full text of the H-Statements mentioned in this Section, see Section 16.

4 FIRST-AID MEASURES

4.1 DESCRIPTION OF FIRST-AID MEASURES

General - Check the vital functions. Unconscious: maintain adequate airway and respiration. Respiratory arrest: artificial respiration or oxygen. Cardiac arrest: perform resuscitation. Victim conscious with labored breathing: half-seated. Victim in shock: on his back with legs slightly raised. Vomiting: prevent asphyxia/aspiration pneumonia. Prevent cooling by covering the victim (no warming up). Keep watching the victim. Give psychological aid. Keep the victim calm, avoid physical strain. Depending on the victim's condition: doctor/hospital.

After inhalation - Remove the victim into fresh air. Respiratory problems: consult a doctor/medical service.

After skin contact - Rinse with water. Soap may be used. Do not apply (chemical) neutralizing agents. Take victim to a doctor if irritation persists.

After eye contact - Rinse immediately with plenty of water for at least 15 minutes. Do not apply neutralizing agents. Take victim to an ophthalmologist if irritation persists.

After ingestion - Rinse mouth with water. Immediately after ingestion: give lots of water to drink. Do not induce vomiting. Consult a doctor/medical service if victim is unwell.

4.2 MOST IMPORTANT SYMPTOMS AND EFFECTS, BOTH ACUTE AND DELAYED

4.2.1 Acute Symptoms

If inhaled - Dry/sore throat. Coughing. Slight irritation. Exposure to high concentrations: Irritation of the respiratory tract. Irritation of the nasal mucous membranes. Respiratory difficulties.

In case of skin contact - Not irritating

In case of eye contact - Inflammation/damage of the eye tissue. Corrosion of the eye tissue. Lacrimation.

If swallowed – After absorption of high quantities: Nausea. Vomiting. Abdominal pain. Irritation of the gastric/intestinal mucosa.

4.2.2 Delayed Symptoms

No effects known.

4.3 INDICATION OF ANY IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED

No data available.

5 Fire-Fighting Measures

5.1 Extinguishing Media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

Upon combustion CO and CO2 are formed. Reacts on exposure to water with some metals. CO2 generation occurs when mixed with acidic materials.

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Special protective equipment for firefighters

Gloves. Safety glasses. Protective clothing. Dust cloud protection and heat/fire exposure: Compressed air respirator.

6 Accidental Release Measures

6.1 Personal Precautions, Protective Equipment and Emergency Procedures

Use personal protective equipment. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions

Contain released substance, pump into suitable containers. Plug the leak, cut off the supply. Knock down/dilute dust cloud with water spray. Violent exothermic reaction with some acids; release of harmful gases/vapors (carbon dioxide). Carbon dioxide is heavier than air and will collect in ducts, drains and low lying areas. Prevent spreading in sewers.

6.3 Methods and material for containment and cleaning up

Prevent dust cloud formation. Scoop solid spill material into closed containers. Carefully collect the spill. Clean contaminated surfaces with an excess of water. Wash clothing and equipment after handling.

6.4 Reference to other sections

For disposal see section 13.

7 HANDLING AND STORAGE

7.1 PRECAUTIONS FOR SAFE HANDLING

Avoid contact with skin and eyes. Use air conveying/mechanical systems for bulk transfer to storage. Provide appropriate exhaust ventilation at places where dust is formed. In case of insufficient ventilation, wear suitable respiratory equipment if release of airborne dust is expected.

7.2 CONDITIONS FOR SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES

Store in original container. Keep in properly labeled containers. Keep container tightly closed.

7.3 SUITABLE PACKAGING MATERIAL

No data available

7.4 INCOMPATIBLE PRODUCTS

Aluminum, powdered aluminum, and acids.

8 EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 COMPONENTS WITH WORKPLACE CONTROL PARAMETERS

Contains no substances with occupational exposure limit values.

8.2 EXPOSURE CONTROLS

Appropriate engineering controls – Avoid formation of dust. Keep away from ignition sources. Keep container tightly closed. Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

8.3 PERSONAL PROTECTIVE EQUIPMENT

Eye / Face Protection - Safety glasses with side shields or protective goggles. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection - Handle with gloves, butyl rubber or PVC, which have good resistance. Gloves must be inspected prior to use. Use proper glove removal technique to avoid skin contact with product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection – Protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection – For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator. For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

8.4 CONTROL OF ENVIRONMENTAL EXPOSURE

Prevent leakage or spillage if safe to do so. Do not let product enter drains. See section 6.2, 6.3, and 13.

9 PHYSICAL AND CHEMICAL PROPERTIES

9.1 INFORMATION ON BASIC PHYSICAL AND CHEMICAL PROPERTIES

Appearance Form:	Crystalline Solid / Crystalline Powder / Grains / Lumps
Color:	Colorless
Odor:	Odorless
Odor Threshold:	No data available
Particle Size:	694 µm
pH:	11.6; 5.0%
Melting Point / Freezing Point:	851 °C / 1,564 °F
Boiling Point	1,600 °C / 2,912 °F
Flash Point:	No data available
Explosion Limits:	No data available
Evaporation Rate:	No data available
Flammability:	Non Combustible
Log Kow:	-6.19 Estimated value
Viscosity:	No data available
Vapor Pressure:	No data available
Vapor Density:	No data available
Solubility water:	212.5 g/l; 20 °C / 68 °F
Relative Density:	2.52 -253; 20 °C / 68 °F
Absolute Density:	2,530 kg/m^3
Decomposition temperature:	>1600 °C / >2912 °F
Auto-ignition temperature:	>400 °C / >752 °F
Explosive Properties:	No data available
Oxidizing Properties:	No data available

9.2 PHYSICAL HAZARDS

No data available

10 STABILITY AND REACTIVITY

10.1 REACTIVITY

None under normal use conditions.

10.2 CHEMICAL STABILITY

Stable. Decomposes by reaction with strong acid.

10.3 POSSIBILITY OF HAZARDOUS REACTIONS

None under normal processing.

10.4 CONDITIONS TO AVOID

Exposure to air or moisture over prolonged periods.

10.5 INCOMPATIBLE MATERIALS

Aluminum, powdered aluminum, and acids.

10.6 HAZARDOUS POLYMERIZATION

Hazardous polymerization does not occur.

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11 TOXICOLOGICAL INFORMATION

11.1 INFORMATION ON TOXICOLOGICAL EFFECTS

11.1.1 Acute toxicity

LD50 Oral - rat – 2,800 mg/kg
LD50 Dermal – rabbit >2,000 mg/kg
LD50 Inhalation - rat – 2.30 mg/l, 2 hour exposure time

11.1.2 Corrosion / irritation

Skin - rabbit
Result: Mild skin irritation – 24 hours

11.1.3 Serious eye damage / eye irritation

Eyes - rabbit
Result: Severe eye irritation – 24 hours

11.1.4 Respiratory or skin sensitization

Inhalation - no data available
Skin Sensitization: no data available

11.1.5 Germ cell mutagenicity

No data available

11.1.6 Carcinogenicity

No data available

11.1.7 Reproductive toxicity

No data available

11.1.8 Specific target organ toxicity - single exposure

No data available

11.1.9 Specific target organ toxicity - repeated exposure

No data available

11.1.10 Chronic effects from short and long-term exposure

On continuous / repeated exposure / contact: Red skin. Dry skin. Tingling / irritation of the skin. Affection of the nasal septum.

12 ECOLOGICAL INFORMATION

12.1 TOXICITY

	Parameter	Method	Value	Duration	Species	Test design	Fresh / salt water	Value determination
Acute toxicity fishes	LC50	Other	300 mg/l	96 h	Lepomis macrohirus	Static system	Fresh water	Experimental value
Acute toxicity invertebrates	EC50	Other	200 - 227 mg/l	48 h	Ceriodaphnia sp.	Semi-static	Fresh water	Experimental value
Toxicity algae and other aquatic plants	EC50		242 mg/l	5 days	Algae			Experimental value

12.2 PERSISTENCE AND DEGRADABILITY:

Biodegradability: not applicable

12.3 BIOACCUMULATIVE POTENTIAL:

Low potential for bioaccumulation (Log Know <4)

12.4 MOBILITY IN SOIL:

Low potential for absorption in soil.

12.5 RESULTS OF PBT AND VPVB ASSESSMENT:

PBT/vPvB assessment not available as chemical safety assessment is not required/not conducted.

12.6 OTHER ADVERSE EFFECTS:

No data available

13 DISPOSAL CONSIDERATIONS

13.1 WASTE DISPOSAL

Remove waste in accordance with local and/or national regulations. Contact a licensed professional waste disposal service to dispose of this material. Different types of hazardous waste should not be mixed together if it will entail a risk of pollution or create problems for the further management of the waste. Hazardous waste shall be managed responsibly. Do not discharge into drains.

14 TRANSPORT INFORMATION

14.1 UNITED STATES DEPARTMENT OF TRANSPORTATION (DOT)
Non-regulated

14.2 INTERNATIONAL MARITIME DANGEROUS GOODS (IMDG)
Non-regulated

14.3 INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA)
Non-regulated

14.4 TDG / ADN / RID / ADR
Non-regulated

15 REGULATORY INFORMATION

15.1 SARA 302 COMPONENTS
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

15.2 SARA 313 COMPONENTS
SARA 313: This material does not contain any chemical with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

15.3 SARA 311/312 HAZARDS
Acute Health Hazard

15.4 PENNSYLVANIA RIGHT TO KNOW COMPONENTS
Sodium carbonate, CAS-No: 497-19-8

15.5 NEW JERSEY RIGHT TO KNOW COMPONENTS
Sodium carbonate, CAS-No: 497-19-8

15.6 WHMIS CLASSIFICATION: C, D2
Note: The product listed on this SDS has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations.

16 OTHER INFORMATION

16.1 FULL TEXT OF H-STATEMENTS REFERRED TO UNDER SECTION 2 AND 3.

Eye Irrit.	Eye Irritation
H319	Causes serious eye irritation

16.2 HMIS RATING

Health Hazard:	2
Flammability:	0
Physical Hazard:	0

16.3 NFPA RATING

Health Hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

16.4 NOTICE

The above information is believed to be correct but is not intended to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Ciner and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product.

MICHELS®

POTENTIAL ADDITIVIVE

SODIUM BICARBONATE

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Soda Ash / Sodium Carbonate

Revision Date: 7/27/2018

SAFETY DATA SHEET

1 PRODUCT AND COMPANY IDENTIFICATION

1.1 PRODUCT IDENTIFIERS

Product Name:	Soda Ash or Sodium Carbonate
Chemical Name:	Sodium Carbonate
Synonyms / Common Names:	Carbonic Acid Sodium Salt
Product Type REACH:	Substance/mono-constituent
CAS Number:	497-19-8
EC Index Number:	011-005-00-2
EC Number:	207-838-8
RTECS Number:	VZ4050000

1.2 RELEVANT IDENTIFIED USES

Glass Production	Paper Production	Manufacture of Substances
Detergent Component	Laboratory Chemicals	Acidity Regulator

1.3 MANUFACTURER

Ciner Wyoming LLC
254 County Road 4-6
Green River, Wyoming 82935
United States
Telephone Number: (307) 875-2600
www.ciner.us.com

1.4 EMERGENCY TELEPHONE NUMBER

Emergency Response Information Provider: CHEMTREC
Within the United States Emergency Telephone Number: 1-800-424-9300
Outside the United States / International Emergency Telephone Number: +1-703-527-3887

2 HAZARD(S) IDENTIIFICATION

2.1 CLASSIFICATION OF THE SUBSTANCE OR MIXTURE

GHS Classification in accordance with 29 CFR 1910 (OSHA HazCom Standard):
Eye Irritation (Category 2A), H319
For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS LABEL ELEMENTS, INCLUDING PRECAUTIONARY STATEMENTS

Pictograms:

Irritant

Signal Word: Warning

Hazard Statement(s):
H319 Causes serious eye irritation.

Precautionary Statement(s):
P264 Wash skin thoroughly after handling.

P280 Wear eye protection / face protection.

P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P337 + P313 If eye irritation persists: Get medical advice / attention.

2.3 HAZARDS NOT OTHERWISE CLASSIFIED OR NOT COVERED BY GHS

None

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3 COMPOSITION / INFORMATION ON INGREDIENTS

3.1 SUBSTANCES

Synonyms: Soda Ash, Sodium Carbonate, Carbonic Acid Sodium Salt
Formula: Na_2CO_3
Molecular Weight: 105.99 g/mol

Component (REACH Registration)	CAS #	Concentration	Classifications	Remark
Sodium Carbonate (01-2119485498-19-0011)	CAS #: 497-19-8	≥ 99%	Eye Irrit. 2A, H319	Monoconstituent

* For the full text of the H-Statements mentioned in this Section, see Section 16.

4 FIRST-AID MEASURES

4.1 DESCRIPTION OF FIRST-AID MEASURES

General - Check the vital functions. Unconscious: maintain adequate airway and respiration. Respiratory arrest: artificial respiration or oxygen. Cardiac arrest: perform resuscitation. Victim conscious with labored breathing: half-seated. Victim in shock: on his back with legs slightly raised. Vomiting: prevent asphyxia/aspiration pneumonia. Prevent cooling by covering the victim (no warming up). Keep watching the victim. Give psychological aid. Keep the victim calm, avoid physical strain. Depending on the victim's condition: doctor/hospital.

After inhalation - Remove the victim into fresh air. Respiratory problems: consult a doctor/medical service.

After skin contact - Rinse with water. Soap may be used. Do not apply (chemical) neutralizing agents. Take victim to a doctor if irritation persists.

After eye contact - Rinse immediately with plenty of water for at least 15 minutes. Do not apply neutralizing agents. Take victim to an ophthalmologist if irritation persists.

After ingestion - Rinse mouth with water. Immediately after ingestion: give lots of water to drink. Do not induce vomiting. Consult a doctor/medical service if victim is unwell.

4.2 MOST IMPORTANT SYMPTOMS AND EFFECTS, BOTH ACUTE AND DELAYED

4.2.1 Acute Symptoms

If inhaled - Dry/sore throat. Coughing. Slight irritation. Exposure to high concentrations: Irritation of the respiratory tract. Irritation of the nasal mucous membranes. Respiratory difficulties.

In case of skin contact - Not irritating

In case of eye contact - Inflammation/damage of the eye tissue. Corrosion of the eye tissue. Lacrimation.
If swallowed – After absorption of high quantities: Nausea. Vomiting. Abdominal pain. Irritation of the gastric/intestinal mucosa.

4.2.2 Delayed Symptoms

No effects known.

4.3 INDICATION OF ANY IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED

No data available.

5 FIRE-FIGHTING MEASURES

5.1 EXTINGUISHING MEDIA

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 SPECIAL HAZARDS ARISING FROM THE SUBSTANCE OR MIXTURE

Upon combustion CO and CO2 are formed. Reacts on exposure to water with some metals. CO2 generation occurs when mixed with acidic materials.

5.3 ADVICE FOR FIREFIGHTERS

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 SPECIAL PROTECTIVE EQUIPMENT FOR FIREFIGHTERS

Gloves. Safety glasses. Protective clothing. Dust cloud protection and heat/fire exposure: Compressed air respirator.

6 ACCIDENTAL RELEASE MEASURES

6.1 PERSONAL PRECAUTIONS, PROTECTIVE EQUIPMENT AND EMERGENCY PROCEDURES

Use personal protective equipment. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 ENVIRONMENTAL PRECAUTIONS

Contain released substance, pump into suitable containers. Plug the leak, cut off the supply. Knock down/dilute dust cloud with water spray. Violent exothermic reaction with some acids; release of harmful gases/vapors (carbon dioxide). Carbon dioxide is heavier than air and will collect in ducts, drains and low-lying areas. Prevent spreading in sewers.

6.3 METHODS AND MATERIAL FOR CONTAINMENT AND CLEANING UP

Prevent dust cloud formation. Scoop solid spill material into closed containers. Carefully collect the spill. Clean contaminated surfaces with an excess of water. Wash clothing and equipment after handling.

6.4 REFERENCE TO OTHER SECTIONS

For disposal see section 13.

7 HANDLING AND STORAGE

7.1 PRECAUTIONS FOR SAFE HANDLING

Avoid contact with skin and eyes. Use air conveying/mechanical systems for bulk transfer to storage. Provide appropriate exhaust ventilation at places where dust is formed. In case of insufficient ventilation, wear suitable respiratory equipment if release of airborne dust is expected.

7.2 CONDITIONS FOR SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES

Store in original container. Keep in properly labeled containers. Keep container tightly closed.

7.3. SUITABLE PACKAGING MATERIAL

No data available.

7.4 INCOMPATIBLE PRODUCTS

Aluminum, powdered aluminum, and acids.

8 EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 COMPONENTS WITH WORKPLACE CONTROL PARAMETERS

Contains no substances with occupational exposure limit values.

8.2 EXPOSURE CONTROLS

Appropriate engineering controls – Avoid formation of dust. Keep away from ignition sources. Keep container tightly closed. Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

8.3 PERSONAL PROTECTIVE EQUIPMENT

Eye / Face Protection - Safety glasses with side shields or protective goggles. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin Protection - Handle with gloves, butyl rubber or PVC, which have good resistance. Gloves must be inspected prior to use. Use proper glove removal technique to avoid skin contact with product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection – Protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory Protection – For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator. For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

8.4 CONTROL OF ENVIRONMENTAL EXPOSURE

Prevent leakage or spillage if safe to do so. Do not let product enter drains. See section 6.2, 6.3, and 13.

9 PHYSICAL AND CHEMICAL PROPERTIES

9.1 INFORMATION ON BASIC PHYSICAL AND CHEMICAL PROPERTIES

Appearance Form:	Crystalline Solid / Crystalline Powder / Grains / Lumps
Color:	Colorless
Odor:	Odorless
Odor Threshold:	No data available
Particle Size:	694 µm
pH:	11.6; 5.0%
Melting Point / Freezing Point:	851°C / 1,564°F
Boiling Point:	1,600°C / 2,912°F
Flash Point:	No data available
Explosion Limits:	No data available
Evaporation Rate:	No data available
Flammability:	Non-Combustible
Log Kow:	-6.19 Estimated Value
Viscosity:	No data available
Vapor Pressure:	No data available
Vapor Density:	No data available
Solubility Water:	212.5 g/l; 20°C / 68°F
Relative Density:	2.52 – 2.53; 20°C / 68°F
Absolute Density:	2,530 kg/m^3
Decomposition Temperature:	>1600°C / >2912°F
Auto-Ignition Temperature:	>400°C / >752°F
Explosive Properties:	No data available
Oxidizing Properties:	No data available

9.2 PHYSICAL HAZARDS
No data available.

10 STABILITY AND REACTIVITY

10.1 REACTIVITY
None under normal use conditions.

10.2 CHEMICAL STABILITY
Stable. Decomposes by reaction with strong acid.

10.3 POSSIBILITY OF HAZARDOUS REACTIONS
None under normal processing.

10.4 CONDITIONS TO AVOID
Exposure to air or moisture over prolonged periods.

10.5 INCOMPATIBLE MATERIALS
Aluminum, powdered aluminum, and acids.

10.6 HAZARDOUS POLYMERIZATION
Hazardous polymerization does not occur.

11 TOXICOLOGICAL INFORMATION

11.1 INFORMATION ON TOXICOLOGICAL EFFECTS

11.1.1 Acute toxicity
LD50 Oral - rat – 2,800 mg/kg
LD50 Dermal - rabbit >2,000 mg/kg
LD50 Inhalation - rat – 2.30 mg/l, 2-hour exposure time

11.1.2 Corrosion/irritation
Skin - rabbit
Result: Mild skin irritation – 24 hours

11.1.3 Serious eye damage/eye irritation
Eyes - rabbit
Result: Severe eye irritation – 24 hours

11.1.4 Respiratory or skin sensitization
Inhalation - no data available
Skin Sensitization: no data available

11.1.5 Germ cell mutagenicity
No data available

11.1.6 Carcinogenicity
No data available

11.1.7 Reproductive toxicity
No data available

11.1.8 Specific target organ toxicity - single exposure
No data available

11.1.9 Specific target organ toxicity - repeated exposure
No data available

11.1.10 Chronic effects from short and long-term exposure
On continuous / repeated exposure / contact: Red skin. Dry skin. Tingling / irritation of the skin. Affection of the nasal septum.

12 ECOLOGOCAL INFORMATION

12.1 TOXICITY

	Parameter	Method	Value	Duration	Species	Test Design	Fresh/Salt Water	Value Determination
Acute toxicity fishes	LC50 Other	Other	300 mg/l	96 h	Lepomis macronhirus	Static system	Fresh water	Experimental value
Acute toxicity invertebrates	EC50	Other	200-227 mg/l	48 h	Ceriodaphnia sp.	Semi-static	Fresh water	Experimental value
Toxicity algae and other aquatic plants	EC50		242 mg/l	5 days	Algae			Experimental value

12.2 PERSISTENCE AND DEGRADABILITY:
Biodegradability: not applicable

12.3 BIOACCUMULATIVE POTENTIAL:
Low potential for bioaccumulation (Log Kow <4)

12.4 MOBILITY IN SOIL:
Low potential for absorption in soil.

12.5 RESULTS OF PBT AND VPVB ASSESSMENT:
PBT/vPvB assessment not available as chemical safety assessment is not required/not conducted.

12.6 OTHER ADVERSE EFFECTS:
No data available.

13 DISPOSAL CONSIDERATIONS

13.1 WASTE DISPOSAL
Remove waste in accordance with local and/or national regulations. Contact a licensed professional waste disposal service to dispose of this material. Different types of hazardous waste should not be mixed together if it will entail a risk of pollution or create problems for the further management of the waste. Hazardous waste shall be managed responsibly. Do not discharge into drains.

14 TRANSPORT INFORMATION

14.1 UNITED STATES DEPARTMENT OF TRANSPORTATION (DOT)
Non-regulated

14.2 INTERNATIONAL MARITIME DANGEROUS GOODS (IMDG)
Non-regulated

14.3 INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA)
Non-regulated

14.4 TDG/ADN/RID/ADR
Non-regulated

15 REGULATORY INFORMATION

15.1 SARA 302 COMPONENTS
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

15.2 SARA 313 COMPONENTS
SARA 313: This material does not contain any chemical with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

15.3 SARA 311/312 HAZARDS
Acute Health Hazard

15.4 PENNSYLVANIA RIGHT TO KNOW COMPONENTS
Sodium carbonate, CAS-No: 497-19-8

15.5 NEW JERSEY RIGHT TO KNOW COMPONENTS
Sodium carbonate, CAS-No: 497-19-8

15.6 WHMIS CLASSIFICATION: C, D2
Note: The product listed on this SDS has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations.

15.7 US CALIFORNIA SAFE DRINKING WATER & TOXIC ENFORCEMENT ACT (PROPOSITION 65)
This product does not contain any chemicals known to the State of California to cause cancer, birth, or any other reproductive defects.

16 OTHER INFORMATION

16.1 FULL TEXT OF H-STATEMENTS REFERRED TO UNDER SECTION 2 AND 3.

Eye Irrit.	Eye Irritation
H319	Causes serious eye irritation

16.2 HMIS RATING

Health Hazard:	2
Flammability:	0
Physical Hazard:	0

16.3 NFPA RATING

Health Hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

16.4 NOTICE

The above information is believed to be correct but is not intended to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Ciner and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product.

16.5 PRODUCT CERTIFICATIONS

This product is certified to NSF/ANSI Standard 60 for use in drinking water treatment at the specified maximum use limit. The MUL (maximum use level) for sodium carbonate anhydrous is 100 mg/L under NSF/ANSI Standard 60.

OU Kosher Certification

CERTIFIED HALAL حلال ISLAMIC FOOD AND NUTRITION COUNCIL OF AMERICA

NSF Certified to NSF/ANSI 60

MICHELS®

POTENTIAL ADDITIVIVE

CITRIC ACID

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Univar USA Inc Safety Data Sheet

SDS No:	
Version No:	003 2015-06-02
Order No:	

3075 Highland Pkwy, Ste 200, Downers Grove, IL 60515
(425) 889 3400

Emergency Assistance

For emergency assistance involving chemicals call
Chemtrec - (800) 424-9300

Safety Data Sheet

CITRIC ACID FCC/USP PWD

SECTION 1:IDENTIFICATION OF THE SUBSTANCE/ MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1 PRODUCT IDENTIFIER

- Chemical name	Citric acid - Food grade
- REACH Registration Number	01-2119457026-42-0031

1.2 RELEVANT IDENTIFIED USES OF THE SUBSTANCE AND USES ADVISED AGAINST

Citric acid can be used in food as food additives and also in technical application as clarifying agent, water softener, buffer, foam booster and stabilizer, complexing agent and as an intermediate in production of organic chemicals.

1.3 DETAILS OF THE SUPPLIER

- Company identification

US:
Tate & Lyle Ingredients Americas, LLC.
2200 E.Eldorado Street
Decatur, IL 62521

Europe:
Tate & Lyle Slovakia s.r.o.
Boleraz 114
919 08 boleraz
Slovakia

1.4 EMERGENCY PHONE NR.

CHEMTREC
Toll-Free: 1-800-424-9300 (USA and Canada)
Non Toll-Free +1-703-527-3887 (Global)

SECTION 2:HAZARDS IDENTIFICATION

2.1. CLASSIFICATION OF THE SUBSTANCE OR MIXTURE

According with the version of the Globally Harmonized system of Classification and labeling adopted in the United states and Regulation 1272/2008/EC [CLP]: Eyes irritant category 2(H319)

Safety Data Sheet

CITRIC ACID FCC/USP PWD

2.2 LABEL ELEMENTS

GHS07

Signal word:
Warning

Hazard Statement:
Causes serious eye irritation. H319

Precautionary Statement:
Wash hands thoroughly after handling. P264
Wear eye protection. P280

Precautionary Statement. IF IN EYES: P305
Response :
Rinse cautiously with water for several minutes. P351
Remove contact lenses, if present and easy to do Continue rinsing. P338
If eye irritation persists: P337
Get medical advice/attention. P313

2.3. OTHER HAZARDS
FIRE AND EXPLOSION HAZARD:
May form combustible dust concentrations in air. Possibility of dust explosion. it is recommended that all dust control equipment and material transport systems involved are engineered to prevent conditions contributing to dust explosions. Do not allow dust to accumulate on flat surfaces, on rafters or building structural components. Keep away from all ignition sources including heat, sparks and flame.

SECTION 3:COMPOSITION/INFORMATION OF INGREDIENTS

- Chemical name Citric acid - Food grade

Safety Data Sheet

CITRIC ACID FCC/USP PWD

- CAS number	77-92-9
- EINECS number	201-069-1
- Synonyms	2 - Hydroxy -1,2,3 propanetricarboxylic acid Acidulant - Citric acid - food additive E330.

SECTION 4:FIRST AID MEASURES

4.1 DESCRIPTION OF FIRST AID MEASURES

- General advise	Seek medical attention if irritation develops after first aid application
- Inhalation	Move people from the exposure to fresh air.
- Skin contact	Wash skin with soap and water.
- Eye contact	Remove particulates by irrigating with eye wash solution or clean water, holding eyelids apart.
- Ingestion	Wash mouth and flush throat upto the stomach.

4.2 MOST IMPORTANT SYMPTOMS AND EFFECTS, BOTH ACUTE AND DELAYED
ROUTE(S) OF ENTRY: Skin Contact; Eye Contact
HUMAN EFFECTS AND SYMPTOMS OF OVEREXPOSURE:
ACUTE SKIN CONTACT: This product is irritating to the skin resulting in reddening, stinging, and swelling.
ACUTE EYE CONTACT: This product is irritating to the eyes resulting in stinging, reddening, tearing, and swelling.
CHRONIC EFFECTS OF EXPOSURE: No applicable information was found concerning any adverse chronic health effects from overexposure to this product.
CARCINOGENICITY: The components of this product are not listed by NTP, IARC or regulated as a carcinogen by OSHA.
MEDICAL CONDITIONS
AGGRAVATED BY EXPOSURE: Persons with pre-existing eye or skin disorders may be more susceptible to the effects of this product.

4.3 INDICATION OF ANY IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED.
None Anticipated

SECTION 5: FIRE-FIGHTING MEASURES

5.1 EXTINGUISHING MEDIA
Water spray, dry powder, carbon dioxide or media appropriate for surrounding fire. Use of water jet may cause explosive dust conditions.

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5.2 SPECIFIC HAZARDS
FIRE AND EXPLOSION HAZARD: Possibility of dust explosion. It is recommended that all dust control equipment and material transport systems involved are engineered to prevent conditions contributing to dust explosions. Do not allow dust to accumulate on flat surfaces, on rafters or building structural components. Use of water jet may cause explosive dust conditions.
SEE NFPA 61, Standard for the prevention of Fire and Dust Explosions in Agricultural and Food Processing Facilities, 2008 or later Edition, and other related standards.

5.3 SPECIFIC PROTECTIVE EQUIPMENT AND PRECAUTIONS FOR FIRE-FIGHTERS
Wear self-contained breathing apparatus and full protective gear. Use water spray to cool fire exposed containers.

FLAMMABILITY CLASS (OSHA)
Not applicable

HAZARDOUS COMBUSTION PRODUCTS
Carbon dioxide and carbon monoxide

SECTION 6:ACCIDENTAL RELEASE MEASURES

6.1 PERSONAL PRECAUTIONS
Use personal protective equipment. Wear eye protection. Avoid contact with skin and eyes.

6.2 ENVIRONMENTAL PRECAUTIONS
Prevent further leakage or spillage if safe to do so. No special environmental precautions required

6.3 METHODS FOR CLEANING UP
Vacuum or sweep spills. Minimize dust generation.
If washing down spilled area is necessary, use copious amounts of water and control runoff.
Follow local, state and federal regulations for product disposal

6.4 REFERENCE TO OTHER SECTIONS
See Section 7 for information on safe handling
See Section 8 for information on personal protection equipment
See Section 13 for disposal information

SECTION 7: HANDLING AND STORAGE

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7.1 PRECAUTIONS FOR SAFE HANDLING
See NFPA 61, Standard for the Prevention of Fire and Dust Explosions in Agricultural and Food Processing Facilities, 2008 Edition, and other related standards. Use with adequate ventilation. Minimize dust generation and accumulation; dust deposits should not be allowed to accumulate on surfaces, as these may form an explosive mixture if they are disturbed.

All dust control equipment and material transport systems involved are engineered to prevent conditions contributing to dust explosions and may require explosion relief vents or an explosion suppression system or an oxygen-deficient environment. Bonding and grounding systems may be required.

Dust-handling systems (such as exhaust ducts, dust collectors, vessels, and processing equipment) should be designed to limit or prevent leakage of dust into the work area.

Do not allow dust to accumulate on flat surfaces, on rafters or building structural components. Routine housekeeping should be instituted to reduce dust accumulation. Use Avoid dispersal of dust in the air; use vacuum or wet sweeping methods. Do not use compressed air to clean surfaces.

Keep away from all ignition sources including heat, sparks, and flame. Where dust accumulations occur use non-sparking tools.

7.2 CONDITIONS OF SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES
Store in a cool dry place. Store in a tightly closed container/bag.
The packaging material should have reasonable moisture and air barriers and comply with food regulations.
7.3 SPECIFIC END USE(S)
See overview of the exposure scenario and summary of risk management measures in Appendix 1

SECTION 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 CONTROL PARAMETERS
Exposure limits: Nuisance dust (also called particulate not otherwise regulated (PNOR)).
OSHA PEL: 15 mg/ mg/m3 Total dust
5 mg/m3 Respirable dust
ACGIH TLV: 10 mg/m3 Inhalable dust
5 mg/m3 Respirable dust
15 mg/m3 Total dust

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8.2 EXPOSURE CONTROLS
APPROPRIATE ENGINEERING CONTROLS:
Ventilation: See NFPA 61, Standard for the Prevention of Fire and Dust Explosions in Agricultural and Food Processing Facilities, 2008 Edition, and National Fire Protection Association 650, Standard for Pneumatic Conveying Systems for Handling Combustible Materials, 1997 Edition and other related standards. Normal industrial hygiene measures should be sufficient for protection of employees from exposure to dusts. Local and mechanical exhaust is desirable when dumping bags.

APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT:
Eye protection: Safety glasses are recommended. Safety goggles are desirable when dumping bags.
Emergency wash facilities: Eye wash is recommended for conditions where dust generation is likely.
Special protective clothing: Not normally required.
Gloves: Not normally required. Use ordinary work gloves if dust dries skin.
Respirator: NIOSH approved N-95 dust respirator if working in situations that could generate large amounts of airborne dust.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:
See section 5.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1 INFORMATION ON BASIC PHYSICAL AND CHEMICAL PROPERTIES

- Physical form	Solid
- Color	White to off-white
- Odor	Essentially odorless to very slight sugar odor
- pH (concentration)	NA
- Boiling point	104°C (219 °F)
- Flash point	345°C
- Melting/freezing point	approx. 153°C at 1,013 hPa
- Decomposition temperature	NA
- Auto-ignition temperature	NA
- Explosion properties	NA
- Oxidising properties	NA
- Vapour pressure	2.21*10-6 Pa at 25°C
- Vapor density	0.62 (Air = 1)
- Relative density	1.665at 20°C

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- Bulk density	Not Established
- Specific gravity	15 °C (1.24 at 59 °F)
- Viscosity	Not Established
- Water solubility	590 g/L at 20°C
- Solubility (non aqueous)	Methyl alcohol: completely miscible
- Partition coefficient	In OCTANOL/ WATER (log value): Log Kow: -0.2 to -1.8
- Dissociation constant	pKa: 3.13, 4.76 and 6.4 at 25°
- Evaporation rate	Less than 1 (Butyl acetate =1)

9.2 OTHER INFORMATION

SECTION 10: STABILITY AND REACTIVITY

10.1 REACTIVITY
Stable

10.2 CHEMICAL STABILITY
Stable under normal conditions.
Polymerization will not occur.

10.3 POSSIBILITY OF HAZARDOUS REACTIONS
Not applicable

10.4 CONDITIONS TO AVOID
Practices which produce dust or disperse finely divided dust in air.
See NFPA 61. Standard for the Prevention of Fire and Dust Explosions in Agricultural and Food Processing Facilities, 2008 Edition, and other related standards.

10.5 INCOMPATIBLE MATERIALS
Oxidizing agents, strong acids

10.6 Hazardous decomposition products:
Nothing unusual

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 INFORMATION ON TOXICOLOGICAL EFFECTS

- Inhalation	ORAL: LD50: 5400 – 5790 mg/kg bw (mouse) / LD50: 11700 mg/kg bw (rat) DERMAL: LD50 >2000 mg/kg bw rat
- Ingestion	No effects known or anticipated.

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- Skin irritation / corrosion	Sustained exposure in a dusty manufacturing environment may result in mechanical irritation in the creases of the skin, particularly at the fingers, or other drying effects. no health effects known or anticipated.
- Eye irritation	Irritating to eyes.
- Skin sensitisation	Not sensitizing
- Chronic toxicity	Not known or anticipated
- Genetic toxicity	Not known or anticipated
- Carcinogenicity	Not classifiable as Carcinogen.
- Reprotoxicity	Not known or anticipated
- Specific effects	Not applicable

SECTION 12: ECOLOGICAL INFORMATION

12.1 TOXICITY
LC50 for freshwater fish: 440 mg/l
EC50/LC50 for freshwater invertebrates: 1535 mg/l.

12.2 PERSISTENCE/DEGRADABILITY
Ready biodegradable

12.3 BIOACCUMULATIVE POTENTIAL
Log Kow <3, not bioaccumulative

12.4 MOBILITY IN SOIL
Not applicable

12.5 BPT, vPvB
The substance does not meet the criteria for PBT or vPvB.

12.6 OTHER ADVERSE EFFECTS
None known

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 WASTE TREATMENT METHODS
Follow local, state and federal regulations for product disposal. Not a hazardous waste unless contaminated with hazardous products.

SECTION 14: TRANSPORTATION INFORMATION

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International regulations (RID/ADR; RTMDR; IMDG; IATA/OACI): Not classified as dangerous for transport.
DOT shipping label: Non-hazardous

SECTION 15: REGULATORY INFORMATION

15.1 SAFETY, HEALTH AND ENVIRONMENTAL REGULATIONS
According with the version of the Globally Harmonized System of Classification and labeling adopted in the United States and Regulation 1272/2008/EC(CLP): Classified

15.2 CHEMICAL SAFETY ASSESSMENT
US FEDERAL REGULATIONS:
Clean Air Act:
ODS: Not applicable.
SARA (EPCRA) Section 313 (40 C.F.R. § 372.65): Not applicable.
TSCA Status: On TSCA inventory.

STATE REPORTING REQUIREMENTS:
California Proposition 65: Not applicable.

SECTION 16: OTHER INFORMATION

See Hazard Communication Guidance for Combustible Dusts, OSHA 3371-08 2009, U.S. Occupational Safety and Health Administration, https://www.osha.gov/Publications/3371combustible-dust.html (accessed 10/8/14)
And
NFPA 654, Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids, for general safe handling and design guidance.

Other classifications of the substance:
TSCA STATUS: On TSCA Inventory.
FDA STATUS: Citrus acid, Anhydrous complies with FDA Regulation 21 C.F.R. § 184.1033;
CALIFORNIA PROPOSITION 65: Not applicable.
HMIS rating:
Health: 1
Flammable: 0

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Reactivity: 0
(0 = minimal ; 1 = slight ; 2 = moderate ; 3 = serious ; 4 = severe)

Safety Data Sheet according to Commission Regulation (EU) No 453/2010 of 20 May 2010 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)

DISCLAIMER OF LIABILITY

The information in this SDS is collected from reliable sources. However, the information is provided without any warranty, expressed or implied. The conditions or methods of handling, storage, use or disposal of the product might be beyond our control and knowledge. For the avoidance of doubt, we shall in no such circumstances be under any liability in respect of loss, damage or expenses arising from handling, storage, use or disposal of the product by your company and/or your subcontractors. This SDS is only applicable for the product mentioned in the identification chapter and title. If the product is used as a component in another product, this SDS may not be applicable on the composite material.

Annex I

SUMMARY OF RISK MANAGEMENT MEASURES
Safe use has been demonstrated by calculation of risk characterisation ratios where appropriate, while qualitative considerations were stipulated where quantification was not possible. The risk characterisation is based on the following risk management measures:
Exposure scenario ,,Description ,,General measures ,,Specific Human Health risk management measures ,,Specific Environment risk management measures ,,
ES1 ,,Production and intermediate use on production sites ,,Good working practices, containment and safe handling in line with industry best practice. ,,(i) Local Exhaust ventilation (LEV)
(ii) Personal Protective Equipment (PPE): Working clothing, protective gloves and safety glasses. Dust masks in areas where dust may be present. In case of open handling of larger quantities or accidental release, a particle mask or respirator with independent air supply is recommended. ,,(i) Treatment of effluent in waste water treatment plant. ,,
ES2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17 ,,Industrial use ,,
Good working practices, containment and safe handling in line with industry best practice. ,,(i) Local Exhaust ventilation (LEV) if
aerosol mists or dusts are present.
(ii) Personal Protective Equipment (PPE): Working clothing, protective gloves and safety glasses. Dust masks in areas where dust may be present. In case of open handling of larger quantities or accidental release, a particle mask or respirator with independent air supply is

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recommended. ,,(i) Treatment of effluent in waste water treatment plant. ,,
ES10 ,,Textile industry ,,Good working practices, containment and safe handling in line with industry best practice. ,,(i) Local Exhaust ventilation (LEV) if aerosol mists or dusts are present.
(ii) Personal Protective Equipment (PPE): Working clothing, ,,(i) Treatment of effluent in waste water treatment plant.
(ii) No direct discharge into the marine environment ,,

Univar USA Inc Safety Data Sheet

For Additional Information contact SDS Coordinator during business hours, Pacific time: (425) 889-3400

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This information relates only to the product designated herein, and does not relate to its use in combination with any other material or in any other process

Andrea Thornton

From: Andrea Thornton
Sent: Tuesday, September 22, 2020 1:44 PM
To: Andrea Thornton
Subject: FW: WBI Tioga Modeling files

From: Kautzman, Rheanna M. <rKautzman@nd.gov>
Sent: Monday, August 31, 2020 11:39 AM
To: Daniel Guido <Daniel.Guido@erm.com>
Subject: RE: WBI Tioga Modeling files

Morning Dan,

I'm finishing up on the modeling project that was in the queue before WBI's and would anticipate starting on the WBI modeling review sometime next week. I can't give you a good estimate of how long the review will take, but if I have any questions I'll reach out to you.

Rheanna Kautzman
Environmental Scientist
Division of Air Quality

I am working from home and may not be as reachable by phone.

701.328.5188 (main AQ) • 701.328.5186 (direct) • 701.328.5185 (fax) • www.deq.nd.gov/aq/

From: Daniel Guido <Daniel.Guido@erm.com>
Sent: Tuesday, August 25, 2020 1:46 PM
To: Kautzman, Rheanna M. <rKautzman@nd.gov>
Subject: RE: WBI Tioga Modeling files

CAUTION: This email originated from an outside source. Do not click links or open attachments unless you know they are safe.

Rheanna –

I just wanted to stay in touch.
If able, please let me know if the WBI Tioga project has entered active review.

Much thanks.

Daniel Guido
Principal Consultant, Scientist

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8425 Woodfield Crossing Blvd. Suite 560W | Indianapolis IN 46240
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E daniel.guido@erm.com | **W** www.erm.com

From: Kautzman, Rheanna M. <rKautzman@nd.gov>
Sent: Thursday, July 23, 2020 11:00 AM
To: Daniel Guido <Daniel.Guido@erm.com>
Subject: RE: WBI Tioga Modeling files

Hi Dan,

With our current workload, I haven't gotten to take a look at it, we have many modeling projects in the queue right now that came in before WBI's app. If I have any questions I won't hesitate to reach out to you.

Rheanna Kautzman
Environmental Scientist
Division of Air Quality

By Executive Order Due to COVID-19, I am working from home and may not be as reachable by phone. I will be checking voice mail twice a day, so please leave a message and I will get back to you as soon as possible.

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NORTH Dakota Be Legendary. | Environmental Quality

From: Daniel Guido <Daniel.Guido@erm.com>
Sent: Thursday, July 23, 2020 9:57 AM
To: Kautzman, Rheanna M. <rKautzman@nd.gov>
Subject: RE: WBI Tioga Modeling files

CAUTION: This email originated from an outside source. Do not click links or open attachments unless you know they are safe.

Just checking in . . . any issues as you have been reviewing?

Daniel Guido
Principal Consultant, Scientist

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E daniel.guido@erm.com | **W** www.erm.com

From: Kautzman, Rheanna M. <rKautzman@nd.gov>
Sent: Tuesday, July 14, 2020 9:27 AM
To: Daniel Guido <Daniel.Guido@erm.com>
Cc: Ann Curnow <Ann.Curnow@erm.com>; Andrea Thornton <Andrea.Thornton@erm.com>
Subject: RE: WBI Tioga Modeling files

Good Morning Dan,

I was able to download the files. I will let you know if I have any questions on the modeling or the files.

Rheanna Kautzman
Environmental Scientist
Division of Air Quality

By Executive Order, I am working from home and may not be as reachable by phone. I will be checking voice mail twice a day, so please leave a message and I will get back to you as soon as possible.

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From: Daniel Guido <Daniel.Guido@erm.com>
Sent: Monday, July 13, 2020 1:35 PM
To: Kautzman, Rheanna M. <rKautzman@nd.gov>
Cc: Ann Curnow <Ann.Curnow@erm.com>; Andrea Thornton <Andrea.Thornton@erm.com>
Subject: RE: WBI Tioga Modeling files

CAUTION: This email originated from an outside source. Do not click links or open attachments unless you know they are safe.

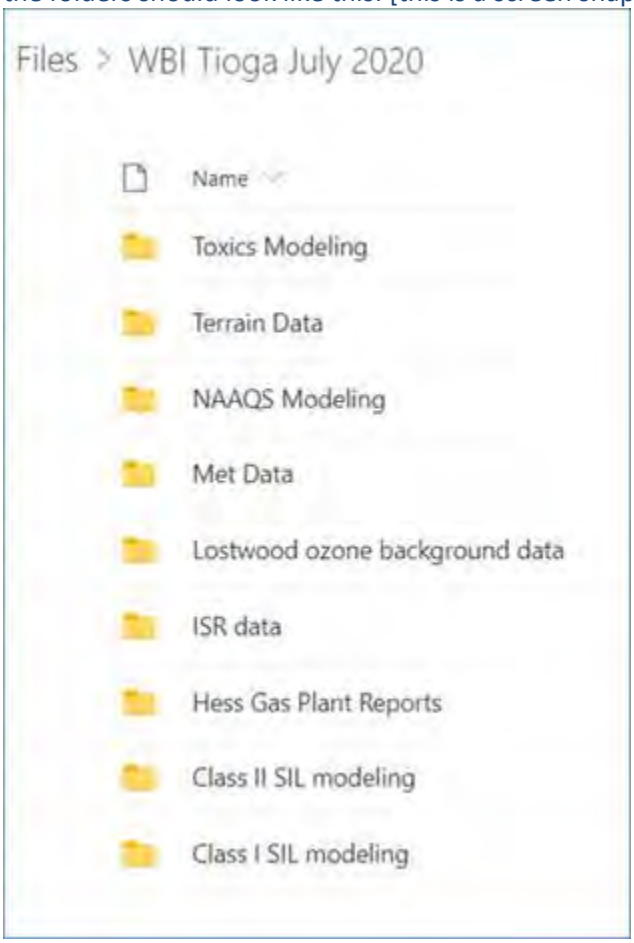
Rheanna –

I have created a folder with subfolders that contain all the electronic files from the updated modeling for the WBI Tioga air permitting.

You will find everything at this web link – this connection should be good for 7 days, let me know if you are not able to acquire all data files before this link expires, and I can refreshe it.

https://theermgroup-my.sharepoint.com/:f:/g/personal/daniel_guido_erm_com/EvoBT3to0gBEnA2ENF_RjlwB3RgY4QgeITuRVmT7pH30wA?e=kIKIxg

the folders should look like this: [this is a screen snap of the primary folder]



When you are able, please send me back a note that confirms that you have all data copied to your local fileserver site.

Daniel Guido
Principal Consultant, Scientist

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From: Kautzman, Rheanna M. <rKautzman@nd.gov>
Sent: Thursday, July 9, 2020 4:06 PM
To: Daniel Guido <Daniel.Guido@erm.com>
Subject: RE: WBI Tioga Modeling files

Afternoon Dan,

The max file size upload on our FTP is 2gb—it should be able to accept ZIP files. I can also send you more than one invite (not sure if you can use the same invite more than once). But if you have an alternative means of transmitting the files that works for me.

Rheanna Kautzman
Environmental Scientist
Division of Air Quality

By Executive Order, I am working from home and may not be as reachable by phone. I will be checking voice mail twice a day, so please leave a message and I will get back to you as soon as possible.

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From: Daniel Guido <Daniel.Guido@erm.com>
Sent: Thursday, July 9, 2020 2:54 PM
To: Kautzman, Rheanna M. <rKautzman@nd.gov>
Subject: RE: WBI Tioga Modeling files

CAUTION: This email originated from an outside source. Do not click links or open attachments unless you know they are safe.

Rheanna –

I have compiled all the files from the updated/revised WBI Tioga air permit modeling.
I connected to the ND DEQ file transfer link you sent to me – and notice that this appears to allow ONE FILE TRANSFER AT A TIME.

This may not be practical for what I need to do – I have 267 files (totaling 8.23 GB). I do not have any single file that exceeds the 2000MB file size limitation, but to repeat this transfer step 267 times?

Instead, I will send you a link to download these from a file transfer site where I can place my data – organized in subfolders, etc.
I hope that will work for you as an alternative to the ND DEQ file transfer option you had provided.

I will be sending a subsequent email with the WEB LINK to the folder I can place these files.

Daniel Guido
Principal Consultant, Scientist

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E daniel.guido@erm.com | **W** www.erm.com

From: Daniel Guido
Sent: Wednesday, July 8, 2020 5:07 PM
To: Kautzman, Rheanna M. <rKautzman@nd.gov>
Subject: WBI Tioga Modeling files

Rheanna –

I wanted to send this simple email to let you know I got the email requesting the modeling files.
I will be able to get this started in the morning. . . .

Regards,

Daniel Guido
Principal Consultant, Scientist

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NORTH BAKKEN EXPANSION PROJECT

Agency Correspondence – North Dakota State Water Commission (SWC)

ERM

1050 SW 6th Ave
Suite 1650
Portland, OR 97204

Telephone: +1 603 488 5282

www.erm.com

Call Log

Log of Telephone Conversation

Call To/From Whom	To: Gerald Heiser
Phone number	701-328-2752
Company	North Dakota State Water Commission
ERM Contact	Andrea Thornton
Phone number	503-459-6864
Date	July 24, 2020
Time of Conversation	7:00 am PST
Reference	North Bakken Expansion Project
Signature	

LOG OF CONVERSATION

Ms. Thornton called the North Dakota State Water Commission to speak with Gerald Heiser regarding the North Bakken Expansion Project. Mr. Heiser took over for Ashley Persinger on the project when Ms. Persinger left the commission.

Ms. Thornton asked Mr. Heiser if there were any updates on the potential need for a scour analysis. She provided an overview that the Soverign Land Permit Application had been subitted in March of 2020. The geotech work on Lake Sakakawea was completed earlier this spring and an udated application will be submitted in August 2020. She noted that the proposed depth of the alignment has not changed. Mr. Heiser indicated that he would run this by his supervisor and have him bring the information to the director meeting on Monday (July 27, 2020). His initial reaction and recommendation is that the analysis will not be needed, but noted he will confirm and get back to Ms. Thornton next week.

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Andrea Thornton

From: Andrea Thornton
Sent: Thursday, July 30, 2020 10:55 AM
To: Heiser, Gerald R.
Subject: RE: Sovereign Land Application Update

Hi Gerald –

Thanks for taking the time to chat last week. You mentioned that you would be bringing the North Bakken Expansion Project up to your supervisor to discuss at the director meeting this past Monday. Are there any updates from that meeting?

Thanks again,
Andrea

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

Environmental Resources Management (ERM)
1050 SW 6th Avenue, Suite 1650 | Portland, Oregon | 97204
M 503-459-6864
E andrea.thornton@erm.com | **W** www.erm.com

From: Andrea Thornton
Sent: Monday, June 8, 2020 3:09 PM
To: Heiser, Gerald R. <gheiser@nd.gov>
Subject: RE: Sovereign Land Application Update

Hi Gerald –

Are there any updates on the potential need for a scour analysis for the North Bakken Expansion Project, or a timeframe as to when this information will be available?

Thanks,
Andrea

Andrea Thornton
Principal Consultant

Environmental Resources Management (ERM)
1050 SW 6th Avenue, Suite 1650 | Portland, Oregon | 97204
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E andrea.thornton@erm.com | **W** www.erm.com

From: Persinger, Ashley C. <apersinger@nd.gov>
Sent: Tuesday, May 12, 2020 12:58 PM
To: Andrea Thornton <Andrea.Thornton@erm.com>
Cc: Heiser, Gerald R. <gheiser@nd.gov>
Subject: Re: Sovereign Land Application Update

Hey Andrea,
The need for a scour is still being discussed. That's good news on the Geotech, keep us posted. Just another update I will be passing this project onto my supervisor Mr. Gerald Heiser, Sovereign Land Manger for the solicitation process and management going forward. I accepted a new position and my last day with the SWC is this upcoming Friday.

It was a pleasure to work with you and best of luck on your project,

Ashley C. Persinger
Sovereign Land Specialist

701.328.4988 • 701.328.3696 (fax) • apersinger@nd.gov • www.swc.nd.gov

NORTH Dakota Be Legendary. | Water Commission & State Engineer

701.328.2750 • swc@nd.gov • mapservice.swc.nd.gov • 900 East Boulevard Avenue • Bismarck, ND 58505

From: Andrea Thornton <Andrea.Thornton@erm.com>
Date: Monday, May 11, 2020 at 5:08 PM
To: Ashley Persinger <apersinger@nd.gov>
Subject: RE: Sovereign Land Application Update

CAUTION: This email originated from an outside source. Do not click links or open attachments unless you know they are safe.

Hi Ashley –

I hope all is well with you. I wanted to check in to see if there were any updates on the need for a scour analysis for the North Bakken Expansion Project. The geotech work in the lake is currently underway and we will provide you with update information based on those bores once the information is in hand.

Thanks again,
Andrea

Andrea Thornton
Principal Consultant

Environmental Resources Management (ERM)
1050 SW 6th Avenue, Suite 1650 | Portland, Oregon | 97204
M 503-459-6864
E andrea.thornton@erm.com | **W** www.erm.com

From: Persinger, Ashley C. <apersinger@nd.gov>
Sent: Friday, March 27, 2020 9:31 AM
To: Andrea Thornton <Andrea.Thornton@erm.com>
Subject: Re: Sovereign Land Application Update

Thanks Andrea. I will begin review of this next week and get you a project number. Discussions on the need for a scour analysis will continue and I will let you know any developments on that front asap. Just FYI our State Engineer is retiring on Tuesday. Our Deputy State Engineer will continue as interim until the position is filled by the Governor.

Ashley C. Persinger
Sovereign Land Specialist

701.328.4988 • 701.328.3696 (fax) • apersinger@nd.gov • www.swc.nd.gov

NORTH Dakota | Water Commission & State Engineer
Be Legendary.

701.328.2750 • swc@nd.gov • mapservice.swc.nd.gov • 900 East Boulevard Avenue • Bismarck, ND 58505

From: Andrea Thornton <Andrea.Thornton@erm.com>
Date: Friday, March 27, 2020 at 9:37 AM
To: Ashley Persinger <apersinger@nd.gov>
Subject: RE: Sovereign Land Application Update

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Hi Ashley –

I submitted the Sovereign Land Permit this morning via email (sovereignlands@nd.gov). As we've discussed, we will continue to send you more information on the crossing and updated plans once the geotech work on the lake is

completed. This work is currently scheduled to start at the end of April. The location/depth of the crossing is not expected to change. Any preliminary information that you can provide on the need for a scour analysis would be appreciated. Based on the information in the criteria provided on the application form, it still sounds likes it would not apply for the project

Please reach out if you have any questions or concerns. I'm going to be taking a couple of days off but will still be checking in.

I hope you have a good weekend,
Andrea

Andrea Thornton
Principal Consultant

Environmental Resources Management (ERM)
1050 SW 6th Avenue, Suite 1650 | Portland, Oregon | 97204
M 503-459-6864
E andrea.thornton@erm.com | **W** www.erm.com

From: Persinger, Ashley C. <apersinger@nd.gov>
Sent: Friday, March 20, 2020 12:59 PM
To: Andrea Thornton <Andrea.Thornton@erm.com>
Cc: Heiser, Gerald R. <gheiser@nd.gov>
Subject: Re: Sovereign Land Application Update

Hi Andrea. Thanks for the update! For now our state offices are closed to the public and a great majority of staff, including myself and my direct supervisor Jerry, fully transitioned to remote work. I will be able to check voicemails remotely, but that yet has be set-up. For now email is the best way to get connected with us.

That's good to hear on your application. We are looking forward to getting that project going here. I'm looking into the size limit question on the emails and will get back to you on that.

We are not anticipating changes in review timeframes at this point. We will be pushing document review in the same systems and they seem to be working on point remotely.

Ashley C. Persinger
Sovereign Land Specialist

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From: Andrea Thornton <Andrea.Thornton@erm.com>
Date: Friday, March 20, 2020 at 12:02 PM
To: Ashley Persinger <apersinger@nd.gov>
Subject: Sovereign Land Application Update

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Hi Ashley –

I hope you and your family are doing well in this interesting time we are in. I wanted to let you know that I will be working from home full time for the foreseeable future as ERM has temporarily closed all of our offices in North America. Are your offices still open? We are still on track for submitting the Sovereign Land Application this month. Do you know if there is a file size limit for the sovereignlands@nd.gov email submittal?

While I know we are in uncharted waters here, I wanted to see if you had any insights on changes in review time periods given our current situation. Any information that you may have would be helpful.

Thank you and I hope you have a good weekend.

-Andrea

Andrea Thornton
Principal Consultant

Environmental Resources Management (ERM)
1050 SW 6th Avenue, Suite 1650 | Portland, Oregon | 97204
M 503-459-6864
E andrea.thornton@erm.com | **W** www.erm.com

From: Persinger, Ashley C. <apersinger@nd.gov>
Sent: Wednesday, February 12, 2020 9:32 AM
To: Dawn Ramsey <Dawn.Ramsey@ferc.gov>
Cc: Andrea Thornton <Andrea.Thornton@erm.com>
Subject: Re: North Bakken Expansion Project - FERC Pre-Filing Bi-Weekly Call

Hi Dawn,

Thanks for the presentation today. The slides will be helpful for future reference as I have done lots of pipelines in state but never crossing state lines. Just confirming that the Water Commission does not need to be a cooperating agency. Our sovereign land permit process and application will give us all the information we need on the crossing of Lake Sakakawea. Andrea and I have been working towards submittal of the sovereign land application for the pipeline crossing. We will be kicking off that process in March which takes average about 90 days.

Andrea thanks for the message yesterday I did receive it this morning before the call. All sounds like we are on track. Discussions happening internally here about the scour analysis policy. Everyone will be in the loop when your application arrives here.

Ashley C. Persinger
Sovereign Land Specialist

701.328.4988 • 701.328.3696 (fax) • apersinger@nd.gov • www.swc.nd.gov

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From: Dawn Ramsey <Dawn.Ramsey@ferc.gov>
Date: Wednesday, February 12, 2020 at 8:49 AM
To: Andrea Thornton <Andrea.Thornton@erm.com>, "Renschler, Jason J CIV USARMY CENWO (USA)" <Jason.J.Renschler@usace.army.mil>, "Thury, Jeremy J CIV USARMY CENWO (USA)" <Jeremy.J.Thury@usace.army.mil>, "jessica_n_johnson@fws.gov" <jessica_n_johnson@fws.gov>, "jerry_reinisch@fws.gov" <jerry_reinisch@fws.gov>, "Jackson, Seth" <sajackson@blm.gov>, "Bickerdyke, Cale E -FS" <cale.bickerdyke@usda.gov>, "Grotte, Kim -FS" <kim.grotte@usda.gov>, "Wax, Peter N." <pwax@nd.gov>, Tina Lyons <Tina.Lyons@erm.com>, "Linn, Dave" <Dave.Linn@WBIEnergy.com>, "Linn, Jill" <Jill.Linn@wbienergy.com>, "Huncovsky, Greg" <Greg.Huncovsky@WBIEnergy.com>, "Myerchin, Lori" <Lori.Myerchin@WBIEnergy.com>, "Lueder, Gay Lynn" <GayLynn.Lueder@WBIEnergy.com>, "Stennes, David" <David.Stennes@WBIEnergy.com>, "Stefka, Kyle" <Kyle.Stefka@WBIEnergy.com>, Ashley Persinger <apersinger@nd.gov>
Cc: "Morris, Michael P CIV USARMY CENWO (USA)" <Michael.P.Morris@usace.army.mil>, "Wallace, Arthur L Jr CIV USARMY CENWO (US)" <A.Luke.Wallace@usace.army.mil>, "Rogers, Richard R II CIV USARMY CENWO (US)" <Richard.R.Rogers@usace.army.mil>, "ekraft@blm.gov" <ekraft@blm.gov>, Shannon Crosley <Shannon.Crosley@ferc.gov>, "Riely, Debbie - FS" <debbie.riely@usda.gov>, "Kenninger, Kate - FS" <Kate.Kenninger@usda.gov>
Subject: RE: North Bakken Expansion Project - FERC Pre-Filing Bi-Weekly Call

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Good morning everyone,

Attached is the FERC process presentation we will be going over during the call today, along with some guidance for federal and state agencies involved in FERC natural gas projects.

Thanks,

Dawn

Dawn Ramsey
Federal Energy Regulatory Commission
Dawn.Ramsey@ferc.gov
202-502-6856

-----Original Appointment-----
From: Andrea Thornton <Andrea.Thornton@erm.com>
Sent: Wednesday, August 14, 2019 10:04 AM
To: Andrea Thornton; Renschler, Jason J CIV USARMY CENWO (USA); Thury, Jeremy J CIV USARMY CENWO (USA); jessica_n_johnson@fws.gov; jerry_reinisch@fws.gov; Jackson, Seth; Bickerdyke, Cale E -FS; Grotte, Kim -FS; Wax, Peter N.; Tina Lyons; Linn, Dave; Linn, Jill; Huncovsky, Greg; Myerchin, Lori; Lueder, Gay Lynn; Stennes, David; Stefka, Kyle; Persinger, Ashley C.
Cc: Dawn Ramsey; Morris, Michael P CIV USARMY CENWO (USA); Wallace, Arthur L Jr CIV USARMY CENWO (US); Rogers, Richard R II CIV USARMY CENWO (US); ekraft@blm.gov; Shannon Crosley; Riely, Debbie - FS; Kenninger, Kate - FS
Subject: North Bakken Expansion Project - FERC Pre-Filing Bi-Weekly Call
When: Wednesday, February 12, 2020 8:00 AM-9:30 AM (UTC-08:00) Pacific Time (US & Canada).
Where: Microsoft Teams Meeting
Importance: High

Hello Everyone –

As we discussed on our January 29, 2020 bi-weekly call, the last North Bakken Expansion Project pre-filing call with be on February 12th. In addition to the standard information we have been providing on these calls, FERC will be providing an overview of the FERC process moving forward once WBI Energy's application is filed. Additionally we will be doing an overview of agency comments on the preliminary draft of the applicant prepared EA. We have extended the duration of the call from 1 hour to 1.5 hours to include this additional information.

We encourage all agencies to attend this call! Please let us know if there are any questions.

-Andrea

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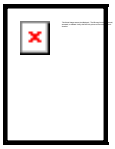

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Andrea Thornton

From: Andrea Thornton
Sent: Wednesday, August 12, 2020 2:58 PM
To: sovereignlands@nd.gov
Cc: Heiser, Gerald R.; Huncovsky, Greg; Linn, Jill
Subject: North Bakken Expansion Project
Attachments: 081220_WBI NBE Soverign Land App.pdf

To: Sovereign Lands Permit Reviewer

From: WBI Energy Transmission, Inc.

WBI Energy Transmission, Inc. (WBI Energy) proposes to install approximately 93 miles of pipeline, including new pipeline, pipeline looping and upgrades to existing pipelines, as well as construction of a new compressor station, upgrades to an existing compressor station, and other appurtenances to transport natural gas from WBI Energy's existing Tioga Compressor Station near Tioga, Williams County, North Dakota, to a new interconnect with North Border's mainline southeast of Waterford City, McKenzie County, North Dakota. The North Bakken Expansion Project (Project) includes a new pipeline that would involve installation of an approximately 62-mile-long, 24-inch-diameter natural gas pipeline that would include the crossing of Lake Sakakawea and U.S. Army Corps of Engineers (USACE)-owned land. WBI Energy is proposing to cross both the lake and USACE property using the horizontal directional drilling (HDD) intersect method.

WBI is submitting the enclosed application for Authorization to Construct a Project within Sovereign Lands of North Dakota (Appendix A) and supporting materials in accordance with North Dakota Administrative Code § 89-10 and the North Dakota Sovereign Land Management Plan. Details regarding the HDD crossing methods and associated plans include the same materials submitted to the USACE for Section 408 permitting, attached as Appendix B. Figure 1, within Appendix B, provides an overview of the proposed Project crossing of Lake Sakakawea. WBI Energy plans to begin construction of the pipeline in May of 2021.

The following appendices are included in this submittal:

- Attachment A - Application To Construct A Project Within Sovereign Lands
- Attachment B - U.S. Army Corps of Engineers Section 408 Permit Application and Attachments

WBI Energy appreciates your assistance and review of the enclosed materials and should you have questions or require additional information during your review, please contact myself or Greg Huncovsky (406) 359-7451.

Respectfully,

Andrea Thornton

Andrea Thornton
Principal Consultant
Pronouns: she/her/hers

Environmental Resources Management (ERM)
1050 SW 6th Avenue, Suite 1650 | Portland, Oregon | 97204
M 503-459-6864
E andrea.thornton@erm.com | **W** www.erm.com

WBI ENERGY TRANSMISSION, INC.
1250 West Century Ave.
P.O. Box 5601
Bismarck, ND 58506-5601
(701) 530-1600
www.wbienergy.com

August 12, 2020

Gerald Heiser
North Dakota State Water Commission
900 East Boulevard Avenue
Bismarck, ND 58505

Re: WBI Energy Transmission, Inc.
North Bakken Expansion Project
Sovereign Land Permit

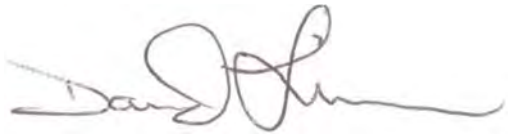
Mr. Heiser,

WBI Energy Transmission, Inc. (WBI Energy) proposes to install approximately 93 miles of pipeline, including new pipeline, pipeline looping and upgrades to existing pipelines, as well as construction of a new compressor station, upgrades to an existing compressor station, and other appurtenances to transport natural gas from WBI Energy's existing Tioga Compressor Station near Tioga, Williams County, North Dakota, to a new interconnect with North Border's mainline southeast of Waterford City, McKenzie County, North Dakota. The North Bakken Expansion Project (Project) includes a new pipeline that would involve installation of an approximately 62-mile-long, 24-inch-diameter natural gas pipeline that would include the crossing of Lake Sakakawea and U.S. Army Corps of Engineers (USACE)-owned land. WBI Energy is proposing to cross both the lake and USACE property using the horizontal directional drilling (HDD) intersect method.

WBI is submitting the enclosed application for Authorization to Construct a Project within Sovereign Lands of North Dakota (Appendix A) and supporting materials in accordance with North Dakota Administrative Code § 89-10 and the North Dakota Sovereign Land Management Plan. Details regarding the HDD crossing methods and associated plans include the same materials submitted to the USACE for Section 408 permitting, attached as Appendix B. Figure 1, within Appendix B, provides an overview of the proposed Project crossing of Lake Sakakawea. WBI Energy plans to begin construction of the pipeline in May of 2021.

WBI Energy appreciates your assistance and review of the enclosed materials and should you have questions or require additional information during your review, please contact Dave Linn (406) 359-7333.

Respectfully submitted,



Dave Linn
Senior Engineering and Projects Manager
WBI Energy Transmission, Inc.

Cc:

Greg Huncovsky, WBI

Andrea Thornton, ERM

Appendix A

Application Form

AUTHORIZATION TO CONSTRUCT A PROJECT WITHIN SOVEREIGN LANDS OF NORTH DAKOTA

OFFICE OF THE STATE ENGINEER
REGULATORY DIVISION
SFN 61408 (5/2018)

No. S
(OSE USE ONLY)

Project Number **1625**

This application must be submitted to the North Dakota Office of the State Engineer by **mail to 900 E Boulevard Ave, Dept. 770, Bismarck, ND 58505-0850, by fax to (701) 328-3696, or by email to sovereignlands@nd.gov.** To be complete, this application must include the additional information listed in the instructions on page 3.

If you need any assistance, please contact the Regulatory Division at (701) 328-2752.

OFFICE OF THE STATE ENGINEER USE ONLY

****** Additional Sheets May Be Attached If Necessary. ******

Project Will Be Located In Which Water Resource District?
Williams County and McKenzie County Water Resource Districts

LOCATION DESCRIPTION TO THE NEAREST 40-ACRE TRACT

¼	¼	Section	Township	Range
See Figure 1	See Figure 1	S.18 in R.96W; S.36 in R.97W	T.154N	R.96W & R. 97W

Is This Application For Modification Of An Existing Project? ☐ Yes ☒ No

If So, What Year Was Project Constructed? N/A

By Whom?
Project is associated with new proposed natural gas pipeline, proposed by WBI Energy Transmission, Inc., no work has been completed.

Proposed Project Involves

- ☐ Bank Stabilization
- ☐ Boat Ramp
- ☐ Bridge Construction
- ☐ Fish And Wildlife
- ☐ Geotechnical Work
- ☐ Levee/Dike Or Dam
- ☐ Other, Explain _____
- ☒ Pipeline Crossing
- ☐ Recreation
- ☐ Utility Line Crossing
- ☐ Vegetation Control
- ☐ Water Outfall
- ☐ Waste Lagoon
- ☐ Temporary Water Intake
- ☐ Perennial Water Intake
- ☐ Permanent Water Intake Structure
- ☐ Dredge, Volume _____
- ☐ Fill, Volume _____

If Proposed Project Involves A Standard Dock (see Supplemental Measurements Sheet For Standard Docks)

Standard Dock Dimension Shape Project does not include a dock installation. Additional details are provided in Appendix B, the same materials submitted to the USACE as part of the Section 408 Permit application.

A	B	C	D
N/A	N/A	N/A	N/A

About Water Body

Water Body On Which Project Will Be Located
Lake Sakakawea (Missouri River)

Purpose
Natural gas pipeline crossing of Lake Sakakawea.

Project Description
WBI Energy proposes to install a new 62-mile-long, 24-inch-diameter natural gas pipeline from WBI Energy's existing Tioga compressor station to a new interconnect with Northern Borders' mainline southeast of Watford City, North Dakota. The pipeline installation will involve use of the HDD intersect method to install a natural gas pipeline across Lake Sakakawea as part of the proposed North Bakken Expansion Project (Appendix B; Figure 1). The HDD intersect method involves using two drill rigs, one on each side of the HDD, and drilling two pilot holes towards each other until they intersect at a predetermined point. For more details pertaining to the proposed activities see Attachments 1 and 8 of the attached Appendix B, "HDD Plan" and "Risk Assessment". WBI Energy plans to begin construction of the pipeline in May 2021.

Contractor (if known)
Michels

Anticipated Construction Start Date	Completion Date
May 2021	4 to 6 months after start of construction

APPLICANT'S CERTIFICATION

I, the undersigned, am applying for authorization as required under North Dakota Century Code (N.D.C.C.) ch. 61-33 from the Office of the State Engineer. I understand that I must comply with N.D.C.C. ch. 61-33 and North Dakota Administrative Code ch. 89-10-01, and that I must adhere to any conditions required by the State Engineer. I acknowledge that my project is accurately described and depicted in this application as I intend to construct it. My signature below acknowledges that I have read and agree to these statements.

PROJECT OWNER

Name of Project Owner			
WBI Energy Transmission, Inc.			
Address	City	State	ZIP Code
2010 Montana Ave.	Glendive	MT	59330
Home Telephone Number	Cell Number		
406-359-7451	N/A		
Email Address			
Greg.Huncovsky@WBIEnergy.com			
Signature of Project Owner or Applicant			Date
			8-12-20

IF DIFFERENT FROM PROJECT OWNER

Name of Applicant			
N/A			
Address	City	State	ZIP Code
Home Telephone Number	Cell Number		
Email Address			

Signature of Project Owner or Applicant	Date

INSTRUCTIONS FOR COMPLETING AN AUTHORIZATION TO CONSTRUCT A PROJECT WITHIN SOVEREIGN LANDS OF NORTH DAKOTA UNDER NORTH DAKOTA ADMINISTRATIVE CODE § 89-10-01-04

A person seeking to construct a project within Sovereign Lands of North Dakota requires authorization from the State Engineer before construction or operation of the project. "Sovereign Lands" means those areas, including the beds and islands, lying within the ordinary high water mark of navigable lake and streams.[1] (N.D.C.C. § 61-33-01). The "ordinary high water mark" is that line on navigable waters below which the action of the water prevents the growth of vegetation, or to restrict its growth to predominantly wetland species.

To be complete, the application must include all information listed below:

1. A completed "Application to Construct a Project within Sovereign Lands of North Dakota" form.
2. A detailed map or drawing of the projects location on an aerial photo.
    i. Size of map must be 8 ½ by 11 inches,
    ii. Map shall have a north arrow and approximate scale, and
    iii. Map shall indicate the proposed work on the drawing.
3. If applying for the installation of a standard dock in which the total length of the dock over the surface of the water does exceed twenty-five feet on a river and fifty feet on a lake, please include measurements requested on "Supplemental Measurements Sheet for Standard Docks".
4. If applying for the installation of a standard dock in which the total length of the dock over the surface of the water does not exceed twenty-five feet AND is located on the Missouri River between the Oliver and Morton County line and Lake Oahe wildlife management area, the project only requires registration with the State Engineer. Please complete the "Registration for Placement of a Dock Under 25 Feet-Long on Specified Waters" form (SFN 61441).
5. If applying for the installation or modification (including change in transported liquid) of a pipeline which transports crude oil, natural gas liquids, or any other hazardous liquid, as determined by the State Engineer, the Applicant must first conduct a scour analysis specific to the proposed crossing for project design purposes.[2]
6. If applying for the installation of riprap or other bank stabilizations, please include a cross sectional drawing of the proposed work which includes the existing and proposed grade and the present location of the water surface.

Further Sovereign Land Permit Guidance:

1. A permit would be required if any portion of the project would occur within, under, or over a navigable water of North Dakota.
2. A permit would be required if any portion of the project would occur below the ordinary high water mark.
3. The permit applicant is responsible for obtaining any other local, state, or federal permits or permissions that may be necessary prior to construction of a project on Sovereign Land.
4. There is no fee administered for a Sovereign Land Permit.
5. Please allow at least 90 days for Sovereign Land Permit processing.
6. Please notify the Office of the State Engineer of project completion at *sovereignlands@nd.gov*.
7. Unless specified, there is no expiration date on an obtained Sovereign Land Permit.

---

[1] North Dakota's Navigable Waters as of 2018: Missouri River, James River, Sheyenne River, Pembina River, Mouse River, Red River of the North, Bois De Sioux, Knife River, Heart River, Cannonball River, Yellowstone River, Devils Lake, Lake Metigoshe, Painted Woods Lake, Sweetwater Lake, Upper Des Lacs Lake, and Long Lake(Bottineau County). List subject to change.

[2] The minimum depth-of-burial for pipelines transporting crude oil, natural gas liquids, or any other hazardous liquid as determined by the state engineer must be total calculated scour plus four feet from the bed of the river to top-of-pipe for pipelines crossing the state's navigable rivers. (N.D.C.C. ch.61-63).

Appendix B

U.S. Army Corps of Engineers Section 408 Permit Application and Attachments,

(Figure 1, HDD Crossing Plan, and Associated Plans)

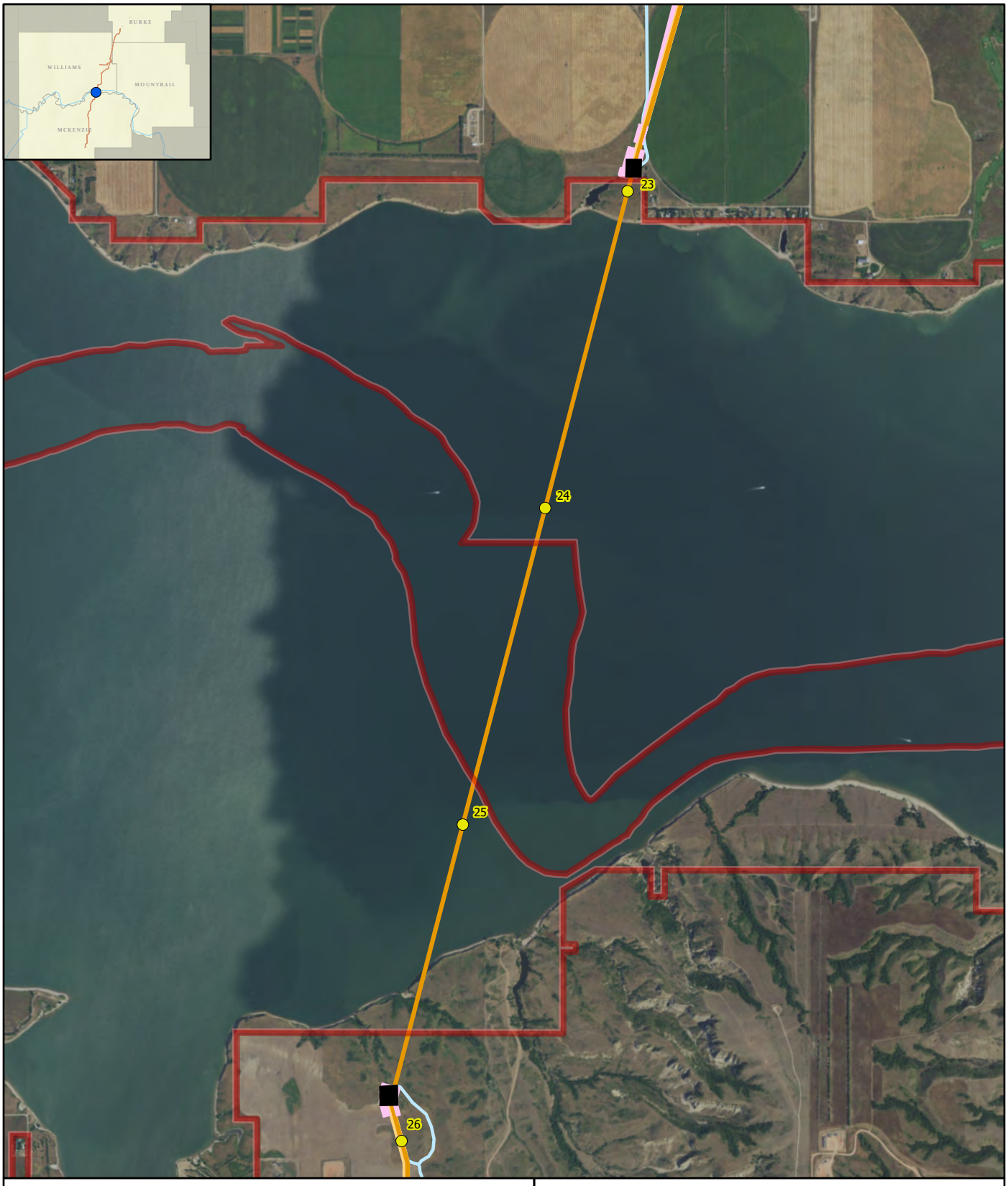


Figure 1
North Bakken Expansion Project
Lake Sakakawea HDD Extent
and Associated USACE Owned Lands Crossing

WBI ENERGY TRANSMISSION

File: M:\Clients\V-X\WBI\North_Bakken_Expansion_ArcGIS\Wetland_WaterbodyReportMaps\USACE_NWP_Report.aprx | Revised: 1/31/2020 | Scale: 1:40,000 Drawn By: RJC

Attachment 1

Horizontal Directional Drilling Installation Plan

HORIZONTAL DIRECTIONAL DRILLING INSTALLATION PLAN

WBI Energy Transmission
Lake Sakakawea/ Missouri River HDD Crossing

Proprietary ... Michels Corp

MICHELS®

August 10, 2020
REVISION -2

MICHELS®

HDD INSTALLATION PLAN
Michels Directional Crossings
WBI Energy Transmission
North Bakken Expansion Project
Lake Sakakawea / Missouri River Crossing
Installation of ~15,442' / 24" Steel Pipe

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Drill Work Sites	Page 2
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Cleaning Pass	Page 7
Drill Mud Cleaning	Page 7
Pull Pipe	Page 8
Contingency Planning	Page 8
Solids Control and Separation	Page 8
Demobilization	Page 8

Intro:
The proposed Lake Sakakawea/Missouri River HDD crossing consists of installation of ~15,442' of 24" steel pipe. HDD has been the selected installation method to minimize surface and water body disruption/impact. Environmental considerations were also a factor in choosing HDD as the construction method. HDD is a trenchless installation method that installs the pipeline far deeper under the waterbody with minimal surface and environmental impact when compared to traditional open-cut installations.

Drill Support and Manpower:
Michels proposes drilling and installing this crossing utilizing the pilot-hole intersect method, which requires cutting edge directional drilling technology & the use of two drill rigs drilling simultaneously toward each other in performance of the installation. Michels has been perfecting this unique cutting-edge method for the past 12-years, while successfully completing numerous complicated and long distance directional drill installations that otherwise would not have been attempted. Each drill rig site requires one shift of 8-12 men. The primary drill rig to be utilized will be a minimum DD-840 Drill Rig with the secondary rig being a minimum DD-840 Drill Rig. The crews will be scheduled to work approximately 12 to 14 hours per day and up to 7-days per week. 24-hour per day operations may be required at any given time on the crossing depending on conditions encountered in the bore-hole & specific requirements which must be met. Michels reserves the right to supply and substitute personnel as required but will provide WBI Energy notice prior to personnel changes being implemented.
(Attachment – Potential On-Site Specialized Manpower and Resumes)
(Attachment- Safety and JSA Information)
(Attachment- SPCC Plan)
(Attachment – Drill Rig Specifications)

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Drill Configuration/Geometry:
Directional drilling using the pilot-hole intersect method is proposed for this crossing. The planned borehole geometry is anticipated to follow the attached HDD plan and profile drawing. Adequate depth of cover should be maintained beneath contours and obstacles in accordance with industry standards at all crossings to minimize the risk for inadvertent drilling fluid returns. The HDD crossing will be installed within the tolerances listed in the construction contract so that the factor of safety ratings will be maintained. Conductor casing may also be installed at either or both the entry and exit locations in order to traverse unconsolidated formation if necessary, this is done in order to alleviate conditions associated with inadvertent drilling fluid returns and settlement or to allow a better transition into more consolidated formation.

(Attachment – HDD Plan and Profile Drawing)

Drill Work Sites Preparation:
The drill work sites required for staging equipment should be prepared by the prime contractor readied for Michels' mobilization to the job site. Cleared and level work pads at both sides of the crossing are necessary for the support and movement of semi-trucks and heavy equipment. The pad may require the installation of matting, gravel or other means for a stable workable surface. A work pad is required at both sides of the proposed crossing capable of supporting a drill rig with ancillary equipment. The two work areas are shown on the attached HDD design drawing and pipe laydown drawing. The two work areas should be connected by a straight centerline alignment. A drill rig dead-man is typically installed in front of the unit to support minimal movement of the rig during drilling operations. The dead-man consists of an 8' x 20' steel plate installed vertically down into the ground placed in front of the rig. It is used to distribute load bearing support across and to the surrounding ground formation during rigorous drilling operations.
(Attachment – Anticipated Entry/Exit Equipment)
(Attachment – HDD Equipment Noise Information)

Pilot Hole:
Michels uses two main pilot hole tracking systems for large scale HDDs such as the Lake Sakakawea / Missouri River crossing. The first being a wireline tracking system called the Para-track system. This system requires a surface cable or solenoid. The second pilot hole tracking system is the Gyroscope which requires no surface cable or solenoid. The typical hole intersect procedure for the two systems are described separately below.

Hole Intersect using the Para-Track System
A 12-1/4" drill bit is advanced from the entry points (Rig Side Entry and Pipe Side Entry) toward the pre-designated intersect point along the proposed bore-hole path alignment using a directional jetting bottom-hole assembly or mud motor with bit and bottom-hole assembly. The pilot hole drilling from Rig Side Entry can be prior to or concurrent with pilot hole drilling from the pipe side entry as intersect procedures do not have to occur at exactly half the distance. The intersect location ±500 feet is pre-determined prior to drilling however, conditions encountered during pilot hole drilling will dictate the approximate location of performing the intersect. The bottom-hole assembly will be advanced from the entry side toward the second pilot-hole projection which will be drilled or is being drilled from the other side. The bottom-hole assembly includes the bit (12-1/4" in diameter), drilling mud motor if required, orientation and pressure measurement sub, steering guidance tool (Vector Magnetics Para Track2 Survey and Guidance System) and non-magnetic drill collars. The drill stem

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added behind this bottom-hole assembly will be S-135 grade 7 5/8" FHDS (Full Hole Double Shoulder) series drill pipe or better and in random 30(±) foot lengths.

The location of the pilot-hole drill paths will be continuously monitored, surveyed then recorded from its respective drill rig location utilizing the data from the down-hole probe (Para Track2 Probe) as drilling proceeds. Critical tracking information to be processed includes elevation, alignment and distance away from each rig which is calculated then recorded in accordance with industry standard, once at the end of every drill stem length (approximately 30-feet).

Constant communication is maintained between the two drill crews as pilot-hole intersect operations progress. Prior to the pilot holes reaching the projected intersect location, the magnetic signal being monitored on the instrument tracking computer inside the control trailer will increase in strength. After the two pilot holes are overlapped by approximately 30', a PMR (Passive Magnetic Ranging) survey will be conducted. At this time, the Para Track2 Probe will be used to collect static magnetic field readings relative to the adjacent drill stem. To perform this operation, the 7 5/8" drill pipe positioned in the previously drilled borehole from the entry end will be retracted in predetermined distance increments, these distance retractions are sensed by the probe and recorded. The magnetic field readings collected by the Para Track2 probe will then be analyzed to verify that sufficient and accurate data has been collected and a position offset between the two boreholes can be calculated and determined. This PMR survey will be repeated once every 30' until the two boreholes are connected.

Hole Intersect using the Gyroscope System

A 12-1/4" drill bit is advanced from the entry points (Rig Side Entry and Pipe Side Entry) toward the pre-designated intersect point along the proposed bore-hole path alignment using a directional jetting bottom-hole assembly or mud motor with bit and bottom-hole assembly. The pilot hole drilling from Rig Side Entry can be prior to or concurrent with pilot hole drilling from the pipe side entry as intersect procedures do not have to occur at exactly half the distance. The intersect location (±500 feet) is pre-determined prior to drilling however, conditions encountered during pilot hole drilling will dictate the approximate location of performing the intersect. The bottom-hole assembly will be advanced from the entry side toward the second pilot-hole projection which will be drilled or is being drilled from the other side. The bottom-hole assembly includes the bit (12-1/4" in diameter), drilling mud motor if required, orientation and pressure measurement sub, steering guidance tool (Gyroscope Guidance System). The drill stem added behind this bottom-hole assembly will be S-135 grade minimum 7 5/8" FHDS (Full Hole Double Shoulder) series drill pipe or better and in random 30(±) foot lengths.

The location of the pilot-hole drill paths will be continuously monitored, surveyed then recorded from its respective drill rig location utilizing the data from the down-hole probe (Gyroscope) as drilling proceeds. Critical tracking information to be processed includes elevation, alignment and distance away from each rig which is calculated then recorded in accordance with industry standard, once at the end of every drill stem length (approximately 30-feet).

As the pilot holes approach the planned intersect area the following steps are typically followed to complete the intersect:

1. A pair of radars are placed, one behind each gyro on either side.
2. The drilling surveyors on both sides stay in contact sharing their survey data as the bore progresses.

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3. When they get within 30’ of the bits overlapping, one side will pull a joint of pipe to the top of the rig and wait for the opposite side to overlap their hole with the bit.
4. While the drilling side is progressing, the other side will monitor annular pressure (if annular pressure is being monitored) and watch for vibrations indicated on survey readouts.
5. If at this time the drilling side notices any changes to the push or rotation indicating they may be coming into the hole drilled from the opposite side, the side which is waiting will slowly push down and see if they bump into the other bit. If they do bump, the drilling superintendent and surveyors will then decide based on the angles at which the intersect occurred, the push and torque on the strings of pipe, and the distance from the intersect point to the ends of the hole, which side will push out of the ground. They will also decide, based on ground conditions how much space to keep between the bits as one side pulls back and the other pushes forward.
6. If the bits do no bump after the two holes are overlapped in a horizontal direction, the side which is not drilling forward will pull back drill stem and bit an appropriate distance so that the drilling side can drill far enough forward without the bits being overlapped until the side which is waiting can push down slowly while the other side monitors for vibrations until the radars are parallel to each other.
7. At this time the surveyors will take a radar survey. Based on the survey, the drilling superintendent and surveyors will determine the best option to drill from one side or the other until the holes are intersected. Usually, another radar survey will be taken in 1 to 3 drill pipes as the hole progresses to verify that the distance between the holes is matching what is expected based on the first set of data.
8. When the holes get close enough in a lateral and vertical direction that intersection is expected one side will pull back far enough that the drilling side can safely drill into the hole without causing damage to the tools. When the drilling superintendent and surveyor believe based on the pressures and survey data the holes are intersected, the other side will push down slowly until the bits are verified to have touched. Usually this is accomplished by pushing until either the push pressure rises above that in open hole, or the other side notices movement. Then one side will move a set distance and see if the other side can now push freely again.
9. When it is verified that the holes are intersected the drilling superintendent and surveyors will then decide based on the angles at which the intersect occurred, the push and torque on the strings of pipe, and the distance from the intersect point to the ends of the hole, which side will push out of the ground. They will also decide, based on ground conditions how much space to keep between the bits as one side pulls back and the other pushes forward. They will also decide, based on ground conditions how much space to keep between the bits as one side pulls back and the other pushes forward.
10. If the ground is soft, it can be necessary for both sides to bump the bits against each other and one side to push as the other side pulls back slowly maintaining contact with the bits to insure that the pushing side stays in the hole.

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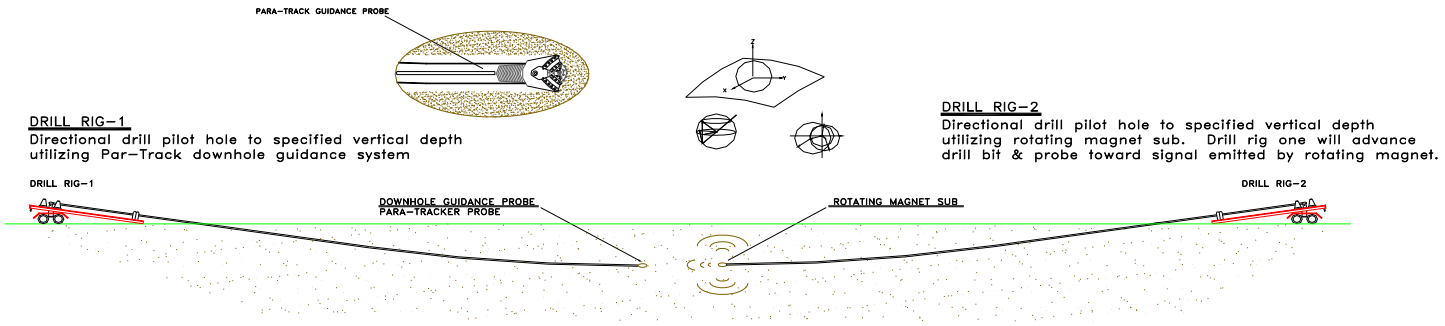
Pilot Hole Intersect Sketch



(Attachment – MGS Steer Tool System; Attachment – Gyroscope; Attachment - Para Tracker Gyro Module; Attachment - Para Tracker, Attachment Tensteer Tool, Attachment – Drill Rig Specification Hercules 1200, Atlas-840, Titan-440 and UNI 250X400, Attachment – Daily Tracking Forms)

Drilling Fluids:

Essential to any successful HDD process is the selection and proper utilization of drilling fluid, which is primarily made up of water and bentonite having pH values between 8 and 9. Bentonite is a naturally occurring, non-toxic, inert substance that meets NSF/ANSI-60 Drinking Water Additive Standards and is used for drilling potable water wells. Often soda ash is added to the drilling fluid to increase the pH to 8 and reduce the soluble calcium. This allows bentonite to perform at its maximum and reduces the amount of bentonite added to the drilling fluid. Soda ash is also NSF standard 60 certified and is used to drill potable water wells. Using these products minimizes the impact to any environmentally sensitive area in the unlikely event that an inadvertent return should occur.

Bentonite serves many notable purposes in the HDD process, which includes but is not limited to:

1) Cleans the drilled cuttings from the bore hole and cools the drilling tools,
2) Transports cuttings to the surface for recycling,
3) Aids in stabilizing formations by supplying a cohesive nature to the surrounding geological formation and preventing fluid loss from the bore hole,
4) Provides lubrication for the drill string and downhole assembly, which reduces frictional forces at the formation,
5) Drives a down-hole drill motor for rock drilling,
6) Provides hydrostatic fluid pressure in the bore hole to offset ground formation pressures.

Drilling fluid is composed of a carrier fluid and solids. The selected carrier fluid for this crossing consists of water (approximately 96%) and an inorganic, bentonite clay (approximately 4%). Michels has access to

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several different brands of bentonite. The selection of which brand to use is typically based on price, availability and proximity to the proposed drill site. The following brands all exhibit similar characteristics providing the same results as listed above.
(Attachment – Potential Bentonite Brands – Product Data Sheets/MSDS Sheets)

Potential Bentonite Brands

- Max Gel
- Super-Gel X
- Bara-Kade

The bentonite will be mixed in a mud mixing tank of up to 5,000 gallons, depending on mud rig size, in accordance with manufacturer's recommendation. Approximately 15 to 20 pounds of powder bentonite will be mixed with 100 gallons of fresh water *(Mud Composition),* and will be used throughout the entire drilling process to establish and maintain optimum drilling fluid properties. Estimated proportions listed above are based on past experience and do not take into account unexpected conditions encountered. Michels maintains fluid performance through the daily sampling, testing and recording of fluid properties throughout drilling operations. This provides Michels' Mud Technician the information required to make educated recommendations regarding maintenance of efficient drilling fluid rheology consistent with hole-stabilization with the intention of limiting inadvertent surface returns and optimizing drilling fluid performance. Following is one of the tables used as a guideline by the Mud Technician referencing recommended fluid consistencies targeted during typical testing. Consistencies of powder and water are varied to achieve these recommended viscosities.

Targeted Drilling Fluid Viscosities Recommended	
Sand	60-80 Viscosity
Silt	50-70 Viscosity
Clay	40-50 Viscosity
Rock	60-80 Viscosity
Gravel	70-90 Viscosity

Once the drilling fluid is thoroughly mixed to an acceptable consistency, it is pumped from the mud tank to the back end of the drill rig. From here it is injected under high pressure through the drill stem at a rate of between 300 to 800 gpm to the apex of the drill head. The spent drill fluid with mixed cuttings maintains a return flow back along the annular space created between the drill stem and the formation wall. Drill fluid returns to the entry pit where it is pumped by a 6hp submersible pump to the fluid recycle and processing system.

Additives may be deemed necessary based on evaluations and recommendations made by the Mud Technician during drilling and hole-opening operations. If the need for drill fluid additives does arise, it is anticipated that one of the attached additives may be required in order to maintain adequate fluid rheology down-hole. Michels formally submits the attached drilling fluid additives for approval and use on this project. (Attachment – Drilling Additives / LCMs for approval)

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Reaming Passes:
Michels anticipates performing one ream pass with a final hole dimeter of ~36" accommodate the 24" steel pipe. However, the final determination as to size and number of ream passes will be based on conditions encountered during pilot-hole drilling and the initial reaming operation.

The reamers proposed for the crossings will be various types of dirt and rock reamers custom fabricated by Michels specifically for this type of formation, which could include conventional fly-cutter type reamers and hole-openers. Michels also has additional resources for various rock-tooling which can be supplied at a moment's notice if needed. Equivalent or better tools may be substituted depending on availability of other supplier's products or if changes in anticipated drilling conditions are encountered.
(Attachment- Michels' Downhole Tools)

Cleaning Pass:
A swab pass will need to be conducted up to the same size as the final ream pass but no larger. The swab pass is typically pulled back from exit to entry.

Drill Mud Cleaning:
The first phase of the mud cleaning system is displacement of solid returns at the shaker. Heavy solids are sifted out by a shaker with screens and deposited into a pit. From here they will be transported by dump truck to a site for disposal.

Drill Mud Cleaning Equipment Specifications

Volume of Mixing/Scalper Tank	54.0-Bbls
Volume of Desander Tank	72.0-Bbls
Volume of Desilter Tank	72.0-Bbls
Quantity of Scalping Shakers	1.0-Shakers
Mesh Size of Scalping Shakers	10-20 Double Stacked
Desander Capability	2 @ 500-GPM (1,000 GPM Total)
Desander Cones	2.0-Cones
Desander Mesh Size	40 to 165
Quantity of Desilter Cones	10 Ea @ 100-GPM
Desilter Mesh Size	60 to 250
Steel Mud Circulating Tank Volume	160-Bbls
Returns Tank Volume (Mud Pit)	320-Bbls
Cuttings Tank Volume (20-yd Roll-off)	150-Bbls
Mud Screening, Max Pass Size	40-Mesh

(Attachment – Mud Cleaning Equipment Specifications)

Bentonite Pump Capabilities (ENTRY/EXIT) (Based on Availability)

Name Brand	Ellis Williams W-446 Triplex Piston Model
Liner Size	6-Inches
Maximum Pressure	1,027 PSI
Maximum Flow Rate	661 GPM
Gallons Per Stroke	2.20 Gallons Per Stroke

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Bentonite Pump Capabilities (ENTRY/EXIT) (Based on Availability)

Name Brand ..... Gardner Denver OPI-350
Liner Size 6-Inches
Maximum Pressure .....1,469 PSI
Maximum Flow Rate..... 529 GPM
Gallons Per Stroke ..... 2.94 Gallons Per Stroke

Pull Pipe:
The 24" pipe will be welded and placed on top of rollers in preparation for pullback. The pipe will be pulled into place utilizing an approved pull head, swivel and reamer from exit to entry. This is a continuous operation which takes place until the product pipe is pulled through the opened hole back to the entry point.
(Attachment - Michels' Support Rollers)

Contingency Planning:
Contingency planning is conducted in response to unforeseen events and conditions which could occur during normal operating sequences.

Included in the contingency plans, Michels has developed an environmentally responsive set of contingency plans including contingency planning for inadvertent returns to be invoked for expeditious attention and handling of various incidence as they arise.
(*Attachment – Contingency Plans for HDD crossing)*

Solids Control and Separation:
The first phase of the mud cleaning system is displacement of solid returns at the shaker. Solid control systems will vary for the various drill rigs however the end product is the same. Heavy solids are sifted out by a shaker with screens and deposited into a pit. From here they will be transported by dump truck to a site for disposal. Spent drill fluids are collected at the drill site and transferred to tanker trucks for disposal at an approved location. *(Attachment – Drill Fluid Recycle Flow Chart)*

Demobilization:
Excess drilling fluid is removed from the site and transported to the approved disposal site. Equipment and personnel will be moved off-site after successful completion of the hydrostatic test and clean-up operations will take place. Mud pits will be backfilled with the native soil that was excavated and temporarily stored. Topsoil will be segregated separately from the subsoil and backfilled appropriately to restore conditions as close to pre-construction as possible.

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ATTACHMENT

ON SITE
SPECIALIZED MANPOWER
AND RESUMES

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PERSONNEL STATEMENT

Personnel for each newly contracted job, from the Project Manager to the Mud Technician, are duly assigned to a project based on a number of circumstances. These may include but are not limited to the following; current projects under contract, geographic location of previous project, scope of work required for the directional drill. Our personnel and equipment have been assembled so that they are interchangeable from project to project.

The key to any directional drilling project is obviously having qualified personnel who are experienced in dealing with unforeseen circumstances as they arise. Michels' personnel are some of the most experienced and highly qualified drilling experts in the industry, as demonstrated on past projects accumulated on our reference list. With the appropriate resources at their disposal, Michels has overcome risks associated with some of the most difficult drilling projects ever attempted and has evolved into one of the foremost leaders in the directional drilling industry.

Each of the Drilling Superintendents employed by Michels is highly experienced in utilizing drill rigs of every size. Michels' Drilling Superintendents are well respected throughout the industry, as represented on the attached resumes. Each has completed countless difficult drills including installation of large diameter pipe and at great lengths. Our Drilling Superintendents have worked up through the ranks providing them a complete and comprehensive understanding of safety, hazards, environmental monitoring, manpower, equipment operations and repairs for each phase of the directional drilling operation. Michels' personnel maintain continuous schooling for all phases of the drilling operation.

As noted on the attached resumes, each Superintendent has drilled throughout North America as well as internationally, and has encountered various soil conditions, from sands, gravels, clay and cobble to solid rock formations.

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Directional Crossings

A Division of Michels Corporation

Jeff Mueller
Vice President of Michels Directional Crossings

Sean Nicholson
Vice President of HSE

Jason Pederson
Director of Safety for HDD

Ed Dye
Safety Coordinator

Michael Miller
Safety Coordinator

Spencer Rusk
Safety Coordinator

Mark Franz
Environmental Manager

Tim McGuire
Senior Advisor

Paul Krings
Sr. Equipment and Logistics Manager

Eric McBrair
HDD Tooling Manager

Dan Pucker
Directional Drill Shop Manager

Scott Nehls
HDD Logistics QA/ QC Manager

Matt Smith
General Manager Contracts and Business Administration

Greg Goral
Senior Design Engineer

Brad Eifert
Engineering Tech

Zach Osborn
Estimator

Diane Dalle Nogare
Executive Assistant

Toni Budahn
Administrative Assistant

Dustin Branscomb
Trenchless Engineer

Don Mueller
Eastern Operations Manager

Bob Spennati
Assistant Operations Manager

Randy Robinson
Midwest Operations Manager

Kurt Myhre
Western Operations Manager

Ray Viator
Marine Operations Manager

Ted Foltz
Special Projects Manager

Project Managers: to be assigned to Operations Managers on a per project basis.

Ken Coleman	Wendell Long	Eric Frawley	Larry Shilman
Jim McGovern	Karl Kornkven	Rick Zavitz	Jeremiah Yliniemi
Dale Schinderle	Michael Geelan	Doug Houska	Chad Johnson

Field Superintendents: to be assigned to Operations Managers on a per project basis.

Mike Brever	Marcus Carratt	Jack Edmunds	Brian Guelig	Nick Leblanc	Tim Monroe	Clifford McLain	Seth Strean	Matt Rohwer	Brady Hickey	Branden Cole
Dan Kriesel	Curt Rischmueller	Steve Sanders	Richard Wulff	Bobby Skipworth	Dave Williams	James Day	Josh Bush	Garrett Derrerr	Steve Case	Carl Bresser
Jamie Hollenbeck	Mark Matthews	Doug Stebbins	Seth Matheny	Ryan Jackson	Nate Mecklenburg	Jason Freund	Tim Bunkelman	Brian Morgan		

Survey Engineers: to be assigned to Operations Managers on a per project basis.

Jeff Nehmer	Cale Mullenix
Lorenzo Rivera	Eric Riha
Jeremiah Erickson	Dan Reynolds

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Jeffrey S. Mueller

Vice President

PROFESSIONAL EXPERIENCE

2020 – Present: **Vice President | Michels Directional Crossings | Brownsville, WI**

Responsible for horizontal directional drilling division construction operations. Duties include profit and loss responsibility for multiple and simultaneous directional drilling gas, product, water, sewer, civil, electric, telephone cable, and environmental projects. Day-to-day involvement with bid estimating, construction feasibility evaluation, specification and design criteria review, proposal preparation, contract and subcontract negotiations, project planning and oversight, cost scheduling, allocation of divisional resources, and interface with utility construction managers, engineers, and owners. Report directly to the Senior Vice President and President of the company.

2003 – Present: **Operations Manager | Michels Directional Crossings | Brownsville, WI**

Supervisor of field operation superintendents and directional drilling project managers. Oversee large inventory of drilling tools and materials during storage and field use. Monitors production by Fleet Department of directional drilling personnel and equipment. Duties include coordinating and scheduling the mobilization of equipment, personnel and materials to remote job sites throughout the United States and Internationally. Involved in estimating of various directional drilling projects. Specialize in the engineering design, build and maintenance of directional drilling fleet. Responsible for pilot hole drilling & survey for complicated bores which include implementing and integrating new technology necessary for successful completion of leading edge HDD crossings (i.e. hole-intersects). Complete project experience available upon request.

Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
42"	3980'	Susquehanna River MP 99.6, PA	2018
20"	7354'	Susquehanna River, PA	2018
36"	6238'	Ohio River, OH/WV	2017
30"	3483'	Ford Island to Landing C, HI	2017
42" Steel with 36" HDPE	3983'	St John's River, FL	2016
30"	6119'	Lake Whitney, TX	2016
12"	11,548'	Union Canal & Martin Barge Canal, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
12"	11,563'	Holland Bottoms Wetlands, AR	2015
18"	12,459'	Houston Ship Channel, TX	2015
6"	6999'	Navajo Reservoir/San Juan River, NM	2014

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
48"	2060'	Tres Palacios River, TX	2014
36"	9040'	Mississippi River & Levees, Il/MO	2014
42"	3008'	I-95 & Tidal Wetlands, NJ	2013
30"	6544'	1st Street, NJ	2013
42"	4441'	Goethals Bridge, NY	2013
30"	8101'	Kill Van Kull River, NY/NJ	2013
30"	5378'	Hudson River, NY/NJ	2012
30"	4850'	Red River, TX/OK	2012
42"	4519'	Freeman Road, LA	2011
42"	5117'	Nature Conservatory, LA	2011

1996 – 2003: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record-keeping of plots and production. Oversees drilling survey during crossing.

1991 – 1996: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, WI**

Responsible for surveying, staking and design of directional drill path and curve, monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software. Complete surveying skills and experience utilizing a Total Station for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points. Additional duties include on-site maintenance of technical equipment and necessary record-keeping of plots and drilling logs.

1989 – 1991: **Skilled Laborer | Michels Directional Crossings | Brownsville, WI**

Experience in working on and around directional drilling rigs as an integral member of a specialized team. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs; hydraulics; fluids; set-up and operation of drill motors; power generators; mud pumps; bentonite mixers; drill pipe; reamers; couplings; and overall equipment maintenance and operation.

EDUCATION

1989 **Lomira High School | Lomira , WI**

High School Diploma

Tim McGuire

Senior Advisor

PROFESSIONAL EXPERIENCE

2020 – Present: **Senior Advisor | Michels Directional Crossings | Brownsville, WI**

Provide advice in the management of domestic and international horizontal directional drilling operations. Responsibilities include business development, contract procurement and negotiation, project oversight and management, and client communication.

2002 – 2020: **Vice President | Michels Directional Crossings | Brownsville, WI**

Responsible for horizontal directional drilling division construction operations. Duties include profit and loss responsibility for multiple and simultaneous directional drilling gas, product, water, sewer, civil, electric, telephone cable, and environmental projects. Day-to-day involvement with bid estimating, construction feasibility evaluation, specification and design criteria review, proposal preparation, contract and subcontract negotiations, project planning and oversight, cost scheduling, allocation of divisional resources, and interface with utility construction managers, engineers, and owners. Report directly to the Senior Vice President and President of the company.

1998 – 2002: **General Manager | Michels Directional Crossings | Brownsville, WI**

1994 – 1998: **Project Engineer/Project Manager | Michels Corporation | Brownsville, WI**

1992 – 1994: **Division Manager | Michels Environmental Services | Brownsville, WI**

1991 – 1992: **Drilling Division Manager | Harrison Western Mining Corporation | Denver, CO**

1987 – 1992: **Project Manager/Geotechnical & Environmental Engineer | Ebasco Corporation | Denver, CO**

INDUSTRY INVOLVEMENT

- MCI Engineer Training Seminar “Horizontal Directional Drilling Design, Specification and Construction for Trenchless Placement of Underground Utilities”
- Midwest Gas Association “Horizontal Directional Drilling Large Diameter Pipeline Installations”
- National Groundwater Association Outdoor Action Conference “Horizontal Directional Drilling Demonstration for Installation of Horizontal Wells”

EDUCATION

Colorado School of Mines | Golden, CO

Bachelor of Science: Geological Engineering - Minor: Hydrogeology

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Matthew Smith

General Manager/Contracts & Business Administration

PROFESSIONAL EXPERIENCE

2019 – Present: **General Manager/Contracts & Business Administration | Michels Directional Crossings | Brownsville, WI**

Oversee day-to-day divisional business operations and management of operational costs.
Duties include profit and loss responsibility for multiple and simultaneous trenchless construction projects in the oil/gas, civil, power and communication business sectors.
Day to day involvement with bid estimating, construction feasibility evaluation, specification and design criteria review, contract and subcontract negotiations, project planning, cost scheduling and interface with utility construction managers, engineers and owners.

2013 – 2019: **Manager-Direct Pipe | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating Direct Pipe projects for various size gas, water, sewer, electrical and communication lines. Assists with project design and methods of operation. Oversees clarification and interpretation of construction drawings. Assumes accountability for the direction and performance of construction personnel. Oversees project schedule, safety, profitability and cost control. Direct pipe installations/pipe assists:

Diameter	Length	Crossing/Location	Year
48"	651'	Juniata River, PA - HK 750PT Installation	2018
42"	484'	Highway 50, West Virginia - HK 500PT Installation	2018
36"	856'	Qu`Appelle River, Canada - HK 750PT Installation	2017
36"	1,280'	Highway #1, Canada - HK 750PT Installation	2017
36"	1,027'	United Blvd & Mundy Creek, Canada - HK 750PT Installation	2017
36"	1,047'	Lougheed Hwy, Canada - HK 750PT Installation	2017
42"	7,200'	Athabasca River, Canada - HK 750PT Installation	2016
36"	827'	Leslie Street, Ontario, Canada - HK 300PT Installation	2015
42"	1,299'	Lisgar Meadowbrook, Ontario, Canada - HK750PT Installation	2015
42"	1,008'	Highway 63, Canada - HK750PT Installation	2015
48"	4,039'	Dow Barge Channel, Clute TX - HK750PT Installation	2015
36"	1,002'	Hwy 225, Deer Park, TX - HK300PT Installation	2015
36"	1,092'	Lubrizol Drainage, LaPorte, TX - HK300PT Installation	2015
48"	2,455'	Rio Grande River, El Refugio, TX - HK750PT Installation	2014
42"	1,200'	Railroad Crossing, Groves, TX - HK750PT Installation	2014
42"	1,050'	Beaver River, Alberta, Canada - HK750PT Installation	2013
42"	470'	I-84, Westfall, PA - HK750PT Installation	2013

PROFESSIONAL EXPERIENCE (continued)

2013: **Project Manager | Michels Tunneling | New Berlin, WI**

Responsible for overall site/field management and safety of microtunneling/tunneling projects. Monitor project budget including month end computations and projections. Coordinate project development between project engineer, superintendent and foreman. Prepare/submit all submittals, RFIs, extra work, contract change orders and pay requests.

2011 – 2013: **Project Engineer | Michels Tunneling | New Berlin, WI**

Planned, scheduled, conducted, and coordinated assigned engineering work; monitored work for compliance to appplicable codes, accepted engineering practices, and ensured effective communication and coordination on projects between all disciplines and project participants.

2010: **Engineer Internship | Michels Tunneling | New Berlin, WI**

2009: **Pipeline Laborer | Michels Pipeline Construction | New Berlin**

2003 – 2007: **Concrete/General Laborer | Forino Developers | Skinking, PA**

PROJECT PROFILES

OCI Project No. DB10-WASD-01 ESP - Miami, FL
Mico-tunnel installation of 1200 LF of 72" Permalok steel casing under the Government Cut Channel in Miami. The casing will be installed through the coral rock formation from a shaft constructed by others on Fisher Island to a shaft in the water off South Beach.

Intracoastal Waterway Pipeline Relocation, Galveston Causeway, Galveston, TX
700' of 48" Permalok tunnel drives through clay underneath the Galveston Bay for installation of new waterline for the City of Galveston. Michels Tunneling was the 4th contractor to attempt this project and completed it successfully and under budget.

Akron II - Akron, Ohio
The second phase of a sewer installation, including 2 microtunneling runs installed 1,086 LF 48" Hobas.

Massillon Road Sanitary Sewer Improvement - Akron, Ohio
Massillon Road 2,925 LF of 42" Cenrifugally Cast Fiberglass Reinforced Polymer Motar Pipe sanitary sewer gravity sewer, microtunnel installation; 1,328 LF of 48" CCFRPM pipe on micropile support, 29 LF of 36" OH CCFRPM pipe, gravity sewer, micropile support. 7 EA shaft excavations with steel sheeted ground and 7 EA manholes structures. 250 LF of open cut excavation with steel sheeted support.

SFPUC Bay Tunnel - San Francisco, CA
The project includes 26,208 LF of 12'-10" diameter concrete segmented tunnel under the San Francisco Bay from Menlo Park on the S.F. Peninsula Bay to Newark in the East Bay area, two slurry diaphragm wall shafts, and 108" cement motor lined steel pipe welded in the tunnel and shafts as a final liner carrier pipe.

TRAINING & CERTIFICATIONS

- Crane Signaler Certified
- Confined Space Certified

INDUSTRY INVOLVEMENT

- 2018 Trent Ralston Young Trenchless Achievement Award
- No-Dig Paper Presentation (2019): Crossing the Calumet

INDUSTRY INVOLVEMENT (continued)

- No-Dig Paper Presentation (2018): Lengthy crossings shortened by Direct Pipe Technology
- No-Dig Paper Presentation (2017): Direct Pipe method using water

EDUCATION

Gonzaga University | Spokane, WA

Bachelors of Science: International Business

Greg Goral

Senior Design Engineer

PROFESSIONAL EXPERIENCE

1988 – Present: **Senior Design Engineer | Michels Directional Crossings | Brownsville, WI**

Create forms for and compile various informational submittals for Directional Drilling and Line and Cable Divisions. Planning and design drawings on AutoCAD from preliminary designs to as-built drawings. Developed computer programs for simplifying preliminary and correction computations required for Directional Drilling. Composed dissertations for various projects proposed and awarded. Compiled engineering computations and studied stress and loading analysis for pipeline installation. Responsible for take-offs, material estimates, material purchasing and project coordination, and map route reproduction.

1986 – 1987: **Estimator/Purchasing | LaForce Hardware and Manufacturing | Green Bay, WI**

Involved in the bid process using skills in estimating and pricing. Scheduled materials for architect's review and approval. Responsible for the purchasing of materials and coordinating shipments to job sites.

1981 – 1984: **Machine Operator | Badger Wood Products, Inc. | De Pere, WI**

Machine operator responsible for setup operations for various machines in a production line process. Responsible for quality control at various machines.

TRAINING & CERTIFICATIONS

- Construction Materials & Techniques
- General Construction Estimating
- Route Laying and Photogramitry
- Engineering Mechanics-Statics
- Elements of Surveying

EDUCATION

1986 **University of Wisconsin–Platteville | Platteville, WI**

Bachelor of Science with Construction Management Major

MICHELS®

Dustin Branscomb

Trenchless Engineer

PROFESSIONAL EXPERIENCE

2018 – Present: **Trenchless Engineer | Michels Directional Crossings | Brownsville, WI**

Responsible for the design & engineering evaluation of trenchless pipeline installations, inclusive but not limited to design & build projects, constructability, feasibility, plan & procedure creation, pre-qualifications, calculations, specification review and/or insight, bid & proposal process, submittals, estimating, scheduling, pre-bid meeting attendance, pre-construction meeting attendance, as-built's, design changes, and ensuring project continuity from inception to execution.

2011 – 2018: **Drilling Survey Supervisor | Michels Directional Crossings | Brownsville, WI**

Responsible for surveying, staking and design of directional drill path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Performed the above operations for crossings which include, but not limited to:

Diameter	Length	Crossing/Location	Year
42"	3087'	Victoria Harbor, Canada	2018
36"	1511'	Hwy #1, Canada	2017
36"	1116'	United Blvd & Mundy Creek, Canada	2017
36"	1076'	Hwy 7 & CP Rail, Canada	2017
36"	827'	Leslie Street, Ontario, Canada - HK 300PT Installation	2015
42"	1,299'	Lisgar Meadowbrook, Ontario, Canada - HK750PT Installation	2015
42"	1,008'	Highway 63, Canada - HK750PT Installation	2015
48"	4,039'	Dow Barge Channel, Clute TX - HK750PT Installation	2015
36"	1,002'	Hwy 225, Deer Park, TX - HK300PT Installation	2015
36"	1,092'	Lubrizol Drainage, LaPorte, TX - HK300PT Installation	2015
48"	2,455'	Rio Grande River, El Refugio, TX - HK750PT Install.	2014
8"	7321'	MP 49.3 Landslide, MT	2014
36"	9040'	Mississippi River, IL/MO	2014
36"	2264'	Otter Creek,IL	2013

PROFESSIONAL EXPERIENCE (continued)

36"	1311'	Fraizer Creek, IL	2013
36"	1518'	Vermillion River, IL	2013
48"	1943'	West Neck Creek, VA	2013
48"	819'	Hunt Club Creek, VA	2013
8"	7177'	115 KV Power Duct, SC	2013
8"	7304'	115 KV Power Duct, SC	2013
36"	3571'	Angelina River, TX	2013
36"	2908'	Neches River & RR, TX	2013
8"	3503'	Hamlin Creek, Charleston, SC	2013
8"	4911'	115 KV Power Duct, SC	2013
36"	1444'	Hwy 155 & UPRR, TX	2012
36"	1740'	Sabine River, TX	2012
30"	2906'	Hickory Creek, Marietta, OK	2012
30"	4850'	Red River, Thackerville, TX/OK	2012
42"	1661'	Cordele, TX	2012
16"	1656'	Chicolete River, TX	2012
16"	1717'	Morales, TX	2012
42"	1670'	Morales, TX	2012
42"	1658'	Dewitt, TX	2012
8"	6675'	Wilmington, NC	2012
8"	6669'	Wilmington, NC	2012

2006 – 2011: **Project Engineer | GeoEngineers, Inc. | Springfield, MO**

Responsible for project management, HDD Design, construction observation, field program planning and conducting technical briefings of field staff, feasibility studies for various natural gas and product pipeline projects, geotechnical exploratin, geotechnical borehole logging and soil classificatino, completion of technical reports and proposals, budget management, client billings and collections, and client interaction.

2004 – 2006: **Assistant Civil Engineer | Coastland Civil Engineering, Inc, | Santa Rosa, CA**

Responsible for project management, land development projects, improvement plan and map review, flood and drainage review, city master plan development, specification and eingineer's estimate development, city engineering and all-embracing experience in struction inspection.

TRAINING & CERTIFICATIONS

- HDD profile design
- Analysis of operating and installation stresses
- Determination of minimum allowable radius of curvature
- Evaluation of pipe buoyancy and potential pull loads
- Slope stability analysis, Subsurface exploration, Laboratory Testing and Structual design

INDUSTRY INVOLVEMENT

- Registered Professional Engineering, Licence No. 20100000796. Missouri Board for Architects, Professional Engineers, Professional Land Surveyors and Landscape Architects
- Registered Professional Engineer, License No. 108030. Texas Board of Professional Engineers
- LEED Accredited Professional. Leadership in Energy and Environmental Design Green Building Accredited Professional (LEED AP)
- National Association of the Remodeling Industry Certified Green Building Professional

EDUCATION

2004 **California Polytechnic State University | San Luis Obispo, CA**

Bachelor of Science, Civil Engineering 2004

El Molino High School | Forestville, CA

High School Diploma

Bradley J. Eifert

Engineering Technician

PROFESSIONAL EXPERIENCE

2005 – Present: **Engineering Technician | Michels Directional Crossings | Brownsville, WI**

Create forms for and compile various informational submittals for Directional Drilling. Planning and design drawings on AutoCAD from preliminary designs to as-built drawings. Developed computer programs for simplifying preliminary and correction computations required for Directional Drilling. Composed dissertations for various projects proposed and awarded. Compiled engineering computations and studied stress and loading analysis for pipeline installation. Responsible for take-offs, material estimates, and map route reproduction.

2004 – 2005: **Assistant Project Coordinator | Michels Directional Crossings | Brownsville, WI**

Performed As-builts, scheduling, dispatch, and project tracking for communication cable burial. Designed and preformed anticipated loads and stress calculations for the following projects:

Diameter	Length	Location	Year
24"	2645'	Corning, NY	2011
36"	4992'	Melville, LA	2011
30"	5786'	Sussex, NJ	2010
16"	9931'	Goose Creek, SC	2010
42"	4512’	Vicksburg, MS	2009
30” Steel	34,000’ (19 Drills)	Atlanta, GA	2008-2009
30” HDPE	3076’	Albany, NY	2008
36” HDPE	2144’	Charleston, SC	2007
8” Steel	8400’	Okaloosa, FL	2006
20” HDPE	2300’	Honolulu, HA	2006
30” Steel	5700’	Trinidad	2006
36” Steel	2130’	Albuquerque, NM	2006
42” Steel	2078’	South Amboy, NJ	2006
24” Steel	24,000’ (6 Drills)	Sacramento, CA	2005-2006

EDUCATION

2005 **Moraine Park Technical College | Fond du Lac, WI**

Associate Degree- Civil Engineering Technician

1995 **Hartford Union High School | Hartford, WI**

High School Diploma

Zach Osborn

Estimator

PROFESSIONAL EXPERIENCE

2019 – Present: **Estimator | Michels Directional Crossings | Brownsville, WI**

Prepare estimates for Directional Drill projects across the United States. Review designs and feasibility of projects. Point of contact for customers during bid process. GIS mapping and tracking of current bids. Follow up on project status. Hand offs to operations when a project is awarded.

2017 – 2019: **Assistant Project Manager | Michels Pipeline Construction | Lakeville, MN**

Oversee projects and provide estimates. Manage projects through the full cycle. Profile HDD's for crews and create asbuilts on completed projects. /worked directly with customer with HDD feasibility and design. Pursue new business opportunities and customer relations. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
10"	1948'	Roads & Bluff, MN	2019
24"	2000'	Woods and Creek, MN	2019
8"	4650'	Little Falls, MN	2019
16"	1200'	Hwy & Railroad, MN	2018
10"	2450'	Missouri River, MT	2018
24"	1200'	I-494, MN	2018
24"	1800'	Crossing Bluff, WI	2017

2015 – 2017: **Foreman | Michels Pipeline Construction | Lakeville, MN**

Point of contact for non contract bores for the Distribution West Division. Managed and tracked units for billing. Time and equipment recording. Managed HDD worksite and constructed gas service work. Worked with distribution crews on miscellaneous projects around the Twin Cities Metropolitan area.

2009 – 2015: **Laborer/Operator | Michels Pipeline Construction | Lakeville, MN**

Labored and Operated equipment for the Distribution West Division. Worked with HDD Operations. Fused for outside projects outside of Centerpoint contract. Traveled and worked on out of state projects.

TRAINING & CERTIFICATIONS

- Class A CDL, HDD Academy, EWN Proctor Certification

EDUCATION

University of Wisconsin - La Crosse | La Crosse , WI

Triton High School | Dodge Center, MN

Diploma

Don Mueller

Eastern Operations Manager

PROFESSIONAL EXPERIENCE

2011 – Present: **Eastern Operations Manager | Michels Directional Crossings | Brownsville, WI**

Supervisor of field operation superintendents and directional drilling project managers. Oversee large inventory of drilling tools and materials during storage and field use. Monitors production by Fleet Department of directional drilling personnel and equipment. Duties include coordinating and scheduling the mobilization of equipment, personnel and materials to remote job sites throughout the United States and Internationally. Involved in estimating of various directional drilling projects. Specialize in the engineering design, build and maintenance of directional drilling fleet. Responsible for pilot hole drilling & survey for complicated bores which include implementing and integrating new technology necessary for successful completion of leading edge HDD crossings (i.e. hole-intersects). Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	4381'	Pennsylvania Drive, PA	2019
16"	6601'	Arch Bishop/S Chester Rd, PA	2019
16"	4399'	Valley Rd/Darlington Rd, PA	2019
16"	7402'	Susquehanna River, PA	2019
30"	3746'	Dix River, KY	2019
16"	3728'	Village Square Dr, PA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
16"	3981'	Glendale Rd & Concord Ave, PA	2019
20"	2236'	Lower Piney Creek, PA	2018
20"	2355'	Joanna Road, PA	2018
12"	1369'	Rocky Point Landing, Jamaica	2018
20"	2209'	Horse Valley Road, PA	2018
20"	7354'	Susquehanna River, PA	2018
16"	2346'	Frankstown Branch-Juniata River, PA	2018
20"	3874'	Waltonville Rd, PA	2018
20"	1337'	Berry Ridge & Old Mill Rd, PA	2018
16"	5869'	Conrail RR, Perth Amboy, NJ	2018
16"	2766'	Hall Street, NJ	2018
16"	1999'	Route-35, Perth Amboy, NJ	2018
20"	5841'	Ohio River MP 33.8, OH/WV	2017
20"	4771'	Raystown Lake, PA	2017
48"	3595'	Road 771 Canal, TX	2017
48"	2222'	Hwy 803, CA Rd & Supply Canal, TX	2017

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
20"	2005'	Hwy 20, PA	2017
36"	6238'	Ohio River, OH/WV	2017
36"	7194'	Ohio River MP 16.07, OH/WV	2017
42"	2431'	Maumee River & State Hwy 24, OH	2017
48"	2807'	Oliver Creek & SH 188, TX	2017
48"	3291'	Meter to LNG Facility, TX	2017
48"	2263'	US Hwy 181/Hwy 35, TX	2017
30"	2278'	Chattahoochee River, GA	2017
24"	2293'	Interstate 20, GA	2017
36"	1606'	Hannahatchee Creek, GA	2017
30"	2757'	Little Rock River, IA	2016
30"	6328'	Big Sioux River, SD/IA	2016
16"	11,397'	Lake Sacagawea South, ND	2016
30"	5714'	James River, SD	2016
30"	2291'	PCN3/Wetland, SD	2016
30"	3352'	Cliff Crossing, ND	2016
30"	1791'	200th St, SD	2016
16"	11,229'	Lake Sacagawea North, ND	2016
30"	1516'	408th & Wetland MP 360, SD	2016
16"	1112'	Palermo Railroad, ND	2016
30"	1407'	Lewis & Clark/274th St, SD	2016
30"	1519'	Turtle Creek, SD	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
36"	1862'	State Highway 50, IL	2015
36"	3461'	Kennedy Ave/Griffith Terminal, IN	2015
36"	2510'	Deep Creek, IL	2015
36"	3011'	Highway 41 & RR, IN	2015
36"	5128'	Lake Ave & RR, IL	2015
10"	4654'	Allegheny River, PA	2015
18"	12,459	Houston Ship Channel, TX	2015
24"	2003'	Highway 612, MS	2014
24"	2750'	Escatawpa River, MS	2014
36"	9040'	Mississippi River, IL/MO	2014
20"	2364'	Missouri River, IA/NE	2014

PROFESSIONAL EXPERIENCE (continued)

1998 – 2011: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States and Canada; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Oversees drilling survey during crossing.

1996 – 1998: **Pipe-Side Superintendent/Pullback Coordinator | Michels Directional Crossings | Brownsville , WI**

Lead person responsible for coordinating the pipe string-out and welding subcontractor located at the exit side of directional drill. Duties include overseeing of pipe string for pullback without delay, maintenance of equipment, material organization, and coordination of labor for specialized pipe coating and testing. Accountable for the critical path of having pipe prepared for pullback. Responsible for maintaining constant communication with Drilling Superintendent during pullback operation and coordinating efforts to pull the pipe in one well-balanced effort.

1995 – 1996: **Operator | Michels Directional Crossings | Brownsville, WI**

Crane operator responsible for safe operation and timely placement of drill stem and equipment. Integral link in the drilling operation, from drill rig set-up, pipe pull back and rig-down of equipment. Also conducted pipe support operations at the exit side during pipeline pullback. Responsible for permitting and mobilization/demobilization of heavy and non-dimensional equipment to drill sites.

1993 – 1995: **Skilled Laborer | Michels Directional Crossings | Brownsville, WI**

Specialized in mechanical repairs, land surveying, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

1987 – 1993: **United States Marine Corps | San Diego, CA**

EDUCATION

1987 **Winnebago Luthern Academy | Fond du Lac, WI**

High School Diploma

Randy Robinson

Midwest Operations Manager

PROFESSIONAL EXPERIENCE

2015 – Present: **Midwest Operations Manager | Michels Directional Crossings | Brownsville, WI**

Manage field crews on the installation of assigned pipeline projects. Specific duties include: material and supply coordinator, field liaison between engineering, estimating and subcontractors to ensure construction compliance, monitor work performance and craft productivity, enforce project quality, safety and environmental issues, regulation and resolution of field construction problems. Plan day-to-day operations onsite and line up the necessary resources to accomplish the plan. Work hand in hand with customers and third party inspection personnel to resolve issues.

2003 – 2015: **Superintendent | Michels Pipeline Construction | Lakeville, MN**

Supervises and assigns duties to directional drill rig crews installing plastic and steel pipelines. Generates daily work progress reports, trains new staff and orders materials and equipment necessary for overall success of the project. Prepares documents on cost, budget, contracts, estimates and other essential aspects of operations.

1993 – 2003: **Crew Foreman | Mueller Pipeline | New Berlin, WI**

Worked in the capacity of a foreman on pipeline related projects. Responsible for safety, schedule and budget of all assigned work. Directly managed crews performing distribution of gas, electric, telephone, and water directional drill instillation. Ensured conformance to specifications, drawings, procedures, and quality.

1987 – 1992: **Line Supervisor | McNeilus Truck & Manufacturing, Inc. | Dodge Center, MN**

1985 – 1987: **Laborer | Donaldson Construction | Dodge Center, MN**

1984 – 1985: **Forklift & Crane Operator | McNeilus Truck & Manufacturing, Inc. | Dodge Center, MN**

1982 – 1984: **Laborer | Steve Kutzler Family Farm | West Concord, MN**

EDUCATION

Marquette University | Milwaukee, WI

EUC Academy for Management

West Concord High School | West Concord, MN

High School Diploma

Kurt Myhre

Western Operations Manager

PROFESSIONAL EXPERIENCE

2020 – Present: **Western Operations Manager | Michels Directional Crossings | Brownsville, WI**

Supervisor of field operation superintendents and directional drilling project managers. Oversee large inventory of drilling tools and materials during storage and field use. Monitors production by Fleet Department of directional drilling personnel and equipment. Duties include coordinating and scheduling the mobilization of equipment, personnel and materials to remote job sites throughout the United States and Internationally. Involved in estimating of various directional drilling projects. Specialize in the engineering design, build and maintenance of directional drilling fleet. Responsible for pilot hole drilling & survey for complicated bores which include implementing and integrating new technology necessary for successful completion of leading edge HDD crossings (i.e. hole-intersects).

2017 – 2020: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production recordkeeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
20"	2236'	Lower Piney Creek, PA	2018
20"	2209'	Horse Valley Road, PA	2018
16"	1912'	Trough Creek Valley Pike/SR 829, PA	2018
20"	1720'	Everett RR-Juniata River, PA	2018
20"	1507'	Trough Creek Valley Pike/SR 829, PA	2018
16"	2346'	Frankstown Branch-Juniata River, PA	2018
20"	1337'	Berry Ridge & Old Mill Rd, PA	2018
20"	1260'	Hollow Road, PA	2017
20"	2307'	Frankstown Branch-Juniata River, PA	2017
20"	4771'	Raystown Lake, PA	2017
36"	7194'	Ohio River MP 16.07, OH/WV	2017

2015 – 2017: **Pipeline Major Maintenance Superintendent | Phillips 66 Pipeline, LLC | Billings, MT**

Supervisor for seven maintenance team members and lead on special projects. Managed the execution for all pipeline and field major maintenance work including the 6 year Division River Mitigation Program.

PROFESSIONAL EXPERIENCE (continued)

2014 – 2015: **Maintenance Craft Team Leader | Phillips 66 Refining | Borger, TX**

Supervisor for area maintenance team and lead on special projects.

2012 – 2014: **Pipeline Major Maintenance Coordinator | Phillips 66 Pipeline, LLC | Missoula, MT**

Provided coordination and oversight for all pipeline maintenance and construction projects for pipeline assets in Montana, Idaho and Washington.

1996 – 2011: **Construction Superintendent | Michels Pipeline (Formally Pilchuck Contractors, Inc.) | Kirkland, WA**

Held multiple positions ranging form laborer to superintendent. Expertise included construction of gas pipelines, phone, fiber optics and installations by directional drilling.

TRAINING & CERTIFICATIONS

- CPR/1st Aid and OSHA 10
- Operator Qualifications for Liquid & Gas Pipelines
- Competent Person Trench Safety Training
- Asbestos Inspector Level Certified
- CEPA Erosion Training
- FMCSA Supervisor Training
- FEMA ICS 100 through 400

EDUCATION

Central Washington University

MICHELS®

Ray J. Viator

Marine Operations Manager

PROFESSIONAL EXPERIENCE

2002 – Present: **Marine Operations Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects across the country. Duties include mobilization of all equipment and personnel to remote job sites: the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment: and necessary record-keeping of plots and production. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
12" Beach Offshore	1,500'	Old Harbour, Jamaica	2018
16" Beach Approach	1,508'	Beverly Harbor, MA	2015
16"	3,27'	Collins Cove, MA	2015
8" Water Approach	7,177'	Charleston, SC	2013
8" Land to Water	7,304'	Charleston, SC	2013
8" Land to Water	3,580'	Charleston, SC	2013
30" Water Exit	5,378'	Hudson River, NY	2012
12" Water to Water	1612'	WBC62, Cameron, LA	2011
36" Beach Approach	3492'	Trinidad/Tabago	2010
42” Land to Water	2208’	Guam	2008
32” Land to Water	1943’	Guam	2007
30” Land to Water	5668’	Trinidad	2006
24”	6183’	Corsicana, TX	2005
30”	2996’	Columbia, LA	2005
24” Beach Approach	3402’	Trinidad & Tobago	2005
12” Beach Approach	2714’	Hadera, Israel	2004
30” Beach Approach	2823’	Dor, Israel	2004
30” Beach Approach	2836’	North Redding, Israel	2004
30” Beach Approach	2728’	South Redding, Israel	2004
30” Water to Water	4300’	Georges Island, MA	2003
30” Water to Water	4631’	Beverly, MA	2003
30” Land to Water	4829’	Salem, MA	2003
30” Land to Water	3041’	Weymouth, MA	2003

1989 – 2001: **Operations Manager | Smit Land & Marine, Inc. | Houston, TX**

Provided pre-contract technical input and operational management of directionally drilled crossings. Contracts completed are briefly described below:

PROFESSIONAL EXPERIENCE (continued)

1985 – 1989: **Rig Superintendent | Smit Land & Marine, Inc. | Houston, TX**
Provided technical input and site supervision of all horizontal directional drilled crossings throughout the United States.

PROJECT PROFILES

Jacob Riis State Park; Construction of 5800’ of 12”steel water main pipe. (2001) – Rockaway, NY

City of Newport | Construction of a 24" HDPE x 2800' and a 20" HDPE with two 4” steel cable ducts x 2800’ crossing of Yaquinna Bay on the Pacific coast at Newport Oregon. The pipelines will be used for sewer/reclaimed water and fiber optic cables.; (2001) – Newport, OR

Georgetown County Water & Sewer District | Design and construction of a 10" HDPE x 4530' crossing of the Waccamaw River near Myrtle Beach South Carolina. The pipeline will be used for potable water supply to Sandy Island.; (2001)

AT&T (Concert Global Networks USA) | Construction of four 5” x 3000’ to 3600’ shore crossings drilled in rock and exiting in 35’ water depths on the Pacific coast of California at Manchester. The 5" dia. drill pipe will be used as a conduit for fiber optic cables linking the US with Japan.; (2000)

Daikin America | Design and construction of a 16" HDPE x 3000' shore crossing into the Tennessee River. The pipeline will be used as a NaCl/water outfall.; (2000) – Decatur, AL

City of Fort Lauderdale | Construction of a 24” x 1230’ steel water main and 7 No. 6” x 1220’ HDPE ducts crossing the Intracoastal Waterway.; (2000) – Fort Lauderdale, FL

City of Austin | Construction of two 24” steel water main crossings for the Davenport Ranch Water Supply Line Project in Austin, Texas: 1640’ Lake Austin (Colorado River) crossing and 1170’ FM 2222 crossing.; (2000)

Solutia | Construction of a 24" x 900' railroad and pipeline corridor crossing.; (1999) – Chocolate Bayou, TX

Exxon Pipeline Company | Construction of a 20" x 3830' shore crossing for the Hoover Offshore Oil Production System.; (1999) – Freeport, TX

Conoco, Inc. | Construction of a 10” x 4650’ crossing of the Old & Lost River Lake to replace an existing ethane line.; (1999) – Mont Belvieu, TX

Exxon Pipeline Company | Construction of the following crude and products pipelines for the “SOLA Project,” 24" x 2300' Mississippi River crossing, Dual 12” x 4300’ Mississippi River crossing, 24” x 4300’ Mississippi River crossing, Dual 12” + 24” x 1200’ Intracoastal Waterway cr; (1998) – Baton Rouge, LA

A.K. Steel | Design and construction of a 16" x 2350' crossing through rock, below Interstate 75 and a creek for gas distribution.; (1998) – Middletown, OH

Dauphin Island Gathering Partners | Design and construction of a 24" x 1800' shore crossing for gas distribution.; (1998) – Mobile Bay, AL

PROJECT PROFILES (continued)

Transco | Design and construction of a 30" x 4000' shore crossing for gas distribution and a 30” x 2800’ water-to-water crossing of Dauphin Island. Drilled from 7' of water to 22' of water.; (1998) – Mobile Bay, AL

Beaufort Jasper Water & Sewer Authority | Design and construction of a 28; (1998) – Hilton Head Island, SC

Amoco Trinidad Oil Company | Design and construction of a 12" x 4030' shore crossing for Trinidad LNG Project.; (1997) – Galeota Point, Trinidad

Dauphin Island Gathering Partners (OEDC) | Construction of a 24” x 4700’ water-to-water crossing. Drilled from 12' of water to 20' of water.; (1997) – Dauphin Island, AL

City of Charleston, CPW | Construction of a 30; (1997) – Charleston, SC

Mobil E & P | Design and construction of a 5" x 5200' and a dual 2" x 5200' water-to-water crossings of Little Dauphin Island and a bundled 6"+2-3"+2" x 900' shore approach in Aloe Bay.; (1996-1997) – Alabama

Texas Eastern Products Pipeline | Construction of an 8" x 5500' crossing of the Red River, an 8" x 570' crossing of the Old River and 2900' of 8" conventionally laid with two (2) valve sites and tie-ins.; (1996) – Louisiana

Shell Pipeline | Construction of a 20” x 4000’ crossing of the Mississippi River at Nairn from outside the flood protection levee.; (1996) – Louisiana

City of Savannah | Construction of a 30” x 5300’ crossing under Presidents Street, Savannah with a 28” HDPE pipeline within a 30” steel casing pipe.; (1996) – Savannah, GA

Dixie Pipeline | Construction of 10" x 2800' gas pipeline crossing the Atchafalaya River.; (1995) – Louisiana

Chevron Pipeline | Design and construction of a 12" x 3500' water-to-water crossing. Drilled from 21' of water to 12' of water.; (1995) – Dauphin Island, AL

City of Charleston, CPW | Construction of a 26” x 5280' crossing of the N. Cooper River with a 24” HDPE pipeline within a 26” steel casing pipe. Construction of a 26” x 5100' shore crossings into 30' of water from Fort Moultrie into Charleston Bay near Fort Sumter again with a 24; (1995) – Charleston, SC

AT&T | Construction of four (4) 5” x 4300’ shore crossings drilled in rock and exiting in 35’ water depths on the Pacific coast of Oregon at Bandon. The 5" dia. drill pipe will be used as a conduit for fiber optic cables linking the US with Japan (the TPC-5 pro; (1995)

Hampton Roads Sanitation District | Construction of five (5) river crossings: Pagan River 24” x 1300’; Bennetts Creek 36” x 1600’; Cypress Creek 30” x 1850’; Nansemond River 30” x 4750’; and Chuckatuck Creek 30” x 3100’.; (1994-1995) – Virginia

PROJECT PROFILES (continued)

Chevron Company USA | Construction of two shore approaches with bundled pipelines from Fourchon with exits in 13' of water: 10"+8" x 1560' and 2-8"+3" x 1350'.; (1994) – Louisiana

Exxon Company USA | Construction of a 12" x 3550' shore approach drilled from Grand Isle with an exit in 12' of water and pipe lay by the SubSea Constructor.; (1994) – Louisiana

Mobile Gas Service Corp. | Construction of a 12" x 2000' gas pipeline crossing of the Mobile River.; (1994) – Alabama

Dixie Pipeline | Construction of a 12" x 3500' gas pipeline crossing of the Amite River.; (1993) – Louisiana

Dixie Pipeline | Construction of a 12" x 2500' gas pipeline crossing of Baton Rouge Bayou in Baker.; (1993) – Louisiana

ARCO | Operational assistance to South East Asian office for the construction of a 26" x 3300' shore approach (drilled from land with pullback from the McDermott derrick / laybarge DB15) and a 26" x 4000' crossing in the open waters of the Java Sea. The 4000' c; (1993) – Jakarta, Indonesia

Chevron Pipeline | Construction of a 20" x 1600' crude oil pipeline replacement crossing of a ship channel in open waters in the approaches to Gulfport. Drilled from lift-boat barges and pullback from a laybarge in water depths of 20'.; (1992) – Mississippi

Corpoven | Construction of a 36" x 4450' pipeline crossing of the Rio Orinoco at Puerto Ordaz.; (1992) – Venezuela

BP Exploration | Construction of 3-12" pipeline bundle under Dauphin Island with a drilled length of 3900'. Drilled from self elevating platforms (lift-boats) and pullback from a laybarge in water depths of 14' and 20' respectively.; (1991) – Alabama

Lagoven | Installation of a 36" x 3300' pipeline crossing of the Rio Morichal Largo on the "orimulsion" trunkline project.; (1991) – Venezuela

Lagoven | Construction of a 36" x 1700' pipeline crossing of the Rio Tigre as part of the "orimulsion" project.; (1991) – Venezuela

Shell Pipeline | Construction of a 4" x 3500' crossing of the Saginaw River in Bay City.; (1991) – Michigan

Columbia Gas | Installation of two 20" diameter pipeline river crossings - Mantua Creek (1650') and Raccoon Creek (1550').; (1990) – New Jersey

Sun Pipeline | Replacement of an 8" x 2200' gas pipeline by drilling through rock on hillside.; (1990) – Ohio

Shell Pipeline | Construction of a 10" x 1500' crossing of the Kawkawlin River.; (1990) – Michigan

Amoco Gas | Construction of a 16" x 3900' crossing of Wolf Creek in Dollar Bay, Texas City.; (1990) – Texas

PROJECT PROFILES (continued)

City of Norfolk | Construction of a 20" x 1600' water pipeline crossing of the Elizabeth River in Norfolk.; (1990) – Norfolk, VA

Seagull | Installation of two beach crossings (drilled from land) and two water-to-water crossings (drilled from spud barges) for a 1-10" and 3-8" pipeline bundle across the Houston Ship Channel at Baytown. The pipelines were pulled from a shallow draft laybarge. ; (1990) – Texas

Dixie Pipe Line | Construction of a 12" x 3000' emergency replacement crossing of the Tangipahoa River at Zachary.; (1990) – Louisiana

City of Chesapeake | Construction of a 24" x 1600' water pipeline crossing of the Elizabeth River at Chesapeake.; (1990) – Chesapeake, VA

Dixie Pipe Line | Installation of a 12" x 2300' crossing of the Comite River at Baton Rouge.; (1990) – Louisiana

Phillips Petroleum | Construction of two 12" diameter crossings near Houston: a 700' crossing of the Brazos River and a similar length crossing of Clear Creek.; (1990) – Texas

ARKLA | Installation of two 12" crossings near Fort Coffee: 2000' at the Arkansas River and 950' at the Poteau River.; (1990) – Oklahoma

Texas Power | Construction of three 16" crossings at Freeport as part of Wacker Oil's offshore development: 1600' Ship Channel crossing, 2300' Intracoastal Waterway crossing and 2700' shore approach.; (1989) – Texas

Transco | Installation of two 20" diameter crossings at Corpus Christi: an 1800' highway crossing and a 2000' lagoon crossing.; (1989) – Texas

Dixie Pipeline | Installation of a 12" x 1800' crossing of the Pearl River near Columbia.; (1989) – Mississippi

Union Camp | Construction of two Savannah River crossings: 42" x 1850' and 10"+6" bundle x 1850'.; (1989) – Georgia

Contel | Construction of a 5" x 750' crossing of the Altamaha River crossing near Jessup.; (1989) – Georgia

Phillips Petroleum | Installation of a 20" x 1800' crossing of the Brazos River at Freeport.; (1989) – Texas

Phillips Petroleum | Construction of two 2300' crossings of the Osage River at Jefferson City for 12" and 6" pipelines.; (1989) – Missouri

AT&T | Installation of five crossings with 5" conduit between Little Rock and Tulsa: Little Maumelle River - 1100' and 650', Fourche La Fave River - 550', Arkansas River - 2000' and Petit Jean River - 550'.; (1989) – Arkansas & Oklahoma

MICHELS®

Robert Spennati

Assistant Operations Manager

PROFESSIONAL EXPERIENCE

2020 – Present: **Assistant Operations Manager | Michels Directional Crossings | Brownsville**

Assistant Supervisor of field operation superintendents and directional drilling project managers. Oversee large inventory of drilling tools and materials during storage and field use. Monitors production by Fleet Department of directional drilling personnel and equipment. Duties include coordinating and scheduling the mobilization of equipment, personnel and materials to remote job sites throughout the United States and Internationally. Involved in estimating of various directional drilling projects. Specialize in the engineering design, build and maintenance of directional drilling fleet. Responsible for pilot hole drilling & survey for complicated bores which include implementing and integrating new technology necessary for successful completion of leading edge HDD crossings (i.e. hole-intersects). Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
16"	6976'	Matlock/W Chester Rd, PA	2020

1993 – 2020: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production record-keeping, and overall on-site management.

Diameter	Length	Location	Year
16"	4381'	Pennsylvania Drive, PA	2019
16"	6601'	Arch Bishop/S Chester Rd, PA	2019
16"	4399'	Valley Rd/Darlington Rd, PA	2019
16"	3728'	Village Square Dr, PA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
16"	3981'	Glendale Rd & CConcord Ave, PA	2019
12"	1070'	Indiana Harbor Canal - 12" & 10" Bundle, IN	2018
20"	7354'	Susquehanna River, PA	2018
20"	3874'	Waltonville Rd, PA	2018
16"	1198'	Harrisburg Pike, PA	2017
20"	2205'	Hwy 15, PA	2017
48"	2807'	Oliver Creek & SH 188, TX	2017
48"	2349'	Chiltipan Creek, TX	2017
48"	2263'	US Hwy 181/Hwy 35, TX	2017

PROFESSIONAL EXPERIENCE (continued)

36"	3829'	Flint River, GA	2016
12"	3144'	Monkton Swamp, VT	2016
12"	2765'	Lewis Creek, VT	2016
12"	1491'	Drinkwater Road, VT	2016
12"	2856'	Wetland Replacement, OH	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
24"	3716'	Barbour's Cut, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
24"	5908'	Tabbs Bay, TX	2015
10"	4654'	Allegheny River, PA	2015
28"	1741'	Lafayette River, VA	2014
12"	2557'	Arkansas River, AR	2014
20"	1193'	SR-265/Leatherwood Rd, OH	2014
36"	1277'	Bear Creek, IL	2013
36"	2264'	Hwy 336 & 172, IL	2013
30"	4987'	Monksville Reservoir, NJ	2013
42"	3008'	I-95 & Tidal Wetlands, NJ	2013
42"	4441'	Goethals Bridge, NY	2013
30"	8101'	Kill Van Kull River, NY/NJ	2013

1988 – 1993: **Labor/Operator/ Foreman | Henkles & McCoy**

Fiber Work

1987 – 1988: **Drywall/Construction**

1985 – 1987: **Gas work/Service Lines | Circle M Construction**

1978 – 1988: **United States Army**

1978-80, Germany, 1980-82 Georiga, 1982-84 Germany, 1984-85 Georiga, 1985-88 US Army Reserves PA

EDUCATION

1978 **Mount Union High School**

High School Diploma

MICHELS®

Paul Krings

Senior Equipment and Logistics Manager

PROFESSIONAL EXPERIENCE

2019 – Present: **Senior Equipment and Logistics Manager | Michels Directional Crossings | Brownsville, WI**

Strategically manage operations in overseeing the coordinating of equipment and personnel to project jobsites. Plan, direct, coordinate purchasing, distribution and forecasting of daily operations. Oversee equipment repair and building of new, inventory control, material handling, customer service, coordinate transportation and hiring of employees. Ensures that project milestones/goals are met and adhering to approved budgets.

Provides direct supervision to supervisors and field personnel in daily operational activities, maintains regular on-site contact to assure services being performed are within Company guidelines and in accordance with consumer specifications.

Reviews daily reports and time tickets to determine hours worked, mechanical problems, etc. to effectively plan and schedule daily operational activities.

Ensures routine and preventative maintenance and repairs to keep all equipment in optimum operating condition, thus minimizing down time.

1996 – 2019: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation.

Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
36"	5841'	Ohio River MP 33.8, OH/WV	2017
25"	5788'	Hwy 41/45, WI	2017
30"	1614'	Mill Creek, IA	2016
20"	996'	O'Plaine Road, IL	2016
30"	6119'	Lake Whitney, TX	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
24"	3716'	Barbour's Cut, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
24"	5908'	Tabbs Bay, TX	2015
36"	3461'	Kennedy Ave/Griffith Terminal, IN	2015
36"	2510'	Deep Creek, IL	2015

PROFESSIONAL EXPERIENCE (continued)

18"	12,459	Houston Ship Channel, TX	2015
1x6" & 2x4" Bundle	1568'	Bore #3, Nageezi, NM	2014
2 x 4" Bundle	1809'	Hwy 550, Nageezi, NM	2014
6"	6999'	Lake Navajo/San Juan River, NM	2014
36"	9040'	Mississippi River, IL/MO	2014
24"	2020'	Unnamed Creek, AL	2014
24"	2884'	Hatchett Creek, AL	2014
36"	1277'	Bear Creek, IL	2013
30"	4987'	Monksville Reservoir, NJ	2013
42"	4441'	Goethals Bridge, NY	2013
30"	8101'	Kill Van Kull River, NY/NJ	2013
30"	3042'	Wyalusing, PA	2012
36"	4505'	Medicine Hat, Alberta Canada	2012
24"	2458'	Jonestown, PA	2012
36"	4992'	Melville, LA	2011
42"	5732'	Melrose, LA	2011
24"	6091'	Homestead, FL	2011
16"	2566'	Hitchcock Plaza, SC	2010
42"	2144'	Lafourche, LA	2010

1992 – 1996: **Fluid Dynamics Technician and Laborer | Michels Directional Crossings | Brownsville, WI**

Solely responsible for mixing bentonite solution to the right consistency with an emphasis in directional drilling. Proficient working in and around drilling rigs and in the overall operation as an integral member of the specialized team. Multi-capable to assist with all types of drilling tasks and familiar with repair, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, steer tool wireline connections, couplings, etc. Involved in various types of directional drilling projects, line and cable, water and setting manholes.

TRAINING & CERTIFICATIONS

- OSHA 510 - OSHA Standards for Construction
- 40-Hour Hazmat Training – Approved for PPE Level A
- Safety Trained – Competent Person
- Veriforce and Various DOT Pipeline Safety Training
- Forklift Training
- CDL with ABCDMNT Endorsements

EDUCATION

1989 **Moraine Park Technical College**

Mig and Tig Welding; Rod, Wire and Brazing Applications;Torch Use, Cutting and Welding

1984 **Waupun High School | Waupun, WI**

High School Diploma

MICHELS®

Eric McBrair

Direct Pipe Equipment Manager

PROFESSIONAL EXPERIENCE

2017 – Present: **Direct Pipe Equipment Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for equipment logistics, as well as assisting with the oversight and management of direct pipe field personnel. Support Direct Pipe field operations by developing, initiating and managing appropriate action plans to ensure quality and efficient performance of Direct Pipe resources. Duties include but not limited to: Collaborate with field operations to determine most suitable resources and means and methods of construction, troubleshoot equipment operation issues. Develop, create and maintain maintenance protocols to be utilized across the division. Coordinate equipment needs between project managers and prioritize work assignments. Manage and coordinate division equipment assets, ensuring proper allocation and efficient utilization.

2011 – Present: **Superintendent/DIRECT PIPE | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling Direct Pipe boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for direct pipe & directional micro-tunnel operations as well as directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
20"	826'	Qu'Appelle River, Canada - HK750PT Installation	2017
36"	1,535'	Calumet River, IL - HK300PT Installation	2017
36"	827'	Leslie Street, Ontario, Canada - HK 300PT Installation	2015
42"	1,299'	Lisgar Meadowbrook, Ontario, Canada - HK 750PT Installation	2015
48"	4,039'	Dow Barge Channel, Clute TX - HK750PT Installation	2015
36"	1,002'	Hwy 225, Deer Park, TX - HK300PT Installation	2015
36"	1,092'	Lubrizol Drainage, LaPorte, TX-HK300PT Installation	2015
48"	2,455	Rio Grande River, El Refugio, TX-HK750PT Installation	2014
42"	1,200'	Railroad Crossing, Groves, TX-HK750PT Installation	2014
42"	1,050'	Beaver River, Alberta, Canada-HK750PT Installation	2013
42"	470'	I-84, Westfall, PA - HK750PT Installation	2013
48"	333'	18th Street, Jersey City, NJ - HK750PT Installation	2012

PROFESSIONAL EXPERIENCE (continued)

30"	5,378'	Hudson River, Manhattan, NJ/NY - HK300PT Assist	2012
36"	6,500'	St. Johns River, Jacksonville, FL - HK300PT Assist	2012
42"	426'	Chemung River, Corning, NY - HK750PT Installation	2011

2011 – 2014: **Operator/Surveyor HDD | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation.

2003 – 2011: **General Laboror | Michels Directional Crossings | Brownsville, WI**

Experience in working on and around directional drilling rigs as an integral member of a specialized team. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs; hydraulics; fluids; set-up and operation of drill motors; power generators; mud pumps; bentonite mixers; drill pipe; reamers; couplings; and overall equipment maintenance and operation.

2001 – 2003: **House Builder**

EDUCATION

2001 **Fox Valley Technical College | Appleton, WI**

2000 **Berlin High School | Berlin, WI**

High School Diploma

Scott Nehls

HDD Logistics QA/QC Manager

PROFESSIONAL EXPERIENCE

2009 – Present: **HDD Logistics QA/QC Manager**

Michels Directional Crossings | Brownsville, WI

Responsible for truck load out and receiving, organization of HDD tooling and equipment, coordination of drill stem supply, tracking and calibration, new hire training, orientation, dispatch, manage divisional labor pool, tractor trailer inspection/maintenance program implementation, safety training/OQ program implementation, on-site review of HDD personnel & operations.

1989 – 2009: **Project Manager**

Michels Directional Crossings | Brownsville, WI

Responsible for coordinating and drilling directional boring projects across the country. Duties include mobilization of all equipment and personnel to remote job sites; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Provides safety training and performs evaluations. Assists with estimating and bid preparation. Some more noteable crossings include, but are not limited to:

Diameter	Length	Location	Year
20” & 42”	1544’ & 2127’	Wisconsin River, WI	2007
20” & 42”	2530’ & 2299’	Chippewa River, WI	2007
20” & 42”	2280’ & 2294’	Flambeau River, WI	2007
42” (2)	2294’ & 2775’	Lake Arrowhead, WI	2007
24”	2172’	Biscayne Bay, FL	2006
30”	2453’	Jackson Creek, WI	2006
30”	1301’	Jackson Creek, WI	2006
30” (2)	1400’ & 2661’	Rausonville & Willis Rd, MI	2005
24”	2429’	Kinnickinnic River, WI	2005
36” (3)	1276’ to 1531’	Clarkston, MI	2005
8”	1374’	Detroit, MI	2005
12” (10)	375’ to 750’	Lansing, MI	2004
16” (2)	2723’ & 2925’	Packard Rd & Washtenaw Ave, MI	2004
22”	2308’	St. Joseph River, MI	2004
30” (2)	1532’ & 1661’	Darien, WI	2004

PROFESSIONAL EXPERIENCE (continued)

6" (6)	1564' to 1880'	Lean, WI	2004
12" (3)	1668' to 3524'	New York/New Jersey	2003
30"	1673'	Huron River, MI	2002
36"	3395'	Huron River, MI	2002

1986 – 1989: **Superintendent**

Michels Mid-America Line & Cable | Brownsville, WI

Working foreman responsible for managing utility construction crews. Accountable for tie-ins behind our rail-mounted plow which consists of horizontal boring operations and dig downs. Implemented supervisory skills for material and labor coordination.

1980 – 1986: **Equipment Operator**

Michels Mid-America Line & Cable | Brownsville, WI

Rubber tire backhoe operator responsible for location of utility line obstructions and the timely placement of telephone pedestals to keep production oriented cable placing operations flowing smoothly.

1977 – 1983: **Marine Corp Sergeant/Section Leader**

Active Reserve Company-G, 24th Marines, 4th Division | Madison, WI

1977 – 1980: **General Laborer/Operator**

Michels Mid-America Line & Cable | Brownsville, WI

General laborer responsible for boring operations for telephone cable with various types of equipment.

1973 – 1977: **Project Set-Up Coordinator**

Michels Pipeline Construction | Brownsville, WI

Involved in coordinating materials and supplies for various job locations. Helped in attaining storage yards for equipment and supplies around the United States. Responsible for establishing accounts at various retailers and suppliers within the job working area.

INDUSTRY INVOLVEMENT

- Midwest Energy Association (MEA) Evaluator

EDUCATION

1977 **Lomira High School | Lomira, WI**

High School Diploma

Sean O. Nicholson

Vice President of HSE

PROFESSIONAL EXPERIENCE

2017 – Present: **Vice President of HSE | Michels Corporation | Brownsville, WI**

2007 – 2017: **Director of Health & Safety | Michels Corporation | Brownsville, WI**

Assigned the responsibility of developing, implementing and maintaining the health, safety and environmental program for Michels Pipeline Construction and Michels Directional Crossing divisions of Michels Corporation. Advise executive management pertaining to matters of safety and health, and monitor day-to-day operations to ensure compliance with applicable regulatory requirements and the company's health and safety policies and procedures.

2000 – 2007: **Corporate Director HSE/Risk Management | Mears Group, Inc.**

Responsible for all facets of HSE initiative compliance and training on an international level. Complied and reviewed incident/injury data to determine trends and develop corrective actions and/or programs to prevent recurrence and improve performance. Managed/directed all aspects of litigation issues and legal proceedings. Conducted investigations on suspected workers' compensation and property damage fraud cases. Developed and audited HSE programs and policies to ensure compliance with regulatory agencies governing the energy industry.

1999 – 2001: **Regional Manager of Safety Training & Environmental Compliance | 360networks Inc.**

Planned, implemented and coordinated programs to reduce and eliminate occupational injuries, illnesses, fatalities and financial losses. Developed accident prevention, loss control systems and programs for incorporation into operational policies of the organization. Duties also included, preparing and presenting various required training; performing routine environmental and safety inspections; leading investigations of accidents and injuries.

1999: **Clearing Foreman–Railway Services Division | 360networks Inc./Ledcor Industries**

Trained and managed 45 flagmen and achieved significant improvements in their productivity and safety. Conferred with department heads concerning problems such as near misses and accidents, and recommended measures and procedure to improve safety.

1998 – 1999: **Lead Hand | Ledcor Communications**

Assisted superiors in planning and coordinating activities of workers engaged in constructing, installing and inspecting long haul fiber optic infrastructures. Inspected work in progress to ensure the work conformed to company specifications.

TRAINING & CERTIFICATIONS

- Certified HSE Auditor with the Albert Construction Safety Association
- Completed "Auditor Certification Training Program" with NCCER
- OSHA 500 and 510
- OSHA Outreach Instructor
- Certified in HSE Law from the Institute of Applied Management and Law
- Certified Defensive Driving Instructor with National Safety Council
- Certified Instructor "Speed Shore" (Competent Person, Trenching and Excavation)

TRAINING & CERTIFICATIONS (continued)

- Certified Instructor–American Traffic Safety Services Association
- Traffic Control Supervisor and Technician
- “TaprooT” Investigations Course
- Certified Medic First Aid/CPR
- Master Trainer–NCCER

EDUCATION

1997 **Trent University | Ontario, Canada**

Bachelor of Arts (Honors)

MICHELS®

Jason Pedersen, CSM

Safety Director

PROFESSIONAL EXPERIENCE

2017 – Present: **Safety Director | Michels Corporation | Brownsville, WI**

The primary function of the HSE Director is to work within corporate strategies and policy frameworks to design, implement and direct safety programs, guidelines and procedures. This position provides personal leadership and sets an example of following all safe work practices and procedures. Regularly interfaces with Senior Management, peers, subordinates and client personnel, overseeing project site HSE plans and alliance with corporate values, requirements and initiatives.

The primary responsibility is to coordinate the company's safety activities including:

- Develop procedures and lead the implementation of processes which have been established to ensure compliance with applicable standards, requirements and identified practices. Ensure Michels Corporation has effective programs to protect the safety of employees and comply with or exceed regulations through personal observation, HSE Manager review and audits.
- Demonstrate leadership by giving clear, complete, and accurate information on HSE requirements, process standards, potential health and safety hazards, and potential process difficulties. Interface with operations providing leadership and coaching to facilitate continuous HSE performance improvement.
- Participate in incident/injury investigations, including on-site presence, preparation of reports, analysis and exhibits. Identify regulatory and civil parties needing involvement.
- Work with all employees to instill a safe and environmentally conscientious work environment, determining the awareness level, discussing policies and procedures, advising on the best means of following those policies and procedures and coaching to improve behavior as needed.
- Recommend, implement, and manage safety devices, equipment, and/or products that help protect employees and customers and mitigate losses.
- Work closely with Operations, Quality Assurance, HR, Risk, and various other departments to enhance HSE systems. Communicate HSE information to key management as directed.

2013 – 2017: **HSE – Senior Manager, Compliance Specialist | Michels Pipeline Construction | Brownsville, WI**

Manage the HSE Team. Carry out supervisory responsibilities in accordance with the organization's policies and applicable laws. Responsibilities include interviewing, hiring, and training employees; planning, assigning, and directing work; providing feedback; rewarding and disciplining employees; addressing complaints and resolving problems. Identify and leverage HSE best practices across divisions. Maintain open communication with divisional and department leads to ensure coordination of HSE needs. Advises HSE Director on Health, Safety, and Environmental-related matters throughout the corporation. Review project safety requirements prior to bid and advise division on site specific training or equipment that may be needed. Is present at or delegates to HSE Coordinators to be present during regulatory site visits. Assist with and participate in client sales presentations and formal client meetings. Represent Michels at conferences, committees, and customer meetings. Work with Information Systems and Technology to identify and implement tools to drive better communication, process-management, and reporting tools. Other duties as assigned.

PROFESSIONAL EXPERIENCE (continued)

2006 – 2013: **Senior Project HSE Manager | Michels Pipeline Construction | Brownsville, WI**

2006: **IL & IA North West Region Local 309 Steward | Minnesota Limited, Inc. | Big Lake, MN**

2005: **IL & IA North West Region Local 309 Steward | J & L Pipeline Services, Inc. | Tipton, IA**

1996 – 2004: **Safety Coordinator/Foreman | Murphy Brothers, Inc. | East Moline, IL**

1989 – 1995: **United States Navy**

1988 – 1989: **Laborer/Oiler | Southern Gas Pipeline Company | Corpus Christie, TX**

PROJECT PROFILES

Dominion | Atlantic Coast Pipeline (ACP), Spread 2-1 and 6; Approximately 71.9 miles of 42" OD mainline pipeline. - Buckhannon, WV and Farmville, VA

Enbridge Energy | NEXUS Gas Transmission, Spreads 4, 3 and 1; Approximately a total of 177.2 miles of 36" steel pipeline. - Belleville, MI, Northwood, OH and Canton, OH

Sunoco | Mariner East II - PPP3, Spread 4; Approximately62.9 miles of dual line 20" and 16" steel pipeline. – Hollidaysburg & Shirleysburg, PA

Williams | Atlantic Sunrise Pipeline (ASR) - Spread 1; 37 miles of 30" – Tunkhannock, PA

Enbridge Energy | Line 3 Replacement, Segment 18; 13 miles of 36" – Superior, WI

Energy Transfer Company | Dakota Access Pipeline Project; 380 Miles of 30" pipe along three mainline spreads, thirteen HDD and three pump stations in Il, IA, SD, and ND

Enbridge | Flanagan South Pipeline Project; 300 miles of 36” – Illinois & Missouri

TransCanada | Keystone XL Gulf Coast Project; 360 miles of 36” – Texas & Oklahoma

Shell Appalachia | 70 miles 20” & 10”; Pennsylvania

Energy Transfer | Tiger Expansion Project; 27 miles 42” – Louisiana

Enbridge | Hot Works Line 6B Replacement Project; 67 Miles 30” – Michigan

Energy Transfer | Tiger Pipeline Project; 100 miles 42 – Louisiana

Enbridge | Alberta Clipper Project; 110 miles 42” – North Dakota & Minnesota

Enbridge/Michels/GPP | Southern Lights; 310 miles 42” & 20” – Wisconsin & Illinois

El Paso/Michels | Two Launcher Stations; 10 miles 30” & 16” – Wisconsin

Kinder Morgan | Rockies Express Project; 53 miles 42” – Ohio

Lake Head | 120 miles 36”; Illinois & Wisconsin

Alliance Ltd | 150 miles 36”; Illinois & Iowa

El Paso | 10 miles 20”; Indiana

TRAINING & CERTIFICATIONS

- Certified Safety Manger/Trainer (CSM)
- Certified Occupational Safety Specialist (COSS)
- DNV Incident Investigation Certified
- Safety Auditor Certificate (SAC)
- OSHA 502 - Update for Construction Trainers
- OSHA 500 - Trainer Course for the Construction Industry
- OSHA 510 - OSHA Standards for Construction
- OSHA 10- and 30-Hour Certified Trainer
- Accident Investigation Technician (AIT)
- Hazard Analysis Techinician (HAT)
- Safety Inspections Technician (SIT)
- CMC Confined Space Rescue
- Reasonable Suspicion Trainer
- HAZWOPER Certification 4 Hour
- NCCER Instructor / Performance Evaluator
- Certified MES Q41 Evaluator
- AMSE Rigging Trainer (Crosby)
- Hazardous Material Trainer
- National Safety Council Defensive Driving Certified Instructor
- ATSSA Flagger Instructor
- ATSSA Certified Traffic Control Supervisor/Technician
- Medic First Aid/CPR/AED Trainer
- Respirator Fit Testing & Certification

Mark Franz

Environmental Manager

PROFESSIONAL EXPERIENCE

2009 – Present: **Environmental Manager | Michels Corporation | Brownsville, WI**

Responsible for environmental due diligence, oversight and compliance for mainline spreads. Function as environmental liaison between Michels and Client.

2009: **Environmental Coordinator | Michels Corporation | Brownsville, WI**

Environmental oversight of Michels-Spread 2 of the Alberta Clipper Pipeline Project for client Enbridge Energy. Project consists of installation of 64 miles of 36” mainline pipeline crossing through 41 permitted waterbodies and 136 wetlands in northwestern Minnesota. Responsible for environmental crew management, and support and oversight for field construction issues. Functioned as environmental liaison between Michels and Enbridge.

2006 – 2009: **Environmental Manager | Global Pipeline Partners, LLC | New Berlin, WI**

Environmental oversight of Phase 1 of the alliance agreement between Global Pipeline Partners LLC (Michels Pipeline, Welded Construction, Precision Pipeline and U.S. Pipeline) and client Enbridge Energy. Phase 1 consisted of installation of 321 miles of 20” and 42” mainline pipeline crossing through over 800 permitted wetlands and 230 permitted water bodies. Responsible for contractor environmental planning, support and oversight for field construction issues. Function as environmental liaison between Enbridge and each of the four contractors. Also responsible for preparation of necessary baseline information, environmental variance submittals and management of contractor compliance issues related to the projects Wisconsin Department of Natural Resources and US Army Corp of Engineers execution permits.

2005 – 2006: **Natural Resource Specialist | Michels Corporation | Brownsville, WI**

Responsible for environmental due diligence, wetland delineations and assessments, storm water management, habitat assessments, regulatory permitting, threatened and endangered species survey, and water resource management. Proficient in native vegetation identification in the midwestern and southeastern United States, and in the use of AutoCAD and ArcGIS.

2004 – 2005: **Environmental Specialist/Project Manager | Earth Tech**

1999 – 2004: **Reclamation Specialist/Project Manager | Michels Corporation | Brownsville, WI**

1996 – 1999: **Ecologist | Biological Research Associates, Ltd.**

1994 – 1996: **Biologist | Sarasota County Department of Natural Resources**

1992 – 1994: **Environmental Scientist | Reynolds Smith and Hill, Inc.**

1990 – 1992: **Assistant Biologist | Florida Department of Environmental Protection**

1984 – 1987: **Assistant Planner | Wiles, Dailey, Kane & Associates**

EDUCATION

New College of the University of South Florida | Sarasota, FL

Bachelor of Arts, Biology/Environmental Science

Edward J. Dye

HDD Safety Coordinator

PROFESSIONAL EXPERIENCE

2017 – Present: **HDD Safety Coordinator**

Michels Directional Crossings | Brownsville, Wisconsin

Develop and implementation of on-site procedure, emergency response plan, on-site safety inspections, equipment inspections and reporting to supervisors. Assigned the responsibility for coordinating and maintaining the company safety program. Advises management in matters of safety and health, and monitors day-to-day operations to ensure that the company's safety policies and procedures are followed.

2016 – 2017: **HSE Coordinator**

Michels Pipeline Construction | Brownsville, WI

Promotes Michels' Core Values, leads by example and is an ambassador for HSE Department and Michels Corporation. Assigned the responsibility for coordinating and maintaining the company safety and health program. Advises management in matters of safety and health, and monitors day-to-day operations to ensure that the company's safety policies and procedures are followed. The primary responsibility is to coordinate the company's safety activities are: daily job safety audits, ensure safety on all construction projects, edit and submit safety plan for projects, Ensure all personal protective equipment in on site when necessary, new hire orientation process, assist with organization of annual safety training, tailgate safety meeting coordination, and write up job hazard analysis. Represents Michels during regulatory inspections, client audits and meetings.

2013 – 2016: **Foreman**

Michels Pipeline Construction | Brownsville, WI

Direct activities of workers pertaining to the repair, maintenance, construction, installation, and reconditioning of pipelines. Determine tie-in locations and coordinate their installations with operating units on project sites while providing leadership and support in field production operations. Lead the crews in quality, safety and environmental compliance.

2006 – 2013: **Foreman**

River City Cutting | River City Cutting, IA

Led a multifunctional team of 6 employees on the demolition and precision cutting of concrete. Bid projects by evaluating blueprints, timelines, square footage, and customer operational needs. All projects under my supervision met their timeline, came in at or under bid, and turned a profit for the company. Performed work at numerous types of project sites such as military installations, nuclear power plants, hospitals, schools, bridges, roads, courthouses, jails, and multiple lock and dams. Taught formal classes to apprentices through the union hall on the use of core drills, concrete chainsaws, walk-behind saws, and remote control wall saws. Conducted interviews and background checks on new employees.

2002 – 2006: **Laborer**

Valley Construction | Rock Island, IL

TRAINING & CERTIFICATIONS

- OSHA 30-Hour
- OSHA 510 - OSHA Standards for Construction

TRAINING & CERTIFICATIONS (continued)

- OSHA 500 - Trainer Course for the Construction Industry
- OSHA 3015 - Excavation, Trenching and Soil Mechanics
- Construction Plan Reading Course
- Power Industrial Truck Operations
- Coating Maintenance Course
- Scaffold Builder
- Locating Pipelines
- First Aid/CPR Certified
- Damage Prevention During Excavation First Aid
- Traffic Control Certification
- Leak and Strength Test Course
- Cathodic Protection Systems
- Backfilling
- Underground Clearance
- Receiving Pigs for Lines In-Service
- Internal Devices for Lines In-Service
- Mechanical Joints

Michael Miller

HSE Safety Coordinator

PROFESSIONAL EXPERIENCE

2019 – Present: **HSE Safety Coordinator | Michels Corporation | Brownsville, WI**

Promotes Michels' Core Values, leads by example and is an ambassador for the HSE Department and Michels Corporation. Assigned the responsibility for coordinating and maintaining the company safety and health program. Advises management in matters of safety and health, and monitors day-to-day operations to ensure that the company's safety policies and procedures are followed. The primary responsibility is to coordinate the company's safety activities, which include but are not limited to: daily job safety audits, ensuring the safety on all construction projects, editing and submitting safety plans for projects, ensuring all personal protective equipment is on site when necessary, new hire orientation process, assisting with the organization of annual safety training, tailgate safety meeting coordination, and writing up job hazard analysis. Represents Michels during regulatory inspections, client audits and meetings.

2014 – 2018: **Safety Coordinator | LMC Industrial Contractors, Inc.**

Responsible for coordinating all safety efforts in both LMC's 550,000 square foot facility, as well as on all active sites. Evaluating all personnel to be Veriforce certified. Properly practice respiratory protection, SABC, confined space principals, hazardous abatement procedures, fall protection practices, trenching & excavation safety and compliance, fatigue management, critical lifts, rigging best practices, electrical safety/LOTO, and proper equipment use. Forklift operator certification and Forklift operation trainer. Conduct new hire orientations for all employees and subcontractors. Lead daily safety meetings for all shop and field work. Perform weekly jobsite safety assessments and reporting any deficiencies and near misses/violations. Perform accident investigations/Root Cause Analysis and enforcement of all environmental, safety, health and accident prevention procedures. Reporting of near hits, spills, releases, and safety or environmental non-compliance issues. Create and review task specific safety analysis/JSA/JHA.

2014: **Safety Coordinator Assistant | Holloman Corporation**

Ensure strict compliance with all federal, state and local safety requirements. Properly practice respiratory protection, SABC, confined space principals, hazardous abatement procedures, fall protection practices and proper equipment use.

2013: **Fleet Vehicle Maintenance Inventory/Tracking | Somerset Regional Water Resources**

Maintained inventory tracking for 70+ company vehicles. Ensure safety, inspection, and scheduled maintenance for all assets.

1993 – 2013: **Aircraft Electrical & Environmental Systems Craftsman/Quality & Safety Inspector | United States Air Force**

Performed and supervised aircraft electrical functions and activities. Compiled maintenance data and daily safe maintenance practice evaluations. Performed off equipment maintenance of system components and associated/special test equipment. Performed cryogenic maintenance on mobile servicing units.

TRAINING & CERTIFICATIONS

- Crosby Communication 4 Hour Fundamentals of Rigging
- Erosion and Sediment Control Lead Certified

TRAINING & CERTIFICATIONS (continued)

- Erosion & Sediment Control Training
- OSHA 10-Hour – Construction Safety & Health
- OSHA 30-Hour Construction
- OSHA 500 - Trainer Course for the Construction Industry
- OSHA 510 - OSHA Standards for Construction
- OSHA 511 - Occupational Safety & Health Standards for General Industry
- OSHA 5810 - Hazards Recognition and Standards for On-Shore Oil and Gas Exploration and Production
- Rigging Training

EDUCATION

USAF Non-Commissioned Officer Academy

1998 **Airforce Leadership School**

1996 **Community College of the Air Force**

Business Associates Degree

1993 **Aircraft Electrical & Environmental System Technical School**

Honors

Spencer Rusk

PROFESSIONAL EXPERIENCE

2018 – Present: **HSE Safety Coordinator | Michels Corporation | Brownsville, WI**

Promotes Michels' Core Values, leads by example and is an ambassador for the HSE Department and Michels Corporation. Assigned the responsibility for coordinating and maintaining the company safety and health program. Advises management in matters of safety and health, and monitors day-to-day operations to ensure that the company's safety policies and procedures are followed. The primary responsibility is to coordinate the company's safety activities, which include but are not limited to: daily job safety audits, ensuring the safety on all construction projects, editing and submitting safety plans for projects, ensuring all personal protective equipment is on site when necessary, new hire orientation process, assisting with the organization of annual safety training, tailgate safety meeting coordination, and writing up job hazard analysis. Represents Michels during regulatory inspections, client audits and meetings.

2017 – 2018: **Welder Helper | Michels Corporation | Cedar Rapids, IA**

- Local 25 Plumbers/Pipefitters Welder Helper. Extra duties include sandblasting & painting pipe, hot wraps and applying epoxy coatings in compliance with OSHA.
- Performed pipeline construction removal and installation e.g. digging, backfilling, final grading while being vocal with peers to make sure Michels safety standards and policies were followed.
- Involved in pigging operations to ensure pipe is clean and inspected ensuring it is up to standards.
- Wrote JSA's, step back for safety cards and actively participated in safety meetings.

2009 – 2018: **Firefighter & EMT | Geneseo Fire Protection District | Geneseo, IL**

- Serve as both firefighter and EMT supporting basic life support/trauma and medical patient care.
- Trained in fire suppression, structural fire classes, vehicle and confined space training as well as vehicle extrication.
- Conduct and teach fire safety education and first aid throughout the area schools.

2005 – 2018: **Automotive Collision Repair Technician | Pro/Tech Auto Body Inc. & Pinks' Paint & Body | Geneseo, IL**

- Analyzed requirements on fulfilling estimation paperwork, while maintaining a budget and completing the job within the time requirements; ensuring damage was repaired flawlessly.
- Created detailed damage assessment to optimize vehicle quality after repairs.
- Worked with customers to answer all questions to ensure customer service was paramount.
- Kept accurate logs of MSDS for the chemicals and paints used on site.

TRAINING & CERTIFICATIONS

- OSHA 10-Hour – Construction Safety & Health
- OSHA 30-Hour Construction
- First Aid/CPR Certified
- Hazardous Materials Awareness
- Basic Wildland Firefighter: I-200, L-180, S-130, S-190
- Firefighter II
- EMT – Basic

Scott Nehls

HDD Logistics QA/QC Manager

PROFESSIONAL EXPERIENCE

2009 – Present: **HDD Logistics QA/QC Manager**

Michels Directional Crossings | Brownsville, WI

Responsible for truck load out and receiving, organization of HDD tooling and equipment, coordination of drill stem supply, tracking and calibration, new hire training, orientation, dispatch, manage divisional labor pool, tractor trailer inspection/maintenance program implementation, safety training/OQ program implementation, on-site review of HDD personnel & operations.

1989 – 2009: **Project Manager**

Michels Directional Crossings | Brownsville, WI

Responsible for coordinating and drilling directional boring projects across the country. Duties include mobilization of all equipment and personnel to remote job sites; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Provides safety training and performs evaluations. Assists with estimating and bid preparation. Some more noteable crossings include, but are not limited to:

Diameter	Length	Location	Year
20” & 42”	1544’ & 2127’	Wisconsin River, WI	2007
20” & 42”	2530’ & 2299’	Chippewa River, WI	2007
20” & 42”	2280’ & 2294’	Flambeau River, WI	2007
42” (2)	2294’ & 2775’	Lake Arrowhead, WI	2007
24”	2172’	Biscayne Bay, FL	2006
30”	2453’	Jackson Creek, WI	2006
30”	1301’	Jackson Creek, WI	2006
30” (2)	1400’ & 2661’	Rausonville & Willis Rd, MI	2005
24”	2429’	Kinnickinnic River, WI	2005
36” (3)	1276’ to 1531’	Clarkston, MI	2005
8”	1374’	Detroit, MI	2005
12” (10)	375’ to 750’	Lansing, MI	2004
16” (2)	2723’ & 2925’	Packard Rd & Washtenaw Ave, MI	2004
22”	2308’	St. Joseph River, MI	2004
30” (2)	1532’ & 1661’	Darien, WI	2004

PROFESSIONAL EXPERIENCE (continued)

6" (6)	1564' to 1880'	Lean, WI	2004
12" (3)	1668' to 3524'	New York/New Jersey	2003
30"	1673'	Huron River, MI	2002
36"	3395'	Huron River, MI	2002

1986 – 1989: **Superintendent**

Michels Mid-America Line & Cable | Brownsville, WI

Working foreman responsible for managing utility construction crews. Accountable for tie-ins behind our rail-mounted plow which consists of horizontal boring operations and dig downs. Implemented supervisory skills for material and labor coordination.

1980 – 1986: **Equipment Operator**

Michels Mid-America Line & Cable | Brownsville, WI

Rubber tire backhoe operator responsible for location of utility line obstructions and the timely placement of telephone pedestals to keep production oriented cable placing operations flowing smoothly.

1977 – 1983: **Marine Corp Sergeant/Section Leader**

Active Reserve Company-G, 24th Marines, 4th Division | Madison, WI

1977 – 1980: **General Laborer/Operator**

Michels Mid-America Line & Cable | Brownsville, WI

General laborer responsible for boring operations for telephone cable with various types of equipment.

1973 – 1977: **Project Set-Up Coordinator**

Michels Pipeline Construction | Brownsville, WI

Involved in coordinating materials and supplies for various job locations. Helped in attaining storage yards for equipment and supplies around the United States. Responsible for establishing accounts at various retailers and suppliers within the job working area.

INDUSTRY INVOLVEMENT

- Midwest Energy Association (MEA) Evaluator

EDUCATION

1977 **Lomira High School | Lomira, WI**

High School Diploma

Ken Coleman

Project Manager

PROFESSIONAL EXPERIENCE

2008 – Present: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production recordkeeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
24"	3183'	Crow River, MN	2019
24"	2100'	Spanish Lake, MO	2019
22"	4986'	Atchafalaya River, LA	2019
42"	4687'	Lake Scranton Finished H2O Tunnel, PA	2018
42"	3980'	Susquehanna River MP 99.6, PA	2018
42"	1810'	Interstate 80, PA	2018
42"	2826'	San Joaquin River, CA	2017
10"	5697'	Mississippi River, LA	2017
6"	3309'	Hauser River, MT	2017
8"	1980'	CHS Yellowstone River, MT	2017
30"	7531'	Lake Oahe & Missouri River, ND	2017
12"	1178'	Howard Cove, ME	2016
12"	1023'	Cutler Site, ME	2016
12"	1114'	Sunflower Field, VT	2016
12"	1129'	Arch Site & Town Hill Rd, VT	2016
12"	686'	Laplatte River, VT	2016
12"	922'	Arch Site & Monkton Rd, VT	2016
12"	492'	Arch Site, VT	2016
42" Steel with 36" HDPE	3983'	St John's River, FL	2016
27" HDPE Bundle	3737'	Little Creek, VA	2016
16"	2249'	Ohio River, OH/KY	2015
24"	1405'	Platte River, MO	2015
36"	1755'	New York St, IL	2015

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
36"	2303'	Liberty Street,IL	2015
24"	3275'	Transfer Line 1, IN	2014
8"	2545'	MP266, Mountain Green, UT	2013
30"	1881'	Bennekill Stream, NJ	2013
30"	6544'	1st Street, NJ	2013
36"	1392'	Seacaucus, NJ	2012
30"	1186'	Bowman Cty., ND	2011
20"	1814'	Marion, OR	2011
20"	3075'	Marion, OR	2011
30"	5786'	Vernon, NJ	2011
42"	3008'	White River, AR	2010
42"	1010'	Albany Ave, NJ	2010

1993 – 2008: **Supervisor | Mears**

Supervised over HDD projects with pipe diameters of 6” to 60” with lengths of 600’ to 7,200’ in the United States, Canada, and Mexico.

1990 – 1993: **Operator | ARB**

Experience operating the following equipment: forklift, front end loader, dozer scraper, motor grader, back hoe, excavator, crane, hot mix plants, trenching machine, rock crusher, horizontal drilling rig and fusing machines from 4” to 32” HDPE.

1968 – 1990: **Operator | Reading & Bates**

Worked as Operator, low boy driver, horizontal drilling rig, and supervisor of equipment yard and warehouse.

EDUCATION

1962 **Harrison Central High School | Gulfport, MS**

High School Diploma

Jim McGovern

Project Manager

PROFESSIONAL EXPERIENCE

1995 – Present: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production recordkeeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
24"	3183'	Crow River, MN	2019
20"	2740'	West Branch Escanaba River, MI	2019
20"	2173'	Escanaba River 2, MI	2019
20"	1421'	Middle Branch Escanaba River, MI	2019
42"	2007'	Las Moras Creek, TX	2019
36"	2438'	Huron River MP 117.2, OH	2018
36"	3199'	Vermillion River MP 104.4, OH	2018
36"	1863'	E. Branch Black River MP 86.7, OH	2018
36"	1886'	Nimisila Rexervoir MP 40.9, OH	2018
16"	5869'	Conrail RR, NJ	2018
16"	2766'	Hall Street, NJ	2018
16"	1999'	Route-35, NJ	2018
12"	5170'	Larch Dr & Wetland, MN	2017
24"	5788'	Hwy 41/45, WI	2017
16"	3065'	Rock Creek & US HWY 67, IA	2016
16"	6693'	Wapsipinicon River, IA	2016
24"	1898'	Vermillion River, IL	2016
20"	1904'	North St Mary's River, IN	2016
20"	1076'	South St Mary's River, IN	2016
36"	1862'	State Highway 50, IL	2015
36"	3461'	Kennedy Ave/Griffith Terminal, IN	2015
36"	1813'	Calumet Ave, IN	2015
36"	2510'	Deep Creek, IL	2015
36"	1803'	Dyer Ditch, IN	2015
36"	3011'	Highway 41 & RR, IN	2015
36"	5128'	Lake Ave & RR, IL	2015

36"	1812'	Highway 394, IL	2015
36"	9040'	Mississippi River, IL/MO	2014
36"	2264'	Otter Creek, IL	2013
36"	3544'	Illinois River, IL	2013
36"	1611'	Mackinaw Rover, IL	2013
36"	3892'	Red River, OK	2013
36"	4213'	Menard Creek, TX	2013
36"	3571'	Angelina River, TX	2013
36"	2908'	Neches River & RR, TX	2013
36"	1867'	Flora, TX	2012
36"	1740'	Sabine River, TX	2012
36"	2567'	South Sulphur River, TX	2012
30"	2906'	Hickory Creek, Marietta, OK	2012
16"	1656'	Chicolete River, TX	2012
42"	1650'	Chicolete River, TX	2012
16"	1717'	Morales, TX	2012
42"	1670'	Morales, TX	2012
16"	1658'	Cordele, TX	2012
42"	1658'	Dewitt, TX	2012
16"	1717'	Morales, TX	2012
16"	1664'	Morales, TX	2012
42"	3205'	Dewitt, TX	2012
42"	1661'	Morales, TX	2012
24"	1386'	Jonestown, PA	2012
24"	2458'	Jonestown, PA	2012
8"	6675'	Wilmington, NC	2012
8"	6669'	Wilmington, NC	2012
8"	7019'	Missouri River, NE	2011
42"	3035'	Rambling Bayou, LA	2011
42"	5340'	Boise Cascade, LA	2011
42"	4932'	Bayou Jean De Jean, LA	2011
12"	2484'	Wetland #13, NC	2011
42"	2094'	Hwy 9, LA	2010
42"	5248'	Saline Bayou, LA	2010
42"	1838'	Steep Bayou, LA	2010

42"	2243'	Beouf River, LA	2010

1991 – 2005: **Pipe-Side Superintendent/Pullback Coordinator | Michels Directional Crossings | Brownsville, WI**

Responsible for coordination of pipe welding subcontractor located on exit side of directional drill. Duties include operation and maintenance of equipment, coordination of labor for specialized pipe coating and testing. Solely responsible for maintaining constant communication with the driller during control of ballasting, which is one of the most critical aspects of pipe pulling.

1987 – 1991: **Operator/Foreman | Michels Directional Crossings | Brownsville, WI**

Skilled in the operation of technical, lifting and heavy equipment for directional drilling operation. Working knowledge of hydraulic engineering and applied mechanical engineering. Experience in working on and around directional drilling rigs as an integral member of a specialized team. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

1972 – 1987: **Operator | Gas Division of Michels Pipeline Construction | Brownsville, WI**

Track-hoe and backhoe operator responsible for maintaining line and grade on civil and gas pipeline projects. Duties include trench maintenance and safety as well as equipment repairs and maintenance.

1968 – 1972: **Skilled Laborer | Michels Pipeline Construction | Brownsville, WI**

Laborer working with underground construction crew. Responsibilities include upholding safety consciousness while performing various duties to help maintain progressive pipe/cable laying production.

EDUCATION

1967 **Waupun High School | Waupun, WI**

High School Diploma

MICHELS®

Larry Shilman

Project Manager

PROFESSIONAL EXPERIENCE

1999 – Present: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production recordkeeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	7402'	Susquehanna River, PA	2019
20"	2355'	Joanna Road, PA	2018
4"	1495'	Des Moines River, IA	2018
16"	5869'	Conrail RR, NJ	2018
36"	5841'	Ohio River MP 33.8, OH/WV	2017
14"	9154'	Nansemond River, VA/ ND	2017
30"	7531'	Lake Oahe & Missouri River, ND	2017
16"	11,397'	Lake Sacagawea South, ND	2016
30"	3352'	Cliff Crossing, ND	2016
16"	11,229'	Lake Sacagawea North, ND	2016
8"	4022'	Lake Macatawa, MI	2016
8"	1957'	Grand River, MI	2016
30"	1418'	Highway 250, OH	2015
16"	1402'	Deer Lake, ND	2015
10"	1971'	Tank Farm/Central Ave, PA	2015
8"	3320'	Yellowstone River, MT	2015
24" HDPE	1061'	Lake Sakakawea, ND	2014
8"	7321'	MP 49.3 Landslide, MT	2014
8"	4159'	MP 54.8 Landslide, MT	2014
20"	2364'	Missouri River, IA/NE	2014
16"	2951'	Line 82, ND	2014
36"	5687'	Missouri River, MO	2013
36"	2355'	Salt Fork River, MO	2013
36"	2077'	Chariton River, MO	2013
48"	1943'	West Neck Creek, VA	2013

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
48"	819'	Hunt Club Creek, VA	2013
8"	7177'	115 KV Power Duct, SC	2013
8"	7304'	115 KV Power Duct, SC	2013
8"	4911'	115 KV Power Duct, SC	2013
36"	1366'	Big Sandy, Maple Springs, TX	2012
36"	1444'	Hwy 155 & UPRR, Big Sandy, TX	2012
36"	1761'	Private Lake, Maple Springs, TX	2012
30"	4850'	Red River, Thackerville, TX/OK	2012
30"	3042'	Wyalusing, PA	2012
24"	2458'	Jonestown, PA	2012

1998 – 1999: **Construction Supervisor | InterCon Construction, Inc. | Lakeville, MN**

Supervisor of 210 mile fiber optic installation, underground and aerial in Minneapolis and surrounding suburbs. Responsible for subcontractors, directional drilling, underground, aerial and InterCon crews.

1998: **Project Engineer | Brungardt, Honimichl & Company, P.A. | Overland Park, KS**

AT&T switched engineering firms from C&S Contract Services to Brungardt, Honimichl & Company. Responsibilities included project management for concurrent multiple projects including route selection, courthouse search, surveying, land acquisition, writing job specifications, bid meetings, inspection, as-built records and permitting. Total start up to completion construction.

1990 – 1997: **Project Manager | C & S Contract Services, Inc. | Martinville, IN**

Responsibilities include project management for concurrent multiple projects including route selection, courthouse search, surveying, land acquisition, writing job specifications, bid meetings, inspection, as-built records and permitting. Total start up to completion construction.

1988 – 1990: **Right-of-Way Supervisor | Bucher, Willis & Ratliff, Inc. | Aurora, IL**

Responsibilities include all start up activities, pre-construction, construction and post-construction damages for 126 miles of fiber optic projects across Northern Indiana as well as three diversity routes in South Bend, Indiana.

EDUCATION

1990 **State of Indiana**

Real Estate License

1973 **Warner High School | Warner, SD**

High School Diploma

MICHELS®

Eric Frawley

Project Manager

PROFESSIONAL EXPERIENCE

2015 – Present: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production recordkeeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
30"	3746'	Dix River, KY	2019
20"	2355'	Joanna Rd, PA	2018
12"	1369'	Rocky Point Landing, Jamaica	2018
20"	7354'	Susquehanna River, PA	2018
20"	3874'	Waltonville Rd, PA	2018
16"	1198'	Harrisburg Pike, PA	2017
24"	2026'	Highway 120, GA	2017
24"	2293'	Interstate 20, GA	2017
16"	11,397'	Lake Sacagawea South, ND	2016
30"	2069'	Floyd River/RR/HWY 60, IA	2016
16"	11,229'	Lake Sacagawea North, ND	2016
16"	1112'	Palermo Railroad, ND	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
16"	1508'	Beverly Harbor, MA	2015
16"	3827'	Collins Cove, MA	2015

2013 – 2015: **Project Manager | Oceaneering International Inc. | Houston, TX**

2010 – 2013: **Project Manager and Project Coordinator | Triton Diving Services | Houston, TX**

2006 – 2009: **Commercial Diver/Saturation Diver | Deep Marine Technology | Houston, TX**

2003 – 2005: **Commercial Diver/Supervisor | Epic Divers | Harley, LA**

2001 – 2003: **Dive Tender/Commercial Diver/EMT | Torch Offshore | LA**

TRAINING & CERTIFICATIONS

- American Petroleum Institute - Certified RIgger an Crane Operator Class A per API RP 2D 2002
- Offshore Water Survival (HUET) per API RP T-4 and T-7

TRAINING & CERTIFICATIONS (continued)

- "Association of Diving Contractors International - Surface-Supplied Air Diver, Surface -Supplied Mixed Gas Diver, Saturation Diver
- American Red Cross - First Aid, Adult, Infant and Child CPR, and CPR for the Professional Rescuer
- TWIC (Transportation Worker Identification Credential)
- EPIC Divers - Visual Weld Inspection, Flange Trained, Safety Incident Support Team 2003
- EMT (Emergency Medical Technician) Nationally Registered 2002
- LOLER (Lifting Operations Lifting Equipment and Regulations)
- BOSET (Basic Offshore Safety and Emergency Training)
- HAZWOPER First Responder
- Hydrogen sulfide safety awareness certified
- Captain 100 Ton License USA Coast Guard
- NORM (Naturally Occurring Radioactive Material Surveyor)
- Confined Space Supervisor/Rescuer 2003

EDUCATION

2010 **VTC, Virtual Training Company**

Major: Microsoft Excel, Word, Projects, Outlook, Adobe Acrobat X

2000 **United States Coast Guard**

One Hundred Ton Captain License

1999 **Santa Barba City College | Santa Barbara, CA**

Major: Marine Diving Technology

MICHELS®

Dale Schinderle

Project Manager

PROFESSIONAL EXPERIENCE

2018 – Present: **Project Manager | Michels Directional Crossings**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production record-keeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	4145'	Loyalhanna Lake, PA	2020
24"	795'	Great Passage Blvd, VA	2018
24"	426'	Amanda Dr, VA	2018
24"	300'	Riva Ridge Dr, VA	2018

1998 – 2018: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
20"	1665'	Aughwick Creek, PA	2018
20"	2209'	Horse Valley Rd, PA	2018
20"	1337'	Berry Ridge & Old Mill Rd, PA	2018
20"	4771'	Raystown Lake, PA	2017
20"	1260'	Hollow Rd, PA	2017
20"	845'	Patterson Rd/RR, IL	2016
20"	748'	Wetlands #1, IL	2016
24"	1029'	Drainage Ditch, IL	2015
36"	9040'	Mississippi River & Levees, IL/MO	2014
12"	2535'	Arkansas River, AR	2014
36"	2908'	Neches River & RR, TX	2013

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
16"	1110'	New Berlin, WI	2012
10"	3745'	Fort Lauderdale, FL	2012
12"	4300'	Marathon County, WI	2012
30"	7600'	Livingston & Oakland County, MI	2011
12"	6106'	Westmoreland County, PA	2010

1992 – 1998: **Foreman | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring rigs for various size gas, water, sewer, electrical and communication lines throughout the United States. Complete knowledge of directional drilling technology and procedures. Duties include rig set-up, operation and maintenance, employee management.

1987 – 1992: **Laborer/Operator | Michels Pipeline Construction | Brownsville, WI**

Experience in working on and around directional drilling rigs as an integral member of a specialized team. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs; hydraulics; fluids; set-up and operation of drill motors; power generators; mud pumps; bentonite mixers; drill pipe; reamers; couplings; and overall equipment maintenance and operation. Was a member or the IBEW out of Michigan.

INDUSTRY INVOLVEMENT

- Member of Operating Engineers-1995

EDUCATION

NWTI (Northeast Wisconsin Technical Institute)

Mechanical Drawing

Michael Geelan

Project Manager

PROFESSIONAL EXPERIENCE

2016 – Present: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production recordkeeping, and overall on-site management.

Diameter	Length	Crossing/Location	Year
16"	3728'	Village Square Dr, PA	2019
24"	3817'	Missouri River, MO	2019
24"	6336'	Mississippi River, IL/MO	2019
12"	1070'	Indiana Harbor Canal - 12" & 10" Bundle, IN	2018
36"	1805'	Portage River MP162.5 OH	2018
36"	2730'	Sanddusky River MP145.8, OH	2018
36"	1522'	Findlay Road MP 179.96, OH	2018
36"	4034'	Maumee River MP 181.7, OH	2018
42"	1501'	Platte River, NE	2018
42"	1861'	San Martin Lake Channel, TX	2018
42"	3717'	Bahia Grande Channel #2, TX	2018
42"	4869'	Bahia Grande Channel #1, TX	2018
48"	3235'	Arroyo Colorado Canal, TX	2017
48"	3085'	Rancho Viego Floodway, TX	2017
48"	3649'	IBWC North Floodway, TX	2017
48"	3595'	Road 771 Canal, TX	2017
48"	2222'	Hwy 803, CA Rd & Supply Canal, TX	2017
48"	2033'	Resaca De Los Cuates Canal, TX	2017
48"	2183'	Resaca De Los Fresnos Canal #2, TX	2017
48"	2555'	Resaca De Los Fresnos Canal #1, TX	2017
48"	2126'	Pinson Rd Canal, TX	2017
48"	2042'	County Rd 300 Canal, TX	2017

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
48"	2398'	CR2340 & Los Olmos Creek, TX	2017
36"	1594'	Dupage River #2, IL	2017
36"	1525'	Dupage River #1, IL	2017
36"	1545'	Van Dyke Road, IL	2017
30"	7282'	Mississippi River, IA/IL	2016

2014 – 2016: **Project Manager | Michels Corporation | New York, NY**

Responsible for contract management and project coordination, including personnel and material, cost and budget control, tracking progress and schedule, submission of proper submittals and support engineering, and review of daily field reports. Serving as the point of contact for the project and maintaining communication with clients, general/subcontractors, vendors, and suppliers.

2011 – 2016: **HSE-Safety Coordinator | Michels Corporation | New York, NY**

Development and implementation of on-site procedure, emergency response plan, on-site safety inspections, equipment inspections and reporting to supervisors. Assigned the responsibility for coordinating and maintaining the company safety program. Advises management in matters of safety and health, and monitors day-to-day operations to ensure that the company's safety policies and procedures are followed.

2007 – 2011: **Project/Field Engineer | Michels Tunneling | New Berlin, WI**

Holds responsibility for coordination of all technical activities on assigned projects. Plans, schedules, conducts, and coordinates assigned engineering work; monitors work for compliance to applicable codes, accepted engineering practices, and ensures effective communication and coordination on assigned projects between all disciplines and all other project participants.

PROJECT PROFILES

MED609 – 62nd St. Tunnel Project; 620 LF of 76" Hard Rock Tunnel using a Robbins TBM. Included pipe jacking operations of 72" Casing pipe for a new water main. Construction in Manhattan – New York City. – New York, NY

East Side Access Tunnel – Contract CM005; interior structures, interior structures, and fit-out for caverns and tunnels beneath the existing Grand Central Terminal in Manhattan. Work included installation of piping/drainage systems, embedded conduits & ground mesh, waterproofing membrane & contact grout pipes, >9 million pounds of rebar, and placement of >70,000 cubic yards of concrete & wet/dry mix shotcrete. – New York, NY

Novartis Institute | Campus Expansion Project at 181 Massachusetts Ave.; Construct a 72" dia. steel Utility Tunnel by Microtunneling one run by jacking a 72" dia. Permalok steel casing pipe for a total of 120'. Jacking from a new building foundation excavation to and existing parking garage basement. – Cambridge, MA

University of Massachusetts | Central Campus Infrastructure; Construct a Jacking Shaft 30' diameter by 40' deep. Microtunnel two runs by jacking 48" dia. Permalok steel casing pipe for a total of 950'. Install 24" dia. PVC carrier pipe inside the casing pipe and gill the annulus with grout. – Amherst, MA

PROJECT PROFILES (continued)

City of Milwaukee | 26th Street Combined Sewer Sliplining; 4,500 LF of slip lining a 126” diameter Hobas pipe inside an existing 144” combined sewer concrete pipe. Included excavation of 2 access shafts (approx. 80’ deep) using rib and lagging construction methods to lower the Hobas pipe into the existing tunnel. – Milwaukee, WI

San Francisco Public Utilities Commission | Bay Division Pipeline Reliability Upgrade, Bay Tunnel; 26,208 LF of 12’ – 10” diameter concrete segmented tunnel under the San Francisco Bay from Menlo Park on the S.F. Peninsula Bay to Newark in the East Bay area, two slurry diaphragm wall shafts, and 108” cement motor lined steel pipe welded in the tunnel and shafts as a final liner carrier pipe. – San Francisco, CA

Massillon Road Sanitary Sewer Improvement; 2,925 LF of 42” Centrifugally Cast Fiberglass Reinforced Polymer Mortar Pipe sanitary sewer gravity sewer, microtunnel installation; 1,328 LF of 48” CCFRPM pipe on micropile support, 29 LF of 36” OH CCFRPM pipe, gravity sewer, micropile support. 7 EA shaft excavations with steel sheeted ground and 7 EA manholes structures. 250 LF of open cut excavation with steel sheeted ground support. – Akron, OH

Brazos River Authority East Williamson County Regional Water System Contract A; Raw Water Intake Pump Station; Two 60-inch Raw Water Intake Pipelines by Microtunnel Construction; 303 LF – Austin, TX

Galveston Causeway; Two 700’ tunnel drives through clay underneath Galveston Bay. 48” Permalok. – Galveston, TX

OCI Project No. DB10-WASD-01 ESP; 1,200 LF of 72” Permalok steel casing under the Government Cut Channel – Miami, FL

Fairfax Department of Public Works & Environmental Services | Dogue Creek Force Main Replacement; Dogue Creek Force Main Replacement – Fairfax County, VA 4,200 LF of 74” dia. Microtunnel between 6 drop shafts and tied into the existing pump station and out fall structures in order to replace an existing sewer. The majority of work performed on and coordinated with the Army Military Base – Fort Belvoir. – Fairfax County, VA

Milwaukee Metropolitan Sewer District | South 43rd Street Relief Sewer; Installation of 4500 LF of RCP using both a Akkerman MTBM slurry machine and Iseki MTBM slurry machine and 2000 LF of RCP using a Decker TBM with Direct Pipe Jacking. Job alsoconsisted of sheet pile shafts and rib and lagging/liner plate shafts at 15 structure locations. – Milwaukee, WI

Milwaukee Metropolitan Sewer District | Canal St. Wet Weather Relief Sewer; Installation of 6,000 LF RCP of Direct Pipe Jack using a 105” Lovat EPB TBM with Direct Pipe Jacking. Job also consisted of sheet pile shafts and rib and lagging/liner plate shafts at 18 structure locations. – Milwaukee, WI

Sacramento Regional County Sanitation District | Upper Northwest Interceptor Sewer 3 & 4; Installation of 3,000 LF of RCP using an 84” Akkerman MTBM slurry machine, 8,000 LF RCP Two-Pass Tunnel using a 130” Lovat TBM, and 6,000 LF RCP of Direct Pipe Jack using a 105” Lovat EPB TBM. Job also consisted of 12 sheet pile shafts and 6 drilled manhole shafts. – Sacramento, CA

TRAINING & CERTIFICATIONS

- OSHA 30-Hour
- OSHA 10-Hour
- OSHA 500 – Trainer Course for Construction (Qualified To train 10 to 30 Hour Classes)

TRAINING & CERTIFICATIONS (continued)

- BioMarine BioPak Re-breather Training and Certification
- Cal/OSHA Certified Gas Tester
- Cal/OSHA Licensed Tunnel Safety Representative
- Certified Associate Constructor - American Institute of Constructors (AIC)
- American HealthCare Assoc. Healthcare Provider Certification
- American HealthCare Assoc. Heartsaver First Aid Certification
- Rigging and Fall Protection Inspection Training (Competent Person)
- Medic First Aid Certification Renewal (CPR, AED, & First Aid)
- Qualified Rigger and Signal Person
- Confined Space Entry Awareness Training (Competent Person)
- Open Trench Safety Awareness Training (Competent Person)
- Wisconsin Lift Truck Operator Training
- Commercial Driver's License (Class ABC)
- 32-Hour Supported Scaffold Certified (NYC-DOB)
- Louisiana State Licensing Board for Contractors -- Pipe Work: 7-43 (Sewer Lines) 7-44 (Storm Drains) 7-45 (Water Lines) #25444
- Louisiana State Licensing Board for Contractors -- Specialty: 7-590 Telecommunications #25444
- North Carolina Licensing Board for General Contractors -- S (Boring & Tunneling) #29269
- State of Rhode Island: Contractors' Registration and Licensing Board -- Commercial & Residential Contractor Registration #40432
- South Carolina Department of Labor, Licensing and Regulation -- Class WL5 (water lines) & BT5 (bore & tunnel) #G10861

INDUSTRY INVOLVEMENT

- 2009 National AGG/ASC Heavy Civil Construction Competition – 4th Place
- 2008 Great Lakes Region AGG/ASC Heavy Civil Construction Competition – 1st Place
- 2007 Great Lakes Region AGG/ASC Heavy Civil Construction Competition – 3rd Place
- 2006 Lynn E. Legault Undergraduate Scholarship (AGC Education Research Foundation)

EDUCATION

University of Wisconsin–Stout | Menomonie, WI

Bachelors of Science – Construction; Minor – Risk Control & Business

University of Wisconsin–Fond du Lac | Fond du Lac, WI

Associates of Arts & Science Degree

MICHELS®

Richard Zavitz

Drilling Fluids Specialist/Project Manager

PROFESSIONAL EXPERIENCE

2012 – Present: **Drilling Fluids Specialist/Project Manager | Michels Directional Crossings | Brownsville, WI**

Develop detailed drilling fluid plans and contingencies based upon geotechnical reports, equipment and scope of project. Measure and testing of drilling fluids and supervising the mixing and pumping operations. Perform technical analysis and interpret geotechnical reports. Control and maintain drilling fluids parameters and provide technical recommendations. More notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	7402'	Susquehanna River, PA	2019
20"	1720'	Everett Railroad & Juniata River, PA	2018
42"	3980'	Susquehanna River MP 99.6, PA	2018
36"	2792'	Middle Island Creek, WV	2017
36"	5841'	Ohio River MP 33.8, OH/WV	2017
10"	5697'	Mississippi River, LA	2017
8"	1530'	SPL Yellowstone River, MT	2017
8"	1542'	YPL Yellowstone River, MT	2017
12"	1285'	XOM Yellowstone River, MT	2017
30"	7531'	Lake Oahe & Missouri River, ND	2017
16"	11,397'	Lake Sacagawea South, ND	2016
30"	3352'	Cliff Crossing, ND	2016
16"	11,229'	Lake Sacagawea North, ND	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
24"	3716'	Barbour's Cut, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
24"	5908'	Tabbs Bay, TX	2015
12"	11,563	Holland Bottoms Wetlands, AK	2015
48"	4039'	Dow Barge Channel, TX (Direct Pipe)	2015
36"	3461'	Kennedy Ave/Griffith Terminal, IN	2015
36"	3011'	Highway 41 & RR, IN	2015
36"	5128'	Lake Ave & RR, IL	2015
36"	1002'	Highway 255, TX (Direct Pipe)	2015
36"	1092'	Lubrizol Drainage, TX (Direct Pipe)	2015
18"	12,459'	Rio Grande River, TX	2014
48"	2400'	Rio Grande River, TX (Direct Pipe)	2014

PROFESSIONAL EXPERIENCE (continued)

42"	1200'	RR Crossing, TX (Direct Pipe)	2014
36"	9040'	Mississippi River, IL/MO	2014
30" & 24"	2,850',1,991', 2,732',2,983'	SE Market Expansion Project MS & AL	2014
36"	3544'	Illinois River, IL	2013
36"	4304'	Bois D' Arc, TX	2013
36"	3892'	Red River, OK/TX	2013
36"	3077'	UP RR & Jefferson St, OK	2013
36"	4213'	Menard Creek, TX	2013
36"	3239'	Clear Boggy Creek, OK	2013

2011 – 2012: **Drilling Fluid Specialist | Mears Group, Inc. | Billings, MT**

Developed detailed drilling fluid plans and contingencies based upon geotechnical reports, available equipment and scope of project. Selected bentonite and polymers based on characteristics required by the project. Trained field personnel on mud testing concepts and drilling fluid theology. Liaised with environmental regulators to obtain approval for drilling fluid products for projects.

2010 – 2011: **Territory Manager | Akkerman, Inc. | Billings, MT**

Sold tunneling and pipe jacking equipment. Analyzed and interpreted geotechnical reports to provide equipment recommendations.

2000 – 2010: **Technical Sales Engineer | Wyo-Ben, Inc. | Billings, MT**

Engineered fluids on HDD, microtunneling, pipe ramming, pipe jacking and auger boring projects. Analyzed geotechnical reports and developed mud/lubrication programs.

1998 – 2000: **Sales Representative | Surface to Surface | London, Ontario, Canada**

Trained new HDD operators. Sold pipe and cable locating equipment.

Colorado School of Mines

Taught bentonite and polymer course at Microtunneling Short Course.

TRAINING & CERTIFICATIONS

- OSHA 510 - OSHA Standards for Construction
- Apprenticed under oil field qualified mud engineer working on HDD projects
- OSHA 10-Hour
- Multiple OQ courses for various energy companies
- Multiple safety courses required by various energy companies
- OFITE trained in repair and calibration of OFITE Model 900 viscometer

EDUCATION

1988 **University of Western Ontario**

Bachelor of Arts, Kinesiology

2000 **Wyo-Ben, Inc. Intensive Mud School**

Graduated

MICHELS®

Wendell Long

Project Manager

PROFESSIONAL EXPERIENCE

2002 – Present: **Project Manager**

Michels Directional Crossings | Brownsville, WI

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production record-keeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
36"	6238'	Ohio River, OH/WV	2017
30"	2278'	Chattahoochee River, GA	2017
30"	2757'	Little Rock River, IA	2016
30"	6328'	Big Sioux River, SD/IA	2016
30"	1614'	Mill Creek, IA	2016
30"	6119'	Lake Whitney, TX	2016
16"	11,563	Holland Bottoms Wetlands, AK	2015
22"	2538'	Barrington Rd, IL	2015
36"	1147'	E. 138th Street, IL	2015
36"	2697'	Barrington Rd, IL	2015
48"	2060'	Tres Palacios River, TX	2014
48"	1692'	Navidad River, TX	2014
24"	2750'	Escatawpa River, MS	2014
24"	3030'	Big Creek Lake, AL	2014
30"	2774'	South Canadian River, OK	2013
28"	4270'	Saline Creek, Alberta, Canada	2013
12"	4272'	Saline Creek, Alberta, Canada	2013
36"	3618'	Johnson Creek, TX	2013
36"	3314'	East Fork Angelina River, TX	2013
36"	3130'	Cypress, TX	2012
16"	1664'	Morales, TX	2012
42"	1657'	Morales, TX	2012
20"	2108'	Bayonne, NJ	2012
24"	6091'	Homestead, FL	2011
36"	2373'	Ravenswood, LA	2011

PROFESSIONAL EXPERIENCE (continued)

10'	778'	Ft. Lauderdale, FL	2011
10"	964'	Ft. Lauderdale, FL	2011
16"	9931'	Cooper River, SC	2010
42"	1998'	I-49, LA	2010
16"	2566'	Hitchcock Plaza, SC	2010
30"	2176'	I-285, Atlanta, GA	2010

1994 – 2002: **Project Manager**

Michels Mid-America Line and Cable | Brownsville, WI

Job estimating, profit and loss coordination of materials and equipment. Labor and production jobs varying in size up to $25 million. Projects include aerial, buried, underground, cooper and fiber routes.

1987 – 1991: **Project Manager**

U.S. Sprint | Midwest and Eastern U.S.A.

Responsible for construction management, permits, schedules and daily work operation to meet completion dates. Jobs varying in size to $20 million.

1985 – 1986: **Senior Engineer**

U.S. Sprint | Midwest and Eastern U.S.A.

In charge of engineering and fiber construction for several miles.

1981 – 1984: **Construction and Maintenance Supervisor**

United Telephone of Florida | Fort Meyers, FL

Responsibilities include new construction, maintenance, splicing and cutover of offices in eight exchanges. Responsible for daily operation of 35 splicers.

1964 – 1980: **Cable Splicer**

United Telephone of Florida | Fort Meyers, FL

Spliced paper and plastic cable, exchange cutover and maintenance of all types of cable.

1962 – 1963: **Lineman**

United Telephone of Florida | Fort Meyers, FL

Worked on open wire circuits including toll circuits and placements of cable.

EDUCATION

1956 **Hardee High School | Wauchula, FL**

High School Diploma

Jeremiah Yliniemi

Project Manager

PROFESSIONAL EXPERIENCE

2020 – Present: **Project Manager | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production record-keeping, and overall on-site management. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	4813'	Raystown Lake, PA	2020

2006 – 2020: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	7402'	Susquehanna River, PA	2019
20"	2236'	Lower Piney Creek, PA	2018
20"	1720'	Everett RR-Juniata River, PA	2018
16"	2346'	Frankstown Branch-Juniata River, PA	2018
16"	1275'	Hollow Road, PA	2017
20"	1260'	Hollow Road, PA	2017
20"	4771'	Raystown Lake, PA	2017
36"	7194'	Ohio River MP 16.07, OH/MV	2017
30"	7531'	Lake Oahe & Missouri River, ND	2017
16"	11,397'	Lake Sacagawea, ND	2016
30"	3352'	Cliff Crossing, ND	2016
16"	1112'	Palermo Railroad, ND	2016
12"	7228'	Athabasca River, Alberta, Canada	2016

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
42"	3885'	Dover River, Alberta, Canada	2016
24"	1230'	Christina River, Wood Buffalo, Canada	2015
42"	7205'	Athabasca River, Alberta, Canada	2015
42"	1008'	Highway 63, Canada - Direct Pipe Installation	2015
42"	2510'	Ruth Lake, Fort McMurray, Canada	2015
12" and 6"	3173'	Beaver Lake, Alberta, Canada	2015
42"	3114'	Beaver Lake, Fort Mc Murray, Canada	2015
42"	3776'	MacKay River, Fort McMurray, Canada	2015
30"	2667'	South Fork Ten Mile Creek, PA	2014
20"	1193'	SR-265/Leatherwood Rd, OH	2014
24"	3269'	Transfer Line 2, IN	2014
36"	1874'	Wetland S-517C, IN	2014
42"	4284'	Vermillion River, Canada	2013
42"	3392'	N. Saskatchewan River, Canada	2013
42"	4441'	Goethals Bridge, NY	2013
30"	8101'	Kill Van Kull River, NY/NJ	2013
36"	2133'	Little River, OK	2013
36"	4342'	Deep Fork river, OK	2013
36"	4505'	Medicine Hat Alberta Canada	2012
36"	4993'	Atchafalaya River, LA	2011
20"	3080'	Rock Creek, OR	2011
42"	4272'	St. John's River, BC	2011
14"	1633'	Ocean Sciences, Newfoundland	2011
42"	2204'	Bayou Comitte, LA	2010
36"	1873'	Petitcodic River, Canada	2009

2004 – 2006: **Nick's Conoco | Park Rapids, MN**

EDUCATION

2002 **Park Rapids Area High School**

High School Diploma

MICHELS®

Doug Houska

Project Manager

PROFESSIONAL EXPERIENCE

2019 – Present: **Project Manager | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production record-keeping, and overall on-site management.

1991 – 2019: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, WI**

Responsible for surveying, staking and design of directional drill path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Performed the above operations for crossings which include, but not limited to:

Diameter	Length	Location	Year
20"	13,247'	Lake Sakakawea River, ND	2019
8"	3768'	MP 50.8 Landslide, MT	2018
36"	1805'	Portage River MP 162.5, OH	2018
36"	2974'	Wetland MP 8.1, OH	2018
42"	3980'	Susquehanna River MP 99.6, PA	2018
42"	1810'	Interstate 80, PA	2018
48"	3649'	IBWC North Floodway, TX	2017
48"	3595'	Road 771 Canal, TX	2017
48"	2222'	Hwy 803, CA Rd & Supply Canal, TX	2017
48"	2033'	Resaca De Los Cuates Canal, TX	2017
30"	2555'	Resaca De Los Fresnos Canal #1, TX	2017
48"	2126'	Pinson Rd Canal, TX	2017
30"	3483'	Ford Island to Landing C, HI	2017
48"	2042'	County Rd 300 Canal, TX	2017
48"	2349'	Chiltipan Creek, TX	2017

PROFESSIONAL EXPERIENCE (continued)

30"	7531'	Lake Oahe & Missouri River, ND	2017
16"	6693'	Wapsipinicon River, IA	2016
30"	2757'	Little Rock River, IA	2016
12"	1114'	Sunflower Field, VT	2016
30"	5714'	James River, SD	2016
30"	2069'	Floyd River/RR/HWY 60, IA	2016
30"	2991'	PCN3/Wetland, SD	2016
30"	1791'	200th St, SD	2016
30"	1372'	183rd St & Wetland MP 331, SD	2016
30"	5154'	House River, Alberta, Canada	2016
42"	3885'	Dover River, Alberta, Canada	2016
42"	3399'	McKay River, Alberta, Canada	2016
24"	1230'	Christina River, Wood Buffalo, Canada	2015
42"	7205'	Athabasca River, Alberta, Canada	2015
36"	5128'	Lake Ave & RR, IL	2015
12" and 6"	3173'	Beaver Lake, Alberta, Canada	2015
42"	3776'	MacKay River, Fort McMurray, Canada	2015

1988 – 1991: **Project Coordinator | Mid America Line and Cable, Division of Michels Pipeline | Brownsville, WI**

Assisted Project Manager with coordinating field personnel for large scale telephone cable installation projects. Recorded and prepared field reports for project, office and customer needs. Acting liaison between project managers, public, existing utility representatives and customer representatives. Coordinated project between existing utilities and placement of new installation. Maintain material inventory required for projects.

1980 – 1988: **Project Assistant/Bookkeeper | Michels Pipeline Construction | Brownsville, WI**

Purchasing agent responsible for coordinating all materials to various locations along project routes for water line and telephone installations . Inventory control of materials. Prepared field reports to keep record of labor and production. Liaison between existing utility representatives and Michels.

EDUCATION

1980 **Mitchell Area Vocational Technical College | Mitchell, SD**

Two year Associate Degree Accounting

1978 **Kimball High School | Kimball, SD**

High School Diploma

Chad R. Johnson

Project Manager

PROFESSIONAL EXPERIENCE

2019 – Present: **Project Manager | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production record-keeping, and overall on-site management. Some more notable crossings include, but are not limited to:

2019: **HDD Operator | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production.

2017 – 2019: **Skilled Laborer | Michels Directional Crossings | Brownsville, Wisconsin**

Integral member of a specialized team working on and around directional drilling rigs. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

2004 – 2017: **Bore Coordinator, Project Manager, Construction Inspection & Water Treatment Operator | Xenia Rural Water District | Bouton, IA**

Coordinated the projects from mapping the project to scheduling of utility locations and equipment. Worked with the state, county and local officials for the projects and acquired DOT permits. Attended landowners meetings/conflict management, completed daily project reports and reported to the executive director. Installation of water lines 1" to 24" PVC, fusible PVC and HDPE and 8" to 36" steel. Operation of multiple pieces of equipment (bore machines, ditch witch, backhoes, track hoes and dozers).

TRAINING & CERTIFICATIONS

- Water Treatment and Distribution Grade II Certification
- Vocational Auto Mechanics

EDUCATION

Boone High School | Boone, IA

High School Graduate

MICHELS®

Karl Kornkven

Project Manager

PROFESSIONAL EXPERIENCE

2020 – Present: **Project Manager | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating directional boring projects for various size gas, water, sewer, electrical and communication lines throughout the United States and Canada. Complete knowledge of directional drilling technology and procedures. Duties include project coordination from start-up to completion, union relations, subcontractor coordination, production record-keeping, and overall on-site management.

2002 – 2020: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	7595'	Houston Ship Channel, TX	2019
16"	6053'	Tabbs Bay, TX	2019
16"	3846'	Barbour's Cut, TX	2019
30"	3746'	Dix River, KY	2019
20"	2355'	Joanna Rd, PA	2018
36"	1886'	Nimisila Reservoir MP 40.9, OH	2018
20"	7354'	Susquehanna River, PA	2018
30"	7531'	Lake Oahe & Missouri river, ND	2017
30"	2991'	PCN3/Wetland, SD	2016
12"	7228'	Athabasca River, Alberta, Canada	2016
30"	5154'	House River, Alberta, Canada	2016
42"	3399'	McKay River, Fort McMurray, Cananda	2016
24"	1230'	Christina River, Wood Buffalo, Canada	2015

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
42"	7205'	Athabasca River, Alberta, Canada	2015
42"	2510'	Ruth Lake, Fort McMurray, Canada	2015
42"	3114'	Beaver Lake, Fort McMurray, Canada	2015
42"	3776'	MacKay River, Fort McMurray, Canada	2015
36"	1613'	Fish Pond, Alberta, Canada	2014
36"	1359'	Wetland Crossing #2, Alberta, Canada	2014
36"	9040'	Mississippi River, IL/MO	2014
42"	4284'	Vermillion River, Canada	2013
30"	4905'	Merseles, NJ	2013
30"	5378'	Hudson River, NJ/NY	2012
30"	4850'	Red River, TX/OK	2012
16"	1649'	Cordele, TX	2012
42"	1661'	Cordele, TX	2012
16"	3214'	Dewitt, TX	2012
42"	3205'	Dewitt, TX	2012
36"	4505'	Medicine Hat, Alberta, Canada	2012
36"	4993'	Atchafalaya River, LA	2011
42"	4272'	St. John's River, BC	2011
36"	4495'	Saskatchewan River, AB	2011
14"	1554'	St. John's Newfoundland	2010
42"	4322'	Cache River, AR	2010
42"	5084'	Mississippi River, AR	2010

2000 – 2002: **Drill Rig Operator | Michels Directional Crossings | Brownsville, WI**

Experience in working on and around directional drilling rigs as an integral member of a specialized team. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs; hydraulics; fluids; set-up and operation of drill motors; power generators; mud pumps; bentonite mixers; drill pipe; reamers; couplings; and overall equipment maintenance and operation.

1998 – 2000: **Drilling Fluid Technician | Michels Directional Crossings | Brownsville, WI**

Solely responsible for mixing bentonite to the right consistency with an emphasis in directional drilling. Proficient working in and around drilling rigs and overall operation as an integral member of the specialized team. Multi-capable to assist with all types of drilling tasks and familiar with repair, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, steer tool wireline connections, couplings, etc. Involved in various types of directional drilling projects, line and cable, water and setting manholes.

PROFESSIONAL EXPERIENCE (continued)

1991 – 1997: **Machinist | Nissen Manufacturing | Larimore, ND**

Machinist performing welding, drilling and assembly

1988 – 1991: **Air Traffic Controller | United States Air Force | Grand Forks, ND**

EDUCATION

University of North Dakota

Bottineau High School | Bottineau, ND

High School Diploma

MICHELS®

Dan Kriesel

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2006 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	3653'	Ship Road/King Road, PA	2019
16"	4358'	Phoenixville Pike Road, PA	2019
22"	4986'	Atchafalaya River, LA	2019
8"	3768'	MP 50.8 Landslide, MT	2018
42"	3980'	Susquehanna River MP 99.6, PA	2018
36"	5841'	Ohio River MP 33.8, OH/WV	2017
14"	9154'	Nansemond River, VA	2017
10"	5697'	Mississippi River, LA	2017
30"	3483'	Ford Island to Landing C, HI	2017
30"	7531'	Lake Oahe & Missouri River, ND	2017
16"	6693'	Wapsipinicon River, IA	2016
30"	6328'	Big Sioux River, SD/IA	2016
24"	4531'	Athabasca River, Alberta, Canada	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
24"	3716'	Barbour's Cut, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
30"	1418'	Highway 250, OH	2015
16"	1402'	Deer Lake, ND	2015
36"	3461'	Kennedy Ave/Griffith Terminal, IN	2015
36"	3011'	Highway 41 & RR, IN	2015
10"	4654'	Allegheny River, PA	2015
8"	3320'	Yellowstone River, MT	2015

24" HDPE	1061'	Lake Sakakawea, ND	2014
8"	7321'	MP 49.3 Landslide, MT	2014
8"	4159'	MP 54.8 Landslide, MT	2014
20"	2364'	Missouri River, NE/IA	2014
16"	2951'	Line 82, ND	2014
36"	2264'	Otter Creek, IL	2013
36"	1611'	Mackinaw River, IL	2013
48"	1943'	West Neck Creek, VA	2013
48"	819'	Hunt Club Creek, VA	2013
8"	7177'	115 KV Power Duct, SC	2013
8"	7304'	115 KV Power Duct, SC	2013
8"	3503'	Hamlin Creek, Charelston, SC	2013
8"	4911'	115 KV Power Duct, SC	2013
8"	12,902'	MP66, Wyola, MT	2012
8"	4475'	MP57, Lodge Grass, MT	2012
8"	2645'	Tioga Junction, PA	2012
16"	3894'	Roaring Branch, PA	2012
10"	1819'	Texas Creek, Tioga, PA	2011
16"	1818'	Texas Creek, Tioga, PA	2011
30"	5786'	Lake Conway, Vernon, NJ	2011
42"	992'	Bayou Rapids, Bunkie, LA	2011
42"	1223'	Bayou Robert, Bunkie, LA	2011
36"	3030'	Black Bear Forest, Bunkie, LA	2011
3"	1879'	Coquille River, Bandon, OR	2010
3"	1895'	Coquille River, Bandon, OR	2010
30"	1275'	Little Powder River, WY	2010

2006: **Operator | InterCon Construction | Madison, WI**

Duties include rig set-up, operation, maintenance, and mud technician for water lines.

2004 – 2006: **Foreman/Operator | Blue Badger, Inc. | Rosebush, MI**

Duties include walk over locating and operating of 80x100 rig for water, gas, fiber optic and sewer line installation.

2002 – 2004: **Operator/Laborer | Mears/HDD, LLC | Rosebush, MI**

Duties include wire line splice technician, mud technician, operate track hoe/back hoe and laborer for water, gas and sewer line installation.

EDUCATION

1994 **Mason County Central High School | Scottville, MI**

High School Diploma

MICHELS®

Marcus Carratt

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2000 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
16"	12,769'	Houston Ship Channel, TX	2019
16"	6053'	Tabbs Bay, TX	2019
8"	12,769'	Montezeuma Slough, CA	2019
24"	3341'	Hwy 367/Coldwater Creek, MO	2019
24"	3817'	Missouri River, MO	2019
36"	2611'	Tuscarawas River MP 47.8, OH	2018
16"	5869'	Conrail RR, NJ	2018
36"	5841'	Ohio River MP 33.8, OH/WV	2017
20"	4771'	Raystown Lake, PA	2017
48"	2349'	Chiltipan Creek, TX	2017
48"	3291'	Meter to LNG Facility, TX	2017
30"	5714'	James River, SD	2016
30"	1516'	408th & Wetland MP 360, SD	2016
30"	1519'	Turtle Creek, SD	2016
42"	3885'	Dover River, Alberta, Canada	2016
4-4" HDPE	764'	Fox River, WI	2015
48"	4039'	Dow Barge Channel, Clute TX - Direct Pipe	2015
36"	9040'	Mississippi River, IL/MO	2014
42"	1153'	Railroad Crossing, TX - Direct Pipe	2014
42"	3392'	N. Saskatchewan River, Canada	2013
42"	4441'	Goethals Bridge, NY	2013

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
42"	3186'	Arthur Kill, Staten Island, NJ/NY	2013
16"	1656'	Chicolete River, TX	2012
42"	1650'	Chicolete River, TX	2012
16"	1717'	Morales, TX	2012
42"	1670'	Morales, TX	2012
36"	4505'	Medicine Hat, Alberta, Canada	2012
24"	2458'	Jonestown, PA	2012
36"	4519'	Freeman Road, LA	2011
42"	5117'	Nature Conservatory, LA	2011
36"	4992'	Atchafalaya River, LA	2011
16"	9931'	Cooper River, SC	2010
42"	3485'	Quachita River, LA	2010
42"	4067'	LA State Hey 34, LA	2010

1999 – 2000: **Foreman | Schatz Underground Cable | Villa Ridge, MO**

Working foreman responsibilities included locating, operating Ditch Witch, directional boring rig, trencher, plow, back hoe, and small back hoe.

1997 – 1999: **Laborer | Michels Pipe Line Construction | Brownsville, WI**

Experience in working on and around directional drilling rigs as an integral member of a specialized team. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs; hydraulics; fluids; set-up and operation of drill motors; power generators; mud pumps; bentonite mixers; drill pipe; reamers; couplings; and overall equipment maintenance and operation.

1993 – 1997: **Beginning Manager | Driver, United States Marine Corps | Camp LeJeune, NC**

sgssg

TRAINING & CERTIFICATIONS

- PCST Certificate Renewal Course (2014)

EDUCATION

1986 **Waupun High School | Waupun, WI**

High School Diploma

Steve Sanders

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2003 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	2518'	Herman O.W. Drive, PA	2019
16"	6601'	Arch Bishp/S Chester Rd, PA	2019
42"	4687'	Lake Scranton Finished H2O Tunnel, PA	2018
36"	2974'	Wetland MP 8.1, OH	2018
30"	2273'	Susquehanna River @ MP 35, PA	2018
42"	2826'	San Joaquin River, CA	2017
12"	5741'	Rum River & Wetland, MN	2017
12"	5170'	Larch Dr & Wetland, MN	2017
6"	3309'	Hauser Lake, MT	2017
8"	1980'	CHS Yellowstone River, MT	2017
8"	1530'	SPL Yellowstone River, MT	2017
8"	1542'	YPL Yellowstone River, MT	2017
12"	1285'	XOM Yellowstone River, MT	2017
24"	1898'	Vermillion River, IL	2016
12"	3144'	Monkton Swamp, VT	2016
12"	1491'	Drinkwater Rd, VT	2016
20"	1904'	North St Mary's River, IN	2016
20"	1076'	South St Mary's River, IN	2016
30"	6119'	Lake Whitney, TX	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
24"	3716'	Barbour's Cut, TX	2015
24"	7432'	Houston Ship Channel, TX	2015

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
24"	5908'	Tabbs Bay, TX	2015
36"	1862'	State Highway 50, IL	2015
36"	1813'	Calumet Ave, IN	2015
36"	1803'	Dyer Ditch, IN	2015
36"	1812'	Highway 394, IL	2015
30"	1376'	Tom's Creek, MS	2014
24"	2750'	Escatawpa River, MS	2014
24"	3030'	Big Creek Lake, AL	2014
24"	2020'	Unnamed Creek, AL	2014
30"	2774'	South Canadian River, OK	2013
30"	4987'	Monksville Reservoir, NJ	2013
30"	1707'	Bayonne Inlet, NJ	2013
30"	8101'	Kill Van Kull River, NY/NJ	2013
20"	869'	Centerview, MO	2012
20"	2458'	Centerview, MO	2012
16"	3894'	Roaring Branch, PA	2012
20"	2513'	Tioga Junction, PA	2012
30"	5786'	Lake Conway, NJ	2011
42"	3008'	White River, AR	2010
42"	1851'	Siphon Creek, LA	2010
20"	5222'	Pokegama Carnegie, WI	2009
36"	2096'	Prairie River, MN	2009
20"	1130'	Wilson Bay, NC	2009

1995 – 2002: **HDD Rig Operator | Michels Directional Crossings | Brownsville, WI**

Experience in working on and around directional drilling rigs as an integral member of a specialized team. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs; hydraulics; fluids; set-up and operation of drill motors; power generators; mud pumps; bentonite mixers; drill pipe; reamers; couplings; and overall equipment maintenance and operation.

EDUCATION

1994 **University of Wisconsin–Stout | Menomonie, WI**

1990 **Berlin High School | Berlin , WI**

High School Diploma

MICHELS®

Jack Edmunds

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

1998 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record-keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down-hole survey along with surveying and surveying instrumentation.

Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
16"	4145'	Loyalhanna Lake, PA	2020
20"	13,247'	Lake Sakakawea, ND	2019
20"	6429'	Badlands Canyon, MT	2019
8"	12,769'	Montezeuma Slough, CA	2019
16"	2734'	Yellowstone River, MT	2019
22"	4986'	Atchafalaya River, LA	2019
42"	4687'	Lake Scranton Finished H2O tunnel, PA	2018
42"	1861'	San Martin Lake Channel, TX	2018
42"	3717'	Bahia Grande Channel #2, TX	2018
42"	4869'	Bahia Grande Channel #1, TX	2018
48"	3235'	Arroyo Colorado Canal, TX	2017
48"	3649'	IBWC North Floodway, TX	2017
48"	2222'	Hwy 803, CA Rd & Supply Canal, TX	2017
48"	2183'	Resaca De Los Fresnos Canal #2, TX	2017
48"	2555'	Resaca De Los Fresnos Canal #1, TX	2017
48"	2398'	CR2340 & Los Olmos Creek, TX	2017
48"	2807'	Oliver Creek & SH 188, TX	2017
48"	2263'	US Hwy 181/Hwy 35, TX	2017
30"	2782'	Mississippi River, IA/IL	2016
42" Steel with 36" HDPE	3983'	St John's River, FL	2016
27" HDPE Bundle	3737'	Little Creek, VA	2016
8"	1957'	Grand River, MI	2016

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
16"	1508'	Beverly Harbor, MA	2015
16"	3827'	Collins Cove, MA	2015
36"	2303'	Liberty Street, IL	2015
18"	12,459	Houston Ship Channel, TX	2015
36"	9040'	Mississippi River, IL/MO	2014
24"	3269'	Transfer Line 2, IN	2014
24"	3275'	Transfer Line 1, IN	2014
30"	2344'	Delaware River, PA/NJ	2013
42"	3008'	I-95 & Tidal Wetlands, NJ	2013
30"	4831'	18th Street, NJ	2013
16"	1664'	Morales, TX	2012
42"	1657'	Morales, TX	2012
10"	1495'	Missoula, MT	2012
24"	1546'	Colorado River, CO	2011
12"	1612'	WBC62 (Offshore), LA	2011

1981 – 1998: **Trenchless Technology Operator/Supervisor & Journeyman Welder | Michels Pipeline Construction | Brownsville, WI**

As Operator/Supervisor he completed profit and loss responsibility for performing trenchless casing installations for civil, pipeline, communications and power at roads, railroads and rivers. Coordinated and executed entire boring operation from mobilization to demobilization.

1977 – 1981: **Skilled Laborer/Operator | Beloit Pipe and Dredge Company | Beloit , WI**

Performed various duties in the construction of natural gas and petroleum product pipeline. Multi-capable to assist with all facets of product pipeline installation including conventional and trenchless methods of construction.

TRAINING & CERTIFICATIONS

- Certified for fusion of plastic natural gas pipe and fittings.
- Certified for butt, sidewall and/or socket fusion of Driscopipe polyethylene pipe and fittings.

INDUSTRY INVOLVEMENT

- Member of Local 601 of United Association of Journeyman and Apprentices for the Plumbing and Pipe Fitting Industry of the United States and Canada (Steamfitters).

EDUCATION

1995 **Moraine Park Technical College**

Welding Courses

1976 **Waupun High School | Waupun , WI**

High School Diploma

MICHELS®

Brian Guelig

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2006 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
20"	2740'	West Branch Escanaba River, MI	2019
20"	13,247'	Lake Sakakawea River, ND	2019
24"	6336'	Mississippi River, IL/MO	2019
42"	4687'	Lake Scranton Finished H2O Tunnel, PA	2018
20"	2355'	Joanna Rd, PA	2018
42"	1501'	Platte River, NE	2018
42"	1861'	San Martin Lake Channel, TX	2018
42"	3717'	Bahia Grande Channel #2, TX	2018
42"	4869'	Bahia Grande Channel #1, TX	2018
48"	3085'	Rancho Viejo Floodway, TX	2017
48"	3649'	IBWC North Floodway, TX	2017
48"	3595'	Road 771 Canal, TX	2017
48"	2033'	Resaca De Los Cuates Canal, TX	2017
48"	2555'	Resaca De Los Fresnos Canal #1, TX	2017
36"	7194'	Ohio River MP 16.07, OH/WV	2017
24"	2026'	Highway 20, GA	2017
36"	1606'	Hannahatchee Creek, GA	2017
36"	1907'	Earthen Dam, GA	2016
36"	3829'	Flint River, GA	2016
36"	4311'	Major Mackenzie Rd, Ontario, Canada	2016
36"	3901'	Rutherford Rd, Ontario, Canada	2016

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
36"	3160'	Christina River, Alberta, Canada	2016
42"	1411'	Torbram Rd, Ontario, Canada	2015
36"	3133'	Pamona Creek, Ontario, Canada	2015
36"	1559'	West Don River, Ontario, Canada	2015
36"	1352'	Bayview Road, Ontario, Canada	2015
36"	2992'	Alden Road, Ontario, Canada	2015
36"	3363'	Steeles Ave, Ontario, Canada	2015
36"	1588'	Hwy 404, Ontario, Canada	2015
36"	1355'	Beaver Creek, Ontario, Canada	2015
36"	3805'	Williamette River, OR	2014
16"	2951'	Line 82, ND	2014
36"	1874'	Wetland S-517C, IN	2014
8"	2545'	MP266, Mountain Green, UT	2013
30"	1881'	Bennekill Stream, NJ	2013
30"	6544'	1st Street, NJ	2013

2002 – 2006: **Operator | Michels Directional Crossings | Brownsville, WI**

Experience in working on and around directional drilling rigs as an integral member of a specialized team. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs; hydraulics; fluids; set-up and operation of drill motors; power generators; mud pumps; bentonite mixers; drill pipe; reamers; couplings; and overall equipment maintenance and operation.

1999 – 2002: **Laborer | Northeast Asphalt | Fond du Lac, WI**

EDUCATION

1999 **New Holstein High School | New Holstein, WI**

High School Diploma

MICHELS®

Nick LeBlanc

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2004 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, wi**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	6601'	Arch Bishop/S Chester Rd, PA	2019
42"	2007'	Las Moras Creek, TX	2019
20"	2355'	Joanna Rd, PA	2018
36"	4034'	Maumee River MP 181.7, OH	2018
16"	5869'	Conrail RR, NJ	2018
16"	2766'	Hall Street, NJ	2018
16"	1999'	Route-35, NJ	2018
30"	2278'	Chattahoochee River, GA	2017
16"	11,397'	Lake Sacagawea South, ND	2016
30"	3352'	Cliff Crossing, ND	2016
16"	11,229'	Lake Sacagawea North, ND	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
4-4" HDPE	764'	Fox River, WI	2015
12"	11,563	Holland Bottoms Wetlands, AK	2015
36"	2510'	Deep Creek, IL	2015
36"	5128'	Lake Ave & RR, IL	2015
18"	12,459	Houston Ship Channel, TX	2015
28"	1741'	Lafayette River, VA	2014
48"	2060'	Tres Palacios River, TX	2014
48"	1692'	Navidad River, TX	2014
36"	1311'	Fraizer Creek, IL	2013

36"	3544'	Illinois River, IL	2013
36"	3077'	UP RR & Jefferson St, Tushka, OK	2013
36"	1499'	60" Water Main, OK	2013
36"	2133'	Little River, OK	2013
36"	2610'	Stroud, OK	2013
30"	4850'	Red River, Thackerville, TX/OK	2012
24"	1386'	Jonestown, PA	2012
8"	6669'	Wilmington, NC	2012
24"	1701'	Howard, MD	2011
36"	2496'	Taterville, LA	2011
36"	5325'	Kingston, LA	2011
16"	9931'	Cooper River, SC	2010
42"	3485'	Quachita River, LA	2010
42"	4067'	LA State Hey 34, LA	2010
36"	5240'	Pokegama Carnegie, WI	2009
42"	3800'	Mississippi River, MO	2009

EDUCATION

1999 **Carencro High**

High School Diploma

MICHELS®

Dave Williams

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2015 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
16"	6976'	Matlock/W Chester Rd, PA	2020
36"	1321'	Saline River MP 237.4, MI	2018
36"	1863'	E. Branch Black River MP 86.7, OH	2018
20"	2355'	Joanna Rd, PA	2018
36"	1430'	Interstate 80 MP 110.3, OH	2018
36"	1810'	Interstate 80, PA	2018
36"	2836'	Nemadji Golf Course, WI	2017
42"	2826'	San Joaquin River, CA	2017
36"	1725'	Tower Ave/Hwy 35, WI	2017
42"	2431'	Maumee River & State Hwy 24, OH	2017
16"	3065'	Rock Creek & US HWY 67, IA	2016
30"	2757'	Little Rock River, IA	2016
30"	2069'	Floyd River/RR/HWY 60, IA	2016
30"	1791'	200th St, SD	2016
30"	1372'	183rd St & Wetland MP 331, SD	2016
30"	1278'	Wetland MP 311, SD	2016
30"	5154'	House River, Alberta, Canada	2016
36"	3160'	Christina River, Alberta, Canada	2016
36"	2215'	Bathurst Rd, Ontario, Canada	2015
36"	3363'	Steeles Ave, Ontario, Canada	2015
36"	1588'	Hwy 404, Ontario, Canada	2015

PROFESSIONAL EXPERIENCE (continued)

2008 – 2015: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
36"	3805'	Williamette River, OR	2014
24"	1961'	County Road 2, AL	2014
24"	2884'	Hatchett Creek, AL	2014
36"	1874'	Wetland S-517C, IN	2014
8"	2545'	MP266, UT	2013
30"	1881'	Bennekill Stream, NJ	2013
42"	3392'	N. Saskatchewan River, Canada	2013
30"	6544'	1st Street, NJ	2013
30"	1633'	Brooklyn, NY	2012
30"	5786'	Vernon, NJ	2011
42"	1851'	Siphin Creek,LA	2010
36"	2096'	Prairie River, MN	2009
36"	5237'	Pokegema Carnegie, WI	2009

1994 – 2008: **Operator | PTS Contractors | Green Bay, WI**

Sewer and water utility contractor.

EDUCATION

1986 **Amber Pocasset High School | Amber, OK**

High School Diploma

Ryan Jackson

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2012 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	2734'	Yellowstone River, MT	2019
22"	4986'	Atchafalaya River, LA	2019
42"	3717'	Bahia Grande Channel #2, TX	2018
42"	4869'	Bahia Grande Channel #1, TX	2018
48"	3235'	Arroyo Colorado Canal, TX	2017
48"	3649'	IBWC North Floodway, TX	2017
42"	3983'	42" Steel with 36" HDPE, St John's River, FL	2016
27"	3737'	27" HDPE Bundle, Little Creek, VA	2016
8"	1957'	Grand River, MI	2016
8"	4022'	Lake Macatawa, MI	2016
16"	1508'	Beverly Harbor, MA	2015
16"	3827'	Collins Cove, MA	2015
18"	12,459'	Houston Ship Channel, TX	2015
36"	3805'	Williamette River, OR	2014
30"	1701'	Red River, OK	2013
30"	2344'	Delaware River, PA/NJ	2013
30"	1246'	OK City Water Main, OK	2013
30"	4987'	Monksville Reservoir, NJ	2013
42"	4441'	Goethels Bridge, NY	2013
30"	4801'	18th Street, NJ	2013
30"	5378'	Hudson River, NY/NJ	2012

PROFESSIONAL EXPERIENCE (continued)

2007 – 2012: **HDD Operator | Michels Directional Crossings | Brownsville, Wisconsin**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation.

TRAINING & CERTIFICATIONS

- Safety Trained with Forklift & Excavator - Competent Person
- OSHA 30 Hour

EDUCATION

2004 **Winnebago Lutheran Academy | Fond du Lac, Wisconsin**

High School Graduate

Mark Matthews

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2017 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. More notable crossings include, but are not limited to:

Diameter	Length	Location	Year
42"	34551'	Bow River, Canada	2019
42"	2264'	Springbank Reservoir, Canada	2019
36"	6135'	Kakwa River 36" Bundle, Canada	2019
42"	3773'	Permanent Creek 42" Bundle, Canada	2019
42"	1640'	Pouce Coupe River, Canada	2019
36"	1749'	Deadhorse Creek, Canada	2018
12"	6986'	Mackenzie River, Canada	2018
42"	3087'	Victoria Harbor, Canada	2018
36"	1511'	Hwy #1, Canada	2017
48"	1112'	134 Street & 92nd Avenue, Canada	2017
36"	1116'	United Blvd & Mundy Creek, Canada	2017
36"	1076'	Hwy 7 & CP Rail, Canada	2017
48"	2349'	Chiltipan Creek, TX	2017

2011 – 2017: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
48"	2263'	US Hwy 181/Hwy 35, TX	2017
48"	2807'	Oliver Creek & SH 188, TX	2017
12"	7228'	Athabasca River, Alberta, Canada	2016
42"	3885'	Dover River, Alberta, Canada	2016

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
24"	1230'	Christina River, Wood Buffalo, Canada	2015
42"	7205'	Athabasca River, Alberta, Canada	2015
12"	3472'	Gilmore Lane, OR	2014
36"	1640'	LaMoine River, IL	2013
36"	5313'	Kansas City RR, LA	2011
42"	4952'	Rambling Bayou, LA	2011
36"	4993'	Atchafalaya Rivre, LA	2011
36"	1518'	Vermillion River, IL	2013
36"	4304'	Bois D' Arc, TX	2013
36"	3239'	Clear Boggy Creek, OK	2013
36"	1792'	North Canadian River, OK	2013
36"	1444'	Hwy 155 & UP RR, Big Sandy, TX	2012
36"	1761'	Private Lake, Maple Springs, TX	2012
36"	4505'	Medicine Hat Alberta, Canada	2012

2009 – 2011: **Operator | Michels Pipeline | Brownsville, WI**

Responsibilities included locating, operating Ditch Witch, directional boring rig, trencher, plow, back hoe, and small back hoe.

2006 – 2009: **Operator/Driller | Laney Directional Drilling | Humble, TX**

Operated Drill Rig, Trackhoe and Crane. Currently hold world record for drilling 6700' of 42" in Sulphur, LA (7/2008).

EDUCATION

1987 **Linville High School | Linville , LA**

High School Diploma

MICHELS®

Richard Wulff

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2015 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Some more notable crossings, but not limited to:

Diameter	Length	Location	Year
16"	2997'	Paoli Pike/E Boot Road, PA	2019
16"	3419'	Greenhill Road, PA	2019
12"	1070'	Indiana Harbor Canal - 12" & 10" Bundle, IN	2018
20"	1665'	Aughwick Creek, PA	2018
20"	2209'	Horse Valley Road, PA	2018
20"	1507'	Trough Creek Valley Pike/SR 829, PA	2018
16"	1999'	Route-35, NJ	2018
16"	1198'	Harrisburg Pike, PA	2017
20"	2005'	Hwy 15, PA	2017
36"	1545'	Van Dyke Road, IL	2017
24"	3166'	N Saskatchewan River, Alberta, Canada	2016
24"	4531'	Athabasca River, Alberta, Canada	2016
30"	2461'	Highway 63, Alberta, Canada	2015
24"	1956'	Clearwater River, Alberta, Canada	2015

1998 – 2015: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
36"	1613'	Fish Pond, Alberta, Canada	2014
36"	2274'	Highway 13, Alberta, Canada	2014
36"	2133'	Wetland Crossing, Alberta, Canada	2014
12"	4272'	Saline Creek, Alberta, Canada	2013
36"	3618'	Johnson Creek, TX	2013

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
36"	3314'	East Fork Angelina River, TX	2013
36"	1867'	Flora, TX	2012
20"	869'	Centerview, MO	2012
20"	2458'	Centerview, MO	2012
16"	3894'	Roaring Branch, PA	2012
30"	3455'	Marysville, MI-Searnia, Ontario	2011
16"	1413'	Mill Ln, NJ	2010
30"	1422'	Mill Ln/Hedding Ave, NJ	2010
36"	3999'	Mississippi River, MN	2009
42"	2429'	Scioto River, OH	2009
42"	3800'	Mississippi River, MO	2009
42"	3043'	Little Miami River, OH	2009
36"	2190'	Souris River, Manitoba	2009

1996 – 1998: **Operator | Haug Roofing | West Bend, WI**

Operate crane and skid loader. Knowledgeable on every aspect of the roofing business; design techniques, blueprints, drawings and structure.

EDUCATION

2003 **Fond du Lac High School | Fond du Lac, WI**

High School Diploma

MICHELS®

Seth Matheny

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2017 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	1933'	W Baltimore/Glenwood Rd, PA	2020
16"	4399'	Valley Rd/Darlington Rd, PA	2019
20"	1720'	Everett Railroad-Juniata River, PA	2018
20"	2209'	Horse Valley Road, PA	2018
20"	1416'	Blacklog Creek, PA	2018
16"	2766'	Hall Street, NJ	2018
36"	6238'	Ohio River, OH/WV	2017
16"	1260'	Hollow Road, PA	2017

2014 – 2016: **Foreman | Kirk Excavating | Columbus, OH**

Oversee day to day operations. Met with contractors. Operated various horizontal directional drills. Set-up and created bore profiles. Steered and/or located pilot bore. Mandated OSHA Regulations.

2011 – 2014: **Operator | Precise Boring of Ohio | Lancaster, OH**

Operated various horizontal directional drills. Operated and maintained mud cleaning systems. Set-up and created bore profiles. Steered and/or located pilot bore. Completed all necessary paperwork pertaing to the job. Mandated OSHA Regulations.

2007 – 2011: **Foreman | Sureshot Directional Drilling | Lancaster, OH**

Maintained inventory for all drilling needs. Fostered communication and relations with contractors and utility companies. Prepared job estimates and bids and trained new employees. Operated various horizontal directional drills. Set-up and created bore profiles. Steered and/or located pilot bore. Mandated OSHA Regulations.

2002 – 2007: **Operator | Tob Gobel Excavating and Well Drilling | Amanda, OH**

Operated backhoe, trackhoe, bulldozer and skid steer. Well driller assistant, grade checker and other duties as needed.

TRAINING & CERTIFICATIONS

- Class A CDL with Tanker Endorsement
- OSHA 10 Training
- Safeland and Safegulf Training
- HDPE Columbia Gas Fusion Certification

EDUCATION

2005 **Amanda-Clearcreek High School | Amanda, OH**

High School Graduate

Jamie Hollenbeck

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2018 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Some more notable crossings, but not limited to:

Diameter	Length	Crossing/Location	Year
20"	13,247'	Lake Sakakawea, ND	2019
20"	6429'	Badlands Canyon, MT	2019
8"	12,769'	Montezeuma Slough, CA	2019
24"	2100'	Spanish Lake, MO	2019
22"	4986'	Atchafalaya River, LA	2019
20"	1068'	Rahway River, NJ	2018
42"	3980'	Susquehanna River MP 99.6, PA	2018

2008 – 2018: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
36"	5841'	Ohio River MP 33.8, OH/WV	2017
10"	5697'	Mississippi River, LA	2017
30"	3483'	Ford Island to Landing C, HI	2017
30"	7531'	Lake Oahe & Missouri River, ND	2017
16"	6693'	Wapsipinicon River, IA	2016
30"	6328'	Big Sioux River, SD/IA	2016
24"	4531'	Athabasca River, Alberta, Canada	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
24"	3716'	Barbour's Cut, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
36"	3461'	Kennedy Ave/Griffith Terminal, IN	2015
36"	3011'	Highway 41 & RR, IN	2015

PROFESSIONAL EXPERIENCE (continued)

10"	4654'	Allegheny River, PA	2015
8"	3320'	Yellowstone River, MT	2015
24" HDPE	1061'	Lake Sakakawea, ND	2014
8"	7321'	MP 49.3 Landslide, MT	2014
8"	4159'	MP 54.8 Landslide, MT	2014
20"	2364'	Missouri River, NE/IA	2014
16"	2951'	Line 82, ND	2014
36"	2264'	Otter Creek, IL	2013
48"	1943'	West Neck Creek, VA	2013
8"	7177'	115 KV Power Duct, SC	2013
8"	7304'	115 KV Power Duct, SC	2013
8"	4911'	115 KV Power Duct, SC	2013
8"	12,902'	MP66, Wyola, MT	2012
8"	4475'	MP57, Lodge Grass, MT	2012
16"	3894'	Roaring Branch, PA	2012
16"	1818'	Texas Creek, Tioga, PA	2011
30"	5786'	Lake Conway, Vernon, NJ	2011
42"	992'	Bayou Rapids, Bunkie, LA	2011
42"	1223'	Bayou Robert, Bunkie, LA	2011
36"	3030'	Black Bear Forest, Bunkie, LA	2011

2005 – 2008: **Laborer | Ballard Utility**

Run Directional Drills

2001 – 2005: **Laborer | NPL**

Installed gas services and mains by Directional Drilling

1994 – 2000: **Operator | Mears Directional Drilling**

Worked as a laborer, became an operator for an excavator and final advancement operating a 24-40 drill rig.

MICHELS®

Doug Stebbins

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2018 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. More notable crossings include, but are not limited to:

Diameter	Length	Location	Year
42"	3451'	Bow River, Cananda	2019
24"	3183'	Crow River, MN	2019
20"	1010'	East Branch Escanaba River, MI	2019
20"	6429'	Badlands Canyon, MT	2019
20"	1421'	Middle Branch Escanaba River, MI	2019
24"	6336'	Mississippi River, IL/MO	2019
20"	2355'	Joanna Rd, PA	2018
36"	2611'	Tuscarawas River MP 47.8, OH	2018
42"	3980'	Susquehanna River MP 99.6, PA	2018
42"	1810'	Interstate 80, PA	2018

2007 – 2017: **HDD Operator | Michels Corporation | Brownsville, wi**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation. Responsible for surveying, staking and design of directional drill path and curve, drilling the pilot hole, monitoring the drill path and calculating and interpreting the ground elevations and contours. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). On-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
36"	1511'	Hwy #1, Canada	2017
36"	1116'	United Blvd & Mundy Creek, Canada	2017
36"	1076'	Hwy 7 & CP Rail, Canada	2017
16"	11,397'	Lake Sacagawea South, ND	2016
16"	11,229'	Lake Sacagawea North, ND	2016

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
12"	7228'	Athabasca River, Alberta, Canada	2016
42"	3399'	McKay River, Alberta, Canada	2016
42"	7205'	Athabasca River, Alberta, Canada	2015
8"	7321'	MP 49.3 Landslide, MT	2014
36"	4005'	Canadian River, OK	2013
36"	1792'	North Canadian River, OK	2013
36"	1366'	Big Sandy, Maple Springs, TX	2012
30"	3042'	Wyalusing, PA	2012
20"	2513'	Tioga Junction, PA	2012

2002 – 2007: **Operator/Foreman | InterCon Construction | Madison, WI**

Skilled in the operation of technical, lifting and heavy equipment for directional drilling operation. Working knowledge of hydraulic engineering and applied mechanical engineering. Experience in working on and around directional drilling rigs as an integral member of a specialized team. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill morors, power generators mud pmps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

EDUCATION

1995 **Wakefield High School | Michigan**

High School Diploma

MICHELS®

Curt Rischmueller

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2006 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville , WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	1933'	W Baltimore Pike/Glenwood Rd, PA	2020
20"	2236'	Lower Piney Creek, PA	2018
36"	2730'	Sanddusky River MP 145.8, OH	2018
20"	3874'	Waltonville Rd, PA	2018
36"	1525'	Dupage River #1, IL	2017
12"	1178'	Howard Cove, ME	2016
12"	1023'	Cutler Site, ME	2016
12"	2765'	Lewis Creek, VT	2016
12"	2856'	Wetland Replacement, OH	2016
20"	845'	Patterson Rd/RR, IL	2016
20"	1335'	Laraway Rd, IL	2016
12"	11,563	Holland Bottoms Wetlands, AK	2015
24"	1405'	Platte River, MO	2015
16"	2249'	Ohio River, OH/KY	2015
22"	2538'	Barrington Rd, IL	2015
36"	1147'	E. 138th Street, IL	2015
36"	2697'	Barrington Rd, IL	2015
36"	3031'	BNSF RR & Aurora Rd, IL	2015
12"	2557'	Arkansas River, AR	2014
36"	2355'	Salt Fork River, MO	2013
36"	2077'	Chariton River, MO	2013

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
36"	3892'	Red River, OK	2013
36"	4213'	Menard Creek, TX	2013
36"	3571'	Angelina River, TX	2013
36"	2908'	Neches River & RR, TX	2013
36"	4505'	S. Saskatchewan River, Alberta	2012
36"	2567'	S. Sulpher, Sandhill, TX	2012
36"	1640'	Sabine River, Pine Hurst Farm, TX	2012
30"	2133'	Alberta, Canada	2012
42"	3443'	Wetland R2, Bienville Parish, LA	2011
30"	5786'	Lake Conway, Vernon, NJ	2011
42"	1223'	Bunkie, LA	2011
20"	2855'	Suwannee River, FL	2010
42"	1786'	Big Creek, LA	2010

2000 – 2006: **HDD Foreman | InterCon Construction | Madison, WI**

Set up drill site location. Maintain daily operations of Directional Drill. Direct correspondence with contractors, landowners and other personnel dealing with drill operations.

1995 – 2000: **Fuser/Welder | InterCon Construction | Madison, WI**

Ran house service and mainline extension for MG&E and Wisconsin Power and Light.

EDUCATION

1980 **Sauk Prairie High School | Sauk City, WI**

High School Diploma

MICHELS®

Bobby Skipworth

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2017 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Some more notable crossings, but not limited to:

Diameter	Length	Location	Year
16"	2997'	Paoli Pike/E boot Road, PA	2019
16"	707'	Eagle View Blvd, PA	2019
16"	1152'	Meadow Ln & Shepard Ln, PA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
4"	1495'	Des Moines River, IA	2018
12"	1070'	Indiana Harbor Canal - 12" & 10" Bundle, IN	2018
12"	1369'	Rocky Point Landing, Jamaica	2018
16"	1999'	Route-35, NJ	2018
16"	1198'	Harrisburg Pike, PA	2017
10"	5697'	Mississippi River, LA	2017
30"	2278'	Chattahoochee River, GA	2017

2014 – 2016: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation.

Diameter	Length	Location	Year
12"	1178'	Howard Cove, ME	2016
12"	1023'	Cutler Site, ME	2016
12"	2765'	Lewis Creek, VT	2016
12"	2856'	Wetland Replacement, OH	2016
20"	845'	Patterson Rd/RR, IL	2016
20"	1335'	Laraway Rd, IL	2016
12"	11,563	Holland Bottoms Wetlands, AK	2015
24"	1405'	Platte River, MO	2015

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
16"	2249'	Ohio River, OH/KY	2015
22"	2538'	Barrington Rd, IL	2015
36"	1147'	E. 138th Street, IL	2015
36"	2697'	Barrington Rd, IL	2015
36"	3031'	BNSF RR & Aurora Rd, IL	2015
12"	2557'	Arkansas River, AR	2014
24"	3030'	Big Creek Lake, AL	2014

MICHELS®

Tim Monroe

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2016 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Some more notable crossings, but not limited to:

Diameter	Length	Location	Year
16"	3628'	Eagleview Blvd, PA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
16"	3981'	Glendale Rd & Concord Ave, PA	2019
36"	3199'	Vermillion River MP 104.4, OH	2018
36"	1522'	Findlay Road MP 179.9, OH	2018
16"	5869'	Conrail RR, NJ	2018
36"	2377'	Hydro Park MP 250.7, MI	2018
36"	6238'	Ohio River, OH/WV	2017
24"	983'	Mystic River, MA	2017
24"	2293'	Interstate 20, GA	2017
36"	3829'	Flint River, GA	2016
30"	5714'	James River, SD	2016
42" Steel w/ 36" HDPE	3983'	St John's River, FL	2016

2008 – 2016: **Drilling Fluids Technician/Laborer | Michels Directional Crossings | Brownsville, WI**

Integral member of a specialized team working on and around directional drilling rigs. Provide onsite services by measuring and testing of fluid mixing and pumping, including technical analysis and practical recommendations for controlling fluid properties. Maintain fluid properties on rig sites by testing fluid properties accurately. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
16"	1508'	Beverly Harbor, MA	2015
16"	3827'	Collins Cove, MA	2015
36"	2303'	Liberty Street, IL	2015
18"	12,459	Houston Ship Channel, TX	2015

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
36"	9040'	Mississippi River, IL/MO	2014
24"	3269'	Transfer Line 2, IN	2014
24"	3275'	Transfer Line 1, IN	2014
20"	1193'	SR-265/Leatherwood Rd, OH	2014
30"	2344'	Delaware River, PA/NJ	2013
42"	3008'	I-95 & Tidal Wetlands, NJ	2013
16"	1664'	Morales, TX	2012
42"	1657'	Morales, TX	2012
10"	1495'	Missoula, MT	2012
24"	1546'	Colorado River, CO	2011
12"	1612'	WBC62 (Offshore), LA	2011
10"	3447'	Grand Lake, OK	2011

EDUCATION

2003 **Fond du Lac High School | Fond du Lac, WI**

High School Diploma

MICHELS®

James Day

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2017 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
36"	2717'	N Saskatchewan River, Canada	2019
16"	7402'	Susquehanna River, PA	2019
20"	2236'	Lower Piney Creek, PA	2018
20"	1720'	Everett RR-Juniata River, PA	2018
20"	2209'	Horse Valley Road, PA	2018
20"	7354'	Susquehanna River, PA	2018
36"	5841'	Ohio River MP 33.8, OH/WV	2017
42"	2431'	Maumee River/State Hwy 24, OH	2017

2008 – 2017: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation. Some notable crossings include, but are not limited to:

Diameter	Length	Location	Year
30"	7531'	Lake Oahe & Missouri River, ND	2017
16"	6693'	Wapsipinicon River, IA	2016
30"	6328'	Big Sioux River, SD/IA	2016
12"	7228'	Athabasca River, Alberta, Canada	2016
42"	7205'	Athabasca River, Alberta, Canada	2015
36"	2510'	Deer Creek, IL	2015
42"	3776	Mackay River, Alberta, Canada	2015

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
6"	6999'	Navajo Reservoir/San Juan river, NM	2014
36"	9040'	Mississippi River & Levees, IL/MO	2014
24"	2020'	Unnamed Creek, AL	2014
42"	1252'	Battle River, Alberta, Canada	2013
30"	6544'	East 1st Street, NJ	2013
30"	4905'	Merseles Streer, NJ	2013
12"	4272'	Saline Creek, Alberta, Canada	2013
30"	5378'	Hudson River, NJ/NY	2012
30"	4850'	Red River, TX/OK	2012
42"	3205'	Dewitt, TX	2012
36"	4505'	Medicine Hat, Alberta, Canada	2012
36"	4993'	Atchafalaya River, LA	2011
42"	4272'	St. John's River, BC	2011
42"	2204'	Bayou Comitte, LA	2010
36"	1873'	Petitcodic River, Canada	2009
24"	3009'	Middle Salinas River, CA	2008
30"	1657'	St. Lucie Canal, FL	2008
30"	2739'	Couse Midden, FL	2008

2007 – 2008: **Laborer | Intercom Construction | Madison, WI**

Directional Drilling, Fusing and hand digging for services

EDUCATION

2002 **Boone High School | Boone, IA**

High School Graduate

MICHELS®

Cliff Mclain

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2006 – Present: **Field Operations Superintendent | Michels Corporation | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
20"	6429'	Badlands Canyon, MT	2019
30"	3746'	Dix River, KY	2019
36"	2974'	Wetland MP 8.1, OH	2018
36"	1886'	Nimisila Reservoir MP 40.9, OH	2018
36"	2611'	Tuscarawas River MP 47.8, OH	2018
30"	2273'	Susquehanna River @ MP 35, PA	2018
12"	5741'	Rum River & Wetland, MN	2017
12"	5170'	Larch Dr & Wetland, MN	2017
36"	1594'	Dupage River #2, IL	2017
30"	7282'	Mississippi River, IA/IL	2016
42"	3885'	Dover River, Alberta, Canada	2016
42"	7205'	Athabasca River, Alberta, Canada	2015
42"	2510'	Ruth Lake, Fort McMurray, Canada	2015
12"	3472'	Gilmore Lane, OR	2014
36"	1640'	LaMoine River, IL	2013
36"	4304'	Bois D' Arc, TX	2013
36"	4005'	Canadian River, OK	2013
36"	1792'	North Canadian River, OK	2013
30"	3042'	Wyalusing, PA	2012
16"	3894'	Roaring Branch, PA	2012
20"	2513'	Tioga Junction, PA	2012

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
12"	2530'	Cornwall, ONT, Canada	2011
10"	964'	US Route 1, Fort Lauderdale, FL	2011
30"	3455'	Marysville, MI-Searnia, Ontario	2011
42"	3008'	White River, Russell, AR	2010
42"	5084'	Mississippi River, Helena, AR	2010
42"	3497'	Little Red River, AR	2010
20"	5022'	Pokegama Carnegie, WI	2009
20"	5087'	Mississippi River, Empire, LA	2009

1995 – 2006: **Drill Operator | InterCon Construction | Madison, WI**

Crane operator responsible for safe operation and timely placement of drill stem and equipment. Integral link in the drilling operation, from drill rig set-up, pipe pull back and rig-down of equipment. Also conducted pipe support operations at the exit side during pipeline pullback. Responsible for permitting and mobilization/demobilization of heavy and non-dimensional equipment to drill sites.

EDUCATION

Florence High School | Florence, WI

High School Diploma

Josh Bush

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2017 – Present: **Field Operations Superintendent | Michels Directional Crossings**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production. Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	6976'	Matlock/W Chester Rd, PA	2020
16"	3728'	Village Square Dr, PA	2019
36"	1487'	River Raisin, MI	2018
36"	1805'	Portage River, OH	2018
16"	2346'	Frankstown Branch-Juniata River, PA	2018
20"	2307'	Frankstown Branch-Juniata River, PA	2017

2016 – 2017: **HDD Operator | Michels Directional Crossings**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation.

2013 – 2016: **Skilled Laborer | Michels Directional Crossings**

Integral member of a specialized team working on and around directional drilling rigs. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

2009 – 2013: **Diesel Mechanic | McCartney Produce | Paris, TN**

TRAINING & CERTIFICATIONS

- Respiratory Protection
- Respirable Crystalline Silica
- First Aid/CPR/AED Certification
- Confined Space Rescue Certification

EDUCATION

2011 **Gateway School | Paris, TN**

High School Graduate

MICHELS®

Jason Freund

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2020 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

2009 – 2020: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings, but not limited to:

Diameter	Length	Crossing/Location	Year
12"	1369'	Rocky Point Landing, Jamaica	2018
36"	2974'	Wetland MP 8.1, OH	2018
30"	2273'	Susquehanna River @ MP 35, PA	2018
42"	2826'	San Joaquin River, CA	2017
12"	5741'	Rum River & Wetland, MN	2017
12"	5170'	Larch Dr & Wetland, MN	2017
6"	3309'	Hauser Lake, MT	2017
8"	1980'	CHS Yellowstone River, MT	2017
8"	1530'	SPL Yellowstone River, MT	2017
8"	1542'	YPL Yellowstone River, MT	2017
12"	1285'	XOM Yellowstone River, MT	2017
24"	1898'	Vermillion River, IL	2016
12"	3144'	Monkton Swamp, VT	2016
12"	1491'	Drinkwater Rd, VT	2016
20"	1904'	North St Mary's River, IN	2016
20"	1076'	South St Mary's River, IN	2016
30"	6119'	Lake Whitney, TX	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Crossing/Location	Year
24"	3716'	Barbour's Cut, TX	2015
24"	7432'	Houston Ship Channel, TX	2015
24"	5908'	Tabbs Bay, TX	2015
36"	1862'	State Highway 50, IL	2015
36"	1813'	Calumet Ave, IN	2015
36"	1803'	Dyer Ditch, IN	2015
36"	1812'	Highway 394, IL	2015

2000 – 2008: **Skilled Laborer | Michels Directional Crossings | Brownsville, WI**

Integral member of a specialized team working on and around directional drilling rigs. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

MICHELS®

Mike Brever

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2018 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Some more notable crossings, but not limited to:

Diameter	Length	Crossing/Location	Year
36"	3199'	Vermillion River MP 104.4, OH	2018
36"	2974'	Wetland MP 8.1, OH	2018

2009 – 2018: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
30"	3483'	Ford Island to Landing C, HI	2017
20"	2005'	Highway 15, PA	2017
36"	1535'	Calumet River, IL Direct Pipe	2017
36"	3901'	Rutherford Rd, Ontario, Canada	2016
42"	3885'	Dover River, Alberta, Canada	2016
36"	3160'	Christina River, Alberta, Canada	2016
30"	5154'	House River, Alberta, Canada	2015
12'	11,563'	Holland Bottoms Wetland, AR	2015
48"	4039'	Dow Barge Channel, TX Direct Pipe	2015
10"	4654'	Allegheny River, PA	2015
36"	3805'	Williamette River, OR	2014
24"	2884'	Hatchett Creek, AL	2014
16"	2951'	Line 82, ND	2014
8"	2545'	MP266, Mountain Green, UT	2013
30"	1881'	Bennekill Stream, NJ	2013
30"	6544'	1st Street, NJ	2013
42"	1670'	Lavaca River, TX	2012

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
42"	1650'	Chicolete River, TX	2017
30"	1633'	Paerdegat Basin, NY	2017
36"	1392'	Hackensack River, NJ	2017
24"	2645'	Chemung River, NY	2016
30"	5786'	Lake Coneay, NJ	2016

2005 – 2009: **Heavy Truck/Diesel Mechanic | Mike's Truck and Trailer Repair | New Brighton, MN**

EDUCATION

2006 **Henippen Technician College | Brooklyn Center, MN**

Heavy Truck Degree

2003 **Columbia Heights High School | Columbia Heights, MN**

High School Diploma

MICHELS®

Tim Bunkelman

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2018 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production.

Diameter	Length	Location	Year
16"	983'	N Chester Rd/Bancroft, PA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
20"	1665'	Aughwick Creek, PA	2018
20"	2209'	Horse Valley Road, PA	2018

1992 – 2018: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
20"	1507'	Trough Creek Valley Pike/SR 829, PA	2018
16"	1999'	Route-35, NJ	2018
16"	1198'	Harrisburg Pike, PA	2017
20"	2005'	Hwy 15, PA	2017
36"	1545'	Van Dyke Road, IL	2017
24"	3166'	N Saskatchewan River, Alberta, Canada	2016
24"	4531'	Athabasca River, Alberta, Canada	2016
30"	2461'	Highway 63, Alberta, Canada	2015
24"	1956'	Clearwater River, Alberta, Canada	2015
36"	1613'	Fish Pond, Alberta, Canada	2014
36"	1359'	Wetland Crossing #2, Alberta, Canada	2014
36"	9040'	Mississippi River, IL/MO	2014
42"	4284'	Vermillion River, Canada	2013
30"	4905'	Merseles, NJ	2013
30"	5378'	Hudson River, NJ/NY	2012

PROFESSIONAL EXPERIENCE (continued)

1989 – 1992: **Skilled Laborer | Michels Directional Crossings | Brownsville, WI**

Integral member of a specialized team working on and around directional drilling rigs. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

1987 – 1989: **Construction of Pole Buildings | Pro Builders | Lomira , WI**

1979 – 1986: **Heavy Equipment Diesel Mechanic | US Army**

EDUCATION

1979 **Campbellsport High School | Campbellsport, WI**

MICHELS®

Seth Strean

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2020 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

2012 – 2019: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings, but not limited to:

Diameter	Length	Crossing/Location	Year
20"	2236'	Lower Piney Creek, PA	2018
36"	2730'	Sanddusky River MP 145.8, OH	2018
20"	3874'	Waltonville Rd, PA	2018
36"	1525'	Dupage River #1, IL	2017
12"	1178'	Howard Cove, ME	2016
12"	1023'	Cutler Site, ME	2016
12"	2765'	Lewis Creek, VT	2016
12"	2856'	Wetland Replacement, OH	2016
20"	845'	Patterson Rd/RR, IL	2016
20"	1335'	Laraway Rd, IL	2016
12"	11,563	Holland Bottoms Wetlands, AK	2015
24"	1405'	Platte River, MO	2015
16"	2249'	Ohio River, OH/KY	2015
22"	2538'	Barrington Rd, IL	2015
36"	1147'	E. 138th Street, IL	2015
36"	2697'	Barrington Rd, IL	2015
36"	3031'	BNSF RR & Aurora Rd, IL	2015
12"	2557'	Arkansas River, AR	2014
36"	2355'	Salt Fork River, MO	2013
36"	2077'	Chariton River, MO	2013

PROFESSIONAL EXPERIENCE (continued)

2000 – 2012: **Skilled Laborer | Michels Directional Crossings | Brownsville , WI**

Integral member of a specialized team working on and around directional drilling rigs. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

EDUCATION

1999 **Goodrich High School | Fond du Lac, WI**

Matt Rohwer

Field Superintendent

PROFESSIONAL EXPERIENCE

2007 – Present: **Field Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical, and communication lines. Complete knowledge of directional drilling technology and procedures. Duties include mobilization of all equipment and personnel to job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; necessary record keeping of production and overall on-site management.

2005 – 2007: **Laborer | NPL | Lakeville, MN**

General labor installing utilities.

PROJECT PROFILES

2018 | CHS | Wastewater Force Main Project; HDD 24" pipe under BSF Railroad Tracks – Laurel, MT

2018 | MERC | Rochester Lateral; HDD 16" pipe under CP Railroad Tracks – Rocxhester, MN

2007-2017 | CPE | Multiple Pipe Sizes | Miscellaneus Railroad Tracks around Twin Cities; MN

TRAINING & CERTIFICATIONS

- ERail Safe

EQUIPMENT EXPERIENCE

- Drill Rig
- Excavator
- Mud Rig

EDUCATION

Triton High School | Dodge Center, MN

Brady Hickey

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2010 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites, set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Oversees drilling survey during crossing.

Diameter	Length	Location	Year
16"	4,100'	Hummelstown, PA	2020
10"	1,200'	Linn, MO	2019
24"	2,000'	Cologne, MN	2019
24"	1,000'	Cologne, MN	2019
8"	4,800'	Little Falls, MN	2019
8"	600'	Spokane, WA	2019

TRAINING & CERTIFICATIONS

- Safety training
- Veriforce training
- TWIC Card

EQUIPMENT EXPERIENCE

- Excavator
- Mud Rig
- Drill Rig

EDUCATION

Triton High School | Dodge Center, MN

Branden Cole

Field Superintendent

PROFESSIONAL EXPERIENCE

2019 – Present: **Field Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines as well as environmental wells. Duties include mobilization of all equipment and personnel to remote job sites, set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary recordkeeping of plots and production. Oversees drilling survey during crossing.

2015 – 2019: **Foreman | Precision Pipeline | Eau Claire, WI**

Horizontal Directional Drilling of steel natural gas and petroleum pipelines. Ordered tooling for drills, supervised crew, interpreted blueprints and profiles, performed daily progress reports and time sheets, and tracking of expenditures on the job.

2009 – 2015: **Laborer | Roese Contracting/Pipeline LLC | Kawkawlin, MI**

Responsibilities included location utilities, installing fiber optic cable, plastic pipeline for gas distribution, gas service and meter sets to customer homes.

1994 – 2009: **Crew Member | Ironworkers Local 25 | Novi, MI**

Erected steel buildings, tied reinforcing steel for concrete placement, made connections on structural steel, steel welding, bolting up steel, setting beams on bridges, steel roofing, sheeting on buildings, and ornamental work.

PROJECT PROFILES

NPL | HDD; Rochester, MN

Sunoco | Manor East II HDD; Harrisburg, PA

DTE | HDD and Open Trench; Detroit, MI

Michigan DOT | Erected Bridges; Detroit, MI

DOW | Erected Buildings; Midland, MI

Michigan DOT | Welding on Bridges; Pontiac, MI

TRAINING & CERTIFICATIONS

- Class A Commercial Driver's License
- ASE Certified Mechanic
- Certified Welder
- First Aid/CPR/AED Certification
- Trenching/Excavation Safety Training
- OSHA 20-Hour

INDUSTRY INVOLVEMENT

- Operating Engineers Local 49
- Laborer's Union 1098
- Ironworkers Local 25

EQUIPMENT EXPERIENCE

- Track/Excavator

EQUIPMENT EXPERIENCE (continued)

- Front end loader
- Skytrac
- Roller
- Skid Steer
- Reclaimer
- Drill Rig

EDUCATION

1998 **Mott Community College | Flint, MI**

Construction Management

Steve Case

Field Operations Superintendent

PROFESSIONAL EXPERIENCE

2008 – Present: **Field Operations Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

Diameter	Length	Location	Year
10"	2100'	Blue Line Replacvement, MO	2019
8"	3100'	Elkhorn River, NE	2019
20"	1800'	County Road B, MN	2019
16"	1400'	Rochester Greenfield Lateral, MN	2019
16"	2300'	Teton River, MT	2019

2006 – 2008: **Forman | Telecom Construction | Clearwater, MN**

Conduct daily tasks, install fiber optic cables, install phone and power cables using HDD methods. Read prints/alignment sheets, locate utility lines using electronic locating devices, set vaults for utilities

2004 – 2006: **Automotive Technician | Nokomis Auto Service | Alexandria, MN**

Perform inspections on automobiles and diagnose problem. Use of electronic scan tools to perform repairs on automobiles. Repair faulty part(s), replace, test vehicle.

INDUSTRY INVOLVEMENT

- Member of Operating Engineers Local 49

EQUIPMENT EXPERIENCE

- Drill Rig, Trackhoe, Dozer and Backhoe

EDUCATION

Park High School | Livingston , MT

High School Diploma

Garrett Derrer

Assistant Superintendent

PROFESSIONAL EXPERIENCE

2020 – Present: **Assistant Superintendent | Michels Directional Crossings | Brownsville, WI**

Responsible for coordinating and drilling directional boring projects for various size gas, water, sewer, electrical and communication lines. Duties include mobilization of all equipment and personnel to remote job sites throughout the United States; the set-up and drilling of crossings; on-site maintenance of mechanical and technical equipment; and necessary record keeping of plots and production.

2016 – 2020: **HDD Operator | Michels Directional Crossings | Brownsville, WI**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation. Some more notable crossings, but not limited to:

Diameter	Length	Location	Year
16"	2518'	Herman O.W. Drive, PA	2019
16"	4381'	Pennsylvania Drive, PA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
16"	3981'	Glendale Rd & Concord Ave, PA	2019
36"	3199'	Vermillion River MP 104.4, OH	2018
16"	5869'	Conrail RR, NJ	2018
36"	2377'	Hydro Park MP 250.7, MI	2018
36"	6238'	Ohio River, OH/WV	2017
24"	983'	Mystic River, MA	2017
24"	2293'	Interstate 20, GA	2017
36"	3829'	Flint River, GA	2016
30"	5714'	James River, SD	2016

2016: **Welder | Whitehead Construction | Elizabethton, TN**

Welding and repairing electrostatic precipitator cleaning systems in power plants and coal burners

2015: **Pipe Fitter | Fagen Inc | Granite Falls, MN**

Installing piping systems and hydro testing product pipe for an ethanol plant

TRAINING & CERTIFICATIONS

- OSHA 30
- NCCER Level 4 Certifiation
- Pipe Fitting Diploma
- Professional Welding Diploma

EDUCATION

Tulsa Welding School | Tulsa , OK

Professional Welding and Pipe Fitting Diploma

TBAISD CTC | Traverse City, MI

Pre Trade Welding

Mancelona High School | Mancelona , MI

High School Diploma

MICHELS®

Jeff Nehmer

Drilling Survey Technician

PROFESSIONAL EXPERIENCE

1997 – Present: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, WI**

Responsible for surveying, staking and design of directional drill path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Performed the above operations to crossings which include, but not limited to:

Diameter	Length	Crossing/Location	Year
20"	2740'	West Branch Escanaba River, MI	2019
20"	6429'	Badlands Canyon, MT	2019
24"	3341'	Hwy 367/Coldwater Creek, MO	2019
24"	2100'	Spanish Lake, MO	2019
22"	4986'	Atchafalaya River, LA	2019
24"	3817'	Missouri River, MO	2019
24"	6336'	Mississippi River, IL/MO	2019
42"	4687'	Lake Scranton Finished H2O Tunnel, PA	2018
20"	2355'	Joanna Rd, PA	2018
20"	1720'	Everett RR-Juniata River, PA	2018
20"	1068'	Rahway River, NJ	2018
30"	2273'	Susquehanna River @ MP 35, PA	2018
36"	2836'	Nemadji Golf Course, WI	2017
20"	2005'	Hwy 15, PA	2017
12"	5741'	Rum River & Wetland, WI	2017
12"	5171'	Larch Dr & Wetland, MN	2017
36"	7194'	Ohio River MP 16.07, OH/WV	2017
24"	5788'	Hwy 41/45, WI	2017
36"	1545'	Van Dyke Road, IL	2017
24"	2293'	Interstate 20, GA	2017
12"	1285'	XOM Yellowstone River, MT	2017

12"	1178'	Howard Cove, ME	2016
12"	1023'	Cutler Site, ME	2016
12"	3144'	Monkton Swamp, VT	2016
12"	2765'	Lewis Creek, VT	2016
12"	1491'	Drinkwater Rd, VT	2016
12"	922'	Arch Site & Monkton Rd, VT	2016
42" Steel with 36" HDPE	3983'	St John's River, FL	2016
20"	983'	Schweitzer Rd, IL	2016
8"	1957'	Grand River, MI	2016
12"	11,548	Union Canal & Martin Barge Canal, TX	2015
16"	3827'	Collins Cove, MA	2015
36"	1147'	E. 138th Street, IL	2015
16"	2249'	Ohio River, OH/KY	2015
10"	4654'	Allegheny River, PA	2015
36"	3805'	Williamette River, OR	2014
24"	1935'	Coosa River, AL	2014
24"	2884'	Hatchett Creek, AL	2014
24"	3269'	Transfer Line 2, IN	2014
24"	3275'	Transfer Line 1, IN	2014
36"	1874'	Wetland S-517C, IN	2014
36"	3544'	Illinois River, IL	2013
8"	2545'	MP266, Mountain Green, UT	2013
30"	4987'	Monksville Reservoir, NJ	2013
30"	4905'	Merseles St, NJ	2013
30"	6544'	1st Street, NJ	2013
42"	4441'	Goethals Bridge, NY	2013
30"	8101'	Kill Van Kull River NY/NJ	2013

1995 – 1996: **Subsurface Exploration | Wisconsin Dept. of Transportation | Madison, WI**

Took core samples vertically from the ground and ran tests on soil conditions for roadways.

EDUCATION

1997 **MATC**

Degree as Civil Engineering Technician

1994 **Columbus High School | Columbus , WI**

High School Diploma

MICHELS®

Cale Mullenix

Drilling Survey Technician

PROFESSIONAL EXPERIENCE

1997 – Present: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, WI**

Responsible for surveying, staking and design of directional drill path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Performed the above operations for crossings which include, but not limited to:

Diameter	Length	Crossing/Location	Year
20"	13,247'	Lake Sakakawea, ND	2019
20"	6429'	Badlands Canyon, MT	2019
8"	12,769'	Montezeuma Slough, CA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
16"	3981'	Glendale Rd & Concord Ave, PA	2019
4"	1495'	Des Moines River, IA	2018
12"	1369'	Rocky Point Landing, Jamaica	2018
36"	2974'	Wetland MP 8.1, OH	2018
36"	2611'	Tuscarawas River, OH	2018
20"	7354'	Susquehanna River, PA	2018
42"	1501'	Platte River, NE	2018
36"	1370'	Interstate-80 MP 251.5, MI	2018
36"	2377'	Hydro Park MP 250.17, MI	2018
42"	4869'	Bahia Grande Channel #1, TX	2018
42"	2826'	San Joaquin River, CA	2017
14"	9154'	Nansemond River, VA	2017
10"	5697'	Mississippi River, LA	2017
12"	5171'	Larch Dr & Wetland, MN	2017
36"	7194'	Ohio River MP 16.07, OH/WV	2017
30"	3483'	Ford Island to Landing C, HI	2017
6"	3309'	Hauser Lake, MT	2017

36"	1545'	Van Dyke Road, IL	2017
30"	7531'	Lake Oahe & Missouri River, ND	2017
30"	2278'	Chattahoochee River, GA	2017
24"	2026'	Highway 120, GA	2017
30"	7282'	Mississippi River, IA/IL	2016
16"	11,397'	Lake Sacagawea South, ND	2016
30"	3352'	Cliff Crossing, ND	2016
16"	11,229'	Lake Sacagawea North, ND	2016
16"	1112'	Palermo Railroad, ND	2016
20"	1904'	North St Mary's River, IN	2016
20"	845'	Patterson Rd/RR, IL	2016
20"	871'	Wetlands #2, IL	2016
8"	1957'	Grand River, MI	2016
24"	7432'	Houston Ship Channel, TX	2015
16"	1508'	Beverly Harbor, MA	2015
16"	3827'	Collins Cove, MA	2015
36"	2510'	Deep Creek, IL	2015
36"	3011'	Highway 41 & RR, IN	2015
36"	2697'	Barrington Rd, IL	2015
36"	1755'	New York St, IL	2015
36"	2303'	Liberty Street, IL	2015
36"	3805'	Williamette River, OR	2014
2 x 4" Bundle	1809'	Hwy 550, Nageezi, NM	2014
6"	6999'	Lake Navajo/San Juan River, NM	2014
8"	7321'	MP 49.3 Landslide, MT	2014
8"	4159'	MP 54.8 Landslide, MT	2014
24"	1935'	Coosa River, AL	2014
16"	2951'	Line 82, ND	2014
36"	5687'	Missouri River, MO	2013
30"	1246'	OK City Water Main, OK	2013
30"	4987'	Monksville Reservoir, NJ	2013
12"	6209'	Jamacian Bay, NY	2013
42"	3008'	I-95 & Tidal Wetlands, NJ	2013
30"	4905'	Merseles St, NJ	2013
30"	6544'	1st Street, NJ	2013

PROFESSIONAL EXPERIENCE (continued)

1996 – 1997: **Fluid Dynamics Technician | Michels Directional Crossings | Brownsville, WI**

Accountable for mixing bentonite solution used throughout directional drilling and reaming operations. Trained to monitor viscosity of mixture and manipulate ratios of solids and fluid to maintain specific viscosities which continually change based on the environment and which vary by operation phases and subterrain. Experience in operation, maintenance and repair of bentonite mixing equipment.

EDUCATION

1996 **University of Wisconsin-Madison | Madison, WI**

1995 **Goodrich High School | Fond du Lac, WI**

High School Diploma

MICHELS®

Lorenzo Rivera Jr

Drilling Survey Technician

PROFESSIONAL EXPERIENCE

2017 – Present: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for surveying, staking and design of directional drill/Direct Pipe path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Performed the above operations for crossings which include, but not limited to:

Diameter	Length	Crossing/Location	Year
16"	7595'	Houston Ship Channel, TX	2019
24"	3183'	Crow River, MN	2019
20"	1421'	Middle Branch Escanaba River, MI	2019
16"	3628'	Eagleview Blvd, PA	2019
42"	2007'	Las Moras Creek, TX	2019
20"	2236'	Lower Piney Creek, PA	2018
42"	4687'	Lake Scranton Finished H2O Tunnel, PA	2018
36"	1863'	E Branch Black River MP 86.7, OH	2018
48"	651'	Juniata River, PA - HK750PT Installation	2018
36"	1682'	W Branch Black River MP 92.3, OH	2018
42"	1861'	San Martin Lake Channel, TX	2018
42"	899'	Highway 50, West Virginia - HK500PT Installation	2018
36"	1535'	Calumet River, IL - HK300PT Installation	2017
48"	2183'	Resaca De Los Fresnos Canal #2, TX	2017
48"	2555'	Resaca De Los Fresnos Canal #1, TX	2017
48"	2126'	Pinson Rd Canal, TX	2017
48"	2042'	County Rd 300 Canal, TX	2017
48"	2398'	CR2340 & Los Olmos Creek, TX	2017
48"	2349'	Chiltipan Creek, TX	2017

PROFESSIONAL EXPERIENCE (continued)

2013 – 2017: Operaor/Direct Pipe | Michels Directional Crossings | Brownsville, WI

Skilled equipment operator with the operation of technical, lifting and heavy equipment for direct pipe & directional micro-tunnel operations as well as directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and downhole survey along with surveying and surveying instrumentation. Some more notable crossings include, but are not limited to:

DIRECT PIPE INSTALLATIONS/PIPE ASSISTS

Diameter	Length	Crossing/Location	Year
36"	827'	Leslie Street, Ontario, Canada - HK 300PT Installation	2015
48"	4,039'	Dow Barge Channel, Clute TX - HK750PT Installation	2015
36"	1,002'	Hwy 225, Deer Park, TX - HK300PT Installation	2015
36"	1,092'	Lubrizol Drainage, LaPorte, TX-HK300PT Installation	2015
48"	2,455	Rio Grande River, El Refugio, TX-HK750PT Installation	2014
42"	1,200'	Railroad Crossing, Groves, TX-HK750PT Installation	2014

HDD PROJECTS

Diameter	Length	Crossing/Location	Year
30"	11,229'	Lake Sacagawea North, SD	2016
30"	6119'	Lake Whitney, TX	2016
12"	11,563	Holland Bottoms Wetlands, AK	2015
36"	2510'	Deep Creek, IL	2015
36"	5128'	Lake Ave & RR, IL	2015
18"	12,459	Houston Ship Channel, TX	2015
28"	1741'	Lafayette River, VA	2014
48"	2060'	Tres Palacios River, TX	2014
48"	1692'	Navidad River, TX	2014

2013: Truck Driver | Billy Cummings | TX

2012 – 2013: Bank Teller | City National Bank | TX

EDUCATION

2013 Texas Technical College | TX

Engineering Prerequisite Classes

2010 PJC Junior College | TX

Eric Riha

Drilling Survey Technician

PROFESSIONAL EXPERIENCE

2019 – Present: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, Wisconsin**

Responsible for surveying, staking and design of directional drill path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs.

Some more notable crossings include, but are not limited to:

Diameter	Length	Crossing/Location	Year
16"	2518'	Herman O.W. Drive, PA, PA	2019

2018 – 2019: **HDD Operator | Michels Directional Crossings | Brownsville, Wisconsin**

Skilled equipment operator with the operation of technical, lifting and heavy equipment for directional drilling operations. Working knowledge of hydraulic engineering and applied mechanical engineering. Skilled in hydraulics repair, electrical repair, welding and troubleshooting. Working knowledge of computers and down hole survey along with surveying and surveying instrumentation.

2017 – 2018: **Skilled Laborer | Michels Directional Crossings | Brownsville, Wisconsin**

Integral member of a specialized team working on and around directional drilling rigs. Multi-capable to assist with all facets of drilling operations. Familiar with mechanical repairs, hydraulics, fluids, set-up and operation of drill motors, power generators, mud pumps, bentonite mixers, drill pipe, reamers, couplings and overall equipment maintenance and operation.

2013 – 2015: **CNC Lathe Operator | D&S Machine Service Inc. | Luxemburg**

Operated a CNC lathe machine to precise dimensions per interpretation of blue prints, prioritize the tasks at hand for the day & operated a forklift.

EDUCATION

2015 **Northeast Wisconsin Technical College | Green Bay, WI**

Natural Gas Utility Construction

2012 **Kewaunee High School | Kewaunee , WI**

High School Graduate

MICHELS®

Jeremiah Erickson

Drilling Survey Technician

PROFESSIONAL EXPERIENCE

2008 – Present: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, WI**

Responsible for surveying, staking and design of directional drill/Direct Pipe path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Performed the above operations for crossings which include, but not limited to:

Diameter	Length	Location	Year
16"	3628'	Eagleview Blvd, PA	2019
16"	1888'	West Baltimore Pike Rd, PA	2019
16"	3981'	Glendale Rd & Concord Ave, PA	2019
36"	856'	Qu'Appelle River, Canada - HK750PT Installation	2017
42"	1861'	San Martin Lake Channel, TX	2017
36"	1535'	Calumet River, IL - HK300PT Installation	2017
20"	2005'	Highway 15, PA	2017
36"	1606'	Hannahatchee Creek, GA	2017
36"	3829'	Flint River, GA	2016
42"	7200'	Athabasca River, Canada - HK750PT Installation	2016
48"	4039'	Dow Barge Channel, Clute TX - HK750PT Installation	2015
36"	1002'	Hwy 225, Deer Park, TX - HK300PT Installation	2015
36"	1092'	Lubrizol Drainage, LaPorte, TX-HK300PT Installation	2015
48"	2455	Rio Grande River, El Refugio, TX-HK750PT Installation	2014
42"	1200'	Railroad Crossing, Groves, TX-HK750PT Installation	2014
8"	7321'	MP 9.3 Landslide, MT	2014
42"	1050'	Beaver River, Alberta, Canada-HK750PT Installation	2013
42"	470'	I-84, Westfall, PA - HK750PT Installation	2013
42"	4441'	Goethals Bridge, NY	2013
36"	5687'	Missouri River, MO	2013

PROFESSIONAL EXPERIENCE (continued)

Diameter	Length	Location	Year
36"	2958'	North Sulpher, Mount Joy, TX	2012
30"	4850'	Red River, Thackerville, TX/OK	2012
42"	1670'	Morales, TX	2012
42"	1658'	Dewitt, TX	2012
16"	5754'	New Berlin, WI	2012
20"	3075'	Rock Creek, OR	2011
42"	1826'	Interstate 49 and RR, LA	2011
42"	3443'	Wetland R2, LA	2011
42"	1704'	Willow Creek, LA	2010
42"	2015'	Flat Creek, LA	2010
42"	2129'	Ceasars Creek, OH	2009
36"	3031'	Four Legged Lake, MN	2009
42"	4068'	Illinois River, IL	2009
42"	2691'	200th Ave, IL	2009
42"	3627'	Salt River, MO	2009
42"	1992'	Hwy 67, TX	2008
42"	3705'	Neches River, TX	2008
42"	6004'	Old River, TX	2008

EDUCATION

2003 High School Graduate

MICHELS®

Dan Reynolds

Drilling Survey Technician

PROFESSIONAL EXPERIENCE

2006 – Present: **Drilling Survey Technician | Michels Directional Crossings | Brownsville, WI**

Responsible for surveying, staking and design of directional drill path and curve, drilling the pilot hole, tracking and monitoring the drill path and calculating and interpreting the ground elevations and contours. Computer literate with knowledge and experience operating various software including: 1) Magnetic Guidance System, 2) Survey, 3) Tru-Tracker and 4) Microsoft applications. Applied working knowledge of advanced mathematics including: 1) Fluid Dynamics, 2) Advanced Algebra, 3) Trigonometry, 4) Calculus, 5) Statistics and 6) Stress Engineering. Complete surveying skills and experience utilizing a Total Station (Theodolite with built-in EDM) for lay out of grade elevations over all types of topography in establishing alignment tying into existing surveyed points (benchmarks). Additional duties include on-site maintenance of technical equipment, and necessary record-keeping of plots and drilling logs. Performed the above operations for crossings which include, but not limited to:

Diameter	Length	Crossing/Location	Year
30"	3746'	Dix River, KY	2019
22"	4986'	Atchafalaya River, LA	2019
20"	2236'	Lower Piney Creek, PA	2018
20"	2209'	Horse Valley Road, PA	2018
20"	1416'	Blacklog Creek, PA	2018
16"	2346'	Frankstown Branch-Juniata River, PA	2018
20"	1337'	Berry Ridge & Old Mill Rd, PA	2018
16"	5869'	Conrail RR, NJ	2018
20"	2307'	Frankstown Branch-Juniata River, PA	2017
36"	6238'	Ohio River, OH/WV	2017
12"	5741'	Rum River & Wetland, MN	2017
42"	2431'	Maumee River & State Hwy 24, OH	2017
48"	2807'	Oliver Creek & SH 188, TX	2017
48"	2263'	US Hwy 181/Hwy 35, TX	2017
36"	3829'	Flint River, GA	2016
30"	7282'	Mississippi River, IA/IL	2016
12"	2765'	Lewis Creek, VT	2016
12"	2856'	Wetland Replacement, OH	2016
42"	3885'	Dover River, Alberta, Canada	2016

"27" HDPE

Bundle"	3737'	Little Creek, VA	2016

12"	11,563	Holland Bottoms Wetlands, AK	2015
30"	1418'	Highway 250, OH	2015
24"	1405'	Platte River, MO	2015
22"	2538'	Barrington Road, IL	2015
12" and 6"	3173'	Beaver Lake, Alberta, Canada	2015
10"	1971'	Tank Farm/Central Ave, PA	2015
42"	3776'	MacKay River, Fort McMurray, Canada	2015
36"	1613'	Fish Pond, Alberta, Canada	2014
36"	1359'	Wetland Crossing #2, Alberta, Canada	2014
36"	2274'	Highway 13, Alberta, Canada	2014
36"	2133'	Wetland Crossing, Aberta, Canada	2014
30"	2667'	South Fork Ten Mile Creek, PA	2014
24"	2750'	Escatawpa River, MS	2014
20"	1193'	SR-265/Leatherwood Rd, OH	2014
36"	2355'	Salt Fork River, MO	2013
30"	2774'	South Canadian River, OK	2013
30"	4400'	Saline Creek, Alberta, Canada	2013
42"	4284'	Vermillion River, Alberta, Canada	2013
28"	4270'	Saline Creek, Alberta, Canada	2013
36"	4304'	Bois D' Arc, TX	2013
30"	1707'	Bayonne Inlet, NJ	2013
36"	2908'	Neches River & RR, TX	2013
8"	10,053'	Potomac River, VA/MD	2012
20"	3048'	St. Clair, Marysville, MI	2012
8"	12,885'	MP66, Big Horn County, MT	2012
8"	4400'	MP57, Big Horn County, MT	2012
30"	2906'	Hickory Creek, Marietta, OK	2012
36"	4505'	Medicine Hat, Alberta, Canada	2012
30"	2133'	Alberta, Canada	2012
8"	6669'	Wilmington, NC	2012

PROFESSIONAL EXPERIENCE (continued)

2003 – 2006: **Drilling Survey Technician | Southeast Pipeline Construction | Casa Grande, AZ**

All aspects of drilling and design utilizing Tru-Tracker software for contractor. Larger projects include:

Diameter	Length	Location/Customer
56" (3)	2100'-2520'	Bechtel/API
16" (9)	800'-3400'	Williston Basin
36"	1185'	Snelson Hoen Rd
24"	3385'	Carbon Mountain

2003: **Drilling Survey Technician | H.M.S. Construction | Rio Vista, CA**

All aspects of drilling and design utilizing Tru-Tracker software for contractor. Larger projects include:

Diameter	Length	Location/Customer
8" & 12"	450'	City of Waikiki, HI
HDPE	615'-1005' (6)	U.S. Navey Aloha-Aina Park
32"	2900'	AP & T Tidal Inlet

2002 – 2003: **Drilling Survey Technician | Thunderbird Exploration | Gilbert, AZ**

Steering hand working on communication projects. Larger projects include:

Diameter	Length	Location/Customer
8"	Various	Telecommunications
8" & 10"	600'-2400'	U.W. I.
24"	800'-1200'	Questar

1998 – 2002: **Drilling Survey Technician | Ozzie's Directional Drilling | Scottsdale, AZ**

EDUCATION

1980 **Soper High School | Soper, OK**

High School Diploma

ATTACHMENT

SAFETY AND JSA INFORMATION

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Performance Indicators

Performance Measure	Target/Achievements
Lagging Indicators:	
Total # of Incidents	Should demonstrate that employees understand what is considered an incident and are appropriately reporting with an emphasis on **Near-Hit reporting**
Incident Severity Totals (near hit, minor, serious, major, critical)	1 Near Hit/Learning Event : 2,500 hours worked
Recordable Injury Related Incidents	No medical aid incidents
Total Exposure Hours	Contractor and Subcontractor total hours.
Total Spills/Releases	Demonstrates employee's knowledge of spill/release definition and the proper methods to use clean-up kits that are provided to all employees/jobs
Recordable Vehicle Incidents	No reportable vehicle incidents
Total Exposure Miles	For contractor and subcontractor
Leading Indicators	
Total # of Tailgate Meetings	Held Daily
Total # of Weekly Safety Meetings	Held Weekly
Total # Monthly Safety Meetings (Project Team)	Held Monthly
Total # of JSAs reviewed for quality assurance	# of JSAs developed and # reviewed
Total # of Safety Stand downs	List and Why they were held
Total # of Formal Inspections	When and Conducted by Whom
Total # Safety Meetings (Michels)	(as per Michels Site Specific Safety Plan (SSSP) • Monthly Safety meeting • Weekly / Shift Safety Meeting • Daily Tailgate Meeting • Total # of Safety Meetings per month
Work Site Inspection – formalized / documented (as per Contractor)	**(**Daily – Safety Inspector) (1 with Project Manager / construction manager) (2 with HSE Representative)
Michels Response to audit/inspection findings or any HSE related issues	Demonstration that Michels takes safety related issues seriously and implements effective controls in a timely manner to ensure a safe work site

STEP BACK FOR SAFETY

MICHELS HSE

CREW TYPE:	JOB#:
DATE:	TIME:

Top Three Hazards?

Controls in Place (PPE, Spotter, etc.)?

PRINT NAME	SIGNATURE	PRINT NAME	SIGNATURE
1.		7.	
2.		8.	
3.		9.	
4.		10.	
5.		11.	
6.		12.	

SUBMIT COMPLETED CARDS WITH YOUR DAILY JSA

JOB SAFETY ANALYSIS

PURPOSE:

A Job Safety Analysis (JSA) is a tool used to identify/recognize potential hazards at your work location, and to help implement solutions or correct actions to reduce or eliminate the hazard prior to the start of work to allow for a safe working environment.

ASSESS ***IDENTIFY*** ***CONTROL***

HAZARDS IDENTIFIED MAY INCLUDE BUT ARE NOT LIMITED TO:

1. Trip Hazards—Timber mats, rough terrain, etc.
2. Existing Utilities—Overhead/Underground
3. Pinch Points—Moving equipment/material
4. Slips & Trips—Slippery /obstructed work surfaces
5. Falls—Working at heights (6ft. or greater)
6. Excavations—Soil failure
7. Environmental—Excessive mud, water, dust, etc.
8. Chemicals—Hazardous substances
9. Wildlife—Venomous snakes & spiders
10. Plants—Poisonous plants

IF YOU HAVE A QUESTIONS…..ASK!!!

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Project Name: _____ Project Location: _____
Inspected by: _____ Date of Inspection: _____
Equipment Name: _____ Number: _____
Hours/Mileage _____

CONSTRUCTION EQUIPMENT INSPECTION
*** Verbally report to supervisor and turn sheets in daily

CONSTRUCTION EQUIPMENT INSPECTION

		N/A	Remarks			N/A	Remarks
Tracks, tires, wheels				Motor (wiring)			
Brakes				Radiator			
Horn				Belts			
Lights				Hoses			
Clutch				Lubrication Points			
Windshield Wiper				Loose Bearings			
Glass				Guards			
Rear View Mirror				Belt Tension			
Body				Loose Gears			
Cover				Brakes			
Frame				Vibration			
Dump Mechanism				Pneu. Interlocks			
Steering				Exhaust System			
Fire Extinguisher				Proper RPM			
Signal System				Overload Protect			
Fuel & Gas Lines				Mech. Switch			
Fuel Tank				Ground Continuity			
Exhaust System				Limit Switches			
Boom				Cords			
Boom Hoist				Plugs/Receptacles			
Sheaves				Fan Shroud			
Hooks,				Back Up Alarm			
Grab Bars, Steps				Pins-Bushings			
Warning Lights				Pins-Keepers			
Cables							

Operator/Print Name _____ Operator/Signature _____

Foreman/Print Name _____ Foreman/Signature _____

Comments: _____

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DIRECTIONAL CROSSINGS
TAILGATE SAFETY MEETING MINUTES

Date: _____ **Job #** _____ **Location:** _____

Company: _____ **Foreman/Supervisor:** _____

First Aid Personnel: _____

	Name	Address	Phone #
NEAREST CLINIC:			
CLOSEST MAJOR INTERSECTION:			

FOR LIFE THREATENING INJURIES OR EMERGENCIES – DIAL 911 or:

 # In Crew: _____ **# Attending:** _____ **Current Weather:** _____

Competent Person(s) (if applicable): _____

Who Will Transport Injured Personnel? _____

Work To Be Performed: _____

Topics Discussed: _____

Potential Site Hazards: _____

Safety Recommendations: _____

Attendance (use additional paper if necessary)

Print	Sign	Print	Sign

JOB SAFETY ANALYSIS WORK SHEET

Tasks to be performed/critical steps to be taken (Check all that apply to job)	Potential Hazard (Check all that apply to tasks/steps from column 1)	Recommended Safe Job Procedures (Check all protective measures that apply to what was identified in column 2)	
☐ Driving	☐ Traffic hazards (vehicular & pedestrian)	☐ Designate a person for a specific task such as confined space attendant, fire watch, etc.	☐ Keep guards in place at all times – no modifications to tools or equipment
☐ Walking	☐ Working on rough/challenging/uneven terrain	☐ Hold a pre job meeting with all involved	☐ Use hearing protection
☐ Manual Digging	☐ Exposure to loud noise	☐ Utilize one call and pothole/daylight existing utilities BEFORE excavating	☐ Know the depth of water and stay out of it
☐ Mechanical Digging	☐ Overhead Utilities / Underground Utilities	☐ Inspect excavations & complete report	☐ Yield for pedestrians & equipment
☐ Manual Lifting	☐ Suspended Loads / Swinging Loads	☐ Barricade or mark areas of excavation	☐ Reduce speed and drive defensively
☐ Mechanical Lifting (Crane)	☐ Heavy Objects/ Back Injuries	☐ Utilize protective systems (shoring/sloping)	☐ Use of additional PPE (face shield, goggles, chaps etc.)
☐ Welding /Cutting/Grinding	☐ Heavy Lifting Equipment	☐ Nobody permitted to enter unsafe excavations (ensure access/egress is provided)	☐ Inspection and color coding of electrical tools
☐ Hauling Equipment/Materials	☐ Heavy Earthmoving Equipment	☐ Walk with small steps, take time & watch footing	☐ Inspect tools for signs of excessive wear/damage & replace if necessary
☐ Setting/Moving Timbers/Mats	☐ Trenches/Excavations (Engulfment/collapse)	☐ Never park a vehicle next to heavy equipment	☐ Stay clear of x-ray operations
☐ Coating	☐ Asphyxiation / confined space hazards	☐ Wear appropriate PPE at all times	☐ Install portable lighting in dark areas
☐ Sandblasting	☐ Slips, trips & falls – rough/slippery working surfaces	☐ Use taglines where appropriate	☐ Use bug spray or other means of pest control
☐ Rigging	☐ Possible hit/struck/crushed by moving trucks or equipment	☐ Stay a minimum of 25 ft. from loads and equipment	☐ Store cylinders upright, secured with the caps on and transport properly
☐ Line-ups	☐ Slings, Cables, Chains could break/fail	☐ Use proper lifting techniques (lift with legs)	☐ Identify and avoid poisonous plants
☐ End-facing/Beveling	☐ Exposure to gamma emitting sources & x-ray	☐ Stay clear of equipment when in operation	☐ Use spotter with warning device (air horn)
☐ Climbing to Lower Levels	☐ Abrasive materials (eye injuries/skin abrasions)	☐ Never stand/walk between two pieces of working equipment	☐ Drink plenty of water, take cool down/warm-up breaks
☐ Climbing to Higher Levels	☐ Multiple pinch/crush points	☐ Stay a minimum of 10 ft. from all power lines	☐ Install pressure relief valve (PRV)
☐ X-Raying	☐ Compressed Gases	☐ Utilize goal post system and spotters	☐ Test the atmospheres for hazards
☐ Cell Phone use	☐ Heat Stress/Hypothermia (Hot/Cold weather)	☐ Flashback arrestors must be in place	☐ Ensure proper ventilation
☐ Run cords, hydraulic lines and Kelley hose	☐ Inclement Weather (Lightning/Rain/Snow/Fog/Icy conditions)	☐ Ensure certifications are in place on all lifting equipment, devices and rigging	☐ Wear sunscreen and appropriate clothing
☐ Road Crossing	☐ Falls from an upper level	☐ Inspect pins and cables daily for problems	☐ Never lift with the teeth of buckets
☐ Loading/Offloading equipment/Materials	☐ Without proper communication drill string can turn inadvertently causing pinched by/ struck by	☐ Establish eye contact and intent with the operator of the equipment before approaching	☐ Visually inspect the leads as they are being run out
☐ Installing shoring/trench box	☐ Poisonous plants (Contact Dermatitis)	☐ Stay on designated ROW	☐ Ensure spill kit is readily available
☐ Break connections apart to install or remove rods or tooling	☐ Worn or damaged leads could cause shock or property damage	☐ Establish good communication between workers and drill operator before any operations start	☐ Ensure hoses are properly connected and whip-checks are in place
☐ Pumping	☐ Uneven/unsecured or bulky loads	☐ Only one person directing operator/driller	☐ Inspect wear points on hoses/HDPE and replace damaged/worn sections
☐ Lowering-in product	☐ Components/drill stem potentially remaining under pressure even after "ALL STOP"	☐ Stop work and take cover in inclement weather	
☐ Backfilling	☐ Overloading equipment – equipment failure	☐ Secure ladders, & ensure they are not damaged	☐ Ensure fall protection (tied-off/guard rails/hand rails) are in place
☐ Boring/Directional Drilling	☐ Welding, cutting, burning tools (Fire Hazard)	☐ Road/traffic signs must be up while working.	
☐ Pipe Entry	☐ Pipe falling off rollers or out of calipers	☐ Use flaggers to control vehicle/pedestrian traffic	☐ Inspect calipers for correct size before use
☐ Ballast operations/buoyancy	☐ Rotating tooling, pinched by, struck by	☐ Ensure adequate number of fire extinguishers on site and in vehicles	☐ Do not place hands in the box or on the ends of the drill stem/pipe
☐ Pre-heating	☐ Grinding tools - Flying Sparks and Debris	☐ Close observation of pipe rollers and cradles	☐ Use GFCI's and proper grounding
☐ Refueling	☐ Water Exposure/Drowning	☐ Install back-up alarms/ensure alarms are working	☐ Communicate with the railroad and ensure flagger protection is provided if necessary – don't work within 25 feet without flagger protection!
☐ Making wire connections	☐ Electrical Shock Hazards	☐ Never step or reach over rotating stems/pipe	
☐ Changing out hydraulic components	☐ Safety Latch on rigging inoperable/missing	☐ Position trailer on level terrain if possible	☐ Erect barricades and ensure personnel are kept clear of test area
☐ Break connections apart – EXIT SIDE	☐ Working near live railroad tracks (train traffic)	☐ Set parking brake on vehicles & equipment when not in use	
☐ Hydrotest product line	☐ Environmental release/spill		☐

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SPCC PLAN

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SPILL PREVENTION/CONTROL/ COUNTERMEASURE PLAN (SPCC)

For HDD - Crossings

A DIVISION OF MICHELS CORPORATION

DIRECTIONAL DRILLED CROSSINGS

Revision 0
March 18, 2020

MICHELS DIRECTIONAL CROSSINGS
A DIVISION OF MICHELS CORPORATION

SPILL PREVENTION CONTROL AND COUNTERMEASURE PLAN (SPCC)

HORIZONTAL DIRECTIONAL DRILLING

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I. Introduction

This Spill Prevention Control and Countermeasure Plans (SPCC) have been developed by Michels Corporation (Michels) to serve as a guideline for horizontal directional drilling (HDD) operations. This plan is intended to ensure that the equipment utilized to perform the work and the fuel, oil, and lubricant products used in the day to day operation of the equipment will have no long-term adverse environmental impact on the staging areas required for construction. The guidelines contained in this plan will be implemented by field personnel to prevent accidental releases of hazardous material to the environment and to outline measures taken should an accidental release occur. The drilling project manager for the project is experienced in these matters and is typically the designated Spill Coordinator for Michels.

This SPCC plan was developed using Federal Energy Regulatory Commission (FERC) guidelines for construction activities along a pipeline right-of-way. This plan is intended to comply with all applicable requirements of FERC and local State and County authorities. Since HDD operations are generally confined to two distinct locations, the rig (entry) side and pipe (exit) side, this SPCC plan addresses construction operations at these specific locations only for hazardous materials. This SPCC plan consists of three sections:

- Preventative measures to be taken prior to initiating construction with hazardous materials;
- Preventative procedures to be followed while using hazardous materials during construction;
- Procedures to be implemented should an accidental spill of hazardous material occur;

II. Pre-Construction Hazardous Material Spill Prevention

Prior to construction, all Michels' personnel who will be performing work on site will have attended a FERC-approved environmental training program within the last year. This training program will serve to indoctrinate the personnel and make them aware of the pollution control laws, rules, and regulations applicable to the pipeline right-of-ways. Michels' personnel are highly experienced with the equipment to be used in HDD operations and have worked on numerous FERC governed projects in the past. However all personnel will be refreshed by the project manager and drill superintendent in the operation and maintenance of construction equipment to prevent the accidental discharge or spill of fuel, oil, or lubricants.

Through the environmental training program and the project manager's guidance along with knowledge obtained from past experience, all Michels' personnel will be thoroughly educated on the following topics:

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- Precautionary measures to prevent spills;
- Potential sources of spills, such as equipment failure or malfunction and re-fueling procedures;
- Standard operating procedures in case of a spill, including applicable notification requirements;
- Equipment, Materials, and Supplies available for clean-up of a spill;
- Review of known spill events, if any.

Prior to mobilizing equipment to the proposed alignment R.O.W., Michels will thoroughly inspect and if necessary repair or replace equipment components that could potentially leak hazardous material. The equipment will be cleaned of any debris or material observed to be hazardous. All hazardous material storage containers and secondary containment devices will be inspected and if necessary repaired or replaced.

The spill containment and clean-up materials used by Michels will be inventoried and if necessary re-stocked prior to initiating construction operations. At a minimum, the following spill containment and clean-up materials will be located in a central location at each side of the HDD crossings where equipment is in use or hazardous materials are stored in sufficient quantities to contain and clean-up a spill or release should one occur:

- Spill containment kits typically consisting of the following items
  - 1 x 55 gal poly drum
  - 50 x 18” x 18” absorbent pads
  - 8 x 3” x 4’ absorbent socks
  - 6 x 18” x 18” absorbent pillows
  - 3 x 5” x 10’ absorbent booms
  - 4 Disposable plastic bags with ties
  - 4 pair nitrile gloves
- Plastic sheeting
- Floor Dry absorbent material (50 pound bag-typical)
- Personal protective equipment (i.e. gloves and safety glasses)
- Replacement parts and equipment for repair of tanks, hoses, nozzles, etc.
- Equipment and tools to divert spilled fluids and create earthen barriers

III. HDD Construction Operations Hazardous Material Spill Prevention

Once construction activities for the HDD are underway, hazardous material spill prevention will be a continuous element of the operations. During equipment set up, potential sources of hazardous material releases, i.e. fuel tanks, hydraulic oil tanks and hoses, antifreeze tanks, and lubricant storage bins will be located as far away as practicably possible from streams, wetlands, and drainage ways. If necessary, and if practicable, temporary barriers may be constructed or placed between the potential sources of spills and areas identified as extremely sensitive to accidental

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spills. Spill containment and clean-up materials/kits will be located in a central location at each side of the drill site location where equipment is in operation or hazardous materials are stored and all personnel will be made aware of the location.

Secondary containment devices will be placed to enclose major sources of potential hazardous spill locations (i.e. fuel storage tanks and hazardous materials storage areas). A site layout drawing for entry locations and exit locations showing the placement of significant sources of hazardous material releases and secondary containment measures are attached in **Appendix A** of this plan. The exact location of the equipment will vary to address specific site conditions after the temporary work space has been prepared for equipment set-up. Access to the sites will be limited by the Project Manager to only authorized personnel and visitors.

During construction, spill refresher briefings will be scheduled quarterly and conducted by Michels. The briefings will refresh Michels' personnel on the topics covered during the pre-construction environmental training as well as review operations to date, including any accidental spills that may have occurred and measures taken for prevention of future spills.

Michels will store, handle and transfer hazardous materials used during HDD operations in a manner to prevent accidental releases or spills of these materials. **Table-1** attached in **Appendix-A** to this plan summarizes the hazardous materials, combined expected volumes, and storage methods for both the entry and exit locations. The Material Safety Data Sheets (MSDS) for every product used by Michels are maintained on file in the drilling survey trailer on site should they be required to assess the hazard potential of a spill. The list of primary hazardous materials (petroleum-based products) to be used by Michels over the course of each HDD crossing is as follows:

- Gasoline
- Diesel Fuel
- Hydraulic Oil
- Lubricants
- Penetrating Oils
- Antifreeze

Michels' personnel will follow specific guidelines set forth in this plan during operation and maintenance of equipment and vehicles used in support of the HDD operations. All waste oil or fuel collected during routine maintenance of the equipment will be contained and disposed of in accordance with state and federal requirements.

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IV. Potential Sources of Hazardous Spill-Preventative Measures to be Implemented

For day to day operations, Michels' personnel will follow these guidelines to prevent the accidental release or spill of hazardous materials:

Potential Source of Hazardous Spill	Preventative Measures To be Implemented
Fuel stored in a storage tank	• Except as specified in **Attachment-A** of Appendix-B, locate storage tank at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. • Install secondary containment devices around tank in excess of 150% of the maximum volume to be stored. • Inspect tank and secondary containment daily and before filling, implement corrective action upon discovery of deterioration that could cause a spill or result in a leak. Record inspection results weekly on log attached in the appendix to this plan. • Remove any precipitation found within the secondary containment. Prior to removing the precipitation, inspect for film, sheen, discoloration, sludge, emulsion or tarry residue, if present then collect the liquid for disposal. Do not discharge to land or surface waters. • Plug or close all tank openings when not in use. • Maintain sufficient quantities of spill control and clean-up materials in a central location near the storage tank, inspect supply daily. • Provide security measures to protect against vandalism of stored materials
Liquid material stored in a container	• Except as specified in **Attachment-A** of Appendix-B, store container at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. • If practicable and if room allows, store containers in a central location within a common secondary containment device. All significant container storage (i.e. greater than 5 gallon) will have secondary containment in excess of 150% of the maximum volume proposed to be stored. • Use small containers which are in good condition (maximum 55 gallon drum). • Take measures to protect the containers from the elements or physical damage. • Inspect containers daily, replace immediately if damaged or leaking. Record inspection results weekly on log attached in **Attachment-B** of Appendix-B to this plan • Close containers when not in use. • Maintain sufficient quantities of spill control and clean-up materials in a central location where the containers are regularly used, inspect supply daily. • Provide security measures to protect against vandalism of stored materials

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Liquid material transferred from a storage tank or container to vehicles or equipment	• Except as specified in **Attachment-A** of Appendix-B**,** transfer materials at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. Exercise extreme caution for transfers in areas where set-back distances from sensitive areas cannot be met such as placement of absorbent pads or drip pans beneath transfer points, creating temporary earthen berms, or other similar precautionary spill measures. • Transfer during daylight hours or where lighting is adequate to illuminate the area. • Monitor transfer operations at all times. • Maintain sufficient quantities of spill control and clean-up materials in a central location where transfers regularly occur, inspect supply daily. • Provide security measures to protect against vandalism of stored materials

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Liquid material used in vehicles and equipment	• Except as specified in **Attachment-A** of Appendix-B, park at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. • Inspect daily for leaks or signs of deterioration that could result in a leak. • Repair or replace defective tanks, hoses, fittings, etc. • Maintain sufficient quantities of spill control and clean-up materials in a central location where equipment or vehicles are in use, inspect supply daily. • Provide security measures to protect against vandalism of stored materials

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Liquid material transferred from tank vehicle to vehicles & equipment	• Except as specified in **Attachment A** of Appendix-B, tank vehicle used during re-fueling operations shall be specifically designed for supplying fuel to vehicle or equipment tanks and will comply with the requirements of NFPA 385 and other applicable state and federal requirements. • Tank vehicle and its equipment shall be maintained in good repair. • Drivers to be thoroughly trained in the proper method and operation of tank vehicles and in acceptable unloading procedures. • The driver or operator will not leave vehicle unattended during re-fueling operations • All engines to be shut off and operators not on the equipment during refueling operations. • Smoking is to be forbidden on or near any vehicle involved in re-fueling operations. Extreme precaution shall be exercised to prevent people in the vicinity from smoking, lighting matches, or carrying any flame or lighted device. Signs prohibiting smoking or open flames to be prominently displayed in open view on the tank vehicle. • Re-fueling procedures will not be initiated until precautions have been taken to prevent the motion of vehicles involved. Parking brakes to be utilized if available. • Length of refueling hose is typically limited to 50-feet from the hose reel. Tank vehicle to be positioned with respect to vehicles being fueled in order to prevent unwanted traffic between the tank vehicle and vehicle/equipment being fueled. • Each vehicle must contain one portable fire extinguisher that has a minimum rating of 4A, or 4-B,C. Ratings to be in accordance with NFPA-10. Signage on vehicles shall clearly indicate location of fire extinguisher. • Fueling/Re-fueling operations should typically take place during daylight hours. Nighttime fueling operations conducted in adequately lighted areas. • Documentation of training to be made available upon request. • Provide security measures to protect against vandalism of stored materials

Should these guidelines prove to be inadequate to prevent the accidental release or spill of hazardous material, they will be revised and implemented as required to ensure that every possible preventative effort is being taken. All personnel will be made aware of any such revisions at the time of the revision and at the environmental refresher meetings.

V. HDD Construction Operations Hazardous Material Spill Procedures

A spill is an unintentional release of hazardous material to the environment. In the unlikely event that an inadvertent spill of a hazardous material occurs the following steps will be followed at a minimum:

- Step 1 - Containment: Assess the situation prior to attempting to control the spill. Secure the spill scene and attempt to identify and stop the source of spill and

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contain at source. Limit access to the site in order to prevent/limit personal and/or property damage. Responders must have knowledge of the spilled material and immediately utilize all available resources (i.e. equipment, personnel, and materials), to contain spill. If adequate resources are not available, expedite mobilization of additional resources from other construction activities as required to fully contain the spill. If the spill cannot be adequately handled by additional resources, Michels will arrange for an approved spill response contractor to mobilize to the site and contain, clean up, and perform required sampling and disposal of spilled materials and residual contaminated debris.

- Step 2 - Remediation: Properly trained personnel shall clean up hazardous material immediately after spill is contained to prevent further migration of hazardous materials into the environment. Responders should consult with proper governmental resource agencies as required. In no case shall containment equipment be used to permanently store contaminated material. Containerize in DOT-approved containers, label, and remove all contaminated material from the construction area and dispose of material in accordance with applicable regulatory guidelines (i.e. transport to hazardous waste disposal facility by licensed waste hauler). The Owner will be provided with proper documentation showing that material was disposed of in a proper manner.

- Step 3 - Notification: Reporting requirements will depend on the quantity of spill. A spill constituting less than a significant spill event will be reported to Owner and/or Owner's representative Chief Inspector **(CI)-_____: ( ) - (office), or ( ) - (cell).**

  Significant spills are defined as: any amount of petroleum, oils, or lubricants discharged to a receiving stream that causes a film, sheen, or discoloration of surface water or adjoining shoreline; or any reportable quantity of hazardous material as defined by 40CFR320. If a significant spill should take place, Michels' Project Manager (PM), will notify the Prime Contractors' Project Manager and Owner's representative Chief Inspector **(CI)-_____( ) - (office), or ( ) - (cell)** of the spill as soon as he has confirmed that the spill has been completely contained. Michels' PM will assist the Owner's representative in submitting the regulatory-required information for hazardous spill notification in accordance with Governing Agency procedures. At the very minimum the project superintendent will provide the CI with the information required on the "Spill Report" included as **Attachment C** in Appendix C.

- Step 4 – Michels' Project Manager will be responsible for any applicable agency reporting requirements. The notification requirements for petroleum and hazardous materials spills are as follows:

  - Federal Contacts:
    National Spill Response Center 1-800-424-8802

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- State Contacts:
  State Department of Environmental
  Quality - Spill Notification ( ) - (Business Hours)
  ( ) - (After Hours)

- Local Contacts:
  Local Fire Department _____

- A completed Petroleum and Hazardous Materials Spill Report must be submitted to OWNER & Governmental Agencies within 48 hours.
- Prior to continuing work, Michels will determine the cause of the spill and implement measures to ensure that further spills will not occur.

A More detailed list of Local Emergency Response Personnel and Hospital Location will be attached and filled out as **Attachment D** in Appendix C.

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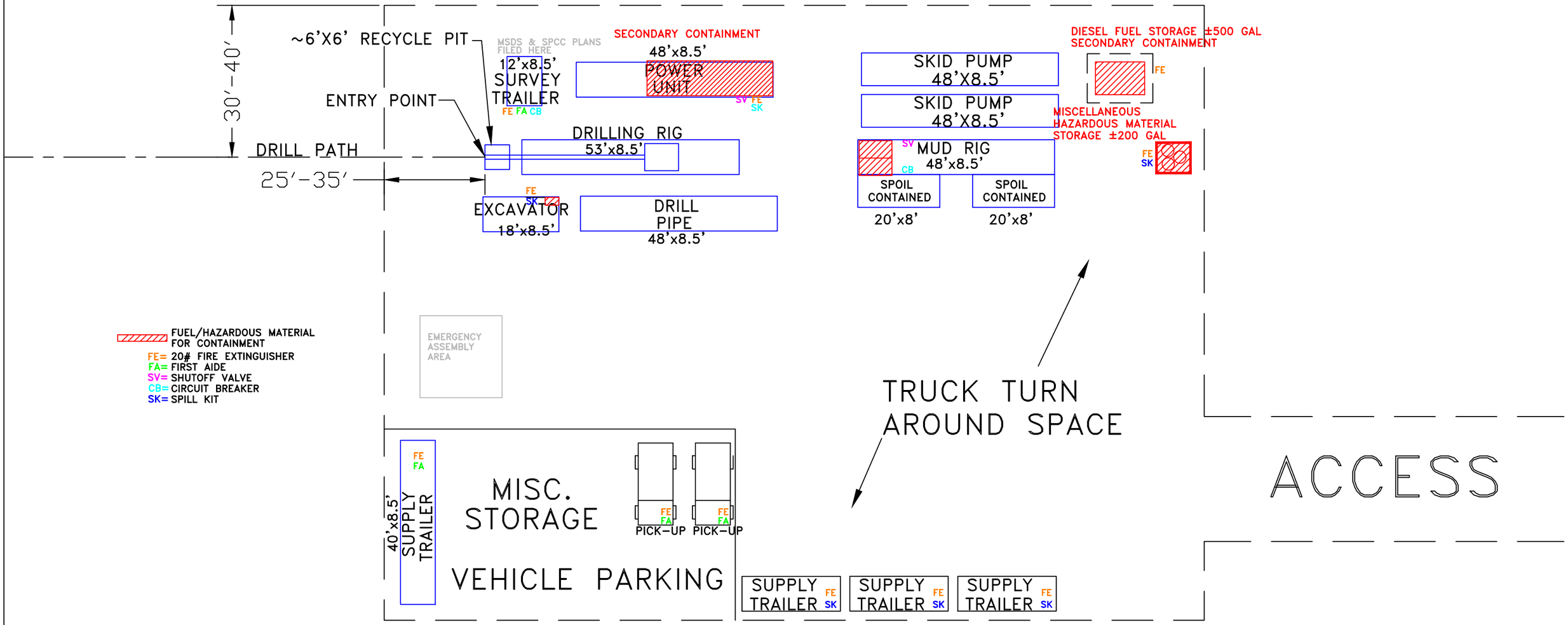
APPENDIX-A

EROSION CONTROL PLACED AROUND PERIMETER OF SITE

200'X150' TEMP WORKSPACE



PLAN VIEW

NOTE: THIS IS A TYPICAL SITE SET-UP. THERE ARE VARIOUS CONFIGURATIONS USED DEPENDING UPON SITE RESTRICTIONS. FIELD MODIFICATIONS TO SUIT SITE.

NOTE: BENTONITE SLURRY PUMPED FROM PIT, COLLECTED & RECYCLED OR DISPOSED OF AT AN APPROVED LOCATION

REVISIONS

NO.	DATE	REVISION DESCRIPTION	SOURCE DRAWING
0			

MICHELS®
817 W. MAIN ST., P.O. BOX 128 BROWNSVILLE, WISCONSIN 53006
PHONE: (920) 583-3132 FAX: (920) 924-4323

DIRECTIONAL BORE FOR: OWNER | PROJECT: PROJECT NAME

DRAWING: ANTICIPATED ENTRY SITE LAYOUT

SCALE: NTS | LOCATION: CROSSING NAME

DRAWN BY: B.J.E. | MDC JOB #: xxx | DATE: 3 / 18 / 20

TABLE I

HAZARDOUS SUBSTANCE INVENTORY

Material	Quantity (gallons)	Storage Location	Reportable Quantity (include reference)
Oil/Fuel:			
Unleaded Gasoline	**10 Gallons**	**5 Gallon DOT-Approved Re-fill able Cans - Storage Trailer**	
	80 Gallons	**Fuel Tank in Bed of Pick-Up Truck**	
Diesel Fuel	**120 Gallons**	**Fuel Tank in Bed of Pick-Up Truck**	
	500 Gallons	**Fuel Tank w/Secondary Containment on Site in excess of 150% of maximum volume**	
Motor Oil	**1 or 5 Gallons**	**Reinforced Plastic Container - Storage Trailer**	
Hydraulic Oil	**110-Gallons**	**Two 55-gallon drums w/Secondary Containment on Site in excess of 150% of maximum volume**	
Commercial Chemicals:			
Ethylene Glycol	**40-Gallons**	**1 or 5 Gallon Reinforced Plastic Containers - Storage Trailer**	
Hazardous Wastes:			

APPENDIX-B

Attachment A

The setbacks specified for refueling, fuel storage, and parking of equipment may not be practicable for certain construction activities, including horizontal directional drilling. Exceptions to the setback requirements may be allowed for:

- Areas where removing equipment from a wetland for servicing or overnight parking would increase adverse impacts to the wetland and/or result in significant construction delays;
- Construction sites where moving equipment to refueling stations from pre-fabricated equipment pads is impracticable or where there is a natural barrier from the water-body or wetland (i.e., dike, road or railroad);
- Locations where the water-body or wetland is located adjacent to a road crossing (from which the equipment can be serviced);
- Refueling and fuel storage for immobile equipment including, but not limited to, bending and boring machines, air compressors, padding machines, and hydro-test fill pumps.

ATTACHMENT B
WEEKLY HAZARDOUS MATERIALS/WASTE INSPECTION LOG

For each item listed below, Contractor will indicate whether existing conditions are acceptable (A) or unacceptable (U). Resolution of all unacceptable conditions must be documented. Contractor will inspect all storage facilities on a regular basis, but not less than weekly. Contractor will keep records of all inspections on file. Contractor will provide a coy of the completed form to the Chief Inspector and Environmental Inspector on a weekly basis.

I. STORAGE AREAS FOR FUELS, LUBRICANTS AND CHEMICALS

General

A/U

_____ Construction yard or storage areas secured

_____ National Fire Protection Association symbol posted in storage area or at yard entrance

_____ Storage areas properly prepared and signed

_____ Material Safety Data Sheets available

_____ Hazardous Materials Management Plan/Spill Prevention and Countermeasure Plan available

Hazardous Materials Management

A/U

_____ No evidence of spilled or leaking materials

_____ Incompatible materials separated

_____ All containers labeled properly

_____ All containers securely closed

_____ All containers upright

_____ No evidence of container bulging, damage, rust or corrosion

Secondary Containment Areas

A/U

_____ Containment berm intact and capable of holding 110% of material stored plus precipitation

_____ Lining intact

_____ No materials overhanging berms

_____ No materials stored on berms

_____ No flammable materials used for berms

Compressed Gases

A/U

_____ Cylinders labeled with contents

_____ Cylinders secured from falling

_____ Oxygen stored at least 25 feet away from fuel

_____ Cylinders in bulk storage are separated from incompatible materials by fire barriers or by appropriate distance

II. HAZARDOUS WASTE MANAGEMENT

Waste Container Storage

A/U

_____ No evidence of spilled or leaking wastes

_____ Adequate secondary containment for all wastes

_____ Separate containers for each waste stream—no piles

_____ Waste area not adjacent to combustibles or compressed gases

_____ All containers securely closed

_____ Bungs secured tightly

_____ Open-top drum hoops secured

_____ All containers upright

_____ No evidence of container bulging, corrosion

_____ No severe container damage or rust

_____ Containers are compatible with waste (e.g. plastic liner for corrosives, metal liner for solvents)

_____ No smoking and general danger/warning signs posted

Waste Container Labeling

A/U

_____ Containers properly labeled

_____ Name, address and EPA ID number or ID Number of generator listed (Not required if Contractor is an exempt small quantity generator.)

_____ Accumulation start date listed

_____ Storage start date listed

_____ Chemical and physical composition of waste listed

_____ Hazardous property listed

Nonhazardous Waste Areas

A/U

_____ No litter in yard

_____ No hazardous wastes or used oil mixed with trash (e.g., contaminated soil, oily rags, diapers, or other oily materials)

_____ Empty oil and aerosol containers for disposal are completely emptied

III. EMERGENCY RESPONSE EQUIPMENT

A/U

_____ Shovels

_____ Absorbent materials (booms, pads, pillows, socks, “Speedy Dry”

_____ Personal protective equipment (goggles, gloves)

_____ Fire-fighting equipment

_____ First aid supplies (e.g. medical supplies, squeeze bottle eye wash)

_____ DOT-approved containers

_____ Plastic sheeting, bags and ties

_____ Communication equipment

_____ Bung wrench (non-sparking)

IV. CORRECTIVE ACTIONS TAKEN (Required for all unacceptable conditions)

_____

_____

_____

_____

_____

_____

_____

_____

_____

Date: _____ **Contractor Name :** _____

Inspected by (Contractor’s Inspector): _____

Signature: _____

APPENDIX-C

ATTACHMENT C

Petroleum and Hazardous Material Spill Report

Date of spill: _____ Incident No: _____ Date of spill discovery: _____

Time of spill: _____ Time of spill recovery: _____

Location Name: _____ Spread: _____ County: _____

Section: _____ Township: _____ Range: _____

Name and Title of Discoverer: _____

Type of material spilled and product name: _____

Manufacturer's Name: _____

Legal description of spill location: _____

Directions from nearest community: _____

_____

_____

Estimated volume of spill: _____ Estimated material recovered: _____

Weather Conditions: _____

Topography and surface conditions of spill site: _____

Spill medium (pavement, sandy soil, water, etc.): _____

Proximity of spill to surface waters or wetland: _____

Did the spill reach a water body? _____ Yes _____ No

If so, was a sheen present? _____ Yes _____ No

Direction and time of travel (if in stream): _____

Responsible party (name, phone number): _____

Describe the causes and circumstances resulting in the spill: _____

_____

_____

Describe the extent of observed contamination, both horizontal and vertical (i.e., spill-stained soil in a 5'' radius to a depth of 1"):

_____

_____

Resources and installations that may be affected: _____

_____

_____

Potential impact on human health: _____

Describe immediate spill control and/or cleanup methods used and implementation schedule: _____

Current status of cleanup actions: _____

Name/Company/Address/Phone Number for the following:

Construction Superintendent: _____

OWNER
Representative: _____

Environmental Director: _____

Person Who Reported the Spill: _____

Environmental Inspector: _____

On-Scene Agency Coordinator (where applicable): _____

Form completed by: _____ Date: _____

The Contractor must complete this for any petroleum or hazardous material spill regardless of size, and submit the form to OWNER or OWNER's designated representative for construction observation within 48 hours of the occurrence.

ATTACHMENT D
LOCAL Emergency RESPONSE PERSONNEL-HOSPITAL LOCATION

The contractor should provide a listing by municipality of the local emergency response organizations near the HDD project site, and the name and phone number of a contact person for each. For example, list fire and police departments, emergency management organizations, etc. The contractor should update and complete this information as required for his/her work locations. Additions will be made by the Project Manager once they become available prior to drilling operations.

Local Emergency Contacts

- Federal Contacts:
  National Spill Response Center 1-800-424-8802

- State Contacts:
-
-
- Local Contacts:
  Emergency Response -
  Emergency Response -
  Local Fire Department 911
  Local Police Department 911

- Nearest Hospital:

Other Phone Numbers to be added to this form if necessary.

MICHELS®

ATTACHMENT

DRILL RIG SPECIFICATIONS

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817 W. Main Street, P.O. Box 128
Brownsville, WI 53006
Telephone: (920) 583-3132
Fax: (920) 583-3429
www.michels.us

HERCULES
(11) RIGS OWNED & OPERATED

DRILL RIG SPECIFICATIONS

Weight:	100,000 – 103,000 Pounds
Height:	13’ 6”
Length:	53’
Width:	8’ 6”
Horsepower:	1500+ HP (750 HP ea)

DRILL RIG CAPACITY

Torque Capacity:	164,500 Ft/Lbs
Max Spindle Speed:	90 RPM
Thrust/Pull:	1,260,000 Lbs

DRILLING SPECIFICATIONS (DIRT)

MAXIMUM RECOMMENDED

Back Ream:	96”
Drilling Distance:	8,000’

DRILLING SPECIFICATIONS (ROCK)

MAXIMUM RECOMMENDED

Back Ream:	60”
Drilling Distance:	8,000’

SURVEY SYSTEM SPECIFICATIONS

Type:	**Downhole probe** transmits tool face, 3 dimensional coordinate data	
Accuracy:	+/-0.1º All Angles	
Max Locating Depth:	Unlimited	
	Tool face	±0.5º
Type:	**Gyro-Steering Tool**	
Accuracy:	Inclination	±0.01°
	Azimuth	±0.04°
	Tool face	±0.02°

SECONDARY SURVEY SYSTEM SPECIFICATIONS

Type:	**ParaTrack**	
Accuracy:	Inclination	±0.1º
	Azimuth	±0.4º
	Tool face	±0.5º

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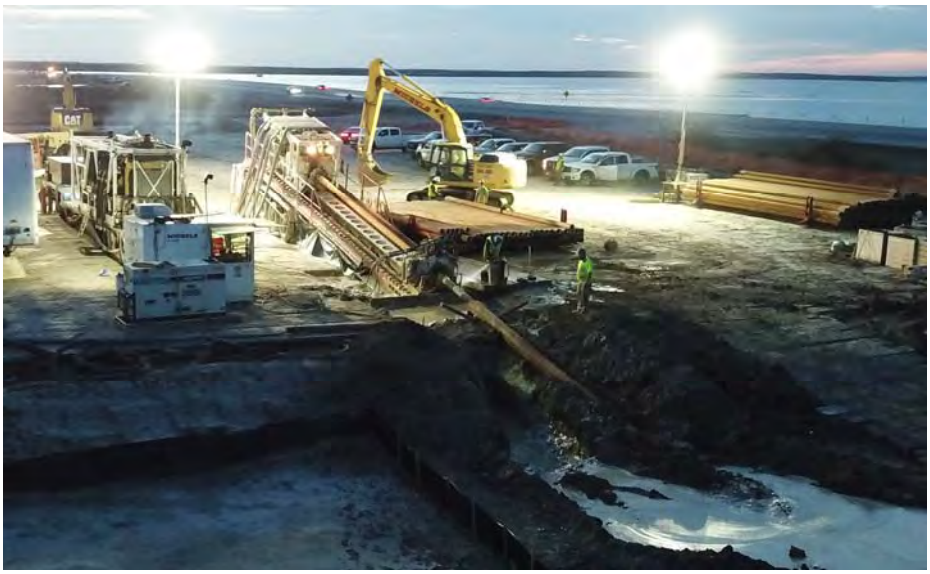
Fax: (920) 583-3429
www.michels.us



ATLAS 840
(7) RIGS OWNED & OPERATED

DRILL RIG SPECIFICATIONS

Weight:	88,000 – 93,000Lbs Varies
Height:	13’ 6”
Length:	54’
Width:	8’ 6”
Engine:	Dsl Cat Model 3456 or 3412
Horsepower:	660 HP or 750 HP

DRILL RIG CAPACITY

Torque Capacity:	164,500 Ft/Lbs
Max Spindle Speed:	100 RPM
Thrust/Pull:	840,000 Lbs

DRILLING SPECIFICATIONS (DIRT)

MAXIMUM RECOMMENDED

Back Ream:	60”
Drilling Distance:	6,500’

DRILLING SPECIFICATIONS (ROCK)

MAXIMUM RECOMMENDED

Back Ream:	52”
Drilling Distance:	6,500’

SURVEY SYSTEM SPECIFICATIONS

Type:	**Downhole probe** transmits tool face, 3 dimensional coordinate data	
Accuracy:	+/-0.1º All Angles	
Max Locating Depth:	Unlimited	
	Tool face	±0.5º
Type:	**Gyro-Steering Tool**	
Accuracy:	Inclination	±0.01°
	Azimuth	±0.04°
	Tool face	±0.02°

SECONDARY SURVEY SYSTEM SPECIFICATIONS

Type:	**ParaTrack**	
Accuracy:	Inclination	±0.1º
	Azimuth	±0.4º
	Tool face	±0.5º

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ATTACHMENT

HDD PLAN AND PROFILE DRAWING

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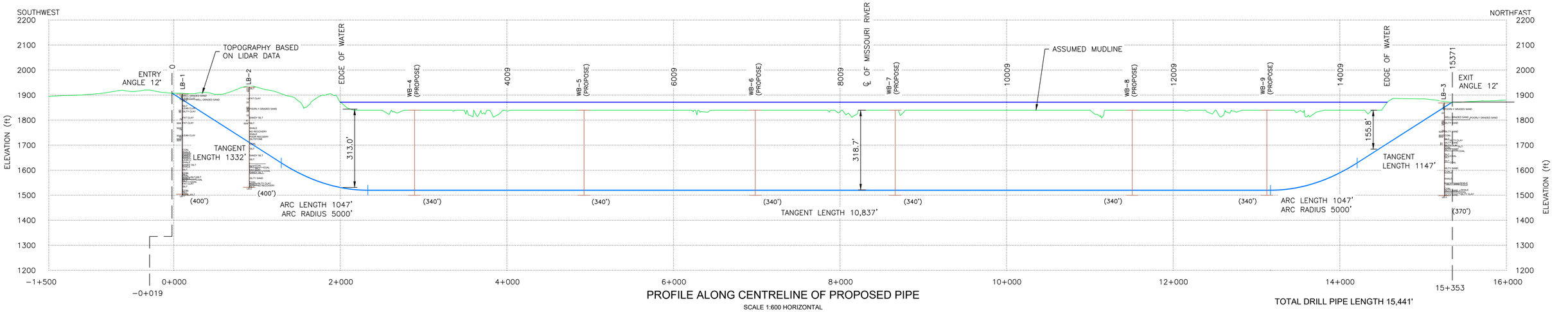
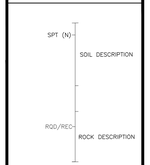
PLAN VIEW
SCALE 1-in:600-ft



PROFILE ALONG CENTRELINE OF PROPOSED PIPE
SCALE 1:600 HORIZONTAL
SCALE 1:300 VERTICAL

TOTAL DRILL PIPE LENGTH 15,441'

BORING LEGEND



HORIZONTAL DIRECTIONAL DRILL DATA MISSOURI RIVER		
DESCRIPTION	STATION (ft)	ELEVATION (ft)
ENTRY @ 12°	−0+019	1908.07
PC1 = 5000' RADIUS	1+293.20	1629.26
PT1 =	2+332.76	1520.00
PC2 = 5000' RADIUS	13+170.24	1520.00
PT2 =	14+210.00	1629.26
EXIT @ 12°	15+353.00	1872.17
HORIZONTAL DISTANCE (ft) = 15371		
DIRECTIONAL DRILL PIPE LENGTH (ft) = 15441.16		

REFERENCE DOCUMENT NO.	DATE
1.	

CCI & Associates Inc.
20333 State Highway 249, Suite 480
Houston, TX 77070
COR F-18518

ENGINEER AND PERMIT STAMPS

ISSUED FOR REVIEW NOT FOR CONSTRUCTION

PIPELINE SPECIFICATIONS

OUTSIDE DIAMETER (OD)(in)	24
WALL THICKNESS (WT)(in)	1.219
GRADE (psi)	52,000
PRODUCT	NATURAL GAS
MATERIAL	STEEL
SPECIFICATIONS	API 5L
INTERNAL COATING	N/A
OUTER COATING	DUAL FBE
MAX. OPER. PRESSURE (psi)	1,480
MIN. TEST PRESSURE (psi)	1,850
MAX. OPER. TEMP (°F)	100
MIN. INSTALLATION TEMP (°F)	23

STEERING TOLERANCES

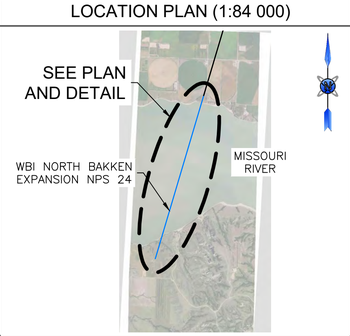
	30ft	100ft	330ft
MINIMUM RADIUS (ft)	1000	1450	4500

PULL FORCE / RIG SIZE / STRESS

PULL FORCE (w/ BUOYANCY CONTROL):	863,000 lbs (w/sf)
MINIMUM RECOMMENDED RIG SIZE:	1,000,000 lbs
COMBINED STRESS UNITY CHECK:	0.44
OPERATING STRESS	65.7%

DRAWING STATUS	DATE	DRN	CHK	DES	GEO	APR	CR
ISSUED FOR REVIEW	2019-12-19	MS		KP		KP	
PRELIMINARY	2019-10-23	MS		KP		KP	
PRELIMINARY	2019-07-25	TL	MAL	KP		KP	
PRELIMINARY	2019-06-14	RL		KP		KP	
PRELIMINARY	2019-06-11	RL		KP		KP	
PRELIMINARY	2019-03-11	AN		CG		KP	

LOCATION PLAN (1:84 000)



ND83-NF

WBI NORTH BAKKEN EXPANSION PROJECT

MISSOURI RIVER HDD CROSSING
PLAN AND PROFILE

WATFORD CITY / TIOGA, NORTH DAKOTA

SCALE	DWG. #	REVISION	SHEET
AS SHOWN	2386-EG-0101	A	1 OF 2

File Name: S:\Current Jobs\2386-WBI-N.Bakken Expansion\Eng\Drawings\01-Lake Sakakawea\Missouri River\Preliminary\2386-EG-0101-F.dwg Date/Time: 11-Dec-19 / 3:48:23 PM Last Saved By: Matthew.Smith

ATTACHMENT

ANTICIPATED ENTRY/EXIT EQUIPMENT

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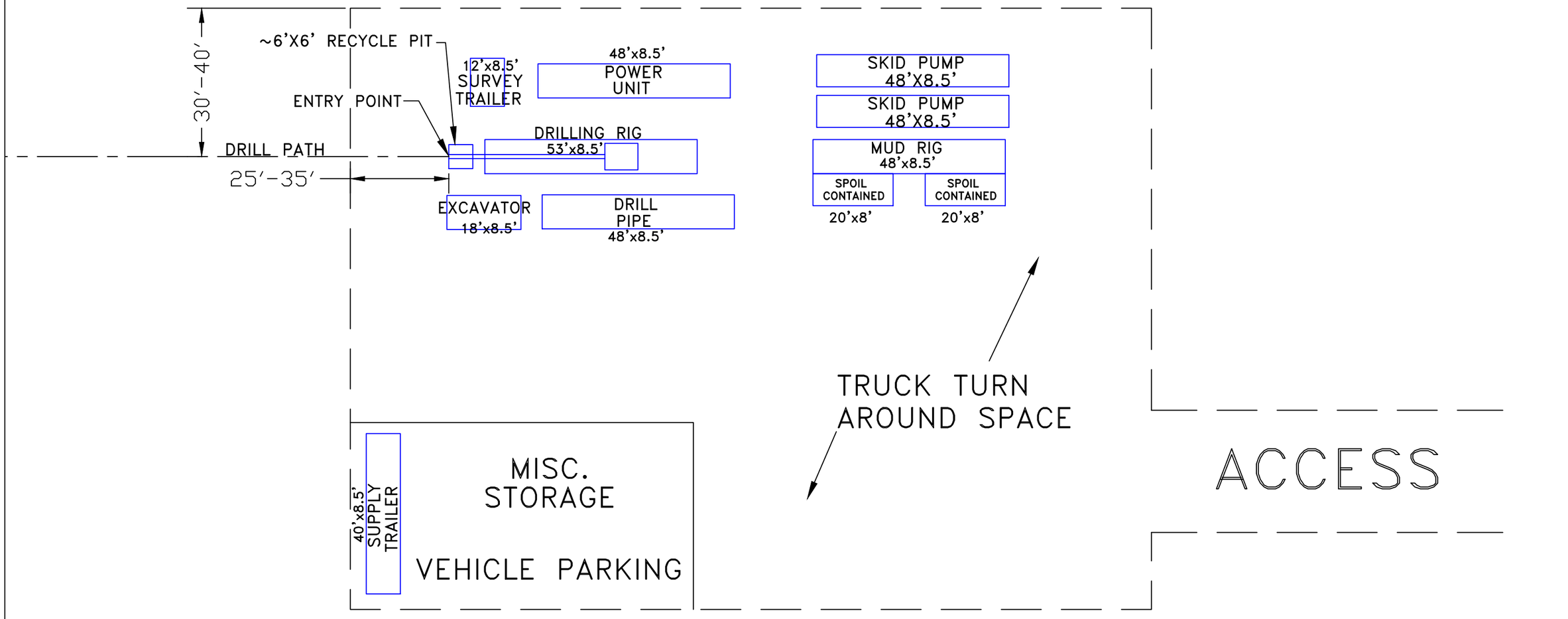
200'X150' TEMP WORKSPACE



PLAN VIEW

NOTE: THIS IS A TYPICAL SITE SET-UP. THERE ARE VARIOUS CONFIGURATIONS USED DEPENDING UPON SITE RESTRICTIONS. FIELD MODIFICATIONS TO SUIT SITE.

NOTE: BENTONITE SLURRY PUMPED FROM PIT, COLLECTED & RECYCLED OR DISPOSED OF AT AN APPROVED LOCATION

REVISIONS

NO.	DATE	REVISION DESCRIPTION	SOURCE DRAWING
0			

MICHELS®
817 W. MAIN ST. P.O. BOX 128 BROWNSVILLE, WISCONSIN 53006
PHONE: (920) 583-3132 FAX: (920) 924-4323

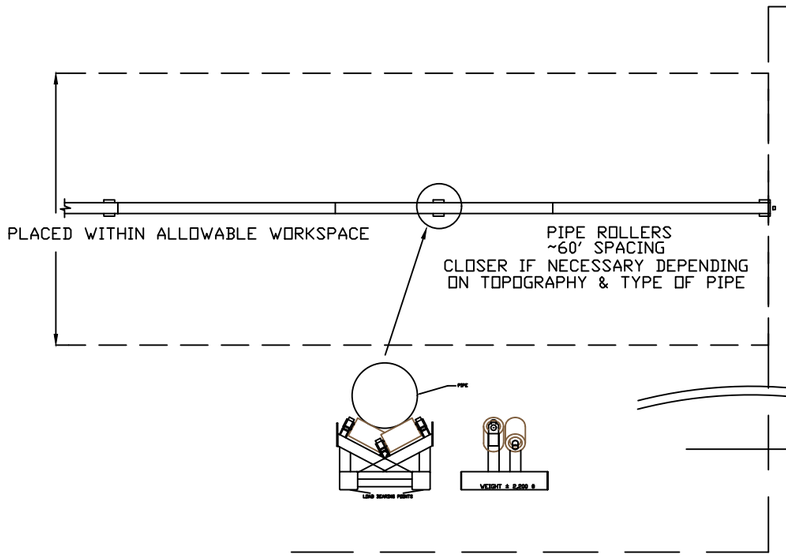
DIRECTIONAL BORE FOR: OWNER | PROJECT: PROJECT NAME

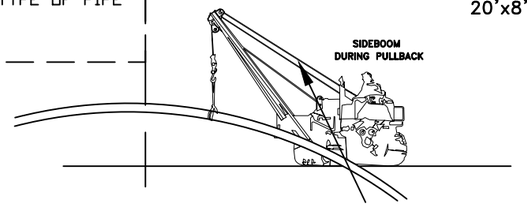
DRAWING: ANTICIPATED ENTRY SITE LAYOUT

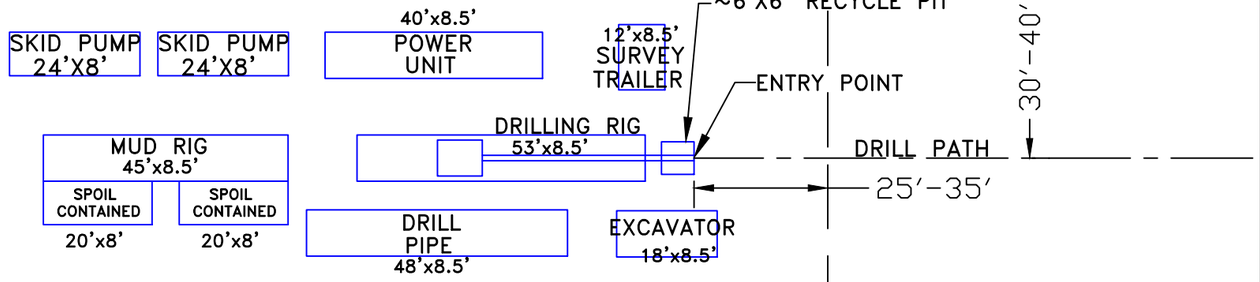
SCALE: NTS | LOCATION: CROSSING NAME

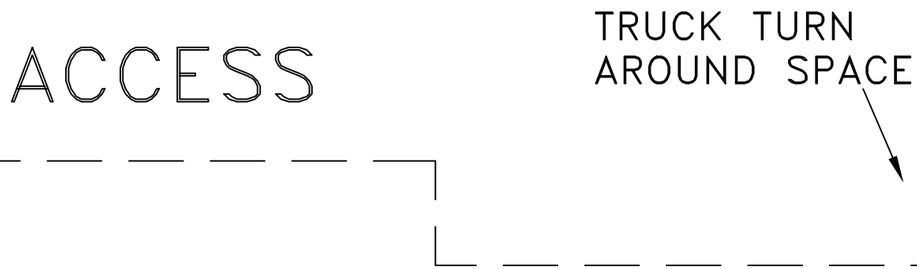
DRAWN BY: B.J.E. | MDC JOB #: xxx | DATE: 1/6/18

200'X150' TEMP WORKSPACE









PLAN VIEW

NOTE: RIG AND SUPPORT EQUIPMENT SHOWN MAY OR MAY NOT BE REQUIRED BUT SHALL BE PLANNED FOR IN CASE A HOLE INTERSECT IS REQUIRED AND/OR AS A HDD CONTINGENCY MEASURE

NOTE: THIS IS A TYPICAL SITE SET-UP. THERE ARE VARIOUS CONFIGURATIONS USED DEPENDING UPON SITE RESTRICTIONS. FIELD MODIFICATIONS TO SUIT SITE.

NOTE: BENTONITE SLURRY PUMPED FROM PIT, COLLECTED & RECYCLED OR DISPOSED OF AT AN APPROVED LOCATION

REVISIONS

NO.	DATE	REVISION DESCRIPTION	SOURCE DRAWING
0			

MICHELS®
817 W. MAIN ST. P.O. BOX 128 BROWNSVILLE, WISCONSIN 53006
PHONE: (920) 583-3132 FAX: (920) 924-4323

DIRECTIONAL BORE FOR: OWNER	PROJECT: PROJECT NAME
DRAWING: ANTICIPATED EXIT SITE LAYOUT	
SCALE: NTS	LOCATION: CROSSING NAME
DRAWN BY: B.J.E.	MDC JOB #: xxx
DATE: 1/6/18	

ATTACHMENT

MGS STEER TOOL SYSTEM

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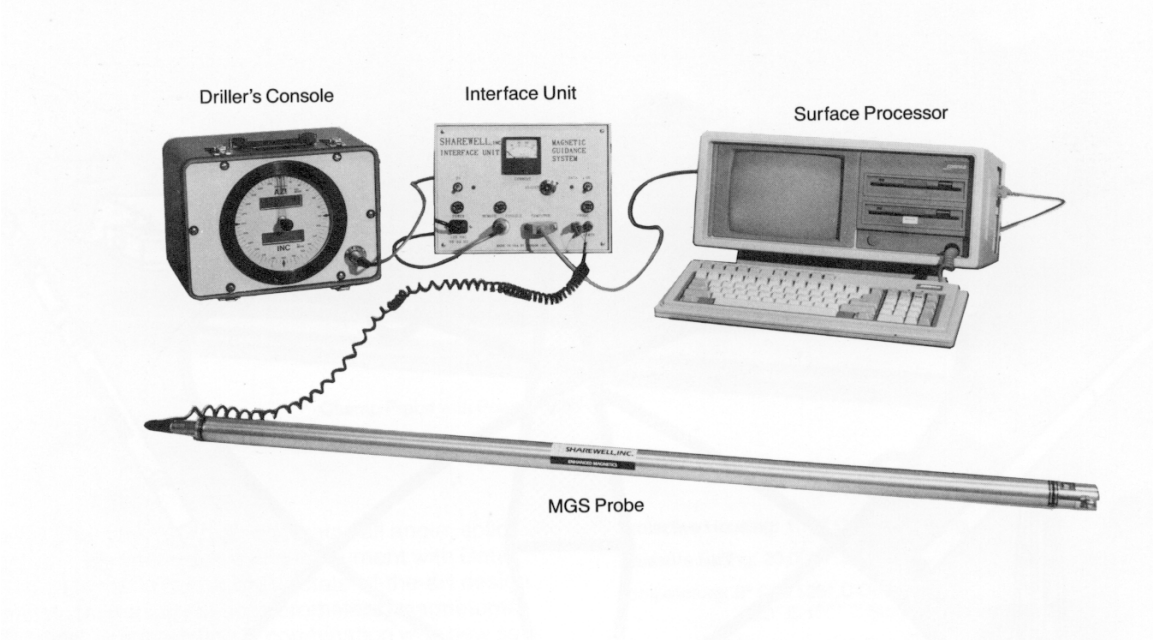
MAGNETIC GUIDANCE SYSTEM



The Magnetic Guidance System (M.G.S.) is designed to address a wide range of applications from normal oil and gas drilling to drainhole and pipeline river crossing drilling.

While directional drilling with either a downhole motor or jetting operation, the system permits you to guide the bit with utmost accuracy. Data is transmitted to surface via a single-conductor wireline.

The system comprises three main sub-sections: the downhole probe, the surface processing unit, and the driller's remote display.

Useful features include the ability to monitor the magnetic moments during drilling operations and to perform probe operational diagnostics while downhole as well as to verify probe calibration at the drilling location.

The directional engineer has the option to drill using either magnetic tool face or gravity tool face, along with having the magnetic hole direction and hole inclination displayed on a continuous basis from the remote readout. The surface processing unit provides duplicate output as the remote display, as well as the magnetic parameters including voltage temperature. A printed record of the data is available at selected intervals by the operator. The M.G.S. downhole probe incorporates the latest technology in accelerometers, magnetometers, calibration and modeling techniques to provide a rugged and reliable tool.

PROBE SPECIFICATIONS

SENSORS:

3 Axis Accelerometers → All Angle Capability
3 Axis Magnetometers → All Angle Capability

DIMENSION & RATING:

Probe Length	47.25"
Probe Diameter	1.38"
Protective Housing	1.75" x 6'
Protective Housing Pressure Rating	20,000 P.S.I.
Maximum Operating Temperature	125°C
Repeatability	0.2° at Horizontal 0.5° at 4° or Less
Accuracy	± 1%

DRILLER'S CONSOLE:

Two 4-character L.C.D. displays for Inclination, Azimuth and Tool Face Mode
360° Rotating Pointer for Tool Face Position
Hermetically Sealed Unit
12 Vac Operation
Electronics Isolated From Case
Easily Positioned Near Driller

SOFTWARE:

Displays Individual Sensor Values
Display of All Magnetic Parameters
Tool Face Offset Option
Complete Diagnostic Check
Automatic Tool Face Switching Mode Option
Data Printout on Request
Menu Driven
Borehole Survey Calculations

SURFACE PROCESSOR:

COMPAQ Portable or IBM Compatible with Printer

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ATTACHMENT

GYROSCOPIC
STEER TOOL SYSTEM

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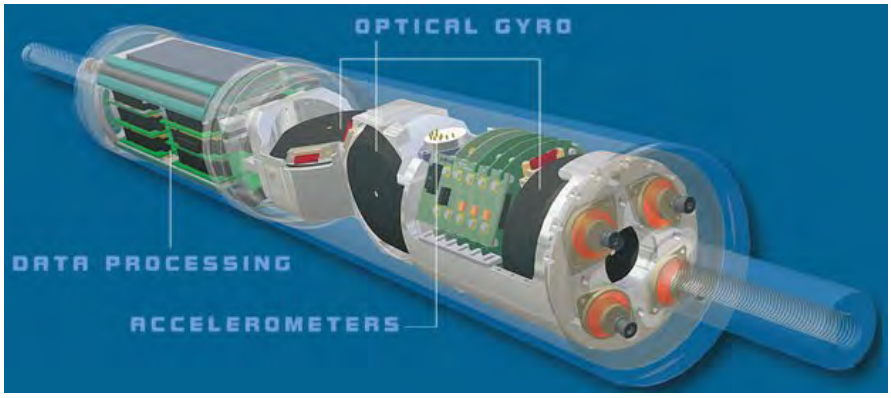
DRILLGUIDE GYRO STEERING TOOL



Technical Specifications –

Electric Power (Input on surface)	110-Volts AC / 50 Hz
Electric Power (Output to Downhole Tool)	48-Volts AC
Tool OD	6-5/8-inches
Tool Length	9-ft
Tool Joint Connection (Box Up x Pin Down)	4-1/2 IF
Maximum Allowed Torque (on Tool Housing)	18,000-foot pounds
Maximum Allowed Push/Pull (on Tool Housing)	75,000-pounds
Maximum Allowed Temperature (on Tool)	120-f
Maximum Allowed Shock (on Tool)	50-g (half sine wave)
Maximum Allowed Vibration (on Tool)	20-g up to 200-Hz
Maximum Allowed Mud Pressure (on Tool)	650-psi
Maximum Allowed Side Load (on Tool Housing)	33,000-pounds

Accuracy –

Azimuth	0.04°
Inclination	0.01°
Tool Face	0.02°

For additional information - http://www.drillguide.com

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ATTACHMENT

PARA TRACKER SYSTEM

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Vector Magnetics LLC
236 Cherry Street
Ithaca, New York 14850
607-273-8351 Fax: 607-273-6137

ParaTrack2 Survey and Guidance System Specifications

Downhole Survey Probe

Shock mounted triaxial accelerometers and magnetometers, temperature sensor and digitizing circuitry contained in 1.750 in. dia. x 55.3 in. long beryllium copper pressure barrel. Telemetry and power via wireline.

Temperature Rating:	85°C
Pressure Rating:	1200 bar
Survey Accuracy:	
Inclination:	±0.1°
Azimuth:	±0.4°
Toolface:	±0.5°
Maximum wireline length:	5000 meters

Interface Unit

Input:	85-265 VAC 50-60 HZ
Output:	48VDC, 50 mA

Guidance System

A single signal wire earthed at each end or with a return wire to close the loop.

Guidance Unit Input:	85-265 VAC 50-60 HZ
Guidance Unit Output:	34 VRMS, 6 Amps p-p max.
Position Accuracy:	±2% of separation from signal wire

Drillpipe and Borehole Pressure Module

(requires compatible survey probe)

Borehole gauge, 0-500 psi Full Scale, 1200 psi survival, 2400 psi burst
Drillpipe gauge, 0-2000 psi Full Scale, 6000 psi survival, 10000 psi burst
Non-linearity +/-0.1 %FS
Hysteresis +/-0.015 %FS
Repeatability +/-0.01 %FS

ATTACHMENT

PARA TRACK GYRO MODULE

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PGM

PARATRACK GYRO MODULE

IMMUNE TO MAGNETIC INTERFERENCE

The ParaTrack Gyro Module (PGM) is the latest in a long line of Vector Magnetics innovations for the HDD market. With no concern of magnetic interference from nearby active utility lines, shorepiles, ship traffic or other transportation activity, drilling may be carried out confidently, regardless of surrounding conditions.

The PGM runs in conjunction with the ParaTrack Steering Tool, providing the ability to tie in with the entire ParaTrack System of tools and software. The PGM is especially effective for initial surface entry, while absolute position may then be verified via the ParaTrack2 Guide Wire or Beacon Tracker, providing confidence that the bore is placed properly relative to the planned exit location prior to punch out.

Features

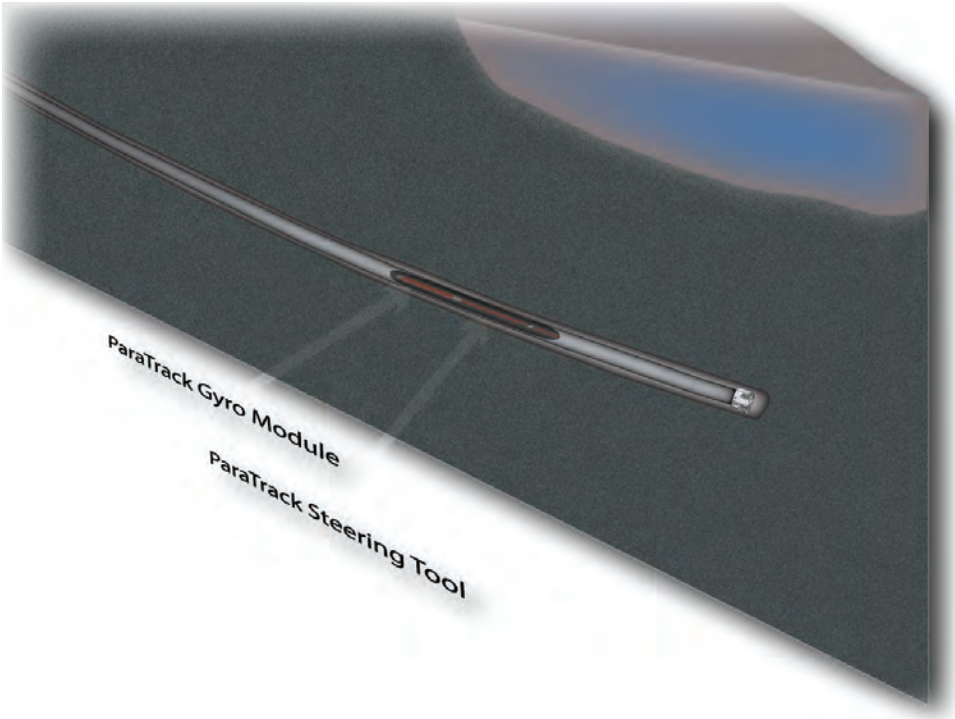
- Fiber optic north seeking gyro system
- Compatible with the entire ParaTrack line of Steering, Tracking and Surveying tools

Benefits

- Accurate surveying in cases of severe magnetic interference
- No specialized handling or personnel required
- Surveys immune from drillstring vibration

Applications

- Surveying in densely developed urban areas
- Verification and correction of magnetic azimuth in long unguided sections



Specifications

Outside Diameter: 2.75" (requires 3.5" collar)

Length: Head to foot - 48"

Internal Operating Temperature: 0-70C

Electrical Connection: 1-3/16", 12 tpi (standard wet connect)

Copyright © 2017 Vector Magnetics LLC

ATTACHMENT

TENSTEER TOOL

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TENSTEER DRILLER'S CONSOLE

- Features a 10.4" TFT color LCD with backlight that is sunlight readable
- Physical dimensions are 12.3" X 10.3" X 4.0"
- Weight is less than 12 lbs
- Operating temperature is –10° C to 70° C
- Internally protected against shock and vibration
- Sealed, metal construction that is resistant to dust, dirt and liquids
- 24V DC input power provided by Tensteer Steering Tool Receiver (STR)
- Inclination: Digital Display, ±90° range with 0.1° resolution
- Azimuth: Digital Display, 360° range with 0.1° resolution
- Tool Face: Digital Display, 360° range with 2.0° resolution
- Tool Face has magnetic and high side indicators
- Values for HTOT and GTOT are displayed
- Pipe and Annulus Pressure are capable of being displayed

For more information, contact Tensteer LLC at the following:

4245 Gattis School Rd Round Rock, TX 78664
Phone: 512-670-0447
Fax: 512-670-1070
Email: fred@tensteer.com
Website: www.tensteer.com

TENSTEER HIGH RESOLUTION STEERING TOOL PROBE

- Probe size: 1.75” diameter x 49” long
- Operating temperature: -20°C to 75°C
- Pressure rating: 12,000 psi
- Shock: 1000g, 0.5 msec, half sine
- Vibration: 30g peak, 30 to 500 Hz
- Maximum lateral displacement error: 2.6 ft. per 1000 ft. or a conical uncertainty of ±0.15°
- Survey resolution: 0.02°
- Magnetic resolution: <0.5 nT
- Power: 36 - 42 VDC, 70 mA
- Can track with DC power supply or welder
- Pressure and gamma upgradable
- Compatible with TrueGyde Software
- Can upgrade Tensor Probes

For more information, contact Tensteer LLC at the following:

4245 Gattis School Rd Round Rock, TX 78664
Phone: 512-670-0447
Fax: 512-670-1070
Email: fred@tensteer.com
Website: www.tensteer.com

TENSTEER STEERING TOOL RECEIVER (STR)

- Physical dimensions: 8.2″ X 8.3″ X 11″
- Weight: under 10 lbs
- Operating temperature: -20°C to 70°C
- Internal shock and vibration protection
- Powered by 110 VAC, 60Hz or 220 VAC 50 Hz, 60W max
- Three communication ports – USB, 9 Pin RS232, 25 Pin RS232
- Compatible with Tensor STDC and future Tensteer Driller's Consoles
- Wireline current shown on analog meter
- Power and data status shown on LED lamps

For more information, contact Tensteer LLC at the following:

4245 Gattis School Rd Round Rock, TX 78664
Phone: 512-670-0447
Fax: 512-670-1070
Email: fred@tensteer.com
Website: www.tensteer.com

ATTACHMENT

DAILY TRACKING FORMS

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Date:
Location:
Superintendent:

MICHELS®

FIELD REPORT

Tester Name
Michels Directional Crossings
817 W. Main Street, Brownsville, WI 53006
E-mail address

TIME	DENSITY "MUD WEIGHT" (lbs/gal)	FUNNEL VISCOSITY use Marsh funnel (sec/qt)	Solids/Sand Content (% by Vol)	pH	Comments

DRILL FLUID PRODUCT USED		DRILL FLUID HAULED OFF
Bentonite Type:	**Additives:**	
Drill-Terge:		

MICHELS DIRECTIONAL CROSSINGS
DAILY PROGRESS REPORT

DATE:
WEATHER:
PREPARED BY:
LOCATION: *ENTRY:* *EXIT:*

MICHELS JOB #

MICHELS®

	EMPLOYEE	CLASS	HOURS	
ENTRY SIDE				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.

	EMPLOYEE	CLASS	HOURS	
EXIT SIDE				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.
				Hrs.

OPERATIONAL INFORMATION

CONDUCTOR CASING:	*Entry:*				
	Exit:				
HOLE SIZE / OPERATION:	*Entry Side*				
TOOL USED:					
TODAY's FOOTAGE:					
TOTAL FOOTAGE:					
% COMPLETED:					
COMPLETED PILOT HOLE:					

DRILLING FLUIDS INFORMATION

	ENTRY			EXIT	
BENTONITE TODAY:					Pallets
BENTONITE TO DATE:		Pallets			Pallets
WATER USED TODAY:					Gal.
WATER USED TOTAL:		Gal.			Gal.
LOSE CIRCULATION TODAY:					
VAC TRUCKS HAULED TODAY:		Ea.			Ea.
DISPOSAL VOLUME TODAY:		Gal.			
DISPOSAL VOLUME TOTAL:		Gal.			Gal.
DUMP TRUCKS TODAY:		Ea.			Ea.
SOLIDS DISPOSED TODAY:		Yds.			Yds.
SOLIDS DISPOSED TOTAL:		Yds.			Yds.

SUMMARY OF DAILY ACTIVITIES AND PROGRESS:

MICHELS®

PROJECT:
LOCATION:
JOB #:
SHEET #:

DATE	SURVEY #	MD	INC	FINAL AZI	HTOTAL	DIP	P2 ELEV	P2 RT	CALC STATION	CALC ELEV	CALC RIGHT	3 JOINT INC RADIUS	3 JOINT AZI RADIUS

MICHELS®

ATTACHMENT

BENTONITE BRANDS
PRODUCT DATA SHEETS

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MAX GEL ™

Certified to ANSI/NSF 60

MAX GEL viscosifier is a premium Wyoming bentonite blended with special extenders producing a viscosifier that will yield more than twice as much viscosity as regular Wyoming bentonite. MAX GEL is a high-yielding, easily mixed, superior mud making bentonite in fresh water.

APPLICATIONS

MAX GEL is used in the following applications to rapidly build mud viscosity and provide superior hole cleaning, as well as to help control lost circulation, formation sloughing and promote hole stability in unconsolidated formations.

- Potable water wells
- Mineral exploration (coring and rotary drilling)
- Horizontal directional drilling
- Blast holes
- Shaft drilling
- Monitor / observation wells
- Gel-foam air drilling applications

ADVANTAGES

- Yields more quickly than API-standard bentonite
- Non-toxic and proven suitable for use in drilling potable water wells
- Increased penetration rates are exhibited due to lower solids content than regular bentonite systems
- Transportation and storage costs are reduced due to lower treatment requirements as compared to bentonite

TYPICAL AMOUNTS OF MAX GEL ADDITIONS ADDED TO FRESH WATER

Drilling Application/Desired Results	lb/100gal	lb/bbl	kg/m3
Normal drilling	15 - 25	6 - 11	15 - 30
In gravel or other poorly consolidated formation	25 - 40	12 - 18	35 - 50
Lost circulation control	35 - 45	15 - 20	40 - 45
Added to freshwater mud to improve hole cleaning properties, increase hole stability and develop filter cakes	5 - 10	2 - 5	6 - 14

LIMITATIONS

- Loses effectiveness in water containing >7500 mg/l sodium chloride / 240 mg/l calcium
- If dispersants or thinners are to be used, they should be added sparingly, using 50% or less of the normal treatment

TYPICAL PHYSICAL PROPERTIES

Physical appearance..... Light tan / gray – green powder
Specific gravity ..... 2.3 - 2.5
Approximate yield..... 220 bbl/ton

TOXICITY AND HANDLING

Bioassay information available upon request. No special requirements are necessary for handling and storage. Avoid inhalation of dust. A dust respirator and goggles are recommended if mixing in an enclosed area.

PACKAGING AND STORAGE

MAX GEL is packaged in 50 lb. (22.7-kg), multi-wall, paper sacks and is available in bulk. Store in a dry location (slip hazard when wet) and minimize dust (use dust-less systems for handling, storage and cleanup).

This material is supplied solely for informational purposes and M-I L.L.C. makes no guarantees or warranties, either expressed or implied, with respect to the accuracy or use of this data. All product warranties and guarantees shall be governed by the Standard Terms of Sale.

MATERIAL SAFETY DATA SHEET
MAX GEL

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

TRADE NAME: MAX GEL

OTHER NAME: Bentonite

CHEMICAL CLASS: Naturally occuring mineral.

APPLICATIONS: Oil well drilling fluid additive. Viscosifier.

EMERGENCY TELEPHONE: 281-561-1600

SUPPLIER: Supplied by a Business Unit of
M-I L.L.C.
P.O. Box 42842, Houston, Texas 77242-2842
See cover sheet for local supplier.

TELEPHONE: 281-561-1509
FAX: 281-561-7240

CONTACT PERSON: Sam Hoskin - Manager, Occupational Health

2. COMPOSITION, INFORMATION ON INGREDIENTS

INGREDIENT NAME:	CAS No.:	CONTENTS :	EPA RQ:	TPQ:
Silica, crystalline, quartz	14808-60-7	2-15 %		
Bentonite	1302-78-9	70-95 %		
Silica, crystalline, Cristobalite	14464-46-1	2-12 %		
Silica, crystalline, Tridymite	15468-32-3	1-5 %		
Gypsum	13397-24-5	0-1 %		

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW:

CAUTION! MAY CAUSE EYE, SKIN AND RESPIRATORY TRACT IRRITATION. Avoid contact with eyes, skin and clothing. Avoid breathing airborne product. Keep container closed. Use with adequate ventilation. Wash thoroughly after handling.

This product is a/an gray to tan powder. Slippery when wet. No significant immediate hazards for emergency response personnel are known.

ACUTE EFFECTS:

HEALTH HAZARDS, GENERAL:

Particulates may cause mechanical irritation to the eyes, nose, throat and lungs. Particulate inhalation may lead to pulmonary fibrosis, chronic bronchitis, emphysema and bronchial asthma. Dermatitis and asthma may result from short contact periods.

INHALATION: May be irritating to the respiratory tract if inhaled.

INGESTION: May cause gastric distress, nausea and vomiting if ingested.

SKIN: May be irritating to the skin.

EYES: May be irritating to the eyes.

CHRONIC EFFECTS:
CARCINOGENICITY:

IARC: Not listed. NTP: Not listed. OSHA: Not regulated.

ATTENTION! CANCER HAZARD. CONTAINS CRYSTALLINE SILICA WHICH CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.

IARC Monographs, Vol. 68, 1997, concludes that there is sufficient evidence that inhaled crystalline silica in the form of quartz or cristobalite from occupational sources causes cancer in humans. IARC classification Group 1.

ROUTE OF ENTRY:

Inhalation. Skin and/or eye contact.

TARGET ORGANS:

Respiratory system, lungs. Skin. Eyes.

4. FIRST AID MEASURES

GENERAL: Persons seeking medical attention should carry a copy of this SDS with them.

INHALATION: Move the exposed person to fresh air at once. Perform artificial respiration if breathing has stopped. Get medical attention.

INGESTION: Drink a couple of glasses water or milk. Do not give victim anything to drink of he is unconscious. Get medical attention.

SKIN: Wash skin thoroughly with soap and water. Remove contaminated clothing. Get medical attention if any discomfort continues.

EYES: Promptly wash eyes with lots of water while lifting the eye lids. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

5. FIRE FIGHTING MEASURES

AUTO IGNITION TEMP. (?F): N/D
FLAMMABILITY LIMIT - LOWER(%): N/D
FLAMMABILITY LIMIT - UPPER(%): N/D

EXTINGUISHING MEDIA:

This material is not combustible. Use extinguishing media appropriate for surrounding fire.

SPECIAL FIRE FIGHTING PROCEDURES:

No specific fire fighting procedure given.

UNUSUAL FIRE & EXPLOSION HAZARDS:

No unusual fire or explosion hazards noted.

HAZARDOUS COMBUSTION PRODUCTS:

Not relevant.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS:

Wear proper personal protective equipment (see SDS Section 8).

SPILL CLEAN-UP PROCEDURES:

Avoid generating and spreading of dust. Shovel into dry containers. Cover and move the containers. Flush the area with water. Do not contaminate drainage or waterways. Repackage or recycle if possible.

7. HANDLING AND STORAGE

HANDLING PRECAUTIONS:

Avoid handling causing generation of dust. Wear full protective clothing for prolonged exposure and/or high concentrations. Eye wash and emergency shower must be available at the work place. Wash hands often and change clothing when needed. Provide good ventilation. Mechanical ventilation or local exhaust ventilation is required.

STORAGE PRECAUTIONS:

Store at moderate temperatures in dry, well ventilated area. Keep in original container.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

		OSHA PEL:		ACGIH TLV:		OTHER:		
INGREDIENT NAME:	**CAS No.:**	**TWA:**	**STEL:**	**TWA:**	**STEL:**	**TWA:**	**STEL:**	**UNITS:**
Silica, crystalline, quartz	14808-60-7	*		0.1				mg/m3 resp.dust
Bentonite	1302-78-9	5		3				mg/m3 resp.dust
Silica, crystalline, Cristobalite	14464-46-1	*		0.05				mg/m3 resp.dust
Silica, crystalline, Tridymite	15468-32-3	*		0.05				mg/m3 resp.dust
Gypsum	13397-24-5	15						mg/m3 total dust

INGREDIENT COMMENTS:

* OSHA PELs for Mineral Dusts containing crystalline silica are 10 mg/m3 / (%SiO2+2) for quartz and 1/2 the calculated quartz value for cristobalite and tridymite.

PROTECTIVE EQUIPMENT:

ENGINEERING CONTROLS:

Use appropriate engineering controls such as, exhaust ventilation and process enclosure, to reduce air contamination and keep worker exposure below the applicable limits.

VENTILATION: Supply natural or mechanical ventilation adequate to exhaust airborne product and keep exposures below the applicable limits.

RESPIRATORS: Use at least a NIOSH-approved N95 half-mask disposable or reuseable particulate respirator. In work environments containing oil mist/aerosol use at least a NIOSH-approved P95 half-mask disposable or reuseable particulate respirator. For exposures exceeding 10 x PEL use a NIOSH-approved N100 Particulate Respirator.

PROTECTIVE GLOVES:

Use suitable protective gloves if risk of skin contact.

EYE PROTECTION:

Wear dust resistant safety goggles where there is danger of eye contact.

PROTECTIVE CLOTHING:

Wear appropriate clothing to prevent repeated or prolonged skin contact.

HYGIENIC WORK PRACTICES:
Wash promptly with soap and water if skin becomes contaminated. Change work clothing daily if there is any possibility of contamination.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE/PHYSICAL STATE:	Powder, dust.
COLOR:	Grey. to Tan.
ODOR:	Odorless or no characteristic odor.
SOLUBILITY DESCRIPTION:	Insoluble in water.
DENSITY/SPECIFIC GRAVITY (g/ml):	2.3-2.6 TEMPERATURE (?F): 68
BULK DENSITY:	67 lb/ft3; 1068 kg/m3
VAPOR DENSITY (air=1):	N/A
VAPOR PRESSURE:	N/A TEMPERATURE (?F):

10. STABILITY AND REACTIVITY

STABILITY: Normally stable.

CONDITIONS TO AVOID:
N/A.

HAZARDOUS POLYMERIZATION:
Will not polymerize.

POLYMERIZATION DESCRIPTION:
Not relevant.

MATERIALS TO AVOID:
N/A

HAZARDOUS DECOMPOSITION PRODUCTS:
No specific hazardous decomposition products noted.

11. TOXICOLOGICAL INFORMATION

TOXICOLOGICAL INFORMATION:
No toxicological data is available for this product.

12. ECOLOGICAL INFORMATION

ECOLOGICAL INFORMATION:
Contact M-I Environmental Affairs for ecological information.

13. DISPOSAL CONSIDERATIONS

WASTE MANAGEMENT:
This product does not meet the criteria of a hazardous waste if discarded in its purchased form. Under RCRA, it is the responsibility of the user of the product to determine at the time of disposal, whether the product meets RCRA criteria for hazardous waste. This is because product uses, transformations, mixtures, processes, etc, may render the resulting materials hazardous. Empty containers retain residues. All labeled precautions must be observed.

DISPOSAL METHODS:

Recover and reclaim or recycle, if practical. Should this product become a waste, dispose of in a permitted industrial landfill. Ensure that containers are empty by RCRA criteria prior to disposal in a permitted industrial landfill.

14. TRANSPORT INFORMATION

PRODUCT RQ: N/A

U.S. DOT:
U.S. DOT CLASS: Not regulated.

CANADIAN TRANSPORT:
TDGR CLASS: Not regulated.

SEA TRANSPORT:
IMDG CLASS: Not regulated.

AIR TRANSPORT:
ICAO CLASS: Not regulated.

15. REGULATORY INFORMATION

REGULATORY STATUS OF INGREDIENTS:

NAME:	CAS No:	TSCA:	CERCLA:	SARA 302:	SARA 313:	DSL(CAN):
Silica, crystalline, quartz	14808-60-7	Yes	No	No	No	Yes
Bentonite	1302-78-9	Yes	No	No	No	Yes
Silica, crystalline, Cristobalite	14464-46-1	Yes	No	No	No	Yes
Silica, crystalline, Tridymite	15468-32-3	Yes	No	No	No	Yes
Gypsum	13397-24-5	Yes	No	No	No	Yes

US FEDERAL REGULATIONS:
WASTE CLASSIFICATION: Not a hazardous waste by U.S. RCRA criteria. See Section 13.

REGULATORY STATUS: This Product or its components, if a mixture, is subject to following regulations (Not meant to be all inclusive - selected regulations represented):

SECTION 313: This product does not contain toxic chemical subject to the reporting requirements of Section 313 of Title III of the Superfund Amendment and Reauthorization Act of 1986 and 40 CFR Part 372.

SARA 311 Categories:
1: Immediate (Acute) Health Effects.
2. Delayed (Chronic) Health Effects.

The components of this product are listed on or are exempt from the following international chemical registries:
TSCA (U.S.)
DSL (Canada)
EINECS (Europe)

STATE REGULATIONS:

STATE REGULATORY STATUS:

This product or its components, if a mixture, is subject to following regulations (Not meant to be all inclusive - selected regulations represented):.

None.

PROPOSITION 65: This product contains the following chemical(s) considered by the State of California's Safe Drinking Water and Toxic Enforcement Act of 1986 as causing cancer or reproductive toxicity, and for which warnings are now required: Silica, crystalline

CANADIAN REGULATIONS:
LABELS FOR SUPPLY:

REGULATORY STATUS:

This Material Safety Data Sheet has been prepared in compilance with the Controled Product Regulations.

Canadian WHMIS Classification: D2A - Other Toxic Effects: Very Toxic Material

16. OTHER INFORMATION

NPCA HMIS HAZARD INDEX: * 1 Slight Hazard
FLAMMABILITY: 0 Minimal Hazard
REACTIVITY: 0 Minimal Hazard
NPCA HMIS PERS. PROTECT. INDEX: E - Safety Glasses, Gloves, Dust Respirator

USER NOTES:

N/A = Not applicable N/D = Not determined

INFORMATION SOURCES:

OSHA Permissible Exposure Limits, 29 CFR 1910, Subpart Z, Section 1910.1000, Air Contaminants.

ACGIH Threshold Limit Values and Biological Exposure Indices for Chemical Substances and Physical Agents (latest edition).

Sax's Dangerous Properties of Industrial Materials, 9th ed., Lewis, R.J. Sr., (ed.), VNR, New York, New York, (1997).

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans, Silica, Some Silicates, Coal Dust, and para-Aramid Fibrils, Vol. 68, World Health Organization, Lyon, France, 1997.
Product information provided by the commercial vendor(s).

PREPARED BY: Sam Hoskin/bb

REVISION No.: 0

SDS STATUS: Approved.

DATE: June 1, 1999

DISCLAIMER:

SDS furnished independent of product sale. While every effort has been made to accurately describe this product, some of the data are obtained from sources beyond our direct supervision. We cannot make any assertions as to its reliability or completeness; therefore, user may rely on it only at user's risk. We have made no effort to censor or conceal deleterious aspects of this product. Since we cannot anticipate or control the conditiions under which this information and product may be used, we make no guarantee that the precautions we have suggested will be adequate for all individuals and/or situations. It is the obligation of each user of this product to comply with the requirements of all applicable laws regarding use and disposal of this product. Additional information will be furnished upon request to assist the user; however, no warranty, either expressed or implied, nor liability of any nature with respect to this product or to the data herein is made or incurred hereunder.

Water Well Drilling &
Mineral Exploration Products

AMERICAN Colloid Company
Water/Mineral Division

Super Gel-X
High Yield Bentonite

DESCRIPTION:

- Super Gel-X is a 200 mesh, high viscosity 200-bbl yield, sodium bentonite for use in all freshwater drilling conditions.

RECOMMENDED USE:

- May be used for all types of freshwater mud rotary drilling.

CHARACTERISTICS:

- Highly concentrated for maximum yield.
- Fast and easy mixing.
- Reduces solids and increases lifting power.
- Removes cuttings.
- Cools and lubricates bit.
- Stabilizes bore holes.

MIXING AND APPLICATION:

- Mixing ratios are based on 200-bbl yield material using freshwater. Level of water purity will affect bentonite performance.

- Super Gel-X mixing ratio in lbs. per 100 gallons of water:

  Normal conditions ..... 15 to 25 lbs.
  Sand and gravel ..... 25 to 35 lbs.
  Fluid loss controls ..... 35 to 40 lbs.

PACKAGING:

- 50 pound, multi-wall, non-tear, waterproof bags, 48 bags per pallet, and all pallets are stretch-wrapped.

1500 W. Shure Drive **Arlington Heights, IL 60004** **1434-(3112) 392-4600**

The information and data contained herein are believed to be accurate and reliable. American Colloid Company makes no warranty of any kind and accepts no responsibility for the results obtained through this application of this information.

MATERIAL SAFETY DATA SHEET

May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

PRODUCT NAME: SUPER GEL-X™

Section I MANUFACTURER'S INFORMATION

MANUFACTURER'S NAME & ADDRESS:

CETCO – *Drilling Products Group*
1500 West Shure Drive
Arlington Heights, IL 60004

Date Prepared: June 1, 2002

Telephone Number: 847-392-5800 Fax 847-506.6150
EMERGENCY CONTACT: CHEMTREC 800-424-9300
E-mail: www.cetco.com

Section II HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

HAZARDOUS COMPONENTS: (Specific Chemical Identity: Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Crystalline Quartz: CAS# 14808-60-7			*	< 6%
Respirable Crystalline Quartz:			NIOSH	< 2%
Present (TWA)	0.1 mg/m^3	0.1 mg/m^3	50 ug/m^3	
Proposed (TWA)		50.0 ug/m^3		
Nuisance Dust:				
Respirable	5 mg/m^3	5 mg/m^3		
Total Dust	15 mg/m^3	10 mg/m^3		

*** WARNING:** This product contains a small amount of crystalline silica, which may cause delayed respiratory disease if inhaled over a prolonged period of time. Avoid breathing dust. Use NIOSH/MSHA approved respirator where TLV for crystalline silica (Quartz) may be exceeded. IARC Monographs on the evaluation of the Carcinogenic Risk of Chemicals to Humans (volume 68, 1997) concludes that crystalline silica is carcinogenic to humans in the form of quartz. IARC classification 1.

The small quantities of crystalline silica (quartz) found in this product are, under normal conditions, naturally coated with an unremovable layer of amorphous silica and/or bentonite clay. IARC (vol. 68, 1997, pg. 191-192) has stated that crystalline silica (quartz) can differ in toxicity depending on the minerals with which it is combined, citing studies in IARC (vol. 42, 1987, p. 86) which stated that the toxic effect of crystalline silica (quartz) is reduced by the "protective effect...due mainly to clay minerals..."

National Institute for Occupational Safety and Health (NIOSH) has recommended that the permissible exposure limit be changed to 50 micrograms respirable free silica per cubic meter of air (0.05 mg/ m^3) as determined by a full shift sample up to a 10 hour working day, 40 hours per week. *See*: 1974 NIOSH criteria for a recommended Standard for Occupational Exposure to Crystalline Silica should be consulted for more detailed information.

PEL - OSHA Permissible Exposure Limit.

TLV - American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value.

TWA - 8 hour time weighted average

Note: The Permissible Exposure Limits (PEL) reported above are the pre - 1989 limits that were reinstated by OSHA June 30, 1993 following a decision by the United States Circuit Court of Appeals for the 11th Circuit. Federal OSHA is now enforcing these PELs. More restrictive exposure limits may be enforced by some other jurisdictions.

PRODUCT IDENTIFICATION:

Chemical Name: Dry Mixture of Inorganic Mineral Compounds.
NFPA/HMIS: Health - 2, Fire - 0, Reactivity - 0, Specific Hazard - *See Section VI.*
Shipping Class: Not Regulated (DOT / 49CFR, IMDG, ICAO / IATA).

Section III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point: Not Applicable.
Vapor Pressure (mm Hg.)**:** Not Applicable.
Vapor Density (AIR = 1)**:** Not Applicable.
Solubility in Water: Negligible.
Specific Gravity (H_2O = 1)**:** 2.5
Melting Point: 1400°F
Evaporation Rate (Butyl Acetate = 1)**:** Not Applicable.
Appearance and Odor: Tan or beige to light gray colored powder to fine granules, odorless.

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PRODUCT NAME: SUPER GEL-X™

Section IV FIRE AND EXPLOSION HAZARD DATA

Flash Point (*Method Used*)**:** Not Available. **Flammable Limits:** Not Available. **LEL** - NA. **UEL** - NA.
Extinguishing Media: Not Applicable. **Special Fire Fighting Procedure:** Not Applicable.
Unusual Fire/Explosion Hazards: Product may pose possible dust explosion under *extremely rare* circumstances or conditions.

Section V REACTIVITY DATA

Stability: Stable **Conditions to Avoid** - None Known.
Incompatibility (*Materials to Avoid*)**:** Powerful oxidizing agents such as fluorine, chlorine trifluoride, manganese trioxide, etc.
Hazardous Decomposition or By-products: Silica will dissolve in hydrofluoric acid producing a corrosive gas, silicon tetrafluoride.
Hazardous Polymerization: Will Not Occur **Conditions to Avoid** - None Known.

Section VI HEALTH HAZARD DATA

Route(s) of Entry: Inhalation? Yes Skin? No Ingestion? No
Health Hazards (Acute and Chronic):

Inhalation: Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may have the following serious chronic health effects:
Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness and reduced pulmonary function. Smoking exacerbates this disease. Individuals with silicosis are predisposed to develop tuberculosis.
Cancer Status: The International Agency for Research on Cancer has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1 - carcinogenic to humans). Refer to *IARC Monograph 68, Silica, Some Silicates and Organic Fibers* (published in June 1997) in conjunction with the use of these
materials. The National Toxicology Program classifies respirable crystalline silica as "reasonably anticipated to be a carcinogen". For further information *See*: "Adverse effects of Crystalline Silica Exposure" published by the American Thoracic Society Medical Section of the American Lung Association, American Journal of Respiratory and Critical Care Medicine, Volume 155, page 761-765, 1997.

Other Data with Possible Relevance to Human Health: The small quantities of crystalline silica (quartz) found in this product are, under normal conditions, naturally coated with an unremovable layer of amorphous silica and/or bentonite clay. IARC (Vol. 68, 1997, pg. 191-192) has stated that crystalline silica (quartz) can differ in toxicity depending on the minerals with which it is combined, citing studies in IARC (Vol. 42, 1987 pg. 86) which stated that the toxic effect of crystalline silica (quartz) is reduced by the "protective effect....due mainly to clay minerals..."

Carcinogenicity: NTP? No IARC Monographs? Yes OSHA Regulated? No

Signs and Symptoms of Exposure: Excessive inhalation of generated dust may result in shortness of breath and reduced pulmonary function.

Medical Conditions Generally Aggravated by Exposure: Individuals with respiratory disease, including but not limited to, asthma and bronchitis, or subject to eye irritation should not be exposed to respirable crystalline silica (quartz) dust.

Emergency and First Aid Procedures:
Eyes & Skin: Flush with water.
Gross Inhalation of Dust: Remove to fresh air; give oxygen or artificial respiration if necessary; seek medical attention.
Ingestion: If large amounts are swallowed, get immediate medical attention.

Section VII PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken in Case Material is Released or Spilled: Vacuum if possible to avoid generating airborne dust. Avoid breathing dust. Wear an approved respirator. Avoid adding water; product will become slippery when wet.
Waste Disposal Method: Bury in an approved sanitary landfill, in accordance with federal, state and local regulations.
Precautions to Be Taken in Handling and Storing: Avoid breathing dust, use NIOSH/MSHA approved respirator where TLV limits for Crystalline Silica may be exceeded.
Other Precautions: Slippery when wet.

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PRODUCT NAME: SUPER GEL-X™

Section VIII CONTROL MEASURES

Respiratory Protection: Use appropriate respiratory protection for respirable particulate based on consideration of airborne workplace concentration and duration of exposure arising from intended end use. Refer to the most recent standards of ANSI (z88.2) OSHA (29 CFR 1910.134), MSHA (30 CFR Parts 56 and 57) and NIOSH Respirator Decision Logic.

Ventilation: Use local exhaust as required to maintain exposures below applicable occupational exposure limits (*See Section II*). See also ACGIH "Industrial Ventilation – A Manual for Recommend Practice", (*current edition*).

Protective Gloves: Not Required. **Eye Protection:** Recommended.

Other Protective Clothing or Equipment: None. **Work/Hygienic Practices:** Use good housekeeping practices.

Section IX REGULATORY INFORMATION

SARA 311/312: Hazard Categories for SARA Section 311/312 Reporting: Chronic Health
SARA 313: This product contains the following chemicals subject to annual release reporting requirements under the SARA section 313 (40 CFR 372): None

CERCLA section 103 Reportable Quantity: None

California Proposition 65: *This product contains the following substances known to the state of California to cause cancer and/or reproductive harm: This product contains crystalline silica (respirable); however, the user should note that the small quantities of crystalline silica (quartz) found in this product are, under normal conditions, naturally coated with an unremovable layer of amorphous silica and/or bentonite clay. IARC (Vol. 68, 1997, pg. 191-192) has stated that crystalline silica (quartz) can differ in toxicity depending on the minerals with which it is combined. Citing studies in IARC (Vol. 42, 1987, p. 86) which stated that the toxic effect of crystalline silica (quartz) is reduced by the "protective effect....due mainly to clay minerals...".*

Toxic Substances Control Act: All of the components of this product are listed on the EPA TSCA Inventory or are exempt from notification requirements.

Canadian Environmental Protection Act: All the components of this product are listed on the Canadian Domestic Substances List or exempt from notification requirements.

European Inventory of Commercial Chemical Substances: All the components of this product are listed on the EINECS Inventory or exempt from notification requirements. (The EINECS number for Quartz: 231-545-5)
European Community Labeling Classification: Harmful (Xn)
European Community Risk and Safety Phrases: R40, R48, S22

Japan MITI: All the components of this product are existing chemical substances as defined in the Chemical Substance Control Law.

Australian Inventory of Chemical Substances: All the components of this product are listed on the AICS Inventory or exempt from notification requirements.

Canadian WHMIS Classification: Class D, Division 2, Subdivision A (Very Toxic Material causing other Toxic Effects)

NF-+PA Hazard Rating: Health: 2 Fire: 0 Reactivity: 0
HMIS Hazard Rating: Health: * Fire: 0 Reactivity: 0

***Warning** - Chronic health effect possible - inhalation of silica dust may cause lung injury/disease (silicosis). Take appropriate measures to avoid breathing dust. *See Section II*.

REFERENCES:

Registry for Toxic Effects of Chemical Substances (RTECS), 1995.

Patty's Industrial Hygiene and Toxicology.

NTP Seventh Annual Report on Carcinogens, 1994.

IARC Monograph Volume 68, Silica, Some Silicates and Organic Fibers, 1997.

The information herein has been compiled from sources believed to be reliable and is accurate to the best of our knowledge. However, CETCO cannot give any guarantees regarding information from other sources, and expressly does not make any warranties, nor assumes any liability, for its use.

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MATERIAL SAFETY DATA SHEET

Product Trade Name: **BARA-KADE® BENTONITE**

Revision Date: 31-Mar-2005

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Trade Name: BARA-KADE® BENTONITE
Synonyms: None
Chemical Family: Mineral
Application: Additive

Manufacturer/Supplier

BPM Minerals LLC
3000 N Sam Houston Parkway East
Houston, TX 77032

Telephone: (281) 871-7900
Fax: (281) 871-7940
Emergency Telephone: (800) 666-9260 or (713) 753-3000

Prepared By

Chemical Compliance
Telephone: 1-580-251-4335

2. COMPOSITION/INFORMATION ON INGREDIENTS

SUBSTANCE	CAS Number	PERCENT	ACGIH TLV-TWA	OSHA PEL-TWA
Crystalline silica, cristobalite	14464-46-1	0 - 1%	0.05 mg/m^3	1/2 x $\frac{10 \text{ mg/m}^3}{\%SiO2 + 2}$
Crystalline silica, tridymite	15468-32-3	0 - 1%	0.05 mg/m^3	1/2 x $\frac{10 \text{ mg/m}^3}{\%SiO2 + 2}$
Crystalline silica, quartz	14808-60-7	1 - 5%	0.05 mg/m^3	$\frac{10 \text{ mg/m}^3}{\%SiO2 + 2}$
Bentonite	1302-78-9	60 - 100%	Not applicable	Not applicable

More restrictive exposure limits may be enforced by some states, agencies, or other authorities.

3. HAZARDS IDENTIFICATION

Hazard Overview

CAUTION! - ACUTE HEALTH HAZARD
May cause eye and respiratory irritation.

DANGER! - CHRONIC HEALTH HAZARD
Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposures below recommended exposure limits. Wear a NIOSH certified, European Standard EN 149, or equivalent respirator when using this product. Review the Material Safety Data Sheet (SDS) for this product, which has been provided to your employer.

4. FIRST AID MEASURES

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Skin Wash with soap and water. Get medical attention if irritation persists.

Eyes In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Ingestion Under normal conditions, first aid procedures are not required.

Notes to Physician Treat symptomatically.

5. FIRE FIGHTING MEASURES

Flash Point/Range (F):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (F):	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined

Fire Extinguishing Media All standard firefighting media.

Special Exposure Hazards Not applicable.

Special Protective Equipment for Fire-Fighters Not applicable.

NFPA Ratings: Health 0, Flammability 0, Reactivity 0
HMIS Ratings: Flammability 0, Reactivity 0, Health 0*

6. ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures Use appropriate protective equipment. Avoid creating and breathing dust.

Environmental Precautionary Measures None known.

Procedure for Cleaning / Absorption Collect using dustless method and hold for appropriate disposal. Consider possible toxic or fire hazards associated with contaminating substances and use appropriate methods for collection, storage and disposal.

7. HANDLING AND STORAGE

Handling Precautions This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposure below recommended exposure limits. Wear a NIOSH certified, European Standard En 149, or equivalent respirator when using this product. Material is slippery when wet.

Storage Information Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits listed in Section 2.

Respiratory Protection Wear a NIOSH certified, European Standard EN 149, or equivalent respirator when using this product.

Hand Protection Normal work gloves.

Skin Protection Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.

Eye Protection Wear safety glasses or goggles to protect against exposure.

Other Precautions None known.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid
Color:	Various
Odor:	Odorless
pH:	8-10
Specific Gravity @ 20 C (Water=1):	2.65
Density @ 20 C (lbs./gallon):	Not Determined
Bulk Density @ 20 C (lbs/ft3):	50-70
Boiling Point/Range (F):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (F):	Not Determined
Freezing Point/Range (C):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Insoluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (lbs./gallon):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistrokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data: Stable

Hazardous Polymerization: Will Not Occur

Conditions to Avoid	None anticipated
Incompatibility (Materials to Avoid)	Hydrofluoric acid.
Hazardous Decomposition Products	Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	Eye or skin contact, inhalation.
Inhalation	Inhaled crystalline silica in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (IARC, Group 1). There is sufficient evidence in experimental animals for the carcinogenicity of tridymite (IARC, Group 2A). Breathing silica dust may cause irritation of the nose, throat, and respiratory passages. Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may also have serious chronic health effects (See "Chronic Effects/Carcinogenicity" subsection below).
Skin Contact	May cause mechanical skin irritation.
Eye Contact	May cause eye irritation.
Ingestion	None known
Aggravated Medical Conditions	Individuals with respiratory disease, including but not limited to asthma and bronchitis, or subject to eye irritation, should not be exposed to quartz dust.
Chronic Effects/Carcinogenicity	Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis. Cancer Status: The International Agency for Research on Cancer (IARC) has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources can cause lung cancer in humans (Group 1 - carcinogenic to humans) and has determined that there is sufficient evidence in experimental animals for the carcinogenicity of tridymite (Group 2A - possible carcinogen to humans). Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997) in conjunction with the use of these minerals. The National Toxicology Program classifies respirable crystalline silica as "Known to be a human carcinogen". Refer to the 9th Report on Carcinogens (2000). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies crystalline silica, quartz, as a suspected human carcinogen (A2). There is some evidence that breathing respirable crystalline silica or the disease silicosis is associated with an increased incidence of significant disease endpoints such as scleroderma (an immune system disorder manifested by scarring of the lungs, skin, and other internal organs) and kidney disease.

Other Information For further information consult "Adverse Effects of Crystalline Silica Exposure" published by the American Thoracic Society Medical Section of the American Lung Association, American Journal of Respiratory and Critical Care Medicine, Volume 155, pages 761-768 (1997).

Toxicity Tests

Oral Toxicity: Not determined

Dermal Toxicity: Not determined

Inhalation Toxicity: Not determined

Primary Irritation Effect: Not determined

Carcinogenicity Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997).

Genotoxicity: Not determined

Reproductive / Developmental Toxicity: Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air) Not determined

Persistence/Degradability Not determined

Bio-accumulation Not Determined

Ecotoxicological Information

Acute Fish Toxicity: TLM96: 10000 ppm (Oncorhynchus mykiss)
Acute Crustaceans Toxicity: Not determined
Acute Algae Toxicity: Not determined

Chemical Fate Information Not determined

Other Information Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method Bury in a licensed landfill according to federal, state, and local regulations.

Contaminated Packaging Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Land Transportation

DOT
Not restricted

Canadian TDG
Not restricted

ADR Not restricted

Air Transportation

ICAO/IATA Not restricted

Sea Transportation

IMDG
Not restricted

Other Shipping Information

Labels: None

15. REGULATORY INFORMATION

US Regulations

US TSCA Inventory	All components listed on inventory.
EPA SARA Title III Extremely Hazardous Substances	Not applicable
EPA SARA (311,312) Hazard Class	Acute Health Hazard Chronic Health Hazard
EPA SARA (313) Chemicals	This product does not contain a toxic chemical for routine annual "Toxic Chemical Release Reporting" under Section 313 (40 CFR 372).
EPA CERCLA/Superfund Reportable Spill Quantity For This Product	Not applicable.
EPA RCRA Hazardous Waste Classification	If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.
California Proposition 65	The California Proposition 65 regulations apply to this product.
MA Right-to-Know Law	One or more components listed.
NJ Right-to-Know Law	One or more components listed.
PA Right-to-Know Law	One or more components listed.

Canadian Regulations

Canadian DSL Inventory	All components listed on inventory.
WHMIS Hazard Class	D2A Very Toxic Materials (Crystalline silica)

16. OTHER INFORMATION

The following sections have been revised since the last issue of this SDS
Not applicable

Additional Information

For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Material Safety Data Sheet for this or other Halliburton products, contact Chemical Compliance at 1-580-251-4335.

Disclaimer Statement

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

*****END OF SDS*****

MATERIAL SAFETY DATA SHEET

Product Trade Name: **BARA-KADE® BENTONITE**

Revision Date: 31-Mar-2005

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Trade Name: BARA-KADE® BENTONITE
Synonyms: None
Chemical Family: Mineral
Application: Additive

Manufacturer/Supplier

BPM Minerals LLC
3000 N Sam Houston Parkway East
Houston, TX 77032

Telephone: (281) 871-7900
Fax: (281) 871-7940
Emergency Telephone: (800) 666-9260 or (713) 753-3000

Prepared By

Chemical Compliance
Telephone: 1-580-251-4335

2. COMPOSITION/INFORMATION ON INGREDIENTS

SUBSTANCE	CAS Number	PERCENT	ACGIH TLV-TWA	OSHA PEL-TWA
Crystalline silica, cristobalite	14464-46-1	0 - 1%	0.05 mg/m^3	1/2 x $\frac{10 \text{ mg/m}^3}{\%SiO2 + 2}$
Crystalline silica, tridymite	15468-32-3	0 - 1%	0.05 mg/m^3	1/2 x $\frac{10 \text{ mg/m}^3}{\%SiO2 + 2}$
Crystalline silica, quartz	14808-60-7	1 - 5%	0.05 mg/m^3	$\frac{10 \text{ mg/m}^3}{\%SiO2 + 2}$
Bentonite	1302-78-9	60 - 100%	Not applicable	Not applicable

More restrictive exposure limits may be enforced by some states, agencies, or other authorities.

3. HAZARDS IDENTIFICATION

Hazard Overview

CAUTION! - ACUTE HEALTH HAZARD
May cause eye and respiratory irritation.

DANGER! - CHRONIC HEALTH HAZARD
Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposures below recommended exposure limits. Wear a NIOSH certified, European Standard EN 149, or equivalent respirator when using this product. Review the Material Safety Data Sheet (SDS) for this product, which has been provided to your employer.

4. FIRST AID MEASURES

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Skin Wash with soap and water. Get medical attention if irritation persists.

Eyes In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Ingestion Under normal conditions, first aid procedures are not required.

Notes to Physician Treat symptomatically.

5. FIRE FIGHTING MEASURES

Flash Point/Range (F):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (F):	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined

Fire Extinguishing Media All standard firefighting media.

Special Exposure Hazards Not applicable.

Special Protective Equipment for Fire-Fighters Not applicable.

NFPA Ratings: Health 0, Flammability 0, Reactivity 0
HMIS Ratings: Flammability 0, Reactivity 0, Health 0*

6. ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures Use appropriate protective equipment. Avoid creating and breathing dust.

Environmental Precautionary Measures None known.

Procedure for Cleaning / Absorption Collect using dustless method and hold for appropriate disposal. Consider possible toxic or fire hazards associated with contaminating substances and use appropriate methods for collection, storage and disposal.

7. HANDLING AND STORAGE

Handling Precautions This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposure below recommended exposure limits. Wear a NIOSH certified, European Standard En 149, or equivalent respirator when using this product. Material is slippery when wet.

Storage Information Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits listed in Section 2.

Respiratory Protection Wear a NIOSH certified, European Standard EN 149, or equivalent respirator when using this product.

Hand Protection Normal work gloves.

Skin Protection Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.

Eye Protection Wear safety glasses or goggles to protect against exposure.

Other Precautions None known.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid
Color:	Various
Odor:	Odorless
pH:	8-10
Specific Gravity @ 20 C (Water=1):	2.65
Density @ 20 C (lbs./gallon):	Not Determined
Bulk Density @ 20 C (lbs/ft3):	50-70
Boiling Point/Range (F):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (F):	Not Determined
Freezing Point/Range (C):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Insoluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (lbs./gallon):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistrokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data: Stable

Hazardous Polymerization: Will Not Occur

Conditions to Avoid	None anticipated
Incompatibility (Materials to Avoid)	Hydrofluoric acid.
Hazardous Decomposition Products	Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	Eye or skin contact, inhalation.
Inhalation	Inhaled crystalline silica in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (IARC, Group 1). There is sufficient evidence in experimental animals for the carcinogenicity of tridymite (IARC, Group 2A). Breathing silica dust may cause irritation of the nose, throat, and respiratory passages. Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may also have serious chronic health effects (See "Chronic Effects/Carcinogenicity" subsection below).
Skin Contact	May cause mechanical skin irritation.
Eye Contact	May cause eye irritation.
Ingestion	None known
Aggravated Medical Conditions	Individuals with respiratory disease, including but not limited to asthma and bronchitis, or subject to eye irritation, should not be exposed to quartz dust.
Chronic Effects/Carcinogenicity	Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis. Cancer Status: The International Agency for Research on Cancer (IARC) has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources can cause lung cancer in humans (Group 1 - carcinogenic to humans) and has determined that there is sufficient evidence in experimental animals for the carcinogenicity of tridymite (Group 2A - possible carcinogen to humans). Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997) in conjunction with the use of these minerals. The National Toxicology Program classifies respirable crystalline silica as "Known to be a human carcinogen". Refer to the 9th Report on Carcinogens (2000). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies crystalline silica, quartz, as a suspected human carcinogen (A2). There is some evidence that breathing respirable crystalline silica or the disease silicosis is associated with an increased incidence of significant disease endpoints such as scleroderma (an immune system disorder manifested by scarring of the lungs, skin, and other internal organs) and kidney disease.

Other Information For further information consult "Adverse Effects of Crystalline Silica Exposure" published by the American Thoracic Society Medical Section of the American Lung Association, American Journal of Respiratory and Critical Care Medicine, Volume 155, pages 761-768 (1997).

Toxicity Tests

Oral Toxicity: Not determined

Dermal Toxicity: Not determined

Inhalation Toxicity: Not determined

Primary Irritation Effect: Not determined

Carcinogenicity Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997).

Genotoxicity: Not determined

Reproductive / Developmental Toxicity: Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air) Not determined

Persistence/Degradability Not determined

Bio-accumulation Not Determined

Ecotoxicological Information

Acute Fish Toxicity: TLM96: 10000 ppm (Oncorhynchus mykiss)
Acute Crustaceans Toxicity: Not determined
Acute Algae Toxicity: Not determined

Chemical Fate Information Not determined

Other Information Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method Bury in a licensed landfill according to federal, state, and local regulations.

Contaminated Packaging Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Land Transportation

DOT
Not restricted

Canadian TDG
Not restricted

ADR Not restricted

Air Transportation

ICAO/IATA Not restricted

Sea Transportation

IMDG
Not restricted

Other Shipping Information

Labels: None

15. REGULATORY INFORMATION

US Regulations

US TSCA Inventory	All components listed on inventory.
EPA SARA Title III Extremely Hazardous Substances	Not applicable
EPA SARA (311,312) Hazard Class	Acute Health Hazard Chronic Health Hazard
EPA SARA (313) Chemicals	This product does not contain a toxic chemical for routine annual "Toxic Chemical Release Reporting" under Section 313 (40 CFR 372).
EPA CERCLA/Superfund Reportable Spill Quantity For This Product	Not applicable.
EPA RCRA Hazardous Waste Classification	If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.
California Proposition 65	The California Proposition 65 regulations apply to this product.
MA Right-to-Know Law	One or more components listed.
NJ Right-to-Know Law	One or more components listed.
PA Right-to-Know Law	One or more components listed.

Canadian Regulations

Canadian DSL Inventory	All components listed on inventory.
WHMIS Hazard Class	D2A Very Toxic Materials (Crystalline silica)

16. OTHER INFORMATION

The following sections have been revised since the last issue of this SDS
Not applicable

Additional Information

For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Material Safety Data Sheet for this or other Halliburton products, contact Chemical Compliance at 1-580-251-4335.

Disclaimer Statement

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

*****END OF SDS*****

MICHELS®

ATTACHMENT

DRILLING ADDITIVES / LCMs FOR APPROVAL

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MICHELS®

Product Name	Manufacturer	Generic Name	Intended Use	NSF 60 APPROVED?
Platinum PAC	M I Swaco	PAC	Fluid Loss Inhibitor	YES
Platinum PAC UL	M I Swaco	PAC	Fluid Loss Inhibitor	YES
Ringfree	M I Swaco	Thinner	Drill Mud Thinner	YES
Torqmaster	WyoBen, Inc.	Surfactant	Torque reduction / reduce bit balling	NO
Plugz It	WyoBen, Inc.	Proprietary bentonite blend	Lost Circulation Material	YES
Clay Cutter	Cetco	Clay Inhibitor	Inhibit swelling of clay formations	NO
Clay Breaker	DCS Fluids	Clay Inhibitor	Inhibit swelling of clay formations	NO
Torque Breaker	DCS Fluids	Surfactant	Torque reduction / reduce bit balling	NO
Ball Buster	DCS Fluids	SAPP	Reduce bit / reamer balling	YES
Soda Ash	Various	pH Enhancement	Increase pH and reduce hardness of make up water	YES
Sodium Bicarbonate	Various	Calcium Control	Reduce calcium contamination of mud from drilling grout	YES
Citric Acid	Various	pH Reducer	Reduce pH when drilling grout	YES

MICHELS®

POTENTIAL ADDITIVIVE

PLATINUM PAC

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SDS no. 12391
Version 7
Revision date 21/Jul/2014
Supersedes date 20/Dec/2013

Safety Data Sheet
PLATINUM PAC†

1. Identification of the substance/preparation and of the Company/undertaking

1.1 Product identifier

Product name PLATINUM PAC†
Product code 12391

1.2 Relevant identified uses of the substance or mixture and uses advised against

Recommended Use Drilling fluid additive Fluid loss reducer.

Uses advised against Consumer use

1.3 Details of the supplier of the safety data sheet

Supplier
M-I L.L.C.
P.O.Box 42842
Houston, TX 77242
www.miswaco.slb.com

Prepared by
Global Chemical Regulatory Compliance (GCRC) , Bethicia Prasek

1.4 Emergency Telephone Number

Emergency telephone - (24 Hour) Australia +61 2801 44558, Asia Pacific +65 3158 1074, China +86 10 5100 3039, Europe +44 (0) 1235 239 670, Middle East and Africa +44 (0) 1235 239 671, New Zealand +64 9929 1483, USA 001 281 561 1600
Telephone Number - 281-561-1512

2. Hazards identification

2.1 Classification of the substance or mixture

GHS - Classification

Health hazards Not classified

Environmental hazards Not classified

Physical Hazards

Combustible dust	-

2.2 Label elements

Signal word
WARNING

May form combustible dust concentrations in air

Precautionary statements
P240 - Ground/bond container and receiving equipment
P243 - Take precautionary measures against static discharge

P241 - Use explosion-proof electrical/ ventilating/ lighting/ equipment

3. Composition/information on Ingredients

3.1 Substances

Component	CAS-No	Weight % - range
Carboxymethylcellulose sodium salt	9004-32-4	99

3.2 Mixtures

Not Applicable

4. First aid measures

4.1 Description of first-aid measures

Inhalation — If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Ingestion — Rinse mouth. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Seek medical attention if irritation occurs.

Skin contact — Wash off immediately with soap and plenty of water removing all contaminated clothes and shoes. Get medical attention immediately if symptoms occur.

Eye contact — Promptly wash eyes with lots of water while lifting eye lids. Remove contact lenses. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

4.2 Most important symptoms and effects, both acute and delayed

General advice — The severity of the symptoms described will vary dependant of the concentration and the length of exposure. If adverse symptoms develop, the casualty should be transferred to hospital as soon as possible.

Main symptoms

Inhalation	Please see Section 11. Toxicological Information for further information.
Ingestion	Please see Section 11. Toxicological Information for further information.
Skin contact	Please see Section 11. Toxicological Information for further information.
Eye contact	Please see Section 11. Toxicological Information for further information.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician Treat symptomatically.

5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Fog, Alcohol Foam, CO_2, Dry Chemical.

Extinguishing media which shall not be used for safety reasons
None known.

5.2 Special hazards arising from the substance or mixture

Unusual fire and explosion hazards
Suspended dust may present a dust explosion hazard.

Hazardous combustion products
Carbon oxides (COx).

5.3 Advice for firefighters

Special protective equipment for fire-fighters
As in any fire, wear self-contained breathing apparatus and full protective gear.

Special Fire-Fighting Procedures
Containers close to fire should be removed immediately or cooled with water.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Extinguish all ignition sources. Avoid sparks, flames, heat and smoking. Evacuate personnel to safe areas. Use personal protective equipment. See also section 8. If spilled, take caution, as material can cause surfaces to become very slippery.

6.2 Environmental precautions

The product should not be allowed to enter drains, water courses or the soil.

Environmental exposure controls
Avoid release to the environment.

6.3 Methods and materials for containment and cleaning up

Methods for containment
Prevent further leakage or spillage if safe to do so.

Methods for cleaning up
Sweep up and shovel into suitable containers for disposal. After cleaning, flush away traces with water. Material becomes slippery when wet. Use caution if wet.

6.4 Reference to other sections

See section 13 for more information.

7. Handling and storage

7.1 Precautions for safe handling

Handling
Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin and eyes. Avoid dust formation.

Hygiene measures
Use good work and personal hygiene practices to avoid exposure. Do not eat, drink or smoke when using this product.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/precautions Ensure adequate ventilation. Provide appropriate exhaust ventilation at places where dust is formed. Keep airborne concentrations below exposure limits.

Storage precautions Keep away from open flames, hot surfaces and sources of ignition. Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure controls/personal protection

8.1 Control parameters

Exposure limits Control as an ACGIH particulate not otherwise specified (PNOS): 10 mg/m^3 (Inhalable); 3 mg/m^3 (Respirable) and an OSHA particulate not otherwise regulated (PNOR): 15 mg/m^3 (Total); 5 mg/m^3 (Respirable).

Component	ACGIH TLV	OSHA PEL
Carboxymethylcellulose sodium salt 9004-32-4 (99)	Not Determined	Not Determined

8.2 Exposure controls

All chemical Personal Protective Equipment (PPE) should be selected based on an assessment of both the chemical hazard present and the risk of exposure to those hazards. The PPE recommendations below are based on an assessment of the chemical hazards associated with this product. Where this product is used in a mixture with other products or fluids, additional hazards may be created and as such further assessment of risk may be required. The risk of exposure and need of respiratory protection will vary from workplace to workplace and should be assessed by the user in each situation.

Engineering measures to reduce exposure
Ensure adequate ventilation.

Personal protective equipment

Eye protection It is good practice to wear goggles when handling any chemical. Tightly fitting safety goggles.

Hand protection Wear chemical resistant gloves such as nitrile or neoprene.

Respiratory protection	All respiratory protection equipment should be used within a comprehensive respiratory protection program that meets the requirements of 29 CFR 1910.134 (U.S. OSHA Respiratory Protection Standard) or local equivalent. If exposed to airborne mist/aerosol of this product, use at least a NIOSH-approved N95 half-mask disposable or re-usable particulate respirator. In work environments containing oil mist/aerosol, use at least a NIOSH-approved P95 half-mask disposable or reuseable particulate respirator. If exposed to vapors from this product use a NIOSH/MSHA-approved respirator with an Organic Vapor cartridge.
Skin and body protection	Wear suitable protective clothing.
Hygiene measures	Wash hands before eating, drinking or smoking, Remove and wash contaminated clothing before re-use.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

Physical state	Solid powder
Appearance	Opaque
Odor	Mild Odorless
Color	Off-white - Tan
Odor threshold	Not applicable

Property	**Values**	**Remarks**
pH	No information available	
pH @ dilution	6.5-8.0 @ 1% in H2O	
Melting/freezing point		
Boiling point/range	No information available	
Flash point	Does not flash	
Evaporation rate (BuAc =1)		
Flammability (solid, gas)	Not Applicable	
Flammability Limits in Air		
Upper flammability limit	Not applicable	
Lower flammability limit	Not applicable	
Vapor pressure	0 mmHg	
Vapor density	Not applicable	
Specific gravity	1.5 - 1.6	
Bulk density	No information available	
Relative density	No information available	
Water solubility	Gels on contact with water	
Solubility in other solvents	No information available	
Autoignition temperature	No information available	
Decomposition temperature	No information available	
Kinematic viscosity	No information available	
Dynamic viscosity	No information available	
Log Pow	Not determined	
Explosive properties	Not Applicable	
Oxidizing properties	None known.	

9.2 Other information

Pour point	No information available
Molecular weight	No information available
VOC content(%)	None
Density	No information available

10. Stability and reactivity

10.1 Reactivity

No specific reactivity hazards associated with this product.

10.2 Chemical stability

Stable under normal temperature conditions and recommended use.

10.3 Possibility of Hazardous Reactions

Hazardous polymerization
Hazardous polymerization does not occur.

Hazardous Reactions
None known.

10.4 Conditions to avoid

Heat, flames and sparks.

10.5 Incompatible materials

Strong oxidizing agents.

10.6 Hazardous decomposition products

Carbon oxides (COx).

11. Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Inhalation — Inhalation of dust may cause shortness of breath, tightness of the chest, a sore throat and cough.

Eye contact — Dust may cause mechanical irritation.

Skin contact — Repeated exposure may cause skin dryness or cracking.

Ingestion — Irritant; may cause pain or discomfort to mouth, throat and stomach.

Acute toxicity — 0% of the mixture consists of ingredient(s) of unknown toxicity.

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Carboxymethylcellulose sodium salt	= 27000 mg/kg (Rat)	> 2 g/kg (Rabbit)	> 5800 mg/m³ (Rat) 4 h

Sensitization — This product does not contain any components suspected to be sensitizing.

Mutagenic effects — This substance has no evidence of mutagenic properties.

Carcinogenicity — This substance has no evidence of carcinogenic properties.

Reproductive toxicity	None known.
Developmental toxicity	Not known to cause birth defects or have a deleterious effect on a developing fetus.
Routes of exposure	Inhalation. Skin contact. Eye contact.
Routes of entry	None known.
Specific target organ toxicity (single exposure)	Not classified
Specific target organ toxicity (repeated exposure)	Not classified.
Aspiration hazard	Not Applicable.

12. Ecological information

12.1 Toxicity

Toxicity to algae
See component information below.

Toxicity to fish
See component information below.

Toxicity to daphnia and other aquatic invertebrates
See component information below.

Component	Toxicity to fish	Toxicity to algae	Toxicity to daphnia and other aquatic invertebrates
Carboxymethylcellulose sodium salt	No information available	No information available	No information available

12.2 Persistence and degradability

No product level data available.

12.3 Bioaccumulative potential

No data available.

12.4 Mobility in soil

No information available.

12.5 Results of PBT and vPvB assessment

This substance is not considered to be persistent, bioaccumulating or toxic (PBT)
This substance is not considered to be very persistent nor very bioaccumulating (vPvB)

12.6 Other adverse effects.

None known. Check for additional information in sect. 7.

13. Disposal considerations

13.1 Waste treatment methods

Waste from residues / unused products	Dispose of in accordance with local regulations.
Contaminated packaging	Empty containers should be taken for local recycling, recovery or waste disposal.

14. Transport information

14.1 UN Number

UN/ID No. (ADR/RID/ADN/ADG)	Not regulated
UN No. (IMDG)	Not regulated
UN No. (ICAO)	Not regulated
UN No. (DOT)	Not regulated

14.2 Proper shipping name

Not regulated for transportation by DOT, TDG, IMDG and ICAO/IATA.

14.3 Hazard class(es)

ADR/RID/ADN Hazard class	Not regulated
IMDG Hazard class	Not regulated
ICAO Hazard class/division	Not regulated
DOT Hazard class	Not regulated

14.4 Packing group

ADR/RID/ADN Packing Group	Not regulated
IMDG Packing group	Not regulated
ICAO Packing group	Not regulated
DOT Packing group	Not regulated

14.5 Environmental hazard

No

14.6 Special precautions

Not Applicable

15. Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

International inventories

USA (TSCA)	Complies
European Union (EINECS and ELINCS)	Complies
Canada (DSL)	Complies
Philippines (PICCS)	Complies
Japan (ENCS)	Complies
China (IECSC)	Complies
Australia (AICS)	Complies
Korean (KECL)	Complies
New Zealand (NZIoC)	Complies

U.S. Federal and State Regulations

SARA 311/312 Hazard Catagories Not a SARA 311/312 hazard.

SARA 302/304, 313, CERCLA RQ, California Proposition 65
Note: If no components are listed below, this product is not subject to the referenced SARA and CERCLA regulations and is not known to contain a Proposition 65 listed chemical at a level that is expected to pose a significant risk under anticipated use conditions.

This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class Not a controlled product.

16. Other information

Supersedes date 20/Dec/2013

Revision date 21/Jul/2014

Version 7

The following sections have been revised All sections.

HMIS classification

Health	0
Flammability	1
Physical hazard	0
PPE	E

N/A - Not Applicable, N/D - Not Determined.

†A mark of M-I L.L.C.

Disclaimer
The information provided in this Material Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

MICHELS®

POTENTIAL ADDITIVIVE

PLATINUM PAC UL

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SDS no. 12481
Version 4
Revision date 08/Jan/2015
Supersedes date 14/Feb/2012

Safety Data Sheet
PLATINUM PAC† UL

1. Identification

1.1 Product identifier

Product name PLATINUM PAC† UL

Product code 12481

1.2 Relevant identified uses of the substance or mixture and uses advised against

Recommended Use Drilling fluid additive.

Uses advised against Consumer use

1.3 Details of the supplier of the safety data sheet

Supplier
M-I L.L.C.
P.O.Box 42842
Houston, TX 77242
www.miswaco.slb.com

Prepared by
Global Chemical Regulatory Compliance (GCRC) , Bethicia Prasek

1.4 Emergency Telephone Number

Emergency telephone (24 Hour) Australia +61 2801 44558, Asia Pacific +65 3158 1074, China +86 10 5100 3039, Europe +44 (0) 1235 239 670, Middle East and Africa +44 (0) 1235 239 671, New Zealand +64 9929 1483, USA 001 281 561 1600
Telephone Number - 281-561-1511

2. Hazards identification

2.1 Classification of the substance or mixture

GHS - Classification

Health hazards Not classified

Environmental hazards Not classified

Physical Hazards

Combustible dust	-

2.2 Label elements

Signal word
WARNING

May form combustible dust concentrations in air

Precautionary statements
P240 - Ground/bond container and receiving equipment
P243 - Take precautionary measures against static discharge

P241 - Use explosion-proof electrical/ ventilating/ lighting/ equipment

Unknown acute toxicity 0% of the mixture consists of ingredient(s) of unknown toxicity.

3. Composition/information on Ingredients

3.1 Substances

Not Applicable

3.2 Mixtures

Component	CAS-No	Weight % - range
Carbohydrate	Proprietary	60 - 100

Comments
The exact percentage (concentration) of composition has been withheld as a trade secret

4. First aid measures

4.1 First-Aid Measures

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Ingestion Rinse mouth. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Seek medical attention if irritation occurs.

Skin contact Wash off immediately with soap and plenty of water removing all contaminated clothes and shoes. Get medical attention immediately if symptoms occur.

Eye contact Promptly wash eyes with lots of water while lifting eye lids. Remove contact lenses. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

4.2 Most important symptoms and effects, both acute and delayed

General advice	The severity of the symptoms described will vary dependant of the concentration and the length of exposure. If adverse symptoms develop, the casualty should be transferred to hospital as soon as possible.
Main symptoms	
Inhalation	Please see Section 11. Toxicological Information for further information.
Ingestion	Please see Section 11. Toxicological Information for further information.
Skin contact	Please see Section 11. Toxicological Information for further information.
Eye contact	Please see Section 11. Toxicological Information for further information.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician Treat symptomatically

5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Fog, Alcohol Foam, CO_2, Dry Chemical.

Extinguishing media which shall not be used for safety reasons
None known.

5.2 Special hazards arising from the substance or mixture

Unusual fire and explosion hazards
Suspended dust may present a dust explosion hazard.

Hazardous combustion products
Carbon oxides (COx).

5.3 Advice for firefighters

Special protective equipment for fire-fighters
As in any fire, wear self-contained breathing apparatus and full protective gear.

Special Fire-Fighting Procedures
Containers close to fire should be removed immediately or cooled with water.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Extinguish all ignition sources. Avoid sparks, flames, heat and smoking. Evacuate personnel to safe areas. Use personal protective equipment. See also section 8. If spilled, take caution, as material can cause surfaces to become very slippery.

6.2 Environmental precautions

As local regulations may vary; all waste must be disposed/recycled/reclaimed in accordance with federal, state, and local environmental control regulations.

Environmental exposure controls
Avoid dust formation.

6.3 Methods and materials for containment and cleaning up

Methods for containment
Prevent further leakage or spillage if safe to do so.

Methods for cleaning up
Sweep up and shovel into suitable containers for disposal. After cleaning, flush away traces with water. Material becomes slippery when wet. Use caution if wet.

6.4 Reference to other sections

See section 13 for more information.

7. Handling and storage

7.1 Precautions for safe handling

Handling
Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin and eyes. Avoid dust formation.

Hygiene measures
Use good work and personal hygiene practices to avoid exposure. Do not eat, drink or smoke when using this product.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/precautions Ensure adequate ventilation. Provide appropriate exhaust ventilation at places where dust is formed. Keep airborne concentrations below exposure limits.

Storage precautions Keep away from open flames, hot surfaces and sources of ignition. Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure controls/personal protection

8.1 Control parameters

Exposure limits **Control as an ACGIH particulate not otherwise specified (PNOS): 10 mg/m³ (Inhalable); 3 mg/m³ (Respirable) and an OSHA particulate not otherwise regulated (PNOR): 15 mg/m³ (Total); 5 mg/m³ (Respirable).**

Component	ACGIH TLV	OSHA PEL
Carbohydrate	Not Determined	Not Determined

8.2 Exposure controls

All chemical Personal Protective Equipment (PPE) should be selected based on an assessment of both the chemical hazard present and the risk of exposure to those hazards. The PPE recommendations below are based on an assessment of the chemical hazards associated with this product. Where this product is used in a mixture with other products or fluids, additional hazards may be created and as such further assessment of risk may be required. The risk of exposure and need of respiratory protection will vary from workplace to workplace and should be assessed by the user in each situation.

Engineering measures to reduce exposure
Ensure adequate ventilation.

Personal protective equipment

Eye protection	Tightly fitting safety goggles.
Hand protection	Wear chemical resistant gloves such as nitrile or neoprene.
Respiratory protection	All respiratory protection equipment should be used within a comprehensive respiratory protection program that meets the requirements of 29 CFR 1910.134 (U.S. OSHA Respiratory Protection Standard) or local equivalent. If exposed to airborne mist/aerosol of this product, use at least a NIOSH-approved N95 half-mask disposable or re-usable particulate respirator. In work environments containing oil mist/aerosol, use at least a NIOSH-approved P95 half-mask disposable or reuseable particulate respirator. If exposed to vapors from this product use a NIOSH/MSHA-approved respirator with an Organic Vapor cartridge.
Skin and body protection	Wear suitable protective clothing.
Hygiene measures	Wash hands before eating, drinking or smoking, Remove and wash contaminated clothing before re-use.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

Physical state	Solid powder
Appearance	Opaque
Odor	Mild Odorless
Color	White - Yellow
Odor threshold	Not applicable

Property	**Values**	**Remarks**
pH		
pH @ dilution	6.5-8.5 @ 1% in H2O	
Melting/freezing point		
Boiling point/range	No information available	
Flash point	Does not flash	
Evaporation rate (BuAc =1)	No information available	
Flammability (solid, gas)	Not Applicable	
Flammability Limits in Air		
Upper flammability limit	No information available	
Lower flammability limit	No information available	
Vapor pressure	0 mmHg	
Vapor density	Not applicable	
Specific gravity	0.3 - 0.5	
Bulk density	No information available	
Water solubility	Soluble in water	
Solubility in other solvents	No information available	
Autoignition temperature	No information available	
Decomposition temperature	No information available	
Kinematic viscosity	No information available	
Dynamic viscosity	No information available	
Log Pow	Not determined	
Explosive properties	Not Applicable	
Oxidizing properties	None known.	

9.2 Other information

Pour point	No information available
Molecular weight	No information available

VOC content(%) None
Density No information available

10. Stability and reactivity

10.1 Reactivity

No specific reactivity hazards associated with this product.

10.2 Chemical stability

Stable under normal temperature conditions and recommended use.

10.3 Possibility of Hazardous Reactions

Hazardous polymerization
Hazardous polymerization does not occur.

Hazardous Reactions
None known.

10.4 Conditions to avoid

Heat, flames and sparks.

10.5 Incompatible materials

Strong oxidizing agents.

10.6 Hazardous decomposition products

Carbon oxides (COx).

11. Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Inhalation Inhalation of dust may cause shortness of breath, tightness of the chest, a sore throat and cough.

Eye contact Dust may cause mechanical irritation.

Skin contact Repeated exposure may cause skin dryness or cracking.

Ingestion Irritant; may cause pain or discomfort to mouth, throat and stomach.

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Carbohydrate	= 27000 mg/kg (Rat)	> 2 g/kg (Rabbit)	> 5800 mg/m³ (Rat) 4 h

Component	IARC Group 1 or 2	ACGIH - Carcinogens	OSHA listed carcinogens	NTP
Carbohydrate	No data available	No data available	No data available	No data available

Sensitization This product does not contain any components suspected to be sensitizing.

Mutagenic effects This substance has no evidence of mutagenic properties.

Carcinogenicity	This substance has no evidence of carcinogenic properties.
Reproductive toxicity	None known.
Developmental toxicity	Not known to cause birth defects or have a deleterious effect on a developing fetus.
Routes of exposure	Inhalation. Skin contact. Eye contact.
Routes of entry	None known.
Specific target organ toxicity (single exposure)	Not classified
Specific target organ toxicity (repeated exposure)	Not classified.
Aspiration hazard	Not Applicable.

12. Ecological information

12.1 Toxicity

Toxicity to algae
See component information below.

Toxicity to fish
See component information below.

Toxicity to daphnia and other aquatic invertebrates
See component information below.

Component	Toxicity to fish	Toxicity to algae	Toxicity to daphnia and other aquatic invertebrates
Carbohydrate (60 - 100)	No information available	No information available	No information available

12.2 Persistence and degradability

No product level data available.

12.3 Bioaccumulative potential

No data available.

12.4 Mobility in soil

No information available.

12.5 Results of PBT and vPvB assessment

This substance is not considered to be persistent, bioaccumulating or toxic (PBT)
This substance is not considered to be very persistent nor very bioaccumulating (vPvB)

12.6 Other adverse effects.

None known.

13. Disposal considerations

13.1 Waste treatment methods

Disposal Method Disposal should be made in accordance with federal, state and local regulations.

Contaminated packaging Empty containers should be taken for local recycling, recovery or waste disposal.

14. Transport information

14.1 UN Number

UN/ID No. (ADR/RID/ADN/ADG)	Not regulated
UN No. (IMDG)	Not regulated
UN No. (ICAO)	Not regulated
UN No. (DOT)	Not regulated

14.2 Proper shipping name

Not regulated for transportation by DOT, TDG, IMDG and ICAO/IATA.

14.3 Hazard class(es)

ADR/RID/ADN Hazard class	Not regulated
IMDG Hazard class	Not regulated
ICAO Hazard class/division	Not regulated
DOT Hazard class	Not regulated

14.4 Packing group

ADR/RID/ADN Packing Group	Not regulated
IMDG Packing group	Not regulated
ICAO Packing group	Not regulated
DOT Packing group	Not regulated

Marine pollutant
No

14.6 Special precautions
Not Applicable

15. Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

International inventories

USA (TSCA)	Complies
European Union (EINECS and ELINCS)	Complies
Canada (DSL)	Complies
Philippines (PICCS)	Complies
Japan (ENCS)	Complies

China (IECSC)	Complies
Australia (AICS)	Complies
Korean (KECL)	Complies
New Zealand (NZIoC)	Complies

U.S. Federal and State Regulations

SARA 311/312 Hazard Categories
Not a SARA 311/312 hazard.

SARA 302/304, 313, CERCLA RQ, California Proposition 65
Note: If no components are listed below, this product is not subject to the referenced SARA and CERCLA regulations and is not known to contain a Proposition 65 listed chemical at a level that is expected to pose a significant risk under anticipated use conditions.

Component	SARA 302 / TPQs	SARA 313	CERCLA RQ
Carbohydrate	N/A	N/A	N/A

State Comments
Proposition 65: This product is not known to contain chemicals considered by the State of California's Safe Drinking Water and Toxic Enforcement Act of 1986 as causing cancer and/or reproductive toxicity at levels that are expected to pose a significant risk under anticipated use conditions.

Canadian Classification

This product has been classified in accordance with the hazard criteria of the CPR and the SDS contains all the information required by the CPR.

WHMIS Hazard Class Not a controlled product.

16. Other information

Supersedes date 14/Feb/2012

Revision date 08/Jan/2015

Version 4

The following sections have been revised All sections. Updated according to GHS/CLP.

HMIS classification

Health	0
Flammability	1
Physical hazard	0
PPE	E

N/A - Not Applicable, N/D - Not Determined.

†A mark of M-I L.L.C.

Disclaimer
The information contained herein is considered in good faith as reliable of the date issued and is based upon on measurements, tests or data derived from supplier's own study or furnished by others. In providing this SDS information, Supplier makes no express or implied warranties as to the information or product; merchantability or fitness of purpose; any express or implied warranty; or non-infringement of intellectual property rights; and supplier assumes no responsibility for any direct, special or consequential damages, results obtained, or the activities of others. To the maximum extent permitted by law, supplier's warranty obligations and buyer's sole remedies are as stated in separate agreement between the parties.

MICHELS®

POTENTIAL ADDITIVIVE

RING FREE

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SDS no. 12003
Version 3
Revision date 24/Jul/2014
Supersedes date 27/Dec/2013

Safety Data Sheet
RINGFREE†

1. Identification of the substance/preparation and of the Company/undertaking

1.1 Product identifier

Product name RINGFREE†
Product code 12003

1.2 Relevant identified uses of the substance or mixture and uses advised against

Recommended Use Drilling fluid additive

Uses advised against Consumer use

1.3 Details of the supplier of the safety data sheet

Supplier
M-I L.L.C.
P.O.Box 42842
Houston, TX 77242
www.miswaco.slb.com

Prepared by
Global Chemical Regulatory Compliance (GCRC) , Mike McDowell

1.4 Emergency Telephone Number

Emergency telephone - (24 Hour) Australia +61 2801 44558, Asia Pacific +65 3158 1074, China +86 10 5100 3039, Europe +44 (0) 1235 239 670, Middle East and Africa +44 (0) 1235 239 671, New Zealand +64 9929 1483, USA 001 281 561 1600
Telephone Number - 281-561-1512

2. Hazards identification

2.1 Classification of the substance or mixture

GHS - Classification

Not a dangerous substance or mixture according to the Globally Harmonized System (GHS)

Health hazards Not classified

Environmental hazards Not classified

Physical Hazards Not classified

2.2 Label elements

Not a dangerous substance or mixture according to the Globally Harmonized System (GHS)
Hazard statements
None

Precautionary statements
None

-

3. Composition/information on Ingredients

3.1 Substances

Not Applicable

3.2 Mixtures

Not Applicable

Comments
No classified ingredients, or those having occupational exposure limits, present above the level of disclosure.

4. First aid measures

4.1 Description of first-aid measures

Inhalation — If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Ingestion — Rinse mouth. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Get medical attention if symptoms occur.

Skin contact — Wash off immediately with soap and plenty of water removing all contaminated clothes and shoes. Get medical attention immediately if symptoms occur.

Eye contact — Remove contact lenses. Promptly wash eyes with lots of water while lifting eye lids. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

4.2 Most important symptoms and effects, both acute and delayed

General advice — The severity of the symptoms described will vary dependant of the concentration and the length of exposure. If adverse symptoms develop, the casualty should be transferred to hospital as soon as possible.

Main symptoms

Inhalation — Please see Section 11. Toxicological Information for further information.

Ingestion — Please see Section 11. Toxicological Information for further information.

Skin contact — Please see Section 11. Toxicological Information for further information.

Eye contact — Please see Section 11. Toxicological Information for further information.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician Treat symptomatically.

5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media
Use extinguishing media appropriate for surrounding material.

Extinguishing media which shall not be used for safety reasons
None known.

5.2 Special hazards arising from the substance or mixture

Unusual fire and explosion hazards
None known.

Hazardous combustion products
Carbon oxides (COx).

5.3 Advice for firefighters

Special protective equipment for fire-fighters
As in any fire, wear self-contained breathing apparatus and full protective gear.

Special Fire-Fighting Procedures
Containers close to fire should be removed immediately or cooled with water.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. See also section 8.

6.2 Environmental precautions

The product should not be allowed to enter drains, water courses or the soil.

Environmental exposure controls
Avoid release to the environment.

6.3 Methods and materials for containment and cleaning up

Methods for containment
Prevent further leakage or spillage if safe to do so. Dike far ahead of liquid spill for later disposal.

Methods for cleaning up
Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. After cleaning, flush away traces with water.

6.4 Reference to other sections

See section 13 for more information.

7. Handling and storage

7.1 Precautions for safe handling

Handling
Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin and eyes. Do not breathe vapors or spray mist. Avoid spills and splashing during use.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/precautions	Ensure adequate ventilation. Keep airborne concentrations below exposure limits.
Storage precautions	Keep containers tightly closed in a dry, cool and well-ventilated place.
Packaging material	Use specially constructed containers only

8. Exposure controls/personal protection

8.1 Control parameters

Exposure limits The product does not contain any hazardous materials with occupational exposure limits established.

8.2 Exposure controls

All chemical Personal Protective Equipment (PPE) should be selected based on an assessment of both the chemical hazard present and the risk of exposure to those hazards. The PPE recommendations below are based on an assessment of the chemical hazards associated with this product. Where this product is used in a mixture with other products or fluids, additional hazards may be created and as such further assessment of risk may be required. The risk of exposure and need of respiratory protection will vary from workplace to workplace and should be assessed by the user in each situation.

Engineering measures to reduce exposure
Ensure adequate ventilation.

Personal protective equipment

Eye protection	It is good practice to wear goggles when handling any chemical. Tightly fitting safety goggles.
Hand protection	Wear chemical resistant gloves such as nitrile or neoprene.
Respiratory protection	No personal respiratory protective equipment normally required, In case of insufficient ventilation wear suitable respiratory equipment.
Skin and body protection	Wear suitable protective clothing, Provide eyewash station.

Hygiene measures Wash hands before eating, drinking or smoking, Remove and wash contaminated clothing before re-use.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

Physical state	Liquid
Appearance	Transparent
Odor	Mild
Color	Light yellow
Odor threshold	Not applicable

Property	Values	Remarks
pH	6 - 8	

pH @ dilution	
Melting/freezing point	
Boiling point/range	90 °C / 194 °F
Flash point	No information available
Evaporation rate (BuAc =1)	
Flammability (solid, gas)	Not Applicable
Flammability Limits in Air	
Upper flammability limit	Not applicable
Lower flammability limit	Not applicable
Vapor pressure	No information available
Vapor density	No information available
Specific gravity	1.27
Bulk density	No information available
Relative density	No information available
Water solubility	Slightly soluble in water.
Solubility in other solvents	No information available
Autoignition temperature	No information available
Decomposition temperature	No information available
Kinematic viscosity	No information available
Dynamic viscosity	No information available
Log Pow	Does not bioaccumulate
Explosive properties	No information available
Oxidizing properties	No information available

9.2 Other information

Pour point	No information available
Molecular weight	No information available
VOC content(%)	No information available
Density	No information available

10. Stability and reactivity

10.1 Reactivity

No specific reactivity hazards associated with this product.

10.2 Chemical stability

Stable under normal temperature conditions and recommended use.

10.3 Possibility of Hazardous Reactions

Hazardous polymerization
Hazardous polymerization does not occur.

10.4 Conditions to avoid

None known.

10.5 Incompatible materials

Strong oxidizing agents.

10.6 Hazardous decomposition products

Carbon oxides (COx).

11. Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Inhalation	Inhalation of vapors in high concentration may cause irritation of respiratory system.
Eye contact	May cause slight irritation.
Skin contact	Prolonged contact may cause redness and irritation.
Ingestion	Ingestion may cause stomach discomfort.
Acute toxicity	0% of the mixture consists of ingredient(s) of unknown toxicity.

Sensitization	This product does not contain any components suspected to be sensitizing.
Mutagenic effects	No evidence of mutagenic properties.
Carcinogenicity	No evidence of carcinogenic properties.
Reproductive toxicity	No evidence of toxicity to reproduction.
Developmental toxicity	Not known to cause birth defects or have a deleterious effect on a developing fetus.
Routes of exposure	Eye contact. Skin contact. Inhalation.
Routes of entry	No route of entry noted.
Specific target organ toxicity (single exposure)	Not classified
Specific target organ toxicity (repeated exposure)	Not classified.
Aspiration hazard	Not Applicable.

12. Ecological information

12.1 Toxicity

Toxicity to algae
See component information below.

Toxicity to fish
See component information below.

Toxicity to daphnia and other aquatic invertebrates
See component information below.

12.2 Persistence and degradability

No product level data available.

12.3 Bioaccumulative potential

No data available.

12.4 Mobility in soil

No information available.

12.5 Results of PBT and vPvB assessment

This preparation contains no substance considered to be persistent, bioaccumulating nor toxic (PBT)
This preparation contains no substance considered to be very persistent nor very bioaccumulating (vPvB)

12.6 Other adverse effects.

None known.

13. Disposal considerations

13.1 Waste treatment methods

Waste from residues / unused products	Dispose of in accordance with local regulations.
Contaminated packaging	Empty containers should be taken for local recycling, recovery or waste disposal.

14. Transport information

14.1 UN Number

UN/ID No. (ADR/RID/ADN/ADG)	Not regulated
UN No. (IMDG)	Not regulated
UN No. (ICAO)	Not regulated
UN No. (DOT)	Not regulated

14.2 Proper shipping name

Not regulated for transportation by DOT, TDG, IMDG and ICAO/IATA.

14.3 Hazard class(es)

ADR/RID/ADN Hazard class	Not regulated
IMDG Hazard class	Not regulated
ICAO Hazard class/division	Not regulated
DOT Hazard class	Not regulated

14.4 Packing group

ADR/RID/ADN Packing Group	Not regulated
IMDG Packing group	Not regulated
ICAO Packing group	Not regulated
DOT Packing group	Not regulated

14.5 Environmental hazard

No

14.6 Special precautions
Not Applicable

15. Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

International inventories

USA (TSCA)	Complies
European Union (EINECS and ELINCS)	Does not Comply
Canada (DSL)	Complies
Philippines (PICCS)	Complies
Japan (ENCS)	Complies
China (IECSC)	Complies
Australia (AICS)	Complies
Korean (KECL)	Complies
New Zealand (NZIoC)	Complies

IMPORTS, Canada
No import volume restrictions.

U.S. Federal and State Regulations

SARA 311/312 Hazard Catagories Not a SARA 311/312 hazard.

State Comments
Proposition 65: This product is not known to contain chemicals considered by the State of California's Safe Drinking Water and Toxic Enforcement Act of 1986 as causing cancer and/or reproductive toxicity at levels that are expected to pose a significant risk under anticipated use conditions.

This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class Not a controlled product.

16. Other information

Supersedes date	27/Dec/2013
Revision date	24/Jul/2014
Version	3
The following sections have been revised	All sections. Updated according to GHS.

Health	0
Flammability	1
Physical hazard	0
PPE	E

Disclaimer
The information provided in this Material Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

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TORQMASTER

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WYO-BEN, INC.

SAFETY DATA SHEET

1. PRODUCT AND COMPANY IDENTIFICATION

Product identifier
Product Code 25392
Product Name **TORQMASTER®**

Other means of identification

Recommended use of the chemical and restrictions on use
Use only for the purpose on the product label.

Details of the supplier of the safety data sheet

Manufacturer / Manufactured For
WYO-BEN
1345 Discovery Dr
Billings, Montana 59102
Phone: 406-652-6351
Emergency telephone number
24 Hour Emergency Phone Number: 1-800-535-5053

2. HAZARDS IDENTIFICATION

This product is not classified according to paragraph (d) of 29 CFR 1910.1200 and does not require a hazard warning label.

Hazard Classification

Acute aquatic toxicity	Category 3
Chronic aquatic toxicity	Category 3

Signal Word
None

Hazard Statements
Harmful to aquatic life with long lasting effects

Hazard Symbol
None

Precautionary Statements - Prevention
Avoid release to the environment.

Precautionary Statements - Response
Specific Treatment (See Section 4 on the SDS).
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
IF ON SKIN: Wash with plenty of soap and water. Wash contaminated clothing before reuse.
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
IF SWALLOWED: Rinse mouth. DO NOT induce vomiting. Drink plenty of water.

Precautionary Statements – Storage
Keep out of reach of children.

Precautionary Statements - Disposal
Dispose of contents/container to an approved waste disposal plant.

Hazards not otherwise classified (HNOC)

Other Information

Unknown Acute Toxicity 0.06% of the mixture consists of ingredient(s) of unknown toxicity.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS No.	Weight-%	Trade Secret
PROPRIETARY	Proprietary	1-5	*
Sodium Carbonate	497-19-8	1-5	*

*The exact percentage (concentration) of composition has been withheld as a trade secret.

4. FIRST AID MEASURES

First aid measures

Skin Contact Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Wash contaminated clothing before reuse. If skin irritation persists, call a physician.

Eye contact Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. If irritation persists, call a physician.

Inhalation If mists/vapors are formed or irritation occurs, leave area and do not return until mists/vapors have dissipated. If irritation persists, see a physician.

Ingestion Rinse mouth. Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Drink plenty of water. If irritation persists, see a physician.

Most important symptoms and effects, both acute and delayed

Symptoms No Information available.

Indication of any immediate medical attention and special treatment needed

Note to physicians Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media

Caution: Use of water spray when fighting fire may be inefficient.

Specific hazards arising from the chemical

No Information available.

Explosion data

Sensitivity to Mechanical Impact None
Sensitivity to Static Discharge None

Protective equipment and precautions for firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA **Health Hazard 0** **Fire Hazard 0** **Reactivity 0**

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions Ensure adequate ventilation, especially in confined areas.

Environmental precautions

Environmental precautions See Section 12 for additional ecological information.

Methods and material for containment and cleaning up

Methods for containment Prevent further leakage or spillage if safe to do so.

Methods for cleaning up Soak up with inert absorbent material. Pick up and transfer to properly labeled containers.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage, including any incompatibilities

Storage Conditions Keep containers tightly closed in a dry, cool and well-ventilated place.

Incompatible materials None known based on information supplied.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Appropriate engineering controls

Engineering Controls Showers, Eyewash stations & Ventilation systems.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin and body protection Wear chemical resistant gloves.

Respiratory protection If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators or air purifying respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.

General Hygiene Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Viscous Liquid
Appearance	Pink, Dark
Odor	Mild
Odor threshold	No Information available

Property	Values
pH	9.5 - 11.5
Specific Gravity	1.01
Viscosity	No Information available
Melting point/freezing point	No Information available
Boiling point / boiling range	> 212 / ° F Degrees
Flash point	> 212 / ° F Degrees
Evaporation rate	No Information available
Flammability (solid, gas)	No Information available
Upper flammability limit:	No Information available
Lower flammability limit:	No Information available
Vapor pressure	No Information available
Vapor density	No Information available
Bulk Density Lbs/Gal	No Information available
Water solubility	Complete
Partition Coefficient (n-octanol/water)	No Information available
Autoignition temperature	No Information available
Decomposition temperature	No Information available
VOC Content (%)	No Information available

10. STABILITY AND REACTIVITY

Reactivity
No data available

Chemical stability
Stable under recommended storage conditions.

Possibility of Hazardous Reactions
None under normal processing.

Conditions to avoid
Extremes of temperature and direct sunlight.

Incompatible materials
None known based on information supplied.

Hazardous Decomposition Products
None known based on information supplied.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information No data available

Inhalation No data available.

Eye contact No data available.

Skin Contact No data available.

Ingestion No data available.

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50
Sodium Carbonate 497-19-8	= 4090 mg/kg (Rat)	-	= 2300 mg/m³ (Rat) 2 h

Information on toxicological effects

Symptoms No Information available.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Sensitization	No Information available.
Germ cell mutagenicity	No Information available.
Carcinogenicity	No Information available.
Reproductive toxicity	No Information available.
STOT - single exposure	No Information available.
STOT - repeated exposure	No Information available.
Aspiration hazard	No Information available.

Numerical measures of toxicity - Product Information

Unknown Acute Toxicity 0.05% of the mixture consists of ingredient(s) of unknown toxicity.
This is based upon values calculated per chapter 3.1 of the GHS document.

12. ECOLOGICAL INFORMATION

Ecotoxicity

0.05% of the mixture consists of components(s) of unknown hazards to the aquatic environment

Chemical Name	Algae/aquatic plants	Fish	Crustacea
PROPRIETARY	-	LC50 Oncorhynchus mykiss, 96 hr.,1.2 mg/L:	LC50 Daphnia sp., 48 hr., 5.3 mg/L
Sodium Carbonate 497-19-8	EC 50 Nitzschia sp.,120 hr.,242 mg/L	LC 50 Lepomis macrochirus, 96 hr., 300 mg/L static LC50 Pimephales promelas, 96 hr., 310 - 1220 mg/L., static	EC50 Daphnia magna, 48 hr., 265 mg/L

Persistence and degradability
No Information available.

Bioaccumulation
No Information available.

Other adverse effects No Information available.

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Disposal of wastes Disposal should be in accordance with applicable regional, national and local laws and regulations.

Contaminated packaging Do not reuse container.

This product contains one or more substances that are listed with the State of California as a hazardous waste.

Chemical Name	California Hazardous Waste Status
Sodium Carbonate 497-19-8	Corrosive

14. TRANSPORT INFORMATION

The shipping classification information in this section (Section 14) is meant as a guide to the overall classification of the product. However, transportation classifications may be subject to change with changes in package size. Consult shipper requirements under 49 CFR, IATA and IMDG to assure regulatory compliance.

DOT Not regulated

15. REGULATORY INFORMATION

International Inventories

TSCA	Complies
DSL/NDSL	Complies
EINECS/ELINCS	Does not comply
ENCS	Does not comply
IECSC	Does not comply
KECL	Does not comply
PICCS	Does not comply
AICS	Does not comply

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory.
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List.
EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances.
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
AICS - Australian Inventory of Chemical Substances

US Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311/312 Hazard Categories

Acute health hazard	No
Chronic Health Hazard	No
Fire hazard	No
Sudden release of pressure hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

US State Regulations

California Proposition 65

This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

This product does not contain chemicals subject to Right-To-Know regulations in other states.

U.S. EPA Label Information

EPA Pesticide Registration Number Not Applicable

16. OTHER INFORMATION

Prepared	12/17/2019
Last Revision	01/17/2020

DISCLAMER

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text. No warranty or guarantee, expressed or implied is made by WYO-BEN, INC. as to this information, or as to the safety, toxicity or effect of the use of this product.

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PLUGZ IT

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WYO-BEN, INC.

SAFETY DATA SHEET

SECTION 1 — CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Trade Name:	**PLUGZ-IT™ MAX**
Chemical Family:	Mineral
Application:	Sealing
Manufacturer/Supplier:	Wyo-Ben, Inc. 1345 Discovery Drive Billings, MT 59102 USA Telephone: 800.548.7055 Facsimile: 406.656.0748
Emergency Phone Number	CHEMTREC® 800.424.9300

SECTION 2 — HAZARD IDENTIFICATION

Hazard Symbol: Health Hazard

Signal Word: Warning

Hazard Overview:

ACUTE HEALTH HAZARD
May cause eye and respiratory irritation.

CHRONIC HEALTH HAZARD
Breathing crystalline silica can cause lung disease, including silicosis and lung cancer.

SECTION 3 — COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	Percent	ACGIH TLV-TWA	OSHA PEL-TWA*
Crystalline Silica, quartz	14808-60-7	1 – 6%	0.025 mg/m^3	$\frac{10\ mg/m^3}{\%SiO2 + 2}$

*More restrictive exposure limits may be enforced by some states, agencies, or other authorities.
Non-hazardous components > 94%

SECTION 4 — FIRST AID MEASURES

Inhalation:	If inhaled, remove to a dust free area. Get medical attention if respiratory irritation develops or if breathing becomes difficult. Inhalation may aggravate existing respiratory illness.
Skin:	Wash with soap and water until clear. Seek medical attention if irritation persists.
Eyes:	In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.
Ingestion:	No adverse effects.
Notes to Physician:	Treat Symptomatically.

SECTION 5 — FIRE FIGHTING MEASURES

Flash Point/Range (F):	Not applicable
Flash Point/Range (C):	Not applicable
Flash Point Method:	Not applicable
Autoignition Temperature (F):	Not applicable
Autoignition Temperature (C):	Not applicable
Flammability Limits in Air – Lower (%):	Not applicable
Flammability Limits in Air – Upper (%):	Not applicable
Fire Extinguishing Media:	All standard firefighting media. (Caution slippery when wet.)
Special Exposure Hazards:	Not applicable
Special Protective Equipment for Firefighters:	Not applicable
NFPA Ratings:	Health 0, Flammability 0, Reactivity 0

SECTION 6 — ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures:	Use appropriate protective equipment. Avoid creating and breathing dust.
Environmental Precautionary Measures:	None known.
Procedure for Cleaning/Absorption:	Collect using appropriate dustless method and hold for appropriate disposal.

SECTION 7 — HANDLING AND STORAGE

Handling Precautions:	This product contains quartz which may become airborne. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposure below recommended exposure limits. Wear a NIOSH/MSHA European Standard En 149, or equivalent certified for silica bearing dust, respirator when using this product. Material is slippery when wet. Promptly clean up spills to avoid breathing airborne dust.
Storage Information:	Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container.

SECTION 8 — EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls:	Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits.
Personal Protective Equipment:	If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.
Respiratory Protection:	Not normally needed. If significant exposures are possible use NIOSH/MSH respirator approved for silica bearing dust.
Hand Protection:	Normal work gloves.
Skin Protection:	Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.
Eye Protection:	Wear safety glasses or goggles to protect against exposure.
Other Precautions:	None known.

SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid
Color:	Light tan to gray as dry powder
Odor:	Odorless
pH:	8 – 10 (5% aqueous solution)
Specific Gravity @ 20 C (Water=1):	2.45 – 2.55
Density @ 20 C (lbs/gallon):	Not determined
Bulk Density @ 20 C (lbs/ft^3):	60 – 66
Boiling Point/Range (F):	Not applicable
Boiling Point/Range (C):	Not applicable
Freezing Point/Range (F):	Not applicable
Freezing Point/Range (C):	Not applicable
Vapor Pressure @ 20 C (mmHg):	Not applicable
Vapor Density (Air=1):	Not applicable
Percent Volatiles:	Not applicable
Evaporation Rate (Butyl Acetate=1):	Not applicable
Solubility in Water (g/100ml):	Insoluble, forms colloidal suspension
Solubility in Solvents (g/100ml):	Not applicable
VOCs (lbs/gallon):	Not applicable
Viscosity, Dynamic @ 20 C (centipoise):	240
Viscosity, Kinematic @ 20 C (centistrokes):	Not applicable
Partition Coefficient/n-Octanol/Water:	Not applicable
Molecular Weight (g/mole):	Not applicable

SECTION 10 — STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid:	None anticipated
Incompatibility (Materials to Avoid):	Hydrofluoric Acid
Hazardous Decomposition Products:	None
Additional Guidelines:	Not applicable

SECTION 11 — TOXICOLOGICAL INFORMATION

Principle Route of Exposure:	Eye or skin contact, inhalation.
Inhalation:	Inhaled crystalline silica in the form or quartz from occupational sources is carcinogenic to humans (IARC, Group 1).
Skin Contact:	May cause mechanical skin irritation.
Eye Contact:	May cause eye irritation.
Ingestion:	None known
Aggravated Medical Conditions:	Individuals with respiratory disease, including but not limited to asthma and bronchitis, or subject to eye irritation, should not be exposed to respirable quartz-bearing dust.
Chronic Effects/Carcinogenicity:	Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis. Cancer Status: The International Agency for Research on Cancer (IARC, 1997) concludes that there is sufficient evidence in humans for carcinogenicity of inhaled crystalline silica from occupational sources (IARC Group 1), that carcinogenicity was not detected in all industrial circumstances studied and that carcinogenicity may depend on characteristics of the crystalline silica or on external factors affecting its biological activity. See IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997). The National Toxicology Program (NTP) classifies respirable crystalline silica as "Known to be a human carcinogen" (NTP 9th Report on Carcinogens, 2000). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies crystalline silica, quartz, as a suspected human carcinogen (A2).
Other Information:	See "Adverse Effects of Crystalline Silica Exposure" published by the American Thoracic Society Medical Section of the American Lung Association, American Journal of Respiratory and Critical Care Medicine, Volume 155, pages 761-768 (1997).
Toxicity Tests	
Oral Toxicity:	Not determined (on FDA GRAS list; used as a food additive)
Dermal Toxicity:	Not determined (on FDA GRAS list; used in cosmetic preparations)
Inhalation Toxicity:	Not determined
Primary Irritation Effect:	Not determined
Carcinogenicity:	Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997).
Genotoxicity:	Not determined
Reproductive/Developmental Toxicity:	Not determined

SECTION 12 — ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air):	Not determined
Persistence/Degradability:	Not determined
Bio-accumulation:	Not determined

Ecotoxicological Information

Acute Fish Toxicity:	Not determined
Acute Crustaceans Toxicity:	Not determined
Acute Algae Toxicity:	Not determined

Chemical Fate Information:	Not determined
Other Information:	Not applicable

SECTION 13 — DISPOSAL CONSIDERATIONS

Disposal Method:	Bury in a licensed landfill according to federal, state and local regulations.
Contaminated Packaging:	Follow all applicable national or local regulations.

SECTION 14 — TRANSPORT INFORMATION

Land Transportation

DOT – Not Restricted
Canadian TDG – Not Restricted
ADR – Not Restricted

Air Transportation

ICAO/IATA – Not Restricted

Sea Transportation

IMDG – Not Restricted

Other Transportation Information

Labels: None

SECTION 15 — REGULATORY INFORMATION

US Regulations

US TSCA Inventory	All components listed on inventory or are exempt.
EPA SARA Title III Extremely Hazardous Substances	Not applicable
EPA SARA (311, 312) Hazard Class	Acute Health Hazard Chronic Health Hazard
EPA SARA (313) Chemicals	This product does not contain a toxic chemical for routine annual “Toxic Chemical Release Reporting” under Section 313 (40 CFR 372).

EPA CERCLA/Superfund Reportable Spill Quantity	Not applicable
EPA RCRA Hazardous Waste Classification	If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.
California Proposition 65	This product contains crystalline silica (respirable) which is a substance known to the State of California to cause cancer.

Canadian Regulations

Canadian DSL Inventory	All components listed on inventory are exempt.
WHMIS Hazard Class	This product contains crystalline silica (respirable) and is classified as a Class D, Division 2, Subdivision A substance.

SECTION 16 — OTHER INFORMATION

Prepared	03/18/2015
Last Revision	07/23/2015

DISCLAIMER

All information presented herein is believed to be accurate; however, it is the user's responsibility to determine in advance of need that the information is current and suitable for their circumstances. No warranty or guarantee, expressed or implied is made by WYO-BEN, INC. as to this information, or as to the safety, toxicity or effect of the use of this product.

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CLAY CUTTER

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MATERIAL SAFETY DATA SHEET

1. Product and Company Identification

Material name CLAY CUTTER™

Version # 05

Revision date 19-December-2008

Chemical name Formation Inhibitor

Chemical description Liquid

CAS # Mixture

Manufacturer

CETCO
Drilling Products Group
2870 Forbs Avenue
Hoffman Estates, IL 60192 US
safetydata@amcol.com
http://www.cetco.com/
General Information (800) 527-9948
CHEMTREC® (800) 424-9300

2. Hazards Identification

Emergency overview No hazards resulting from the material as supplied. Health injuries are not known or expected under normal use.

OSHA regulatory status While this material is not considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200), this MSDS contains valuable information critical to the safe handling and proper use of the product. This MSDS should be retained and available for employees and other users of this product.

Potential health effects

Eyes Contact with eyes may cause irritation.

Skin May cause skin irritation in susceptible persons.

Inhalation Health injuries are not known or expected under normal use.

Ingestion Ingestion of this product may cause nausea, vomiting and diarrhea.

3. Composition / Information on Ingredients

The manufacturer lists no ingredients as hazardous according to OSHA 29 CFR 1910.1200.

Composition comments This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

4. First Aid Measures

First aid procedures

Eye contact Immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation develops or persists.

Skin contact Wash off with soap and water. Remove contaminated clothing. Get medical attention if irritation develops or persists.

Inhalation Remove to fresh air. If the affected person is not breathing, apply artificial respiration. If breathing is difficult, give oxygen. Get medical attention, if needed.

Ingestion Give victim water or milk. If swallowed, do NOT induce vomiting. Never give anything by mouth to an unconscious person. Obtain medical attention.

General advice If you feel unwell, seek medical advice (show the label where possible).

5. Fire Fighting Measures

Flammable properties Not a fire hazard.

Extinguishing media

Suitable extinguishing media Use any media suitable for the surrounding fires.

Protection of firefighters

Protective equipment and precautions for firefighters	Move containers from fire area if you can do it without risk. Cool containers with flooding quantities of water until well after fire is out.
Hazardous combustion products	None known.

6. Accidental Release Measures

Environmental precautions	Prevent spreading over a wide area (e.g. by containment or oil barriers). Prevent further leakage or spillage if safe to do so. Do not flush into surface water or sanitary sewer system.
Methods for containment	Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible.
Methods for cleaning up	Absorb spill with inert material (e.g., dry sand or earth), then place in a chemical waste container. Do not allow the spilled product to enter public drainage system or open water courses. Wear appropriate protective equipment and clothing during clean-up.

7. Handling and Storage

Handling	Use only in well-ventilated areas. Provide sufficient air exchange and/or exhaust in work rooms. In case of insufficient ventilation, wear suitable respiratory equipment.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Store in original container.

8. Exposure Controls / Personal Protection

Engineering controls	Good general ventilation should be sufficient to control airborne levels. Local exhaust is suggested for use, where possible, in enclosed or confined spaces. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower.

Personal protective equipment

Eye / face protection	Wear safety glasses; chemical goggles (if splashing is possible).
Skin protection	Wear appropriate chemical resistant gloves. Use of an impervious apron is recommended.
Respiratory protection	None required where adequate ventilation conditions exist.
General hygeine considerations	Use good industrial hygiene practices in handling this material. Wash hands before breaks and immediately after handling the product.

9. Physical & Chemical Properties

Appearance	Not available.
Color	Not available.
Odor	Not available.
Odor threshold	Not available.
Physical state	Liquid.
Form	Liquid.
pH	Not available.
Melting point	Not available.
Freezing point	Not available.
Boiling point	Not available.
Flash point	Not available.
Evaporation rate	Not available.
Flammability	Not available.
Flammability limits in air, upper, % by volume	Not available.
Flammability limits in air, lower, % by volume	Not available.
Vapor pressure	Not available.
Vapor density	Not Determined
Specific gravity	Not available.
Relative density	Not available.
Solubility (water)	Not available.

Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Percent volatile	50 % v/v

10. Chemical Stability & Reactivity Information

Chemical stability	No hazards to be especially mentioned. Stable at normal conditions.
Conditions to avoid	None known.
Incompatible materials	None known.
Hazardous decomposition products	Upon decomposition, this product may yield gaseous nitrogen oxides, carbon monoxide, carbon dioxide and/or low molecular weight hydrocarbons.
Possibility of hazardous reactions	Will not occur.

11. Toxicological Information

Component analysis - LD50	This product is judged to have an acute oral LD50 (rat) greater than 5 g/kg of body weight, and ar acute dermal LD50 (rabbit) greater than 3.16 g/kg of body weight.
Further information	This product has no known adverse effect on human health.

12. Ecological Information

Ecotoxicity	This material is not expected to be harmful to aquatic life. This material has a biodegradatior percentage of 85.2% and is considered to have ready biodegradability. This material exceeds the OECD Guideline 301B for environmental friendliness
Environmental effects	Ecological injuries are not known or expected under normal use.
Persistence and degradability	Not available.

13. Disposal Considerations

Disposal instructions	Dispose in accordance with all applicable regulations.

14. Transport Information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory Information

US federal regulations	OSHA Process Safety Standard: This material is not known to be hazardous by the OSHA Highly Hazardous Process Safety Standard, 29 CFR 1910.119.

CERCLA (Superfund) reportable quantity

None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - No Delayed Hazard - No Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No
Section 302 extremely hazardous substance	No
Section 311 hazardous chemical	No

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	No

Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	No
Europe	European Inventory of New and Existing Chemicals (EINECS)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	No
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	No

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

State regulations This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

16. Other Information

Further information This safety datasheet only contains information relating to safety and does not replace any product information or product specification.

HMIS ratings

NFPA ratings Health: 0
Flammability: 0
Instability: 0

Disclaimer The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The manufacturer expressly does not make any representations, warranties, or guarantees as to its accuracy, reliability or completeness nor assumes any liability, for its use. It is the user's responsibility to verify the suitability and completeness of such information for each particular use.

Third party materials: Insofar as materials not manufactured or supplied by this manufacturer are used in conjunction with, or instead of this product, it is the responsibility of the customer to obtain, from the manufacturer or supplier, all technical data and other properties relating to these and other materials and to obtain all necessary information relating to them. No liability can be accepted in respect of the use of this product in conjunction with materials from another supplier.

Issue date 19-December-2008

This data sheet contains changes from the previous version in section(s): Composition / Information on Ingredients: Component information

MICHELS®

POTENTIAL ADDITIVIVE

CLAY BREAKER

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1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

TRADE NAME: ClayBreaker

24-HOUR EMERGENCY TELEPHONE: 1-800-535-5053 (Infotrac)

SUPPLIER: DCS Fluids Solutions LP
P.O. Box 1027
Graham, TX 76450
(940) 521-0400

Product Use: Well Stimulation Additive, Clay Stabilizer
CAS #: Mixture

2. COMPOSITION, INFORMATION ON INGREDIENTS

No hazardous ingredients as defined by OSHA 29 CFR 1910.1200

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Colorless to amber liquid with a strong odor. May be irritating to eyes, skin and respiratory tract. May be harmful if swallowed. Avoid contact with skin, eyes and clothing.

POTENTIAL HEALTH HAZARDS:

- **INHALATION:** May cause irritation of respiratory tract.
- **INGESTION:** May cause irritation of the gastrointestinal tract including nausea, vomiting and diarrhea.
- **SKIN:** May cause skin irritation.
- **EYES:** May cause eye irritation.

CHRONIC EFFECTS: None known

Ingredients found on one of the OSHA designated carcinogen lists are listed below.

No ingredients listed in this section.

4. FIRST AID MEASURES

INHALATION: If breathing is difficult, remove to fresh air and keep at rest in a comfortable position for breathing. Obtain immediate medical attention.

INGESTION: If swallowed, seek immediate medical attention and show this container or label. Do not induce vomiting without medical advice.

SKIN: Wash skin thoroughly with soap and water. Remove contaminated clothing. Get medical attention if any irritation continues.

EYES: Immediately flush eyes with large quantities of water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of all eye and lid tissue. Get medical attention if irritation develops.

ADVICE TO PHYSICIANS: No specific treatment. Treat according to symptoms present.

5. FIRE FIGHTING MEASURES

FLASH POINT: >200° F (>93.3° C)
FLAMMABLE LIMITS: LEL: N/A
UEL: N/A

EXTINGUISHING AGENTS:

Water, dry chemical, CO2, water spray or regular foam.
Do not use a solid water stream as it may scatter and spread fire.

SPECIAL FIRE FIGHTING PROCEDURES:

Wear positive-pressure, self-contained breathing apparatus (SCBA) and protective fire fighting clothing (including fire fighting helmet, coat, pants, boots, and gloves). If protective equipment is not available or not used, fight fire from a protected location or safe distance.

UNUSUAL FIRE & EXPLOSION HAZARDS:

Always stay away from tanks engulfed in flame. Withdraw immediately in case of rising sound from venting safety devices of any discoloration of tanks due to fire. Move containers from fire area if you can do it without risk. Do not scatter spilled material with high pressure water streams. Use water spray to cool unopened containers. Cool containers with flooding quantities of water until well after fire is out.

6. ACCIDENTAL RELEASE MEASURE

PERSONAL PROTECTION:

Don appropriate personal protective equipment prior to entering spill/leak area.
(See Section 8)

SPILL CLEAN-UP PROCEDURES:

Limit access to area, as necessary. Shut off leak if it can be done safely. Contain spill with dike. Prevent run-off into sewers or waterways. Pump large spills into salvage containers. Soak up residue and small spills with vermiculite, paper, clay or other absorbent material. Remove affected soils. Place in salvage containers. Continue to observe handling precautions.

WASTE DISPOSAL METHOD:

Follow approved local beneficial reuse guidelines for uncontaminated spent drilling fluids. If contaminated, dispose of in a licensed industrial landfill according to local, state and federal regulations. If released to the environment for other than its intended purpose, this product, in its current state, does not meet the definition of a hazardous waste under 40 CFR 261.

7. HANDLING AND STORAGE

HANDLING PRECAUTIONS:

Always wear recommended personal protection equipment. Do not get in eyes, on skin or clothing. Avoid breathing mist or vapor. Use only with adequate ventilation or wear respiratory protection.

STORAGE PRECAUTIONS:

Keep containers tightly closed and properly labeled. Store at moderate temperatures in dry, well-ventilated area. Keep container closed when not in use. Keep in original container. Store containers in upright position. Since emptied containers retain product residue, follow hazard precautions even when empty.

HYGIENIC WORK PRACTICES:

Use good personal hygiene practices. Wash hands and skin thoroughly after handling. Promptly remove contaminated clothing and wash before reuse. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

ENGINEERING CONTROLS:

There are no occupational exposure limits established at this time. Since this material may be irritating to skin and mucous membranes, general room ventilation plus local exhaust at points of emission should be used to maintain levels of airborne contaminants as low as feasibly possible.

PERSONAL PROTECTION EQUIPMENT

RESPIRATORY:

Respiratory protection is not required under normal use. Wear a NIOSH/MSHA approved respirator following manufacturer's recommendations where airborne contaminants may occur.

EYE / FACE PROTECTION:

Wear chemical safety goggles or face shield to protect against splashing.

SKIN PROTECTION:

Chemical resistant gloves and splash aprons made of impermeable material should be worn.

9. PHYSICAL AND CHEMICAL PROPERTIES

- **Appearance and Odor:** Colorless to amber liquid with strong odor.
- **Physical State:** Liquid
- **pH:** 6.5 – 9
- **Vapor Pressure:** Not determined
- **Vapor Density:** Not determined
- **Boiling Point:** Not determined
- **Melting Point:** 469.4° F estimated
- **Solubility in Water:** Complete
- **Specific Gravity:** 1.01 – 1.03

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable at normal conditions**.**

CONDITIONS TO AVOID: Heat, flames and sparks.

MATERIALS TO AVOID: Strong acids.

HAZARDOUS DECOMPOSITION PRODUCTS: None expected.

HAZARDOUS POLYMERIZATION: Does not occur.

11. TOXICOLOGICAL INFORMATION

ACUTE EFFECTS:

Acute LD50: 400 – 4000 mg/kg, Rat, Oral
Acute LC50: > 4000 mg/kg, Rat, Dermal

Not expected to be hazardous by OSHA criteria.

CHRONIC EFFECTS:

None known. Not expected to be hazardous by OSHA criteria.
This product has no known adverse effect on human health.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL INFORMATION:

ClayBreaker has a biodegradation percentage of 85.2% and is considered to have ready biodegradability. Test of ready biodegradability are stringent tests that provide limited opportunity for acclimation and biodegradation to occur. A positive result in a test of ready biodegradability is an indication that the test substance will undergo rapid and ultimate biodegradation in the environment. OECD Guideline 301B has set the standard for ready biodegradability at 60%. ClayBreaker exceeds this standard for environmental friendliness.

13. DISPOSAL CONSIDERATIONS

Follow approved local beneficial reuse guidelines for uncontaminated spent drilling fluids. If contaminated, dispose of in a licensed industrial landfill according to local, state and federal regulations. If released to the environment for other than its intended purpose, this product does not meet, in its present state, the definition of a hazardous waste under 40 CFR 261. Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for a hazardous waste. Dispose in accordance with all applicable regulations.

14. TRANSPORTATION INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION (DOT):

Not regulated as dangerous goods.

CANADIAN TRANSPORTATION OF DANGEROUS GOODS (TDG):

Not regulated as dangerous goods.

IMDG:

Not regulated as dangerous goods.

IATA:

Not regulated as dangerous goods.

15. REGULATORY INFORMATION

OSHA: This product is not a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200. We request that you make all information in the Material Safety Data Sheet available to your employees.

TSCA: Not on inventory.

SARA TITLE III/CERCLA:

To aid our customers in complying with regulatory requirements, SARA Title III Hazard Categories for this product are indicated below. If the word "YES" appears next to any category, this product may be reportable by you under the requirements of 40 CFR Part 370. Please consult those regulations for details.

Immediate (Acute) Health:	YES
Delayed (Chronic) Health:	NO
Fire Hazard:	NO
Reactive Hazard:	NO
Sudden Release of Pressure:	NO

Reportable Quantity: Not reportable

Spills/release resulting in the loss of any ingredient at or above its RQ requires immediate notification to the National Response Center (1-800-424-8802) and to your Local Emergency Planning Committee.

16. OTHER INFORMATION

HMIS RATINGS: HEALTH (1) FLAMMABILITY (0) PHYSICAL HAZARD (0)
Based on the NPCA HMIS III rating system.

CURRENT ISSUE DATE: August 1, 2014
Updated information on LD50 and LC50.

DCS Fluid Solutions LP believes the information contained in this material safety data sheet is accurate based on the information supplied by reputable suppliers of our raw materials. We cannot make any assertions as to its reliability or completeness; therefore, the user may rely on it only at user's risk. We have made no effort to censor or conceal deleterious aspects of this product. Since we cannot anticipate or control the conditions under which this information and product may be used, we make no guarantee that the precautions we have suggested will be adequate for all individuals and/or situations. It is the obligation of each user of this product to comply with the requirements of all applicable laws regarding use and disposal of this product. Neither warranty, either expressed or implied, nor liability of any nature with respect to this product or to the data herein is made or incurred hereunder.

MICHELS®

POTENTIAL ADDITIVIVE

TORQUE BREAKER

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MATERIAL SAFETY DATA SHEET

5/04/04

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: TorqBreaker™
Chemical Family: Surfactant
Supplier: DCS Fluid Solutions.
PO Box1027
Graham TX 76450
940-521-0500

2. COMPOSITION/INFORMATION ON INGREDIENTS

OSHA Regulated Components: None

3. HAZARDS IDENTIFICATION

Acute Health Effects: None
Chronic Health Effects: None
Carcinogen: No

PRIMARY ENTRY ROUTES:

1) Skin and Eyes: Repeated contact with the skin may be irritating. Eye contact may be irritating.
2) Ingestion: May be harmful.
3) Inhalation: Not considered a hazard.

4. FIRST AID MEASURES

SKIN CONTACT: Remove contaminated clothing without delay. Wash skin thoroughly with water. If irritation persists, get medical attention.
EYE CONTACT: Rinse thoroughly with plenty of water for 15 minutes. In case of persistent eye irritation, consult a physician.
INGESTION: Give large volumes of water. Do not induce vomiting. Get medical attention.
INHALATION: N/A

5. FIRE FIGHTING MEASURES

FLASH POINT: None (will not burn)
EXTINGUISHING MEDIA: N/A
FIRE FIGHTING PROCEDURES: N/A

UNUSUAL FIRE AND EXPLOSION HAZARD: Fire fighters should observe all precautions that apply to any fire where chemicals are stored.

6. ACCIDENTAL RELEASE MEASURES

If product leaks or spills, flood area with water. Mop up and dispose to sanitary sewer. Adhere to all Federal, State and Local Regulations.

7. HANDLING AND STORAGE

Store containers tightly closed and in an upright position.
Do not destroy or deface the label.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Food, beverages and tobacco products should not be carried, stored or consumed where this material is in use. Before eating, drinking or smoking, wash face and hands with soap and water. Avoid skin contact. Protective clothing such as impervious gloves are recommended to prevent skin contact. For operations where eye or face contact can occur, wear eye protection such as chemical splash proof goggles or face shield.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Viscous Liquid
Color:	Red
Odor:	Slight Citrus
Solubility:	Completely soluble in water
Specific Gravity:	1.035
pH	10.0
Freezing Point:	N/A
Flash Point:	None (will not burn)
Vapor Pressure	N/A

10. STABILITY AND REACTIVITY

STABILITY: Stable Conditions to Avoid: None known
POLYMERIZATION: Will not occur. Conditions to Avoid: None known

11. TOXICOLOGICAL INFORMATION

None Available

12. ECOLOGICAL INFORMATION

None Available

13. DISPOSAL INFORMATION

If released into the environment for other than its intended purpose, this product does not meet the definition of a hazardous waste under 40 CFR 261. Follow approved local beneficial reuse guidelines for uncontaminated spent drilling fluids. If contaminated, dispose of in a licensed industrial landfill according to local, state and federal regulations..Recover and reuse if possible.

14. TRANSPORT INFORMATION

SHIPPING NAME: Not applicable/Not Regulated
HAZARD CLASS: Not applicable
UN NUMBER: Not applicable
DOT HAZARDOUS SUBSTANCES: Not applicable
TRANSPORT LABEL: None Required

15. REGULATORY INFORMATION

US TSCA: All components of this product are included on the TSCA Inventory in compliance with the Toxic Substances Control Act, 15 U.S.C. 2601

SECTION 313 SUPPLIER NOTIFICATION (SARA): This product contains the following toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right to Know Act of 1986 and of 40 CFR 372: None.

16. OTHER INFORMATION – NFPA Hazard Rating

Fire
0
Health 0 0 Reactivity
2
PPE

Health: 0=minimal
1=slightly hazardous
2=hazardous
3=serious hazard
4=severe hazard

Fire: 0=will not burn
1=FP>141F
2=FP>73=<141F
3=FP<73F
4=BP<95F FP by Pensky Marten closed cup

Reactivity: 0=None

PPE 0=not necessary

1=mild	1=goggles
2=strong	2=goggles, gloves
	3=goggles, gloves, protective clothes
	4=goggles, gloves, respirator

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POTENTIAL ADDITIVIVE

BALL BUSTER

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BHS Marketing

Western Briquette

BALLBUSTER

MATERIAL SAFETY DATA SHEET

Sodium Acid Pyrophosphate

Date: June 20, 2001

I Company Identification

Company Name:	BHS Marketing / Western Briquette
Mailing Address:	P.O. Box 27955 SLC, UT 84127-0955
Physical Address:	2320 West Indiana Ave. SLC, UT 84104
Telephone:	(801) 973-8232
Fax:	(801) 973-8838
Emergency Number:	Chemtrec (800) 424-9300

II Product Identification

Product Name:	Sodium Acid Pyrophosphate, SAPP, Disodium pyrophosphate
Chemical Formula:	$Na_2H_2P_2O_7$
Molecular Weight:	221.96
CAS Number:	7758-16-9

III Typical Physical Properties

Physical Appearance:	White powder
Odor:	Odorless
Bulk Density:	0.9 kg/l approx.
pH (1% aqueous solution):	3.7-4.4
Melting Point:	Decomposes at 220°C
Solubility in Water:	approx. 13g in 100g water, room temperature
Vapor Pressure:	Negligible

IV Reactivity Data

Chemical Stability:	Stable
Materials to Avoid:	Avoid contact with strong bases

V Toxicological Information

Toxicity:	Oral-rat LD-50: > 1000 mg/kg

VI Hazard Data

Acute	
Eye Contact:	Causes irritation
Skin Contact:	Causes irritation
Ingestion:	Causes irritation
Inhalation:	Causes irritation
Symptoms of Overexposure:	Irritant to eyes, skin and respiratory systems. Ingestion can cause vomiting and diarrhea

VII Recommended First Aid Measures

General First Aid:	Remove the person from source of exposure. Wash with plenty of water. Upon ingestion, if the person is conscious, cause him/her to vomit. Get medical attention

VIII Fire Fighting Measures

Flash Point:	Not flammable
Extinguishing Media:	Not combustible
Special Firefighting Procedures:	Protective clothing and self contained breathing apparatus

IX Accidental Release Measures

Clean up & Disposal of Spills:	Spillage or leakages are cleaned up by mechanical removal, if possible. Flushing with plenty of water

X Handling & Storage

Handling:	Avoid inhalation, contact with eyes, skin or clothing. Do not ingest
Storage:	Store in a cool, well ventilated, dry place, in tightly closed containers

XI Exposure Controls/ Personal Protection

Appropriate Hygienic Practices:	As part of good industrial, personal hygiene and safety procedure, avoid all unnecessary exposure to the product and ensure prompt removal from eyes, skin and clothing. Maintain good housekeeping to control dust accumulations.

Personal Protection Equipment

Eye Protection:	Use safety glasses
Skin Protection:	Wear protective clothing, gloves and dust respirator if necessary
Ventilation Protection:	Adequate ventilation

XII Additional Information

The information in this MSDS was obtained from sources, which we believe are reliable. However, the information is provided without any warranty, expressed or implied, regarding its correctness.

The conditions or methods of handling, storage, use and disposal are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use or disposal of the product.

*n/a= Not Applicable

MICHELS®

POTENTIAL ADDITIVIVE

SODA ASH

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Soda Ash / Sodium Carbonate

Revision Date: 1/18/2016

SAFETY DATA SHEET

1 PRODUCT AND COMPANY IDENTIFICATION

1.1 PRODUCT IDENTIFIERS

Product Name:	Soda Ash or Sodium Carbonate
Chemical Name:	Sodium Carbonate
Synonyms / Common Names:	Carbonic Acid Sodium Salt
Registration Number REACH:	01-2119485498-19-0011
Product Type REACH:	Substance/mono-constituent
CAS Number:	497-19-8
EC Index Number:	011-005-00-2
EC Number:	207-838-8
RTECS Number:	VZ4050000

1.2 RELEVANT IDENTIFIED USES

Glass production	Paper production	Manufacture of substances
Detergent component	Laboratory chemicals	Acidity regulator

1.3 MANUFACTURER

Ciner Wyoming LLC
254 County Road 4-6
Green River, Wyoming 82935
United States
Telephone Number: (307) 875-2600
www.ciner.us.com

1.4 EMERGENCY TELEPHONE NUMBER

Emergency Response Information Provider: CHEMTREC

Within the United States Emergency Telephone Number: 1-800-424-9300

Outside the United States / International Emergency Telephone Number: +1-703-527-3887

2 HAZARD(S) IDENTIFICATION

2.1 CLASSIFICATION OF THE SUBSTANCE OR MIXTURE

GHS Classification in accordance with 29 CFR 1910 (OSHA HazCom Standard):

Eye Irritation (Category 2A), H319

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS LABEL ELEMENTS, INCLUDING PRECAUTIONARY STATEMENTS

Pictograms:

Irritant

Signal Word: Warning

Hazard Statement(s):

H319 Causes serious eye irritation.

Precautionary Statement(s):

P264 Wash skin thoroughly after handling.

P280 Wear eye protection / face protection.

P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P337 + P313 If eye irritation persists: Get medical advice / attention.

2.3 HAZARDS NOT OTHERWISE CLASSIFIED OR NOT COVERED BY GHS

None

3 COMPOSITION / INFORMATION ON INGREDIENTS

3.1 SUBSTANCES

Synonyms:	Soda Ash, Sodium Carbonate, Carbonic Acid Sodium Salt
Formula:	Na_2CO_3

Molecular Weight: 105.99 g/mol

Component (REACH Registration)	CAS # / EC #	Concentration	Classifications	Remark
Sodium carbonate (01-2119485498-19-0011)	CAS #: 497-19-8 EC #: 207-838-8	≥ 99%	Eye Irrit. 2A, H319	Mono-constituent

* For the full text of the H-Statements mentioned in this Section, see Section 16.

4 FIRST-AID MEASURES

4.1 DESCRIPTION OF FIRST-AID MEASURES

General - Check the vital functions. Unconscious: maintain adequate airway and respiration. Respiratory arrest: artificial respiration or oxygen. Cardiac arrest: perform resuscitation. Victim conscious with labored breathing: half-seated. Victim in shock: on his back with legs slightly raised. Vomiting: prevent asphyxia/aspiration pneumonia. Prevent cooling by covering the victim (no warming up). Keep watching the victim. Give psychological aid. Keep the victim calm, avoid physical strain. Depending on the victim's condition: doctor/hospital.

After inhalation - Remove the victim into fresh air. Respiratory problems: consult a doctor/medical service.

After skin contact - Rinse with water. Soap may be used. Do not apply (chemical) neutralizing agents. Take victim to a doctor if irritation persists.

After eye contact - Rinse immediately with plenty of water for at least 15 minutes. Do not apply neutralizing agents. Take victim to an ophthalmologist if irritation persists.

After ingestion - Rinse mouth with water. Immediately after ingestion: give lots of water to drink. Do not induce vomiting. Consult a doctor/medical service if victim is unwell.

4.2 MOST IMPORTANT SYMPTOMS AND EFFECTS, BOTH ACUTE AND DELAYED

4.2.1 Acute Symptoms

If inhaled - Dry/sore throat. Coughing. Slight irritation. Exposure to high concentrations: Irritation of the respiratory tract. Irritation of the nasal mucous membranes. Respiratory difficulties.

In case of skin contact - Not irritating

In case of eye contact - Inflammation/damage of the eye tissue. Corrosion of the eye tissue. Lacrimation.

If swallowed – After absorption of high quantities: Nausea. Vomiting. Abdominal pain. Irritation of the gastric/intestinal mucosa.

4.2.2 Delayed Symptoms

No effects known.

4.3 INDICATION OF ANY IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED

No data available.

5 Fire-Fighting Measures

5.1 Extinguishing Media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

Upon combustion CO and CO2 are formed. Reacts on exposure to water with some metals. CO2 generation occurs when mixed with acidic materials.

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Special protective equipment for firefighters

Gloves. Safety glasses. Protective clothing. Dust cloud protection and heat/fire exposure: Compressed air respirator.

6 Accidental Release Measures

6.1 Personal Precautions, Protective Equipment and Emergency Procedures

Use personal protective equipment. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions

Contain released substance, pump into suitable containers. Plug the leak, cut off the supply. Knock down/dilute dust cloud with water spray. Violent exothermic reaction with some acids; release of harmful gases/vapors (carbon dioxide). Carbon dioxide is heavier than air and will collect in ducts, drains and low lying areas. Prevent spreading in sewers.

6.3 Methods and material for containment and cleaning up

Prevent dust cloud formation. Scoop solid spill material into closed containers. Carefully collect the spill. Clean contaminated surfaces with an excess of water. Wash clothing and equipment after handling.

6.4 Reference to other sections

For disposal see section 13.

7 HANDLING AND STORAGE

7.1 PRECAUTIONS FOR SAFE HANDLING

Avoid contact with skin and eyes. Use air conveying/mechanical systems for bulk transfer to storage. Provide appropriate exhaust ventilation at places where dust is formed. In case of insufficient ventilation, wear suitable respiratory equipment if release of airborne dust is expected.

7.2 CONDITIONS FOR SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES

Store in original container. Keep in properly labeled containers. Keep container tightly closed.

7.3 SUITABLE PACKAGING MATERIAL

No data available

7.4 INCOMPATIBLE PRODUCTS

Aluminum, powdered aluminum, and acids.

8 EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 COMPONENTS WITH WORKPLACE CONTROL PARAMETERS

Contains no substances with occupational exposure limit values.

8.2 EXPOSURE CONTROLS

Appropriate engineering controls – Avoid formation of dust. Keep away from ignition sources. Keep container tightly closed. Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

8.3 PERSONAL PROTECTIVE EQUIPMENT

Eye / Face Protection - Safety glasses with side shields or protective goggles. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection - Handle with gloves, butyl rubber or PVC, which have good resistance. Gloves must be inspected prior to use. Use proper glove removal technique to avoid skin contact with product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection – Protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection – For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator. For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

8.4 CONTROL OF ENVIRONMENTAL EXPOSURE

Prevent leakage or spillage if safe to do so. Do not let product enter drains. See section 6.2, 6.3, and 13.

9 PHYSICAL AND CHEMICAL PROPERTIES

9.1 INFORMATION ON BASIC PHYSICAL AND CHEMICAL PROPERTIES

Appearance Form:	Crystalline Solid / Crystalline Powder / Grains / Lumps
Color:	Colorless
Odor:	Odorless
Odor Threshold:	No data available
Particle Size:	694 µm
pH:	11.6; 5.0%
Melting Point / Freezing Point:	851 °C / 1,564 °F
Boiling Point	1,600 °C / 2,912 °F
Flash Point:	No data available
Explosion Limits:	No data available
Evaporation Rate:	No data available
Flammability:	Non Combustible
Log Kow:	-6.19 Estimated value
Viscosity:	No data available
Vapor Pressure:	No data available
Vapor Density:	No data available
Solubility water:	212.5 g/l; 20 °C / 68 °F
Relative Density:	2.52 -253; 20 °C / 68 °F
Absolute Density:	2,530 kg/m^3
Decomposition temperature:	>1600 °C / >2912 °F
Auto-ignition temperature:	>400 °C / >752 °F
Explosive Properties:	No data available
Oxidizing Properties:	No data available

9.2 PHYSICAL HAZARDS

No data available

10 STABILITY AND REACTIVITY

10.1 REACTIVITY

None under normal use conditions.

10.2 CHEMICAL STABILITY

Stable. Decomposes by reaction with strong acid.

10.3 POSSIBILITY OF HAZARDOUS REACTIONS

None under normal processing.

10.4 CONDITIONS TO AVOID

Exposure to air or moisture over prolonged periods.

10.5 INCOMPATIBLE MATERIALS

Aluminum, powdered aluminum, and acids.

10.6 HAZARDOUS POLYMERIZATION

Hazardous polymerization does not occur.

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11 TOXICOLOGICAL INFORMATION

11.1 INFORMATION ON TOXICOLOGICAL EFFECTS

11.1.1 Acute toxicity

LD50 Oral - rat – 2,800 mg/kg
LD50 Dermal – rabbit >2,000 mg/kg
LD50 Inhalation - rat – 2.30 mg/l, 2 hour exposure time

11.1.2 Corrosion / irritation

Skin - rabbit
Result: Mild skin irritation – 24 hours

11.1.3 Serious eye damage / eye irritation

Eyes - rabbit
Result: Severe eye irritation – 24 hours

11.1.4 Respiratory or skin sensitization

Inhalation - no data available
Skin Sensitization: no data available

11.1.5 Germ cell mutagenicity

No data available

11.1.6 Carcinogenicity

No data available

11.1.7 Reproductive toxicity

No data available

11.1.8 Specific target organ toxicity - single exposure

No data available

11.1.9 Specific target organ toxicity - repeated exposure

No data available

11.1.10 Chronic effects from short and long-term exposure

On continuous / repeated exposure / contact: Red skin. Dry skin. Tingling / irritation of the skin. Affection of the nasal septum.

12 ECOLOGICAL INFORMATION

12.1 TOXICITY

	Parameter	Method	Value	Duration	Species	Test design	Fresh / salt water	Value determination
Acute toxicity fishes	LC50	Other	300 mg/l	96 h	Lepomis macrohirus	Static system	Fresh water	Experimental value
Acute toxicity invertebrates	EC50	Other	200 - 227 mg/l	48 h	Ceriodaphnia sp.	Semi-static	Fresh water	Experimental value
Toxicity algae and other aquatic plants	EC50		242 mg/l	5 days	Algae			Experimental value

12.2 PERSISTENCE AND DEGRADABILITY:

Biodegradability: not applicable

12.3 BIOACCUMULATIVE POTENTIAL:

Low potential for bioaccumulation (Log Know <4)

12.4 MOBILITY IN SOIL:

Low potential for absorption in soil.

12.5 RESULTS OF PBT AND VPVB ASSESSMENT:

PBT/vPvB assessment not available as chemical safety assessment is not required/not conducted.

12.6 OTHER ADVERSE EFFECTS:

No data available

13 DISPOSAL CONSIDERATIONS

13.1 WASTE DISPOSAL

Remove waste in accordance with local and/or national regulations. Contact a licensed professional waste disposal service to dispose of this material. Different types of hazardous waste should not be mixed together if it will entail a risk of pollution or create problems for the further management of the waste. Hazardous waste shall be managed responsibly. Do not discharge into drains.

14 TRANSPORT INFORMATION

14.1 UNITED STATES DEPARTMENT OF TRANSPORTATION (DOT)
Non-regulated

14.2 INTERNATIONAL MARITIME DANGEROUS GOODS (IMDG)
Non-regulated

14.3 INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA)
Non-regulated

14.4 TDG / ADN / RID / ADR
Non-regulated

15 REGULATORY INFORMATION

15.1 SARA 302 COMPONENTS
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

15.2 SARA 313 COMPONENTS
SARA 313: This material does not contain any chemical with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

15.3 SARA 311/312 HAZARDS
Acute Health Hazard

15.4 PENNSYLVANIA RIGHT TO KNOW COMPONENTS
Sodium carbonate, CAS-No: 497-19-8

15.5 NEW JERSEY RIGHT TO KNOW COMPONENTS
Sodium carbonate, CAS-No: 497-19-8

15.6 WHMIS CLASSIFICATION: C, D2
Note: The product listed on this SDS has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations.

16 OTHER INFORMATION

16.1 FULL TEXT OF H-STATEMENTS REFERRED TO UNDER SECTION 2 AND 3.

Eye Irrit.	Eye Irritation
H319	Causes serious eye irritation

16.2 HMIS RATING

Health Hazard:	2
Flammability:	0
Physical Hazard:	0

16.3 NFPA RATING

Health Hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

16.4 NOTICE

The above information is believed to be correct but is not intended to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Ciner and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product.

MICHELS®

POTENTIAL ADDITIVIVE

SODIUM BICARBONATE

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Soda Ash / Sodium Carbonate

Revision Date: 7/27/2018

SAFETY DATA SHEET

1 PRODUCT AND COMPANY IDENTIFICATION

1.1 PRODUCT IDENTIFIERS

Product Name:	Soda Ash or Sodium Carbonate
Chemical Name:	Sodium Carbonate
Synonyms / Common Names:	Carbonic Acid Sodium Salt
Product Type REACH:	Substance/mono-constituent
CAS Number:	497-19-8
EC Index Number:	011-005-00-2
EC Number:	207-838-8
RTECS Number:	VZ4050000

1.2 RELEVANT IDENTIFIED USES

Glass Production	Paper Production	Manufacture of Substances
Detergent Component	Laboratory Chemicals	Acidity Regulator

1.3 MANUFACTURER

Ciner Wyoming LLC
254 County Road 4-6
Green River, Wyoming 82935
United States
Telephone Number: (307) 875-2600
www.ciner.us.com

1.4 EMERGENCY TELEPHONE NUMBER

Emergency Response Information Provider: CHEMTREC
Within the United States Emergency Telephone Number: 1-800-424-9300
Outside the United States / International Emergency Telephone Number: +1-703-527-3887

2 HAZARD(S) IDENTIIFICATION

2.1 CLASSIFICATION OF THE SUBSTANCE OR MIXTURE

GHS Classification in accordance with 29 CFR 1910 (OSHA HazCom Standard):
Eye Irritation (Category 2A), H319
For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS LABEL ELEMENTS, INCLUDING PRECAUTIONARY STATEMENTS

Pictograms:

Irritant

Signal Word: Warning

Hazard Statement(s):
H319 Causes serious eye irritation.

Precautionary Statement(s):
P264 Wash skin thoroughly after handling.

P280 Wear eye protection / face protection.

P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P337 + P313 If eye irritation persists: Get medical advice / attention.

2.3 HAZARDS NOT OTHERWISE CLASSIFIED OR NOT COVERED BY GHS

None

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3 COMPOSITION / INFORMATION ON INGREDIENTS

3.1 SUBSTANCES

Synonyms: Soda Ash, Sodium Carbonate, Carbonic Acid Sodium Salt
Formula: Na_2CO_3
Molecular Weight: 105.99 g/mol

Component (REACH Registration)	CAS #	Concentration	Classifications	Remark
Sodium Carbonate (01-2119485498-19-0011)	CAS #: 497-19-8	≥ 99%	Eye Irrit. 2A, H319	Monoconstituent

* For the full text of the H-Statements mentioned in this Section, see Section 16.

4 FIRST-AID MEASURES

4.1 DESCRIPTION OF FIRST-AID MEASURES

General - Check the vital functions. Unconscious: maintain adequate airway and respiration. Respiratory arrest: artificial respiration or oxygen. Cardiac arrest: perform resuscitation. Victim conscious with labored breathing: half-seated. Victim in shock: on his back with legs slightly raised. Vomiting: prevent asphyxia/aspiration pneumonia. Prevent cooling by covering the victim (no warming up). Keep watching the victim. Give psychological aid. Keep the victim calm, avoid physical strain. Depending on the victim's condition: doctor/hospital.

After inhalation - Remove the victim into fresh air. Respiratory problems: consult a doctor/medical service.

After skin contact - Rinse with water. Soap may be used. Do not apply (chemical) neutralizing agents. Take victim to a doctor if irritation persists.

After eye contact - Rinse immediately with plenty of water for at least 15 minutes. Do not apply neutralizing agents. Take victim to an ophthalmologist if irritation persists.

After ingestion - Rinse mouth with water. Immediately after ingestion: give lots of water to drink. Do not induce vomiting. Consult a doctor/medical service if victim is unwell.

4.2 MOST IMPORTANT SYMPTOMS AND EFFECTS, BOTH ACUTE AND DELAYED

4.2.1 Acute Symptoms

If inhaled - Dry/sore throat. Coughing. Slight irritation. Exposure to high concentrations: Irritation of the respiratory tract. Irritation of the nasal mucous membranes. Respiratory difficulties.

In case of skin contact - Not irritating

In case of eye contact - Inflammation/damage of the eye tissue. Corrosion of the eye tissue. Lacrimation.
If swallowed – After absorption of high quantities: Nausea. Vomiting. Abdominal pain. Irritation of the gastric/intestinal mucosa.

4.2.2 Delayed Symptoms

No effects known.

4.3 INDICATION OF ANY IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED

No data available.

5 FIRE-FIGHTING MEASURES

5.1 EXTINGUISHING MEDIA

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 SPECIAL HAZARDS ARISING FROM THE SUBSTANCE OR MIXTURE

Upon combustion CO and CO2 are formed. Reacts on exposure to water with some metals. CO2 generation occurs when mixed with acidic materials.

5.3 ADVICE FOR FIREFIGHTERS

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 SPECIAL PROTECTIVE EQUIPMENT FOR FIREFIGHTERS

Gloves. Safety glasses. Protective clothing. Dust cloud protection and heat/fire exposure: Compressed air respirator.

6 ACCIDENTAL RELEASE MEASURES

6.1 PERSONAL PRECAUTIONS, PROTECTIVE EQUIPMENT AND EMERGENCY PROCEDURES

Use personal protective equipment. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 ENVIRONMENTAL PRECAUTIONS

Contain released substance, pump into suitable containers. Plug the leak, cut off the supply. Knock down/dilute dust cloud with water spray. Violent exothermic reaction with some acids; release of harmful gases/vapors (carbon dioxide). Carbon dioxide is heavier than air and will collect in ducts, drains and low-lying areas. Prevent spreading in sewers.

6.3 METHODS AND MATERIAL FOR CONTAINMENT AND CLEANING UP

Prevent dust cloud formation. Scoop solid spill material into closed containers. Carefully collect the spill. Clean contaminated surfaces with an excess of water. Wash clothing and equipment after handling.

6.4 REFERENCE TO OTHER SECTIONS

For disposal see section 13.

7 HANDLING AND STORAGE

7.1 PRECAUTIONS FOR SAFE HANDLING

Avoid contact with skin and eyes. Use air conveying/mechanical systems for bulk transfer to storage. Provide appropriate exhaust ventilation at places where dust is formed. In case of insufficient ventilation, wear suitable respiratory equipment if release of airborne dust is expected.

7.2 CONDITIONS FOR SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES

Store in original container. Keep in properly labeled containers. Keep container tightly closed.

7.3. SUITABLE PACKAGING MATERIAL

No data available.

7.4 INCOMPATIBLE PRODUCTS

Aluminum, powdered aluminum, and acids.

8 EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 COMPONENTS WITH WORKPLACE CONTROL PARAMETERS

Contains no substances with occupational exposure limit values.

8.2 EXPOSURE CONTROLS

Appropriate engineering controls – Avoid formation of dust. Keep away from ignition sources. Keep container tightly closed. Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

8.3 PERSONAL PROTECTIVE EQUIPMENT

Eye / Face Protection - Safety glasses with side shields or protective goggles. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin Protection - Handle with gloves, butyl rubber or PVC, which have good resistance. Gloves must be inspected prior to use. Use proper glove removal technique to avoid skin contact with product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection – Protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory Protection – For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator. For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

8.4 CONTROL OF ENVIRONMENTAL EXPOSURE

Prevent leakage or spillage if safe to do so. Do not let product enter drains. See section 6.2, 6.3, and 13.

9 PHYSICAL AND CHEMICAL PROPERTIES

9.1 INFORMATION ON BASIC PHYSICAL AND CHEMICAL PROPERTIES

Appearance Form:	Crystalline Solid / Crystalline Powder / Grains / Lumps
Color:	Colorless
Odor:	Odorless
Odor Threshold:	No data available
Particle Size:	694 µm
pH:	11.6; 5.0%
Melting Point / Freezing Point:	851°C / 1,564°F
Boiling Point:	1,600°C / 2,912°F
Flash Point:	No data available
Explosion Limits:	No data available
Evaporation Rate:	No data available
Flammability:	Non-Combustible
Log Kow:	-6.19 Estimated Value
Viscosity:	No data available
Vapor Pressure:	No data available
Vapor Density:	No data available
Solubility Water:	212.5 g/l; 20°C / 68°F
Relative Density:	2.52 – 2.53; 20°C / 68°F
Absolute Density:	2,530 kg/m^3
Decomposition Temperature:	>1600°C / >2912°F
Auto-Ignition Temperature:	>400°C / >752°F
Explosive Properties:	No data available
Oxidizing Properties:	No data available

9.2 PHYSICAL HAZARDS
No data available.

10 STABILITY AND REACTIVITY

10.1 REACTIVITY
None under normal use conditions.

10.2 CHEMICAL STABILITY
Stable. Decomposes by reaction with strong acid.

10.3 POSSIBILITY OF HAZARDOUS REACTIONS
None under normal processing.

10.4 CONDITIONS TO AVOID
Exposure to air or moisture over prolonged periods.

10.5 INCOMPATIBLE MATERIALS
Aluminum, powdered aluminum, and acids.

10.6 HAZARDOUS POLYMERIZATION
Hazardous polymerization does not occur.

11 TOXICOLOGICAL INFORMATION

11.1 INFORMATION ON TOXICOLOGICAL EFFECTS

11.1.1 Acute toxicity
LD50 Oral - rat – 2,800 mg/kg
LD50 Dermal - rabbit >2,000 mg/kg
LD50 Inhalation - rat – 2.30 mg/l, 2-hour exposure time

11.1.2 Corrosion/irritation
Skin - rabbit
Result: Mild skin irritation – 24 hours

11.1.3 Serious eye damage/eye irritation
Eyes - rabbit
Result: Severe eye irritation – 24 hours

11.1.4 Respiratory or skin sensitization
Inhalation - no data available
Skin Sensitization: no data available

11.1.5 Germ cell mutagenicity
No data available

11.1.6 Carcinogenicity
No data available

11.1.7 Reproductive toxicity
No data available

11.1.8 Specific target organ toxicity - single exposure
No data available

11.1.9 Specific target organ toxicity - repeated exposure
No data available

11.1.10 Chronic effects from short and long-term exposure
On continuous / repeated exposure / contact: Red skin. Dry skin. Tingling / irritation of the skin. Affection of the nasal septum.

12 ECOLOGOCAL INFORMATION

12.1 TOXICITY

	Parameter	Method	Value	Duration	Species	Test Design	Fresh/Salt Water	Value Determination
Acute toxicity fishes	LC50 Other	Other	300 mg/l	96 h	Lepomis macronhirus	Static system	Fresh water	Experimental value
Acute toxicity invertebrates	EC50	Other	200-227 mg/l	48 h	Ceriodaphnia sp.	Semi-static	Fresh water	Experimental value
Toxicity algae and other aquatic plants	EC50		242 mg/l	5 days	Algae			Experimental value

12.2 PERSISTENCE AND DEGRADABILITY:
Biodegradability: not applicable

12.3 BIOACCUMULATIVE POTENTIAL:
Low potential for bioaccumulation (Log Kow <4)

12.4 MOBILITY IN SOIL:
Low potential for absorption in soil.

12.5 RESULTS OF PBT AND VPVB ASSESSMENT:
PBT/vPvB assessment not available as chemical safety assessment is not required/not conducted.

12.6 OTHER ADVERSE EFFECTS:
No data available.

13 DISPOSAL CONSIDERATIONS

13.1 WASTE DISPOSAL
Remove waste in accordance with local and/or national regulations. Contact a licensed professional waste disposal service to dispose of this material. Different types of hazardous waste should not be mixed together if it will entail a risk of pollution or create problems for the further management of the waste. Hazardous waste shall be managed responsibly. Do not discharge into drains.

14 TRANSPORT INFORMATION

14.1 UNITED STATES DEPARTMENT OF TRANSPORTATION (DOT)
Non-regulated

14.2 INTERNATIONAL MARITIME DANGEROUS GOODS (IMDG)
Non-regulated

14.3 INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA)
Non-regulated

14.4 TDG/ADN/RID/ADR
Non-regulated

15 REGULATORY INFORMATION

15.1 SARA 302 COMPONENTS
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

15.2 SARA 313 COMPONENTS
SARA 313: This material does not contain any chemical with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

15.3 SARA 311/312 HAZARDS
Acute Health Hazard

15.4 PENNSYLVANIA RIGHT TO KNOW COMPONENTS
Sodium carbonate, CAS-No: 497-19-8

15.5 NEW JERSEY RIGHT TO KNOW COMPONENTS
Sodium carbonate, CAS-No: 497-19-8

15.6 WHMIS CLASSIFICATION: C, D2
Note: The product listed on this SDS has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations.

15.7 US CALIFORNIA SAFE DRINKING WATER & TOXIC ENFORCEMENT ACT (PROPOSITION 65)
This product does not contain any chemicals known to the State of California to cause cancer, birth, or any other reproductive defects.

16 OTHER INFORMATION

16.1 FULL TEXT OF H-STATEMENTS REFERRED TO UNDER SECTION 2 AND 3.

Eye Irrit.	Eye Irritation
H319	Causes serious eye irritation

16.2 HMIS RATING

Health Hazard:	2
Flammability:	0
Physical Hazard:	0

16.3 NFPA RATING

Health Hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

16.4 NOTICE

The above information is believed to be correct but is not intended to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Ciner and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product.

16.5 PRODUCT CERTIFICATIONS

This product is certified to NSF/ANSI Standard 60 for use in drinking water treatment at the specified maximum use limit. The MUL (maximum use level) for sodium carbonate anhydrous is 100 mg/L under NSF/ANSI Standard 60.

OU Kosher Certification

CERTIFIED HALAL حلال ISLAMIC FOOD AND NUTRITION COUNCIL OF AMERICA

NSF Certified to NSF/ANSI 60

MICHELS®

POTENTIAL ADDITIVIVE

CITRIC ACID

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Univar USA Inc Safety Data Sheet

SDS No:	
Version No:	003 2015-06-02
Order No:	

3075 Highland Pkwy, Ste 200, Downers Grove, IL 60515
(425) 889 3400

Emergency Assistance

For emergency assistance involving chemicals call
Chemtrec - (800) 424-9300

Safety Data Sheet

CITRIC ACID FCC/USP PWD

SECTION 1:IDENTIFICATION OF THE SUBSTANCE/ MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1 PRODUCT IDENTIFIER

- Chemical name	Citric acid - Food grade
- REACH Registration Number	01-2119457026-42-0031

1.2 RELEVANT IDENTIFIED USES OF THE SUBSTANCE AND USES ADVISED AGAINST

Citric acid can be used in food as food additives and also in technical application as clarifying agent, water softener, buffer, foam booster and stabilizer, complexing agent and as an intermediate in production of organic chemicals.

1.3 DETAILS OF THE SUPPLIER

- Company identification

US:
Tate & Lyle Ingredients Americas, LLC.
2200 E.Eldorado Street
Decatur, IL 62521

Europe:
Tate & Lyle Slovakia s.r.o.
Boleraz 114
919 08 boleraz
Slovakia

1.4 EMERGENCY PHONE NR.

CHEMTREC
Toll-Free: 1-800-424-9300 (USA and Canada)
Non Toll-Free +1-703-527-3887 (Global)

SECTION 2:HAZARDS IDENTIFICATION

2.1. CLASSIFICATION OF THE SUBSTANCE OR MIXTURE

According with the version of the Globally Harmonized system of Classification and labeling adopted in the United states and Regulation 1272/2008/EC [CLP]: Eyes irritant category 2(H319)

Safety Data Sheet

CITRIC ACID FCC/USP PWD

2.2 LABEL ELEMENTS

GHS07

Signal word:
Warning

Hazard Statement:
Causes serious eye irritation. H319

Precautionary Statement:
Wash hands thoroughly after handling. P264
Wear eye protection. P280

Precautionary Statement. IF IN EYES: P305
Response :
Rinse cautiously with water for several minutes. P351
Remove contact lenses, if present and easy to do Continue rinsing. P338
If eye irritation persists: P337
Get medical advice/attention. P313

2.3. OTHER HAZARDS
FIRE AND EXPLOSION HAZARD:
May form combustible dust concentrations in air. Possibility of dust explosion. it is recommended that all dust control equipment and material transport systems involved are engineered to prevent conditions contributing to dust explosions. Do not allow dust to accumulate on flat surfaces, on rafters or building structural components. Keep away from all ignition sources including heat, sparks and flame.

SECTION 3:COMPOSITION/INFORMATION OF INGREDIENTS

- Chemical name Citric acid - Food grade

Safety Data Sheet

CITRIC ACID FCC/USP PWD

- CAS number	77-92-9
- EINECS number	201-069-1
- Synonyms	2 - Hydroxy -1,2,3 propanetricarboxylic acid Acidulant - Citric acid - food additive E330.

SECTION 4:FIRST AID MEASURES

4.1 DESCRIPTION OF FIRST AID MEASURES

- General advise	Seek medical attention if irritation develops after first aid application
- Inhalation	Move people from the exposure to fresh air.
- Skin contact	Wash skin with soap and water.
- Eye contact	Remove particulates by irrigating with eye wash solution or clean water, holding eyelids apart.
- Ingestion	Wash mouth and flush throat upto the stomach.

4.2 MOST IMPORTANT SYMPTOMS AND EFFECTS, BOTH ACUTE AND DELAYED
ROUTE(S) OF ENTRY: Skin Contact; Eye Contact
HUMAN EFFECTS AND SYMPTOMS OF OVEREXPOSURE:
ACUTE SKIN CONTACT: This product is irritating to the skin resulting in reddening, stinging, and swelling.
ACUTE EYE CONTACT: This product is irritating to the eyes resulting in stinging, reddening, tearing, and swelling.
CHRONIC EFFECTS OF EXPOSURE: No applicable information was found concerning any adverse chronic health effects from overexposure to this product.
CARCINOGENICITY: The components of this product are not listed by NTP, IARC or regulated as a carcinogen by OSHA.
MEDICAL CONDITIONS
AGGRAVATED BY EXPOSURE: Persons with pre-existing eye or skin disorders may be more susceptible to the effects of this product.

4.3 INDICATION OF ANY IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED.
None Anticipated

SECTION 5: FIRE-FIGHTING MEASURES

5.1 EXTINGUISHING MEDIA
Water spray, dry powder, carbon dioxide or media appropriate for surrounding fire. Use of water jet may cause explosive dust conditions.

Safety Data Sheet

CITRIC ACID FCC/USP PWD

5.2 SPECIFIC HAZARDS
FIRE AND EXPLOSION HAZARD: Possibility of dust explosion. It is recommended that all dust control equipment and material transport systems involved are engineered to prevent conditions contributing to dust explosions. Do not allow dust to accumulate on flat surfaces, on rafters or building structural components. Use of water jet may cause explosive dust conditions.
SEE NFPA 61, Standard for the prevention of Fire and Dust Explosions in Agricultural and Food Processing Facilities, 2008 or later Edition, and other related standards.

5.3 SPECIFIC PROTECTIVE EQUIPMENT AND PRECAUTIONS FOR FIRE-FIGHTERS
Wear self-contained breathing apparatus and full protective gear. Use water spray to cool fire exposed containers.

FLAMMABILITY CLASS (OSHA)
Not applicable

HAZARDOUS COMBUSTION PRODUCTS
Carbon dioxide and carbon monoxide

SECTION 6:ACCIDENTAL RELEASE MEASURES

6.1 PERSONAL PRECAUTIONS
Use personal protective equipment. Wear eye protection. Avoid contact with skin and eyes.

6.2 ENVIRONMENTAL PRECAUTIONS
Prevent further leakage or spillage if safe to do so. No special environmental precautions required

6.3 METHODS FOR CLEANING UP
Vacuum or sweep spills. Minimize dust generation.
If washing down spilled area is necessary, use copious amounts of water and control runoff.
Follow local, state and federal regulations for product disposal

6.4 REFERENCE TO OTHER SECTIONS
See Section 7 for information on safe handling
See Section 8 for information on personal protection equipment
See Section 13 for disposal information

SECTION 7: HANDLING AND STORAGE

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7.1 PRECAUTIONS FOR SAFE HANDLING
See NFPA 61, Standard for the Prevention of Fire and Dust Explosions in Agricultural and Food Processing Facilities, 2008 Edition, and other related standards. Use with adequate ventilation. Minimize dust generation and accumulation; dust deposits should not be allowed to accumulate on surfaces, as these may form an explosive mixture if they are disturbed.

All dust control equipment and material transport systems involved are engineered to prevent conditions contributing to dust explosions and may require explosion relief vents or an explosion suppression system or an oxygen-deficient environment. Bonding and grounding systems may be required.

Dust-handling systems (such as exhaust ducts, dust collectors, vessels, and processing equipment) should be designed to limit or prevent leakage of dust into the work area.

Do not allow dust to accumulate on flat surfaces, on rafters or building structural components. Routine housekeeping should be instituted to reduce dust accumulation. Use Avoid dispersal of dust in the air; use vacuum or wet sweeping methods. Do not use compressed air to clean surfaces.

Keep away from all ignition sources including heat, sparks, and flame. Where dust accumulations occur use non-sparking tools.

7.2 CONDITIONS OF SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES
Store in a cool dry place. Store in a tightly closed container/bag.
The packaging material should have reasonable moisture and air barriers and comply with food regulations.
7.3 SPECIFIC END USE(S)
See overview of the exposure scenario and summary of risk management measures in Appendix 1

SECTION 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 CONTROL PARAMETERS
Exposure limits: Nuisance dust (also called particulate not otherwise regulated (PNOR)).
OSHA PEL: 15 mg/ mg/m3 Total dust
5 mg/m3 Respirable dust
ACGIH TLV: 10 mg/m3 Inhalable dust
5 mg/m3 Respirable dust
15 mg/m3 Total dust

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8.2 EXPOSURE CONTROLS
APPROPRIATE ENGINEERING CONTROLS:
Ventilation: See NFPA 61, Standard for the Prevention of Fire and Dust Explosions in Agricultural and Food Processing Facilities, 2008 Edition, and National Fire Protection Association 650, Standard for Pneumatic Conveying Systems for Handling Combustible Materials, 1997 Edition and other related standards. Normal industrial hygiene measures should be sufficient for protection of employees from exposure to dusts. Local and mechanical exhaust is desirable when dumping bags.

APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT:
Eye protection: Safety glasses are recommended. Safety goggles are desirable when dumping bags.
Emergency wash facilities: Eye wash is recommended for conditions where dust generation is likely.
Special protective clothing: Not normally required.
Gloves: Not normally required. Use ordinary work gloves if dust dries skin.
Respirator: NIOSH approved N-95 dust respirator if working in situations that could generate large amounts of airborne dust.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:
See section 5.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1 INFORMATION ON BASIC PHYSICAL AND CHEMICAL PROPERTIES

- Physical form	Solid
- Color	White to off-white
- Odor	Essentially odorless to very slight sugar odor
- pH (concentration)	NA
- Boiling point	104°C (219 °F)
- Flash point	345°C
- Melting/freezing point	approx. 153°C at 1,013 hPa
- Decomposition temperature	NA
- Auto-ignition temperature	NA
- Explosion properties	NA
- Oxidising properties	NA
- Vapour pressure	2.21*10-6 Pa at 25°C
- Vapor density	0.62 (Air = 1)
- Relative density	1.665at 20°C

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- Bulk density	Not Established
- Specific gravity	15 °C (1.24 at 59 °F)
- Viscosity	Not Established
- Water solubility	590 g/L at 20°C
- Solubility (non aqueous)	Methyl alcohol: completely miscible
- Partition coefficient	In OCTANOL/ WATER (log value): Log Kow: -0.2 to -1.8
- Dissociation constant	pKa: 3.13, 4.76 and 6.4 at 25°
- Evaporation rate	Less than 1 (Butyl acetate =1)

9.2 OTHER INFORMATION

SECTION 10: STABILITY AND REACTIVITY

10.1 REACTIVITY
Stable

10.2 CHEMICAL STABILITY
Stable under normal conditions.
Polymerization will not occur.

10.3 POSSIBILITY OF HAZARDOUS REACTIONS
Not applicable

10.4 CONDITIONS TO AVOID
Practices which produce dust or disperse finely divided dust in air.
See NFPA 61. Standard for the Prevention of Fire and Dust Explosions in Agricultural and Food Processing Facilities, 2008 Edition, and other related standards.

10.5 INCOMPATIBLE MATERIALS
Oxidizing agents, strong acids

10.6 Hazardous decomposition products:
Nothing unusual

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 INFORMATION ON TOXICOLOGICAL EFFECTS

- Inhalation	ORAL: LD50: 5400 – 5790 mg/kg bw (mouse) / LD50: 11700 mg/kg bw (rat) DERMAL: LD50 >2000 mg/kg bw rat
- Ingestion	No effects known or anticipated.

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- Skin irritation / corrosion	Sustained exposure in a dusty manufacturing environment may result in mechanical irritation in the creases of the skin, particularly at the fingers, or other drying effects. no health effects known or anticipated.
- Eye irritation	Irritating to eyes.
- Skin sensitisation	Not sensitizing
- Chronic toxicity	Not known or anticipated
- Genetic toxicity	Not known or anticipated
- Carcinogenicity	Not classifiable as Carcinogen.
- Reprotoxicity	Not known or anticipated
- Specific effects	Not applicable

SECTION 12: ECOLOGICAL INFORMATION

12.1 TOXICITY
LC50 for freshwater fish: 440 mg/l
EC50/LC50 for freshwater invertebrates: 1535 mg/l.

12.2 PERSISTENCE/DEGRADABILITY
Ready biodegradable

12.3 BIOACCUMULATIVE POTENTIAL
Log Kow <3, not bioaccumulative

12.4 MOBILITY IN SOIL
Not applicable

12.5 BPT, vPvB
The substance does not meet the criteria for PBT or vPvB.

12.6 OTHER ADVERSE EFFECTS
None known

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 WASTE TREATMENT METHODS
Follow local, state and federal regulations for product disposal. Not a hazardous waste unless contaminated with hazardous products.

SECTION 14: TRANSPORTATION INFORMATION

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International regulations (RID/ADR; RTMDR; IMDG; IATA/OACI): Not classified as dangerous for transport.
DOT shipping label: Non-hazardous

SECTION 15: REGULATORY INFORMATION

15.1 SAFETY, HEALTH AND ENVIRONMENTAL REGULATIONS
According with the version of the Globally Harmonized System of Classification and labeling adopted in the United States and Regulation 1272/2008/EC(CLP): Classified

15.2 CHEMICAL SAFETY ASSESSMENT
US FEDERAL REGULATIONS:
Clean Air Act:
ODS: Not applicable.
SARA (EPCRA) Section 313 (40 C.F.R. § 372.65): Not applicable.
TSCA Status: On TSCA inventory.

STATE REPORTING REQUIREMENTS:
California Proposition 65: Not applicable.

SECTION 16: OTHER INFORMATION

See Hazard Communication Guidance for Combustible Dusts, OSHA 3371-08 2009, U.S. Occupational Safety and Health Administration, https://www.osha.gov/Publications/3371combustible-dust.html (accessed 10/8/14)
And
NFPA 654, Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids, for general safe handling and design guidance.

Other classifications of the substance:
TSCA STATUS: On TSCA Inventory.
FDA STATUS: Citrus acid, Anhydrous complies with FDA Regulation 21 C.F.R. § 184.1033;
CALIFORNIA PROPOSITION 65: Not applicable.
HMIS rating:
Health: 1
Flammable: 0

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Reactivity: 0
(0 = minimal ; 1 = slight ; 2 = moderate ; 3 = serious ; 4 = severe)

Safety Data Sheet according to Commission Regulation (EU) No 453/2010 of 20 May 2010 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)

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Annex I

SUMMARY OF RISK MANAGEMENT MEASURES
Safe use has been demonstrated by calculation of risk characterisation ratios where appropriate, while qualitative considerations were stipulated where quantification was not possible. The risk characterisation is based on the following risk management measures:
Exposure scenario ,,Description ,,General measures ,,Specific Human Health risk management measures ,,Specific Environment risk management measures ,,
ES1 ,,Production and intermediate use on production sites ,,Good working practices, containment and safe handling in line with industry best practice. ,,(i) Local Exhaust ventilation (LEV)
(ii) Personal Protective Equipment (PPE): Working clothing, protective gloves and safety glasses. Dust masks in areas where dust may be present. In case of open handling of larger quantities or accidental release, a particle mask or respirator with independent air supply is recommended. ,,(i) Treatment of effluent in waste water treatment plant. ,,
ES2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17 ,,Industrial use ,,
Good working practices, containment and safe handling in line with industry best practice. ,,(i) Local Exhaust ventilation (LEV) if
aerosol mists or dusts are present.
(ii) Personal Protective Equipment (PPE): Working clothing, protective gloves and safety glasses. Dust masks in areas where dust may be present. In case of open handling of larger quantities or accidental release, a particle mask or respirator with independent air supply is

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recommended. ,,(i) Treatment of effluent in waste water treatment plant. ,,
ES10 ,,Textile industry ,,Good working practices, containment and safe handling in line with industry best practice. ,,(i) Local Exhaust ventilation (LEV) if aerosol mists or dusts are present.
(ii) Personal Protective Equipment (PPE): Working clothing, ,,(i) Treatment of effluent in waste water treatment plant.
(ii) No direct discharge into the marine environment ,,

Univar USA Inc Safety Data Sheet

For Additional Information contact SDS Coordinator during business hours, Pacific time: (425) 889-3400

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DOWNHOLE TOOLS/REAMERS

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Reaming Tools/Equipment

The reamers utilized for hole-opening operations are custom fabricated by Michels Corporation, however equivalent or better tools may be substituted depending on availability of other suppliers' products, or, if changes in anticipated drilling conditions are encountered. Michels R&D program for downhole tools includes monitoring of performance & longevity of reaming equipment in differing soil conditions throughout North America as well as foreign destinations. Utilizing the latest technology, tooling and materials available to the industry is a continuing goal of Michels.

There is essentially no limit to the length of time these tools can be run since simple repairs can be made in the field to keep the reamers in good working condition. The condition of the reamers will depend on the type of ground encountered; typically these reamers are discarded when they are observed to be beyond field repair. Initial maximum run time for specific reamers recommended by Michels is 50-100 hours.

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DRILL FLUID RECYCLING
MUD CLEANING EQUIPMENT

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Drill Mud Cleaning and Disposal

The first phase of the mud cleaning system is displacement of solid returns at the shakers. Heavy solids are sifted out by a shaker with screens and deposited into a pit. From here they will be transported by dump truck to a site for disposal.

Drill Mud Cleaning Equipment Specifications

Volume of Mixing/Scalper Tank	54.0-Bbls
Volume of Desander Tank	72.0-Bbls
Volume of Desilter Tank	72.0-Bbls
Quantity of Scalping Shakers	1.0-Shakers
Mesh Size of Scalping Shakers	10-20 Double Stacked
Desander Capability	2 @ 500-GPM (1,000 GPM Total)
Desander Cones	2.0-Cones
Desander Mesh Size	40 to 165
Quantity of Desilter Cones	10 Ea @ 100-GPM
Desilter Mesh Size	60 to 250
Steel Mud Circulating Tank Volume	160-Bbls
Returns Tank Volume (Mud Pit)	320-Bbls
Cuttings Tank Volume (20-yd Roll-off)	150-Bbls
Mud Screening, Max Pass Size	40 Mesh

Due to the quantity and types of mud pumps owned by Michels and located on multiple drill sites Michels utilizes one of the following pumps based on availability and geographic location:

Bentonite Pump Capabilities (ENTRY/EXIT)

Name Brand	Gardner Denver OPI-350
Liner Size	6-Inches
Maximum Pressure	1,469 PSI
Maximum Flow Rate	529 GPM
Gallons Per Stroke	2.94 Gallons Per Stroke

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Bentonite Pump Capabilities (ENTRY/EXIT SIDE)

Name Brand..... Ellis Williams W-446 Super Force Triplex Piston Model

Liner Size..... 6-Inches

Maximum Pressure..... 1,027 PSI

Maximum Flow Rate..... 661 GPM

Gallons Per Stroke..... 2.20 Gallons Per Stroke

Bentonite Pump Capabilities (ENTRY/EXIT SIDE)

Name Brand..... Gardner Denver OPI-700

Liner Size..... 7-Inches

Maximum Pressure..... 1,690 PSI

Maximum Flow Rate..... 599 GPM

Gallons Per Stroke..... 3.99 Gallons Per Stroke

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MICHELS ROLLERS

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Michels Directional Crossings Pipeline Rollers

General Description: Steel tubing welded frame supporting two urethane coated rollers. Pillow block bearings are used to mount the rollers. The rollers are opposed to each other and set @ 125° to accommodate various pipe sizes.

Size: Footprint of 50”x48” with overall height of 40”

Load Capacity: 167,000 Lbs per assembly

Shafts: Material is steel 4140, 2-15/16 Diameter.

Frame: Frame weldment made of steel ASTM A-500 Grade square tubing

Rollers: 11” O.D., 20” face width, 8-5/8” core size. Coating is urethane approximately 1” thick (95 Shore-A)

Bearings: 4-required per assembly, 2 on each coated roller. Manufacturer is Linkbelt, Part Number PB22447E w/ 2-15/16” spherical roller, self aligning, contact seal.

Load Capacity for Bearings;

Basic = 41,800 Lbs
Static = 71,500 Lbs,
L-10 Life = 9,410 Hours @ 300 RPM

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MICHELS CONTINGENCY PLANS

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DIRECTIONAL DRILL CONTINGENCY PLANS

WBI

Lake Sakakawea Crossing

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Horizontal Directional Drilling

CONTINGENCY PLANS

Michels believes contingency planning begins with the appointment of competent field personnel having the greatest amount of experience to complete a project. Michels' personnel are some of the most qualified drilling experts in the industry, as demonstrated by resumes and experience lists highlighting past projects completed. With the abundant resources at their disposal, Michels has overcome risks associated with some of the most difficult drilling projects ever attempted and has evolved into an industry leader. Michels Project Managers are some of the best in the industry utilizing the many resources available while coordinating the various facets of a productive drill site.

Michels' Drill Superintendents are highly experienced at utilizing drill rigs and ancillary equipment of every size. They have worked up though the ranks providing them a complete and comprehensive understanding of safety, environmental monitoring, manpower, equipment operations and repairs for each phase of the drilling operation. As noted on the attached resumes, each Superintendent has drilled throughout North America and has encountered varying soil conditions, from sands, gravels, clay and cobble to solid rock formation. They are well respected throughout the industry and have worked with a majority of the major Pipeline Construction Companies in North America. Michels' personnel maintain continuous certification through accredited schooling for all phases of the drilling operation.

Contingency planning is conducted in response to unforeseen events and conditions, which could occur during normal operating sequences. The following contingency plans are in place to ensure completion of the project in accordance with governing authorities. The Field Operations Superintendent oversees preventative measures before product line installation. This alleviates the probability for adverse conditions such as stuck pipe. The following are some of the more common variables, which we have developed contingency plans for. They include but are not limited to:

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Possible Condition: *Inadvertent Drill Fluid Release Response and Control*

Contingency:

A large reduction or sudden loss in drill fluid returns is a signal to the driller and monitoring personnel that monitoring for inadvertent returns should be intensified for possible surface release. Therefore, the proposed drill R.O.W. will be inspected for inadvertent returns at a minimum of twice per shift and becoming more frequent if there is a large reduction or sudden loss. The frequency and results of R.O.W. inspections will be documented and recorded on the daily reports. Early detection and quick response is the key to controlling and/or limiting surface release. Additional information regarding access to USACE-Owned Land is addressed later in this document.

The absence of an open bore-hole conduit or the presence of a major formation fracture can lead to partial and/or potentially total loss of drilling fluid circulation. While it is impossible to determine the precise nature of this type of fluid loss, it is possible to accurately monitor for it by watching for a significant difference between the rate fluid is being pumped down-hole and the rate it returns to the surface. The drilling fluid pumping rate and the rate of drilling fluid return to the surface is constantly monitored by the mud technician and relayed to the driller while the HDD operation is progressing. The driller will know immediately if an unusually high volume of drilling fluid is being lost down-hole, depending on the ground conditions encountered in the crossing and taking into account the volume used to fill the bore-hole. Should the driller believe that circulation is being completely lost he will implement the following procedures:

1) Temporarily cease drilling operations, including pump shut down;
2) Dispatch experienced observers as required to monitor the area in the vicinity of the crossing, for inadvertent returns of drilling fluid at the surface or in the river;
3) Identify the position of the drill head in relation to the point of entry
4) Re-start the pump and stroke the bore-hole up and down in stroke lengths up to 30 feet up to 6 times but no fewer than 2 in an effort to size the bore-hole annulus and re-open the circulation pathway.

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In addition, the thixotropic properties of the drilling fluid may be thickened within the guidelines set forth by the manufacturer to aid in re-establishing circulation as required depending on bore-hole conditions. Observers will regularly monitor for inadvertent fluid returns as long as the pump remains on. Occasionally, based on the driller's discretion, it may be useful to increase the stroke length up to 90 feet or past the point at which he believes circulation was lost.

If circulation is re-established, drilling will proceed as usual and monitoring for inadvertent fluid will take place once again if the rate of drilling returns progressively decreases at the fluid entry pit. If circulation is not re-established, monitoring for inadvertent fluid returns to the ground surface and river will continue and drilling will proceed.

If the amount of inadvertent returns is not great enough to allow practical collection, the affected area will be diluted with fresh water and allowed to dry and dissipate naturally back into the earth. If the amount of returns exceeds that which can be suitably contained with hand placed containment barriers, small collection sumps (less than 3.8 cubic meters) will be used to pump fluid back to the solids control system.

When drilling fluid returns are observed to be continuously surfacing above ground at an accessible location the following procedure will be followed:

1) Immediately cease pumping of drilling fluid;
2) Contain the location such that the drilling fluid cannot migrate across the ground surface;

On-Site Materials and equipment used for containment:

- Straw Bales, if available;
- Silt Fence;
- Check Dams;
- Backhoe for Accessible Areas;
- Shovels;

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- Portable Pumps;
- 100 feet of Hose.

3) Excavate a small sump pit at the location and provide a means for the fluid to be returned to either the drilling operations or a disposal site (i.e. pump through hose or into tanker);
4) Notify on-site contractor supervisor and Owner's representative as required by the communication plan;
5) Continue drilling operations, maintain the integrity of the containment measures, and monitor the fluid returns as required to ensure that no surface migration occurs;
6) Clean-up is carried out once inadvertent returns are contained/controlled;
7) Fluid pumped to a secure containment vessel;
8) Area is diluted with water;
9) Area is restored to original condition.

If inadvertent drilling fluid returns are observed to be surfacing above-ground at a location that is inaccessible, i.e. along the bed of a water body, or, into the water, the following procedures will be followed:

Ensure that all reasonable measures within the limitations of the technology have been taken to re-establish circulation;

Continue drilling with the minimum amount of drilling fluid required to penetrate the formation and successfully install the product line.

Typically lost circulation has the highest probability of occurring while the pilot hole is being drilled due to the smaller bore-hole annulus and the relatively large volume of solids being displaced and carried out in the drilling fluid. In the course of drilling the pilot hole, circulation will often be temporarily lost as the pilot bit is advanced through more permeable or less

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competent sections of the ground formation when fluid pressures are at a maximum. As the pilot bit advances beyond these sections of the bore-hole fluid pressure will fall and circulation within the bore-hole will naturally be re-established. Much of the fluid lost to the formation under the greater pressures will return back to the bore-hole as the pressures fall, in which case the drilling fluid is not likely to migrate to the surface or the river. It is also possible for the drilling fluid to leave the bore-hole and migrate in a direction other than the ground surface or the wetland, in which case it may never be observed even if circulation is lost for long periods of time.

It should be noted that frequently drill cuttings generated as a result of the drilling process will naturally bridge and subsequently seal fractures or voids as drilling progresses, thus providing another means of re-establishing circulation. This is especially likely during the reaming process as higher volumes of larger cuttings are typically generated. Therefore it is usually beneficial to proceed with the pilot hole even if circulation has not been re-established since it will likely be re-established at some point during the reaming process.

The use of an environmentally safe drilling fluid ensures that even in the unlikely event of fluid loss at sensitive areas, there will be no adverse environmental impact other than a temporary minor increase in turbidity until the drilling fluid dissipates. It is important to note that any temporary increase in turbidity as a result of inadvertent drilling fluid loss while directional drilling the crossing will be several orders of magnitude less than that of an open-cut crossing.

Contingency Access Plan for USACE-Owned Lands in Event of Unanticipated Return

In event of an unanticipated return of drilling fluid on U.S. Army Corps of Engineer (USACE) owned lands, WBI Energy, Inc. (WBI) and its contractors would mobilize clean-up crews as soon as practicable. Crews would utilize access points and routes identified on Figures 1 and 2 (North Side and South Side of the Lake Sakakawea horizontal directional drill). To the extent practicable WBI Energy will use publically available access roads to reach inadvertent return cleanup areas. WBI and its contractors will notify landowners prior to the commencement of HDD drilling activities and will work expediently to contact landowners in event of an inadvertent return.

If necessary, equipment used to access and clean-up inadvertent returns of drilling fluid on the ground surface of USACE owned property would include rubber tired vehicles, such as pick-ups

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and vacuum trucks (vac-trucks). It is anticipated that for an inadvertent return of drilling fluid to the ground surface, access to USACE owned property would follow the paths illustrated on Figures 1 and 2, the primary route on both sides of the Lake Sakakawea HDD would be along the permanent right-of-way leading from the drill box to the banks above the shoreline. From the permanent right-of-way, a direct perpendicular route would be taken to reach the site of the inadvertent return with the shortest path. To the maximum extent practicable, woody vegetation (trees and shrubs) will not be cleared; access paths would avoid trees and general vegetation disturbance to the maximum extent practicable. Where necessary crews will travel around persistent, live, woody vegetation.

If access is necessary along the beach on either the north side of Lake Sakakawea, as shown in Figure 1, or the south side of Lake Sakakawea, as shown in Figure 2, crews will either access the clean-up location by walking in, or utilizing small, low ground pressure equipment, such as UTVs or ATVs. A secondary option for beach access would be to mobilize a small boat from a public dock to bring personnel and cleanup equipment to the beach. Every effort will be made to access clean-up sites, if necessary, from the higher ground along the permanent right-of-way. After clean-up of drilling fluid is complete, crews will follow the same path out that was taken in to the inadvertent return, to minimize additional disturbance. Calls will be made to the appropriate USACE point of contact as soon as feasible, but not greater than 24 hours from the time crews are mobilized to clean-up the inadvertent return.

Attachment – Figure 1

Attachment – Figure 2

Possible Condition: *EQUIPMENT MALFUNCTION/FAILURE-SPARE PARTS*

Contingency: Based on past experience, Michels can reasonably estimate the average life expectancy of all major components of the drilling operation under normal operating conditions. The operating hours of the equipment are recorded prior to start of drilling operations and maintained throughout completion of the crossing. Documentation and maintenance records are maintained by the drilling superintendent so that replacement of key components can be routinely performed in a timely manner to prevent failure. Occasionally, a component of the drilling operation will fail unexpectedly even with the most stringent maintenance and replacement schedule. These types of failures have occurred in the past and

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Michels has established a spare parts inventory with each drill rig based on the most common failures of this type. Spare parts kept on site include hydraulic pumps, flendor motors, and drive gears. In addition, odd sized or extremely high pressure hydraulic hoses that are not readily available "off the shelf" are kept on site.

Major Spare Parts kept on-site

- 1,800-Mission pump
- 2,500-Halco pump
- Mud Rig – Clutch and Transmission
- 11 – Vise Blocks
- 4 - Vise Hydraulic Rams
- 2 - Rotary Motors
- 2 – Drive Motors
- 1 – Hydraulic Pump
- 2 – Vise Travel Motors
- 1 – Circulation Pump
- 2 – Mud Swivels
- 2 – Complete Rebuilds for OPI-350
- Rebuild Parts for EW-446
- Electric Motor for Halco
- Electric Motor for Cooling Fans
- 2 – Shaker Motors

It is not feasible to maintain a complete spare parts inventory with each drilling rig on site so Michels immediately identifies local sources for commonly available spare parts and equipment upon job start up. Spare parts not readily available locally are kept in one of four Michels' permanent warehouse locations in Bothell, Washington; Adrie, Alberta Canada; Harrisburg, Pennsylvania; or Brownsville, Wisconsin, where the parts can be shipped overnight to the job site to prevent extensive down time caused as a result of equipment failure if necessary.

Possible Condition: *STUCK PIPE*

Contingency: The following are some of the preventative measures invoked by the Drilling Foreman in order to reduce the chances for complications while pulling back product pipe.

1. Utilize drilling equipment capable of supplying enough power to remove seized pipe from either entry or exit location.

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2. Performing an extra reaming pass with the purpose of cleaning out the reamed hole (not a cutting pass) and adding proper lubrication with precise weight bentonite mixture.
3. Reduce torsional and axial loads through the use of properly spaced rollers, well maintained swivels and creating a smooth transition between downhole exit angle and pipe strung out on top of ground readied for pullback.
4. Utilize Ballasting to control the weight of the pipe by achieving negative or neutral buoyancy.

Contingencies for stuck pipe

If above preventative methods fail and the pipe become seized in the borehole we invoke Best Available Control Technology (BACT). One of the methods involves specific techniques in conjunction with ballasting, which is controlled loading with water. Past experience has shown us that if the leading end of the pipe remains too heavy during ballasting, air can be supplied to this area of pipe, displacing water back toward the middle, and in some circumstances freeing up the point of greatest friction.

If the drilling rig is unable to supply the initial thrust to release the seized pipe, side booms and or track-hoes can supply thrusting pressure from the exit side in order to start momentum. Michels drilling rigs have the potential to supply up to 1,200,000 pounds of thrust and pulling-force, add additional equipment and there is not much that cannot be dislodged.

Not only can force be applied from the drill-rig side but additional force can be applied from the pipe installation side for large diameter installations through the use of a Herrenknect pipe thruster for land to land crossings. This alternative source of power supplied from the opposite end can dramatically assist large diameter pipe pullback during significant changes in the effective weight of the pipe during pullback (buoyancy) caused by either losing circulation or re-establishing circulation unexpectedly therefore causing drastic changes in the buoyancy of the pipe. This method also reduces the risk for damage to pipe coating during pullback by reducing the tensile force needed to pull back the pipe. If the large diameter pipe becomes stuck additional control can be established to move pipe back and forth in the event gravel, cobble and/or boulder sized

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materials fall in the hole after swabbing. This can be used as an alternative to the percussion hammer which has been used as a contingency measure on previous past projects.

(See Attachment Herrenknect Pipe Thruster)

If percussion assistance is determined to be necessary to supply the energy required to complete the pullback operation, Michels is capable of performing this operation utilizing a GrundoRam percussion hammer supplied by TT-Technologies. The work area needed for invoking hammer assist procedures is located on the pipe pullback side of the crossing. This will encompass an area of 40-feet long x 20-feet wide for staging of the "Taurus" GrundoRam percussion hammer and assist equipment. This pipe-ramming machine has a thrust of up to 2,000 tones and a ramming speed of 180-strokes/minute. A GrundoRam and 1600 CFM air compressor will be made available by Michels on-site. Additional sources for spare parts and accessories should also be identified.

(See Attachment Grundo-Ram Percussion)

A specially manufactured reinforced push ring is positioned at the back end of the product line so that equal transmission of percussion energy can be transmitted down the product pipe, and to protect the steel pipe end while in contact with the GrundoRam "Taurus". The persistent exertion of energy along the descending steel pipeline aids in aggressively sliding the pipe through suspect areas of unconsolidated formation or through areas of cave-in. Although this is not a regular occurrence due to mitigative measures taken prior to installation, Michels has successfully completed this unique form of pipeline pullback assist periodically over the past 10-years and has built a solid reputation as an innovator in this field.

Possible Condition: *INCLEMENT WEATHER*

Contingency: Key personnel monitor long range forecasts for the project areas to be affected. Various weather services (i.e. NOAA, Weather Channel etc) are monitored by computer for bad weather and potential hurricanes. Regular updates are given to Michels' personnel to make them aware of approaching weather conditions. Evacuation routes will be identified and reviewed with all personnel for potential hurricanes prior to beginning work and responsibilities will

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be assigned. If electrical storms are projected to affect a drill site, approaching storms will be monitored by radar and radio and communication will be maintained between Project Manager and personnel. Electrical storms can potentially cause serious problems for a drilling operation. The Drill Superintendent must use his discretion as to the appropriate safe action to be taken for the safety of the crew and entire drilling operation. Proper grounding must be maintained throughout a drilling operation.

A safe area on the site will also be designated for response to an approaching tornado. Stream gages will also be identified and monitor for potential flooding conditions.

Possible Condition: *NOISE*

Contingency: Noise reduction can be accomplished using several methods. To begin with, a site reconnaissance or noise modeling must be completed by the Owner to determine what decibel (dB) level will be allowable at the affected locations. Some of the Noise Control Considerations include: Redirection of sound waves or deadening just by the simple positioning of drilling equipment and strategic location of frac-tanks. This option generally has little affect upon cost and may cause minor inconveniences for the drilling operation.

Another option is to utilize hospital/industrial grade mufflers to deaden sound as it leaves engines of motorized equipment. This could impede maximum operating output from equipment and also slow down the drilling operation.

More costly forms of Sound Control include; Building walls made of hay bales, sound curtain matting or plywood, or, building sound deadening enclosures constructed of wood.

Possible Condition: *DAMAGE TO EXISTING UTILITIES*

Contingency: Preventative measures include proper notification of local utilities through area one-call programs or site investigation and recording of area markers, manholes and valves. Pot-holing existing utilities is the most reliable method of exact utility location

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Damage to existing utilities or structures may occur during drilling or reaming operations. Occasionally unknown or unmarked utilities may be hit during drilling or reaming operations. If this circumstance does occur the type of utility is first identified so that severity of response can be identified. Emergency personnel for the identified utility are then notified. Pertinent personnel for the Owner and/or Owner Representatives are then notified, following the chain of command. Decisions are then made as to appropriate action to be taken.

Possible Condition: *ENCOUNTERING SUBSURFACE OBSTRUCTION*

Contingency: Occasionally an unknown subsurface obstruction is encountered during drilling operations such as; 1) buried tanks, 2) Building foundations/piers/pilings, 3) buried junk/cars. If this situation occurs, the location of the object is first identified in relation to the drill path. If the current R.O.W. is ample and soils provide adequate steering capabilities, the drill head is pulled back to a pre-calculated point along the previously drilled path and the drill bit is rotated and steered around the obstruction.

The chance of encountering an obstruction during reaming operations is highly unlikely. But, if this should occur, the magnitude of the obstruction must first be evaluated. If the obstruction is determined to be impassible, operations will be halted until an agreeable solution can be determined.

Possible Condition: *RUNNING SANDS*

Contingency: It is possible that loose cohesionless soils, such as running sands, may not support the drilled annular space over a long directional drill length. Although this circumstance sounds serious, it may not prevent the installation of a pipeline. Mechanical agitation of the formation by the downhole tool and trailing drill string, combined with the injection of bentonite drilling fluid causes the soils to experience a decrease in shear strength. When the resulting shear strength is low enough, the soil will react in a fluid-like manner thus, allowing the pipeline to be pulled through it.

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It would be highly unusual for soil strata to be of the same consistency from drill entry to drill exit, especially at the various depths encountered during pilot hole drilling. Prior to drilling, only general soil information is known for estimating and hypothesizing. The type of drilling fluid providing the best performance capabilities for the conditions is chosen based upon this information. Adjustments are then made in the field correlating to specific soil properties in order to improve performance.

Possible Condition: *PIPELINE MISALIGNMENT*

Contingency: Today's technology in the directional drilling industry provides state of the art instrumentation and tracking capabilities. The directional drill alignment is accurately known to within ± 0.01° or, ± 1.4 feet per 1,000 feet in both profile and plan view. The addition of Para Tracker as a secondary form of verification and validation for plan view orientation, left and right of center line, provides precise information which is updated regularly during drilling operations. The most frequent cause of misalignment is the inability to steer in transitional zones near the exit location. These soils may include varying degrees of overburden or formations allowing unpredictable degrees of penetration. The orientation or angle of these zones from horizontal may deflect the drill bit having a direct affect upon steering capabilities.

In any case, the steering probe maintains its tracking capabilities and allows the Survey Technician continuous feedback for locating the drill string in a three dimensional plane. Any deviation from the targeted exit is known and can be compensated for. If the target area is not large enough to accommodate the deviation, the drill string can be pulled back to a calculated point and be redirected toward the proposed exit location.

Possible Condition: *PRESSURE CONTROL*

Contingency: An important function of the drilling fluid is to prevent the uncontrolled entry into the hole of fluids from the formation penetrated by the bit. The pressure exerted by the column of drilling fluid (hydrostatic head) must be somewhat greater than the pressure exerted by the formation fluids to allow raising the drill string without any problems. Following are some mitigative measures taken to counteract pressures.

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1. Avoid swabbing drill string (plunging the drill string back and forth with great force)
2. Keep the hole full of drill mud while pulling the drill pipe, especially when hydrostatic head is not much greater than formation pressure.

At any given depth, the hydrostatic pressure (in psi) of the mud column is equal to mud density (in lb/gal) times depth (in feet) times 0.052

Psi (hydrostatic pressure)	=	lb/gal (density)	x	feet (depth)	x	0.052

Possible Condition: *HOLE COLLAPSE*

Contingency: Most drillable formations, whether consolidated or unconsolidated, have some form of cohesive properties allowing drilling fluid to interact and add to its bonding properties, thus avoiding hole collapse. Some soils, such as large gravel zones or cobble areas may not be capable of holding a hole. If this type of formation exists in the overburden soil (upper strata), a steel casing pipe may be washed over the drill stem into competent soil and left in place during operations. Drilling and reaming operations will then resume utilizing this conduit as a means of carrying drill cuttings back up-hole without obstruction. This reduces the chance for lost circulation. Under this circumstance, the integrity of the pipe coating **cannot** be guaranteed.

If this type of formation exists throughout the borehole, it should be known and researched prior to drilling so that an alternate route may be researched. The route that provides the best chance for success should be the route chosen. If a competent drilling contractor properly investigates a route, the chance for a hole collapse is greatly reduced.

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Possible Condition: *PIPELINE COLLAPSE*

Contingency: Pipeline collapse during pulling operations is a rare occurrence caused by certain factors, which must be considered before pullback begins. Some of the main factors, which must be considered during pre-planning stages or prior to pipeline pullback operations, include:

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1. Pre-engineered profile must reflect the minimum radius of curvature calculated for the given pipe (wall thickness, pipe size, tensile strength, X-rating)
2. Drilled profile should not exceed pipe tolerance throughout the drilled borehole.
3. Experienced directional drilling Survey Technician verifies three joint radii calculations for maximum degree of bend per 30-foot joint.
4. Industry standard safety factor should be included in the profile and calculations taking into account unknowns.
5. Exit and entry angles must be within specified tolerances so that support equipment capabilities are not exceeded in order to provide the pipeline a smooth, uninhibited transition into the opened hole.
6. Calculations performed for anticipated stresses the pipe will be subjected to during pullback (i.e. Pull loads, tensile, unconstrained buckle, hoop stress.) This way upper stress limits will be known.
7. Proper ballasting of product line through controlled loading of water to the leading end of pipeline. This procedure also provides internal pressure to the product line as a counter balance to external pressures. If water is added to the opened end of the product line and allowed to flow down toward the leading end during pullback, a vacuum may occur creating undue stress on the product line which would increase the possibility of implosion or collapse. Therefore, a conduit is positioned to carry water through the interior of the product pipe dispersing water at the leading end of the pipe filling it from the lowest portion (elevation) toward the highest elevation. Volume calculations are maintained to ensure only the lowest portion of the pipe is maintained full of water.

The appointment of highly competent personnel experienced in pipeline pullback procedures is a must. There is no substitute for experience. Experienced personnel should be placed at critical positions at both the drill entry and exit locations.

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FIGURE 1

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Milepost
Workspace
Access Route
Low Impact Access Route
Surveyed Wetland
Surveyed Waterbody

N

125 62.5 0 125
Feet

Figure 1
North Bakken Expansion Project
Preliminary Access Plan in Event of Inadvertent Returns for Access to USACE Lands

WBI ENERGY TRANSMISSION

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Drawn By: RJC

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FIGURE 2

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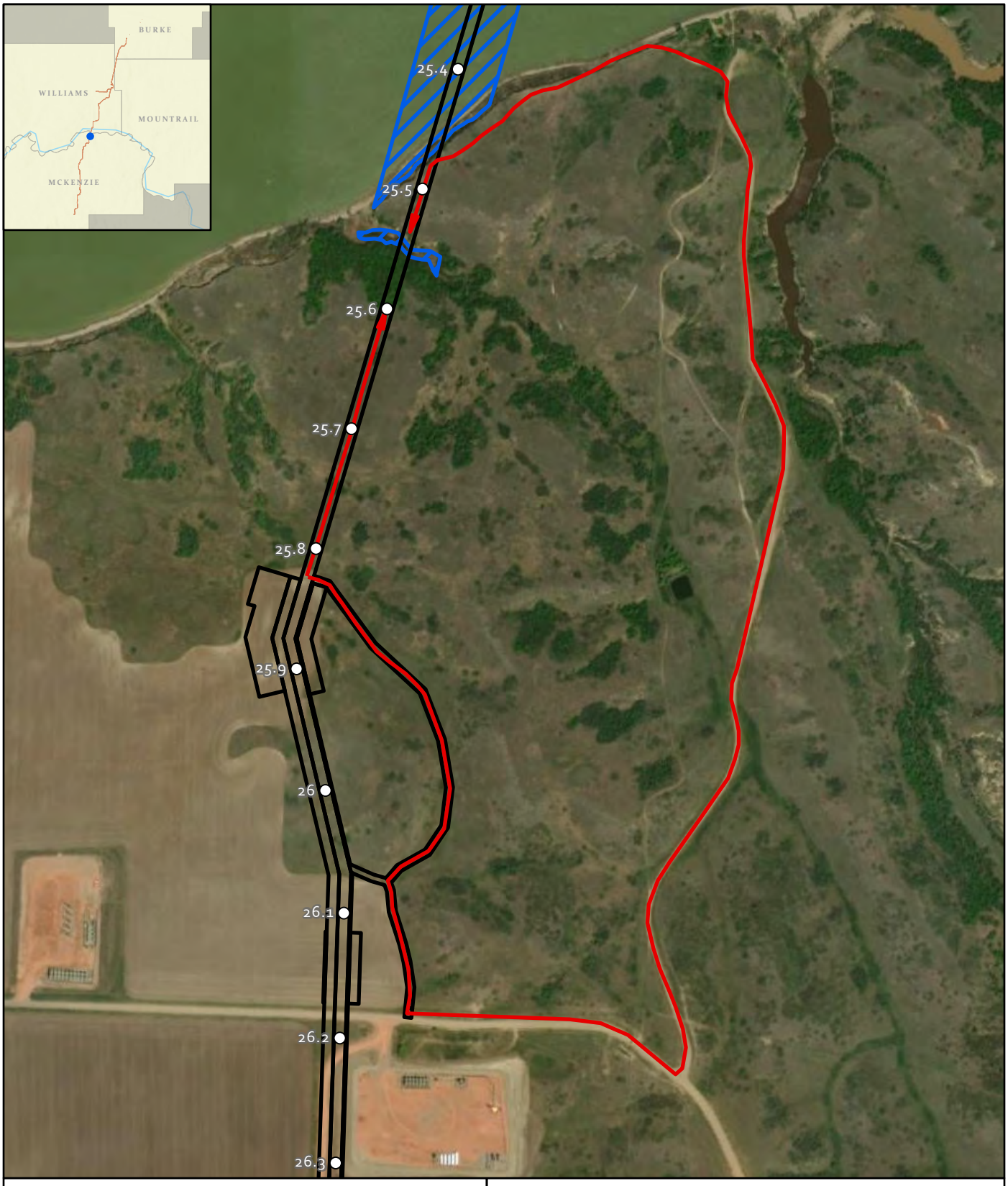

Figure 2
North Bakken Expansion Project
Preliminary Access Plan in Event of Inadvertent Returns for Access to USACE Lands

WBI ENERGY TRANSMISSION

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ATTACHMENT

GRUNDO RAM
PNEUMATIC PIPE RAMMER

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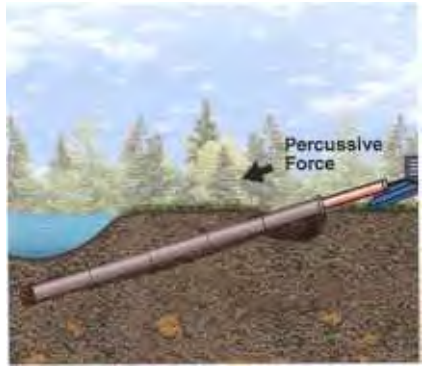
Percussive Power

for directional drilling assist

Conductor Barrel™

A sure start for your bore even in the worst soil.

- Ram casings through difficult soil conditions to more desirable drill starting points.
- Guide down-hole or mud motors to rocky soils through the conductor barrel.
- Provides friction-free section for product pullback.



Pullback Assist

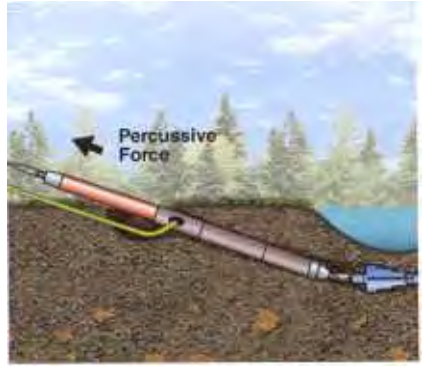
Overcome hydrolock with a pipe rammer.

- Rammer attached to product pipe during pullback.
- Percussive action keeps pipe moving and helps prevent high levels of pullback stress.
- Percussive power frees immobilized product pipes.

Pipe Removal

Remove stuck product pipe and bore again.

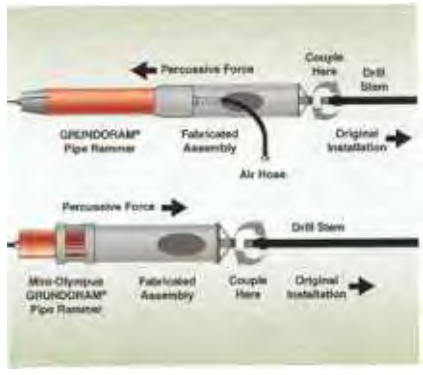
- Rammer attached to product pipe after pullback fails.
- Percussive action pulls product pipe, removing it from the bore.
- Salvage the job and bore again.



Drill Stem Recovery

Retrieve stuck drill stems.

- Pipe Rammer fitted with a special sleeve.
- Stuck drill stem welded to the back of the rammer sleeve.
- Percussive power frees drill stem, saving time and money.



"Power without limits!"

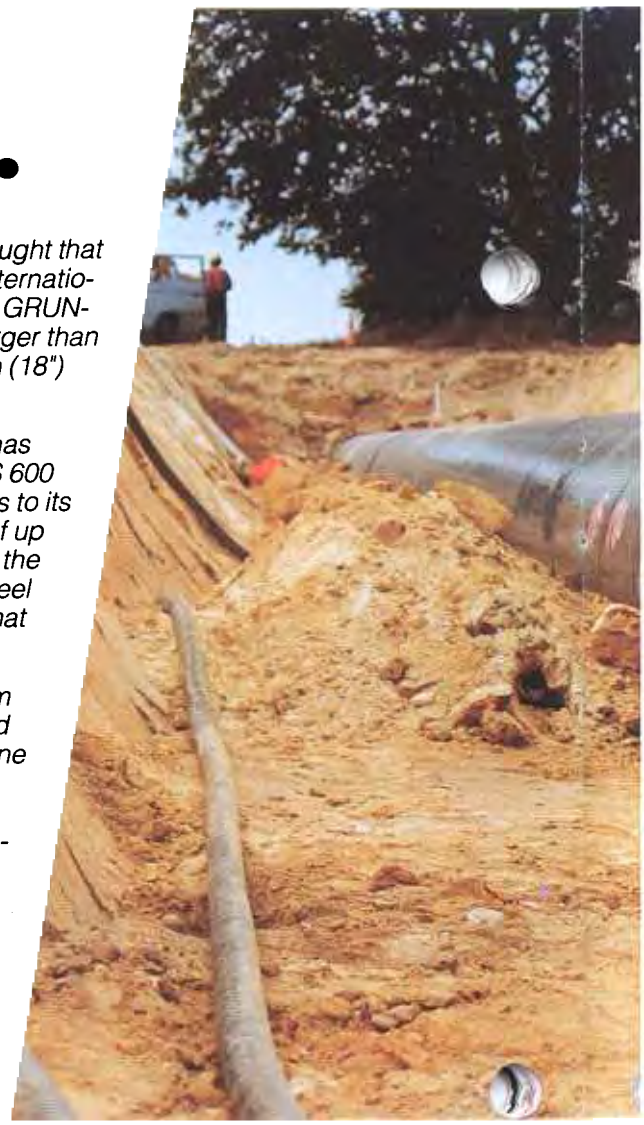
The strongest in existance ...

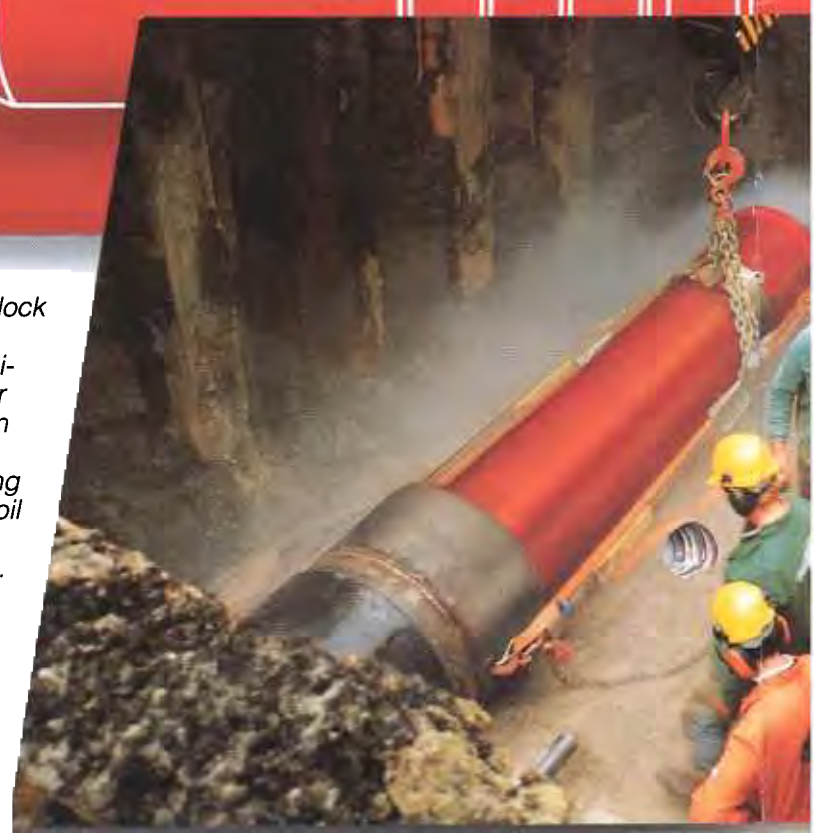
Who would have thought that there would be an international requirement for a GRUNDORAM hammer - larger than the GOLIATH 450 mm (18") machine?

International demand has made the new TAURUS 600 mm (24") a must. Thanks to its dimensions and thrust of up to 2,000 tons (4,480 lbs) the TAURUS is the largest steel pipe ramming machine that exists.

Steel pipes up to 2,000 mm (80") can now be installed with this powerful machine when installing casing or product pipes for the water, sewage, telephone, electricity and gas industries or railway authorities.

When other ramming equipment has reached its power limit the TAURUS offers that extra power to get that pipe into the ground.





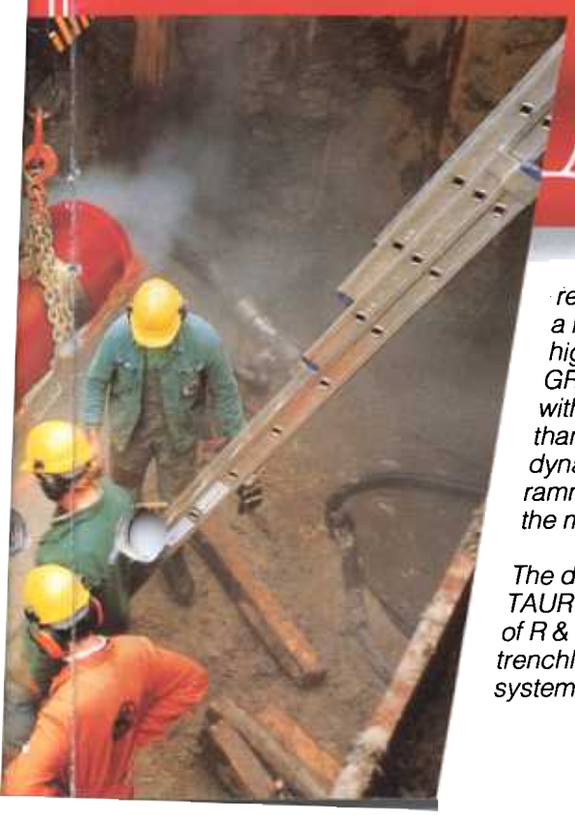
It is designed of a monoblock main casing made from a high quality alloy with a unique flexible control stud for perfect impact transmission onto the steel pipe. This makes it a reliable and lasting boring unit even in difficult soil conditions or over long stretches of steel pipe installation.

A GRUNDORAM's number of strokes has a direct influence on the forward ramming speed. However, high ground

TAURUS

Ø of rammer.....	.....24"
Length.....	.....12 ft
Weight.....	....10,580 lbs
Air consumption.	1.766 ft³/min
Strokes per min..	180
Thrust.....	....4,400 lbs
Suitable for pipes.	.....>380

A TAURUS used on a gas pipeline installation.



resistance and friction require a low stroke frequency with a higher single impact. The GRUNDORAM model TAURUS with 180 strokes/min and more than 2,000 tons (4,480 lbs) of dynamic thrust ensures high ramming speeds even under the most difficult conditions.

The development of the new TAURUS is the result of years of R & D in the field of trenchless pipe laying systems.

The GRUNDORAM is suitable to resist the highest stress in difficult soils thanks to its monoblock casing and flexible control stud.

GRUNDORAM

Good examples back up our claims

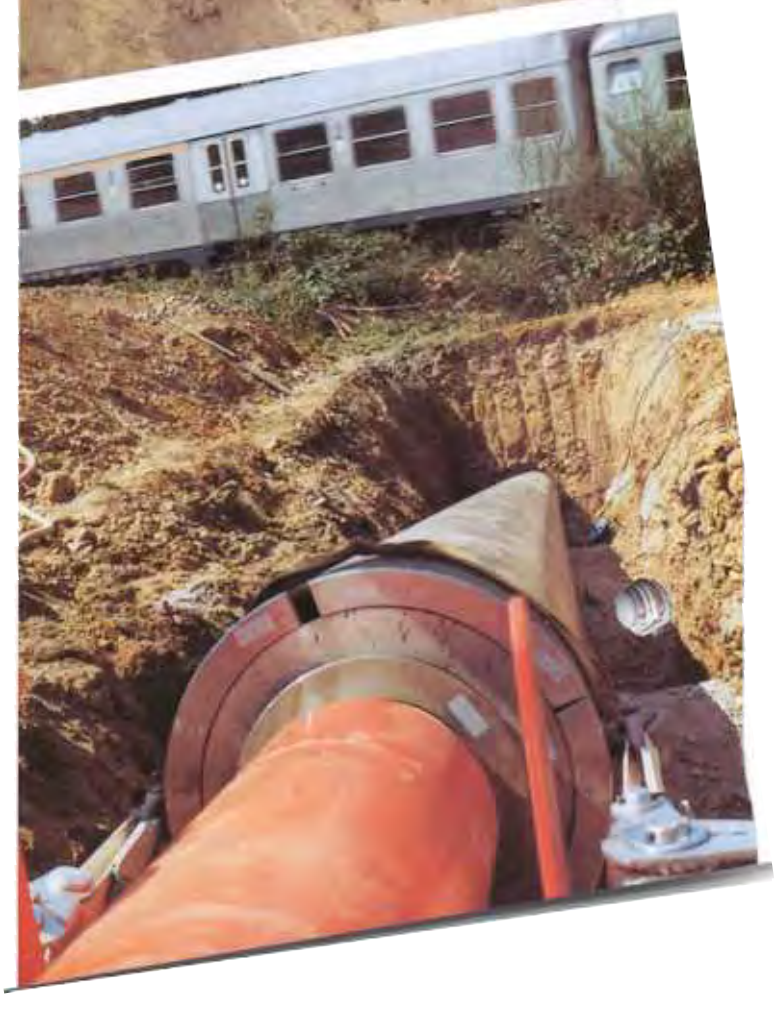
Global usage is quickly leading to the general acceptance of the robust GRUNDORAM system. Contractors value the ● simple operation and ● reliability the ● enormous impact power, the ● wide range of applications, the ● quick and easy preparation and the ● sturdy accessories.

● 220 ft of steel pipe, 14" diameter was rammed under a canal to accommodate 8 fibre-optic cables.

● 125 ft of 59" diameter pipe was laid under an embankment in Manchester, England, as a drainage system.

● 65 steel pipes of 28" diameter were installed parallel to each other under the main Seoul-Pusan railway line in South Korea.

● A 24" steel pipe was easily rammed along a 131 ft stretch under a railway embankment south of Cairo/Egypt.



"Typical" but also not everyday jobsite projects are excellent references, for example

● 115 ft of steel drainage pipe of 55" diameter was perfectly installed under the river Pader in the heart of the city of Paderborn/ Germany

● 200 ft of 30" steel casing for gas/telecom/mains supply was installed under the A 1 motorway without traffic disruption or diversions

● *90 steel pipes of 20" diameter were driven in vertically to provide solid foundations for a noise-protection barrier in Germany.*

There are many other typically good examples that could be listed. If you are interested in specific cases, contact us - we will supply you with detailed information.

GRUNDORAM

ATTACHMENT

HERRENKNECT
PIPE THRUSTER

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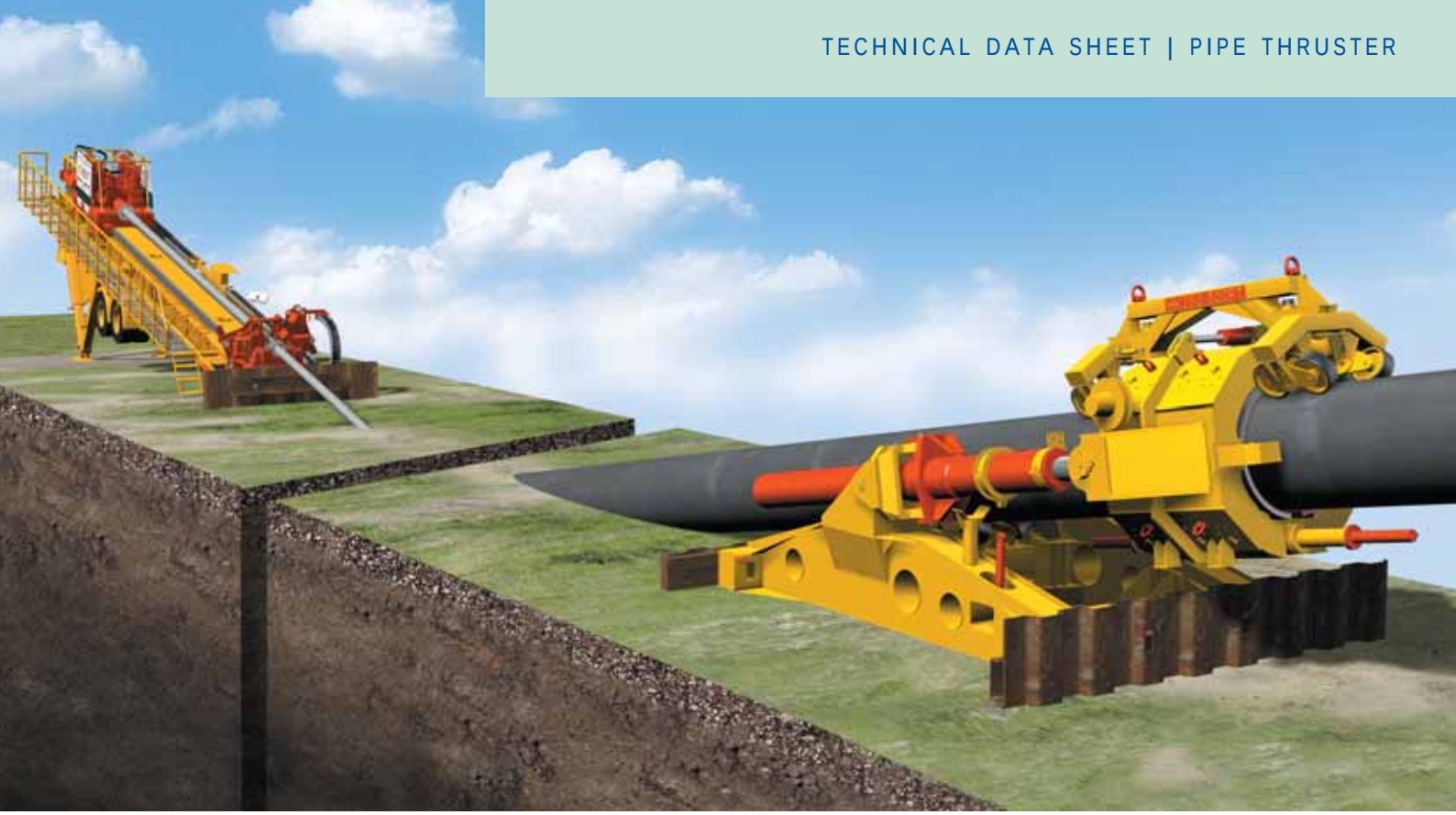

Additional Power for Pipe Pullback.

The newly developed Herrenknecht Pipe Thruster is an auxiliary device for Horizontal Directional Drilling Technology and extends its field of application. The Thruster is mounted at the exit point and helps to push the entire pipeline into the ground. It is particularly suited for extremely long pipelines, very large diameters or difficult geological conditions. Depending on the project the Pipe Thruster can be used as a support tool, a rescue tool or as a pipe installation tool.

After finishing the pilot hole and the reaming procedures using a HDD Rig the Pipe Thruster assists during the pipe pull. The Pipe Thruster is mounted at the exit point and pushs the product pipe into the enlarged hole while the Rig is pulling the pipe. This simultaneuos process will reduce the stresses on the drillpipe and the product pipe.

Beside improved safety the Pipe Thruster allows drill lengths of more than 3,000m and makes the use of big pipe diameters more common.

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HERRENKNECHT
Tunnelling Systems

Innovative Solution: The Pipe Thruster

Range of Application

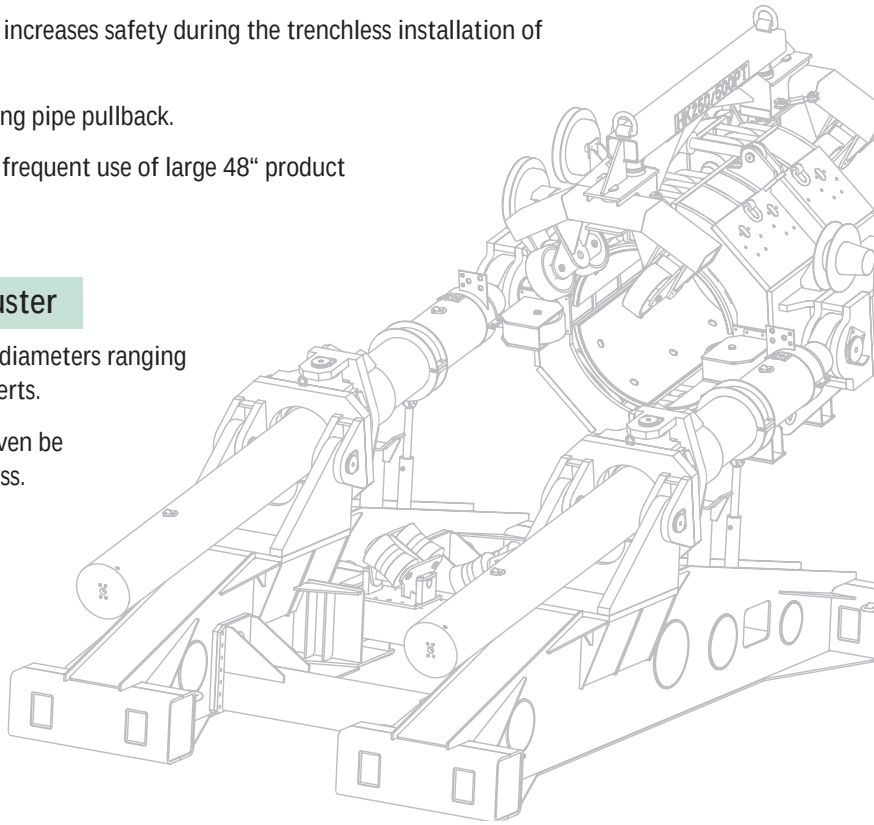
- Support of the HDD process during pipe pullback.
- Sea Outfall projects: ashore thrusting of the product pipeline.
- Rescue Tool for the recovery of stucked pipelines, e.g. in difficult geological conditions.

Advantages of the Method

- The deployment of the Pipe Thruster allows to add a push force from the exit point to the pull force of the HDD Rig.
- The flexible load distribution at the entry and exit point increases safety during the trenchless installation of pipelines considerably.
- Reduced stress for drill pipes and rigsite equipment during pipe pullback.
- Increase of drill lengths to more than 3,000m and more frequent use of large 48“ product pipe diameters.

Advantages of the Herrenknecht Pipe Thruster

- The Herrenknecht Pipe Thruster can be used for all pipe diameters ranging between 20“ and 48“ by just changing the clamping inserts.
- Due to a tilting clamping device the Pipe Thruster can even be installed when the pipeline pullback is already in progress.
- The clamping device is suitable for all types of pipelines and coatings.
- The modular design does not require special cargo transports.



Technical Data

Pipe Thruster

- Operating angle: 5° - 15°
- Push and pull force (normal): 250t (2,500kN)
- Push and pull force (maximum): 500t (5,000kN)
- Min. clamp diameter: 20“ (508mm)
- Max. clamp diameter: 48“ (1,219mm)
- Max. speed: 5m/min.
- Stroke of push/pull cylinder: 5,000mm
- Dimensions: 9 x 4.1 x 4.4m
- Weight: 45t

Power Unit

- Dimensions: 20ft container
- Installed power: 400kW
- Weight: 10t
- Remote control and hydraulic hoses to the Pipe Thruster are included.

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ATTACHMENT

DRILL FLUID RECYCLING FLOW CHART

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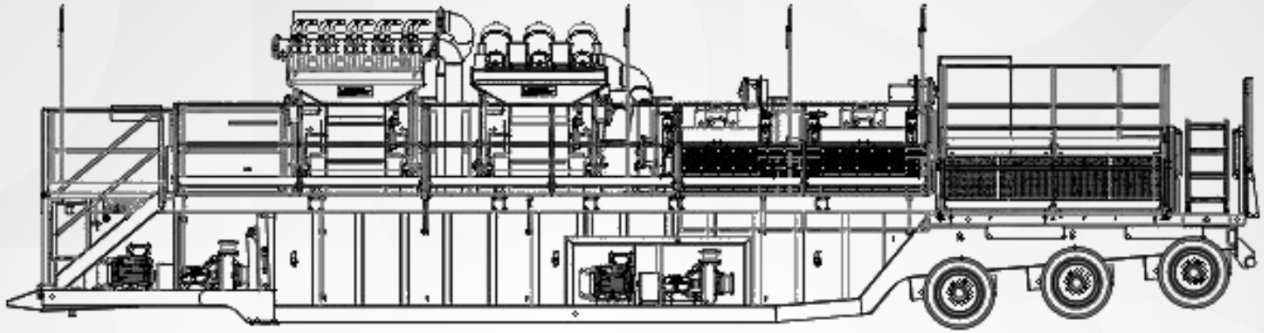
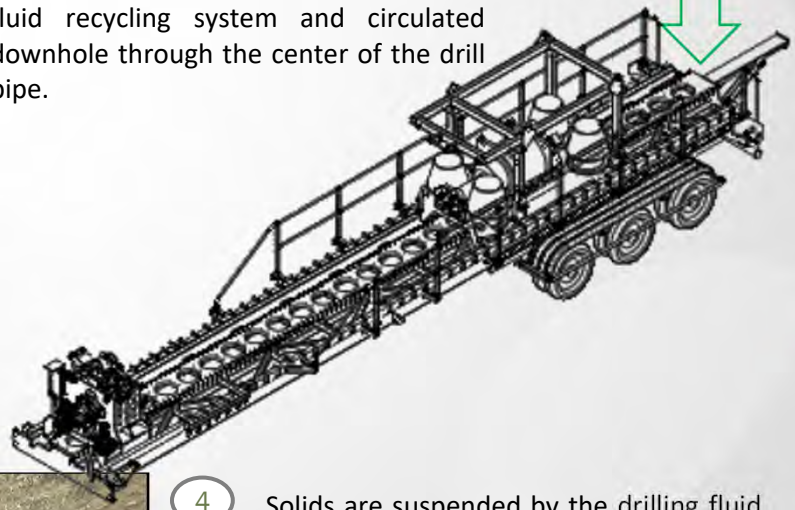
1 Drilling fluid volume is initially prepared consisting primarily of bentonite (NSF/ANSI-60 Drinking Water Additive Standard Certified) & water. Pumps are used to circulate the fluid downhole.



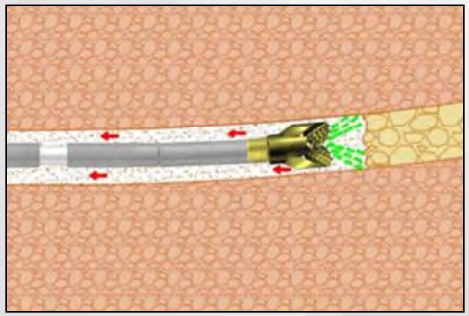
CLEAN FLUID

2 Drilling fluid is pumped from the drilling fluid recycling system and circulated downhole through the center of the drill pipe.



3 Once downhole, drilling fluid serves the following purposes;

- In alluvial formations, assists with jetting the hole
- Transports cuttings to the surface
- Aids in stabilizing formations
- Provides lubrication & tool cooling
- Provides hydrostatic fluid pressure to balance formation pressure.



SOLIDS LADEN FLUID

4 Solids are suspended by the drilling fluid downhole and transported throughout the annular space to the entry pit at surface.

5 Solid laden drilling fluid returns to the recycling system where it is processed by large particle shakers, de-sanders & de-silters. It is during this stage that the suspended cuttings are removed and the desired drilling fluid rheology is restored.

MICHELS®

WBI ENERGY TRANSMISSION, INC.
North Bakken Expansion Project
Section 408 Application

Attachment 2
Surface Use Plan of Operation

August 2020

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT
SURFACE USE PLAN OF OPERATION

1.0 PROJECT DESCRIPTION

WBI Energy Transmission, Inc. (WBI Energy) proposes to construct and operate the North Bakken Expansion Project (or Project), which consists of an approximately 62-mile-long, new 24-inch-diameter natural gas pipeline from new facilities at WBI Energy's Tioga Compressor Station near Tioga, North Dakota, to a new compressor station (Elkhorn Creek Compressor Station) southeast of Watford City, North Dakota.

The Project also involves construction of approximately 0.3 mile of new 24-inch-diameter natural gas pipeline between the proposed Elkhorn Creek Compressor Station to a new interconnect with Northern Border Pipeline Company, approximately 20.4 miles of new 12-inch-diameter natural gas pipeline looping along WBI Energy's Line Section 25, approximately 9.4 miles of new 12-inch-diameter natural gas pipeline looping along WBI Energy's Line Section 30, approximately 0.5 mile of new 20-inch-diameter receipt lateral to the Tioga Compressor Station, and uprating of WBI Energy's Line Section 25. The Project includes additional horsepower at the Tioga Compressor Station; the installation of new and modifications to existing delivery, receipt and transfer stations along WBI Energy's pipeline routes; the replacement of small segments of pipeline facilities; and the installation of block valves, pig launcher/receiver stations and other associated appurtenances.

The Project will require crossing of the Lake Sakakawea Reservoir, which is managed by the U.S. Army Corps of Engineers (USACE), along with USACE-owned lands adjacent to Lake Sakakawea. WBI Energy proposes to install the natural gas pipeline under Lake Sakakawea and USACE lands using the horizontal directional drill (HDD) construction method, a trenchless method designed to avoid direct impacts to sensitive features. The HDD workspaces will be located adjacent to USACE-owned lands on the north side of the lake, and approximately 800 feet from USACE-owned lands on the south side of Lake Sakakawea. No surface impact to USACE lands is anticipated for this Project during installation and operation of the pipeline; all temporary surface impacts will be located outside of USACE lands. Access in the area of the proposed HDD will be along public and private roads.

2.0 CONSTRUCTION TECHNIQUE

The proposed HDD will be approximately 2.9 miles (15,393 feet) in length and will cross 12,934 feet of USACE-owned lands. For the HDD crossing of Lake Sakakawea, WBI Energy anticipates using the intersect method, where a single alignment is achieved by drilling from both ends so as to connect the drills underground. Electromagnetic sensors located on the tip of the drill bit will allow the operator to follow the sensor grid along the prescribed path. Once the pilot hole is completed, the sensor grid will be removed and the hole will be enlarged through a process called reaming. A reaming tool will be installed at one end of the drill string on the exit side of the pilot hole, and then pushed or drawn back to the drill rig to enlarge the hole. Several passes with progressively larger reaming tools may be required to enlarge the hole to a sufficient diameter to accommodate the pipeline. During this process, drilling fluid, or mud, consisting of in-situ material and water (and possibly bentonite clay) will be circulated through the hole to remove drill cuttings and maintain the integrity of the hole. Once the reaming process is complete, a prefabricated segment of pipe will be attached to the drill string on the exit side of the crossing, and pulled back

through the hole toward the drill rig. The pipe segment will generally be hydrostatically tested prior to its installation, and once installed, connected on either side of the crossing to adjoining sections of pipe. The pipe segment will be hydrostatically tested a second time with the remainder of the pipeline system.

3.0 LAND REQUIREMENTS

WBI Energy has requested that the USACE issue a real estate easement across Lake Sakakawea and on adjacent USACE-owned lands. The requested easement would be 50-feet (25-feet either side of centerline) in width and 12,934 feet in length centered on the proposed pipeline. A legal description of the requested easement is provided in Appendix A – Easement Plats.

WBI Energy will maintain the easement according to easement provisions. No surface occupancy of USACE land is proposed as part of the Project. Additionally, WBI Energy does not propose to maintain vegetation (i.e., clear, mow, or apply herbicide) within the easement on USACE lands during operation of the pipeline. However, WBI Energy will conduct periodic inspections of the pipeline right-of-way as outlined in WBI Energy Transmission – Gas System Operation and Maintenance Manual (CUI/PRIV – DO NOT RELEASE included as Appendix A of Attachment 6 of the 408 Permit Application package). The proposed Project will be incorporated into WBI Energy's extensive Supervisory, Control, and Data Acquisition System (SCADA). The Gas Control Center is located at WBI Energy's headquarters in Bismarck, North Dakota, and is staffed 24 hours a day, 365 days a year. Gas controllers use SCADA to monitor the pipeline system, which includes a wide range of activities such as monitoring gas pressures and flows along the pipeline, physical startup and shutdown of compressor sites, and operating system valves along the pipeline.

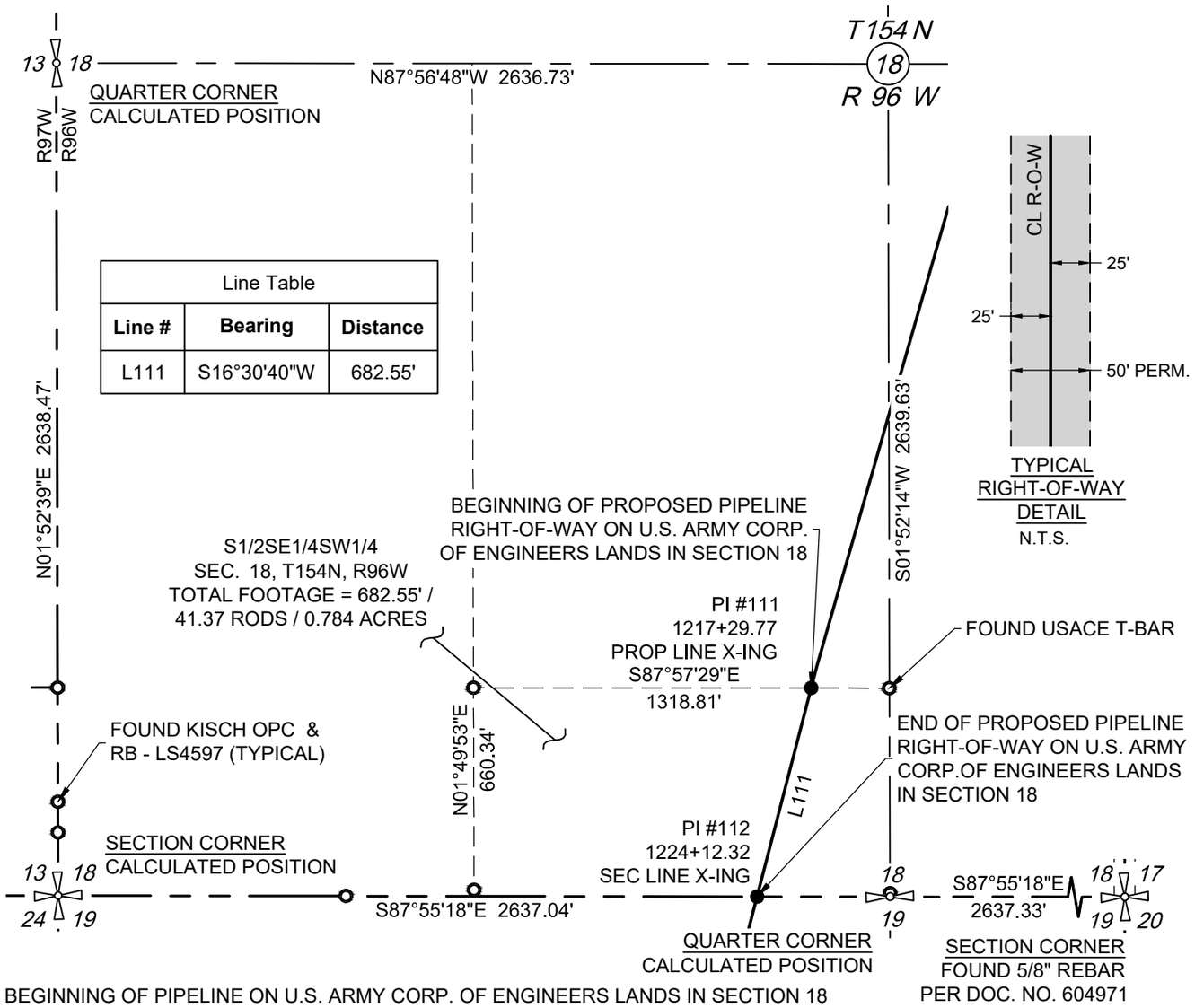
Data acquisition occurs at many locations along the mainline, such as compressor stations, and meter stations. This data is transmitted to Gas Control through SCADA. If system parameters fall outside a predetermined range, an alarm is activated at Gas Control and corrective action is taken by the gas controller as needed. Local WBI Energy personnel are dispatched in response to these alarms if intervention is required outside Gas Control. WBI Energy will also conduct a baseline assessment using in-line inspection of the proposed pipeline in accordance with U.S. Department of Transportation requirements to check for damage, deformities, or other factors that could affect the integrity of the pipelines. If potential problems are identified and maintenance or repair of the pipeline is required, WBI Energy would request separate authorization from the USACE and other applicable agencies to repair or maintain the pipeline.

NORTH BAKKEN EXPANSION PROJECT
Surface Use Plan of Operation

APPENDIX A
Easement Plats

WBI NORTH BAKKEN EXPANSION

TRACT NO. 154 -96-18-066
50' WIDE PIPELINE EASEMENT
S1/2SE1/4SW1/4 SEC. 18, T154N, R96W, 5TH P.M.,
WILLIAMS COUNTY, NORTH DAKOTA
EXHIBIT A



Line Table		
Line #	**Bearing**	**Distance**
L111	S16°30'40"W	682.55'

BEGINNING OF PIPELINE ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 18 BEARS N87°57'29"W, A DISTANCE OF 247.72' FROM THE NORTHEAST CORNER OF THE SOUTH HALF OF THE SOUTHEAST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 18, T154N, R96W, 5TH P.M.

END OF PIPELINE ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 18 BEARS N87°55'18"W, A DISTANCE OF 3058.32' FROM THE SOUTHEAST SECTION CORNER OF SECTION 18, T154N, R96W, 5TH P.M.

Notes:

1. This survey was prepared without the benefit of title research. Ownership information provided by client.

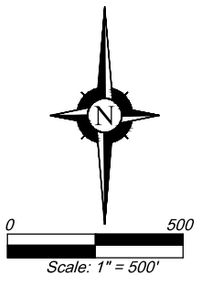
2. Date of Survey: February 2019

Survey Datum:

NORTH DAKOTA NORTH (NAD 83) - International Foot
**Distances are Grid Distances. Combined Scale Factor = 0.999846363*
Grid Distance x 1.000153661 = Ground Distance.

Certificate of Surveyor:

I, Lee S. Hurst, a Registered Professional Land Surveyor, North Dakota Registration No. LS-9208, hereby certify that the survey shown hereon represents a survey performed by me or under my direct supervision and is true and correct to the best of my knowledge and belief.



WBI ENERGY TRANSMISSION Tract No. 154-96-18-066 System Name: North Bakken Expansion Sheet 1 of 10 XX/XX	WBI ENERGY TRANSMISSION Tract No. 154-96-18-066 50' Wide Pipeline Easement Over, Under & Across S1/2SE1/4SW1/4 Sec. 18, T154N, R96W, 5TH P.M., Williams County, North Dakota	Project No.: 2018-23-0200.100 Dwg. Date: 2-11-20 Drawn By: H. Nickoloff Checked By: J. Reineking Rev. No: ___ Date: ___	Surveying & Drafting Services By: ECS INC. ERICKSON CONTRACT SURVEYING 333 10th AVE SE Sidney, Montana Office 406-482-6606 / Fax 406-482-6600

WBI NORTH BAKKEN EXPANSION

TRACT NO. 154 -96-18-066
50' WIDE PIPELINE EASEMENT
S1/2SE1/4SW1/4 SEC. 18, T154N, R96W, 5TH P.M.,
WILLIAMS COUNTY, NORTH DAKOTA
EXHIBIT A

PIPELINE RIGHT-OF-WAY DESCRIPTION ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 18

A 50' WIDE RIGHT-OF WAY 25' ON EACH SIDE OF THE FOLLOWING DESCRIBED CENTERLINE.

BEGINNING AT A POINT OF THE NORTH LINE OF THE SOUTH HALF OF THE SOUTHEAST QUARTER OF THE SOUTHWEST QUARTER (S1/2SE1/4SW1/4) OF SECTION 18, T154N, R96W, 5TH P.M. WHICH BEARS N87°57'29"W, A DISTANCE OF 247.72' FROM THE NORTHEAST CORNER OF SAID SOUTH HALF OF THE SOUTHEAST QUARTER OF THE SOUTHWEST QUARTER; THENCE S16°30'40"W, A DISTANCE OF 682.55' TO A POINT ON THE SOUTH SECTION LINE OF SAID SECTION 18, WHICH BEARS N87°55'18"W, A DISTANCE OF 3058.32' FROM THE SOUTHEAST SECTION CORNER OF SAID SECTION 18. THE SIDE LINES OF SAID DESCRIBE RIGHT-OF-WAY BEING SHORTENED OR ELONGATED TO MEET THE GRANTOR'S PROPERTY LINES. CONTAIN 0.784 ACRES MORE OR LESS.

Notes:

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2. Date of Survey: February 2019

Survey Datum:

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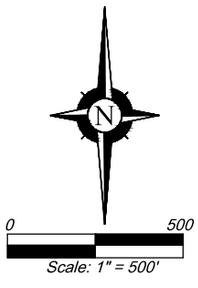
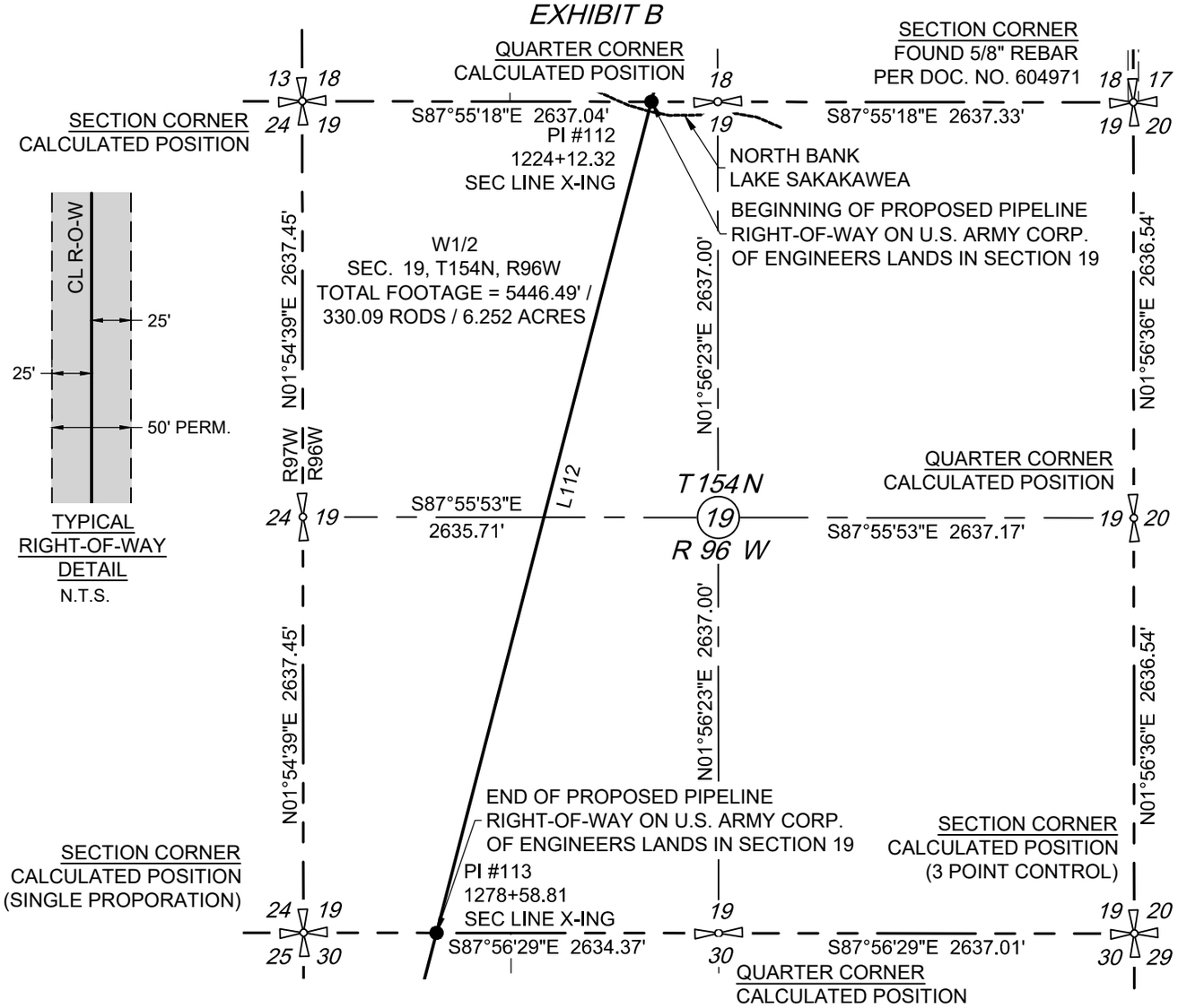


WBI ENERGY TRANSMISSION An MDU Resources Group company Tract No. 154-96-18-066 System Name: North Bakken Expansion Sheet 2 of 10 XX/XX	*WBI ENERGY TRANSMISSION* Tract No. 154-96-18-066 *50' Wide Pipeline Easement Over, Under & Across S1/2SE1/4SW1/4* *Sec. 18, T154N, R96W, 5TH P.M.,* *Williams County, North Dakota*	*Project No.: 2018-23-0200.100* *Dwg. Date: 2-11-20* *Drawn By: H. Nickoloff* *Checked By: J. Reineking* *Rev. No:___ Date:___*

Surveying & Drafting Services By:
ECS INC.
ERICKSON CONTRACT SURVEYING
333 10th AVE SE Sidney, Montana
Office 406-482-6606 / Fax 406-482-6600

WBI NORTH BAKKEN EXPANSION

TRACT NO. 154-96-19-067 & 154-96-19-068
50' WIDE PIPELINE EASEMENT
W1/2 SEC. 19, T154N, R96W, 5TH P.M.,
McKENZIE COUNTY, NORTH DAKOTA
EXHIBIT B



BEGINNING OF PIPELINE ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 19 BEARS N87°55'18"W, A DISTANCE OF 3058.32' FROM THE NORTHEAST SECTION CORNER OF SECTION 19, T154N, R96W, 5TH P.M.

END OF PIPELINE ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 19 BEARS S87°56'29"E, A DISTANCE OF 843.16' FROM THE SOUTHWEST COMPUTED SECTION CORNER OF SECTION 19, T154N, R96W, 5TH P.M.

Line Table		
Line #	**Bearing**	**Distance**
L112	S16°30'40"W	5446.49'

Notes:

1. This survey was prepared without the benefit of title research. Ownership information provided by client.

2. Date of Survey: February 2019

Survey Datum:

NORTH DAKOTA NORTH (NAD 83) - International Foot
**Distances are Grid Distances. Combined Scale Factor = 0.999846363*
Grid Distance x 1.000153661 = Ground Distance.

Certificate of Surveyor:

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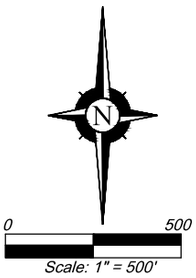

WBI ENERGY TRANSMISSION Tract No. 154-96-19-067 & 68 System Name: North Bakken Expansion Sheet 3 of 10 XX/XX	*WBI ENERGY TRANSMISSION* Tract No. 154-96-19-067 & 154-96-19-068 *50' Wide Pipeline Easement Over, Under & Across W1/2* *Sec. 19, T154N, R96W, 5TH P.M.,* *Williams County, North Dakota*	*Project No.: 2018-23-0200.100* *Dwg. Date: 2-11-20* *Drawn By: H. Nickoloff* *Checked By: J. Reineking* *Rev. No: ___ Date: ___*	*Surveying & Drafting Services By:* ECS INC. ERICKSON CONTRACT SURVEYING 333 10th AVE SE Sidney, Montana Office 406-482-6606 / Fax 406-482-6600

WBI NORTH BAKKEN EXPANSION

TRACT NO. 154-96-19-067 & 154-96-19-068
50' WIDE PIPELINE EASEMENT
W1/2 SEC. 19, T154N, R96W, 5TH P.M.,
McKENZIE COUNTY, NORTH DAKOTA
EXHIBIT B

PIPELINE RIGHT-OF-WAY DESCRIPTION ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 19

A 50' WIDE RIGHT-OF WAY 25' ON EACH SIDE OF THE FOLLOWING DESCRIBED CENTERLINE.

BEGINNING AT A POINT OF THE NORTH SECTION LINE OF SECTION 19, T154N, R96W, 5TH P.M. WHICH BEARS N87°55'18"W, A DISTANCE OF 3058.32' FROM THE NORTHEAST SECTION CORNER OF SAID SECTION 19; THENCE S16°30'40"W, A DISTANCE OF 5446.49' TO A POINT ON THE SOUTH SECTION LINE OF SAID SECTION 19, WHICH BEARS S87°56'29"E, A DISTANCE OF 843.16' FROM THE SOUTHWEST COMPUTED SECTION CORNER OF SAID SECTION 19. THE SIDE LINES OF SAID DESCRIBE RIGHT-OF-WAY BEING SHORTENED OR ELONGATED TO MEET THE GRANTOR'S PROPERTY LINES. CONTAIN 6.252 ACRES MORE OR LESS.

Notes:

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2. Date of Survey: February 2019

Survey Datum:

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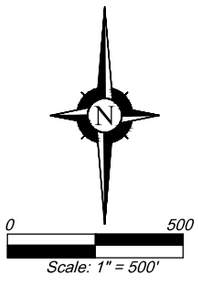
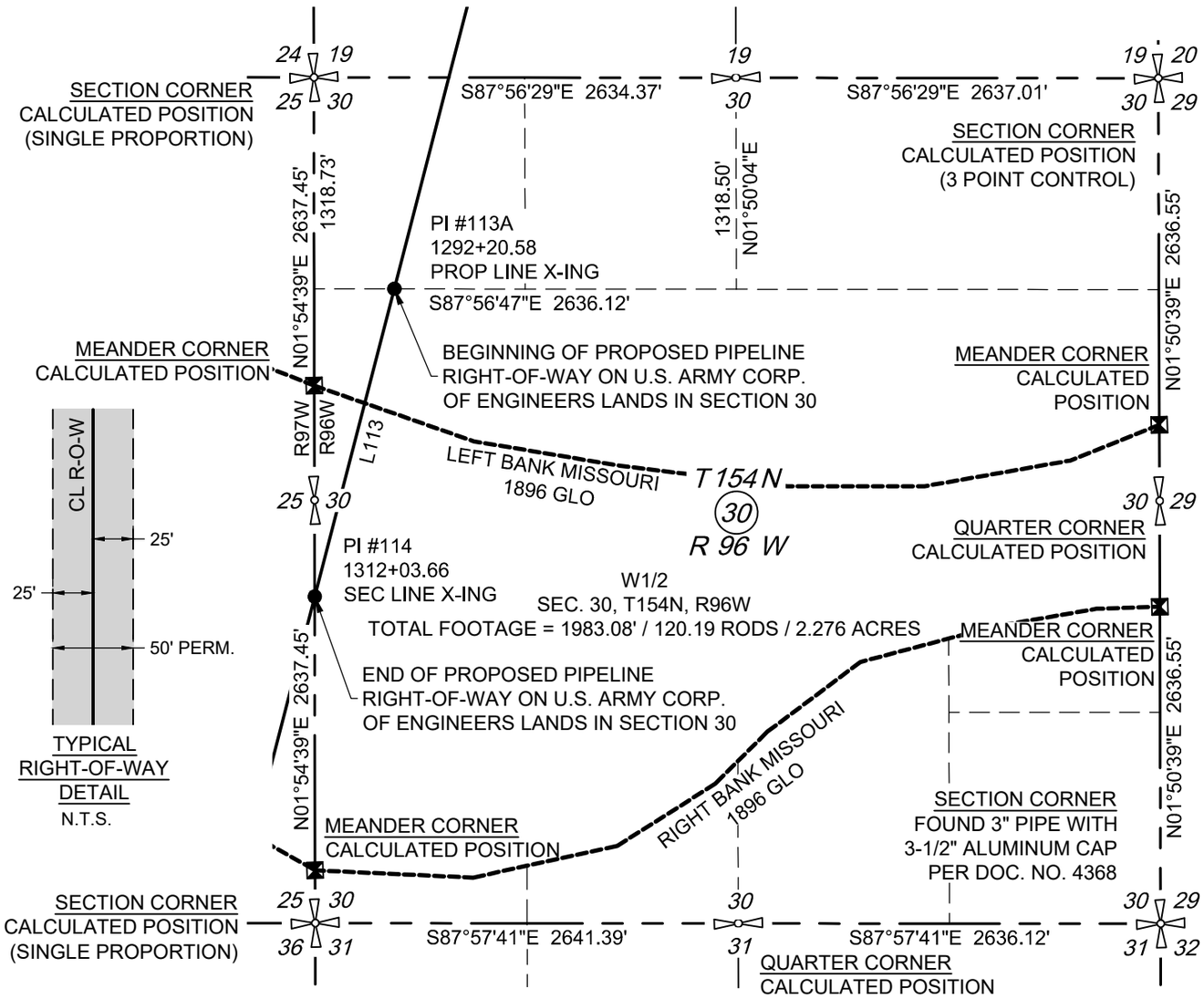


WBI ENERGY TRANSMISSION An MDU Resources Group company Tract No. 154-96-19-067 & 068 System Name: North Bakken Expansion Sheet 4 of 10 XX/XX	*WBI ENERGY TRANSMISSION* Tract No. 154-96-19-067 & 154-96-19-068 *50' Wide Pipeline Easement Over, Under & Across W1/2* *Sec. 19, T154N, R96W, 5TH P.M.,* *Williams County, North Dakota*	*Project No.: 2018-23-0200.100* *Dwg. Date: 2-11-20* *Drawn By: H. Nickoloff* *Checked By: J. Reineking* *Rev. No:___ Date:___*	*Surveying & Drafting Services By:* ECS INC. ERICKSON CONTRACT SURVEYING 333 10th AVE SE Sidney, Montana Office 406-482-6606 / Fax 406-482-6600

WBI NORTH BAKKEN EXPANSION

TRACT NO. 154-96-30-071
50' WIDE PIPELINE EASEMENT
W1/2 SEC. 30, T154N, R96W, 5TH P.M.,
WILLIAMS COUNTY, NORTH DAKOTA
EXHIBIT C



BEGINNING OF PIPELINE ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 30 BEARS S18°49'53"E, A DISTANCE OF 1411.46' FROM THE NORTHWEST COMPUTED SECTION CORNER OF SECTION 30, T154N, R96W, 5TH P.M.

END OF PIPELINE ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 30 BEARS N01°54'39"E, A DISTANCE OF 2035.89' FROM THE SOUTHWEST COMPUTED SECTION CORNER OF SECTION 30, T154N, R96W, 5TH P.M.

Line Table		
Line #	**Bearing**	**Distance**
L113	S16°30'40"W	1983.08'

Notes:

1. This survey was prepared without the benefit of title research. Ownership information provided by client.

2. Date of Survey: February 2019

Survey Datum:

NORTH DAKOTA NORTH (NAD 83) - International Foot
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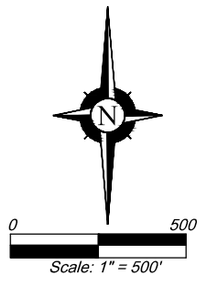

WBI ENERGY TRANSMISSION An MDU Resources Group company Tract No. 154-96-30-070 & 071 System Name: North Bakken Expansion Sheet 5 of 10 XX/XX	*WBI ENERGY TRANSMISSION* Tract No. 154-96-30-071 *50' Wide Pipeline Easement Over, Under & Across W1/2* *Sec. 30, T154N, R96W, 5TH P.M.,* *Williams County, North Dakota*	*Project No.: 2018-23-0200.100* *Dwg. Date: 2-11-20* *Drawn By: H. Nickoloff* *Checked By: J. Reineking* *Rev. No:___ Date:___*	*Surveying & Drafting Services By:* ECS INC. ERICKSON CONTRACT SURVEYING 333 10th AVE SE Sidney, Montana Office 406-482-6606 / Fax 406-482-6600

WBI NORTH BAKKEN EXPANSION

TRACT NO. 154-96-30-071
50' WIDE PIPELINE EASEMENT
W1/2 SEC. 30, T154N, R96W, 5TH P.M.,
WILLIAMS COUNTY, NORTH DAKOTA
EXHIBIT C

PIPELINE RIGHT-OF-WAY DESCRIPTION ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 30

A 50' WIDE RIGHT-OF WAY 25' ON EACH SIDE OF THE FOLLOWING DESCRIBED CENTERLINE.

BEGINNING AT A POINT OF THE NORTH LINE OF LOT 2 IN SECTION 30, T154N, R96W, 5TH P.M. WHICH BEARS S18°49'53"E, A DISTANCE OF 1411.46' FROM THE NORTHWEST COMPUTED SECTION CORNER OF SECTION 30; THENCE S16°30'40"W, A DISTANCE OF 1983.08' TO A POINT ON THE WEST SECTION LINE OF SAID SECTION 30, WHICH BEARS N01°54'39"E, A DISTANCE OF 2035.89' FROM THE SOUTHWEST COMPUTED SECTION CORNER OF SAID SECTION 30. THE SIDE LINES OF SAID DESCRIBE RIGHT-OF-WAY BEING SHORTENED OR ELONGATED TO MEET THE GRANTOR'S PROPERTY LINES. CONTAIN 2.276 ACRES MORE OR LESS.

Notes:

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Survey Datum:

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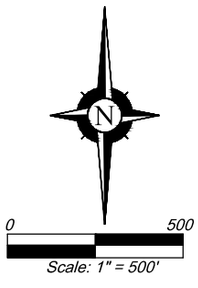
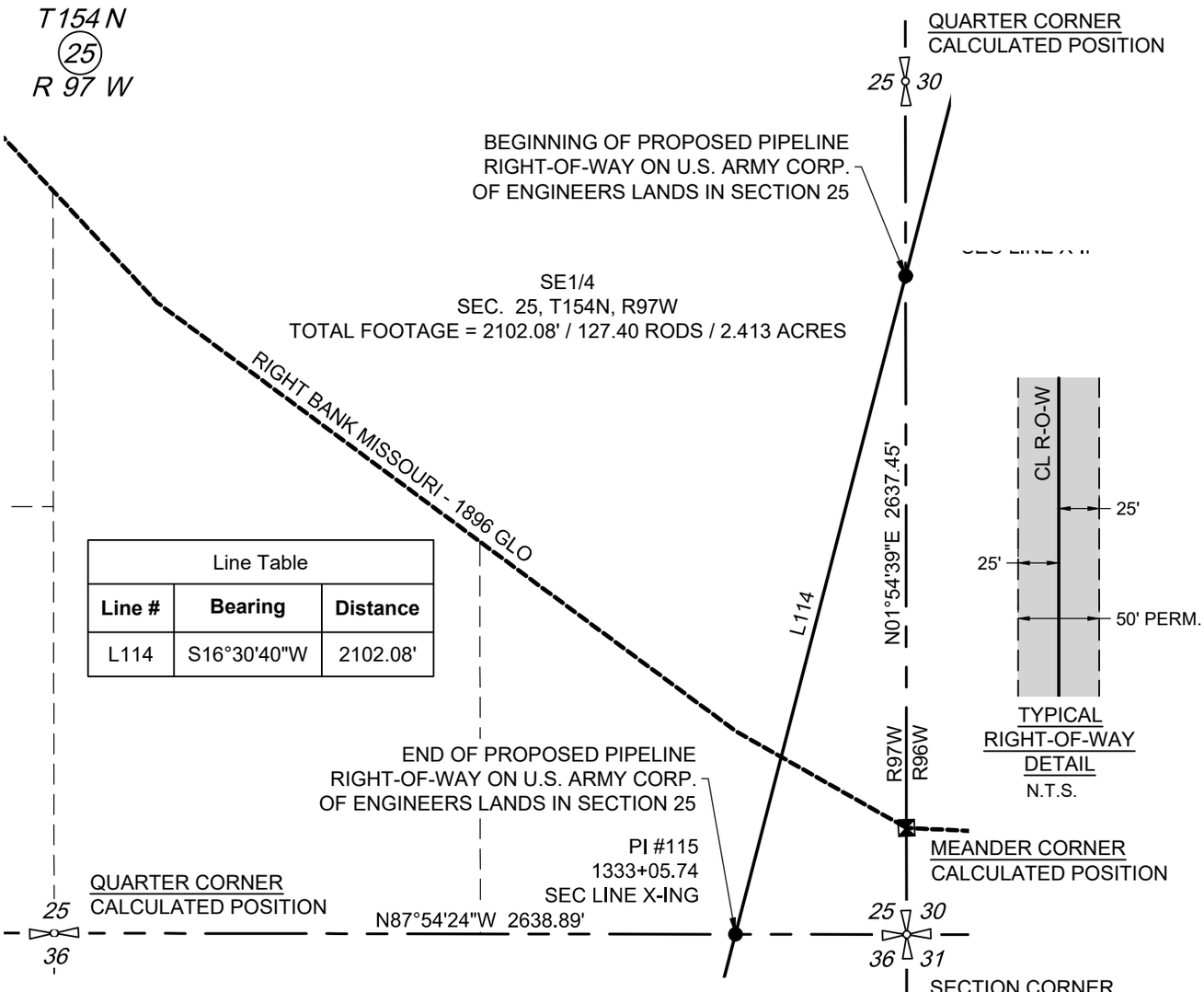


WBI ENERGY TRANSMISSION An MDU Resources Group company Tract No. 154-96-30-070 & 071 System Name: North Bakken Expansion Sheet 6 of 10 XX/XX	*WBI ENERGY TRANSMISSION* Tract No. 154-96-30-071 *50' Wide Pipeline Easement Over, Under & Across W1/2* *Sec. 30, T154N, R96W, 5TH P.M.,* *Williams County, North Dakota*	*Project No.: 2018-23-0200.100* *Dwg. Date: 2-11-20* *Drawn By: H. Nickoloff* *Checked By: J. Reineking* *Rev. No: ___ Date: ___*	*Surveying & Drafting Services By:* ECS INC. ERICKSON CONTRACT SURVEYING 333 10th AVE SE Sidney, Montana Office 406-482-6606 / Fax 406-482-6600

WBI NORTH BAKKEN EXPANSION

TRACT NO. 154-97-25-073a
50' WIDE PIPELINE EASEMENT
SE1/4 SEC. 25, T154N, R97W, 5TH P.M.,
WILLIAMS COUNTY, NORTH DAKOTA
EXHIBIT D



Line Table		
Line #	**Bearing**	**Distance**
L114	S16°30'40"W	2102.08'

BEGINNING OF PIPELINE ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 25 BEARS N01°54'39"E, A DISTANCE OF 2035.89' FROM THE SOUTHEAST COMPUTED SECTION CORNER OF SECTION 25, T154N, R97W, 5TH P.M.

END OF PIPELINE ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 25 BEARS N87°54'24"W, A DISTANCE OF 529.88' FROM THE SOUTHEAST COMPUTED SECTION CORNER OF SECTION 25, T154N, R97W, 5TH P.M.

Notes:

1. This survey was prepared without the benefit of title research. Ownership information provided by client.

2. Date of Survey: February 2019

Survey Datum:

NORTH DAKOTA NORTH (NAD 83) - International Foot
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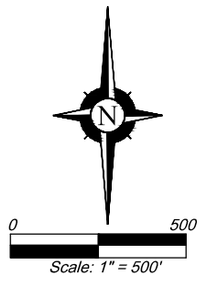

WBI ENERGY TRANSMISSION An MDU Resources Group company Tract No. 154-97-25-073 System Name: North Bakken Expansion Sheet 7 of 10 XX/XX	*WBI ENERGY TRANSMISSION* Tract No. 154-97-25-073a *50' Wide Pipeline Easement Over, Under & Across SE1/4* *Sec. 25, T154N, R97W, 5TH P.M.,* *Williams County, North Dakota*	*Project No.:* 2018-23-0200.100 *Dwg. Date:* 2-11-20 *Drawn By:* H. Nickoloff *Checked By:* J. Reineking *Rev. No:* ___ *Date:* ___	*Surveying & Drafting Services By:* ECS INC. ERICKSON CONTRACT SURVEYING 333 10th AVE SE Sidney, Montana Office 406-482-6606 / Fax 406-482-6600

WBI NORTH BAKKEN EXPANSION

TRACT NO. 154-97-25-073a
50' WIDE PIPELINE EASEMENT
SE1/4 SEC. 25, T154N, R97W, 5TH P.M.,
WILLIAMS COUNTY, NORTH DAKOTA
EXHIBIT D

PIPELINE RIGHT-OF-WAY DESCRIPTION ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 25

A 50' WIDE RIGHT-OF WAY 25' ON EACH SIDE OF THE FOLLOWING DESCRIBED CENTERLINE.

BEGINNING AT A POINT OF THE EAST SECTION LINE OF SECTION 25, T154N, R97W, 5TH P.M. WHICH BEARS N01°54'39"E, A DISTANCE OF 2035.89' FROM THE SOUTHEAST COMPUTED SECTION CORNER OF SAID SECTION 25; THENCE S16°30'40"W, A DISTANCE OF 2102.08' TO A POINT ON THE SOUTH SECTION LINE OF SAID SECTION 25, WHICH BEARS N87°54'24"W, A DISTANCE OF 529.88' FROM THE SOUTHEAST COMPUTED SECTION CORNER OF SAID SECTION 25. THE SIDE LINES OF SAID DESCRIBE RIGHT-OF-WAY BEING SHORTENED OR ELONGATED TO MEET THE GRANTOR'S PROPERTY LINES. CONTAIN 2.413 ACRES MORE OR LESS.

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Survey Datum:

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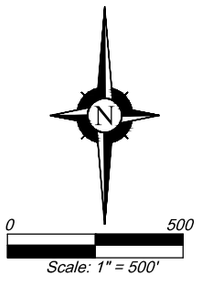
Certificate of Surveyor:

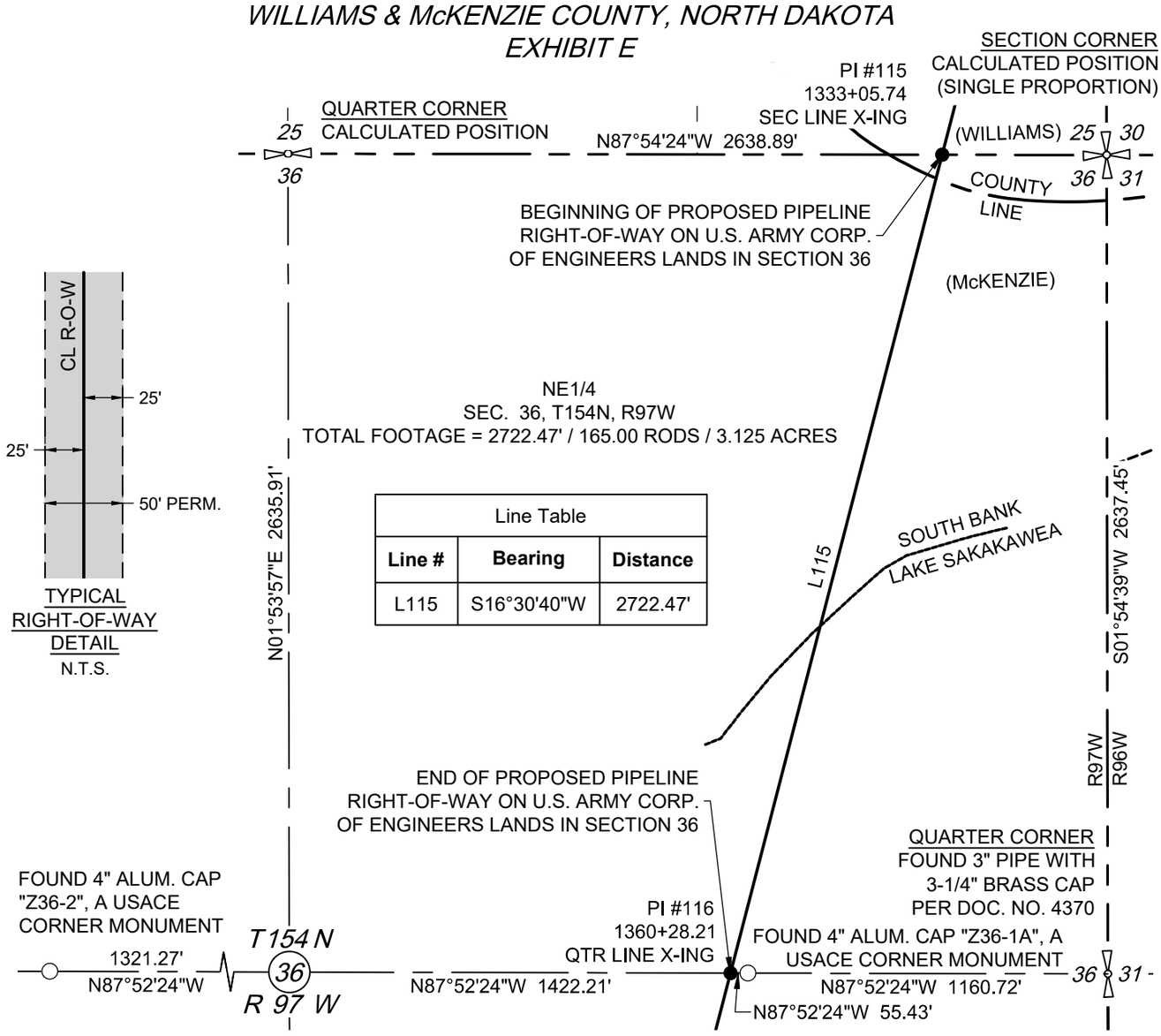
I, Lee S. Hurst, a Registered Professional Land Surveyor, North Dakota Registration No. LS-9208, hereby certify that the survey shown hereon represents a survey performed by me or under my direct supervision and is true and correct to the best of my knowledge and belief.



WBI ENERGY TRANSMISSION An MDU Resources Group company Tract No. 154-97-25-073 System Name: North Bakken Expansion Sheet 8 of 10 XX/XX	*WBI ENERGY TRANSMISSION* Tract No. 154-97-25-073a *50' Wide Pipeline Easement Over, Under & Across SE1/4* *Sec. 25, T154N, R97W, 5TH P.M.,* *Williams County, North Dakota*	*Project No.: 2018-23-0200.100* *Dwg. Date: 2-11-20* *Drawn By: H. Nickoloff* *Checked By: J. Reineking* *Rev. No: ___ Date: ___*	*Surveying & Drafting Services By:* ECS INC. ERICKSON CONTRACT SURVEYING 333 10th AVE SE Sidney, Montana Office 406-482-6606 / Fax 406-482-6600

WBI NORTH BAKKEN EXPANSION

TRACT NO. 154-97-36-074a
50' WIDE PIPELINE EASEMENT
NE1/4 SEC. 36, T154N, R97W, 5TH P.M.,
WILLIAMS & McKENZIE COUNTY, NORTH DAKOTA
EXHIBIT E



Line Table		
Line #	**Bearing**	**Distance**
L115	S16°30'40"W	2722.47'

BEGINNING OF PIPELINE ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 36 BEARS N87°54'24"W, A DISTANCE OF 529.88' FROM THE NORTHEAST COMPUTED SECTION CORNER OF SECTION 36, T154N, R97W, 5TH P.M.

END OF PIPELINE ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 36 BEARS N87°52'24"W, A DISTANCE OF 55.43' FROM THE USACE CORNER MONUMENT NUMBER Z36-1A, IN SECTION 36, T154N, R97W, 5TH P.M.

Notes:

1. This survey was prepared without the benefit of title research. Ownership information provided by client.

2. Date of Survey: February 2019

Survey Datum:

NORTH DAKOTA NORTH (NAD 83) - International Foot
**Distances are Grid Distances. Combined Scale Factor = 0.999846363*
Grid Distance x 1.000153661 = Ground Distance.

Certificate of Surveyor:

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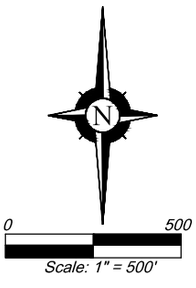

WBI ENERGY TRANSMISSION An MDU Resources Group company	WBI ENERGY TRANSMISSION	Project No.: 2018-23-0200.100	Surveying & Drafting Services By:
Tract No. 154-97-36-074	Tract No. 154-97-36-074a	Dwg. Date: 2-11-20	ECS INC.
System Name: North Bakken Expansion	50' Wide Pipeline Easement Over, Under & Across NE1/4	Drawn By: H. Nickoloff	ERICKSON CONTRACT SURVEYING
Sheet 9 of 10 XX/XX	Sec. 36, T154N, R97W, 5TH P.M., Williams & McKenzie County, North Dakota	Checked By: J. Reineking	333 10th AVE SE Sidney, Montana
		Rev. No: ___ Date: ___	Office 406-482-6606 / Fax 406-482-6600

WBI NORTH BAKKEN EXPANSION

TRACT NO. 154-97-36-074a
50' WIDE PIPELINE EASEMENT
NE1/4 SEC. 36, T154N, R97W, 5TH P.M.,
WILLIAMS & McKENZIE COUNTY, NORTH DAKOTA
EXHIBIT E

PIPELINE RIGHT-OF-WAY DESCRIPTION ON U.S. ARMY CORP. OF ENGINEERS LANDS IN SECTION 36

A 50' WIDE RIGHT-OF WAY 25' ON EACH SIDE OF THE FOLLOWING DESCRIBED CENTERLINE.

BEGINNING AT A POINT OF THE NORTH SECTION LINE OF SECTION 36, T154N, R97W, 5TH P.M. WHICH BEARS N87°54'24"W, A DISTANCE OF 529.88' FROM THE NORTHEAST COMPUTED SECTION CORNER OF SAID SECTION 36; THENCE S16°30'40"W, A DISTANCE OF 2722.47' TO A POINT ON THE EAST-WEST QUARTER LINE OF SAID SECTION 36, WHICH BEARS N87°52'24"W, A DISTANCE OF 55.43' FROM THE USACE CORNER MONUMENT # Z36-1A, IN SAID SECTION 36. THE SIDE LINES OF SAID DESCRIBE RIGHT-OF-WAY BEING SHORTENED OR ELONGATED TO MEET THE GRANTOR'S PROPERTY LINES. CONTAIN 3.125 ACRES MORE OR LESS.

Notes:

1. This survey was prepared without the benefit of title research. Ownership information provided by client.

2. Date of Survey: February 2019

Survey Datum:

NORTH DAKOTA NORTH (NAD 83) - International Foot
**Distances are Grid Distances. Combined Scale Factor = 0.999846363*
Grid Distance x 1.000153661 = Ground Distance.

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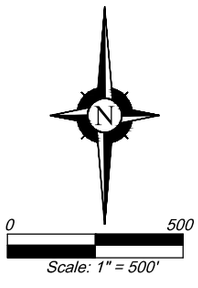

WBI ENERGY TRANSMISSION An MDU Resources Group company	*WBI ENERGY TRANSMISSION*	*Project No.: 2018-23-0200.100*	*Surveying & Drafting Services By:*
Tract No. 154-97-36-074	Tract No. 154-97-36-074a	*Dwg. Date: 2-11-20*	ECS INC.
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Sheet 10 of 10 *XX/XX*	*Sec. 36, T154N, R97W, 5TH P.M., Williams & McKenzie County, North Dakota*	*Checked By: J. Reineking* *Rev. No: ___ Date: ___*	*333 10th AVE SE Sidney, Montana* *Office 406-482-6606 / Fax 406-482-6600*

Attachment 3

Erosion Sedimentation Control Plan

WBI ENERGY TRANSMISSION, INC.
North Bakken Expansion Project
Section 408 Application

Attachment 3
Erosion and Sedimentation Control Plan

August 2020

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT
EROSION AND SEDIMENTATION CONTROL PLAN

WBI Energy Transmission, Inc. (WBI Energy) proposes to construct and operate the North Bakken Expansion Project (or Project), which consists of an approximately 61.9-mile-long, new 24-inch-diameter natural gas pipeline from new facilities at WBI Energy's Tioga Compressor Station near Tioga, North Dakota, to a new compressor station (Elkhorn Creek Compressor Station) southeast of Watford City, North Dakota.

The Project also involves construction of approximately 0.3 mile of new 24-inch-diameter natural gas pipeline between the proposed Elkhorn Creek Compressor Station to a new interconnect with Northern Border Pipeline Company, approximately 20.4 miles of new 12-inch-diameter natural gas pipeline looping along WBI Energy's Line Section 25, approximately 9.4 miles of new 12-inch-diameter natural gas pipeline looping along WBI Energy's Line Section 30, approximately 0.5 mile of new 20-inch-diameter receipt lateral to the Tioga Compressor Station, and uprating of WBI Energy's Line Section 25. The Project includes additional horsepower at the Tioga Compressor Station; the installation of new and modifications to existing delivery, receipt and transfer stations along WBI Energy's pipeline routes; the replacement of small segments of pipeline facilities; and the installation of block valves, pig launcher/receiver stations and other associated appurtenances.

The Project will require crossing of the Lake Sakakawea Reservoir, which is managed by the U.S. Army Corps of Engineers (USACE), along with USACE-owned lands adjacent to Lake Sakakawea. WBI Energy proposes to install the natural gas pipeline under Lake Sakakawea and USACE lands using the horizontal directional drill (HDD) construction method, a trenchless method designed to avoid direct impacts to sensitive features. The HDD workspaces will be located adjacent to USACE-owned lands on the north side of the lake, and approximately 800 feet from USACE-owned lands on the south side of Lake Sakakawea. No surface impact to USACE lands is anticipated for this Project during installation and operation of the pipeline; all known temporary surface impacts will be located outside of USACE lands.

Construction of the Project will be completed in adherence to the Federal Energy Regulatory Commission's *Upland Erosion Control, Revegetation, and Maintenance Plan* and *Wetland and Waterbody Construction and Mitigation Procedures*, which are attached for reference as Appendix A and B, respectively.

NORTH BAKKEN EXPANSION PROJECT

Erosion and Sediment Control Plan

APPENDIX A
Federal Energy Regulatory Commission's Upland Erosion Control, Revegetation, and Maintenance Plan

Federal Energy Regulatory Commission

Office of Energy Projects

May 2013

UPLAND EROSION CONTROL, REVEGETATION, AND MAINTENANCE PLAN

Washington, DC 20426

MAY 2013 VERSION

UPLAND EROSION CONTROL, REVEGETATION, AND MAINTENANCE PLAN

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UPLAND EROSION CONTROL, REVEGETATION, AND MAINTENANCE PLAN (PLAN)

I. APPLICABILITY

A. The intent of this Plan is to assist project sponsors by identifying baseline mitigation measures for minimizing erosion and enhancing revegetation. Project sponsors shall specify in their applications for a new FERC authorization and in prior notice and advance notice filings, any individual measures in this Plan they consider unnecessary, technically infeasible, or unsuitable due to local conditions and fully describe any alternative measures they would use. Project sponsors shall also explain how those alternative measures would achieve a comparable level of mitigation.

Once a project is authorized, project sponsors can request further changes as variances to the measures in this Plan (or the applicant's approved plan). The Director of the Office of Energy Projects (Director) will consider approval of variances upon the project sponsor's written request, if the Director agrees that a variance:

1. provides equal or better environmental protection;

2. is necessary because a portion of this Plan is infeasible or unworkable based on project-specific conditions; or

3. is specifically required in writing by another federal, state, or Native American land management agency for the portion of the project on its land or under its jurisdiction.

Sponsors of projects planned for construction under the automatic authorization provisions in the FERC's regulations must receive written approval for any variances in advance of construction.

Project-related impacts on wetland and waterbody systems are addressed in the staff's Wetland and Waterbody Construction and Mitigation Procedures (Procedures).

II. SUPERVISION AND INSPECTION

A. ENVIRONMENTAL INSPECTION

1. At least one Environmental Inspector is required for each construction spread during construction and restoration (as defined by section V). The number and experience of Environmental Inspectors assigned to each construction spread shall be appropriate for the length of the construction spread and the number/significance of resources affected.

2. Environmental Inspectors shall have peer status with all other activity inspectors.

3. Environmental Inspectors shall have the authority to stop activities that violate the environmental conditions of the FERC's Orders, stipulations of other environmental permits or approvals, or landowner easement agreements; and to order appropriate corrective action.

B. RESPONSIBILITIES OF ENVIRONMENTAL INSPECTORS

At a minimum, the Environmental Inspector(s) shall be responsible for:

1. Inspecting construction activities for compliance with the requirements of this Plan, the Procedures, the environmental conditions of the FERC's Orders, the mitigation measures proposed by the project sponsor (as approved and/or modified by the Order), other environmental permits and approvals, and environmental requirements in landowner easement agreements.

2. Identifying, documenting, and overseeing corrective actions, as necessary to bring an activity back into compliance;

3. Verifying that the limits of authorized construction work areas and locations of access roads are visibly marked before clearing, and maintained throughout construction;

4. Verifying the location of signs and highly visible flagging marking the boundaries of sensitive resource areas, waterbodies, wetlands, or areas with special requirements along the construction work area;

5. Identifying erosion/sediment control and soil stabilization needs in all areas;

6. Ensuring that the design of slope breakers will not cause erosion or direct water into sensitive environmental resource areas, including cultural resource sites, wetlands, waterbodies, and sensitive species habitats;

7. Verifying that dewatering activities are properly monitored and do not result in the deposition of sand, silt, and/or sediment into sensitive environmental resource areas, including wetlands, waterbodies, cultural resource sites, and sensitive species habitats; stopping dewatering activities if such deposition is occurring and ensuring the design of the discharge is changed to prevent reoccurrence; and verifying that dewatering structures are removed after completion of dewatering activities;

8. Ensuring that subsoil and topsoil are tested in agricultural and residential areas to measure compaction and determine the need for corrective action;

9. Advising the Chief Construction Inspector when environmental conditions (such as wet weather or frozen soils) make it advisable to restrict or delay construction activities to avoid topsoil mixing or excessive compaction;

10. Ensuring restoration of contours and topsoil;

11. Verifying that the soils imported for agricultural or residential use are certified as free of noxious weeds and soil pests, unless otherwise approved by the landowner;

12. Ensuring that erosion control devices are properly installed to prevent sediment flow into sensitive environmental resource areas (e.g., wetlands, waterbodies, cultural resource sites, and sensitive species habitats) and onto roads, and determining the need for additional erosion control devices;

13. Inspecting and ensuring the maintenance of temporary erosion control measures at least:

    a. on a daily basis in areas of active construction or equipment operation;

    b. on a weekly basis in areas with no construction or equipment operation; and

    c. within 24 hours of each 0.5 inch of rainfall;

14. Ensuring the repair of all ineffective temporary erosion control measures within 24 hours of identification, or as soon as conditions allow if compliance with this time frame would result in greater environmental impacts;

15. Keeping records of compliance with the environmental conditions of the FERC's Orders, and the mitigation measures proposed by the project sponsor in the application submitted to the FERC, and other federal or state environmental permits during active construction and restoration;

16. Identifying areas that should be given special attention to ensure stabilization and restoration after the construction phase; and

17. Verifying that locations for any disposal of excess construction materials for beneficial reuse comply with section III.E.

III. PRECONSTRUCTION PLANNING

The project sponsor shall do the following before construction:

A. CONSTRUCTION WORK AREAS

1. Identify all construction work areas (e.g., construction right-of-way, extra work space areas, pipe storage and contractor yards, borrow and disposal areas, access roads) that would be needed for safe construction. The project sponsor must ensure that appropriate cultural resources and biological surveys are conducted, as determined necessary by the appropriate federal and state agencies.

2. Project sponsors are encouraged to consider expanding any required cultural resources and endangered species surveys in anticipation of the need for activities outside of authorized work areas.

3. Plan construction sequencing to limit the amount and duration of open trench sections, as necessary, to prevent excessive erosion or sediment flow into sensitive environmental resource areas.

B. DRAIN TILE AND IRRIGATION SYSTEMS

1. Attempt to locate existing drain tiles and irrigation systems.

2. Contact landowners and local soil conservation authorities to determine the locations of future drain tiles that are likely to be installed within 3 years of the authorized construction.

3. Develop procedures for constructing through drain-tiled areas, maintaining irrigation systems during construction, and repairing drain tiles and irrigation systems after construction.

4. Engage qualified drain tile specialists, as needed to conduct or monitor repairs to drain tile systems affected by construction. Use drain tile specialists from the project area, if available.

C. GRAZING DEFERMENT

Develop grazing deferment plans with willing landowners, grazing permittees, and land management agencies to minimize grazing disturbance of revegetation efforts.

D. ROAD CROSSINGS AND ACCESS POINTS

Plan for safe and accessible conditions at all roadway crossings and access points during construction and restoration.

E. DISPOSAL PLANNING

Determine methods and locations for the regular collection, containment, and disposal of excess construction materials and debris (e.g., timber, slash, mats, garbage, drill cuttings and fluids, excess rock) throughout the construction process. Disposal of materials for beneficial reuse must not result in adverse environmental impact and is subject to compliance with all applicable survey, landowner or land management agency approval, and permit requirements.

F. AGENCY COORDINATION

The project sponsor must coordinate with the appropriate local, state, and federal agencies as outlined in this Plan and/or required by the FERC's Orders.

1. Obtain written recommendations from the local soil conservation authorities or land management agencies regarding permanent erosion control and revegetation specifications.

2. Develop specific procedures in coordination with the appropriate agencies to prevent the introduction or spread of invasive species, noxious weeds, and soil pests resulting from construction and restoration activities.

3. Develop specific procedures in coordination with the appropriate agencies and landowners, as necessary, to allow for livestock and wildlife movement and protection during construction.

4. Develop specific blasting procedures in coordination with the appropriate agencies that address pre- and post-blast inspections; advanced public notification; and mitigation measures for building foundations, groundwater wells, and springs. Use appropriate methods (e.g., blasting mats) to prevent damage to nearby structures and to prevent debris from entering sensitive environmental resource areas.

G. SPILL PREVENTION AND RESPONSE PROCEDURES

The project sponsor shall develop project-specific Spill Prevention and Response Procedures, as specified in section IV of the staff's Procedures. A copy must be filed with the Secretary of the FERC (Secretary) prior to construction and made available in the field on each construction spread. The filing requirement does not apply to projects constructed under the automatic authorization provisions in the FERC's regulations.

H. RESIDENTIAL CONSTRUCTION

For all properties with residences located within 50 feet of construction work areas, project sponsors shall: avoid removal of mature trees and landscaping within the construction work area unless necessary for safe operation of construction equipment, or as specified in landowner agreements; fence the edge of the construction work area for a distance of 100 feet on either side of the residence; and restore all lawn areas and landscaping immediately following clean up operations, or as specified in landowner agreements. If seasonal or other weather conditions prevent compliance with these time frames, maintain and monitor temporary erosion controls (sediment barriers and mulch) until conditions allow completion of restoration.

I. WINTER CONSTRUCTION PLANS

If construction is planned to occur during winter weather conditions, project sponsors shall develop and file a project-specific winter construction plan with the FERC application. This filing requirement does not apply to projects constructed under the automatic authorization provisions of the FERC's regulations.

The plan shall address:

1. winter construction procedures (e.g., snow handling and removal, access road construction and maintenance, soil handling under saturated or frozen conditions, topsoil stripping);

2. stabilization and monitoring procedures if ground conditions will delay restoration until the following spring (e.g., mulching and erosion controls, inspection and reporting, stormwater control during spring thaw conditions); and

3. final restoration procedures (e.g., subsidence and compaction repair, topsoil replacement, seeding).

IV. INSTALLATION

A. APPROVED AREAS OF DISTURBANCE

1. Project-related ground disturbance shall be limited to the construction right-of-way, extra work space areas, pipe storage yards, borrow and disposal areas, access roads, and other areas approved in the FERC's Orders. Any project-related ground disturbing activities outside these areas will require prior Director approval. This requirement does not apply to activities needed to comply with the Plan and Procedures (i.e., slope breakers, energy-dissipating devices, dewatering structures, drain tile system repairs) or minor field realignments and workspace shifts per landowner needs and requirements that do not affect other landowners or sensitive environmental resource areas. All construction or restoration activities outside of authorized areas are subject to all applicable survey and permit requirements, and landowner easement agreements.

2. The construction right-of-way width for a project shall not exceed 75 feet or that described in the FERC application unless otherwise modified by a FERC Order. However, in limited, non-wetland areas, this construction right-of-way width may be expanded by up to 25 feet without Director approval to accommodate full construction right-of-way topsoil segregation and to ensure safe construction where topographic conditions (e.g., side-slopes) or soil limitations require it. Twenty-five feet of extra construction right-of-way width may also be used in limited, non-wetland or non-forested areas for truck turn-arounds where no reasonable alternative access exists.

   Project use of these additional limited areas is subject to landowner or land management agency approval and compliance with all applicable survey and permit requirements. When additional areas are used, each one shall be identified and the need explained in the weekly or biweekly construction reports to the FERC, if required. The following material shall be included in the reports:

   a. the location of each additional area by station number and reference to previously filed alignment sheets, or updated alignment sheets showing the additional areas;

   b. identification of the filing at FERC containing evidence that the additional areas were previously surveyed; and

c. a statement that landowner approval has been obtained and is available in project files.

Prior written approval of the Director is required when the authorized construction right-of-way width would be expanded by more than 25 feet.

B. TOPSOIL SEGREGATION

1. Unless the landowner or land management agency specifically approves otherwise, prevent the mixing of topsoil with subsoil by stripping topsoil from either the full work area or from the trench and subsoil storage area (ditch plus spoil side method) in:

   a. cultivated or rotated croplands, and managed pastures;

   b. residential areas;

   c. hayfields; and

   d. other areas at the landowner's or land managing agency's request.

2. In residential areas, importation of topsoil is an acceptable alternative to topsoil segregation.

3. Where topsoil segregation is required, the project sponsor must:

   a. segregate at least 12 inches of topsoil in deep soils (more than 12 inches of topsoil); and

   b. make every effort to segregate the entire topsoil layer in soils with less than 12 inches of topsoil.

4. Maintain separation of salvaged topsoil and subsoil throughout all construction activities.

5. Segregated topsoil may not be used for padding the pipe, constructing temporary slope breakers or trench plugs, improving or maintaining roads, or as a fill material.

6. Stabilize topsoil piles and minimize loss due to wind and water erosion with use of sediment barriers, mulch, temporary seeding, tackifiers, or functional equivalents, where necessary.

C. DRAIN TILES

1. Mark locations of drain tiles damaged during construction.

2. Probe all drainage tile systems within the area of disturbance to check for damage.

3. Repair damaged drain tiles to their original or better condition. Do not use filter-covered drain tiles unless the local soil conservation authorities and the landowner agree. Use qualified specialists for testing and repairs.

4. For new pipelines in areas where drain tiles exist or are planned, ensure that the depth of cover over the pipeline is sufficient to avoid interference with drain tile systems. For adjacent pipeline loops in agricultural areas, install the new pipeline with at least the same depth of cover as the existing pipeline(s).

D. IRRIGATION

Maintain water flow in crop irrigation systems, unless shutoff is coordinated with affected parties.

E. ROAD CROSSINGS AND ACCESS POINTS

1. Maintain safe and accessible conditions at all road crossings and access points during construction.

2. If crushed stone access pads are used in residential or agricultural areas, place the stone on synthetic fabric to facilitate removal.

3. Minimize the use of tracked equipment on public roadways. Remove any soil or gravel spilled or tracked onto roadways daily or more frequent as necessary to maintain safe road conditions. Repair any damages to roadway surfaces, shoulders, and bar ditches.

F. TEMPORARY EROSION CONTROL

Install temporary erosion controls immediately after initial disturbance of the soil. Temporary erosion controls must be properly maintained throughout construction (on a daily basis) and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls or restoration is complete.

1. Temporary Slope Breakers

   a. Temporary slope breakers are intended to reduce runoff velocity and divert water off the construction right-of-way. Temporary slope

breakers may be constructed of materials such as soil, silt fence, staked hay or straw bales, or sand bags.

b. Install temporary slope breakers on all disturbed areas, as necessary to avoid excessive erosion. Temporary slope breakers must be installed on slopes greater than 5 percent where the base of the slope is less than 50 feet from waterbody, wetland, and road crossings at the following spacing (closer spacing shall be used if necessary):

Slope (%)	Spacing (feet)
5 - 15	300
>15 - 30	200
>30	100

c. Direct the outfall of each temporary slope breaker to a stable, well vegetated area or construct an energy-dissipating device at the end of the slope breaker and off the construction right-of-way.

d. Position the outfall of each temporary slope breaker to prevent sediment discharge into wetlands, waterbodies, or other sensitive environmental resource areas.

2. Temporary Trench Plugs

Temporary trench plugs are intended to segment a continuous open trench prior to backfill.

a. Temporary trench plugs may consist of unexcavated portions of the trench, compacted subsoil, sandbags, or some functional equivalent.

b. Position temporary trench plugs, as necessary, to reduce trenchline erosion and minimize the volume and velocity of trench water flow at the base of slopes.

3. Sediment Barriers

Sediment barriers are intended to stop the flow of sediments and to prevent the deposition of sediments beyond approved workspaces or into sensitive resources.

a. Sediment barriers may be constructed of materials such as silt fence, staked hay or straw bales, compacted earth (e.g., driveable berms across travelways), sand bags, or other appropriate materials.

b. At a minimum, install and maintain temporary sediment barriers across the entire construction right-of-way at the base of slopes greater than 5 percent where the base of the slope is less than 50 feet from a waterbody, wetland, or road crossing until revegetation is successful as defined in this Plan. Leave adequate room between the base of the slope and the sediment barrier to accommodate ponding of water and sediment deposition.

c. Where wetlands or waterbodies are adjacent to and downslope of construction work areas, install sediment barriers along the edge of these areas, as necessary to prevent sediment flow into the wetland or waterbody.

4. Mulch

a. Apply mulch on all slopes (except in cultivated cropland) concurrent with or immediately after seeding, where necessary to stabilize the soil surface and to reduce wind and water erosion. Spread mulch uniformly over the area to cover at least 75 percent of the ground surface at a rate of 2 tons/acre of straw or its equivalent, unless the local soil conservation authority, landowner, or land managing agency approves otherwise in writing.

b. Mulch can consist of weed-free straw or hay, wood fiber hydromulch, erosion control fabric, or some functional equivalent.

c. Mulch all disturbed upland areas (except cultivated cropland) before seeding if:

(1) final grading and installation of permanent erosion control measures will not be completed in an area within 20 days after the trench in that area is backfilled (10 days in residential areas), as required in section V.A.1; or

(2) construction or restoration activity is interrupted for extended periods, such as when seeding cannot be completed due to seeding period restrictions.

d. If mulching before seeding, increase mulch application on all slopes within 100 feet of waterbodies and wetlands to a rate of 3 tons/acre of straw or equivalent.

e. If wood chips are used as mulch, do not use more than 1 ton/acre and add the equivalent of 11 lbs/acre available nitrogen (at least 50 percent of which is slow release).

f. Ensure that mulch is adequately anchored to minimize loss due to wind and water.

g. When anchoring with liquid mulch binders, use rates recommended by the manufacturer. Do not use liquid mulch binders within 100 feet of wetlands or waterbodies, except where the product is certified environmentally non-toxic by the appropriate state or federal agency or independent standards-setting organization.

h. Do not use synthetic monofilament mesh/netted erosion control materials in areas designated as sensitive wildlife habitat, unless the product is specifically designed to minimize harm to wildlife. Anchor erosion control fabric with staples or other appropriate devices.

V. RESTORATION

A. CLEANUP

1. Commence cleanup operations immediately following backfill operations. Complete final grading, topsoil replacement, and installation of permanent erosion control structures within 20 days after backfilling the trench (10 days in residential areas). If seasonal or other weather conditions prevent compliance with these time frames, maintain temporary erosion controls (i.e., temporary slope breakers, sediment barriers, and mulch) until conditions allow completion of cleanup.

   If construction or restoration unexpectedly continues into the winter season when conditions could delay successful decompaction, topsoil replacement, or seeding until the following spring, file with the Secretary for the review and written approval of the Director, a winter construction plan (as specified in section III.I). This filing requirement does not apply to projects constructed under the automatic authorization provisions of the FERC's regulations.

2. A travel lane may be left open temporarily to allow access by construction traffic if the temporary erosion control structures are installed as specified in section IV.F. and inspected and maintained as specified in sections II.B.12 through 14. When access is no longer required the travel lane must be removed and the right-of-way restored.

3. Rock excavated from the trench may be used to backfill the trench only to the top of the existing bedrock profile. Rock that is not returned to the trench shall be considered construction debris, unless approved for use as mulch or for some other use on the construction work areas by the landowner or land managing agency.

4. Remove excess rock from at least the top 12 inches of soil in all cultivated or rotated cropland, managed pastures, hayfields, and residential areas, as well as other areas at the landowner's request. The size, density, and distribution of rock on the construction work area shall be similar to adjacent areas not disturbed by construction. The landowner or land management agency may approve other provisions in writing.

5. Grade the construction right-of-way to restore pre-construction contours and leave the soil in the proper condition for planting.

6. Remove construction debris from all construction work areas unless the landowner or land managing agency approves leaving materials onsite for beneficial reuse, stabilization, or habitat restoration.

7. Remove temporary sediment barriers when replaced by permanent erosion control measures or when revegetation is successful.

B. PERMANENT EROSION CONTROL DEVICES

1. Trench Breakers

a. Trench breakers are intended to slow the flow of subsurface water along the trench. Trench breakers may be constructed of materials such as sand bags or polyurethane foam. Do not use topsoil in trench breakers.

b. An engineer or similarly qualified professional shall determine the need for and spacing of trench breakers. Otherwise, trench breakers shall be installed at the same spacing as and upslope of permanent slope breakers.

c. In agricultural fields and residential areas where slope breakers are not typically required, install trench breakers at the same spacing as if permanent slope breakers were required.

d. At a minimum, install a trench breaker at the base of slopes greater than 5 percent where the base of the slope is less than 50 feet from a waterbody or wetland and where needed to avoid draining a waterbody or wetland. Install trench breakers at wetland boundaries, as specified in the Procedures. Do not install trench breakers within a wetland.

2. Permanent Slope Breakers

a. Permanent slope breakers are intended to reduce runoff velocity, divert water off the construction right-of-way, and prevent sediment deposition into sensitive resources. Permanent slope breakers may be constructed of materials such as soil, stone, or some functional equivalent.

b. Construct and maintain permanent slope breakers in all areas, except cultivated areas and lawns, unless requested by the landowner, using spacing recommendations obtained from the local soil conservation authority or land managing agency.

In the absence of written recommendations, use the following spacing unless closer spacing is necessary to avoid excessive erosion on the construction right-of-way:

Slope (%)	Spacing (feet)
5 - 15	300
>15 - 30	200
>30	100

c. Construct slope breakers to divert surface flow to a stable area without causing water to pool or erode behind the breaker. In the absence of a stable area, construct appropriate energy-dissipating devices at the end of the breaker.

d. Slope breakers may extend slightly (about 4 feet) beyond the edge of the construction right-of-way to effectively drain water off the disturbed area. Where slope breakers extend beyond the edge of the construction right-of-way, they are subject to compliance with all applicable survey requirements.

C. SOIL COMPACTION MITIGATION

1. Test topsoil and subsoil for compaction at regular intervals in agricultural and residential areas disturbed by construction activities. Conduct tests on the same soil type under similar moisture conditions in undisturbed areas to approximate preconstruction conditions. Use penetrometers or other appropriate devices to conduct tests.

2. Plow severely compacted agricultural areas with a paraplow or other deep tillage implement. In areas where topsoil has been segregated, plow the subsoil before replacing the segregated topsoil.

If subsequent construction and cleanup activities result in further compaction, conduct additional tilling.

3. Perform appropriate soil compaction mitigation in severely compacted residential areas.

D. REVEGETATION

1. General

a. The project sponsor is responsible for ensuring successful revegetation of soils disturbed by project-related activities, except as noted in section V.D.1.b.

b. Restore all turf, ornamental shrubs, and specialized landscaping in accordance with the landowner's request, or compensate the landowner. Restoration work must be performed by personnel familiar with local horticultural and turf establishment practices.

2. Soil Additives

Fertilize and add soil pH modifiers in accordance with written recommendations obtained from the local soil conservation authority, land management agencies, or landowner. Incorporate recommended soil pH modifier and fertilizer into the top 2 inches of soil as soon as practicable after application.

3. Seeding Requirements

a. Prepare a seedbed in disturbed areas to a depth of 3 to 4 inches using appropriate equipment to provide a firm seedbed. When hydroseeding, scarify the seedbed to facilitate lodging and germination of seed.

b. Seed disturbed areas in accordance with written recommendations for seed mixes, rates, and dates obtained from the local soil conservation authority or the request of the landowner or land management agency. Seeding is not required in cultivated croplands unless requested by the landowner.

c. Perform seeding of permanent vegetation within the recommended seeding dates. If seeding cannot be done within those dates, use appropriate temporary erosion control measures discussed in section IV.F and perform seeding of permanent vegetation at the beginning of the next recommended seeding season. Dormant seeding or temporary

seeding of annual species may also be used, if necessary, to establish cover, as approved by the Environmental Inspector. Lawns may be seeded on a schedule established with the landowner.

d. In the absence of written recommendations from the local soil conservation authorities, seed all disturbed soils within 6 working days of final grading, weather and soil conditions permitting, subject to the specifications in section V.D.3.a through V.D.3.c.

e. Base seeding rates on Pure Live Seed. Use seed within 12 months of seed testing.

f. Treat legume seed with an inoculant specific to the species using the manufacturer's recommended rate of inoculant appropriate for the seeding method (broadcast, drill, or hydro).

g. In the absence of written recommendations from the local soil conservation authorities, landowner, or land managing agency to the contrary, a seed drill equipped with a cultipacker is preferred for seed application.

Broadcast or hydroseeding can be used in lieu of drilling at double the recommended seeding rates. Where seed is broadcast, firm the seedbed with a cultipacker or roller after seeding. In rocky soils or where site conditions may limit the effectiveness of this equipment, other alternatives may be appropriate (e.g., use of a chain drag) to lightly cover seed after application, as approved by the Environmental Inspector.

VI. OFF-ROAD VEHICLE CONTROL

To each owner or manager of forested lands, offer to install and maintain measures to control unauthorized vehicle access to the right-of-way. These measures may include:

A. signs;

B. fences with locking gates;

C. slash and timber barriers, pipe barriers, or a line of boulders across the right-of-way; and

D. conifers or other appropriate trees or shrubs across the right-of-way.

VII. POST-CONSTRUCTION ACTIVITIES AND REPORTING

A. MONITORING AND MAINTENANCE

1. Conduct follow-up inspections of all disturbed areas, as necessary, to determine the success of revegetation and address landowner concerns. At a minimum, conduct inspections after the first and second growing seasons.

2. Revegetation in non-agricultural areas shall be considered successful if upon visual survey the density and cover of non-nuisance vegetation are similar in density and cover to adjacent undisturbed lands. In agricultural areas, revegetation shall be considered successful when upon visual survey, crop growth and vigor are similar to adjacent undisturbed portions of the same field, unless the easement agreement specifies otherwise.

   Continue revegetation efforts until revegetation is successful.

3. Monitor and correct problems with drainage and irrigation systems resulting from pipeline construction in agricultural areas until restoration is successful.

4. Restoration shall be considered successful if the right-of-way surface condition is similar to adjacent undisturbed lands, construction debris is removed (unless otherwise approved by the landowner or land managing agency per section V.A.6), revegetation is successful, and proper drainage has been restored.

5. Routine vegetation mowing or clearing over the full width of the permanent right-of-way in uplands shall not be done more frequently than every 3 years. However, to facilitate periodic corrosion/leak surveys, a corridor not exceeding 10 feet in width centered on the pipeline may be cleared at a frequency necessary to maintain the 10-foot corridor in an herbaceous state. In no case shall routine vegetation mowing or clearing occur during the migratory bird nesting season between April 15 and August 1 of any year unless specifically approved in writing by the responsible land management agency or the U.S. Fish and Wildlife Service.

6. Efforts to control unauthorized off-road vehicle use, in cooperation with the landowner, shall continue throughout the life of the project. Maintain signs, gates, and permanent access roads as necessary.

B. REPORTING

1. The project sponsor shall maintain records that identify by milepost:

   a. method of application, application rate, and type of fertilizer, pH modifying agent, seed, and mulch used;

   b. acreage treated;

   c. dates of backfilling and seeding;

   d. names of landowners requesting special seeding treatment and a description of the follow-up actions;

   e. the location of any subsurface drainage repairs or improvements made during restoration; and

   f. any problem areas and how they were addressed.

2. The project sponsor shall file with the Secretary quarterly activity reports documenting the results of follow-up inspections required by section VII.A.1; any problem areas, including those identified by the landowner; and corrective actions taken for at least 2 years following construction.

   The requirement to file quarterly activity reports with the Secretary does not apply to projects constructed under the automatic authorization, prior notice, or advanced notice provisions in the FERC's regulations.

NORTH BAKKEN EXPANSION PROJECT

Erosion and Sediment Control Plan

APPENDIX B
Federal Energy Regulatory Commission's Wetland and Waterbody Construction and Mitigation Procedures

Federal Energy Regulatory Commission

Office of Energy Projects

May 2013

WETLAND AND WATERBODY CONSTRUCTION AND MITIGATION PROCEDURES

Washington, DC 20426

MAY 2013 VERSION

WETLAND AND WATERBODY CONSTRUCTION AND MITIGATION PROCEDURES

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WETLAND AND WATERBODY
CONSTRUCTION AND MITIGATION PROCEDURES (PROCEDURES)

I. APPLICABILITY

A. The intent of these Procedures is to assist project sponsors by identifying baseline mitigation measures for minimizing the extent and duration of project-related disturbance on wetlands and waterbodies. Project sponsors shall specify in their applications for a new FERC authorization, and in prior notice and advance notice filings, any individual measures in these Procedures they consider unnecessary, technically infeasible, or unsuitable due to local conditions and fully describe any alternative measures they would use. Project sponsors shall also explain how those alternative measures would achieve a comparable level of mitigation.

Once a project is authorized, project sponsors can request further changes as variances to the measures in these Procedures (or the applicant's approved procedures). The Director of the Office of Energy Projects (Director) will consider approval of variances upon the project sponsor's written request, if the Director agrees that a variance:

1. provides equal or better environmental protection;

2. is necessary because a portion of these Procedures is infeasible or unworkable based on project-specific conditions; or

3. is specifically required in writing by another federal, state, or Native American land management agency for the portion of the project on its land or under its jurisdiction.

Sponsors of projects planned for construction under the automatic authorization provisions in the FERC's regulations must receive written approval for any variances in advance of construction.

Project-related impacts on non-wetland areas are addressed in the staff's Upland Erosion Control, Revegetation, and Maintenance Plan (Plan).

B. DEFINITIONS

1. "Waterbody" includes any natural or artificial stream, river, or drainage with perceptible flow at the time of crossing, and other permanent waterbodies such as ponds and lakes:

   a. "minor waterbody" includes all waterbodies less than or equal to 10 feet wide at the water's edge at the time of crossing;

   b. "intermediate waterbody" includes all waterbodies greater than 10 feet wide but less than or equal to 100 feet wide at the water's edge at the time of crossing; and

   c. "major waterbody" includes all waterbodies greater than 100 feet wide at the water's edge at the time of crossing.

2. "Wetland" includes any area that is not in actively cultivated or rotated cropland and that satisfies the requirements of the current federal methodology for identifying and delineating wetlands.

II. PRECONSTRUCTION FILING

A. The following information must be filed with the Secretary of the FERC (Secretary) prior to the beginning of construction, for the review and written approval by the Director:

1. site-specific justifications for extra work areas that would be closer than 50 feet from a waterbody or wetland; and

2. site-specific justifications for the use of a construction right-of-way greater than 75-feet-wide in wetlands.

B. The following information must be filed with the Secretary prior to the beginning of construction. These filing requirements do not apply to projects constructed under the automatic authorization provisions in the FERC's regulations:

1. Spill Prevention and Response Procedures specified in section IV.A;

2. a schedule identifying when trenching or blasting will occur within each waterbody greater than 10 feet wide, within any designated coldwater fishery, and within any waterbody identified as habitat for federally-listed threatened or endangered species. The project sponsor will revise the schedule as necessary to provide FERC staff at least 14 days advance notice. Changes within this last 14-day period must provide for at least 48 hours advance notice;

3. plans for horizontal directional drills (HDD) under wetlands or waterbodies, specified in section V.B.6.d;

4. site-specific plans for major waterbody crossings, described in section V.B.9;

5. a wetland delineation report as described in section VI.A.1, if applicable; and

6. the hydrostatic testing information specified in section VII.B.3.

III. ENVIRONMENTAL INSPECTORS

A. At least one Environmental Inspector having knowledge of the wetland and waterbody conditions in the project area is required for each construction spread. The number and experience of Environmental Inspectors assigned to each construction spread shall be appropriate for the length of the construction spread and the number/significance of resources affected.

B. The Environmental Inspector's responsibilities are outlined in the Upland Erosion Control, Revegetation, and Maintenance Plan (Plan).

IV. PRECONSTRUCTION PLANNING

A. The project sponsor shall develop project-specific Spill Prevention and Response Procedures that meet applicable requirements of state and federal agencies. A copy must be filed with the Secretary prior to construction and made available in the field on each construction spread. This filing requirement does not apply to projects constructed under the automatic authorization provisions in the FERC's regulations.

1. It shall be the responsibility of the project sponsor and its contractors to structure their operations in a manner that reduces the risk of spills or the accidental exposure of fuels or hazardous materials to waterbodies or wetlands. The project sponsor and its contractors must, at a minimum, ensure that:

a. all employees handling fuels and other hazardous materials are properly trained;

b. all equipment is in good operating order and inspected on a regular basis;

c. fuel trucks transporting fuel to on-site equipment travel only on approved access roads;

d. all equipment is parked overnight and/or fueled at least 100 feet from a waterbody or in an upland area at least 100 feet from a wetland boundary. These activities can occur closer only if the Environmental Inspector determines that there is no reasonable alternative, and the

project sponsor and its contractors have taken appropriate steps (including secondary containment structures) to prevent spills and provide for prompt cleanup in the event of a spill;

e. hazardous materials, including chemicals, fuels, and lubricating oils, are not stored within 100 feet of a wetland, waterbody, or designated municipal watershed area, unless the location is designated for such use by an appropriate governmental authority. This applies to storage of these materials and does not apply to normal operation or use of equipment in these areas;

f. concrete coating activities are not performed within 100 feet of a wetland or waterbody boundary, unless the location is an existing industrial site designated for such use. These activities can occur closer only if the Environmental Inspector determines that there is no reasonable alternative, and the project sponsor and its contractors have taken appropriate steps (including secondary containment structures) to prevent spills and provide for prompt cleanup in the event of a spill;

g. pumps operating within 100 feet of a waterbody or wetland boundary utilize appropriate secondary containment systems to prevent spills; and

h. bulk storage of hazardous materials, including chemicals, fuels, and lubricating oils have appropriate secondary containment systems to prevent spills.

2. The project sponsor and its contractors must structure their operations in a manner that provides for the prompt and effective cleanup of spills of fuel and other hazardous materials. At a minimum, the project sponsor and its contractors must:

a. ensure that each construction crew (including cleanup crews) has on hand sufficient supplies of absorbent and barrier materials to allow the rapid containment and recovery of spilled materials and knows the procedure for reporting spills and unanticipated discoveries of contamination;

b. ensure that each construction crew has on hand sufficient tools and material to stop leaks;

c. know the contact names and telephone numbers for all local, state, and federal agencies (including, if necessary, the U. S. Coast Guard and the National Response Center) that must be notified of a spill; and

d. follow the requirements of those agencies in cleaning up the spill, in excavating and disposing of soils or other materials contaminated by a spill, and in collecting and disposing of waste generated during spill cleanup.

B. AGENCY COORDINATION

The project sponsor must coordinate with the appropriate local, state, and federal agencies as outlined in these Procedures and in the FERC's Orders.

V. WATERBODY CROSSINGS

A. NOTIFICATION PROCEDURES AND PERMITS

1. Apply to the U.S. Army Corps of Engineers (COE), or its delegated agency, for the appropriate wetland and waterbody crossing permits.

2. Provide written notification to authorities responsible for potable surface water supply intakes located within 3 miles downstream of the crossing at least 1 week before beginning work in the waterbody, or as otherwise specified by that authority.

3. Apply for state-issued waterbody crossing permits and obtain individual or generic section 401 water quality certification or waiver.

4. Notify appropriate federal and state authorities at least 48 hours before beginning trenching or blasting within the waterbody, or as specified in applicable permits.

B. INSTALLATION

1. Time Window for Construction

Unless expressly permitted or further restricted by the appropriate federal or state agency in writing on a site-specific basis, instream work, except that required to install or remove equipment bridges, must occur during the following time windows:

a. coldwater fisheries - June 1 through September 30; and

b. coolwater and warmwater fisheries - June 1 through November 30.

2. Extra Work Areas

a. Locate all extra work areas (such as staging areas and additional spoil storage areas) at least 50 feet away from water's edge, except where

the adjacent upland consists of cultivated or rotated cropland or other disturbed land.

b. The project sponsor shall file with the Secretary for review and written approval by the Director, site-specific justification for each extra work area with a less than 50-foot setback from the water's edge, except where the adjacent upland consists of cultivated or rotated cropland or other disturbed land. The justification must specify the conditions that will not permit a 50-foot setback and measures to ensure the waterbody is adequately protected.

c. Limit the size of extra work areas to the minimum needed to construct the waterbody crossing.

3. General Crossing Procedures

a. Comply with the COE, or its delegated agency, permit terms and conditions.

b. Construct crossings as close to perpendicular to the axis of the waterbody channel as engineering and routing conditions permit.

c. Where pipelines parallel a waterbody, maintain at least 15 feet of undisturbed vegetation between the waterbody (and any adjacent wetland) and the construction right-of-way, except where maintaining this offset will result in greater environmental impact.

d. Where waterbodies meander or have multiple channels, route the pipeline to minimize the number of waterbody crossings.

e. Maintain adequate waterbody flow rates to protect aquatic life, and prevent the interruption of existing downstream uses.

f. Waterbody buffers (e.g., extra work area setbacks, refueling restrictions) must be clearly marked in the field with signs and/or highly visible flagging until construction-related ground disturbing activities are complete.

g. Crossing of waterbodies when they are dry or frozen and not flowing may proceed using standard upland construction techniques in accordance with the Plan, provided that the Environmental Inspector verifies that water is unlikely to flow between initial disturbance and final stabilization of the feature. In the event of perceptible flow, the project sponsor must comply with all applicable Procedure requirements for "waterbodies" as defined in section I.B.1.

4. Spoil Pile Placement and Control

   a. All spoil from minor and intermediate waterbody crossings, and upland spoil from major waterbody crossings, must be placed in the construction right-of-way at least 10 feet from the water's edge or in additional extra work areas as described in section V.B.2.

   b. Use sediment barriers to prevent the flow of spoil or silt-laden water into any waterbody.

5. Equipment Bridges

   a. Only clearing equipment and equipment necessary for installation of equipment bridges may cross waterbodies prior to bridge installation. Limit the number of such crossings of each waterbody to one per piece of clearing equipment.

   b. Construct and maintain equipment bridges to allow unrestricted flow and to prevent soil from entering the waterbody. Examples of such bridges include:

      (1) equipment pads and culvert(s);
      (2) equipment pads or railroad car bridges without culverts;
      (3) clean rock fill and culvert(s); and
      (4) flexi-float or portable bridges.

      Additional options for equipment bridges may be utilized that achieve the performance objectives noted above. Do not use soil to construct or stabilize equipment bridges.

   c. Design and maintain each equipment bridge to withstand and pass the highest flow expected to occur while the bridge is in place. Align culverts to prevent bank erosion or streambed scour. If necessary, install energy dissipating devices downstream of the culverts.

   d. Design and maintain equipment bridges to prevent soil from entering the waterbody.

   e. Remove temporary equipment bridges as soon as practicable after permanent seeding.

   f. If there will be more than 1 month between final cleanup and the beginning of permanent seeding and reasonable alternative access to the right-of-way is available, remove temporary equipment bridges as soon as practicable after final cleanup.

g. Obtain any necessary approval from the COE, or the appropriate state agency for permanent bridges.

6. Dry-Ditch Crossing Methods

a. Unless approved otherwise by the appropriate federal or state agency, install the pipeline using one of the dry-ditch methods outlined below for crossings of waterbodies up to 30 feet wide (at the water's edge at the time of construction) that are state-designated as either coldwater or significant coolwater or warmwater fisheries, or federally-designated as critical habitat.

b. Dam and Pump

(1) The dam-and-pump method may be used without prior approval for crossings of waterbodies where pumps can adequately transfer streamflow volumes around the work area, and there are no concerns about sensitive species passage.

(2) Implementation of the dam-and-pump crossing method must meet the following performance criteria:

(i) use sufficient pumps, including on-site backup pumps, to maintain downstream flows;
(ii) construct dams with materials that prevent sediment and other pollutants from entering the waterbody (e.g., sandbags or clean gravel with plastic liner);
(iii) screen pump intakes to minimize entrainment of fish;
(iv) prevent streambed scour at pump discharge; and
(v) continuously monitor the dam and pumps to ensure proper operation throughout the waterbody crossing.

c. Flume Crossing

The flume crossing method requires implementation of the following steps:

(1) install flume pipe after blasting (if necessary), but before any trenching;

(2) use sand bag or sand bag and plastic sheeting diversion structure or equivalent to develop an effective seal and to divert stream flow through the flume pipe (some modifications to the stream bottom may be required to achieve an effective seal);

(3) properly align flume pipe(s) to prevent bank erosion and streambed scour;

(4) do not remove flume pipe during trenching, pipelaying, or backfilling activities, or initial streambed restoration efforts; and

(5) remove all flume pipes and dams that are not also part of the equipment bridge as soon as final cleanup of the stream bed and bank is complete.

d. Horizontal Directional Drill

For each waterbody or wetland that would be crossed using the HDD method, file with the Secretary for the review and written approval by the Director, a plan that includes:

(1) site-specific construction diagrams that show the location of mud pits, pipe assembly areas, and all areas to be disturbed or cleared for construction;

(2) justification that disturbed areas are limited to the minimum needed to construct the crossing;

(3) identification of any aboveground disturbance or clearing between the HDD entry and exit workspaces during construction;

(4) a description of how an inadvertent release of drilling mud would be contained and cleaned up; and

(5) a contingency plan for crossing the waterbody or wetland in the event the HDD is unsuccessful and how the abandoned drill hole would be sealed, if necessary.

The requirement to file HDD plans does not apply to projects constructed under the automatic authorization provisions in the FERC's regulations.

7. Crossings of Minor Waterbodies

Where a dry-ditch crossing is not required, minor waterbodies may be crossed using the open-cut crossing method, with the following restrictions:

a. except for blasting and other rock breaking measures, complete instream construction activities (including trenching, pipe installation, backfill, and restoration of the streambed contours) within 24 hours.

Streambanks and unconsolidated streambeds may require additional restoration after this period;

b. limit use of equipment operating in the waterbody to that needed to construct the crossing; and

c. equipment bridges are not required at minor waterbodies that do not have a state-designated fishery classification or protected status (e.g., agricultural or intermittent drainage ditches). However, if an equipment bridge is used it must be constructed as described in section V.B.5.

8. Crossings of Intermediate Waterbodies

Where a dry-ditch crossing is not required, intermediate waterbodies may be crossed using the open-cut crossing method, with the following restrictions:

a. complete instream construction activities (not including blasting and other rock breaking measures) within 48 hours, unless site-specific conditions make completion within 48 hours infeasible;

b. limit use of equipment operating in the waterbody to that needed to construct the crossing; and

c. all other construction equipment must cross on an equipment bridge as specified in section V.B.5.

9. Crossings of Major Waterbodies

Before construction, the project sponsor shall file with the Secretary for the review and written approval by the Director a detailed, site-specific construction plan and scaled drawings identifying all areas to be disturbed by construction for each major waterbody crossing (the scaled drawings are not required for any offshore portions of pipeline projects). This plan must be developed in consultation with the appropriate state and federal agencies and shall include extra work areas, spoil storage areas, sediment control structures, etc., as well as mitigation for navigational issues. The requirement to file major waterbody crossing plans does not apply to projects constructed under the automatic authorization provisions of the FERC's regulations.

The Environmental Inspector may adjust the final placement of the erosion and sediment control structures in the field to maximize effectiveness.

10. Temporary Erosion and Sediment Control

Install sediment barriers (as defined in section IV.F.3.a of the Plan) immediately after initial disturbance of the waterbody or adjacent upland.

Sediment barriers must be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls or restoration of adjacent upland areas is complete. Temporary erosion and sediment control measures are addressed in more detail in the Plan; however, the following specific measures must be implemented at stream crossings:

a. install sediment barriers across the entire construction right-of-way at all waterbody crossings, where necessary to prevent the flow of sediments into the waterbody. Removable sediment barriers (or driveable berms) must be installed across the travel lane. These removable sediment barriers can be removed during the construction day, but must be re-installed after construction has stopped for the day and/or when heavy precipitation is imminent;

b. where waterbodies are adjacent to the construction right-of-way and the right-of-way slopes toward the waterbody, install sediment barriers along the edge of the construction right-of-way as necessary to contain spoil within the construction right-of-way and prevent sediment flow into the waterbody; and

c. use temporary trench plugs at all waterbody crossings, as necessary, to prevent diversion of water into upland portions of the pipeline trench and to keep any accumulated trench water out of the waterbody.

11. Trench Dewatering

Dewater the trench (either on or off the construction right-of-way) in a manner that does not cause erosion and does not result in silt-laden water flowing into any waterbody. Remove the dewatering structures as soon as practicable after the completion of dewatering activities.

C. RESTORATION

1. Use clean gravel or native cobbles for the upper 1 foot of trench backfill in all waterbodies that contain coldwater fisheries.

2. For open-cut crossings, stabilize waterbody banks and install temporary sediment barriers within 24 hours of completing instream construction activities. For dry-ditch crossings, complete streambed and bank stabilization before returning flow to the waterbody channel.

3. Return all waterbody banks to preconstruction contours or to a stable angle of repose as approved by the Environmental Inspector.

4. Install erosion control fabric or a functional equivalent on waterbody banks at the time of final bank recontouring. Do not use synthetic monofilament

mesh/netted erosion control materials in areas designated as sensitive wildlife habitat unless the product is specifically designed to minimize harm to wildlife. Anchor erosion control fabric with staples or other appropriate devices.

5. Application of riprap for bank stabilization must comply with COE, or its delegated agency, permit terms and conditions.

6. Unless otherwise specified by state permit, limit the use of riprap to areas where flow conditions preclude effective vegetative stabilization techniques such as seeding and erosion control fabric.

7. Revegetate disturbed riparian areas with native species of conservation grasses, legumes, and woody species, similar in density to adjacent undisturbed lands.

8. Install a permanent slope breaker across the construction right-of-way at the base of slopes greater than 5 percent that are less than 50 feet from the waterbody, or as needed to prevent sediment transport into the waterbody. In addition, install sediment barriers as outlined in the Plan.

   In some areas, with the approval of the Environmental Inspector, an earthen berm may be suitable as a sediment barrier adjacent to the waterbody.

9. Sections V.C.3 through V.C.7 above also apply to those perennial or intermittent streams not flowing at the time of construction.

D. POST-CONSTRUCTION MAINTENANCE

1. Limit routine vegetation mowing or clearing adjacent to waterbodies to allow a riparian strip at least 25 feet wide, as measured from the waterbody's mean high water mark, to permanently revegetate with native plant species across the entire construction right-of-way. However, to facilitate periodic corrosion/leak surveys, a corridor centered on the pipeline and up to 10 feet wide may be cleared at a frequency necessary to maintain the 10-foot corridor in an herbaceous state. In addition, trees that are located within 15 feet of the pipeline that have roots that could compromise the integrity of the pipeline coating may be cut and removed from the permanent right-of-way. Do not conduct any routine vegetation mowing or clearing in riparian areas that are between HDD entry and exit points.

2. Do not use herbicides or pesticides in or within 100 feet of a waterbody except as allowed by the appropriate land management or state agency.

3. Time of year restrictions specified in section VII.A.5 of the Plan (April 15 – August 1 of any year) apply to routine mowing and clearing of riparian areas.

VI. WETLAND CROSSINGS

A. GENERAL

1. The project sponsor shall conduct a wetland delineation using the current federal methodology and file a wetland delineation report with the Secretary before construction. The requirement to file a wetland delineation report does not apply to projects constructed under the automatic authorization provisions in the FERC's regulations.

   This report shall identify:

   a. by milepost all wetlands that would be affected;

   b. the National Wetlands Inventory (NWI) classification for each wetland;

   c. the crossing length of each wetland in feet; and

   d. the area of permanent and temporary disturbance that would occur in each wetland by NWI classification type.

   The requirements outlined in this section do not apply to wetlands in actively cultivated or rotated cropland. Standard upland protective measures, including workspace and topsoiling requirements, apply to these agricultural wetlands.

2. Route the pipeline to avoid wetland areas to the maximum extent possible. If a wetland cannot be avoided or crossed by following an existing right-of-way, route the new pipeline in a manner that minimizes disturbance to wetlands. Where looping an existing pipeline, overlap the existing pipeline right-of-way with the new construction right-of-way. In addition, locate the loop line no more than 25 feet away from the existing pipeline unless site-specific constraints would adversely affect the stability of the existing pipeline.

3. Limit the width of the construction right-of-way to 75 feet or less. Prior written approval of the Director is required where topographic conditions or soil limitations require that the construction right-of-way width within the boundaries of a federally delineated wetland be expanded beyond 75 feet. Early in the planning process the project sponsor is encouraged to identify site-specific areas where excessively wide trenches could occur and/or where spoil piles could be difficult to maintain because existing soils lack adequate unconfined compressive strength.

4. Wetland boundaries and buffers must be clearly marked in the field with signs and/or highly visible flagging until construction-related ground disturbing activities are complete.

5. Implement the measures of sections V and VI in the event a waterbody crossing is located within or adjacent to a wetland crossing. If all measures of sections V and VI cannot be met, the project sponsor must file with the Secretary a site-specific crossing plan for review and written approval by the Director before construction. This crossing plan shall address at a minimum:

   a. spoil control;

   b. equipment bridges;

   c. restoration of waterbody banks and wetland hydrology;

   d. timing of the waterbody crossing;

   e. method of crossing; and

   f. size and location of all extra work areas.

6. Do not locate aboveground facilities in any wetland, except where the location of such facilities outside of wetlands would prohibit compliance with U.S. Department of Transportation regulations.

B. INSTALLATION

1. Extra Work Areas and Access Roads

   a. Locate all extra work areas (such as staging areas and additional spoil storage areas) at least 50 feet away from wetland boundaries, except where the adjacent upland consists of cultivated or rotated cropland or other disturbed land.

   b. The project sponsor shall file with the Secretary for review and written approval by the Director, site-specific justification for each extra work area with a less than 50-foot setback from wetland boundaries, except where adjacent upland consists of cultivated or rotated cropland or other disturbed land. The justification must specify the site-specific conditions that will not permit a 50-foot setback and measures to ensure the wetland is adequately protected.

   c. The construction right-of-way may be used for access when the wetland soil is firm enough to avoid rutting or the construction right-of-way has been appropriately stabilized to avoid rutting (e.g., with timber riprap, prefabricated equipment mats, or terra mats).

      In wetlands that cannot be appropriately stabilized, all construction equipment other than that needed to install the wetland crossing shall

use access roads located in upland areas. Where access roads in upland areas do not provide reasonable access, limit all other construction equipment to one pass through the wetland using the construction right-of-way.

d. The only access roads, other than the construction right-of-way, that can be used in wetlands are those existing roads that can be used with no modifications or improvements, other than routine repair, and no impact on the wetland.

2. Crossing Procedures

a. Comply with COE, or its delegated agency, permit terms and conditions.

b. Assemble the pipeline in an upland area unless the wetland is dry enough to adequately support skids and pipe.

c. Use "push-pull" or "float" techniques to place the pipe in the trench where water and other site conditions allow.

d. Minimize the length of time that topsoil is segregated and the trench is open. Do not trench the wetland until the pipeline is assembled and ready for lowering in.

e. Limit construction equipment operating in wetland areas to that needed to clear the construction right-of-way, dig the trench, fabricate and install the pipeline, backfill the trench, and restore the construction right-of-way.

f. Cut vegetation just above ground level, leaving existing root systems in place, and remove it from the wetland for disposal.

The project sponsor can burn woody debris in wetlands, if approved by the COE and in accordance with state and local regulations, ensuring that all remaining woody debris is removed for disposal.

g. Limit pulling of tree stumps and grading activities to directly over the trenchline. Do not grade or remove stumps or root systems from the rest of the construction right-of-way in wetlands unless the Chief Inspector and Environmental Inspector determine that safety-related construction constraints require grading or the removal of tree stumps from under the working side of the construction right-of-way.

h. Segregate the top 1 foot of topsoil from the area disturbed by trenching, except in areas where standing water is present or soils are

saturated. Immediately after backfilling is complete, restore the segregated topsoil to its original location.

i. Do not use rock, soil imported from outside the wetland, tree stumps, or brush riprap to support equipment on the construction right-of-way.

j. If standing water or saturated soils are present, or if construction equipment causes ruts or mixing of the topsoil and subsoil in wetlands, use low-ground-weight construction equipment, or operate normal equipment on timber riprap, prefabricated equipment mats, or terra mats.

k. Remove all project-related material used to support equipment on the construction right-of-way upon completion of construction.

3. Temporary Sediment Control

Install sediment barriers (as defined in section IV.F.3.a of the Plan) immediately after initial disturbance of the wetland or adjacent upland. Sediment barriers must be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench). Except as noted below in section VI.B.3.c, maintain sediment barriers until replaced by permanent erosion controls or restoration of adjacent upland areas is complete. Temporary erosion and sediment control measures are addressed in more detail in the Plan.

a. Install sediment barriers across the entire construction right-of-way immediately upslope of the wetland boundary at all wetland crossings where necessary to prevent sediment flow into the wetland.

b. Where wetlands are adjacent to the construction right-of-way and the right-of-way slopes toward the wetland, install sediment barriers along the edge of the construction right-of-way as necessary to contain spoil within the construction right-of-way and prevent sediment flow into the wetland.

c. Install sediment barriers along the edge of the construction right-of-way as necessary to contain spoil and sediment within the construction right-of-way through wetlands. Remove these sediment barriers during right-of-way cleanup.

4. Trench Dewatering

Dewater the trench (either on or off the construction right-of-way) in a manner that does not cause erosion and does not result in silt-laden water flowing into any wetland. Remove the dewatering structures as soon as practicable after the completion of dewatering activities.

C. RESTORATION

1. Where the pipeline trench may drain a wetland, construct trench breakers at the wetland boundaries and/or seal the trench bottom as necessary to maintain the original wetland hydrology.

2. Restore pre-construction wetland contours to maintain the original wetland hydrology.

3. For each wetland crossed, install a trench breaker at the base of slopes near the boundary between the wetland and adjacent upland areas. Install a permanent slope breaker across the construction right-of-way at the base of slopes greater than 5 percent where the base of the slope is less than 50 feet from the wetland, or as needed to prevent sediment transport into the wetland. In addition, install sediment barriers as outlined in the Plan. In some areas, with the approval of the Environmental Inspector, an earthen berm may be suitable as a sediment barrier adjacent to the wetland.

4. Do not use fertilizer, lime, or mulch unless required in writing by the appropriate federal or state agency.

5. Consult with the appropriate federal or state agencies to develop a project-specific wetland restoration plan. The restoration plan shall include measures for re-establishing herbaceous and/or woody species, controlling the invasion and spread of invasive species and noxious weeds (e.g., purple loosestrife and phragmites), and monitoring the success of the revegetation and weed control efforts. Provide this plan to the FERC staff upon request.

6. Until a project-specific wetland restoration plan is developed and/or implemented, temporarily revegetate the construction right-of-way with annual ryegrass at a rate of 40 pounds/acre (unless standing water is present).

7. Ensure that all disturbed areas successfully revegetate with wetland herbaceous and/or woody plant species.

8. Remove temporary sediment barriers located at the boundary between wetland and adjacent upland areas after revegetation and stabilization of adjacent upland areas are judged to be successful as specified in section VII.A.4 of the Plan.

D. POST-CONSTRUCTION MAINTENANCE AND REPORTING

1. Do not conduct routine vegetation mowing or clearing over the full width of the permanent right-of-way in wetlands. However, to facilitate periodic corrosion/leak surveys, a corridor centered on the pipeline and up to 10 feet wide may be cleared at a frequency necessary to maintain the 10-foot corridor in an herbaceous state. In addition, trees within 15 feet of the pipeline with roots that could compromise the integrity of pipeline coating may be selectively cut and removed from the permanent right-of-way. Do not conduct any routine vegetation mowing or clearing in wetlands that are between HDD entry and exit points.

2. Do not use herbicides or pesticides in or within 100 feet of a wetland, except as allowed by the appropriate federal or state agency.

3. Time of year restrictions specified in section VII.A.5 of the Plan (April 15 – August 1 of any year) apply to routine mowing and clearing of wetland areas.

4. Monitor and record the success of wetland revegetation annually until wetland revegetation is successful.

5. Wetland revegetation shall be considered successful if all of the following criteria are satisfied:

   a. the affected wetland satisfies the current federal definition for a wetland (i.e., soils, hydrology, and vegetation);

   b. vegetation is at least 80 percent of either the cover documented for the wetland prior to construction, or at least 80 percent of the cover in adjacent wetland areas that were not disturbed by construction;

   c. if natural rather than active revegetation was used, the plant species composition is consistent with early successional wetland plant communities in the affected ecoregion; and

   d. invasive species and noxious weeds are absent, unless they are abundant in adjacent areas that were not disturbed by construction.

6. Within 3 years after construction, file a report with the Secretary identifying the status of the wetland revegetation efforts and documenting success as defined in section VI.D.5, above. The requirement to file wetland restoration reports with the Secretary does not apply to projects constructed under the automatic authorization, prior notice, or advance notice provisions in the FERC's regulations.

   For any wetland where revegetation is not successful at the end of 3 years after construction, develop and implement (in consultation with a

professional wetland ecologist) a remedial revegetation plan to actively revegetate wetlands. Continue revegetation efforts and file a report annually documenting progress in these wetlands until wetland revegetation is successful.

VII. HYDROSTATIC TESTING

A. NOTIFICATION PROCEDURES AND PERMITS

1. Apply for state-issued water withdrawal permits, as required.

2. Apply for National Pollutant Discharge Elimination System (NPDES) or state-issued discharge permits, as required.

3. Notify appropriate state agencies of intent to use specific sources at least 48 hours before testing activities unless they waive this requirement in writing.

B. GENERAL

1. Perform 100 percent radiographic inspection of all pipeline section welds or hydrotest the pipeline sections, before installation under waterbodies or wetlands.

2. If pumps used for hydrostatic testing are within 100 feet of any waterbody or wetland, address secondary containment and refueling of these pumps in the project's Spill Prevention and Response Procedures.

3. The project sponsor shall file with the Secretary before construction a list identifying the location of all waterbodies proposed for use as a hydrostatic test water source or discharge location. This filing requirement does not apply to projects constructed under the automatic authorization provisions of the FERC's regulations.

C. INTAKE SOURCE AND RATE

1. Screen the intake hose to minimize the potential for entrainment of fish.

2. Do not use state-designated exceptional value waters, waterbodies which provide habitat for federally listed threatened or endangered species, or waterbodies designated as public water supplies, unless appropriate federal, state, and/or local permitting agencies grant written permission.

3. Maintain adequate flow rates to protect aquatic life, provide for all waterbody uses, and provide for downstream withdrawals of water by existing users.

4. Locate hydrostatic test manifolds outside wetlands and riparian areas to the maximum extent practicable.

D. DISCHARGE LOCATION, METHOD, AND RATE

1. Regulate discharge rate, use energy dissipation device(s), and install sediment barriers, as necessary, to prevent erosion, streambed scour, suspension of sediments, or excessive streamflow.

2. Do not discharge into state-designated exceptional value waters, waterbodies which provide habitat for federally listed threatened or endangered species, or waterbodies designated as public water supplies, unless appropriate federal, state, and local permitting agencies grant written permission.

Attachment 4

Spill Prevention Control Countermeasure Plan

WBI ENERGY TRANSMISSION, INC.
North Bakken Expansion Project
Section 408 Application

Attachment 4
Spill Prevention, Control, and Countermeasure Plan

August 2020

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT
SPILL PREVENTION, CONTROL, AND COUNTERMEASURE PLAN

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APPENDICES

Appendix A Spill Report Form

ACRONYMS AND ABBREVIATIONS

EI	Environmental Inspector
Project	North Bakken Expansion Project
SPCC Plan	Spill Prevention, Control, and Countermeasure Plan
WBI Energy	WBI Energy Transmission, Inc.

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT

1.0 INTRODUCTION

This Spill Prevention, Control, and Countermeasure Plan (SPCC Plan) was prepared for WBI Energy Transmission, Inc.'s (WBI Energy) proposed North Bakken Expansion Project (Project) to be implemented during construction of the Project. This SPCC Plan outlines specific preventive measures and practices to reduce the likelihood of an accidental release of a hazardous or regulated liquid and, in the event such a release occurs, to expedite the response to and remediation of the release.

This SPCC Plan restricts the location of fuel storage, fueling activities, and construction equipment maintenance along the construction right-of-way and provides procedures for these activities. Training and lines of communication to facilitate the prevention, response, containment, and cleanup of spills during construction activities are also described.

All contractor personnel working on the Project are responsible for implementation of the measures and procedures defined in this SPCC Plan. Contractors are expected to meet or exceed WBI Energy's standards for spill response, reporting, and cleanup. Contractors whose activities could result in a spill of fuel or other regulated or hazardous materials on the right-of-way will adopt the measures identified in this SPCC Plan. All measures outlined in this SPCC Plan are consistent with the applicable requirements of the Federal Energy Regulatory Commission's *Wetland and Waterbody Construction and Mitigation Procedures*.

This SPCC Plan will be updated to include information specific to the horizontal directional drill crossing of Lake Sakakawea once a contractor has been selected for the Project. A complete copy of the SPCC Plan shall be maintained on site. A copy of the SPCC Plan will be available for a review during normal working hours. *[Note: An updated version of this plan will be filed with the Federal Energy Regulatory Commission and the U.S. Army Corps of Engineers as more detailed information is finalized.]*

1.1 TRAINING

Experienced, well-trained staff are essential for the successful implementation of the SPCC Plan. Contractors will provide spill prevention training as well as safety training to their work crews. The training program will be designed to improve awareness of safety requirements, pollution control laws, and proper operation and maintenance of equipment. Contractors will train all employees who handle fuels and other regulated substances to prevent spills and to quickly and effectively contain and clean up spills in accordance with applicable regulations and the provisions of this plan.

1.2 ROLES AND RESPONSIBILITIES

1.2.1 Spill Coordinator

Contractors will appoint a Spill Coordinator who will be responsible for coordinating Contractor Work Crews for spill cleanup, conducting site investigations, and assisting with completing spill reports. The Spill Coordinator will report all spills to an Environmental Inspector

(EI). The Spill Coordinator will be responsible for completing WBI Energy's internal Spill Report Form as soon as possible but no later than the end of the work day that the spill occurred, regardless of the size of the spill. The Spill Report Form will be submitted to the WBI Energy Designated Representative.

Spill Coordinator:	[To Be Determined Prior to Construction]
Phone Number:	[To Be Determined Prior to Construction]

1.2.2 Contractor Work Crews

Contractor Work Crews will comply with this SPCC Plan and will notify the Spill Coordinator immediately of any spill of fuel or other regulated or hazardous material, regardless of the volume of the spill. Contractor Work Crews will assist with the cleanup of the spill as directed by the Spill Coordinator, if trained to do so.

1.2.3 Environmental Inspectors

The EIs will monitor the Contractors' compliance with the provisions of the SPCC Plan to ensure that spill resources are allocated and cleanup accomplished in accordance with this plan and any applicable regulatory requirements. The EIs will work in conjunction with WBI Energy's Designated Representative to promptly report spills to appropriate federal, state, and local agencies, as required, and to coordinate with these agencies regarding contacting additional parties or agencies.

Environmental Inspector:	[To Be Determined Prior to Construction]
Phone Number:	[To Be Determined Prior to Construction]

1.2.4 WBI Energy's Designated Representative

The Designated Representative has the authority to commit resources to implement this SPCC Plan. The Designated Representative will work in conjunction with the EIs to promptly report spills to appropriate federal, state, and local agencies.

ALL SPILLS, REGARDLESS OF SIZE, MUST BE REPORTED TO THE SPILL COORDINATOR AND ENVIRONMENTAL INSPECTORS

2.0 PREVENTATIVE MEASURES

Contractors will minimize the potential for a spill during construction activities at WBI Energy's facilities and on its right-of-way by implementing appropriate measures to prevent and contain spills. Equipment and materials will be located on site to meet the provisions of this SPCC Plan. The Contractor shall supply each construction crew with a quantity of absorbent and barrier materials sufficient to contain and recover spills that could potentially occur from the equipment with the largest on-board volume of fuel and lubricant. These materials may include, but are not limited to, drip pans, buckets, absorbent pads, containment booms, straw bales, absorbent clay, saw dust, floor drying agents, spill containment barriers, plastic sheeting, skimmer pumps, covered holding tanks, and fire extinguishers.

The Contractor shall make known to all construction personnel the locations of staging areas where spill response equipment and materials are stored, and have them readily accessible during construction. Contractors will comply with applicable environmental and safety laws and regulations and will ensure that a copy of this plan is available on site to all Construction Work Crew members.

In addition, periodic discussions between construction personnel and their supervisors must be held. These are conversations where problems in field operations are discussed and solved. This SPCC Plan, together with specific techniques, will be reviewed with the appropriate employees at a safety meeting before construction starts.

The contractor will provide, maintain, and make available the appropriate Safety Data Sheets for vehicle and equipment fuel, lubricating oil, and any other regulated or hazardous materials utilized for the Project.

The following sections describe spill prevention measures to be taken on Project locations.

2.1 PETROLEUM AND HAZARDOUS LIQUID STORAGE, REFUELING, AND EQUIPMENT MAINTENANCE

2.1.1 Staging Areas and Facility Sites:

- Contractors will construct temporary liners and seamless impermeable berms, or other appropriate containment, around aboveground storage containers so that liquids will be contained and collected in specified areas isolated from waterbodies in the event of a leak or spill. Storage containers will not be placed in areas subject to periodic flooding and washout.

- Contractors will visually inspect aboveground storage containers for leaks and spills frequently and whenever containers are refilled.

- Secondary containment structures must provide a containment volume equal to a minimum of 110 percent of the maximum storage volume of the largest storage container in the containment structure.

- Secondary containment structures must be constructed so that no outlet is provided and any spill will be contained within the containment structure. Accumulated rainwater may be removed if authorized by an EI. Accumulated water with a visible sheen will be collected for proper storage, transport and disposal.

- Contractors will remove all secondary containment structures at the conclusion of the Project. Contractors also will be responsible for returning any storage impoundment areas to original contours and appearance upon completion of the Project.

- Fuels and lubricants will be stored only at designated staging areas and in appropriate service vehicles. The storage areas will be located at least 100 feet away from edges of wetlands and waterbodies, at least 100 feet away from

designated municipal watershed areas, at least 200 feet away from private water supply wells, and at least 400 feet away from municipal water-supply wells unless a larger buffer is required by regulatory agencies.

- Storage containers will display labels that identify the contents of the container and whether the contents are hazardous. Contractors will maintain and provide to WBI Energy, when requested, copies of all Safety Data Sheets.

- Contractors will conduct routine equipment maintenance such as oil changes in staging areas, or as necessary in additional temporary workspace, and will dispose of waste oil in an appropriate manner (e.g. the Contractors will collect the waste oil in labeled, sealed containers and transport the waste oil to a recycling facility).

- Contractors will correct visible leaks in storage containers as soon as possible. Leaks outside of secondary containment, regardless of volume, will be reported to an EI.

- All fuel nozzles will be equipped with functional automatic shut-off valves.

- The drivers of tank trucks will be responsible for spill prevention and secondary containment during loading and unloading operations. Procedures for loading and unloading tank trucks will meet the minimum requirements established by applicable regulations. Drivers will observe and control the fueling operations at all times to prevent overfilling. Contractors will be responsible for training drivers of tank trucks to comply with these provisions.

- Prior to departure of any tank truck, all outlets of the vehicle will be closely examined by the driver for leakage and tightened, adjusted, or replaced, as necessary, to prevent liquid leakage while in transit. Contractors will be responsible for training drivers of tank trucks to comply with these provisions.

2.1.2 Project Right-of-Way

- All machinery will arrive on the right-of-way in a clean, washed condition, and free of fluid leaks.

- Contractors will wash, refuel, and service machinery at locations well away from any wetlands and waterbodies to prevent petroleum or chemical substances from entering surface waters.

- Overnight parking of equipment, as well as refueling and lubricating of construction equipment, will be restricted to upland areas at least 100 feet away from stream channels and wetlands, at least 200 feet from private water-supply wells, and at least 400 feet from municipal water-supply wells. Where this is not possible, and where an EI finds in advance no reasonable alternative, the equipment will be fueled by designated personnel with specific training in refueling, spill containment, and cleanup, under the supervision of an EI. Prior to refueling, appropriate steps will be taken (including deployment of secondary containment structures) to prevent spills and provide for prompt cleanup in the event of a spill.

- Fuel trucks transporting fuels to construction areas will only travel on approved access roads.

- Contractors will keep a spill kit on site in case of machinery leaks or spills.

2.1.3 Restricted Refueling Areas

Restricted refueling areas include areas where the appropriate buffer (e.g., 100 feet from a wetland or waterbody) cannot be maintained. All restricted refueling areas will be identified in the field with flagging or signs. A site-specific plan and written approval from an EI will be required to refuel in restricted areas.

- Approval must be received from an EI and, where necessary, appropriate regulatory permits must be obtained, prior to refueling in restricted refueling areas.

- In large wetlands where no upland site is available for refueling, auxiliary fuel tanks may be mounted to equipment to minimize the need for refueling.

- Trained personnel must be available for refueling, and an EI must be present unless a case-specific exemption is obtained in writing from WBI Energy's Designated Representative.

- Equipment such as large, stationary pumps will be fitted with auxiliary tanks as appropriate. The auxiliary tanks will be placed within secondary containment which provides for a containment volume equal to a minimum of 110 percent of the volume of the largest tank in the containment structure.

- Refueling within restricted refueling areas will take place only in areas designated by an EI. Fuel trucks with a capacity in excess of 300 gallons will not be allowed within a restricted refueling area unless adequate secondary containment is provided.

- Refueling of dewatering pumps, generators, and other small, portable equipment will be performed using approved containers with a maximum volume of 5 gallons.

- Fuel trucks will be prohibited from traveling on temporary equipment bridges at stream crossings. An EI may waive this restriction on a site-specific basis if a reasonable refueling option is not available. Such case-specific exemptions must be approved in writing by WBI Energy's Designated Representative.

2.2 SPILL RESPONSE EQUIPMENT

2.2.1 Staging Areas and Facility Sites

- Contractors will stock a sufficient supply of sorbent and barrier materials at construction staging areas to allow the rapid containment and recovery of spilled material. Sorbent and barrier materials will also be used to contain runoff from spill areas.

- Shovels and labeled drums will be kept at each of the individual staging areas. If small quantities of soil become contaminated within the staging area, they will be collected and placed in the drums. Large quantities of contaminated soil will be collected using heavy equipment and will be stored in drums, lined bermed areas, or other suitable containment, prior to disposal. The Contractors will dispose of all contaminated soil in accordance with applicable state and federal regulations.

2.2.2 Project Right-of-Way

- Each construction crew must have adequate absorbent materials and containment booms on hand to enable the rapid and complete cleanup of spills, as well as sufficient tools and materials to stop leaks.

- Contractors must maintain spill kits containing a sufficient quantity of absorbent and barrier materials to adequately contain and recover foreseeable spills. These kits may include, but are not limited to, absorbent pads, straw bales, absorbent clay, saw dust, floor drying agents, spill containment barriers, plastic sheeting, skimmer pumps, and drums. The equipment will be located near fuel storage areas and other locations as necessary to be readily available in the event of a spill.

- All fuel, and where possible, service trucks, will carry adequate spill response materials. Spill response materials present on trucks should consist of absorbent pads, absorbent material, plastic bags, and a shovel.

- The Spill Coordinator will inform an EI, and all Contractor personnel of the location of spill control equipment and materials, and have them readily accessible while construction activities are occurring.

2.3 CONCRETE COATING

Concrete coating activities will not be performed within 100 feet of a wetland or waterbody unless the location is an existing industrial site designated for such use.

3.0 STORAGE, CONTAINMENT AND FACILITY TRANSFER

All chemical storage containers, tanks, or barrels will be made of compatible materials with the appropriate temperature and pressure rating, overpressure protection, valving, and equalization lines necessary to comply with the appropriate state and federal regulations regarding storage of regulated substances. All chemicals, regardless of container size, will be stored in secondary containment or designated storage areas when not actively in use.

Fuel valves used for the final control of flow shall be of the self-closing type and shall be manually held open except were automatic means are provided for shutting off the flow when the vehicle is full.

Contaminated liquids inside containment areas will not be allowed to be drained outside the containment structures onto the ground or into any open water course. These liquids will be pumped or wiped out of containment structures and disposed of appropriately.

4.0 SPILL RESPONSE

Any employee who detects a spill incident while it is occurring should take the necessary measures to stop the flow but only if that employee has been trained to do so. If the employee is unprepared to effectively control the spill, caution and good judgment should be used as to personal safety until a cleanup crew arrives. Immediate containment by the discovering person can reduce the extent of the spill damage.

4.1 FIRST PRIORITIES

The first priorities after discovering a spill are to protect the safety of personnel and the public, minimize damage to the environment, and control costs associated with cleanup and reclamation. Actions to be taken immediately following a spill include the following:

1. Assess the safety of the situation (including the surrounding public).
2. Sources of ignition will be removed from the area, **if safe to do so**.
3. The source of the spill will be shut off, **if safe to do so**.
4. Efforts to contain the spill immediately will be initiated, **if safe to do so**.

Cleanup activities will be initiated as soon as possible after the spill is contained using properly trained and protected personnel with adequate spill cleanup materials and equipment.

5.0 SPILL REPORTING

All spills will be reported immediately to the Spill Coordinator who will in turn work with an EI and WBI Energy's Designated Representative to address and report the spill as necessary. The Spill Coordinator will record at a minimum the following information (found on the Spill Report Form in appendix A):

1. Date, time, and location of the spill.
2. Type of material spilled.
3. Amount of material spilled.
4. Extent of spill area.
5. Whether the material has reached or has the potential to reach a waterbody.
6. Status of spill containment and cleanup.
7. Circumstances leading up to the spill.

WBI Energy's Designated Representative will report the spill to the appropriate regulatory agencies if the spill meets or exceeds a reportable threshold. Appropriate agencies include, but may not be limited to, the following:

1. North Dakota Department of Health at 1-701-328-5210 for non-emergencies or North Dakota Department of Emergency Services at 1-800-472-2121 (24 hour hotline) for emergencies. The North Dakota Department of Health also requires completion of an online "General Environmental Incident" form available at http://www.ndhealth.gov/ehs/eir/eirform.htm for any spill of any volume.

2. National Spill Response Center (Washington D.C.) at 1-800-424-8802 (24 hours).

3. U.S. Army Corp of Engineers – Jeremy Thury (701-654-7761) and Reece Nelson (402-995-2505) for any spills occurring on U.S. Army Corp of Engineers owned land.

4. U.S. Forest Service Little Missouri National Grasslands– McKenzie Ranger District (701-842-8500) Cale Bickerdyke or Kim Grotte for any spills occurring on U.S Forest Service owned land.

Contractors are responsible for assisting WBI Energy with preparing follow-up written incident reports to regulatory agencies upon request and with accommodating any inspections performed by regulatory agencies.

WBI Energy's internal Spill Report Form will be completed by the Spill Coordinator and provided to WBI Energy's Designated Representative as soon as possible but no later than the end of the day on the day the spill event occurred so agencies can be notified in a timely manner and pertinent information is available for reporting. State and federal agencies must be notified within 24 hours of a reportable spill event. Field personnel will report the spill to the state and federal agencies only if the WBI Energy's Designated Representative is unavailable to do so. All Spill Report Forms and other reporting documentation will be kept on file by WBI Energy's Designated Representative.

6.0 SPILL CONTROL AND CLEANUP

Spill control should only be done by employees trained and prepared to effectively control the spill. Good judgment should be made by employees as to their personal role in the containment actions; however, prompt action can often prevent extensive spill damage. Employees engaged in spill control will use the proper precautions and safety equipment as specified in the Safety Data Sheet(s). The Designated Representative and EI will devise a cleanup plan, as necessary, based on location, quantity, and type of substance spilled.

Upon learning of the spill, the Spill Coordinator will implement the measures in the following sections.

6.1 LAND SPILL

- As necessary, berms will be constructed with available equipment to physically contain the spill and sorbent materials will be applied to the spill area. Traffic on contaminated soils will be minimized.

- Contaminated soils and vegetation will be removed and disposed of at a licensed waste disposal facility.

- Waste materials from the spill will be disposed of according to state and federal regulatory requirements.

- The following information will be provided to the EI and the WBI Energy Designated Representative:

    - The amount of spilled material that was recovered during cleanup.

- Proposed reclamation of remaining contaminated areas.
- Storage method for the contaminated waste material before transport and disposal.
- Transport and disposal documentation for the contaminated waste material.

6.2 WETLAND AND WATERBODY SPILL

Regardless of size, the following conditions apply if a spill occurs near or into a stream, wetland, or an open surface water source.

- For spills in standing water, floating booms, skimmer pumps, and holding tanks shall be used as appropriate by the contractor to recover and contain released materials on the surface of the water.
- For a spill threatening a waterbody, berms and/or trenches will be constructed to contain the spill before it reaches the waterbody. Deployment of booms, sorbent materials, and skimmers may be necessary if the spill reaches the water. The spilled product will be collected and the affected area cleaned up in accordance with appropriate state or federal regulations.
- Contaminated soils in wetlands must be excavated from the wetland. The soils must be placed on and covered by plastic sheeting in approved containment areas a minimum of 100 feet away from wetlands or waterbodies. Contaminated soil will be disposed of as soon as possible in accordance with appropriate state or federal regulations.

All cleanup activities will be conducted according to this SPCC Plan. Personnel involved in cleanup activities will meet the minimum requirements for hazardous materials training and will use approved Occupational Safety and Health Administration safety equipment.

WBI Energy's contractor responsible for the HDD has also developed an activity-specific SPCC plan for the HDD of Lake Sakakawea. In event of a spill or inadvertent release of drilling fluid during the HDD crossing of Lake Sakakawea, the SPCC plan included as Appendix B will be implemented.

NORTH BAKKEN EXPANSION PROJECT
Spill Prevention, Control, and Countermeasure Plan

APPENDIX A
Spill Report Form

WBI Energy Transmission, Inc. Spill Report Form		
Date of Spill:	Date of Spill Discovery:	
Time of Spill:	Time of Spill Discovery:	
Name and Title of Discoverer:		
Type of material spilled and manufacturer's name:		
Legal description of spill location to the quarter section:		
Directions to nearest community:		
Estimated volume of spill (gallons):		
Weather conditions:		
Topography and surface conditions of spill site:		
Spill medium (pavement, sandy soil, water, etc.)		
Proximity of spill to surface waters:		
Did the spill reach a waterbody?	Yes	No
If so, was a sheen present?	Yes	No
Describe the causes and circumstances of the spill:		
Describe the extent of observed contamination, both horizontal and vertical (i.e., spill-stained soil in a 5-foot radius to a depth of 1 inch):		
Describe immediate spill control and/or cleanup methods used and implementation schedule:		
Current status of cleanup actions:		
Name and Company of:		
Construction Superintendent:		
Spill Coordinator:		
Environmental Inspector:		
Person who reported spill:		
Form completed by:	Date:	

NORTH BAKKEN EXPANSION PROJECT
Spill Prevention, Control, and Countermeasure Plan

APPENDIX B
Michels SPCC Plan

SPILL PREVENTION/CONTROL/ COUNTERMEASURE PLAN (SPCC)

For HDD - Crossings

A DIVISION OF MICHELS CORPORATION

DIRECTIONAL DRILLED CROSSINGS

Revision 1
August 4, 2020

MICHELS DIRECTIONAL CROSSINGS
A DIVISION OF MICHELS CORPORATION

SPILL PREVENTION CONTROL AND COUNTERMEASURE PLAN (SPCC)

HORIZONTAL DIRECTIONAL DRILLING

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I. Introduction

This Spill Prevention Control and Countermeasure Plans (SPCC) have been developed by Michels Corporation (Michels) to serve as a guideline for horizontal directional drilling (HDD) operations. This plan is intended to ensure that the equipment utilized to perform the work and the fuel, oil, and lubricant products used in the day to day operation of the equipment will have no long-term adverse environmental impact on the staging areas required for construction. The guidelines contained in this plan will be implemented by field personnel to prevent accidental releases of hazardous material to the environment and to outline measures taken should an accidental release occur. The drilling project manager for the project is experienced in these matters and is typically the designated Spill Coordinator for Michels.

This SPCC plan was developed using Federal Energy Regulatory Commission (FERC) guidelines for construction activities along a pipeline right-of-way. This plan is intended to comply with all applicable requirements of FERC and local State and County authorities. Since HDD operations are generally confined to two distinct locations, the rig (entry) side and pipe (exit) side, this SPCC plan addresses construction operations at these specific locations only for hazardous materials. This SPCC plan consists of three sections:

- Preventative measures to be taken prior to initiating construction with hazardous materials;
- Preventative procedures to be followed while using hazardous materials during construction;
- Procedures to be implemented should an accidental spill of hazardous material occur;

II. Pre-Construction Hazardous Material Spill Prevention

Prior to construction, all Michels' personnel who will be performing work on site will have attended a FERC-approved environmental training program within the last year. This training program will serve to indoctrinate the personnel and make them aware of the pollution control laws, rules, and regulations applicable to the pipeline right-of-ways. Michels' personnel are highly experienced with the equipment to be used in HDD operations and have worked on numerous FERC governed projects in the past. However all personnel will be refreshed by the project manager and drill superintendent in the operation and maintenance of construction equipment to prevent the accidental discharge or spill of fuel, oil, or lubricants.

Through the environmental training program and the project manager's guidance along with knowledge obtained from past experience, all Michels' personnel will be thoroughly educated on the following topics:

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- Precautionary measures to prevent spills;
- Potential sources of spills, such as equipment failure or malfunction and re-fueling procedures;
- Standard operating procedures in case of a spill, including applicable notification requirements;
- Equipment, Materials, and Supplies available for clean-up of a spill;
- Review of known spill events, if any.

Prior to mobilizing equipment to the proposed alignment R.O.W., Michels will thoroughly inspect and if necessary repair or replace equipment components that could potentially leak hazardous material. The equipment will be cleaned of any debris or material observed to be hazardous. All hazardous material storage containers and secondary containment devices will be inspected and if necessary repaired or replaced.

The spill containment and clean-up materials used by Michels will be inventoried and if necessary re-stocked prior to initiating construction operations. At a minimum, the following spill containment and clean-up materials will be located in a central location at each side of the HDD crossings where equipment is in use or hazardous materials are stored in sufficient quantities to contain and clean-up a spill or release should one occur:

- Spill containment kits typically consisting of the following items
  - 1 x 55 gal poly drum
  - 50 x 18” x 18” absorbent pads
  - 8 x 3” x 4’ absorbent socks
  - 6 x 18” x 18” absorbent pillows
  - 3 x 5” x 10’ absorbent booms
  - 4 Disposable plastic bags with ties
  - 4 pair nitrile gloves
- Plastic sheeting
- Floor Dry absorbent material (50 pound bag-typical)
- Personal protective equipment (i.e. gloves and safety glasses)
- Replacement parts and equipment for repair of tanks, hoses, nozzles, etc.
- Equipment and tools to divert spilled fluids and create earthen barriers

III. HDD Construction Operations Hazardous Material Spill Prevention

Once construction activities for the HDD are underway, hazardous material spill prevention will be a continuous element of the operations. During equipment set up, potential sources of hazardous material releases, i.e. fuel tanks, hydraulic oil tanks and hoses, antifreeze tanks, and lubricant storage bins will be located as far away as practicably possible from streams, wetlands, and drainage ways. If necessary, and if practicable, temporary barriers may be constructed or placed between the potential sources of spills and areas identified as extremely sensitive to accidental

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spills. Spill containment and clean-up materials/kits will be located in a central location at each side of the drill site location where equipment is in operation or hazardous materials are stored and all personnel will be made aware of the location.

Secondary containment devices will be placed to enclose major sources of potential hazardous spill locations (i.e. fuel storage tanks and hazardous materials storage areas). A site layout drawing for entry locations and exit locations showing the placement of significant sources of hazardous material releases and secondary containment measures are attached in **Appendix A** of this plan. The exact location of the equipment will vary to address specific site conditions after the temporary work space has been prepared for equipment set-up. Access to the sites will be limited by the Project Manager to only authorized personnel and visitors.

During construction, spill refresher briefings will be scheduled quarterly and conducted by Michels. The briefings will refresh Michels' personnel on the topics covered during the pre-construction environmental training as well as review operations to date, including any accidental spills that may have occurred and measures taken for prevention of future spills.

Michels will store, handle and transfer hazardous materials used during HDD operations in a manner to prevent accidental releases or spills of these materials. **Table-1** attached in **Appendix-A** to this plan summarizes the hazardous materials, combined expected volumes, and storage methods for both the entry and exit locations. The Material Safety Data Sheets (MSDS) for every product used by Michels are maintained on file in the drilling survey trailer on site should they be required to assess the hazard potential of a spill. The list of primary hazardous materials (petroleum-based products) to be used by Michels over the course of each HDD crossing is as follows:

- Gasoline
- Diesel Fuel
- Hydraulic Oil
- Lubricants
- Penetrating Oils
- Antifreeze

Michels' personnel will follow specific guidelines set forth in this plan during operation and maintenance of equipment and vehicles used in support of the HDD operations. All waste oil or fuel collected during routine maintenance of the equipment will be contained and disposed of in accordance with state and federal requirements.

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IV. Potential Sources of Hazardous Spill-Preventative Measures to be Implemented

For day to day operations, Michels' personnel will follow these guidelines to prevent the accidental release or spill of hazardous materials:

Potential Source of Hazardous Spill	Preventative Measures To be Implemented
Fuel stored in a storage tank	• Except as specified in **Attachment-A** of Appendix-B, locate storage tank at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. • Install secondary containment devices around tank in excess of 150% of the maximum volume to be stored. • Inspect tank and secondary containment daily and before filling, implement corrective action upon discovery of deterioration that could cause a spill or result in a leak. Record inspection results weekly on log attached in the appendix to this plan. • Remove any precipitation found within the secondary containment. Prior to removing the precipitation, inspect for film, sheen, discoloration, sludge, emulsion or tarry residue, if present then collect the liquid for disposal. Do not discharge to land or surface waters. • Plug or close all tank openings when not in use. • Maintain sufficient quantities of spill control and clean-up materials in a central location near the storage tank, inspect supply daily. • Provide security measures to protect against vandalism of stored materials
Liquid material stored in a container	• Except as specified in **Attachment-A** of Appendix-B, store container at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. • If practicable and if room allows, store containers in a central location within a common secondary containment device. All significant container storage (i.e. greater than 5 gallon) will have secondary containment in excess of 150% of the maximum volume proposed to be stored. • Use small containers which are in good condition (maximum 55 gallon drum). • Take measures to protect the containers from the elements or physical damage. • Inspect containers daily, replace immediately if damaged or leaking. Record inspection results weekly on log attached in **Attachment-B** of Appendix-B to this plan • Close containers when not in use. • Maintain sufficient quantities of spill control and clean-up materials in a central location where the containers are regularly used, inspect supply daily. • Provide security measures to protect against vandalism of stored materials

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Liquid material transferred from a storage tank or container to vehicles or equipment	• Except as specified in **Attachment-A** of Appendix-B**,** transfer materials at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. Exercise extreme caution for transfers in areas where set-back distances from sensitive areas cannot be met such as placement of absorbent pads or drip pans beneath transfer points, creating temporary earthen berms, or other similar precautionary spill measures. • Transfer during daylight hours or where lighting is adequate to illuminate the area. • Monitor transfer operations at all times. • Maintain sufficient quantities of spill control and clean-up materials in a central location where transfers regularly occur, inspect supply daily. • Provide security measures to protect against vandalism of stored materials

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Liquid material used in vehicles and equipment	• Except as specified in **Attachment-A** of Appendix-B, park at least 100 feet from wetlands or surface waters, at least 200 feet from private water supplies, and at least 400 feet from public water supplies. • Inspect daily for leaks or signs of deterioration that could result in a leak. • Repair or replace defective tanks, hoses, fittings, etc. • Maintain sufficient quantities of spill control and clean-up materials in a central location where equipment or vehicles are in use, inspect supply daily. • Provide security measures to protect against vandalism of stored materials

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Liquid material transferred from tank vehicle to vehicles & equipment	• Except as specified in **Attachment A** of Appendix-B, tank vehicle used during re-fueling operations shall be specifically designed for supplying fuel to vehicle or equipment tanks and will comply with the requirements of NFPA 385 and other applicable state and federal requirements. • Tank vehicle and its equipment shall be maintained in good repair. • Drivers to be thoroughly trained in the proper method and operation of tank vehicles and in acceptable unloading procedures. • The driver or operator will not leave vehicle unattended during re-fueling operations • All engines to be shut off and operators not on the equipment during refueling operations. • Smoking is to be forbidden on or near any vehicle involved in re-fueling operations. Extreme precaution shall be exercised to prevent people in the vicinity from smoking, lighting matches, or carrying any flame or lighted device. Signs prohibiting smoking or open flames to be prominently displayed in open view on the tank vehicle. • Re-fueling procedures will not be initiated until precautions have been taken to prevent the motion of vehicles involved. Parking brakes to be utilized if available. • Length of refueling hose is typically limited to 50-feet from the hose reel. Tank vehicle to be positioned with respect to vehicles being fueled in order to prevent unwanted traffic between the tank vehicle and vehicle/equipment being fueled. • Each vehicle must contain one portable fire extinguisher that has a minimum rating of 4A, or 4-B,C. Ratings to be in accordance with NFPA-10. Signage on vehicles shall clearly indicate location of fire extinguisher. • Fueling/Re-fueling operations should typically take place during daylight hours. Nighttime fueling operations conducted in adequately lighted areas. • Documentation of training to be made available upon request. • Provide security measures to protect against vandalism of stored materials

Should these guidelines prove to be inadequate to prevent the accidental release or spill of hazardous material, they will be revised and implemented as required to ensure that every possible preventative effort is being taken. All personnel will be made aware of any such revisions at the time of the revision and at the environmental refresher meetings.

V. HDD Construction Operations Hazardous Material Spill Procedures

A spill is an unintentional release of hazardous material to the environment. In the unlikely event that an inadvertent spill of a hazardous material occurs the following steps will be followed at a minimum:

- Step 1 - Containment: Assess the situation prior to attempting to control the spill. Secure the spill scene and attempt to identify and stop the source of spill and

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contain at source. Limit access to the site in order to prevent/limit personal and/or property damage. Responders must have knowledge of the spilled material and immediately utilize all available resources (i.e. equipment, personnel, and materials), to contain spill. If adequate resources are not available, expedite mobilization of additional resources from other construction activities as required to fully contain the spill. If the spill cannot be adequately handled by additional resources, Michels will arrange for an approved spill response contractor to mobilize to the site and contain, clean up, and perform required sampling and disposal of spilled materials and residual contaminated debris.

- Step 2 - Remediation: Properly trained personnel shall clean up hazardous material immediately after spill is contained to prevent further migration of hazardous materials into the environment. Responders should consult with proper governmental resource agencies as required. In no case shall containment equipment be used to permanently store contaminated material. Containerize in DOT-approved containers, label, and remove all contaminated material from the construction area and dispose of material in accordance with applicable regulatory guidelines (i.e. transport to hazardous waste disposal facility by licensed waste hauler). The Owner will be provided with proper documentation showing that material was disposed of in a proper manner.

- Step 3 - Notification: Reporting requirements will depend on the quantity of spill. A spill constituting less than a significant spill event will be reported to Owner and/or Owner's representative Chief Inspector **(CI)-_____: ( ) - (office), or ( ) - (cell).**

  Significant spills are defined as: any amount of petroleum, oils, or lubricants discharged to a receiving stream that causes a film, sheen, or discoloration of surface water or adjoining shoreline; or any reportable quantity of hazardous material as defined by 40CFR320. If a significant spill should take place, Michels' Project Manager (PM), will notify the Prime Contractors' Project Manager and Owner's representative Chief Inspector **(CI)-_____( ) - (office), or ( ) - (cell)** of the spill as soon as he has confirmed that the spill has been completely contained. Michels' PM will assist the Owner's representative in submitting the regulatory-required information for hazardous spill notification in accordance with Governing Agency procedures. At the very minimum the project superintendent will provide the CI with the information required on the "Spill Report" included as **Attachment C** in Appendix C.

- Step 4 – Michels' Project Manager will be responsible for any applicable agency reporting requirements. The notification requirements for petroleum and hazardous materials spills are as follows:

  - Federal Contacts:
    National Spill Response Center 1-800-424-8802

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- State Contacts:
  State Department of Environmental
  Quality - Spill Notification ( ) - (Business Hours)
  ( ) - (After Hours)

- Local Contacts:
  Local Fire Department _____

- A completed Petroleum and Hazardous Materials Spill Report must be submitted to OWNER & Governmental Agencies within 48 hours.
- Prior to continuing work, Michels will determine the cause of the spill and implement measures to ensure that further spills will not occur.

A More detailed list of Local Emergency Response Personnel and Hospital Location will be attached and filled out as **Attachment D** in Appendix C.

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APPENDIX-A

TABLE I

HAZARDOUS SUBSTANCE INVENTORY

Material	Quantity (gallons)	Storage Location	Reportable Quantity (include reference)
Oil/Fuel:			
Unleaded Gasoline	**10 Gallons**	**5 Gallon DOT-Approved Re-fill able Cans - Storage Trailer**	
	80 Gallons	**Fuel Tank in Bed of Pick-Up Truck**	
Diesel Fuel	**120 Gallons**	**Fuel Tank in Bed of Pick-Up Truck**	
	500 Gallons	**Fuel Tank w/Secondary Containment on Site in excess of 150% of maximum volume**	
Motor Oil	**1 or 5 Gallons**	**Reinforced Plastic Container - Storage Trailer**	
Hydraulic Oil	**110-Gallons**	**Two 55-gallon drums w/Secondary Containment on Site in excess of 150% of maximum volume**	
Commercial Chemicals:			
Ethylene Glycol	**40-Gallons**	**1 or 5 Gallon Reinforced Plastic Containers - Storage Trailer**	
Hazardous Wastes:			

APPENDIX-B

Attachment A

The setbacks specified for refueling, fuel storage, and parking of equipment may not be practicable for certain construction activities, including horizontal directional drilling. Exceptions to the setback requirements may be allowed for:

- Areas where removing equipment from a wetland for servicing or overnight parking would increase adverse impacts to the wetland and/or result in significant construction delays;
- Construction sites where moving equipment to refueling stations from pre-fabricated equipment pads is impracticable or where there is a natural barrier from the water-body or wetland (i.e., dike, road or railroad);
- Locations where the water-body or wetland is located adjacent to a road crossing (from which the equipment can be serviced);
- Refueling and fuel storage for immobile equipment including, but not limited to, bending and boring machines, air compressors, padding machines, and hydro-test fill pumps.

ATTACHMENT B
WEEKLY HAZARDOUS MATERIALS/WASTE INSPECTION LOG

For each item listed below, Contractor will indicate whether existing conditions are acceptable (A) or unacceptable (U). Resolution of all unacceptable conditions must be documented. Contractor will inspect all storage facilities on a regular basis, but not less than weekly. Contractor will keep records of all inspections on file. Contractor will provide a coy of the completed form to the Chief Inspector and Environmental Inspector on a weekly basis.

I. STORAGE AREAS FOR FUELS, LUBRICANTS AND CHEMICALS

General

A/U

_____ Construction yard or storage areas secured

_____ National Fire Protection Association symbol posted in storage area or at yard entrance

_____ Storage areas properly prepared and signed

_____ Material Safety Data Sheets available

_____ Hazardous Materials Management Plan/Spill Prevention and Countermeasure Plan available

Hazardous Materials Management

A/U

_____ No evidence of spilled or leaking materials

_____ Incompatible materials separated

_____ All containers labeled properly

_____ All containers securely closed

_____ All containers upright

_____ No evidence of container bulging, damage, rust or corrosion

Secondary Containment Areas

A/U

_____ Containment berm intact and capable of holding 110% of material stored plus precipitation

_____ Lining intact

_____ No materials overhanging berms

_____ No materials stored on berms

_____ No flammable materials used for berms

Compressed Gases

A/U

_____ Cylinders labeled with contents

_____ Cylinders secured from falling

_____ Oxygen stored at least 25 feet away from fuel

_____ Cylinders in bulk storage are separated from incompatible materials by fire barriers or by appropriate distance

II. HAZARDOUS WASTE MANAGEMENT

Waste Container Storage

A/U

_____ No evidence of spilled or leaking wastes

_____ Adequate secondary containment for all wastes

_____ Separate containers for each waste stream—no piles

_____ Waste area not adjacent to combustibles or compressed gases

_____ All containers securely closed

_____ Bungs secured tightly

_____ Open-top drum hoops secured

_____ All containers upright

_____ No evidence of container bulging, corrosion

_____ No severe container damage or rust

_____ Containers are compatible with waste (e.g. plastic liner for corrosives, metal liner for solvents)

_____ No smoking and general danger/warning signs posted

Waste Container Labeling

A/U

_____ Containers properly labeled

_____ Name, address and EPA ID number or ID Number of generator listed (Not required if Contractor is an exempt small quantity generator.)

_____ Accumulation start date listed

_____ Storage start date listed

_____ Chemical and physical composition of waste listed

_____ Hazardous property listed

Nonhazardous Waste Areas

A/U

_____ No litter in yard

_____ No hazardous wastes or used oil mixed with trash (e.g., contaminated soil, oily rags, diapers, or other oily materials)

_____ Empty oil and aerosol containers for disposal are completely emptied

III. EMERGENCY RESPONSE EQUIPMENT

A/U

_____ Shovels

_____ Absorbent materials (booms, pads, pillows, socks, “Speedy Dry”

_____ Personal protective equipment (goggles, gloves)

_____ Fire-fighting equipment

_____ First aid supplies (e.g. medical supplies, squeeze bottle eye wash)

_____ DOT-approved containers

_____ Plastic sheeting, bags and ties

_____ Communication equipment

_____ Bung wrench (non-sparking)

(Required for all unacceptable conditions)

IV. CORRECTIVE ACTIONS TAKEN

_____

_____

_____

_____

_____

_____

_____

_____

_____

Date: _____ **Contractor Name :** _____

Inspected by (Contractor’s Inspector): _____

Signature: _____

APPENDIX-C

ATTACHMENT C

Petroleum and Hazardous Material Spill Report

Date of spill: _____ Incident No: _____ Date of spill discovery: _____

Time of spill: _____ Time of spill recovery: _____

Location Name: _____ Spread: _____ County: _____

Section: _____ Township: _____ Range: _____

Name and Title of Discoverer: _____

Type of material spilled and product name: _____

Manufacturer's Name: _____

Legal description of spill location: _____

Directions from nearest community: _____

_____

_____

Estimated volume of spill: _____ Estimated material recovered: _____

Weather Conditions: _____

Topography and surface conditions of spill site: _____

Spill medium (pavement, sandy soil, water, etc.): _____

Proximity of spill to surface waters or wetland: _____

Did the spill reach a water body? _____ Yes _____ No

If so, was a sheen present? _____ Yes _____ No

Direction and time of travel (if in stream): _____

Responsible party (name, phone number): _____

Describe the causes and circumstances resulting in the spill: _____

_____

_____

Describe the extent of observed contamination, both horizontal and vertical (i.e., spill-stained soil in a 5'' radius to a depth of 1"):

_____

_____

Resources and installations that may be affected: _____

_____

_____

Potential impact on human health: _____

Describe immediate spill control and/or cleanup methods used and implementation schedule: _____

Current status of cleanup actions: _____

Name/Company/Address/Phone Number for the following:

Construction Superintendent: _____

OWNER
Representative: _____

Environmental Director: _____

Person Who Reported the Spill: _____

Environmental Inspector: _____

On-Scene Agency Coordinator (where applicable): _____

Form completed by: _____ Date: _____

The Contractor must complete this for any petroleum or hazardous material spill regardless of size, and submit the form to OWNER or OWNER's designated representative for construction observation within 48 hours of the occurrence.

ATTACHMENT D
LOCAL Emergency RESPONSE PERSONNEL-HOSPITAL LOCATION

The contractor should provide a listing by municipality of the local emergency response organizations near the HDD project site, and the name and phone number of a contact person for each. For example, list fire and police departments, emergency management organizations, etc. The contractor should update and complete this information as required for his/her work locations. Additions will be made by the Project Manager once they become available prior to drilling operations.

Local Emergency Contacts

- Federal Contacts:

National Spill Response Center	1-800-424-8802
US Army Corps of Engineers	(402) 995-2505 office (785) 213-1507 cell

- State Contacts:

North Dakota Department of Emergency Services	(701) 328-8100 (24 hr.) (800) 773-3259 (toll free) (800) 472-2121 (Div. State Radio Notification)
North Dakota Department of Health	(701) 328-5210 (24 hr.)
North Dakota Oil & Gas Division	(701) 328-8020

- Local Contacts:

Emergency Response -	
Emergency Response -	
Local Fire Department	911
Local Police Department	911

- Nearest Hospital:

North Drill Site: **Tioga Medical Center** - Hospital
810 Welo St N
Tioga, ND 58852
(701) 664-3305

South Drill Site: **McKenzie County Healthcare Systems, Inc.** - Hospital
709 4th Ave NE
Watford City, ND 58854
(701) 842-3000

Other Phone Numbers to be added to this form if necessary.

Attachment 2

Surface Use Plan of Operation

Attachment 5

Emergency Response Plan, Facility Response Plan, Geographical Response Plan

WBI ENERGY TRANSMISSION, INC.
North Bakken Expansion Project
Section 408 Application

Attachment 5
Emergency Response Plan, Facility Response Plan, and Geographical Response Plan

August 2020

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT
EMERGENCY RESPONSE PLAN, FACILITY RESPONSE PLAN, AND GEOGRAPHICAL RESPONSE PLAN

1.0 PROJECT DESCRIPTION

WBI Energy Transmission, Inc. (WBI Energy) proposes to construct and operate the North Bakken Expansion Project (or Project), which consists of an approximately 61.9-mile-long, new 24-inch-diameter natural gas pipeline from new facilities at WBI Energy's Tioga Compressor Station near Tioga, North Dakota, to a new compressor station (Elkhorn Creek Compressor Station) southeast of Watford City, North Dakota.

The Project also involves construction of approximately 0.3 mile of new 24-inch-diameter natural gas pipeline between the proposed Elkhorn Creek Compressor Station to a new interconnect with Northern Border Pipeline Company, approximately 20.4 miles of new 12-inch-diameter natural gas pipeline looping along WBI Energy's Line Section 25, approximately 9.4 miles of new 12-inch-diameter natural gas pipeline looping along WBI Energy's Line Section 30, approximately 0.5 mile of new 20-inch-diameter receipt lateral to the Tioga Compressor Station, and uprating of WBI Energy's Line Section 25. The Project includes additional horsepower at the Tioga Compressor Station; the installation of new and modifications to existing delivery, receipt and transfer stations along WBI Energy's pipeline routes; the replacement of small segments of pipeline facilities; and the installation of block valves, pig launcher/receiver stations and other associated appurtenances.

2.0 EMERGENCY REPONSE PLAN

WBI Energy will manage potential sources of gas releases by implementing WBI Energy's Gas System Operations and Maintenance Manual and Control Room Management Manual (CUI/PRIV – DO NOT RELEASE). These are Pipeline Hazardous Materials Safety Administration (PHMSA) approved manuals for the entire WBI Energy system. Copies of these manuals are provided as Appendix A and B in Attachment 6 of the Section 408 application. Once the Project becomes operational, these manuals will be updated to include the required notification procedures and points of contact for the U.S. Army Corps of Engineers.

3.0 FACILITY RESPONSE PLAN

As noted in section 2.0, WBI Energy prepares Operation and Maintenance Plans that include emergency response procedures according to and approved by the U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration. In addition, Per 40 CFR 112.20, the EPA Facility Response Planning Compliance Assistance Guide, the North Bakken Expansion Project is not an oil pipeline and does not trigger the need for a Facility Response Plan. Furthermore, the portion of the Project that will be installed below U.S. Army Corps of Engineers owned property and below Lake Sakakawea is a natural gas pipeline, and will not require storage or transport of oil.

4.0 GEOGRAPHICAL RESPONSE PLAN

Most natural gas used in the United States is delivered to consumers through approximately 319,400 miles of gathering and transmission pipelines, providing about 25 percent of the total energy consumption in the United States. Because of the critical role transmission

pipelines play in supplying a large portion of the country's energy needs, it is imperative that they are safe and reliable. Pipelines and related facilities are designed and maintained with strict adherence to Pipeline and Hazardous Materials Safety Administration regulations, which are intended to provide public safety and reliability and minimize the risk of system failure.

The natural gas transmission industry has an excellent record of public safety and reliability. Nevertheless, the transportation of natural gas by pipeline involves some risk to the public in the event of an accidental release of natural gas. The Project will transport natural gas that contains primarily methane, but also smaller amounts of ethane, propane, and higher hydrocarbon gases such as butane. This product is a colorless, practically odorless gas. If natural gas is breathed in high concentrations, oxygen deficiency can occur, resulting in serious injury or suffocation. Natural gas has an auto-ignition temperature of approximately 1,000 degrees Fahrenheit and is flammable at methane concentrations between 5 and 15 percent in air. These concentrations can be reached when natural gas is in a confined space, and could result in a hazard in the presence of an ignition source. Unconfined mixtures of natural gas and air become highly diluted and are not usually explosive. Lighter components of natural gas such as methane are buoyant at atmospheric temperatures and, if released, rise and disperse rapidly in air. Higher hydrocarbon components of natural gas such as propane are heavier than air and, although unlikely, may form a potentially flammable cloud near the ground until sufficiently dispersed in air.

The Pipeline and Hazardous Materials Safety Administration administers the national regulatory program to provide for the safe transportation of natural gas and other hazardous materials by pipeline. Safety regulations and other approaches to risk management provide for safety in the design, construction, testing, operation, and maintenance of pipeline facilities. These standards are specified in Title 49 of the Code of Federal Regulations (CFR) Part 192 (49 CFR 192).

WBI Energy is committed to protecting the safety of those living or working near its pipeline system and working proactively to keep its system operating safely and effectively. Accordingly, the Project will be designed, constructed, tested, operated, inspected, and maintained to meet or exceed the DOT's Minimum Federal Safety Standards specified in 49 CFR 192. These regulations are intended to ensure adequate protection of the public from natural gas pipeline facility accidents and failures; in addition, 49 CFR 192 specifies the minimum material, design, welding, construction, testing, protection from corrosion, operations, maintenance, and personnel qualifications for pipelines. Further, Subpart O requires each pipeline operator to have a detailed integrity management program. As a part of the integrity management program, high-resolution in-line inspection tools (i.e., smart pigs), pressure tests, or direct assessments are periodically performed on the line to assess the pipe for any features requiring remediation (e.g., corrosion, dents, gouges).

As the Project is not an oil pipeline, WBI Energy is not required to develop a Facility Response Plan per 49 CFR 194.101 and 194.103.3. As noted in section 2.0 above, WBI Energy will implement the company-wide Gas System Operations and Maintenance Manual and the Control Room Management Manual (CUI/PRIV – DO NOT RELEASE), which are PHMSA approved documents. Appropriate points of contact and procedures for notifications to the U.S. Army Corps of Engineers will be included in these manuals once the Project becomes operational. Copies of these manuals are included with Attachment 6 of the Section 408 application.

Attachment 6

Operation and Maintenance Plan

(CUI/PRIV - DO NOT RELEASE - WBI Energy's Gas System Operation and Maintenance Manual and Control Room Management Manual**)**

Attachment 7

Reclamation and Monitoring Plan

WBI ENERGY TRANSMISSION, INC.
North Bakken Expansion Project
Section 408 Application

Attachment 7
Reclamation and Monitoring Plan

August 2020

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT
RECLAMATION AND MONITORING PLAN

WBI Energy Transmission, Inc. (WBI Energy) proposes to construct and operate the North Bakken Expansion Project (or Project), which consists of an approximately 61.9-mile-long, new 24-inch-diameter natural gas pipeline from new facilities at WBI Energy's Tioga Compressor Station near Tioga, North Dakota, to a new compressor station (Elkhorn Creek Compressor Station) southeast of Watford City, North Dakota.

The Project also involves construction of approximately 0.3 mile of new 24-inch-diameter natural gas pipeline between the proposed Elkhorn Creek Compressor Station to a new interconnect with Northern Border Pipeline Company, approximately 20.4 miles of new 12-inch-diameter natural gas pipeline looping along WBI Energy's Line Section 25, approximately 9.4 miles of new 12-inch-diameter natural gas pipeline looping along WBI Energy's Line Section 30, approximately 0.5 mile of new 20-inch-diameter receipt lateral to the Tioga Compressor Station, and uprating of WBI Energy's Line Section 25. The Project includes additional horsepower at the Tioga Compressor Station; the installation of new and modifications to existing delivery, receipt and transfer stations along WBI Energy's pipeline routes; the replacement of small segments of pipeline facilities; and the installation of block valves, pig launcher/receiver stations and other associated appurtenances.

The Project will require crossing of the Lake Sakakawea Reservoir, which is managed by the U.S. Army Corps of Engineers (USACE), along with USACE-owned lands adjacent to Lake Sakakawea. WBI Energy proposes to install the natural gas pipeline under Lake Sakakawea and USACE lands using the horizontal directional drill (HDD) construction method, a trenchless method designed to avoid direct impacts to sensitive features. The HDD workspaces will be located adjacent to USACE-owned lands on the north side of the lake, and approximately 800 feet from USACE-owned lands on the south side of Lake Sakakawea. No surface impact to USACE lands is anticipated for this Project during installation and operation of the pipeline; all temporary surface impacts will be located outside of USACE lands. Access in the area of the proposed HDD will be along public and private roads.

WBI Energy has acquired Michels Corporation (Michels) to perform the horizontal direction drilling operations for installation of the pipeline beneath Lake Sakakawea. Two drilling rigs will be used (both on private land), located on either side of Lake Sakakawea. The drilling rigs will be installed on matting and minimal surface disturbance outside of the proposed drill box locations is anticipated to occur.

No excavation will occur on USACE lands and no tracked equipment is anticipated to be used on USACE lands. Based on the technical analysis completed to date, WBI Energy does not anticipate an inadvertent return of drilling fluid into Lake Sakakawea. In the unlikely event of an inadvertent return of drilling fluid within Lake Sakakawea, WBI Energy would implement emergency procedures outlined in Michels' Horizontal Direction Drilling Installation Plan filed as Attachment 1 of the Section 408 Application. Notifications would be made to the appropriate federal and state contacts within one hour of identification. Specialized crews would mobilize utilizing agreed upon routes from the Project workspace if the return is located on USACE owned property and deploy turbidity curtains (as appropriate) to contain the release to the smallest impact.

WBI Energy is requesting that the post-construction monitoring requirement be waived on USACE lands, assuming no inadvertent return occurs on USACE property. No surface improvements (e.g., fencing, recreation facilities) will be impacted by the proposed Project. No land disturbance occurring on USACE land is anticipated to occur, however in the unlikely event of an inadvertent return, any land disturbance occurring on USACE land will be restored and revegetated according to the FERC Plan and Procedures and additional requests beyond those outlined in the Plan and Procedures would be address in coordination with the USACE Garrison Project Office.

On lands impacted by typical pipeline construction (outside of the HDD path) WBI Energy will restore Project work areas to pre-construction conditions as required in the Federal Energy Regulatory Commission's (FERC) *Upland Erosion Control, Revegetation, and Maintenance Plan* (Plan) and *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures), which have been provided for reference as attachments to the Erosion and Sediment Control Plan included for the Project.

Attachment 8

Risk Assessment Plan

WBI ENERGY TRANSMISSION, INC.
North Bakken Expansion Project
Section 408 Application

Attachment 8
Risk Assessment Plan

August 2020

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT
RISK ASSESSMENT PLAN

1.0 PROJECT DESCRIPTION

WBI Energy Transmission, Inc. (WBI Energy) proposes to construct and operate the North Bakken Expansion Project (or Project), which consists of an approximately 61.9-mile-long, new 24-inch-diameter natural gas pipeline from new facilities at WBI Energy's Tioga Compressor Station near Tioga, North Dakota, to a new compressor station (Elkhorn Creek Compressor Station) southeast of Watford City, North Dakota.

The Project also involves construction of approximately 0.3 mile of new 24-inch-diameter natural gas pipeline between the proposed Elkhorn Creek Compressor Station to a new interconnect with Northern Border Pipeline Company, approximately 20.4 miles of new 12-inch-diameter natural gas pipeline looping along WBI Energy's Line Section 25, approximately 9.4 miles of new 12-inch-diameter natural gas pipeline looping along WBI Energy's Line Section 30, approximately 0.5 mile of new 20-inch-diameter receipt lateral to the Tioga Compressor Station, and uprating of WBI Energy's Line Section 25. The Project includes additional horsepower at the Tioga Compressor Station; the installation of new and modifications to existing delivery, receipt and transfer stations along WBI Energy's pipeline routes; the replacement of small segments of pipeline facilities; and the installation of block valves, pig launcher/receiver stations and other associated appurtenances.

The Project will require crossing of the Lake Sakakawea Reservoir, which is managed by the U.S. Army Corps of Engineers (USACE), along with USACE-owned lands adjacent to Lake Sakakawea. WBI Energy proposes to install the natural gas pipeline under Lake Sakakawea and USACE lands using the horizontal directional drill (HDD) construction method, a trenchless method designed to avoid direct impacts to sensitive features. The HDD workspaces will be located adjacent to USACE-owned lands on the north side of the lake, and approximately 800 feet from USACE-owned lands on the south side of Lake Sakakawea. No surface impact to USACE lands is anticipated for this Project during installation and operation of the pipeline; all temporary surface impacts will be located outside of USACE lands. Access in the area of the proposed HDD will be along public and private roads.

2.0 RISK ASSESSMENT OVERVIEW

WBI Energy and their contractors have prepared a HDD Design Report that addresses the engineering design for the HDD of Lake Sakakawea and evaluates the factor of safety for the HDD. The HDD Design Report is attached as Appendix A. The sections below provide additional information on the regulatory safety framework for natural gas pipelines and WBI Energy's operating and emergency response measures

2.1 NATURAL GAS TRANSMISSION PIPELINE SAFETY STANDARDS

Most natural gas used in the United States is delivered to consumers through approximately 319,400 miles of gathering and transmission pipelines, providing about 25 percent of the total energy consumption in the United States (U.S. Department of Transportation [DOT], Pipeline and Hazardous Materials Safety Administration [PHMSA], 2019a,b). Because of the critical role transmission pipelines play in supplying a large portion of the country's energy needs,

it is imperative that they are safe and reliable. Pipelines and related facilities are designed and maintained with strict adherence to PHMSA regulations, which are intended to provide public safety and reliability and minimize the risk of system failure.

The natural gas transmission industry has an excellent record of public safety and reliability. Nevertheless, the transportation of natural gas by pipeline involves some risk to the public in the event of an accidental release of natural gas. The Project will transport natural gas that contains primarily methane, but also smaller amounts of ethane, propane, and higher hydrocarbon gases such as butane. This product is a colorless, practically odorless gas. Project facilities will be odorized as appropriate per Title 49 of the CFR Part 192 (49 CFR 192) part 625. If natural gas is breathed in high concentrations, oxygen deficiency can occur, resulting in serious injury or suffocation. Natural gas has an auto-ignition temperature of approximately 1,000 degrees Fahrenheit and is flammable at methane concentrations between 5 and 15 percent in air. These concentrations can be reached when natural gas is in a confined space, and could result in a hazard in the presence of an ignition source. Unconfined mixtures of natural gas and air become highly diluted and are not usually explosive. Lighter components of natural gas such as methane are buoyant at atmospheric temperatures and, if released, rise and disperse rapidly in air. Higher hydrocarbon components of natural gas such as propane are heavier than air and, although unlikely, may form a potentially flammable cloud near the ground until sufficiently dispersed in air.

The PHMSA administers the national regulatory program to provide for the safe transportation of natural gas and other hazardous materials by pipeline. Safety regulations and other approaches to risk management provide for safety in the design, construction, testing, operation, and maintenance of pipeline facilities. These standards are specified in 49 CFR 192.

2.1.1 Pipeline Design, Construction, and Operating Standards

WBI Energy is committed to protecting the safety of those living or working near its pipeline system and working proactively to keep its system operating safely and effectively. Accordingly, the Project will be designed, constructed, tested, operated, inspected, and maintained to meet or exceed the DOT's Minimum Federal Safety Standards specified in 49 CFR 192. These regulations are intended to ensure adequate protection of the public from natural gas pipeline facility accidents and failures; in addition, 49 CFR 192 specifies the minimum material, design, welding, construction, testing, protection from corrosion, operations, maintenance, and personnel qualifications for pipelines. Further, Subpart O requires each pipeline operator to have a detailed integrity management program (IMP). As a part of the IMP, high-resolution in-line inspection tools (i.e., smart pigs), pressure tests, or direct assessments are periodically performed on the line to assess the pipe for any features requiring remediation (e.g., corrosion, dents, gouges).

DOT regulations in 49 CFR 192 define area classifications (called class location units) based on population density in the vicinity of a pipeline, and specify more rigorous safety requirements for populated areas. Each class location unit covers the area extending 220 yards on either side of the centerline of any continuous 1-mile length of pipeline. The proposed Project will fall under a Class 1 designation for its entire length, which is specified by any class location unit that has 10 or fewer buildings intended for human occupancy.

WBI Energy will monitor population changes in the vicinity of the pipeline over the life of the pipeline system. If an increase in population density adjacent to the right-of-way is detected,

WBI Energy will evaluate whether a change in class location is required and respond accordingly while meeting requirements of 49 CFR 192.

DOT regulations (49 CFR 192, Subpart O) additionally specify how pipeline operators must identify, prioritize, assess, evaluate, repair, and validate the integrity of natural gas transmission pipelines that could affect High Consequence Areas (HCAs) in the event of a leak or failure. The regulations require pipeline operators to develop and follow a written IMP that contains all the elements described in 49 CFR 192.911 and addresses the risks on each covered segment of the transmission pipeline. The criteria for an HCA in regards to a natural gas pipeline is the area within the potential impact circle containing 20 or more buildings intended for human occupancy, or any area within a potential impact circle that contains an identified site.[1]

No HCAs have been identified along the proposed Project route. However, the Project will be incorporated into WBI Energy's existing IMP and use the following criteria to determine HCA locations if conditions change along the pipeline system:

- identification of a site with 20 or more buildings intended for human occupancy; or
- location of an identified site.

On October 1, 2019, PHMSA issued a final rule amending the Federal Pipeline Safety Regulations in 49 CFR 191 and 192 to address integrity management requirements and improve the safety of onshore gas transmission lines (84 Federal Register 52180). The amendments, which will become effective July 1, 2020, focus on reconfirmation of MAOP for existing pipelines and the expansion of assessment requirements for pipelines in areas not designated as HCAs. The criteria for a moderate consequence area (MCA) as defined in the new amendments is an area that is within the potential impact circle of the pipeline that contains five or more buildings intended for human occupancy, or any portion of the paved surface including shoulders of a designated interstate, freeway, expressway, or any other principal arterial roadway with four or more lanes that lies within the potential impact circle. WBI Energy has identified one MCA that will exist where the new Tioga-Elkhorn Creek pipeline will cross 64th Street NW/Highway 2. WBI Energy will install additional launching and receiving facilities on both sides of this MCA that will allow for assessing the area.

2.2 OPERATING AND EMERGENCY RESPONSE MEASURES TO PROTECT THE PUBLIC

WBI Energy maintains operating policies and procedures that are periodically reviewed by the DOT. The policies provide specific directions in regular preventive maintenance and vigilant patrols of facilities, as well as procedures to follow in the event of an accident or natural catastrophe. All operating personnel are trained to perform operations and maintenance activities in accordance with these policies and procedures. Further, periodic training sessions are conducted for operations employees to review typical operating and emergency response procedures or to update employees on changes in procedures. This training includes safe operation of pipeline and aboveground facilities; hazardous material handling procedures;

[1] An identified site is defined as an outside area or open structure that is occupied by 20 or more persons on at least 50 days in any 12-month period; a building that is occupied by 20 or more persons on at least 5 days a week for any 10 weeks in any 12-month period; or a facility that is occupied by persons who are confined, are of impaired mobility, or would be difficult to evacuate.

firefighting; public liaison; and general operating procedures. The proposed Project will be operated and maintained in accordance with each of these policies and procedures.

2.2.1 Line Patrols

WBI Energy will inspect the pipelines periodically on foot, by all-terrain vehicle, or by other vehicle as required by applicable regulatory requirements to identify potential concerns that may affect the safety and operation of the pipelines. Pipeline markers and signs will be inspected and maintained or replaced, as necessary, to ensure that pipeline locations are clearly identified. Field personnel will advise the appropriate operations personnel of new construction along or near the pipeline system. Issues identified are investigated and appropriately remediated based on risk assessment.

2.2.2 Integrity Management

The proposed Project will be hydrostatically tested throughout its entire length before it is put into service. In this procedure, water or test media is introduced into the pipelines and pressurized to a specified level above the maximum allowable operating pressure for a specified amount of time. This test is used to confirm that the facility will operate safely at the designed pressure.

WBI Energy will also conduct a baseline assessment using in-line inspection of the proposed pipelines to check for damage, deformities, or other factors that could affect the integrity of the pipelines. If potential problems are identified, repairs will be made to the affected segment of pipe.

2.2.3 System Control

The proposed Project will be incorporated into WBI Energy's extensive Supervisory, Control, and Data Acquisition System (SCADA). The Gas Control Center is located at WBI Energy's headquarters in Bismarck, North Dakota, and is staffed 24 hours a day, 365 days a year. Gas controllers use SCADA to monitor the pipeline system, which includes a wide range of activities such as monitoring gas pressures and flows along the pipeline, physical startup and shutdown of compressor sites, and operating system valves along the pipeline.

Data acquisition occurs at many locations along the mainline, such as compressor stations, and meter stations. This data is transmitted to Gas Control through SCADA. If system parameters fall outside a predetermined range, an alarm is activated at Gas Control and corrective action is taken by the gas controller as needed. Local WBI Energy personnel are dispatched in response to these alarms if intervention is required outside Gas Control.

2.2.4 Corrosion and Cathodic Protection

49 CFR 192 Subpart I prescribes minimum requirements for the protection of metallic pipelines from external, internal, and atmospheric corrosion. Line pipe used to construct the Project will be externally coated at the pipe mill with fusion bond epoxy. A compatible coating will be applied in the field over circumferential welds and assembly piping will be coated with epoxy-based or tape style coatings.

In accordance with PHMSA requirements, WBI Energy will install cathodic protection systems at various points along the proposed pipelines to inhibit external corrosion of the

underground facilities. This cathodic protection system imparts a low-voltage current to the pipeline to offset natural soil corrosion potential should the coating become damaged over the life of the pipeline. WBI Energy will inspect the cathodic protection system at regular intervals to ensure proper operating conditions consistent with PHMSA requirements for corrosion mitigation.

2.2.5 Pipeline Markers

WBI Energy will install markers at road and railroad crossings, as well as other locations (e.g., fence lines and stream crossings) to indicate the pipeline location and convey emergency information in accordance with DOT safety requirements.

2.2.6 Emergency Preparedness and Procedures

DOT regulations prescribe minimum standards for operating and maintaining pipeline facilities, including a requirement to establish a written plan governing these activities. Additionally, pipeline operators are required to establish an emergency plan that identifies procedures to minimize hazards in a natural gas pipeline emergency to protect the public and the environment. Key elements of the plan include procedures for the following tasks:

- receiving, identifying, and classifying emergency events, gas leakage, fires, explosions, and natural disasters;
- establishing and maintaining communications with local fire, police, and public officials, and coordinating emergency response;
- emergency system shutdown and safe restoration of service;
- making personnel, equipment, tools, and materials available at the scene of an emergency; and
- protecting people first and then property, and making them safe from actual or potential hazards.

WBI Energy currently has an emergency response plan (ERP) for its existing pipeline system in accordance with DOT regulations. WBI Energy will update its ERP, as necessary, to incorporate the proposed Project. The ERP will be made available prior to and during construction and will contain the appropriate emergency contacts (e.g., names and telephone numbers).

2.2.7 Liaison with Local Authorities

The DOT requires that pipeline operators establish and maintain liaison with local fire, police, and other emergency responders to plan for and coordinate emergency response efforts in the event of an incident during construction or operation of the proposed facilities. Each operator must also establish a continuing education program to enable customers, the public, government officials, and those engaged in excavation activities to recognize a gas pipeline emergency and report it to the appropriate public officials. The proposed Project is located within WBI Energy's existing operating counties. As such, WBI Energy will continue to work with the local public officials and emergency responders, and provide appropriate training to responders.

2.2.8 Public Awareness

WBI Energy's public awareness program for its existing pipeline system provides information to the affected public, emergency officials, and public officials, as well as excavators. The messaging includes but is not limited to:

- pipeline purpose and reliability;
- awareness of hazards and prevention measures undertaken;
- emergency preparedness communications;
- damage prevention awareness;
- one-call requirements;
- leak recognition and response;
- pipeline location and operator information;
- National Pipeline Mapping System information; and
- how to get additional information.

WBI Energy will incorporate the Project into its public awareness program.

2.2.9 Damage Prevention

WBI Energy is a member of "One Call" and related pre-excavation notification organizations in the states where it operates, including North Dakota. Through "One Call," contractors or private individuals provide notification of proposed excavations to a central agency that, in turn, will notify WBI Energy of the excavation locations. If WBI Energy facilities are located in the area of proposed excavation, company representatives will mark the pipeline location, consult with the excavator as needed, and observe the excavation as necessary to prevent damage to the pipeline. WBI Energy supports enforceable one-call legislation in all of the states crossed by its pipeline facilities.

3.0 REFERENCES

U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration. 2019a. Pipeline Mileage and Facilities. Available online at https://www.phmsa.dot.gov/data-and-statistics/pipeline/pipeline-mileage-and-facilities. Accessed July 2019.

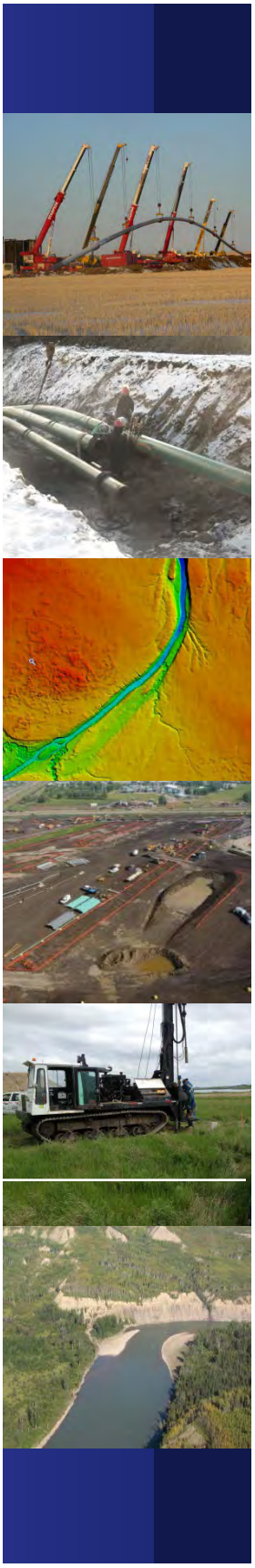
U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration. 2019b. General Pipeline FAQs. Available online at https://www.phmsa.dot.gov/faqs/general-pipeline-faqs. Accessed July 2019.

NORTH BAKKEN EXPANSION PROJECT

Risk Assessment Plan

Appendix A
HDD Design Report

CCI & Associates Inc.



North Bakken Expansion

HDD Design Report

Missouri River NPS 24 HDD Crossing

Prepared for:

WBI Energy Transmission

Project No.: 2386

Document No.: 2386-01-DESIGN REPORT-00

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North Bakken Expansion

HDD Design Report - Missouri River NPS 24 HDD Crossing

CCI & Associates Inc. – North Dakota CoCP # 27692PE

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1 INTRODUCTION

WBI Energy Transmission, Inc. (WBI) is planning to construct a pipeline crossing of the Missouri River (Lake Sakakawea) within North Dakota, between the cities of Tioga and Watford City as part of the North Bakken Expansion Project. The project involves approximately 60 miles of new NPS 24 (24" O.D.) natural gas pipeline that will connect WBI Energy's Tioga Compressor Station near Tioga, North Dakota, with Northern Border Pipeline Company's mainline at a new interconnection point south of Watford City, North Dakota. The pipeline is for natural gas takeaway to help reduce natural gas flaring in the area. The pipeline alignment crosses the Missouri River approximately 24 miles north of Watford City and 23 miles east of Williston, ND. At the crossing location, the Missouri River forms Lake Sakakawea, which contains a historic channel traversing the lake, and is a United States Army Corps of Engineers (USACE) monitored navigable waterway. This report will focus on the feasibility of the North Bakken Missouri River crossing utilizing the Horizontal Directional Drill (HDD) trenchless construction method. The proposed HDD crossing will cross beneath the entire width of the lake, measuring 15,393 ft in length from entry to exit.

This report is provided as a feasibility assessment of site conditions, incorporating the available geotechnical information and a geometric review of the proposed HDD alignment and design along with annular pressure analysis and pipe stress analysis. Also included are some challenges the contractor may face and some mitigation strategies that may be implemented to minimize the project risks. This assessment is also intended to provide verification that the HDD design meets USACE requirements.

2 DESIGN PARAMETERS

The parameters utilized in the design of the crossing are as follows:

a) The Pipeline Research Council International (PRCI) design guidelines (PR-277-144507-R01) and ASME B31.8 requirements, as applicable, were utilized to model the bending, external hoop, tensile, and combined stress cases for the installation and operating conditions imposed on the pipe.
b) The calculations consider the pipe material, diameter, wall thickness, grade, depth, and the geometric design of the crossing.
c) The geotechnical conditions at the site were analyzed to design the drill for progression through formations that are favorable for horizontal directional drills, where possible, with consideration given to potential borehole instability and surficial casing installation.
d) The HDD crossing was designed by completing an assessment of the annular pressure to minimize the risk of hydraulic fracture to the surface or water body during drilling of the pilot hole. The HDD crossing was designed to have a factor of safety against hydraulic fracture beneath the Missouri River (Lake Sakakawea) of greater than 2.0, as per USACE calculations. The annular pressure calculation models the potential fracture pressure of the overburden formation versus the downhole pressures created during the pilot hole phase of the construction.
e) Space limitations associated with points of inflection (PI), topographical features, and achievable temporary workspace (TWS) were considered. Temporary workspace has been selected to ensure that the required equipment can be set up on site to complete the work and to minimize grading requirements and disturbance.
f) The entry and exit positions have been identified based on the location of the pipe section lay out for installation, generally at the exit location. The drill is designed as an intersect and will have a drill rig set up at both the entry and exit locations.
g) The crossing has been designed with consideration of the pullback section and available layout. These plans will be updated (if required) to allow for multiple sections and/or contractor input.

h) All elevations and topographic survey data utilized are based off North American Vertical Datum 88 (NAVD 88) and State Plane North Dakota North coordinate system.

3 MISSOURI RIVER CROSSING LOCATION

3.1 SITE DESCRIPTION

The proposed HDD crosses the Missouri River (Lake Sakakawea) within McKenzie and Williams County, North Dakota. The proposed pipeline alignment is located approximately 24 miles north of Watford City and 23 miles east of Williston, ND, and is shown in Figure 1, below. The length of the proposed HDD measures approximately 15,393 ft.

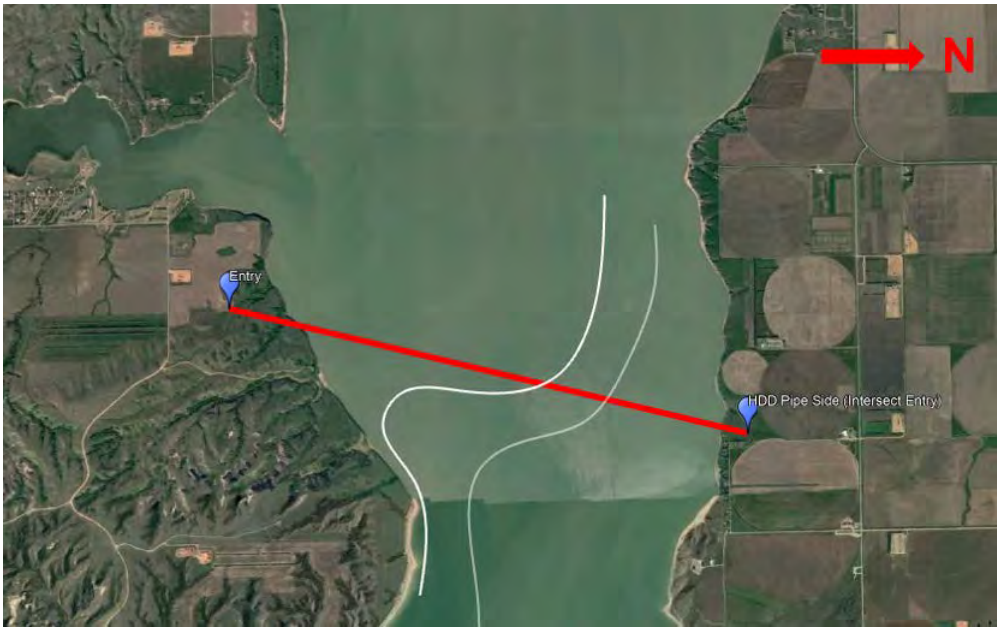


Figure 1. Proposed HDD Alignment Location

The proposed HDD entry location is situated in a relatively level, cultivated grass field, southwest of rugged terrain along the edge of the Missouri River and east of Tobacco Garden Bay. From entry, the HDD alignment follows the proposed pipeline right-of-way down rolling, sloped terrain towards the south bank, crosses the Missouri River (Lake Sakakawea) and climbs the north bank to the location of the HDD exit. The exit location is situated within a maintained grass field, west of several houses along the lake. The pipe string staging and preparation area, shown in Figure 2, is located to the north of the exit point (pipe side) within a proposed temporary workspace area. The planned pipe string and pullback alignment continues to the north, crossing 52nd Street NW and a cultivated field before roping to parallel Highway 17A, ending at Highway 1804 (54th Street NW).

The land near the proposed HDD consists of primarily agricultural fields and grassed areas with several residential buildings in proximity of the northern work site.

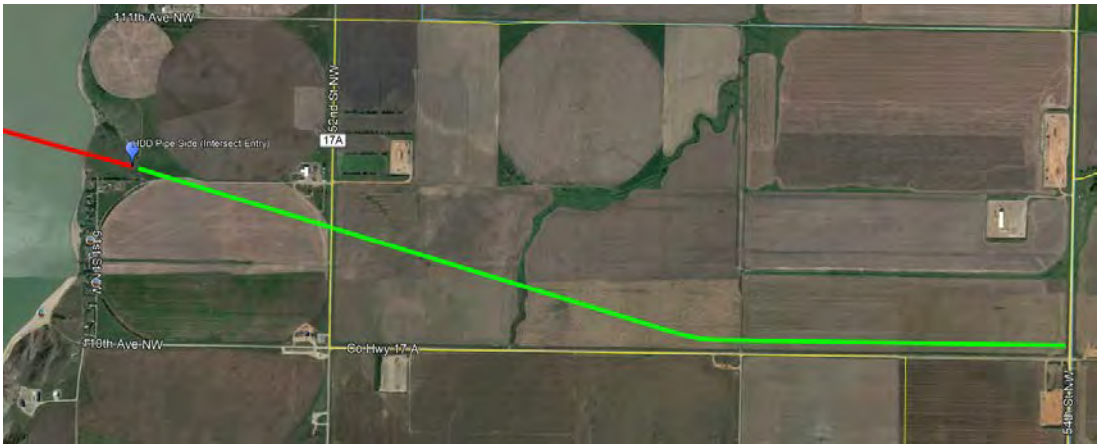


Figure 2. Proposed HDD Pipe Stringing Location

3.2 GEOLOGICAL SETTING

The geology in the area consists of glacial deposits overlying the Sentinel Butte Formation followed by the Bullion Creek Formation, both of the Paleocene Age. The Sentinel Butte Formation consists of layers of silt, clay, sand, lignite, carbonaceous shale, and mudstone. The Bullion Creek Formation comprises primarily silt, clay, sand with interbedded sandstone, lignite, baked clay, and limestone. Both formations are poorly lithified and form rolling topography over areas of Western North Dakota. It is expected that the proposed HDD bore path will be encompassed within the Sentinel Butte Formation and not encounter the Bullion Creek Formation.

3.3 GEOTECHNICAL REVIEW

To form a basis on evaluating the site specific subsurface conditions, CCI sub-contracted Groundwater & Environmental Services, Inc. (GES) to perform a subsurface exploration and laboratory testing program at the proposed HDD site to support the feasibility evaluation and design of the Lake Sakakawea crossing. As part of the geotechnical program, two investigations were completed: one (1) land-based investigation and one (1) water-based investigation. Associated subsequent geotechnical reports entitled "Geotechnical Investigation Report – WBI North Bakken Expansion Project", dated June 14, 2019 and "Geotechnical Investigation Report, Water-Based Borings – WBI North Bakken Expansion Project", dated July 9, 2020 were completed. As part of the land-based investigation, three (3) exploratory land borings, LB-1 to LB-3, were drilled/sampled to depths between 372 and 403 ft below ground surface. As part of the water-based investigation, six (6) additional water-based borings, WB-1 to WB-6, were drilled/sampled to depths between 300 and 315 ft below the Lake Sakakawea thalweg.

The locations of the nine (9) geotechnical borings relative to the HDD alignment are shown in Figure 2, below, and depicted in the design drawing attached in Appendix A.

Figure 3. Borings Location Plan

The borehole coordinates were obtained during the geotechnical investigation by GES using a handheld GPS. The borehole depths and coordinates are shown below in Table 1.

Table 1. Geotechnical Boring Locations and Depths

Borehole	Depth (ft)	Latitude	Longitude
LB -1	403	48.115647°	-103.092842°
LB-2	400	48.117656°	-103.092611°
LB-3	372	48.156139°	-103.077672°
WB-4	300	48.123139°	-103.090536°
WB-5	300	48.128400°	-103.087644°
WB-6	300	48.133994°	-103.086317°
WB-7	315	48.138314°	-103.083792°
WB-8	300	48.146003°	-103.081647°
WB-9	310	48.150150°	-103.079189°

A summary of the encountered subsurface conditions encountered during the geotechnical program, as well as some concerns regarding the geotechnical conditions as they relate to HDD construction operations is listed below in Table 2 and 3. A copy of the detailed geotechnical boring logs from GES' geotechnical investigation is located within the Geotechnical Reports provided in Appendix E.

Table 1. Generalized Summary of the Boring Logs for Missouri River

Borehole	Location	Geologic Description[1, 2]	Primary Geotechnical Concerns
LB -1	Approx. 130 ft NE of entry point, near NE corner of entry pad TWS	0 – 25 ft: Med. Dense Sand 25 – 110 ft: V. Stiff to Hard Lean/Fat Clay and Silt 110 – 211 ft: Hard Fat/Lean Clay 211 – 233 ft: Coal 233 – 288 ft: Highly Weathered, Hard Shale 288 – 403 ft: Hard Silt	Thick coal layer encountered from 211 to 233 ft. Intermittent coal layers/lenses frequently encountered below 233 ft. Fat clays/shale could contain high swell potential.
LB-2	Approx. 930 ft NE of entry point, west side of HDD CL	0 –35 ft: Loose to Med. Dense Silt/Silty Sand. 35-55 ft: V. Stiff Fat Clay 55 – 120 ft: Loose to Dense Sand 120 – 153 ft: Hard Silt and Lean Clay 153 – 215 ft: Highly Weathered Shale and Siltstone	Loose granular materials encountered poses slough risk. Thick coal layer encountered from 215 to 238 ft. Intermittent coal layers/lenses frequently

Borehole	Location	Geologic Description[1, 2]	Primary Geotechnical Concerns
		215 – 238: Coal 238 – 350 ft: Hard Silt 350 – 380 ft: Dense Sand 380 – 400 ft: Highly Weathered Shale	encountered below 238 ft. Fat clays/shale could contain high swell potential.
LB-3	Approx. 100 ft from exit point, along southern edge of exit pad TWS	0 – 115 ft: V. Loose to V. Dense Sand and Silty Sand 115 – 140 ft: Coal 140 – 202 ft: V Dense/Hard Sand, Silt and Lean Clay 202 – 252 ft: Hard Silt with coal lenses 252 – 290 ft: V. Dense Sand 290 – 336 ft: Highly Weathered, Hard Shale 347 – 372 ft: V. Dense Silty Sand	Loose granular materials encountered poses slough risk. Thick coal layer encountered from 115 to 140 ft. Intermittent coal layers/lenses frequently encountered below 140 ft. Shale contains swell potential.
WB-4	Approx. 2,900 ft from entry point, west side of HDD CL	0 – 45 ft: Soft/Loose Lean Clay and Sand 45 – 53 ft: Loose Gravelly Sand 53 – 81 ft: Hard Lean Clay 81 – 102 ft: Highly Weathered, Hard Shale 102 – 127 ft: Coal 127 – 277 ft: Highly Weathered, Hard Shale and Weakly Cemented, V. Dense Sandstone 287 – 300 ft: Highly Weathere, Hard Shale	Granular (alluvial) materials encountered poses slough risk. Thick coal layer encountered from 102 to 127 ft. Intermittent coal layers/lenses frequently encountered below 127 ft. Shale could contain high swell potential.
WB-5	Approx. 4,950 ft from entry point, east side of HDD CL	0 – 35 ft: Med. Stiff/Loose Silt and Sand 35 – 85 ft: Med. to V. Dense Sand and Gravel 85 – 140 ft: Hard/Dense Lean Clay and Sand 140 – 245 ft: Highly Weathered, Hard Shale 245 – 267 ft: Weakly Cemented, V. Dense Sand 267 – 280 ft: Coal 280 – 300 ft: Hard Lean Clay	Thick coal layer encountered from 267 to 280 ft. Intermittent coal layers/lenses frequently encountered below 140 ft. Shale could contain high swell potential.
WB-6	Approx. 7,000 ft from entry point, west side of HDD CL	0 – 70 ft: V. Loose to Med. Dense Sand 70 – 115 ft: V. Stiff Lean/Fat Clay and Silt 115 – 220 ft: Dense to V. Dense Sand 220 – 300 ft: Highly Weathered, Hard Shale	Frequent coal layers/lenses encountered below 220 ft. Fat clays/shale could contain high swell potential.
WB-7	Approx. 8,690 ft from entry point, east side of HDD CL	0 – 56 ft: V. Loose to Med. Dense Sand 56 – 120 ft: Med. Dense/V. Stiff Sand and Lean Clay 120 – 210 ft: Dense to V. Dense Sand 210 – 235 ft: Highly Weathered, Hard Shale 235 – 253 ft: Coal 253 – 315 ft: Highly Weathered, Hard Shale	Thick coal layer encountered from 235 to 253 ft. Intermittent coal layers/lenses frequently encountered below 253 ft. Shale could contain high swell potential.
WB-8	Approx. 3,840 ft from exit point, west side of HDD CL	0 – 35 ft: V. Soft to Med. Stff Lean Clay and Silt 35 – 150 ft: V. Loose to V. Dense Sand 150 – 230 ft: Highly Weathered, Hard Shale 230 – 240 ft: Coal 240 – 290 ft: Highly Weathered, Hard Shale 290 – 300 ft: Coal	Thick coal layers encountered in the bedrock. As well, thinner intermittent coal layers/lenses frequently encountered. Shale could contain high swell potential.
WB-9	Approx. 2,230 ft from exit point, west side of HDD CL	0 – 140 ft: V. Loose to V. Dense Sand and Gravelly Sand 140 – 225 ft: Highly Weathered, Hard, Shale 225 – 235 ft: Coal 235 – 290 ft: Highly Weathered, Hard, Shale 290 – 305 ft: Coal 305 – 310 : Highly Weathered, Hard, Shale	Thick coal layers encountered in the bedrock. As well, thinner intermittent coal layers/lenses frequently encountered. Shale could contain high swell potential.

Note 1: Soil descriptions as per United Soil Classification System (USCS)
Note 2: Soil Consistency and Relative Density determined as per in-situ SPT N-Value

Although variations exist, the subsurface conditions were similar in the nine (9) borings. In general, the subsurface conditions comprised overburden glacial and alluvial deposits to depths between 127 and 290 ft below the surface/thalweg overlying the Sentinel Butte Formation to the depth of the investgation. The glacial and alluvial deposits predominantly consisted of variable deposits of fat/lean clay, sand and silt with thin, frequent interbedded layers of gravel and coal. The consistency of the overburden material increased with depth, starting as soft/loose and becoming hard/very dense. As noted, the bedrock of the Sentinel Butte Formation consisted of primarily poorly lithified shale and sand. Within the formation, two

(2) relatively continuous coal layers were identified along the length of the drill. The coal layers varied in thickness from approximately 5 to 30 ft, with frequently encountered thinner layers/lenses.

Although not encountered in the geotechnical investigation, there is potential to encounter cobbles and/or boulders along the drill path. By definition, glacial deposits consists of a variations of all soil types, including a random distribution of cobble and boulder sized materials, and granular layers/lenses.

No standpipes were installed. Rather, groundwater conditions were inferred from seepages noted and measurements taken during drilling. For the land-based borings, water was observed at 24 ft in LB-3 whereas LB-1 and LB-2 remained dry; however, in each of these borings mud-rotary drilling commenced at a depth of 25 ft, precluding deeper measurements. No groundwater measurements were obtainable in the water-based borings since a perfect seal was not feasible on the casing through the lake. It is expected that the groundwater is situated at an elevation equivalent to the elevation of Lake Sakakawea.

The proposed HDD is anticipated to be within shale of the Sentinel Butte Formation for most of its length, passing through overburden/alluvial deposits as it nears surface at the entry and exit locations. As noted, the overburden/alluvial deposits consist of variations of fat/lean clay, sand and silt. Two relatively continuous coal layers, approximately 5 to 30 ft thick, are proximate to the bottom tangent of the bore path.

4 HDD CROSSING CONSIDERATIONS

4.1 PIPE SPECIFICATIONS

The pipeline specifications provided by WBI are summarized in Table 3. These parameters were used in the engineering design of the Missouri River HDD crossing.

Table 3. Pipe Specifications for the Missouri River HDD Crossing

Parameter	NPS 24 HDD
Outside Diameter (inch)	24
Wall Thickness (inch)	0.99
Pipe Material	Steel
Carried Product	Natural Gas
Specification	API 5L
Grade	X60
Specified Minimum Yield Strength (SMYS) (psi)	60,000
Chosen Design Radius (ft)	5,000
Minimum Allowable Design Radius (MADR) (ft)	1,500
Entry Angle	15°
Exit Angle	14°
Borehole Diameter (inch)	36
Maximum Operating Temperature (°F)	100
Minimum Installation Temperature (°F)	60
Maximum Operating Pressure (psi)	1,480

4.2 HDD ALIGNMENT

The proposed crossing follows a southwest to northeast alignment with the proposed entry and exit (pipe layout) points located approximately 2,100 ft south and 850 ft north of the Missouri River edge of water, respectively. The crossing passes beneath the lake for approximately 12,300 ft. Temporary workspace (TWS) is required at both ends of the crossing to facilitate entry and exit-side construction spreads, which are planned to have workspace dimensions of 300 ft x 300 ft (on the south) and 270 ft x 300 ft (on the north).

The proposed crossing is planned to be completed by intersect methodology, approximately 6000-9000 ft will be competed from either direction, the drill paths will intersect within a 3200 ft "intersect zone". The details of the design are shown on the Issued for Permit (IFP) HDD design drawing [2386-EG-0101, Rev G, dated July 31, 2020] provided in Appendix A.

4.3 BOREHOLE SIZE

The final borehole diameter must be larger than pipe outer diameter to facilitate pipeline installation and reduce the drag forces acting on the pipe while allowing for proper drilling fluid circulation within the annulus. The general industry standard for pipes with diameter more than 20 inches is a final borehole diameter 12 inches larger than the pipe outer diameter. For the proposed NPS 24 HDD crossing, the minimum final borehole diameter is expected to be 36 inches.

4.4 ENTRY AND EXIT ANGLES

The entry and exit angles have been selected based on expected geologic formations and casing requirements, bending restrictions, topography and the support of the pullback section. The entry angle (south) has both been selected to be 15° for this crossing to minimize casing requirements while adhering to geometric constraints and depth. The exit angle was selected to minimize casing requirements on exit while considering the overbend support height and support equipment requirements. The exit angle has been designed to be 14° for the proposed crossing. Due to the pipe size and specification, significant equipment is still required to lift and safely support the pipe above ground during installation. The risks associated with above-ground pipe support equipment requirements on site will be discussed further in the construction risk assessment.

4.5 HDD DEPTH OF COVER

Selection of an HDD depth is based on several parameters including geological formation, casing requirements, required overburden pressure to overcome the drilling fluid annular pressure (while maintaining an adequate factor of safety), and watercourse geometric parameters. The proposed installation depth considered should maximize the length of drill advancing through favorable materials for directional drilling to maximizing borehole stability during hole opening and pipe installation. The drill path is designed to avoid the coal layers identified in the geotechnical investigation for as much of the drill path as possible.

The bottom tangent depth for the proposed NPS 24 HDD is around 250 ft below the bottom of the lake. It is expected that the majority of the drill path will be within shale of the Sentinel Butte Formation based on the 9 geotechnical borings described above. The design depth for the proposed crossing is expected to provide adequate overburden pressure to counteract the expected drilling fluid pressures while utilizing the HDD pilot hole intersect method. Further details about annular pressure modeling are discussed in Section 5.1.

4.6 DESIGN RADIUS

The standard practice in the HDD industry is to utilize 1,200 times the nominal pipe diameter (in ft) as the design radius of curvature (ROC). For example, an NPS 24 (2 ft O.D.) pipe would utilize a 2,400 ft ROC. This is a general "Rule of Thumb" for quick calculations which has been developed over the years based on constructability as opposed to pipe stress limitations. The minimum vertical curve chosen for the proposed HDD is 5,000 ft, which is much larger than the minimum based on the above criteria. This increased design radius has been chosen to assist in ease of steering for the contractor during construction. Applying the design radius, the bending stress and operational shear stress have been calculated to be 13.1% and 48.1%, of allowable, respectively.

An essential part of the design of HDD crossings is providing the contractor with minimum steering tolerances during pilot-hole based on an acceptable level of stress on the pipe. These tolerances are designed to allow the contractor to follow the designated drill path as closely as possible while avoiding any variation that may result in overstressing the product pipe. CCI has calculated the minimum allowable design radius (MADR) for the pipe based on limiting the bending stress to less than 45% of allowable (as per PRCI). For this crossing, an additional design factor has been added to this typical MADR calculation, in order to ensure major variations from the design radius which may negatively affect installation pull-forces are avoided. In addition to the calculated 3-joint minimum allowable design radius (MADR), CCI recommends the additional minimum 1-joint radius specification as shown in Table 4.

Table 4. Minimum Radius Allowances

	Radius Specification
30ft (single-joint)	Minimum ROC – 1,100 ft
100ft Average (3-joint) / MADR	Minimum ROC – 2,000 ft
Design Radius	5,000 ft

If the contractor adheres to these minimum radius specifications, the product pipe will be within allowable stress limits during installation and operation. It should be noted that a recommended single-joint minimum radius has been included, which is sometimes not specified within HDD designs. Without a single-joint radius specification, it is possible that the contractor may be able to include an excessive steer within a single joint, yet still adhere to the provided 3-joint minimum radius average. In order to avoid overstressing of the pipe that may occur in such an instance, adherence to the single-joint radius specification is recommended.

4.7 LAYDOWN AREA

The design proposes that the product pipe be laid out in one (1) continuous section. The proposed pullback workspace is 100 ft wide and crosses an unnamed road and 52nd Street NW (Highway 17A). The proposed pullback alignment also crosses an un-named creek which would likely require two (2) additional side booms to support the pipe from either side of the creek bed. The creek may need to be diverted, bridged, or infilled within the temporary workspace to support machinery traffic and equipment. From an initial desktop study, most of the designated workspace that is planned to be used during pullback will travel through cleared land, so minimal clearing will be required. Near the end of the pullback section, the workspace turns and parallels Co Highway 17A. To accommodate this curve, the pullback includes a 4000 ft radius horizontal curve.

Due to the usage of 52nd Street, it is expected that it will not be possible to close for pullback and it is expected the pipe will be lifted and supported over the road during pullback operations after final welds.

Due to the pipe size, a significant excavation length would be required if the pipe were to be strung under the road in a culvert. The culvert option could be investigated if permission to support the pipe over the road are not granted.

Based on CCI's stress analysis, the minimum allowable overbend radius of the pullback section is roughly 1,600 ft for the NPS 24 pipe. The stress analysis also yielded a maximum crane/side boom support spacing of 80 ft (based on typical roller-cradle capacities) and roller spacing of 40 ft, assuming adequately sized supports will be used. It is also recommended the maximum unsupported overhang not exceed 60 ft. The overbend radius and maximum support spacing was selected to maintain the imposed stress on the product pipe below 80% of allowable stress as per PRCI and with consideration of roller-cradle capacities.

The pullback alignment described above encounters a relatively level topography, with one geographically noticeable hill approximately 2,800 ft north along the pipe stringing alignment. The hill is gradual and should not affect pullback operations. Given the 14° exit angle, the height of the pullback overbend will reach approximately 35 ft above ground surface. This overbend results in approximately 6 cranes and 3 side booms to support the pipe within the overbend.

At the end of the existing 100 ft wide workspace, CCI has proposed an additional 40' of workspace, ending at the road surface of 54th Street NW. This additional workspace is to allow the pipe to be laid out in one section. Due to the topographical elevation changes within the layout, it is expected the pipe will not be as close to the road as is conservatively shown on the Issued for Permit (IFP) HDD design drawing [2386-EG-0102, Rev D, dated July 31, 2020] provided in Appendix A.

5 HDD ENGINEERING ANALYSES

The proposed HDD design has incorporated supplied topographical information, geotechnical information, and ROW alignment. In addition to these considerations, detailed annular pressure analysis and pipe stress analysis calculations have been completed as outlined below.

5.1 ANNULAR PRESSURE MODELING

The annular pressure (AP) was modeled to simulate the downhole pressure during the pilot hole phase of construction and compare it with the limiting pressure of the substrata above the drill path. The AP simulation was conducted with CCI's analysis tools, which have been developed with industry standard calculation models (Bingham Plastic, General Overburden, and USACE/Delft model) and additional modified safety factors based on our experience from over 15,000 completed HDD crossings. CCI developed geotechnical parameters for the crossing that are closely representative of the soil formations observed in the land boring logs and water boring logs completed by GES at the crossing.

Drilling fluid properties, used to model the downhole pressure during drilling, are dependent on construction practices of the HDD contractor, field conditions, and interpretations of the drilling fluid technician. Annular drilling fluid pressures can significantly change with changes in drilling fluid properties. Therefore, it is important to re-evaluate drilling fluid pressures based on fluid properties during HDD operations and compare them with estimated limiting pressures of the formation. Additionally, annular pressure measurement tools should be used to monitor annular pressure during the HDD installation.

The drilling parameters utilized by CCI for this analysis are based on tooling specifications provided by the drilling contractor and are as follows:

- 13 1/2" drill bit (pilot)
- 7 5/8" drill pipe

- 650 gpm (2.5 m^3/min) fluid pump rate
- 9.6 lb/gal fluid density
- 25 lb/100ft^2 yield point of fluid
- 20 cP plastic viscosity of fluid

Calculated expected annular pressure graphs for each drill direction were produced with the above drilling parameters and are modeled in Figure 3 and Figure 4. These annular pressure graphs form the basis for establishing whether a proposed HDD crossing is at risk for hydraulic fracture during the pilot hole phase. This graph shows a calculated expected downhole pressure, as well as an *Operating Zone* above the expected downhole pressure, shown as 125% of the calculated pressure. According to this model, drilling pressures that exceed the overburden fracture pressure do not necessarily indicate a fracture will occur, but rather a higher risk that hydraulic fracture may occur in those areas.

CCI has reviewed and incorporated the geotechnical program laboratory testing results from the geotechnical investigation and developed three geotechnical parameter sets for this crossing. These geotechnical parameter sets represent a “Firm CL-CI Clay” layer at surface, a variable thickness “Compact Sand” layer, and a “Shale Bedrock” layer in which the drill progresses for the majority of the crossing. The Parameters utilized by CCI are listed below.

Firm CL-CI:

- 26° Internal Angle of Friction
- 200 psf Cohesion Coefficient
- 120 pcf Unit weight of Soil
- 0.4 ksi Shear Modulus of the Soil
- Variable Radius of Plastic Zone based on soil parameters

Compact Sand:

- 32° Internal Angle of Friction
- 0 psf Cohesion Coefficient
- 125 pcf Unit weight of Soil
- 2.2 ksi Shear Modulus of the Soil
- Variable Radius of Plastic Zone based on soil parameters

Shale Bedrock:

- 26° Internal Angle of Friction
- 902 psf Cohesion Coefficient
- 131 pcf Unit weight of Bedrock
- 6.7 ksi Shear Modulus of the Bedrock
- Variable Radius of Plastic Zone based on soil parameters

Due to the length of the Missouri River HDD crossing, the crossing will be completed by intersect methodology. Figure 3 and 4 represent the annular pressure curves for the north and south portions of the HDD pilot hole. The Intersect Zone is shown on both drills, and represents the maximum length drilled from either side. The graphs shown are based on a modified CCI Delft equation. The modified Delft equation used here utilizes a smaller Radius of Plastic Zone than the standard Delft equation which results in much lower limiting pressure outputs, equating to more conservative allowable pressures in the curves shown below than would be shown in typical Delft model outputs.

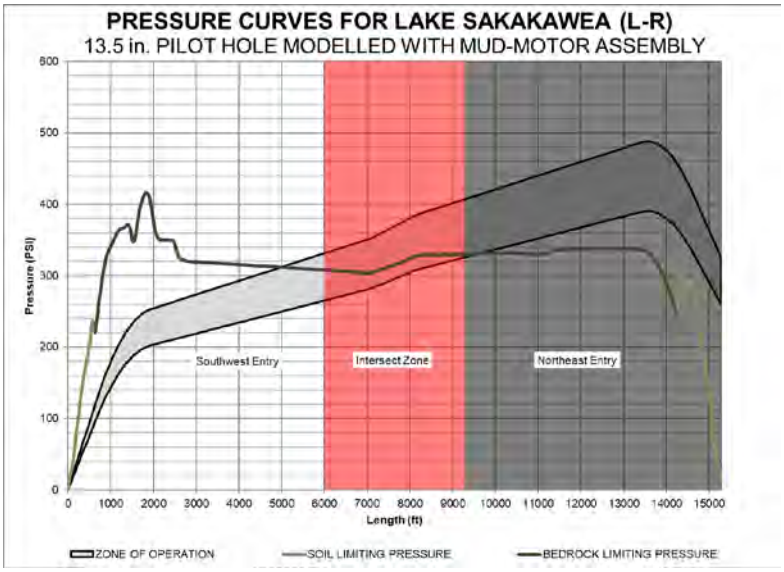


Figure 3. Modeled Annular Pressure During South Pilot Hole

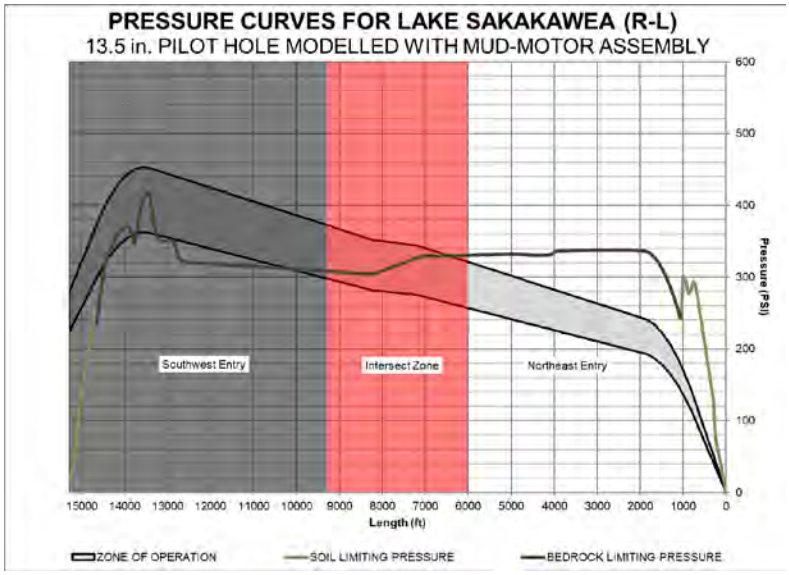


Figure 4. Modeled Annular Pressure During North Pilot Hole

The modified CCI annular pressure graphs above suggest that the drilling pressures remain below the limiting pressures of the overburden along the first 5000-6000 ft of the drill from either side. Within the 5000-8000 ft measured depth range, the lower operating pressures are below or slightly over the limiting over burden pressures. Once past the planned intersect zones, the drilling pressures greatly exceed the overburden pressure, illustrating the need for an intersect based on annular pressure considerations. Within the middle section of the drill, near the intersect zone, the risk of hydraulic fracture for the HDD is moderate.

The annular pressure graphs in Figures 5 and 6, below, have been run using the standard USACE Delft equation. These annular pressure graphs correspond to the factor of safety graphs seen in Figures 7 and 8.

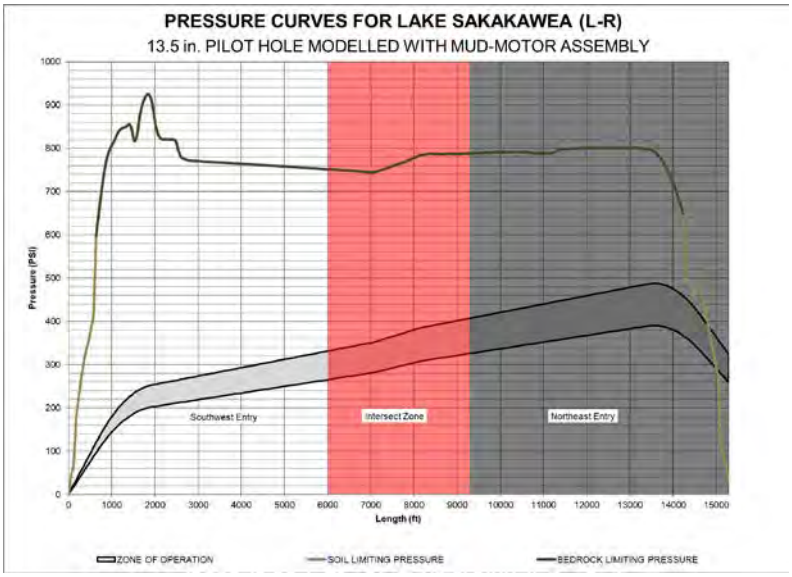


Figure 5. USACE Modeled Annular Pressure During South Pilot Hole

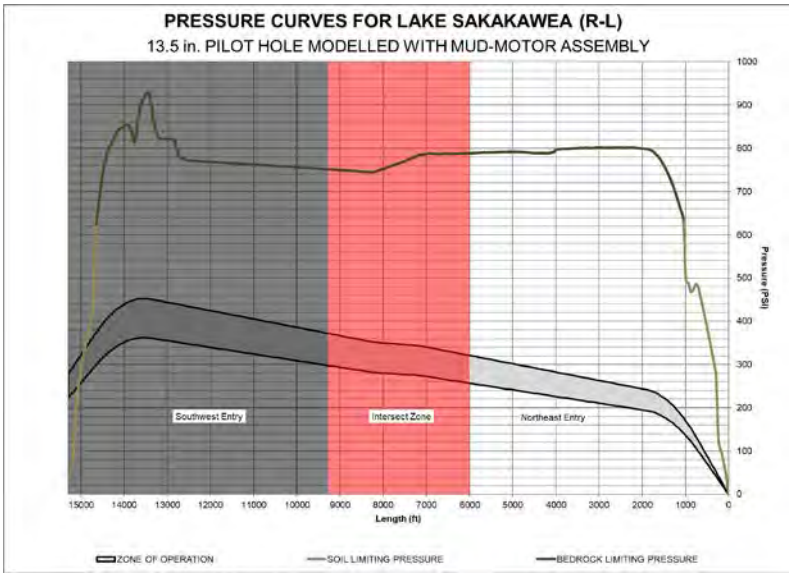


Figure 6. USACE Modeled Annular Pressure During North Pilot Hole

USACE requires a factor of safety against hydraulic fracturing, generally in the 2.0 range, for the portion of the drill passing beneath a regulated waterbody. The factor of safety is calculated by dividing the calculated limiting pressure of the formation by the expected annular pressure along the length of the drill path. Figure 7 and 8 shows the factor of safety against hydraulically fracturing the formation during pilot hole installations utilizing the standard USACE calculation models without any additional factor of safety applied to the equations at the design depth.

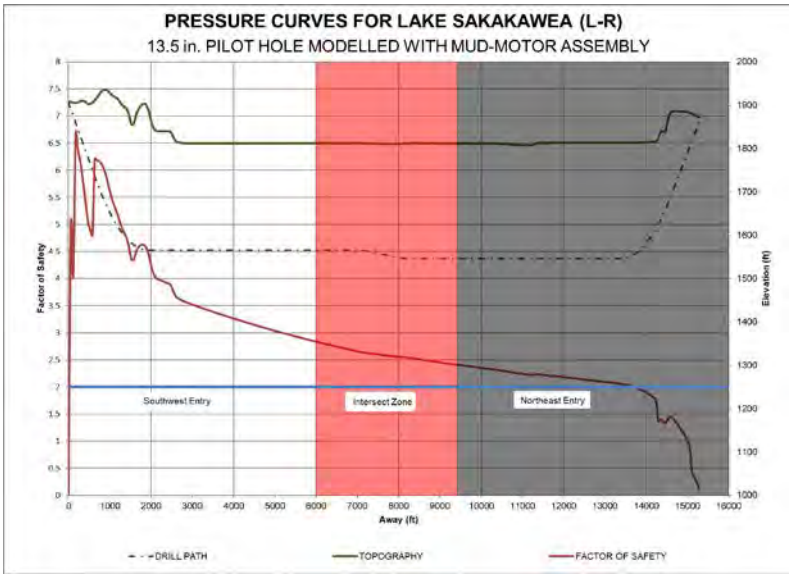


Figure 7. Factor of Safety Against Hydraulic Fracture South Pilot Hole

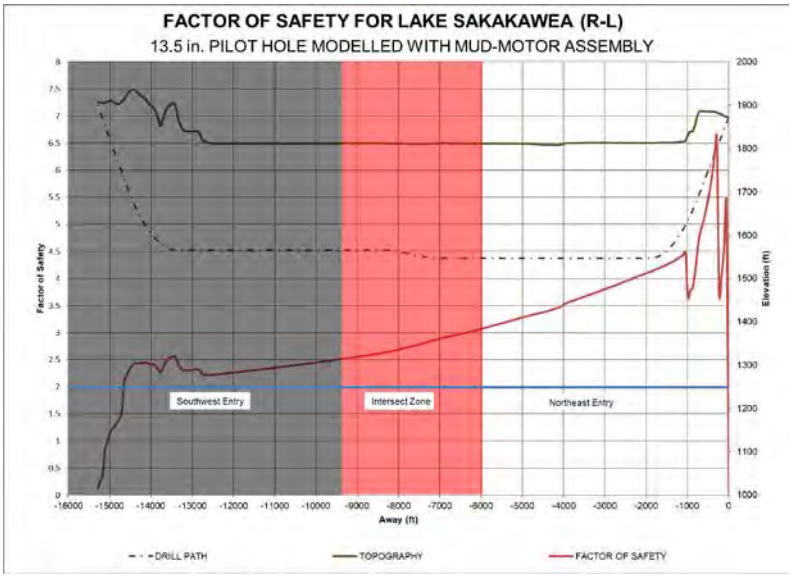


Figure 8. Factor of Safety Against Hydraulic Fracture North Pilot Hole

Figure 7 and 8 indicate that the Factor of Safety (FOS) against hydraulic fracture is above 2.0 for the entire planned pilot hole from the south and north sides. Utilizing USACE calculations, the FOS is roughly 2.5-4 below the Missouri River. Based on the results of the analysis, the HDD design meets the USACE minimum requirements for factor of safety against hydraulic fracture.

During construction, the risk and impact of hydraulic fracture and inadvertent returns (IR) to surface can be reduced by implementing preventative measures during pilot hole. It is recommended that the contractor reduce pump rates as the drills approach the intersect location. It is also recommended that contractor maintain drilling fluid densities at the low end of what is industry standard. An annular pressure

tool should be used during construction to monitor pressures as the drill progresses, avoiding exceeding containment pressures under any critical locations, as required by the USACE. The contractor should review the drilling fluid parameters and tooling and ensure the proposed equipment is in alignment. It may be preferential to utilize a larger drill bit to increase the annular space and decrease the expected pressures.

5.2 HDD STRESS ANALYSIS

The installation and operating conditions imposed on the product pipe during and after installation have been modelled against the respective code requirements as laid out in Section 2. The HDD stress modeling determines if given pipe specifications are adequate for the design.

5.2.1 Pulling Load

To pull the product line inside the borehole, the pull force must overcome several resisting forces including effective weight of the pipe, fluidic drag, frictional drag between the pipe and the borehole walls and between the pipe and the rollers, drag due to length of drill string in the hole, and the reamer assembly in front of the pull section.

The pull force has been calculated with the assumption that the pipe will be installed in one continuous section with no mid-welds as it is suspected there will be sufficient, or nearly sufficient, workspace. It is expected a small section of pipe may need to be pulled into the borehole prior to a single, final weld. This portion of the pipe would be expected to be in the surface casing, and it is not anticipated increased pull forces will be experienced due to this stop near the beginning of pull. If the pipeline installation requires multiple sections beyond this short initial section, the pull forces should be reevaluated to account for the effects of downtime due to intermittent welds during pullback. The soil around the borehole could slough or swell while the pipe remains stationary downhole during the welding process which would result in increased friction on the pipe during pulling.

The calculated expected installation pull force is dependent on the geometry of the HDD, geologic formations present along the drill path, drilling mud properties, and pipe size and weight. CCI has calculated the expected range of pull forces for the product pipe installation, accounting for typical ranges of downhole mud densities. In this analysis, 9.5 ppg (pounds per gallon) drilling fluid is applicable for relatively clean drilling fluid with minimal suspended cuttings, while 12 ppg fluid would be applicable for relatively “dirty” drilling fluid containing significant suspended solids and cuttings. CCI utilizes a safety factor of 1.5 when calculating pull force to account for variations in drilling practices, geology, etc. and addition of the reamer and swivel in the pullback bottom hole assembly. CCI has calculated pull forces for the proposed HDD crossings with and without the additional factor of safety. The calculated pull forces are shown in Table 5. Due to the wall thickness of the product pipe and its associated weight, the pipe is relatively close to neutrally buoyant and therefore buoyancy control is not required for this installation.

Table 5. Pullforce Calculation Analysis

	Drilling Fluid (9.5 ppg)	Drilling Fluid (12 ppg)
Pull force	502,000 lbs	640,000 lbs
Pull force incl. 1.5 x S.F.	752,000 lbs	960,000 lbs

5.2.2 Installation & Operating Stresses

As the pipeline is installed through the final borehole, it is subjected to three primary loading conditions: tension, bending, and external (hoop) pressure. As part of the design process, the individual stresses and their combined effect on the pipe were evaluated to check the pipeline potential for failure.

During operation, the stress imposed on a pipeline installed by HDD is similar to a conventionally installed pipe with the exception of the elastic bending resulting from a continually welded pipeline pulled through a curved borehole. The operating loads including bending, net hoop stress (difference between external and internal pressures), thermal expansion, and combined stresses were checked to evaluate the risk of failure for the NPS 24 product pipe.

The stress analysis completed by CCI based on the design geometry, pipe specifications, and operating conditions for the proposed HDD installation is summarized in Table 6.

A summary of the maximum expected installation and operating stresses and their allowable limits are presented in Appendix B.

Table 6. Installation & Operating Stresses

	Missouri River HDD Crossing	
	Installation Stresses	**% of Allowable (PRCI)**
Maximum Tensile Stress (PRCI 5.1.1, 5.5)	8,935 psi	16.5%
Maximum Bending Stress (PRCI 5.2.2)	5,900 psi	13.1%
Maximum Hoop Stress (PRCI 5.2.3)	2,642 psi	11.3%
Maximum Operating Stress (PRCI 5.4.4.2)	13,000 psi	48.1%
Maximum Combined Installation Stress (tensile and bending) (PRCI 5.2.4)	0.29	29%
Maximum Combined Installation Stress (tensile, bending, and hoop) (PRCI 5.2.4)	0.10	10%

5.2.3 Pipe Lifting Stress Modeling

An analysis was completed to evaluate stresses and imposed loading on the product pipe and supporting equipment during lifting and pullback operations. Minimum support spacing was determined based on pipe specifications and capacity of expected equipment. Summaries of the maximum expected support loading and stresses on the pipe and supports are presented in Appendix B.

The lifting plan requirements including minimum allowable overbend radii, maximum support spacing and maximum allowable overhang to not overstress the pipe or supporting equipment are shown in Table 7. The stresses imposed on the pipeline and loadings on supporting equipment during pullback are also shown. The stress analysis assumes that the pipe is installed empty without buoyancy control.

Table 7. Pullback Support Stresses & Loading

Parameter	
Tensile Stress / % SMYS	10,412 psi / 20%
Bending Stress / % SMYS	18,718 psi / 36%
Combined Tensile & Bending Stress / % SMYS	28,400 psi / 55%
Vertical Load at Support	55,400 lbs
Longitudinal Load At Support	5,540 lbs

Parameter	
Vertical Load at Roller Support	9,700 lbs
Support Spacing	80 ft
Roller Spacing	40 ft
Maximum Unsupported Overhang	60 ft
Overbend Radius	1,600 ft

CCI recommends that designed stresses imposed on the product pipe during pullback are limited to 80% SMYS to account for mishandling in the field during maneuvering and installation. The results from the stress analysis completed for the pullback show that the pipe will be subjected to stresses that are below the recommended limit and are therefore considered acceptable.

CCI recommends that the contractor selects adequately sized lifting equipment and rollers that can handle the expected loadings while providing an adequate factor of safety as per OSHA requirements. CCI recommends that the selected contractor independently evaluate the pullback and pipe lifting plan and account for weather conditions such as snow, rain, and winds to ensure that the equipment and product pipe do not become overloaded or overstressed during pipe handling and pullback.

5.2.4 Design Summary

For this crossing, the operating stresses govern the design of the pipe, and not the installation stresses. Calculations carried out by CCI indicate that the provided pipe specifications are suitable for the HDD installation, based upon the installation and operating conditions supplied.

5.3 HDD CONSTRUCTION RISK ASSESSMENT

The main construction risks and challenges for the Missouri River HDD crossing were identified in the risk assessment conducted by CCI, based on available data and previous experience. The risk items are ranked into the risk categories ranging from low risk to very high risk based on the probability and the consequence of each risk factor.

The descriptions of risk items and a summary of the risk assessment for the crossing detailing the risks prior to any mitigation and after mitigation is presented in Appendix C. The following are major risks and the main mitigation strategies developed.

Casing Installation / Removal:

Casing not Being Installed to Depth

Risk: Geotechnical conditions near surface can pose a problem when driving casing to a designed depth. It is expected both the entry and exit locations will require casing. The entry (south) is expected to be cased to the shale/siltstone bedrock, and the exit location will be cased past the coal layer. The proposed lengths of casing install, although expected to be achievable, are quite considerable.

Mitigation: Achievable casing installation lengths should be investigated prior to construction. The casing should be installed in 160-200ft lengths of telescoped casing. The final casing size shall be 48" and the initial casing should be sized to ensure the final casing will reach the required depth for seating.

Casing Not Being Fully Removed Upon Completion

Risk: Due to the proposed lengths of casing install, the makeup of the subsurface material traversed by the casing, and the expected length of time the casing will remain stationary, there is a risk that the full lengths of casing on either end may not be easily or successfully removed after completion of the product pipe installation.

Mitigation: Contractor shall submit casing plan that includes proper welding specifications to ensure integrity of the casing. Contractor shall also have a mitigation plan for grouting off any portions of casing left below-ground. Owner's integrity management personnel shall evaluate impact of casing left downhole and have a suitable cathodic protection mitigation plan prepared to address any possible related concerns.

Pilot Hole Operations:

Fracture to Water Body

Risk: Fractured formations (including coal seams as identified within the bedrock formation) or high annular pressures could result in release of fluid to surface. The length of the Missouri River crossing results in high pressures due to the building friction forces. The bedrock layer is inconsistent and dips significantly in the middle of the Missouri River, reducing the expected strength of the overburden formation.

Mitigation: The crossing is designed to be completed as an intersect which will limit the expected drilling pressures. The crossing has been designed with significant depth to limit the potential for fracture. Casing will also help with circulation back to entry/exit locations, which should reduce the potential for climbing annular pressures. Contractor shall utilize an Annular Pressure Tool to measure actual downhole pressures during drilling of the pilot hole to ensure any significant increases in pressure beyond planned ranges can be addressed and reduced to within expected ranges with mechanical tripping or additional circulation as applicable.

Large Fluid Loss to the Formation

Risk: Drilling fluid has the potential to migrate outside of the designed drill path in fractures. The crossing location is characterized by several coal seams, including two thick coal seams above and below the bottom tangent of the drill path, which may act as preferential path for drilling fluid.

Mitigation: The drill depth has been chosen to limit the risk of fracture to surface. Casing is included in the design to minimize the amount of coal seams the drill path will encounter. The contractor shall develop a mitigation plan for reducing significant losses where possible, including the use of Loss Circulation Material (LCM) pills to try to plug off any encountered zones of significant fluid loss.

Steering Control Issues

Risk: The crossing is 15,393ft long and each rig will need to drill approximately 7,000 – 8,000 ft. Maintaining weight on bit in order to be able to steer at this length is expected to be difficult, complicating the intersect operations.

Mitigation: The crossing is designed with a large radius which will reduce the steering requirements. The Contractor is utilizing 7 5/8" drill string and gyro steering systems to ensure accuracy and a successful intersect. The bottom tangent is very long and will allow the drills

sufficient time to align for intersect operations. Casing at the entry and exit locations may help to maintain weight on bit.

Annular Pressure Issues

Risk: Drilling operations require soil cuttings to be cleaned out of the bore and hydro-transported back to the rig by the drilling fluid. This process requires large volumes of pressurized drilling fluid to be pumped downhole. The length of the crossing will increase the risk of annular pressure issues.

Mitigation: The Contractor shall maintain returns to both entry pits and monitor annular pressures. A mud engineer shall be on site to monitor adherence to the crossing specific Engineered Drilling Fluid Plan (EDFP). A bottoms up procedure (circulating the calculated amount of fluid that it takes to flow from the bit downhole back up to the entry pit) should be in place and followed when necessary to clean the hole.

Over Schedule Risk

Risk: Geotechnical conditions, permitting, and environmental issues can all contribute to delays in the schedule. The crossing is long with a large borehole size. Over schedule could significantly increase costs. Significant delays could have a large financial impact due to delay to in-service date.

Mitigation: All requirements of the permits should be strictly followed. The Contractor shall ensure proper drilling procedures are in place. Encountered geotechnical conditions should be monitored and reported during drilling so modifications can be made to execution strategy, as required, to ensure no negative impacts. It is recommended construction proceed 24/7 with 2 12hr rotational shifts per day.

Disposal of Drilling Fluid

Risk: Drilling fluid needs to be stored and disposed of. Running out of temporary storage can lead to schedule delays and environmental concerns. The length and large borehole size will result in significant volumes of drilling fluid. Drilling fluid may be contaminated due to coal seams.

Mitigation: Adequate storage should be on site. An EDFP should be followed and an adequate recycling system will be on site. An approved disposal plan should be developed prior to construction. Facility disposal should be expected.

Reaming Operations:

Over Schedule Risk

Risk: Geotechnical conditions, permitting, and environmental issues can all contribute to delays in the schedule. The crossing is long with a large borehole size. Over schedule could significantly increase costs. Significant delays could have a large financial impact due to delay to in-service date.

Mitigation: All requirements of the permits should be strictly followed. The Contractor shall ensure proper drilling procedures are in place. Encountered geotechnical conditions should be monitored and reported during drilling so modifications can be made to execution strategy, as required, to ensure no negative impacts. Using two rigs will split the workload which would be normally be placed upon a single rig.

Loss of Equipment in the Borehole

Risk: Reaming or enlarging the bore to the desired diameter may cause instability areas. These areas may cause downhole tooling to get stuck or lost. Loss of equipment within the borehole is a larger risk than with a shorter crossing.

Mitigation: The utilization of intersect methodology will mitigate the risk of losing equipment within the borehole. Using two rigs will split the workload which would be normally be placed upon a single rig. If problems arise on one side of the reamer, the opposite rig will maintain contact with the downhole tooling and be able to trip to surface. Drill string management plan should be provided by the contractor, which should include regularly switching out drill stem on either side of the reamers.

Poor Removal of Cuttings

Risk: Due to the large ream pass and length a large volume of cuttings will be created and therefore will have to be removed from the borehole.

Mitigation: Drilling fluid parameters will be optimized for maximum cutting transportation, through adherence to the EDFP. High pump rates throughout the ream passes of the HDD will increase the annular velocity and therefore carrying capacity. Additional trips will be necessary to mechanically remove cuttings from the borehole. The number of trips required will be based on the borehole conditions. The cut size should ensure that cuttings can be removed.

Drilling Fluid Control

Risk: As the volume of drilling fluid within the borehole increases, it becomes more difficult to change its properties with drilling fluid additives. The large diameter borehole combined with the length will impact the quality and makeup of the drilling fluid. Coal seams may contaminate drilling fluid. Contractor will be hauling in water.

Mitigation: The Contractor should prepare and adhere to an approved EDFP which will outline the steps required to ensure the highest quality of drilling fluid is used for the crossing. A premix tank should be made available in addition to the mud tank. Contractor should continue to adhere to the EDFP throughout reaming operations even if they are experiencing fluid losses.

Pullback Operations:

Stuck Pipe

Risk: There is a risk that the pipe section becomes stuck in the borehole due to borehole length, instability, blockages, or irregularities. The pullforce for this length is between approximately 502,000 and 960,000lbs.

Mitigation: One or more wiper trips shall be completed to ensure a clean hole. Required force should be monitored during the wiper passes. It is recommended that a Pipe Thruster (with custom inserts for NPS 24) be available on exit side to assist the rig with pullback in the event pullforces start to become exceedingly high.

Pull Forces Exceeding Theoretical Model

Risk: There is a risk that pull forces exceed the theoretical model, especially with the length of the drill. Contributing factors can include cuttings in the borehole, having to temporarily halt line pull, borehole instability, and heavy drilling fluid.

Mitigation: A swab pass should be completed and downtime during installation should be minimized. It is expected pipe pull will continue overnight as required. This should be planned for with crews in advance, lighting shall be sufficient to allow overnight operations for pull. Pipe thruster should be available on exit side to assist the rig will pullback.

Coating Damage

Risk: Gravel, cobbles, boulders, and bedrock interfaces within the bore path pose a risk that the pipe coating is damaged during line pull.

Mitigation: Wiper passes shall be completed to gauge any possible areas of issue, and additional passes may be used to ensure minimized risk prior to pullback. FBE and ARO coated pipe shall be used.

Pipe Handling

Risk: The exit angle, wall thickness, and size of the pipe result in a large radius overbend that reaches a height of 35 ft. The pipe section requires significant support equipment.

Mitigation: A pullback lift plan should be created prior to construction for review and approval. The equipment capacities should be sufficient for the anticipated loads. Spreader bars may reduce crane requirements. A traffic plan should be created for Highway 17A (52nd Street NW) and 54th Street NW (if required).

Pipe Preparation:

Over Schedule Risk

Risk: There is significant support equipment required for pullback. If pullback is delayed this could be a large cost to keep the equipment on site. If the pipe section is not ready for pull the hole could tighten.

Mitigation: A pullback lift plan should be created prior to construction for review and approval. The equipment capacities should be sufficient for the anticipated loads. Spreader bars may reduce crane requirements. A traffic plan should be created for Highway 17A (52nd Street NW) and 54th Street NW (if required). Progress of the HDD should be tracked closely.

Other Risks:

Crossing Length

Risk: The crossing is 15,393ft long, approaching record lengths for an HDD crossing. There is a risk that the crossing could encounter compounding issues that lead to the crossing not being completed successfully.

Mitigation: A competent contractor with adequate tooling and relevant experience with similarly large installations has been selected. The risks should be highlighted to all stakeholders.

Access to Water

Risk: Water sources should be investigated/confirmed. Water transport should be a major consideration.

Mitigation: Additional transport and water sources should be investigated prior to construction. Transport should include contingency to ensure a lack of water does not lead to any delays with progress of the drill, particularly in the event of significant fluid losses during drilling, where large volumes of make-up water may be required.

Public Attention

Risk: Scrutiny is possible in the area. There is a risk of negative public perception issues. The summer season will see high levels of lake use.

Mitigation: The contractor shall ensure all procedures are being followed and their impact is minimized. The contractor shall ensure all correspondence with the public is completed by WBI representation.

6 RECOMMENDATIONS

The following recommendations outline the main action items that should be completed in order to ensure smooth progression of the project into the construction phase:

a) Review of information by all stakeholders and issuance of the Issued for Construction (IFC) drawings incorporating any changes from the Owner, environment, or other consultants.

b) Ensure that all the requirements of the USACE Omaha district are met, and an open line of communication is maintained throughout design and construction.

c) Ensure all required ROW and TWS, environmental notifications and permits, and water withdrawal and disposal sites are acquired.

d) Review the Construction Execution Plan, including but not limited to Pullback Plan, Water Management and Drilling Fluid Disposal Plan, Drilling Rig Anchoring Plan, Casing Plan, and Site-Specific Environmental Plan.

e) Scope of construction inspection, turbidity monitoring and fluid disposal management services should be identified.

f) Review any new environmental concerns with respect to the crossings and develop contingency plans if required.

g) Select an appropriate level of qualified supervision on site for all stages of the drill to ensure that the drill profile is adhered to within the radius limits set forth on the IFC drawing, the proper drilling techniques and equipment are utilized, and schedule and costs are controlled.

h) Select a qualified drilling contractor with experience completing HDD installations of similar size and scope in the area who is familiar with the local geologic formations and associated risks.

7 CONCLUSIONS

This assessment shows the risks identified on the Missouri River NPS 24 HDD crossing and if adequately mitigated, reduces the overall impact on the project. Based on the available data, it is deemed feasible to construct the Missouri River HDD crossing along the proposed North Bakken Expansion Pipeline project

successfully. The crossing is one of the longest HDD crossings completed, and there is potential for an unsuccessful HDD installation, however, this risk will be minimized if the recommendations included within this report are followed.

8 LIMITATIONS

This report has been prepared based on the available site-specific information for the exclusive use of WBI in the construction of the proposed Missouri River HDD crossing. No other warranty is expressed or implied and the information presented within this report shall not be applied to other projects.

Although subsurface conditions are not expected to vary significantly from those shown on the drawings, it should be appreciated that extrapolation of subsurface conditions between boreholes and to depths below the depth of exploration is subject to interpretation and could be at variance with actual field conditions.

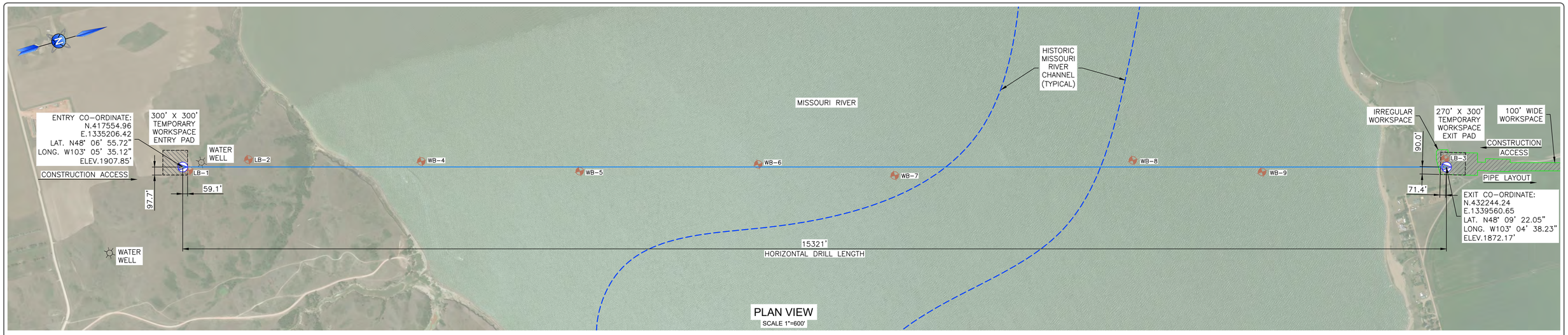
9 REFERENCE DOCUMENTS – HDD DESIGN DRAWINGS

Drawing Name	Drawing Number	Revision	Sheet
Missouri River HDD Crossing Plan and Profile	2386-EG-0101	G	1 of 3
Missouri River HDD Pullback Plan and Detail	2386-EG-0102	D	2 of 3
Missouri River HDD Construction Notes	2386-EG-0103	A	3 of 3

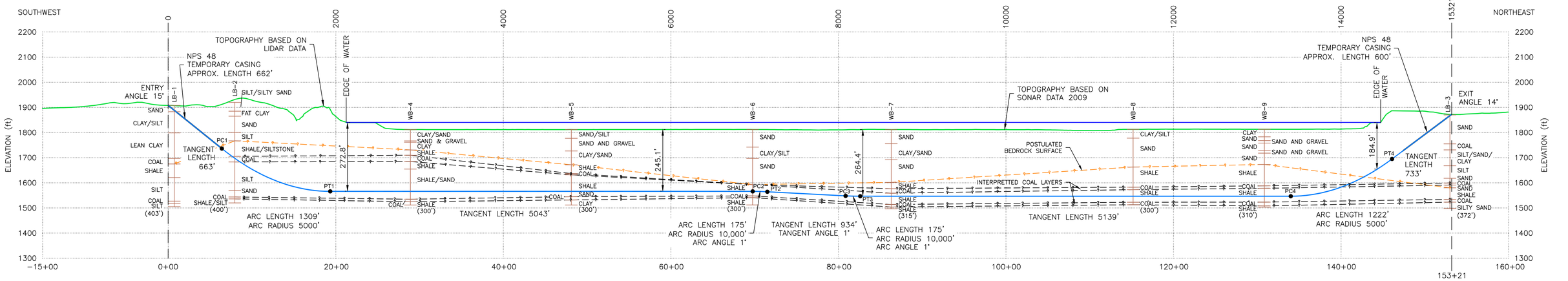
Geotechnical Report: WBI North Bakken Land-based Geotech Report

Geotechnical Report: WBI North Bakken Water-based Geotech Report

APPENDIX A – HDD DESIGN DRAWINGS



PLAN VIEW
SCALE 1"=600'



PROFILE ALONG PROPOSED PIPELINE
SCALE 1"=600' HORIZONTAL
SCALE 1"=200' VERTICAL

TOTAL DRILL LENGTH 15393'

HORIZONTAL DIRECTIONAL DRILL DATA MISSOURI RIVER HDD		
DESCRIPTION	STATION (ft)	ELEVATION (ft)
ENTRY @ 15°	0+00.00	1907.85
PC1 = 5000' RADIUS	6+40.51	1736.23
PT1	19+34.61	1565.86
PC2 = 10,000' RADIUS	69+78.43	1565.86
PT2	71+52.95	1564.33
PC3 = 10,000' RADIUS	80+87.31	1548.02
PT3	82+61.83	1546.50
PC4 = 5000' RADIUS	134+00.95	1546.50
PT4	146+10.56	1695.02
EXIT @ 14°	153+21.04	1872.17
HORIZONTAL DISTANCE (ft) = 15321.04		
DIRECTIONAL DRILL PIPE LENGTH (ft) = 15392.57		

Pilot Hole Tolerances	
Item	Tolerance
Pilot Entry Angle	Increase in angle up to 1° (deeper), but no decrease in angle allowed as long as minimum 3-joint bending radius is not compromised.
Pilot Entry Location	As staked by COMPANY. No change without COMPANY approval.
Pilot Exit Angle	Change in angle up to +/-1° allowed as long as minimum 3-joint bending radius is not compromised.
Pilot Exit Location	Up to 40 feet longer or 10 feet shorter than exit stake. Between 10 feet left and 10 feet right of COMPANY survey centerline.
Pilot Depth	Up to 5 feet decrease in design depth (shallower) allowed except under critical areas such as roads, utilities, levees etc. near the entry and exit points. Up to 10 feet increase in depth (deeper) allowed. Best efforts shall be made to stay at or below pipe design profile depth.
Pilot Alignment	Shall remain within 10 feet left or right of COMPANY centerline survey.

GEOTECHNICAL BORE HOLE INFORMATION			
BOREHOLE	LATITUDE	LONGITUDE	DEPTH (ft)
LB-1	48° 6' 56.33"	-103° 5' 34.23"	403
LB-2	48° 7' 3.56"	-103° 5' 33.40"	400
LB-3	48° 9' 22.10"	-103° 4'39.62"	372
WB-4	48° 7' 23.30"	-103° 5'25.93"	300
WB-5	48° 7' 42.24"	-103° 5' 15.52"	300
WB-6	48° 8' 2.38"	-103° 5' 10.74"	300
WB-7	48° 8' 17.93"	-103° 5' 1.65"	315
WB-8	48° 8' 45.61"	-103° 4' 53.93"	300
WB-9	48° 9' 0.54"	-103° 4' 45.08"	310

REFERENCE DOCUMENT NO.	DATE
1. NBE_PL-PROPOSED_ROUTES 190824	2019-08-24
2. 2386-01-IMP STEEL STRESS-24-inch-02	2020-07-30

ENGINEER AND PERMIT STAMPS

PIPELINE SPECIFICATIONS	NPS 24
OUTSIDE DIAMETER (OD)(in)	24
WALL THICKNESS (WT)(in)	0.99
GRADE (psi)	60,000
PRODUCT	NATURAL GAS
MATERIAL	STEEL
SPECIFICATIONS	API 5L
INTERNAL COATING	N/A
OUTER COATING	DUAL FBE
MAX. OPER. PRESSURE (psi)	1,480
MIN. TEST PRESSURE (psi)	1,850
MAX. OPER. TEMP (°F)	100
MIN. INSTALLATION TEMP (°F)	60

STEERING TOLERANCES	30ft	100ft	DESIGN
MINIMUM RADIUS (ft)	1100	2000	5000

PULL FORCE / RIG SIZE / STRESS	
PULL FORCE (w/o BUOYANCY CONTROL):	752,000 lbs (w/sf)
MINIMUM RECOMMENDED RIG SIZE:	1,000,000 lbs
COMBINED STRESS UNITY CHECK:	0.29
OPERATING STRESS	48.1%

DRAWING STATUS	DATE	DRN	CHK	DES	GEO	APR	CR
ISSUED FOR PERMIT	2020-07-31	MS	EY	CG	LC	KP	NM

LOCATION PLAN (1"=7000')

NAD83.ND-Nft

WBI ENERGY TRANSMISSION
An MDU Resources Group company

WBI NORTH BAKKEN EXPANSION PROJECT
MISSOURI RIVER HDD CROSSING
PLAN AND PROFILE
WATFORD CITY / TIOGA, MCKENZIE COUNTY, NORTH DAKOTA

SCALE	DWG. #	REVISION	SHEET
AS SHOWN	2386-EG-0101	G	1 OF 3

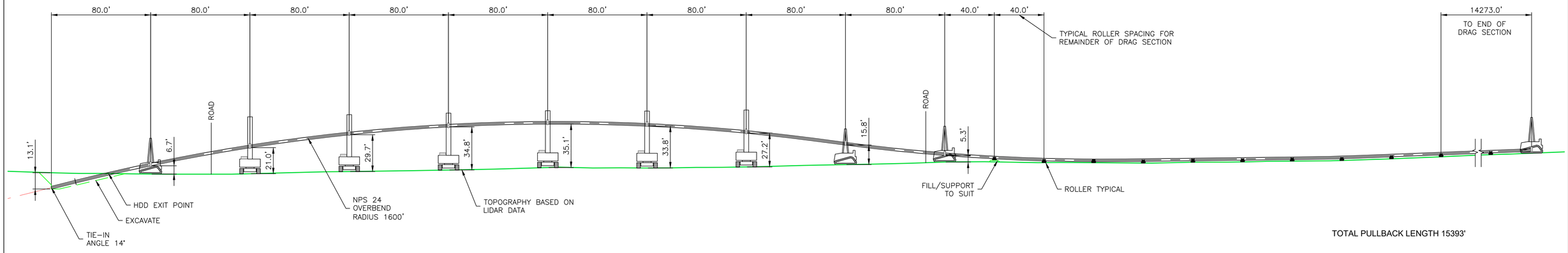
CCI & Associates Inc.
20445 State Highway 249, Suite 250
Houston, TX 77070
COCP 27692PE

1"=600'
FT 0 600 1200 2400

1"=200'
FT 0 200 400 800

PULLBACK PLAN VIEW

SCALE 1"=600'



TOTAL PULLBACK LENGTH 15393'

PULLBACK DETAIL

SCALE 1"=40' HORIZONTAL
SCALE 1"=40' VERTICAL

REFERENCE DOCUMENT NO.	DATE
1. NBE_PL-PROPOSED_ROUTES 190824	2019-08-24
2. 2386-01-IMP STEEL STRESS-24-inch-02	2020-07-30

CCI & Associates Inc.
20445 State Highway 249, Suite 250
Houston, TX 77070
COCP 27692PE

ENGINEER AND PERMIT STAMPS

1"=600'
FT 0 600 1200 2400

1"=40'
FT 0 40 80 160

PIPELINE SPECIFICATIONS

	NPS 24
OUTSIDE DIAMETER (OD)(in)	24
WALL THICKNESS (WT)(in)	0.99
GRADE (psi)	60,000
PRODUCT	NATURAL GAS
MATERIAL	STEEL
SPECIFICATIONS	API 5L
INTERNAL COATING	N/A
OUTER COATING	DUAL FBE
MAX. OPER. PRESSURE (psi)	1,480
MIN. TEST PRESSURE (psi)	1,850
MAX. OPER. TEMP (°F)	100
MIN. INSTALLATION TEMP (°F)	60

PULL FORCE / RIG SIZE / STRESS

PULL FORCE (w/o BUOYANCY CONTROL):	752,000 lbs (w/sf)
MINIMUM RECOMMENDED RIG SIZE:	1,000,000 lbs

DRAWING STATUS	DATE	DRN	CHK	DES	GEO	APR	CR
ISSUED FOR PERMIT	2020-07-31	MH	EY	CG	N/A	KP	NM

LOCATION PLAN (1"=7000')

NAD83.ND-Nft

WBI ENERGY TRANSMISSION
An MDU Resources Group company

WBI NORTH BAKKEN EXPANSION PROJECT
MISSOURI RIVER HDD CROSSING
PULLBACK PLAN AND DETAIL
TIOGA, MCKENZIE COUNTY, NORTH DAKOTA

SCALE	DWG. #	REVISION	SHEET
AS SHOWN	2386-EG-0102	D	2 OF 3

NOTES

1. All dimensions are in feet unless otherwise specified. All dimensions are to the centerline of borehole unless otherwise specified.
2. All drill path lengths are rounded to the nearest foot and angles are rounded to the nearest degree, unless otherwise specified.
3. This drawing is based on information provided from various sources. Consulting company does not take responsibility for the accuracy of information provided by others.
4. The crossing shall be constructed in accordance with ASME B31.8 2018.

CONSTRUCTION

5. The estimated theoretical pull force (including safety factor) for this HDD crossing has been calculated to be 752,000 lbs without the consideration of pipeline buoyancy control.
6. Assumed final borehole size is 36".
7. The Contractor shall submit a Drilling Execution Plan for Company approval (prior to start of drilling operations) meeting the minimum requirements of the Contract Documents. Any deviation from the Execution Plan shall only be allowed with Company approval.
8. The Contractor shall verify topographical survey information represented on this drawing in the field prior to construction. Contractor shall inform the Owner of any topographical discrepancies identified.
9. The design drill path and existing utilities being crossed shall have a minimum separation of 10ft.
10. Contractor shall supply and use an approved annular pressure tool capable of operating within the expected pressure range. Annular pressure information provided is based on a mud motor assembly for a 13 1/2" pilot hole.
11. The locations of existing utilities, pipelines and structures shown on the drawing are approximate and shall be verified in the field by the Contractor prior to start of any excavation or pilot hole operations. Verification shall be in accordance with Company specifications and procedures. The Contractor shall ensure any utilities, pipelines and structures in the area are protected and not damaged by the construction.
12. The Contractor shall take specific precautions in protecting existing utilities, pipelines and structures at the entry and exit sites. Such precautions may include: entry/exit pits excavated below existing utilities, casing or sheet piling used to protect pipelines, ramping/matting and special drilling precautions employed during drilling. These precautions shall be used to ensure the drilling tools, pipe and product pipe maintain a safe distance from the existing pipelines, utilities and structures.
13. The Contractor shall assess the need for temporary casing, including both small diameter "wash-over" type casing during pilot hole, and large diameter hammered-in place casing. If large diameter casing is utilized, casing shall be sized to accommodate the final ream pass and shall utilize centralizer casing within the temporary conductor casing. Casing diameter, wall thickness, grade, and drive shoe design shall be determined by the Contractor. A Contractor's Casing Plan shall be submitted and approved by Company prior to casing installation. All temporary casings shall be removed at completion unless otherwise noted.
14. The pilot hole shall be drilled along the design drill path with the designated design radius of curvature shown in the drawing. The pilot hole shall be within the pilot hole tolerances noted on the drawing.
15. The design radius for this crossing is 5000 ft. The pilot hole drilling shall adhere to the following tolerances:
    30ft (single joint) radius shall not be less than 1100 ft
    100ft (3-joint) average radius shall not be less than 2000 ft
16. Crossing to be completed using an intersect methodology utilizing an HDD rig on either side of the crossing. Intersect shall be planned for near the mid-point of the drill geometry in order to ensure minimized risk of drilling fluid release throughout the drill.
17. This engineered design is based on the following minimum equipment requirements that the Contractor shall have onsite:
    a. Drilling Equipment:
    - Drilling Rig with a minimum pull force of 1,000,000 lbs;
    - Drill Pipe 7 5/8" (inspected as per the HDD specification);
    - Drill Bit – 13 1/2" in diameter or larger (provide details, condition, and supplier);
    - 8" Mud Motor or larger capable of running within its specified maximum load range (provide details, condition, and supplier);
    - Annular Pressure Tool (0 to 510 psi range);
    - Reamers designed for the formation (provide manufacturer's operating specifications, condition, and supplier);
    - Gyroscopic steering system;
    - Casing (specifications and details to be provided for approval).

    b. Drilling Fluid Recycling Equipment:
    - Pump Capacity (Operable Rate – 1050 gpm);
    - Shakers (Operable Rate – 1050 gpm);
    - Centrifuge/Desander/Desilter (Minimum Capacity of 1050 gpm);
    - Engineered Drilling Fluid Plan must be able to be implemented in the field with the proposed equipment.

    c. This is a minimum list of equipment and should not be considered a directive on how to complete the work. The Contractor is responsible for the execution of the work under its Approved Execution Plan and shall supply all necessary equipment to complete its plan at its own cost. All equipment shall be supplied in good working order, maintained, fueled and serviced.
18. Drilling Fluid is assumed to have a maximum density of 10 lbs/gallon and 1.0% sand content.

ENVIRONMENTAL

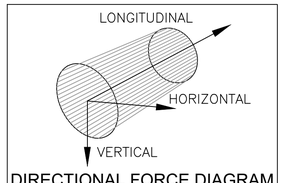
19. Emergency response spill kits must be on-site and available for use for the duration of the project.
20. Terrestrial "inadvertent return walks" shall be initiated every 4hrs. (at a minimum), or immediately following a loss of fluid event.
21. Contractor's proposed drilling fluid composition, including all expected additives, shall be reviewed and approved by the Owner's representative prior to construction.
22. The watercourse must be monitored for a potential release of drilling fluid and to assess the immediate effects of the works on the aquatic environment in accordance with applicable Federal and State regulations.
23. The Contractor shall ensure that the following documentation is on-site and readily available at all times (at a minimum):
    a. Emergency Response Procedure (ERP);
    b. Environmental Protection Plan (EPP);
    c. MSDS for all on-site material;
    d. Copies of Land Use Agreements.

GEOTECHNICAL

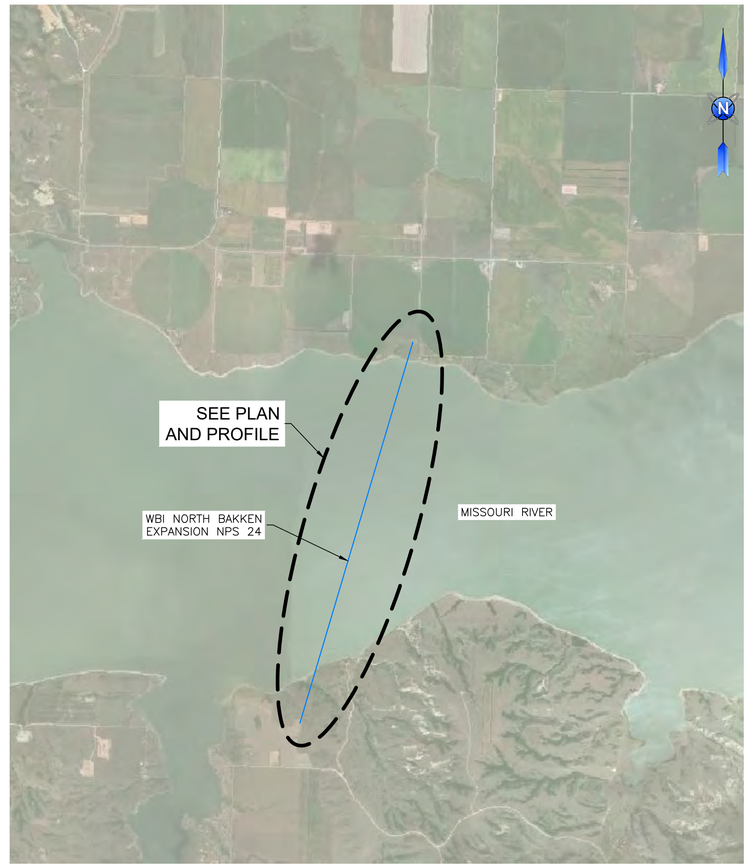
24. A land-based geotechnical investigation was completed at this site by Groundwater and Environmental Services, Inc (GES), and can be referenced from the report titled "Geotechnical Investigation Report WBI North Bakken Expansion Project", dated June 14, 2019. A supplemental water-based geotechnical investigation was also completed and can be referenced from the report titled "Geotechnical Investigation Report Water Based Borings", dated July 9, 2020.
25. The soil and bedrock stratigraphy shown is based on interpretation of data from three (3) land-based boreholes, and six (6) water-based boreholes, drilled at the locations shown and the designer's understanding of the local geology. Due to natural variations in subsurface conditions and inherent uncertainties associated with the interpretation of subsurface data, some variation in stratigraphy between boreholes and along the length of the bore should be expected.
26. The Contractor should independently evaluate the crossing with due consideration given to the suitability of its proposed equipment and construction procedures. Proposed construction means and methods shall be submitted to Company for approval but remain the sole responsibility of the Contractor.

PULLBACK NOTES

1. This drawing is engineered and designed to ensure the pipe section is not overstressed during the installation process.
2. This drawing is developed to inform the Contractor of the maximum spacing, anticipated lifting heights, minimum loading requirements and the minimum amount of support equipment to be provided by the Contractor. It is expected that the Pipeline Contractor will choose the type and size of equipment to manage the minimum loads provided.
3. The shown spacing and heights of supports represent a modeled maximum total stress on the pipe (including tension, bending and shear stress at the supports) of 80% of SMYS.
4. The support placement and spacing shown is based on provided topographical survey data. The Contractor shall field fit equipment according to the terrain or other on-site requirements adhering to a maximum spacing provided of 80ft between any two supports.
5. This drawing is based on information provided from various sources. Contractor shall confirm the accuracy of information prior to construction.
6. All loads shown assume that no buoyancy control will be utilized for this pullback.
7. All dimensions are to the bottom of pipe.
8. It is anticipated that all support equipment will utilize roller cradles during the pullback operation. Load capacity of each roller cradle is 56,500lbs (24"-36" roller cradle model). The load capacity shall be confirmed prior to use.
9. Equipment shall be sized with an adequate safety factor (2.0x or greater) to safely handle expected loads and to suit the heights recommended to facilitate the proper radius of curvature. It is expected that extended boom lengths or ramping under the side-booms may be necessary.
10. Shown pipe roller spacing based on roller load capacity of 12,000lbs. Roller spacing shall be adjusted to suit model of roller used.
11. It is the Contractor's responsibility to ensure they have crossing agreements from all utility and pipeline companies in the area where work will be performed overtop or in the vicinity of high pressure pipelines or utilities.
12. Proper padding/ramping above existing lines is required for all areas in which heavy equipment is moved or placed where the equipment may impact these lines.
13. Contractor shall ensure that there is minimal public disturbance and disruption during all parts of the work.
14. Contractor shall be prepared to work with other Contractors in the area.
15. Care shall be taken in manipulating the first and last section of pipe throughout the pullback. The maximum unsupported length at the leading and trailing ends of the pull section shall not exceed 60ft in order to prevent overstressing of the pipe.
16. Contractor shall implement an adequately sized catch off tractor as an anchor when the pipe section involves a slope, horizontal curve and/or a high to low installation. The tractor must be secured to the pipe section in an acceptable manner such as a pull head.
17. Contractor shall consider other factors such as weather conditions (wind, rain, snow, etc.) and site conditions on the pullback operations to ensure a safe lift and installation.
18. Contractor shall secure the load lines on cranes (if required) to the ground to minimize movement of the cradles along the pipe.
19. Contractor to take all precautions to minimize damage to pipe coating during pullback. Any damage to coating shall be repaired as specified in contract documents.
20. Contractor shall modify this plan (as required) to ensure the pipe pull section is sufficiently supported at all times during pullback. Contractor must provide a Pullback Plan for approval by the owner's representative two weeks in advance of commencing the work.
21. For the support design shown, the largest expected forces are:
    Single Cradle Support
    a. Vertical 55,400lbs
    b. Horizontal 95lbs
    c. Longitudinal 5,540lbs
22. The loads on the supports during pullback resolve to three directions; vertical, horizontal and longitudinal. The vertical direction is the weight of the pipe, the horizontal direction results from horizontal curves and the longitudinal direction results from the pipe being pulled through the cradles. A diagram can be seen in the detail to the right.

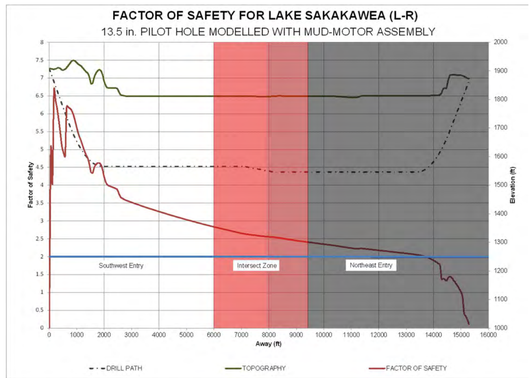


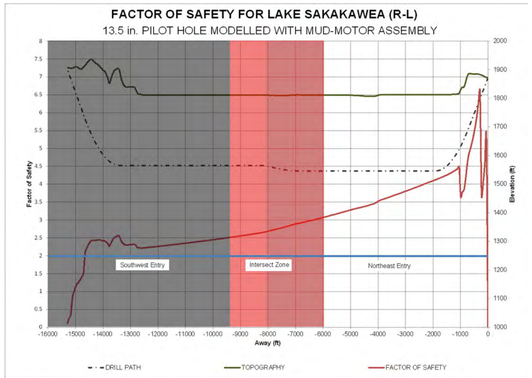
DIRECTIONAL FORCE DIAGRAM
N.T.S.



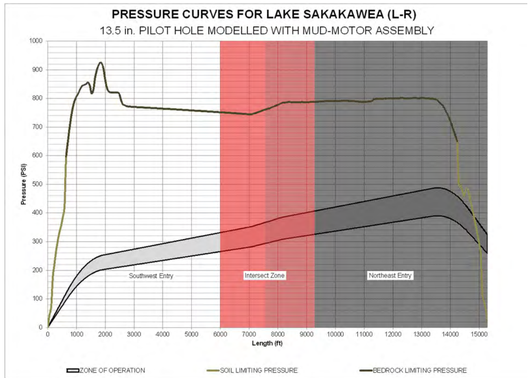
LOCATION PLAN
SCALE 1"=3000'

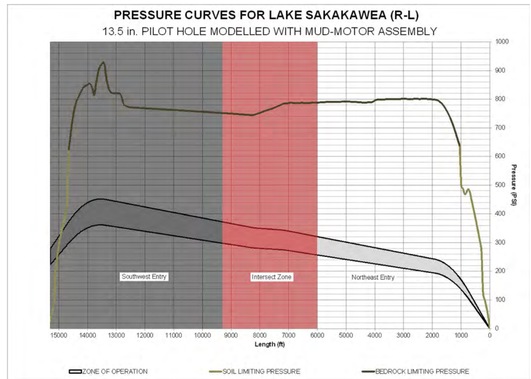
FACTOR OF SAFETY GRAPHS





ANNULAR PRESSURE CHART





REFERENCE DOCUMENT NO.	DATE
1. NBE_PL-PROPOSED_ROUTES 190824	2019-08-24
2. 2386-01-IMP STEEL STRESS-24-inch-02	2020-07-30
3. 2386-01-L2R-AP-02	2020-07-23
4. 2386-01-R2L-AP-02	2020-07-23
5. 2386-01-L2R-AP-02 (USACE FS)	2020-07-23
6. 2386-01-R2L-AP-02 (USACE FS)	2020-07-23

CCI & Associates Inc.
20445 State Highway 249, Suite 250
Houston, TX 77070
COCP 27692PE

ENGINEER AND PERMIT STAMPS

PIPELINE SPECIFICATIONS

	NPS 24
OUTSIDE DIAMETER (OD)(in)	24
WALL THICKNESS (WT)(in)	0.99
GRADE (psi)	60,000
PRODUCT	NATURAL GAS
MATERIAL	STEEL
SPECIFICATIONS	API 5L
INTERNAL COATING	N/A
OUTER COATING	DUAL FBE
MAX. OPER. PRESSURE (psi)	1,480
MIN. TEST PRESSURE (psi)	1,850
MAX. OPER. TEMP (°F)	100
MIN. INSTALLATION TEMP (°F)	60

STEERING TOLERANCES

	30ft	100ft	DESIGN
MINIMUM RADIUS (ft)	1100	2000	5000

PULL FORCE / RIG SIZE / STRESS

PULL FORCE (w/o BUOYANCY CONTROL):	752,000 lbs (w/sf)
MINIMUM RECOMMENDED RIG SIZE:	1,000,000 lbs
COMBINED STRESS UNITY CHECK:	0.29
OPERATING STRESS	48.1

DRAWING STATUS	DATE	DRN	CHK	DES	GEO	APR	CR
ISSUED FOR PERMIT	2020-07-31	MH	EY	CG	LC	KP	NM

NAD83.ND-Nft

WBI ENERGY TRANSMISSION
An MDU Resources Group company

WBI NORTH BAKKEN EXPANSION PROJECT

MISSOURI RIVER HDD CROSSING
CONSTRUCTION NOTES AND PIPELINE INFORMATION

WATFORD CITY / TIOGA, MCKENZIE COUNTY, NORTH DAKOTA

SCALE	DWG. #	REVISION	SHEET
AS SHOWN	2386-EG-0103	A	3 OF 3

APPENDIX B – HDD STRESS SUMMARY

Owner:	WBI Energy Transmission
Project:	North Bakken Expansion
Date:	2020-07-29
Calculation Description:	Stress Assessment NPS 24 HDD
Applicable Crossings:	Lake Sakakawea - 9.5 lb/gal Fluid

CCI & Associates Inc.

Completed By:	KP	Reviewed By:	JT	Sheet Revision:	R19.1

Pipe Information			Design Criteria				Crossing Characteristics	
Pipe Diameter (in)	Pipe W.T. (in)	Pipe Grade (psi)	MOP (psi)	Max. Operating Temperature (°F)	Installation Temperature (°F)	Design Radius (ft)	Maximum Depth From Entry Location (ft)	HDD Length (ft)
24	0.990	60000	1,480	100	60	5000	361	15393

The pipe section installated stresses are modelled in 5 sections (exit tangent (5), exit arc (4), bottom tangent (3), entry arc (2), entry tangent (1)) incorporating effects of buoyancy, soil friction, curvature, fluidic drag and pipe weight. The calculated stresses are evaluated using the AGA method (PRCI). Operating stresses incorporate hoop, bending, tensile, and thermal expansion.

Variable Definitions:

F_y - Specified Minimum Yield Strength
D - Outer Diameter of Product Pipe
E - Young's Modulus (Steel)
t - Wall Thickness of Product Pipe

Tensile Stress:

			% of Allowable
5	6761.2 psi	**PRCI 5.1.1, 5.5**	12.5%
4	7007.0 psi		**13.0%**
3	6434.7 psi	**Allowable Tensile Stress**	11.9%
2	6758.5 psi	$F_t = (0.9) * F_y$	12.5%
1	6961.7 psi	= 54000 psi	12.9%

Bending Stress:

			% of Allowable
5	295.0 psi	**PRCI 5.2.2**	0.7%
4	5900.0 psi	$f_b = (E/D)/(2R)$	**13.1%**
3	295.0 psi	**Allowable Bending Stress**	0.7%
2	5900.0 psi	$F_b = \{0.72 - (0.58\ F_y\ D / (E\ t)\}\ F_y$	**13.1%**
1	295.0 psi	= 45000 psi	0.7%

Hoop Stress:

			% of Allowable
5	1242.0 psi	**PRCI 5.2.3**	5.3%
4	2130.2 psi	$f_h = P_{ext}D/2t$	**9.1%**
3	2130.2 psi	**Allowable Hoop Stress**	**9.1%**
2	2130.2 psi	$F_{hc} = [0.88 \times E \times (t/D)^2] / 1.5$	**9.1%**
1	1111.3 psi	= 23300.7 psi	4.8%

Operating Stresses:

			% of Allowable
5	10197.0 psi	**PRCI 5.4.4.2:**	37.8%
4	12999.5 psi	**Allowable Shear Stress**	**48.1%**
3	10197.0 psi	$F(v) = 45\%$ of F_y	37.8%
2	12999.5 psi	$F(v) = 27000$ psi	**48.1%**
1	10197.0 psi		37.8%

Combined Stress (Tensile and Bending)

			% of Allowable
5	0.13	**PRCI 5.2.4**	13%
4	0.26	$f_t/0.9F_y+f_b/F_b \le 1$	**26%**
3	0.13		13%
2	0.26		26%
1	0.14		14%

Combined Stress (Tensile, Bending, and Hoop)

			% of Allowable
5	0.02	**PRCI 5.2.4**	2%
4	0.08	$A^2+B^2+2v\lvert A\rvert B \le 1$	**8%**
3	0.02	$A = ((f_t+f_b-0.5f_h)1.25)/F_y$	2%
2	0.07	$B = 1.5f_h/F_{hc}$	7%
1	0.02		2%

Estimated PullForce (without Buoyancy Control)

501,204 lbs 751,805 lbs (including 1.5x Safety Factor)

Owner:	WBI Energy Transmission
Project:	North Bakken Expansion
Date:	2020-07-29
Calculation Description:	Stress Assessment NPS 24 HDD
Applicable Crossings:	Lake Sakakawea - 10.5 lb/gal Fluid

CCI & Associates Inc.

Completed By:	KP	Reviewed By:	JT	Sheet Revision:	R19.1

Pipe Information			Design Criteria				Crossing Characteristics	
Pipe Diameter (in)	Pipe W.T. (in)	Pipe Grade (psi)	MOP (psi)	Max. Operating Temperature (°F)	Installation Temperature (°F)	Design Radius (ft)	Maximum Depth From Entry Location (ft)	HDD Length (ft)
24	0.990	60000	1,480	100	60	5000	361	15393

The pipe section installated stresses are modelled in 5 sections (exit tangent (5), exit arc (4), bottom tangent (3), entry arc (2), entry tangent (1)) incorporating effects of buoyancy, soil friction, curvature, fluidic drag and pipe weight. The calculated stresses are evaluated using the AGA method (PRCI). Operating stresses incorporate hoop, bending, tensile, and thermal expansion.

Variable Definitions:

F_y - Specified Minimum Yield Strength
D - Outer Diameter of Product Pipe
E - Young's Modulus (Steel)
t - Wall Thickness of Product Pipe

Tensile Stress:

			% of Allowable
5	6777.8 psi	**PRCI 5.1.1, 5.5**	12.6%
4	7208.1 psi		**13.3%**
3	5968.7 psi	**Allowable Tensile Stress**	11.1%
2	6336.4 psi	$F_t = (0.9) * F_y$	11.7%
1	6454.9 psi	= 54000 psi	12.0%

Bending Stress:

			% of Allowable
5	295.0 psi	**PRCI 5.2.2**	0.7%
4	5900.0 psi	$f_b = (E/D)/(2R)$	**13.1%**
3	295.0 psi	**Allowable Bending Stress**	0.7%
2	5900.0 psi	$F_b = \{0.72 - (0.58\ F_y\ D / (E\ t)\}\ F_y$	**13.1%**
1	295.0 psi	= 45000 psi	0.7%

Hoop Stress:

			% of Allowable
5	1353.3 psi	**PRCI 5.2.3**	5.8%
4	2335.1 psi	$f_h = P_{ext}D/2t$	**10.0%**
3	2335.1 psi	**Allowable Hoop Stress**	**10.0%**
2	2335.1 psi	$F_{hc} = [0.88 \times E \times (t/D)^2] / 1.5$	**10.0%**
1	1208.9 psi	= 23300.7 psi	5.2%

Operating Stresses:

			% of Allowable
5	10197.0 psi	**PRCI 5.4.4.2:**	37.8%
4	12999.5 psi	**Allowable Shear Stress**	**48.1%**
3	10197.0 psi	F(v) = 45% of F_y	37.8%
2	12999.5 psi	F(v) = 27000 psi	**48.1%**
1	10197.0 psi		37.8%

Combined Stress (Tensile and Bending)

			% of Allowable
5	0.13	**PRCI 5.2.4**	13%
4	0.26	$f_t/0.9F_y+f_b/F_b \le 1$	**26%**
3	0.12		12%
2	0.25		25%
1	0.13		13%

Combined Stress (Tensile, Bending, and Hoop)

			% of Allowable
5	0.02	**PRCI 5.2.4**	2%
4	0.08	$A^2+B^2+2v\lvert A\rvert B \le 1$	**8%**
3	0.02	$A = ((f_t+f_b-0.5f_h)1.25)/F_y$	2%
2	0.07	$B = 1.5f_h/F_{hc}$	7%
1	0.02		2%

Estimated PullForce (without Buoyancy Control)

515,588 lbs 773,382 lbs (including 1.5x Safety Factor)

Owner:	WBI Energy Transmission
Project:	North Bakken Expansion
Date:	2020-07-29
Calculation Description:	Stress Assessment NPS 24 HDD
Applicable Crossings:	Lake Sakakawea - 12 lb/gal Fluid

CCI & Associates Inc.

Completed By: KP | Reviewed By: JT | Sheet Revision: R19.1

Pipe Information			Design Criteria				Crossing Characteristics	
Pipe Diameter (in)	Pipe W.T. (in)	Pipe Grade (psi)	MOP (psi)	Max. Operating Temperature (°F)	Installation Temperature (°F)	Design Radius (ft)	Maximum Depth From Entry Location (ft)	HDD Length (ft)
24	0.990	60000	1,480	100	60	5000	361	15393

The pipe section installated stresses are modelled in 5 sections (exit tangent (5), exit arc (4), bottom tangent (3), entry arc (2), entry tangent (1)) incorporating effects of buoyancy, soil friction, curvature, fluidic drag and pipe weight. The calculated stresses are evaluated using the AGA method (PRCI). Operating stresses incorporate hoop, bending, tensile, and thermal expansion.

Variable Definitions:

F_y - Specified Minimum Yield Strength
D - Outer Diameter of Product Pipe
E - Young's Modulus (Steel)
t - Wall Thickness of Product Pipe

Tensile Stress:

			% of Allowable
5	6969.8 psi	**PRCI 5.1.1, 5.5**	12.9%
4	7689.7 psi		14.2%
3	8133.7 psi	**Allowable Tensile Stress**	15.1%
2	8807.5 psi	$F_t = (0.9) * F_y$	16.3%
1	8935.1 psi	= 54000 psi	**16.5%**

Bending Stress:

			% of Allowable
5	295.0 psi	**PRCI 5.2.2**	0.7%
4	5900.0 psi	$f_b = (E/D)/(2R)$	**13.1%**
3	295.0 psi	**Allowable Bending Stress**	0.7%
2	5900.0 psi	$F_b = \{0.72 - (0.58\ F_y\ D / (E\ t)\}\ F_y$	**13.1%**
1	295.0 psi	= 45000 psi	0.7%

Hoop Stress:

			% of Allowable
5	1520.4 psi	**PRCI 5.2.3**	6.5%
4	2642.4 psi	$f_h = P_{ext}D/2t$	**11.3%**
3	2642.4 psi	**Allowable Hoop Stress**	**11.3%**
2	2642.4 psi	$F_{hc} = [0.88 \times E \times (t/D)^2] / 1.5$	**11.3%**
1	1355.4 psi	= 23300.7 psi	5.8%

Operating Stresses:

			% of Allowable
5	10197.0 psi	**PRCI 5.4.4.2:**	37.8%
4	12999.5 psi	**Allowable Shear Stress**	**48.1%**
3	10197.0 psi	F(v) = 45% of F_y	37.8%
2	12999.5 psi	F(v) = 27000 psi	**48.1%**
1	10197.0 psi		37.8%

Combined Stress (Tensile and Bending)

			% of Allowable
5	0.14	**PRCI 5.2.4**	14%
4	0.27	$f_t/0.9F_y+f_b/F_b \le 1$	27%
3	0.16		16%
2	0.29		**29%**
1	0.17		17%

Combined Stress (Tensile, Bending, and Hoop)

			% of Allowable
5	0.03	**PRCI 5.2.4**	3%
4	0.09	$A^2+B^2+2\nu\lvert A\rvert B \le 1$	9%
3	0.04	$A = ((f_t+f_b-0.5f_h)1.25)/F_y$	4%
2	0.10	$B = 1.5f_h/F_{hc}$	**10%**
1	0.04		4%

Estimated PullForce (without Buoyancy Control)

639,119 lbs 958,679 lbs (including 1.5x Safety Factor)

Owner:	WBI Energy Transmission
Project:	North Bakken Expansion
Date:	08/01/2019
Calculation Description:	HDD Pipe Pullback Analysis NPS 24
Applicable Crossings:	Lake Sakakawea - 12 lb/gal Fluid

CCI & Associates Inc.

Completed By:	KP	Reviewed By:	JT	Sheet Revision: R19.1

Pipe Information			Design Criteria					
Pipe Diameter (in)	**Pipe W.T. (in)**	**Pipe Grade (psi)**	**Overbend Radius (ft)**	**Total Supported Weight (lbs/ft)**	**Maximum Support Spacing (ft)**	**Roller Spacing (ft)**	**Maximum Unsupported Overhang (ft)**	**Estimated Pullforce (lbs)**
24.00	0.990	60000	1,600	242.0	80	40	60	958,679

The pipe pullback is modelled such that the pipe is not over-stressed due to the combination of bending, tensile, and shear stresses throughout the pullback section, both in the spans between supports and at the support locations.
The pullback is also modelled such that the supports are not overloaded with the weight of the pipe at any point during the pipe installation, including as the tailing end passes from support to support.

Definitions:

SMYS - Specified Minimum Yield Strength
Overhang - Where Unsupported Tail End of Pipe Extends Beyond Support
Full Span - Where Pipe Is Supported Between 2 Supports at Maximum Support Spacing Shown Above

SUPPORT LOADING

Vertical Load at Each Boom/Crane Support — **% of Support Capacity ***

At Support With Full Span:
25,100 kg 55,400 lbs — **97.9%**
At Support With Overhang:
15,400 kg 33,900 lbs — 60.1%

Longitudinal Load at Each Boom/Crane Support
2510.0 kg 5,540 lbs

* based on load capacity of Darby 24"-36" Rolli-Cradle

Horizontal Load at Each Boom/Crane Support
43 kg 95 lbs

Horizontal Load at Each Roller Support
43 kg 95 lbs

PIPE STRESS

Bending Stress	**% SMYS**	**% of Allowable (PRCI)**
At Support With Full Span:		
22355.6 psi	37.3%	53.9%
At Support with Overhanging Pipe:		
26363.1 psi	43.9%	**63.5%**

Tensile Stress

10411.5 psi	17.4%	**19.3%**

Combined Stress (Tensile and Bending)

32767.1 psi	54.6%	**73%**

APPENDIX C – RISK ASSESSMENT SUMMARY

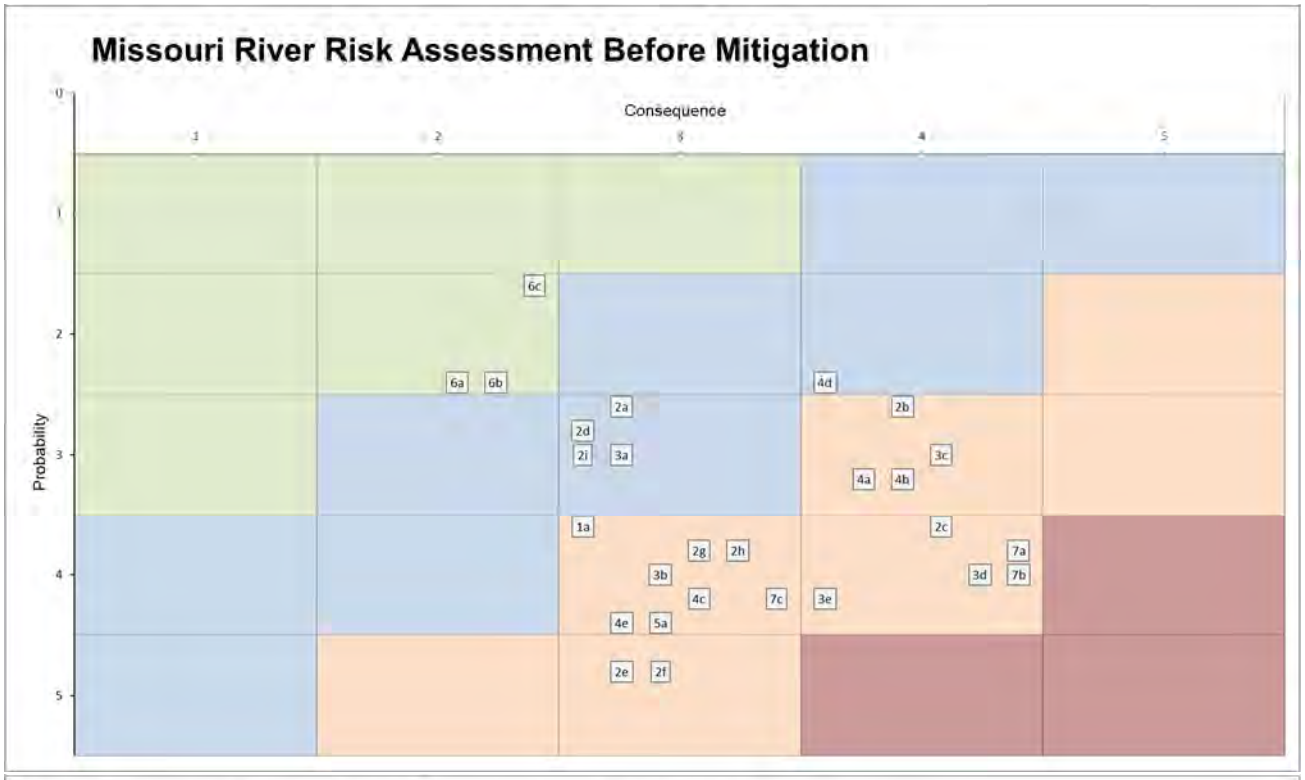
Missouri River Risk Assessment Summary

Phase	#	Description	Safety and Health Risk	Environmental Risk	Financial Risk	Production/Schedule Risk	Reputation Risk	Business Impact Risk	Risk Before Mitigation	Risk After Mitigation
Installation of Casing (Entry and Exit Points)	1a	Casing not Being Installed to Depth							High Risk	Medium Risk
Pilot Hole	2a	Fracture to Surface (Entry or exit, whichever poses as the greatest risk)		✓	✓	✓			Medium Risk	Medium Risk
	2b	Fracture to Water Body		✓	✓	✓	✓	✓	High Risk	Medium Risk
	2c	Large Fluid Loss to the Formation (>25% of total volume)		✓	✓	✓			High Risk	Medium Risk
	2d	Unstable Borehole (swelling, broken up, etc.)			✓	✓			Medium Risk	Medium Risk
	2e	Steering Control Issues			✓	✓			High Risk	High Risk
	2f	Annular Pressure Issues		✓	✓	✓			High Risk	High Risk
	2g	Over-Schedule Risk			✓	✓			High Risk	Medium Risk
	2h	Disposal of Drilling Fluid		✓	✓	✓			High Risk	Medium Risk
	2i	Water Ingress to Borehole			✓	✓			Medium Risk	Low Risk
Reaming Operations	3a	Unstable Borehole			✓	✓			Medium Risk	Medium Risk
	3b	Over-Schedule Risk			✓	✓			High Risk	Medium Risk
	3c	Loss of Equipment in Borehole			✓	✓	✓		High Risk	Medium Risk
	3d	Poor Removal of Cuttings			✓	✓			High Risk	High Risk
	3e	Drilling Fluid Control			✓	✓			High Risk	Medium Risk
Pullback Operations	4a	Pipe Section Gets Stuck in Borehole			✓	✓			High Risk	Medium Risk
	4b	Pull Forces Exceed Theoretical Model							High Risk	Medium Risk
	4c	Coating Damaged during Installation			✓	✓			High Risk	Medium Risk
	4d	Product Pipe is Damaged during Installation			✓	✓	✓		Medium Risk	Medium Risk
	4e	Pipe Handling on Exit	✓		✓	✓			High Risk	Medium Risk
Pipeline Contractor - Pipe Preparation and Support	5a	HDD Takes Longer than Scheduled to Complete			✓	✓			High Risk	Medium Risk
Construction Access and Pad Preparation	6a	Construction Access			✓	✓			Low Risk	Low Risk
	6b	Pad Layout & Construction			✓	✓			Low Risk	Low Risk
	6c	Travel Safety	✓				✓		Low Risk	Low Risk
Other Risks	7a	Crossing Length			✓	✓	✓	✓	High Risk	High Risk
	7b	Access to Water			✓	✓			High Risk	Medium Risk
	7c	Public Attention			✓		✓	✓	High Risk	Medium Risk
	7d				✓	✓	✓	✓		

Probability		
Value	Description	Chance
1	Rare	≤ 5%
2	Unlikely	~ 25%
3	Possible	~ 50%
4	Likely	~ 75%
5	Almost Certain	≥ 95%

Consequence	
Value	Description
1	Insignificant
2	Minor
3	Moderate
4	Major
5	Catastrophic

L	Low Risk - Managed by routine procedures
M	Medium Risk - Planned Mitigation Strategy Required
H	High Risk - Prioritized Mitigation Strategy Required
VH	Very High Risk - Immediate Mitigation Strategy Required


Missouri River Risk Assessment Before Mitigation
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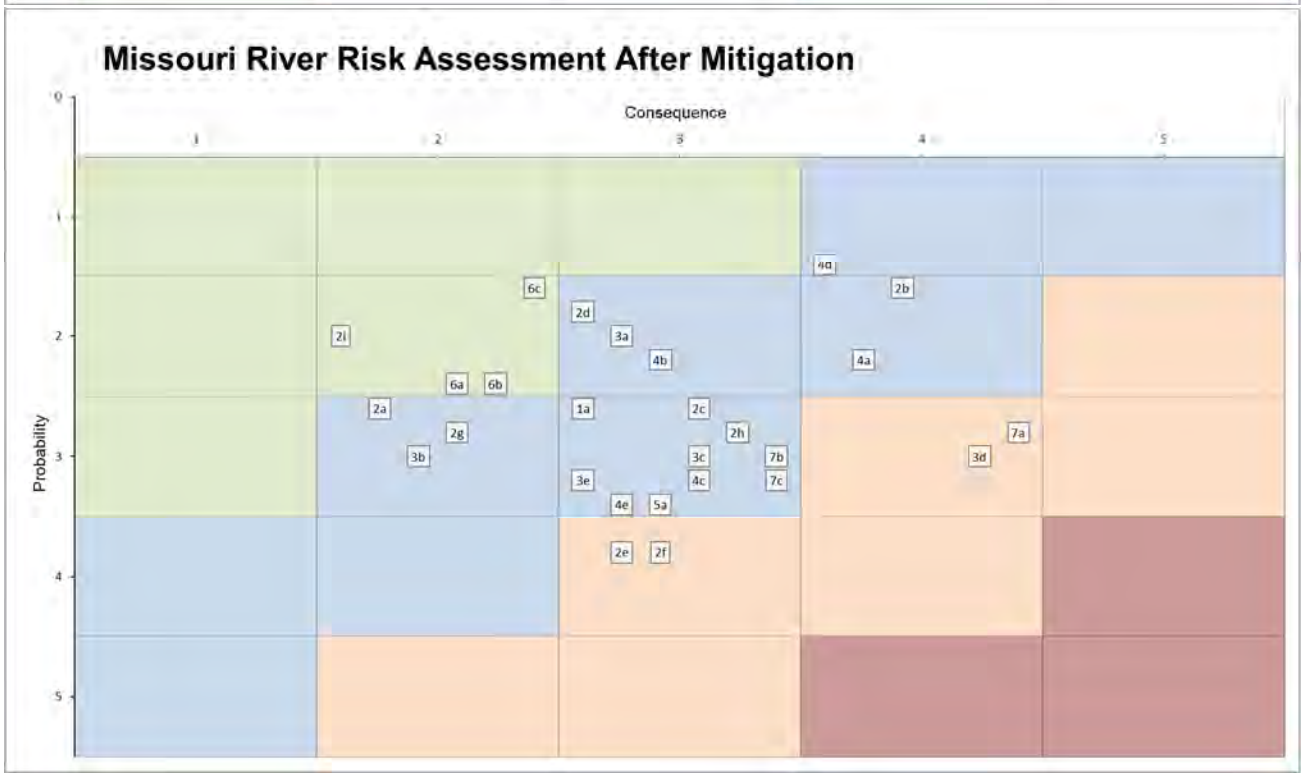
Missouri River Risk Assessment After Mitigation
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2f

Attendance: Kerby, Chelsea, Justin, Landon, Stefan, Steve, Neil

Missouri River

Date: July 31, 2020
Rev: 0

Mud Motor HDD Risk Assessment

No.	Risk/Issue	Type of Risk/Issue		Pre-Mitigation Probability	Pre-Mitigation Consequence	Post-Mitigation Probability	Post-Mitigation Consequence	Review Cost Needed?
Installation of Casing (Entry and Exit Points)								
1a	Casing not Being Installed to Depth	Safety and Health	-	4	3	3	3	Select
		Environment	-	High Risk		Medium Risk		
		Financial	-	**Description**		**Mitigation Strategy**		
		Production/Schedule	-	Geotechnical conditions near surface can pose a problem when driving casing to a designed depth. It is expected both the entry and exit locations will require casing. The entry (south) is expected to be cased to the shale/siltstone bedrock, and the exit location will be cased past the coal layer. The proposed lengths of casing install, although expected to be achievable, are quite considerable.		Achievable casing installation lengths should be investigated prior to construction. The casing should be installed in 160-200ft lengths of telescoped casing. The final casing size shall be 48" and the initial casing should be sized to ensure the final casing will reach the required depth for seating.		
		Reputation	-					
		Business Impact	-					
Pilot Hole								
2a	Fracture to Surface (Entry or exit, whichever poses as the greatest risk)	Safety and Health	-	3	3	3	2	Select
		Environment	Yes	Medium Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Granular material near surface can pose a potential risk for drilling fluid to fracture to surface. The crossing is characterized by well graded to poorly graded sand to depths of 20-120ft.		The sand is expected to be stable enough to maintain an open borehole, or cased. The topography near entry and exit is relatively flat and allows the drill to obtain sufficient depth to effectively mitigate the risk of fracture.		
		Reputation	-					
		Business Impact	-					
2b	Fracture to Water Body	Safety and Health	-	3	4	2	4	Select
		Environment	Yes	High Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Fractured formations (including coal seams as identified within the bedrock formation) or high annular pressures could result in release of fluid to surface. The length of the Missouri River crossing results in high pressures due to the building friction forces. The bedrock layer is inconsistent and dips fairly significantly in the middle of the Missouri River, reducing the expected strength of the overburden formation.		The crossing is designed to be completed as an intersect which will limit the expected drilling pressures. The crossing has been designed with significant depth to limit the potential for fracture. Casing will also help with circulation back to entry/exit locations, which should reduce the potential for climbing annular pressures. Contractor shall utilize an Annular Pressure Tool to measure actual downhole pressures during drilling of the pilot hole to ensure any significant increases in pressure beyond planned ranges can be addressed and reduced to within expected ranges with mechanical tripping or additional circulation as applicable.		
		Reputation	Yes					
		Business Impact	Yes					
2c	Large Fluid Loss to the Formation (>25% of total volume)	Safety and Health	-	4	3	3	3	Select
		Environment	Yes	High Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Drilling fluid has the potential to migrate outside of the designed drill path in fractures. The crossing location is characterized by several coal seams, including two thick coal seams above and below the bottom tangent of the drill path, which may act as preferential path for drilling fluid.		The drill depth has been chosen to limit the risk of fracture to surface. Casing is included in the design to minimize the amount of coal seams the drill path will encounter. The contractor shall develop a mitigation plan for reducing significant losses where possible, including the use of Loss Circulation Material (LCM) pills to try to plug off any encountered zones of significant fluid loss.		
		Reputation	-					
		Business Impact	-					
2d	Unstable Borehole (swelling, broken up, etc.)	Safety and Health	-	3	3	2	3	Select
		Environment	-	Medium Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Site conditions have identified granular materials at both entry and exit locations. During drilling operations this material can become unstable and collapse, which may cause reduced returns. Casing has been specified on entry and exit.		The Contractor should monitoring annular pressure and returns to ensure the borehole remains clear of obstructions, if returns slow the Contractor should mechanically clean the hole.		
		Reputation	-					
		Business Impact	-					
2e	Steering Control Issues	Safety and Health	-	5	3	4	3	Select
		Environment	-	High Risk		High Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	The crossing is 15,393ft long and each rig will need to drill 7000ft-8000ft. Maintaining weight on bit in order to be able to steer at this length is expected to be difficult, complicating the intersect.		The crossing is designed with a large radius which will reduce the steering requirements. The Contractor is utilizing 7 5/8" drill string and gyro steering systems to ensure accuracy and a successful intersect. The bottom tangent is very long and will allow the drills sufficient time to align for intersect operations. Casing may help to maintain weight on bit.		
		Reputation	-					
		Business Impact	-					
2f	Annular Pressure Issues	Safety and Health	-	5	3	4	3	Select
		Environment	Yes	High Risk		High Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Drilling operations require soil cuttings to be cleaned out of the bore and hydro-transported back to the rig by the drilling fluid. This process requires large volumes of pressurized drilling fluid to be pumped downhole. The length of the crossing will increase the risk of annular pressure issues.		The Contractor shall maintain returns to both entry pits and monitor annular pressures. A mud engineer shall be on site to monitor adherence to the crossing specific Engineered Drilling Fluid Plan (EDFP). A bottoms up procedure (circulating the calculated amount of fluid that it takes to flow from the bit downhole back up to the entry pit) should be in place and followed when necessary to clean the hole.		
		Reputation	-					
		Business Impact	-					
2g	Over-Schedule Risk	Safety and Health	-	4	3	3	2	Select
		Environment	-	High Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Geotechnical conditions, permitting, and environmental issues can all contribute to delays in the schedule. The crossing is long with a large borehole size. Over schedule could significantly increase costs. Significant delays could have a large financial impact due to delay to in-service date.		All requirements of the permits should be strictly followed. The Contractor shall ensure proper drilling procedures are in place. Encountered geotechnical conditions should be monitored and reported during drilling so modifications can be made to execution strategy, as required, to ensure no negative impacts. It is recommended construction proceed 24/7 with 2 12hr rotational shifts per day.		
		Reputation	-					
		Business Impact	-					
2h	Disposal of Drilling Fluid	Safety and Health	-	4	3	3	3	Select
		Environment	Yes	High Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Drilling fluid needs to be stored and disposed of. Running out of temporary storage can lead to schedule delays and environmental concerns. The length and large borehole size will result in significant volumes of drilling fluid. Drilling fluid may be contaminated due to coal seams.		Adequate storage should be on site. An EDFP should be followed and an adequate recycling system will be on site. An approved disposal plan should be developed prior to construction. Facility disposal should be expected.		
		Reputation	-					
		Business Impact	-					
2i	Water Ingress to Borehole	Safety and Health	-	3	3	2	2	Select
		Environment	-	Medium Risk		Low Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Ground water tends to migrate to where soil has been cut/ displaced. Coal seams may provide preferential paths for water ingress into the borehole. The ingress of water may dilute the bentonite drilling fluid and reduce the carrying capacity.		The crossing is level and the hole will be full of drilling fluid. Since the identified seams are below rig elevation, it is anticipated that the hydrostatic pressure of the drilling fluid will minimize water ingress to a manageable range.		
		Reputation	-					
		Business Impact	-					
Reaming Operations								
3a	Unstable Borehole	Safety and Health	-	3	3	2	3	Select
		Environment	-	Medium Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Site conditions have identified granular materials at both entry and exit locations. During drilling operations this material can become unstable and collapse, which may cause reduced returns.		The Contractor should monitoring annular pressure and returns to ensure the borehole remains clear of obstructions, if returns slow the Contractor should mechanically clean the hole. Adequate pumps for the ream size and length should be on site.		
		Reputation	-					
		Business Impact	-					
3b	Over-Schedule Risk	Safety and Health	-	4	3	3	2	Select
		Environment	-	High Risk		Medium Risk		
		Financial	Yes	**Description**		**Mitigation Strategy**		
		Production/Schedule	Yes	Geotechnical conditions, permitting, and environmental issues can all contribute to delays in the schedule. The crossing is long with a large borehole size.		All requirements of the permits should be strictly followed. The Contractor shall ensure proper drilling procedures are in place. Geotechnical conditions should be monitored and reported during drilling so modifications can be made to execution strategy, as required, to ensure no negative impacts. Using two rigs will split the workload which would be normally be placed upon a single rig.		
		Reputation	-					
		Business Impact	-					
		Safety and Health	-	3	4	3	3	Select
		Environment	-	High Risk		Medium Risk		

3c	Loss of Equipment in Borehole	Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	Reaming or enlarging the bore to the desired diameter may cause instability areas. These areas may cause downhole tooling to get stuck or lost. Loss of equipment within the borehole is a larger risk than with a shorter crossing.			The utilization of intersect methodology will mitigate the risk of losing equipment within the borehole. Using two rigs will split the workload which would be normally be placed upon a single rig. If problems arise on one side of the reamer, the opposite rig will maintain contact with the downhole tooling and be able to trip to surface. Drill string management plan should be provided by the contractor, which should include regularly switching out drill stem on either side of the reamers.		
		Reputation	Yes						
		Business Impact	-						
3d	Poor Removal of Cuttings	Safety and Health	-	4	4		3	4	Select
		Environment	-	High Risk			High Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	Due to the large ream pass and length a large amount of cuttings will be created and therefore will have to be removed from the borehole.			Drilling fluid parameters will be optimized for maximum cutting transportation, through adherence to the EDFP. High pump rates throughout the ream passes of the HDD will increase the annular velocity and therefore carrying capacity. Additional trips will be necessary to mechanically remove cuttings from the borehole. The number of trips required will be based on the borehole conditions. The cut size should ensure that cuttings can be removed.		
		Reputation	-						
		Business Impact	-						
3e	Drilling Fluid Control	Safety and Health	-	4	4		3	3	Select
		Environment	-	High Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	As the volume of drilling fluid within the borehole increases, it becomes more difficult to change its properties with drilling fluid additives. The large diameter borehole combined with the length will impact the quality and makeup of the drilling fluid. Coal seams may contaminate drilling fluid. Contractor will be hauling in water.			The Contractor should prepare and adhere to an approved EDFP which will outline the steps required to ensure the highest quality of drilling fluid is used for the crossing. A premix tank should be made available in addition to the mud tank. Contractor should continue to adhere to the EDFP throughout reaming operations even if they are experiencing fluid losses.		
		Reputation	-						
		Business Impact	-						
Pullback Operations									
4a	Pipe Section Gets Stuck in Borehole	Safety and Health	-	3	4		2	4	Select
		Environment	-	High Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	There is a risk that the pipe section becomes stuck in the borehole due to borehole length, instability, blockages, or irregularities. The pullforce for this length is between approximately 502,000 and 960,000lbs.			One or more wiper trips shall be completed to ensure a clean hole. Required force should be monitored during the wiper passes. It is recommended that a Pipe Thruster (with custom inserts for NPS 24) be available on exit side to assist the rig with pullback in the event pullforces start to become exceedingly high.		
		Reputation	-						
		Business Impact	-						
4b	Pull Forces Exceed Theoretical Model	Safety and Health	-	3	4		2	3	Select
		Environment	-	High Risk			Medium Risk		
		Financial	-	Description			Mitigation Strategy		
		Production/Schedule	-	There is a risk that pull forces exceed the theoretical model, especially with the length of the drill. Contributing factors can include cuttings in the borehole, having to temporarily halt line pull, borehole instability, and heavy drilling fluid.			A swab pass should be completed and downtime during installation should be minimized. It is expected pipe pull will continue overnight as required. This should be planned for with crews in advance, lighting shall be sufficient to allow overnight operations for pull. Pipe thruster should be available on exit side to assist the rig will pullback.		
		Reputation	-						
		Business Impact	-						
4c	Coating Damaged during Installation	Safety and Health	-	4	3		3	3	Select
		Environment	-	High Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	Gravel, cobbles, boulders, and bedrock interfaces within the bore path pose a risk that the pipe coating is damaged during line pull.			Wiper passes shall be completed to gauge any possible areas of issue, and additional passes may be used to ensure minimized risk prior to pullback. FBE and ARO coated pipe shall be used.		
		Reputation	-						
		Business Impact	-						
4d	Product Pipe is Damaged during Installation	Safety and Health	-	2	4		1	4	Select
		Environment	-	Medium Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	If the borehole has any ledges (intersect location or bedrock interface), the pipe could get hung up or scratched on these ledges resulting in pipe damage.			Ledges shall be reamed/smoothed out prior to product pipe installation. The intersect should be completed as straight as possible to reduce the potential for a ledges where the bits meet.		
		Reputation	Yes						
		Business Impact	-						
4e	Pipe Handling on Exit	Safety and Health	Yes	4	3		3	3	Select
		Environment	-	High Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	The exit angle, wall thickness, and size of the pipe result in a large radius overbend that reaches a height of 35 ft. The pipe section requires significant support equipment.			A pullback lift plan should be created prior to construction for review and approval. The equipment capacities should be sufficient for the anticipated loads. Spreader bars may reduce crane requirements. A traffic plan should be created for Highway 17A (52nd Street NW) and 54th Street NW (if required).		
		Reputation	-						
		Business Impact	-						
Pipeline Contractor - Pipe Preparation and Support									
5a	HDD Takes Longer than Scheduled to Complete	Safety and Health	-	4	3		3	3	Select
		Environment	-	High Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	There is significant support equipment required for pullback. If pullback is delayed this could be a large cost to keep the equipment on site. If the pipe section is not ready for pull the hole could tighten.			The pullback section should be completed significantly before pull is expected to ensure no unneccesary delays. Coordination of all contractors. Traffic plan for Highway 17A.		
		Reputation	-						
		Business Impact	-						
Construction Access and Pad Preparation									
6a	Construction Access	Safety and Health	-	2	2		2	2	Select
		Environment	-	Low Risk			Low Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	Access is assumed to be along ROW, through agricutural fields.			All agreements should be in place prior to mobilization. All workspace should be cleared as required. Access should be prepared.		
		Reputation	-						
		Business Impact	-						
6b	Pad Layout & Construction	Safety and Health	-	2	2		2	2	Select
		Environment	-	Low Risk			Low Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	The workspace are within grassy fields, clearing and grading are expected to be minimal.			All agreements should be in place prior to mobilization. All workspace should be cleared as required.		
		Reputation	-						
		Business Impact	-						
6c	Travel Safety	Safety and Health	Yes	2	2		2	2	Select
		Environment	-	Low Risk			Low Risk		
		Financial	-	Description			Mitigation Strategy		
		Production/Schedule	-	Contractor will have to travel to site from a off project location. Could continue into winter.			A travel plan should be in place.		
		Reputation	Yes						
Other Risks									
7a	Crossing Length	Safety and Health	-	4	4		3	4	Select
		Environment	-	High Risk			High Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	The crossing is 15,393ft long, approaching record lengths for an HDD crossing. There is a risk that the crossing could encounter compounding issues that lead to the crossing not being completed successfully.			A competent contractor with adequate tooling and relevant experience with similarly large installations has been selected. The risks should be highlighted to all stakeholders.		
		Reputation	Yes						
		Business Impact	Yes						
7b	Access to Water	Safety and Health	-	4	4		3	3	Select
		Environment	-	High Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	Yes	Water sources should be investigated/confirmed. Water transport should be a major consideration.			Additional transport and water sources should be investigated prior to construction. Transport should include contingency to ensure a lack of water does not lead to any delays with progress of the drill, particularly in the event of significant fluid losses during drilling, where large volumes of make-up water may be required.		
		Reputation	-						
		Business Impact	-						
7c	Public Attention	Safety and Health	-	4	3		3	3	Select
		Environment	-	High Risk			Medium Risk		
		Financial	Yes	Description			Mitigation Strategy		
		Production/Schedule	-	Scrutiny is possible in the area. There is a risk of negative public perception issues. The summer season will see high levels of lake use.			The contractor shall ensure all procedures are being followed and their impact is minimized. The contractor shall ensure all correspondence with the public is completed by WBI representation.		
		Reputation	Yes						
		Business Impact	Yes						

APPENDIX D – GEOTECHNICAL REPORTS

CCI and Associates, Inc.

Geotechnical Investigation Report

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Date:
June 14, 2019

Geotechnical Investigation Report

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Prepared for:
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ANTHONY P. FRANCIS REGISTERED PROFESSIONAL 8204 ENGINEER NORTH DAKOTA

6/14/2019

Anthony Frances, PE
Geotechnical Engineering
Material Testing Services, LLC.

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Figure 1 – Soil Boring Location Map

Tables

Table 1 – Soil Boring Locations
Table 2 – Laboratory Soil Test Data

Appendices

Appendix A - Boring Logs
Appendix B - Photographic Documentation
Appendix C - Laboratory Reports

Acronyms

ASTM	American Society for Testing and Materials
CCI	CCI and Associates, Inc.
GES	Groundwater & Environmental Services, Inc.
HDD	horizontal directional drilling
HSA	Hollow-stem auger
IDS	Interstate Drilling Services, LLP
MTS	Material Testing Services, LLC
TGCBA	Tobacco Garden Creek Bay Area
USACE	US Army Corp of Engineers

1 Introduction

This report presents the results of the geotechnical investigation that was performed by Groundwater and Environmental Services, Inc. (GES) for the project known as the WBI North Bakken Expansion Project in western North Dakota. Specifically, this report covers the geotechnical exploration at 3 land-based soil borings located along the proposed horizontal directional drilling (HDD) pipeline project under Lake Sakakawea/Missouri River (**Figure 1**). The proposed pipeline alignment under Lake Sakakawea is located approximately 1 mile northeast of the Tobacco Garden Creek Bay Area (TGCBA). The TGCBA is located approximately 23 miles northeast of Watford City, North Dakota.

Services for this investigation were performed in general accordance with the April 1, 2019 Services Contract by and between CCI and Associates, Inc. (CCI) and GES.

1.1 Project Location and Scope

The objective of this phase of the geotechnical investigation is to assist CCI with evaluating the subsurface conditions at 3 land-based boring locations (LB-1 through LB-3) located along the proposed HDD pipeline alignment on the north and south sides of Lake Sakakawea.

The scope of work included the following:

- Prepare a site-specific health and safety plan for GES employees and subcontractors for the proposed geotechnical investigation activities.
- Coordinate field activities and communication with project team and CCI.
- Arrange for utility clearance through North Dakota One Call.
- Mobilize our drilling project team to the project including Interstate Drilling Services, LLP (IDS) and GES personnel.
- Advance 3 land-based soil borings and collect samples at designated locations surveyed by a CCI subcontractor.
- Contract laboratory tests on soil samples obtained from the 3 land-based soil borings to evaluate physical properties.
- Provide a written geotechnical report.

2 Methods

2.1 Soil Borings

As part of the geotechnical investigation, GES contracted with IDS of Grand Forks, North Dakota, to advance the 3 land-based soil borings (**Figure 1**). IDS used a Diedrich D-50 track-mounted drill rig to advance the borings and collect soil samples.

The drilling rig, equipment and supplies mobilized to the project location on April 23, 2019. Advancement of soil boring LB-1 began on April 24 and the last soil boring LB-3 was completed on May 5, 2019. The drilling operation consisted of one crew working 12-hour shifts. Borehole locations for LB-1 through LB-3 were provided by CCI and are provided in **Table 1**.

Soil borings LB-1, LB-2, and LB-3 were completed to depths of 403 feet, 400 feet, and 370 feet below grade, respectively. Hollow-stem auger (HSA) boring methodology was used to collect soil samples while boring through unconsolidated sediment in the upper portion of each soil boring. Once competent sediment was encountered, a closed loop, fluid rotary drilling methodology was used to advance the borings. Rock coring drilling methodology was used at each boring for the last, approximately 200+ feet (to boring terminus). Upon completion, each boring was sealed from the boring terminus to ground surface with a concrete/bentonite slurry through a tremie rod. Drilling cuttings and sediment were thin spread at each boring location.

During HSA and fluid rotary drilling methodology, 1.5-foot samples were collected at 5 foot intervals using a split-spoon sampler in accordance with American Society for Testing and Materials (ASTM) D1586 (*Standard Test Method for Standard Penetration Test [SPT] and Split-Barrel Sampling of Soils*) using a 2-inch diameter split-spoon sampler. During rock coring drilling methodology, samples were generally collected at 5-foot sample intervals continuously in accordance with ASTM D2113 (*Standard Practice for Rock Core Drilling and Sampling of Rock for Site Exploration*) using a using a NQ3 size, triple-tube core barrel with a diamond bit.

Soils were classified in the field by a GES field geologist using ASTM Visual-Manual procedures (ASTM D2488, *Standard Practice for Description and Identification of Soils [Visual-Manual Procedure]*). The field geologist also collected samples from the split-spoon sampler and rock core sampler for geotechnical laboratory testing.

The boring logs and standard boring classification guidelines are contained in **Appendix A**. Photographic documentation of the project is provided in **Appendix B.**

2.2 Laboratory Testing

GES contracted with Material Testing Services, LLC (MTS) of Minot, North Dakota to provide geotechnical laboratory testing and evaluation services to aid in classifying and evaluating the physical properties of the soil/rock samples. Soil/rock sample selection and laboratory test parameters were determined by CCI.

The laboratory testing included the following:

- Moisture Content (ASTM D4959 - Standard Test Method for Determination of Water Content of Soil by Direct Heating and D4643 - Standard Test Method for Determination of Water Content of Soil and Rock by Microwave Oven Heating).
- Sieve Analysis (ASTM D422 – Test Method for Particle-size Analysis of Soils).
- Atterberg Limits (ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils).
- Unconfined Compression Testing (ASTM D2166 – Standard Test Method for Unconfined Compressive Strength of Cohesive Soils).

Test results are summarized in **Table 2** with the exception of the unconfined compression test results, which are provided with the laboratory reports in **Appendix C.**

3 Site Conditions

The proposed HDD pipeline crossing traverses southwest to northeast across Lake Sakakawea approximately 1 mile northeast of the TGCBA. The physiographic regions where the proposed HDD pipeline crossing is located consist of the McKenzie Upland Unit, located southwest of the Missouri River and the Coteau Slope Unit, located northeast of the Missouri River. These units are part of the Great Plains and are characterized by rolling to hilly plains with both erosional and glacial landforms. The proposed HDD crossing is located within the historic Missouri River floodplain that was flooded with the construction of the Garrison Dam in 1956 to form Lake Sakakawea. This area is located in the central portion of the Williston Basin.

The surface geology in the area consists of thin layers of glacial deposits underlain by the Tertiary-Aged Sentinel Butte Formation and Bullion Creek Formation. The Sentinel Butte Formation consists of layers of silt, clay, sand, lignite, carbonaceous shale, and mudstone (Carlson, 1985). The Bullion Creek Formation underlies the Sentinel Butte Formation and consists of yellowish layers of silt, clay, and sand with interbedded sandstone, lignite, baked clay, and limestone (Bluemle, 1977). Both formations form rolling topography over broad areas and has been eroded to badlands near rivers.

Soil borings LB-1 through LB-3 generally consisted of well graded to poorly graded sand in the upper portion of the borings. The well graded to poorly graded sand was logged from the ground surface to a depth of approximately 25 feet below grade at LB-1 and from the ground surface to approximately 120 feet below grade at LB-2 and LB-3. Underlying the sand, silt, clay (lean and fat), weathered shale, and silty sand were logged. Underlying the sand, lignite (laminations to layers >20 feet thick) were logged throughout each boring to boring terminus. Saturated conditions were only encountered at boring LB-3, at 24.5 feet below grade.

4 Limitations

The data generated and conclusions and opinions provided are based on the scope of work performed. All work was conducted in a manner consistent with currently accepted geotechnical

engineering practices exercised by members of the profession practicing under similar conditions. No other warranty, expressed or implied, is made.

The samples collected and described in this report are representative of the subsurface conditions at the sampled locations and intervals, and therefore, do not necessarily reflect strata variations that may exist between sampled intervals and locations. If variations from the subsurface conditions described in this study are noted during additional investigations and/or construction, recommendations in this report must be re-evaluated.

GES is not responsible for the independent conclusions, opinions, or recommendations made by others based on the data presented in this report. Nor can GES warrant that this report will satisfy the dictates of or provide a legal defense in connection with an environmental law or regulation.

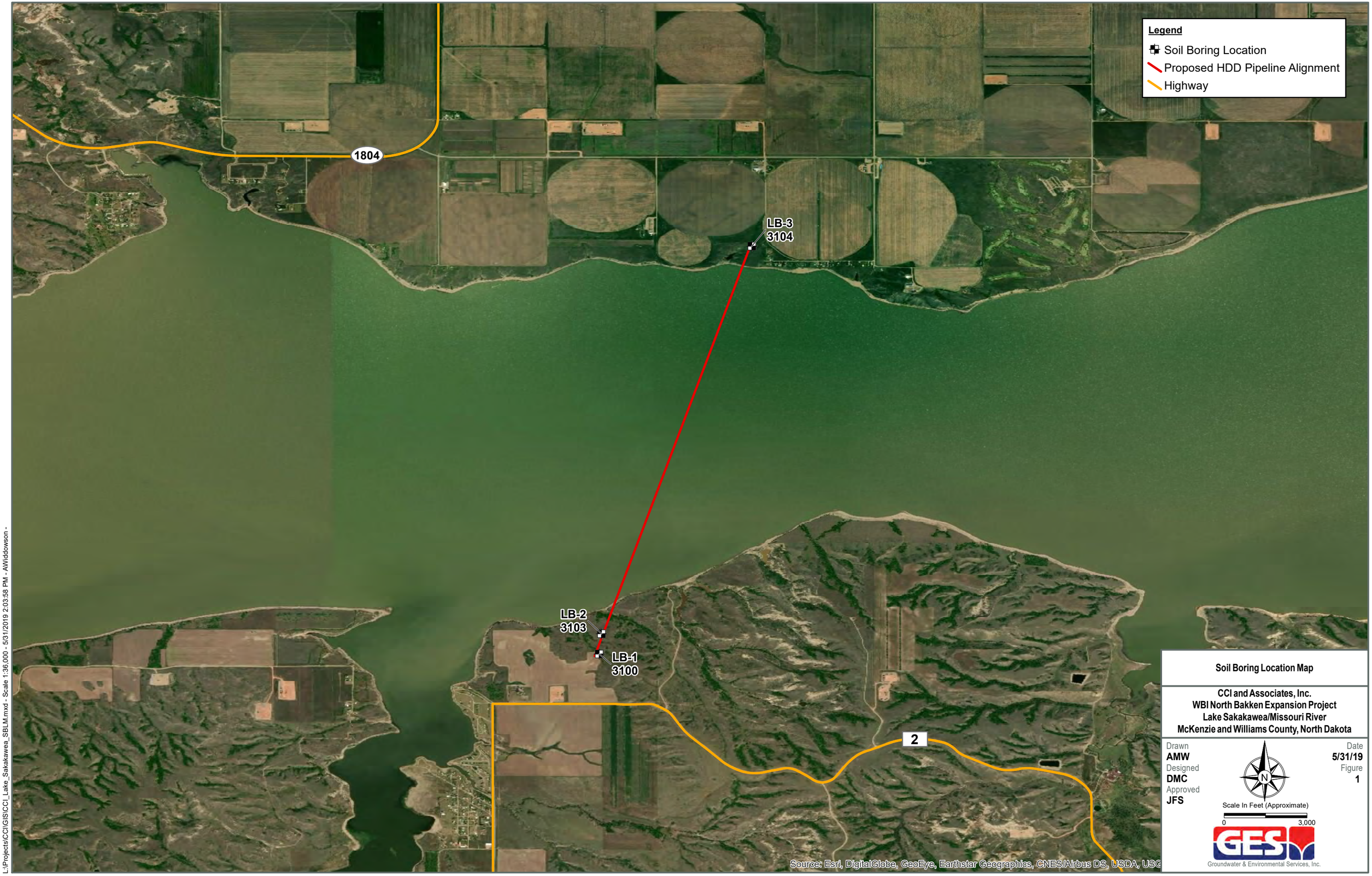
The results reported and any opinions reached by GES are for the benefit of the CCI & Associates and their client and unless agreed to by GES in writing, are not to be disclosed to or relied upon by any third party. The results and opinions set forth by GES in this report will be valid as of the date of the report.

References

Bluemle, J.P. 1977. *Geologic Highway Map of North Dakota*. North Dakota Geological Survey Educational Series 11, Miscellaneous Map 19.

Carlson, Clarence G. 1985. *Geology of McKenzie County, North Dakota.* North Dakota Geological Survey, Bulletin 80 – Part 1 and North Dakota State Water Commission, County Groundwater Studies 37 – Part 1.

Figure



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Soil Boring Location Map

CCI and Associates, Inc.
WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Drawn **AMW**
Designed **DMC**
Approved **JFS**

Date **5/31/19**
Figure **1**

Scale In Feet (Approximate)
0 3,000

Groundwater & Environmental Services, Inc.

Tables

Table 1

Soil Boring Locations

HDD Crossing	Boring ID	Boring Depth (ft)	Sample Interval (ft)	Boring Coordinates	
				Northing	Easting
Lake Sakakawea/Missouri River	LB-1	403	5	417613.836	1335268.645
	LB-2	400	5	418344.342	1335349.645
	LB-3	372	5	432251.954	1339466.302

Table 2

Laboratory Soil Test Data

Boring No.	Sample Depth (ft)	Sample Type	Moisture Content	Grain Size Distribution				Atterberg Limits		
				% Gravel	% Sand	% Silt	% Clay	LL	PL	PI
LB-1	4.5 - 6	SS	9.5							
LB-1	9.5 - 11	SS	13.2							
LB-1	14.5 - 16	SS	32.4							
LB-1	19.5 - 21	SS	4.4							
LB-1	24.5 - 26	SS	19.2							
LB-1	29.5 - 31	SS	24.3							
LB-1	34.5 -36	SS	25.8					50	19	30
LB-1	39.5 - 41	SS	23.8							
LB-1	44.5 - 46	SS	22							
LB-1	49.5 - 51	SS								
LB-1	54.5 - 56	SS	20.7							
LB-1	59.5 - 61	SS	22.2							
LB-1	64.5 - 66	SS	25.8							
LB-1	69.5 - 70	SS								
LB-1	74.5 - 76	SS	26.3							
LB-1	79.5 - 81	SS	24.8							
LB-1	84.5 - 86	SS	22.9							
LB-1	89.5 - 91	SS						57	21	36
LB-1	94.5 - 95	SS								
LB-1	99.5 - 101	SS	23.2							
LB-1	104.5 - 106	SS	24.6							
LB-1	109.5 - 111	SS	23.9							
LB-1	114.5 - 116	SS	22							
LB-1	119.5 - 121	SS	24.4							
LB-1	124.5 - 126	SS	19.1							
LB-1	129.5 - 131	SS						36	20	16
LB-1	134.5 - 136	SS	21.2							
LB-1	139.5 - 141	SS	21.1							
LB-1	144.5 - 146	SS	21.9							
LB-1	149.5 - 151	SS	28.5							
LB-1	154.5 - 156	SS	19.4							
LB-1	159.5 - 161	SS	21							
LB-1	164.5 - 165.5	SS	24.9							
LB-1	169.5 - 171	SS						48	19	28
LB-1	174.5 - 175.5	SS	19.9							
LB-1	179.5 - 180.5	SS	22.6							

Table 2

Laboratory Soil Test Data

Boring No.	Sample Depth (ft)	Sample Type	Moisture Content	Grain Size Distribution				Atterberg Limits		
				% Gravel	% Sand	% Silt	% Clay	LL	PL	PI
LB-1	185 - 189	RC	8.5							
LB-1	189 - 193	RC	13.8							
LB-1	193 - 198	RC	15.4							
LB-1	198 - 203	RC	16							
LB-1	203 - 208	RC								
LB-1	208 -213	RC	16							
LB-1	213 - 218	RC								
LB-1	218 - 223	RC								
LB-1	223 - 228	RC	54.1							
LB-1	228 - 233	RC	60.4							
LB-1	233 - 238	RC	15.4							
LB-1	238 -243	RC								
LB-1	243 - 248	RC	11.6							
LB-1	248 - 253	RC	11							
LB-1	253 - 258	RC	17.9							
LB-1	258 - 263	RC						41	18	23
LB-1	263 - 268	RC	21.2							
LB-1	268 - 273	RC	12.2							
LB-1	273 - 278	RC	11.8							
LB-1	278 - 283	RC	13.8							
LB-1	283 - 288	RC	15.5							
LB-1	288 - 293	RC	15.3							
LB-1	293 -298	RC	14.1							
LB-1	298 - 203	RC	14.2							
LB-1	303 - 308	RC								
LB-1	308 - 313	RC	15.3							
LB-1	313 - 318	RC	21.3							
LB-1	318 - 323	RC	16.9							
LB-1	323 - 328	RC	16.3							
LB-1	328 - 333	RC	13.1							
LB-1	333 - 338	RC	14.3							
LB-1	338 - 343	RC	15.5							
LB-1	343 - 348	RC	15.5							
LB-1	348 - 353	RC	17.6							
LB-1	353 - 358	RC	16.9							
LB-1	358 - 363	RC	16							
LB-1	363 - 368	RC	18.9							
LB-1	368 - 373	RC	16.2							
LB-1	373 - 378	RC	20.2							

Table 2

Laboratory Soil Test Data

Boring No.	Sample Depth (ft)	Sample Type	Moisture Content	Grain Size Distribution				Atterberg Limits		
				% Gravel	% Sand	% Silt	% Clay	LL	PL	PI
LB-1	378 -383	RC	19.8							
LB-1	383 - 388	RC								
LB-1	388 - 393	RC	18.9							
LB-1	393 - 398	RC								
LB-1	398 - 403	RC	19.9							
LB-2	4.5 - 6	SS	20.5							
LB-2	9.5 - 11	SS	17.3							
LB-2	14.5 - 16	SS	25.5							
LB-2	19.5 - 21	SS	22.6							
LB-2	24.5 - 26	SS	10.4							
LB-2	29.5 - 31	SS	27.5							
LB-2	34.5 - 36	SS								
LB-2	39.5 - 41	SS	32.9							
LB-2	44.5 - 46	SS						73	26	46
LB-2	49.5 - 51	SS	33							
LB-2	54.5 - 56	SS	19.9							
LB-2	59.5 - 61	SS	12.5							
LB-2	64.5 - 66	SS	14.1							
LB-2	69.5 - 71	SS	18.8							
LB-2	74.5 - 76	SS	14.3							
LB-2	79.5 - 81	SS	22	0.0	82.0	11.5	6.5			
LB-2	84.5 - 86	SS	17.3							
LB-2	89.5 - 91	SS	16							
LB-2	94.5 - 96	SS	18.2							
LB-2	99.5 - 101	SS	17.5							
LB-2	104.5 - 106	SS	14.8							
LB-2	109.5 - 111	SS	18.6							
LB-2	114.5 - 116	SS	21.7							
LB-2	119.5 - 121	SS	19							
LB-2	124.5 - 126	SS	21.9							
LB-2	129.5 - 131	SS	23.4							
LB-2	134.5 - 136	SS						NP	NP	NP
LB-2	139.5 - 140.5	SS	20.6							
LB-2	144.5 - 145.5	SS	25.8							
LB-2	149.5 - 150.5	SS	23.6							
LB-2	153 - 158	RC						33	17	16
LB-2	158 - 160	RC	15.6							
LB-2	160 - 165	RC								
LB-2	165 - 170	RC	16.1							
LB-2	170 - 175	RC	17.4							
LB-2	175 - 180	RC	19.1							
LB-2	180 - 185	RC	57.2							
LB-2	185 - 190	RC	12.3							
LB-2	190 - 195	RC	11.8							

Table 2

Laboratory Soil Test Data

Boring No.	Sample Depth (ft)	Sample Type	Moisture Content	Grain Size Distribution				Atterberg Limits		
				% Gravel	% Sand	% Silt	% Clay	LL	PL	PI
LB-2	195 - 200	RC	15.5							
LB-2	200 - 205	RC	16.3							
LB-2	205 - 210	RC								
LB-2	210 - 215	RC	15.5							
LB-2	215 - 220	RC								
LB-2	220 - 225	RC	61.2							
LB-2	225 - 230	RC	53.5							
LB-2	230 - 235	RC	65.6							
LB-2	235 - 240	RC	17.4							
LB-2	240 - 245	RC	15.5							
LB-2	245 - 250	RC	11.7							
LB-2	250 - 255	RC	15.6							
LB-2	255 - 260	RC	21.5							
LB-2	260 - 265	RC						26	23	3
LB-2	265 - 270	RC	14.1							
LB-2	270 - 275	RC	16.3							
LB-2	275 - 280	RC	16							
LB-2	280 - 285	RC	15.4							
LB-2	285 - 290	RC								
LB-2	290 - 295	RC	14.9							
LB-2	295 - 300	RC	16							
LB-2	300 - 305	RC	17.8							
LB-2	305 - 310	RC	23.1							
LB-2	310 - 315	RC	20.7							
LB-2	315 - 320	RC	13.6							
LB-2	320 - 325	RC	11.2							
LB-2	325 - 330	RC	17.9							
LB-2	330 - 335	RC						53	24	29
LB-2	335 - 340	RC	16.9							
LB-2	340 - 345	RC	16.3							
LB-2	345 - 350	RC	17.5							
LB-2	350 - 355	RC	16.3							
LB-2	355 - 360	RC	18	0.0	57.7	24.7	17.6			
LB-2	360 - 365	RC								
LB-2	365 - 370	RC	14.2							
LB-2	370 - 375	RC	15.3							
LB-2	375 - 380	RC	17.2							
LB-2	380 - 385	RC	15.3							
LB-2	385 - 390	RC	17.2							
LB-2	390 - 395	RC	16.2							
LB-2	395 - 400	RC								
LB-3	4.5 - 6	SS	4.3							
LB-3	9.5 - 11	SS	3.7							
LB-3	14.5 - 16	SS	2.4							

Table 2

Laboratory Soil Test Data

Boring No.	Sample Depth (ft)	Sample Type	Moisture Content	Grain Size Distribution				Atterberg Limits		
				% Gravel	% Sand	% Silt	% Clay	LL	PL	PI
LB-3	19.5 - 21	SS	3							
LB-3	24.5 - 26	SS	24.3							
LB-3	29.5 - 31	SS	25							
LB-3	34.5 - 36	SS	22	0.0	96.0	0.0	0.0			
LB-3	39.5 - 41	SS	22.2							
LB-3	44.5 - 46	SS	18.5							
LB-3	49.5 - 51	SS	14.1							
LB-3	54.5 - 56	SS	21							
LB-3	59.5 - 61	SS	20.9							
LB-3	64.5 - 66	SS	11	19.5	72.6	5.9	1.9			
LB-3	69.5 - 71	SS	23.8							
LB-3	74.5 - 76	SS	21							
LB-3	79.5 - 81	SS	18.2							
LB-3	84.5 - 86	SS	17.7							
LB-3	89.5 - 91	SS	12							
LB-3	94.5 - 96	SS	20.8							
LB-3	99.5 - 101.5	SS	12.5							
LB-3	104.5 - 105.5	SS	21.9							
LB-3	109.5 - 111	SS	16	0.0	59.1	29.2	11.2			
LB-3	114.5 - 115.5	SS								
LB-3	119.5 - 120	SS								
LB-3	124.5 - 125	SS								
LB-3	129.5 - 130	SS								
LB-3	134.5 - 135	SS								
LB-3	139.5 - 141	SS	17.1							
LB-3	144.5 - 146	SS	22.3							
LB-3	149.5 - 151	SS	20.2							
LB-3	154.5 - 156	SS	21.4							
LB-3	159.5 - 161	SS	20.4							
LB-3	164.5 - 166	SS						24	18	6
LB-3	169.5 - 171	SS	19.2							
LB-3	175 - 180	RC	32.5							
LB-3	180 - 185	RC	28.4							
LB-3	185 - 187	RC	51							
LB-3	187 - 192	RC	60.3							
LB-3	192 - 197	RC								
LB-3	197 - 202	RC	20.3							
LB-3	202 - 207	RC	18.9							
LB-3	207 - 212	RC	15.1							
LB-3	212 - 217	RC	15.4							
LB-3	217 - 222	RC	13.3							
LB-3	222 - 227	RC	15.9							
LB-3	227 - 232	RC						24	23	1
LB-3	232 - 237	RC	11.1							

Table 2

Laboratory Soil Test Data

Boring No.	Sample Depth (ft)	Sample Type	Moisture Content	Grain Size Distribution				Atterberg Limits		
				% Gravel	% Sand	% Silt	% Clay	LL	PL	PI
LB-3	237 - 242	RC	18.5							
LB-3	242 - 247	RC	15.6							
LB-3	247 - 252	RC	17							
LB-3	252 - 257	RC	20.2							
LB-3	257 - 262	RC								
LB-3	262 - 267	RC	19.4							
LB-3	267 - 272	RC	16.9							
LB-3	272 - 277	RC								
LB-3	277 - 282	RC	18							
LB-3	282 - 287	RC	23.8							
LB-3	287 - 292	RC	17.1							
LB-3	292 - 297	RC	19.2							
LB-3	297 - 302	RC								
LB-3	302 - 307	RC	14.8							
LB-3	307 - 312	RC	15.9							
LB-3	312 - 317	RC	17.4							
LB-3	317 - 322	RC	16.3							
LB-3	322 - 327	RC	15.8							
LB-3	327 - 332	RC								
LB-3	332 - 337	RC	19.2							
LB-3	337 - 342	RC	17.9							
LB-3	342 - 347	RC								
LB-3	347 - 352	RC	15.8							
LB-3	352 - 357	RC								
LB-3	357 - 362	RC	16.2							
LB-3	362 - 367	RC	22.3							
LB-3	367 - 372	RC	18.7							

Notes:
SS = Split Spoon
RC = Rock Core
Per MTS, some moisture content tests were not conducted because of lignite or moisture was done with the Atterberg Limit Testing.

Appendix A – Boring Logs

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-1**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
0				SW: WELL GRADED SAND, fine to medium grained, with trace silt, pale brown (10YR 6/3), moist, medium dense.							
5	1	11 in.	7-7-6		-						
10	2	12 in.	8-5-4	Color changes to light yellowish brown (10YR 6/4) and loose at 9.5 ft.	-						
15	3	18 in.	5-3-4	CL: LEAN CLAY, with trace silt, brownish yellow (10YR 6/6), moist, medium stiff.	0.5						
20	4	13 in.	7-5-8	SW: WELL GRADED SAND, fine to medium grained, pale brown (10YR 6/3), moist, medium dense.	-						
25	5	17 in.	5-10-13	ML: SILT, light yellowish brown (2.5Y 6/3), moist, medium dense.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 6' 56.33"

Lon: 103° 5' 34.23"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-1**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

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Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

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Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	6		18 in.	9-10-13	CL: LEAN CLAY, with trace silt, light olive brown (2.5Y 5/3) with gray (2.5Y 5/1) mottling, moist, very stiff to hard.	4.25						
35	7		18 in.	9-13-20		4.5	19	50	30			
40	8		14 in.	10-16-27	CL: LEAN CLAY, light brownish gray (2.5Y 6/2), moist, hard.	1.0						
45	9		17 in.	8-10-18	ML: SILT, light olive brown (2.5Y 5/3), moist, medium dense.	4.5						
50	10		18 in.	13-33-50/6"	CL: LEAN CLAY, gray (2.5Y 5/1), moist, hard. Lignite seam at least 12 in. thick at 50 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 6' 56.33"

Lon: 103° 5' 34.23"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-1**

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Address: **NA** GES Job #: **3502056**

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Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
55	11	18 in.	9-16-26		4.5						
60	12	13 in.	18-20-33	CL: LEAN CLAY, with trace silt, dark gray (2.5Y 4/1), moist, hard.	4.5						
65	13	18 in.	9-13-16	CL-ML: SILTY CLAY, gray (2.5Y 5/1), moist, very stiff.	3.25						
70	14	4 in.	50/4"	Lignite seam at least 4 in. thick at 69.5 ft.	-						
75	15	18 in.	15-21-32	ML: SILT, with trace clay, gray (2.5Y 5/1), moist, very dense. Lignite seam 1 in. thick at 75 ft.	4.5						
80	16	18 in.	10-14-16	CL: LEAN CLAY, with trace silt, gray (2.5Y 5/1), moist, hard.	4.5						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 6' 56.33"

Lon: 103° 5' 34.23"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-1**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
85	17		18 in.	10-13-15	With trace lignite and very stiff at 84.5 ft.	3.75						
90	18		18 in.	23-30-41	CH: FAT CLAY, consolidated, possibly highly weathered shale, gray (2.5Y 5/1) moist, hard.	4.5	21	57	36			
95	19		5 in.	50/5"	Lignite seam at least 5 in. thick at 94.5 ft.	-						
100	20		18 in.	17-27-40	ML: SILT, with trace clay, gray (2.5Y 6/1), moist, very dense.	4.5						
105	21		18 in.	19-28-45		4.5						

Notes:

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NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-1**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
110	22		18 in.	11-28-48	CH: FAT CLAY, with trace silt and trace coal, consolidated, possibly highly weathered shale, gray (2.5Y 5/1) moist, hard.	4.5						
115	23		18 in.	17-33-50/6"	Lignite seam at least 1 in. thick at 116 ft.	4.5						
120	24		18 in.	21-28-41	CL: LEAN CALY, with some silt, gray (2.5Y 5/1), moist, very dense.	4.5						
125	25		18 in.	21-36-50/6"	With trace lignite at 124.5 ft.	4.5						
130	26		18 in.	16-25-36		4.5	20	36	16			

Notes:

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Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	27		15 in.	21-36-50/3"		4.5						
140	28		18 in.	22-35-43	Lignite seam at least 2 in. thick at 139.5 ft.	4.5						
145	29		17 in.	24-36-50/5"		4.5						
150	30		18 in.	24-36-50/6"	Consolidated, weakly cemented, with lignite seam at least 1 in. thick at 151 ft.	4.5						
155	31		17 in.	27-43-50/5"	CL: LEAN CLAY, with some silt, consolidated, highly weathered shale, gray (2.5Y 5/1), moist, hard.	4.5						
160	32		12 in.	27-33-50/6"		4.5						

Notes:

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Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

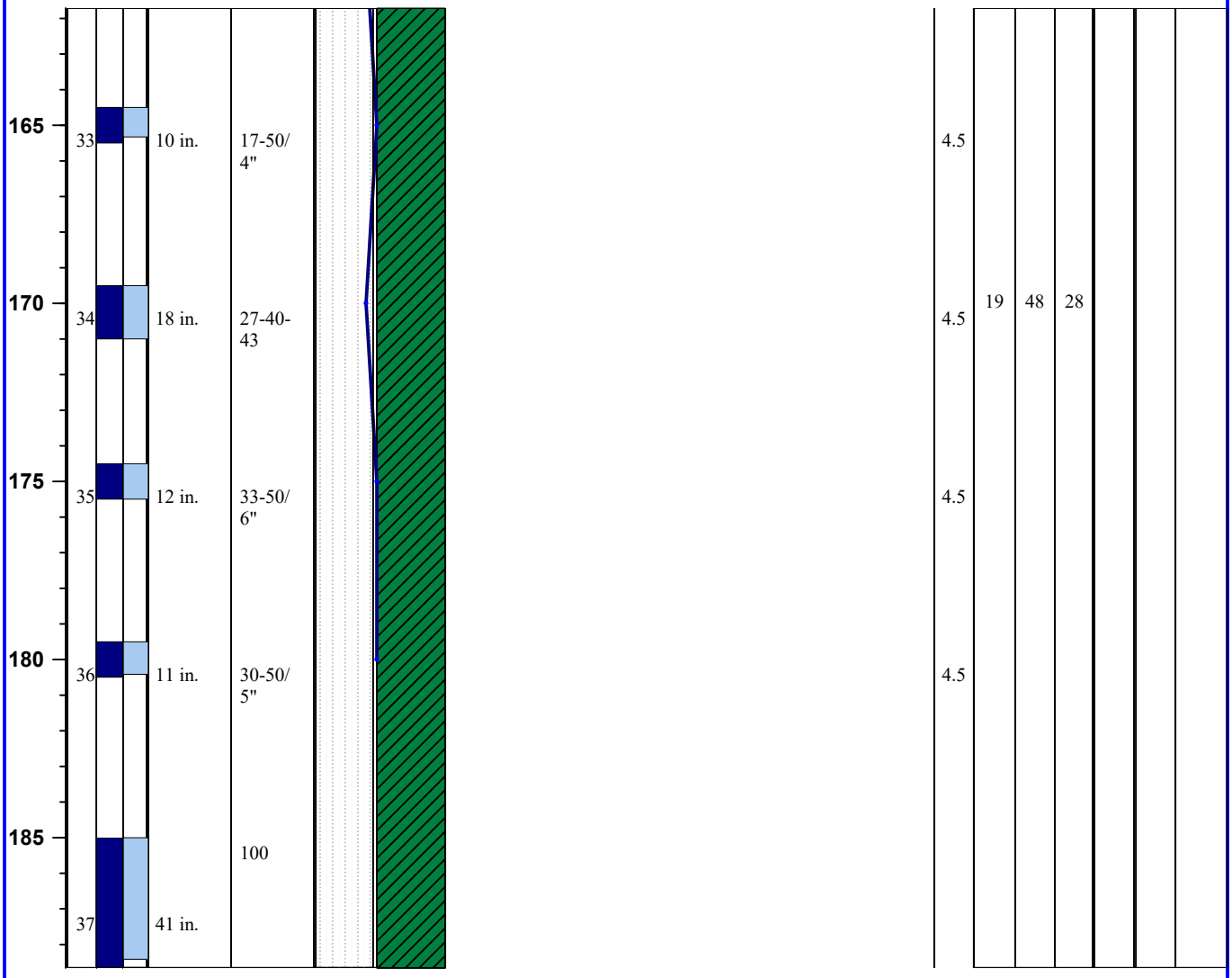
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**



Notes:

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M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-1**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
190			100								
	38	36 in.	83								
195											
	39	54 in.	63								
200				Silt seam 4 in. thick at 200 ft.							
	40	60 in.	95								
205											
	41	60 in.	81								
210				Lignite seam 1 in. thick at 210 ft.							
	42	60 in.		Coal: Lignite coal, black (2.5Y 2.5/1).							
			83								
215	43										

Notes:

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Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

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SOIL BORING LOG

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Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
220	44	60 in.	87								
			68								
225	45	60 in.									
			53								
230	46	60 in.									
			100	Shale: SHALE, highly weathered, gray (2.5Y 5/1), moist, hard.							
235	47	48 in.		ML: SILT, gray (2.5Y 5/1), moist, very dense.							
				Shale: SHALE, highly weathered, gray (2.5Y 5/1), moist, hard.							
			97	Trace Lignite less than 1 in. thick at 238 ft.							
240	48	60 in.		Lignite seam 6 in. thick at 242 ft.							

Notes:

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M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

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Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
245	49	50 in.	81	ML: SANDY SILT, fine grained, gray (2.5Y 5/1), moist, very dense.							
				Shale: SHALE, highly weathered, gray (2.5Y 5/1), moist, hard.							
			85	Trace Lignite 1 in. thick at 248 ft.							
				ML: SANDY SILT, fine grained, gray (2.5Y 5/1), moist, very dense.							
250	50	60 in.		Shale: SHALE, highly weathered, gray (2.5Y 5/1), moist, hard.							
				Calcified layer, light gray (2.5Y 7/1), harder than surrounding shale, 6 in. thick at 251.5 ft.							
			43	CL: LEAN CLAY with fine grained sand and silt, gray (2.5Y 5/1), moist, very dense.							
255	51	42 in.									
			100			18	41	23			
260	52	60 in.									
			100	Shale: SHALE, highly weathered, gray (2.5Y 5/1), moist, hard.							
265	53	55 in.									
			95	Lignite seam 2 in. thick at 269 ft.							

Notes:

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SOIL BORING LOG

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Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
270	54	60 in.		Color turns greenish gray (GLEY1 6/1) at 272 ft.							
			97	Shale: SHALE, highly weathered, with trace lignite, dark gray (2.5Y 4/1), moist, hard.							
275	55	60 in.		Lignite seam 5 in. thick at 276 ft.							
			93	Color turns to gray (2.5Y 5/1) and lignite seam 4 in. thick at 278 ft.							
280	56	60 in.		ML: SANDY SILT, fine grained, gray (2.5Y 5/1), moist, very dense.							
			100	Shale: SHALE, highly weathered, with trace lignite, greenish gray (GLEY1 6/1), moist, hard.							
285	57	60 in.		Color turns to gray (2.5Y 5/1) and lignite seam 1 in. thick at 285.5 ft.							
			97	ML: SILT, with trace clay, consolidated, weakly cemented, greenish gray (GLEY1 6/1) moist, very dense.							
290	58	60 in.		Lignite seam 1 in. thick at 288.5 ft.							
			100	Color turns to gray (2.5Y 5/1) at 293 ft.							
295	59	54 in.									

Notes:

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SOIL BORING LOG

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Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

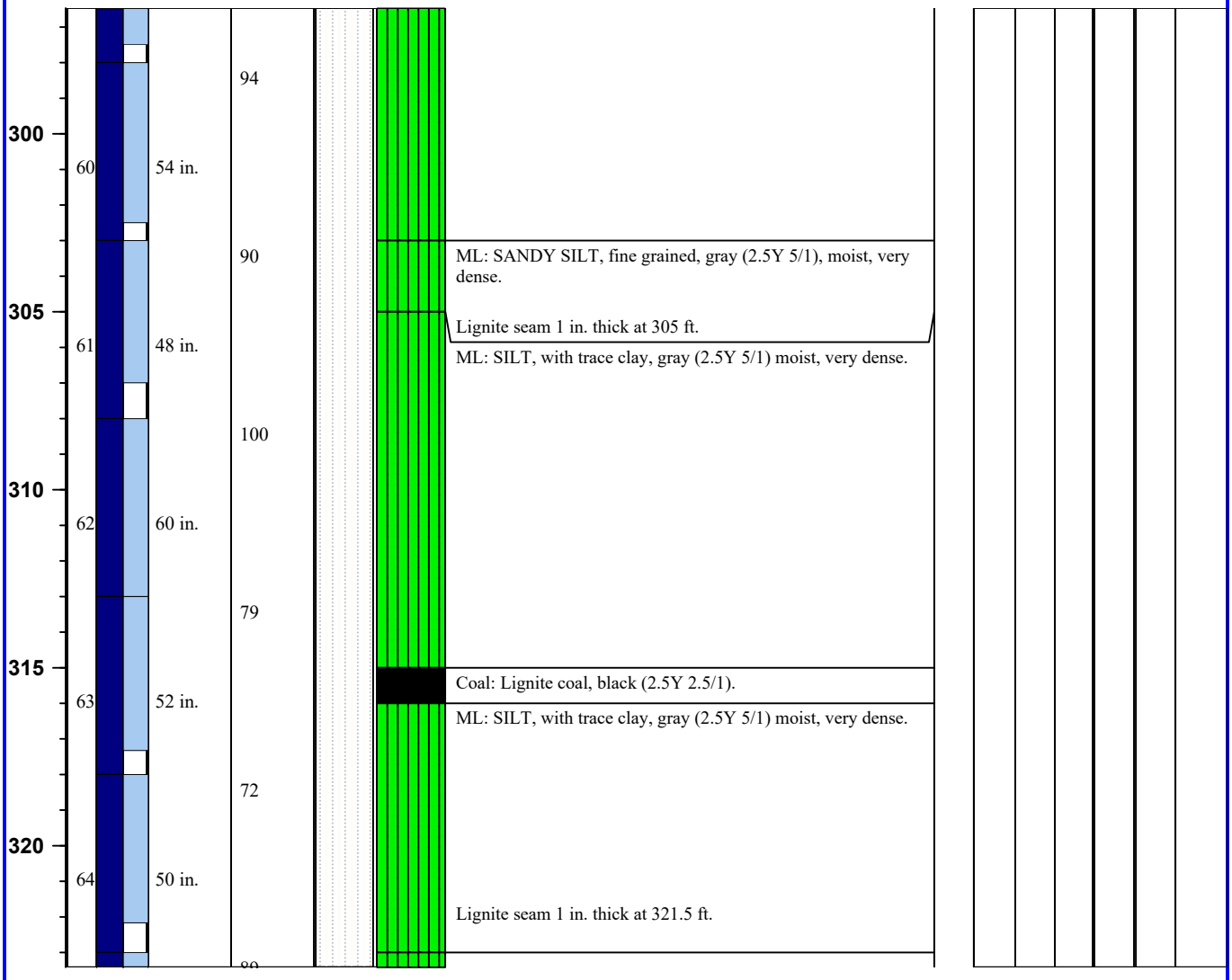
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**



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Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

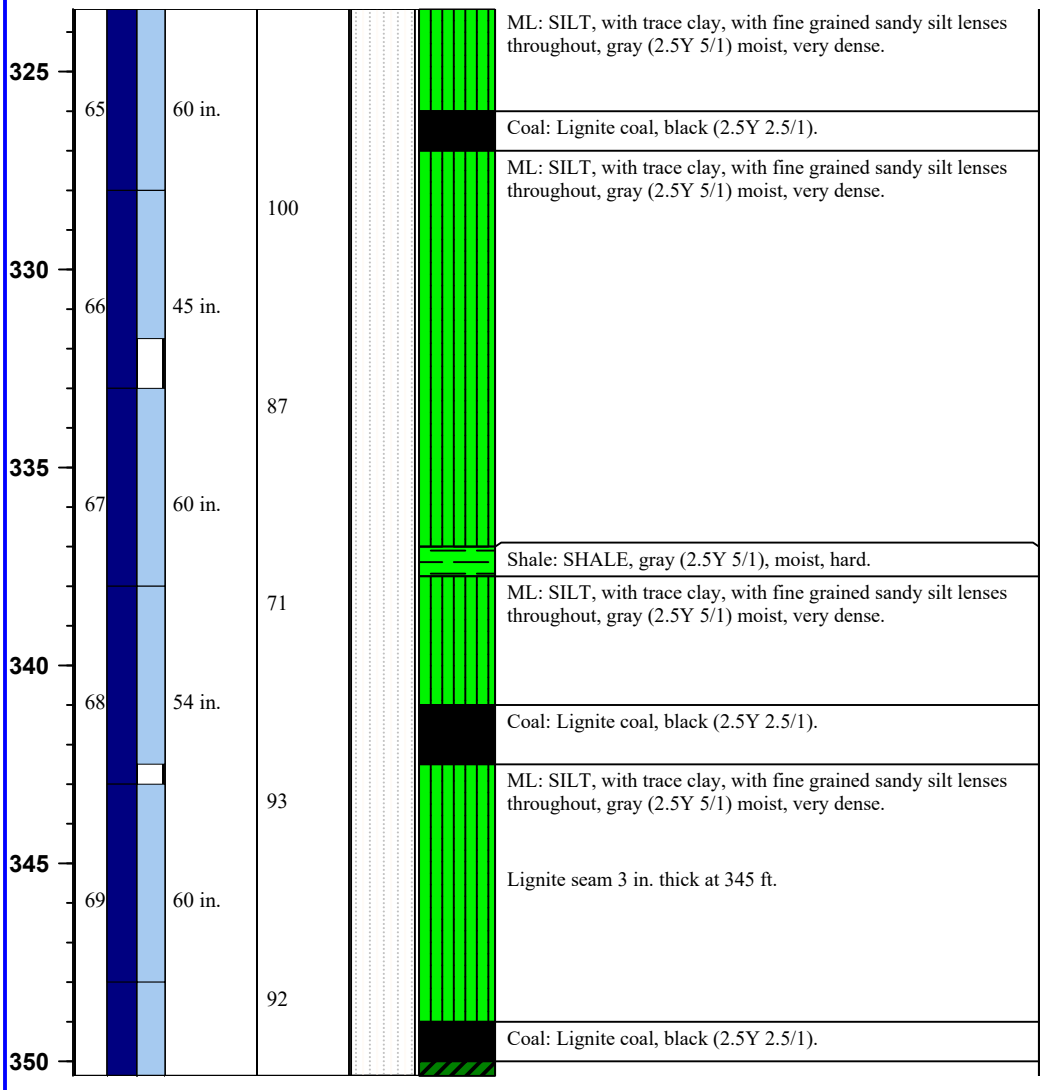
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**



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SOIL BORING LOG

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ID NO. **LB-1**

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Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
355	70	32 in.	100	CH: FAT CLAY, with silt, with fine grained sandy silt lenses throughout, gray (2.5Y 5/1) moist, very dense.		23	196	173			
	71	60 in.									
360			92	ML: SILT, with trace fine grained sand, weakly cemented, gray (2.5Y 6/1) moist, very dense.							
	72	60 in.									
365			100								
	73	50 in.									
370			98								
	74	60 in.									
375			100								
	75	60 in.									

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 6' 56.33"

Lon: 103° 5' 34.23"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-1**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/24/19 through 4/28/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **4/28/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 185 ft.), NQ Rock Core (185 to 403 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,908 ft. msl** Abandonment Method: **Tremie**

Total Depth: **403 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **4/28/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
380	76	60 in.	83	Coal: Lignite coal, black (2.5Y 2.5/1).							
385	77	58 in.	74								
390	78	60 in.	94	ML: SILT, with trace clay, weakly cemented, gray (2.5Y 6/1) moist, very dense.							
395	79	60 in.	100								
400	80	58 in.	74	Coal: Lignite coal, black (2.5Y 2.5/1).							
				ML: SILT, with trace clay, weakly cemented, gray (2.5Y 6/1) moist, very dense.							
				EOB at 403 ft. Target depth reached.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 6' 56.33"

Lon: 103° 5' 34.23"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
0				ML: SILT, with trace clay, light brownish gray (2.5Y 6/2), moist, medium dense.							
5	1	6 in.	7-8-9		-						
10	2	11 in.	6-6-11	SM: SILTY SAND, fine grained, light olive brown (2.5Y 5/3), moist, medium dense.	-						
15	3	13 in.	7-9-9	ML: SILT, with trace clay, light olive brown (2.5Y 5/3), moist, medium dense.	-						
20	4	16 in.	6-7-10	Color turns to dark grayish brown (2.5Y 4/2) at 19.5 ft.	-						
25	5	16 in.	4-4-4	SM: SILTY SAND, fine grained, light olive brown (2.5Y 5/3), moist, loose.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

Lon: 103° 5' 33.40"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	6		15 in.	5-5-6	ML: SANDY SILT, fine grained, grayish brown (2.5Y 5/2), moist, medium dense.	-						
35	7		18 in.	4-4-8	CH: FAT CLAY, with trace silt, gray (2.5Y 5/1), moist, very stiff.	2.25						
40	8		18 in.	4-5-8		2.75						
45	9		18 in.	4-6-7		2.75	26	73	46			
50	10		18 in.	5-7-8		3.0						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

Lon: 103° 5' 33.40"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
55	11		12 in.	10-13-13	SP: POORLY GRADED SAND, fine grained, with trace silt, grayish brown (2.5Y 5/2) moist, medium dense.	-						
60	12		16 in.	8-10-10	SP: POORLY GRADED SAND, fine grained, grayish brown (2.5Y 5/2) moist, medium dense.	-						
65	13		18 in.	7-8-12		-						
70	14		12 in.	7-4-6	SP: POORLY GRADED SAND, fine grained with trace medium grained, with trace silt, grayish brown (2.5Y 5/2) moist, loose.	-						
75	15		14 in.	11-14-16	SP: POORLY GRADED SAND, fine to medium grained, grayish brown (2.5Y 5/2) moist, medium dense.	-						
80	16		12 in.	13-11-12	With some silt and clay at 79.5 ft.	-					82.0	18.0

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

Lon: 103° 5' 33.40"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
85	17	12 in.	13-17-19	Fine grained and dense at 84.5 ft.	-						
90	18	14 in.	6-7-9	With trace silt and medium dense at 89.5 ft.	-						
95	19	13 in.	10-14-14	Mostly fine grained with some medium grained at 94.5 ft.	-						
100	20	12 in.	9-17-17	Fine grained and dense at 99.5 ft.	-						
105	21	13 in.	8-9-9	Medium dense at 104.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

Lon: 103° 5' 33.40"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
110	22	13 in.	10-8-8	Trace lignite at 110 ft.	-						
115	23	16 in.	7-10-11	With trace silt and trace clay at 114.5 ft.	-						
120	24	15 in.	10-15-18	ML: SANDY SILT, fine grained, with trace clay, gray (2.5Y 5/1), moist, dense.	0.5						
125	25	18 in.	8-11-21	CL-ML: SILTY CLAY, gray (2.5Y 5/1), moist, hard.	3.0						
130	26	18 in.	15-25-36		4.5						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

Lon: 103° 5' 33.40"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	27		18 in.	17-24-34	ML: SILT, with trace fine grained sand, gray (2.5Y 5/1), moist, very dense.	-						
140	28		12 in.	20-50/6"	ML: SILT, with trace clay, weakly cemented, gray (2.5Y 5/1), moist, very dense. Lignite seam at least 1 in. thick at 140.5 ft.	4.5						
145	29		12 in.	20-50/6"	With trace lignite at 144.5 ft.	4.5						
150	30		12 in.	18-50/6"		4.5						
				100	Shale: SHALE, highly weathered, consolidated lean clay, gray (2.5Y 5/1), moist, hard.		17	33	16			
155	31		48 in.									
				97								
160	32		24 in.	83	Lignite seam at least 4 in. thick at 160 ft.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

Lon: 103° 5' 33.40"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
165	33	60 in.	83	Poor recovery, suspect non-cohesive sand was washed out and not collected in the core barrel from 165 to 170 ft.							
	34	15 in.									
170			81	Poor recovery, suspect non-cohesive sand was washed out and not collected in the core barrel from 170 to 175 ft.							
	35	11 in.									
175			0	No Recovery 175 to 180 ft.							
	36	0 in.									
180			35	Shale: SHALE, highly weathered, consolidated silty clay, gray (2.5Y 5/1), moist, hard. Poor recovery, suspect non-cohesive sand was washed out and not collected in the core barrel from 180 to 185 ft.							
	37	20 in.		Fine grained silty sand seam 3 in. thick at 183 ft.							
185			100								
	38	41 in.									

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

Lon: 103° 5' 33.40"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

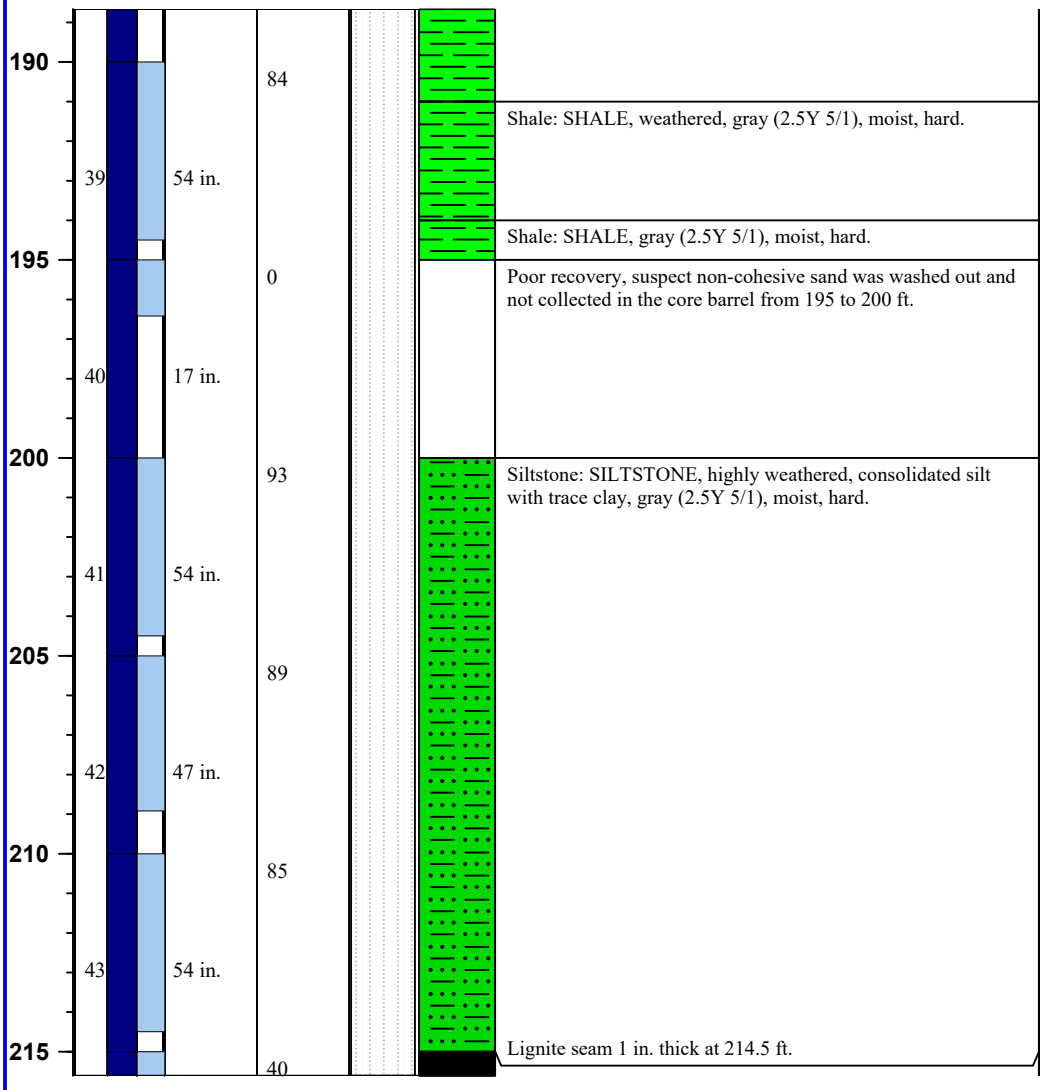
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**



Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

Lon: 103° 5' 33.40"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
220	44	48 in.	33	Coal: Lignite coal, black (2.5Y 2.5/1).							
225	45	60 in.	9								
	46	58 in.									
230			33								
	47	60 in.									
235			50								
	48	48 in.		ML: SILT, with trace lignite, gray (2.5Y 5/1), moist, very dense.							
240			100	With trace fine grained sand at 240 ft. Lignite seam less than 1 in. thick at 240.5 ft.							
	49										

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

Lon: 103° 5' 33.40"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
245	49		100	Lignite seam less than 1 in. thick at 243.5 and 244 ft.							
				Poor recovery, suspect non-cohesive sand was washed out and not collected in the core barrel from 245 to 250 ft.							
	50	33 in.									
250			0	Poor recovery, suspect non-cohesive sand was washed out and not collected in the core barrel from 250 to 255 ft.							
	51	0 in.									
255			56	ML: SANDY SILT, fine grained, with trace clay, gray (2.5Y 5/1), moist, dense.							
				ML: SILT, gray (2.5Y 5/1), moist, very dense.							
	52	48 in.									
260			95	With trace clay at 260 ft.		23	26	3			
	53	60 in.									
265			95	Weakly cemented at 265 ft.							
	54	60 in.									

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

Lon: 103° 5' 33.40"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
270			75	ML: SANDY SILT, fine grained, weakly cemented, gray (2.5Y 5/1), moist, dense.							
	55	57 in.									
275			69	ML: SILT, with trace clay, weakly cemented, gray (2.5Y 5/1), moist, very dense.							
	56	48 in.		Lignite seam 3 in. thick at 276 ft. Lignite seam 6 in. thick at 277.5 ft.							
280			100	With trace lignite seams throughout at 280 ft.							
	57	60 in.									
285			85								
	58	45 in.		Lignite seam 4 in. thick at 286 ft.							
				Lignite seam 4 in. thick at 288.5 ft.							
290			100	ML: SILT, with trace clay, weakly cemented, with trace lignite throughout, gray (2.5Y 5/1), moist, very dense.							
	59	54 in.									
295			95								

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
	60	60 in.		Lignite seam 1 in. thick at 297.5 ft.							
300			97	Sandy silt seam 4 in. thick at 299 ft.							
	61	48 in.		SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.							
305			30	Silt seam with trace clay 6 in. thick at 304 ft.							
				SP-SM: SAND WITH SILT, fine grained, gray (2.5Y 5/1), moist, very dense.							
	62	43 in.		ML: SILT, gray (2.5Y 5/1), moist, very dense.							
				Fine grained sand with silt seam 4 in. thick at 309 ft.							
310			80	Lignite seam 2 in. thick at 310 ft.							
				ML: SILT, with trace clay, gray (2.5Y 5/1) moist, very dense.							
	63	60 in.		Coal: Lignite coal, black (2.5Y 2.5/1).							
315			95	ML: SILT, with trace fine grained sand, with trace lignite throughout, gray (2.5Y 5/1) moist, very dense.							
	64	57 in.									
320			93	Coal: Lignite coal, black (2.5Y 2.5/1).							
				ML: SILT, with trace clay, gray (2.5Y 5/1) moist, very dense.							
	65	60 in.									

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

Lon: 103° 5' 33.40"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

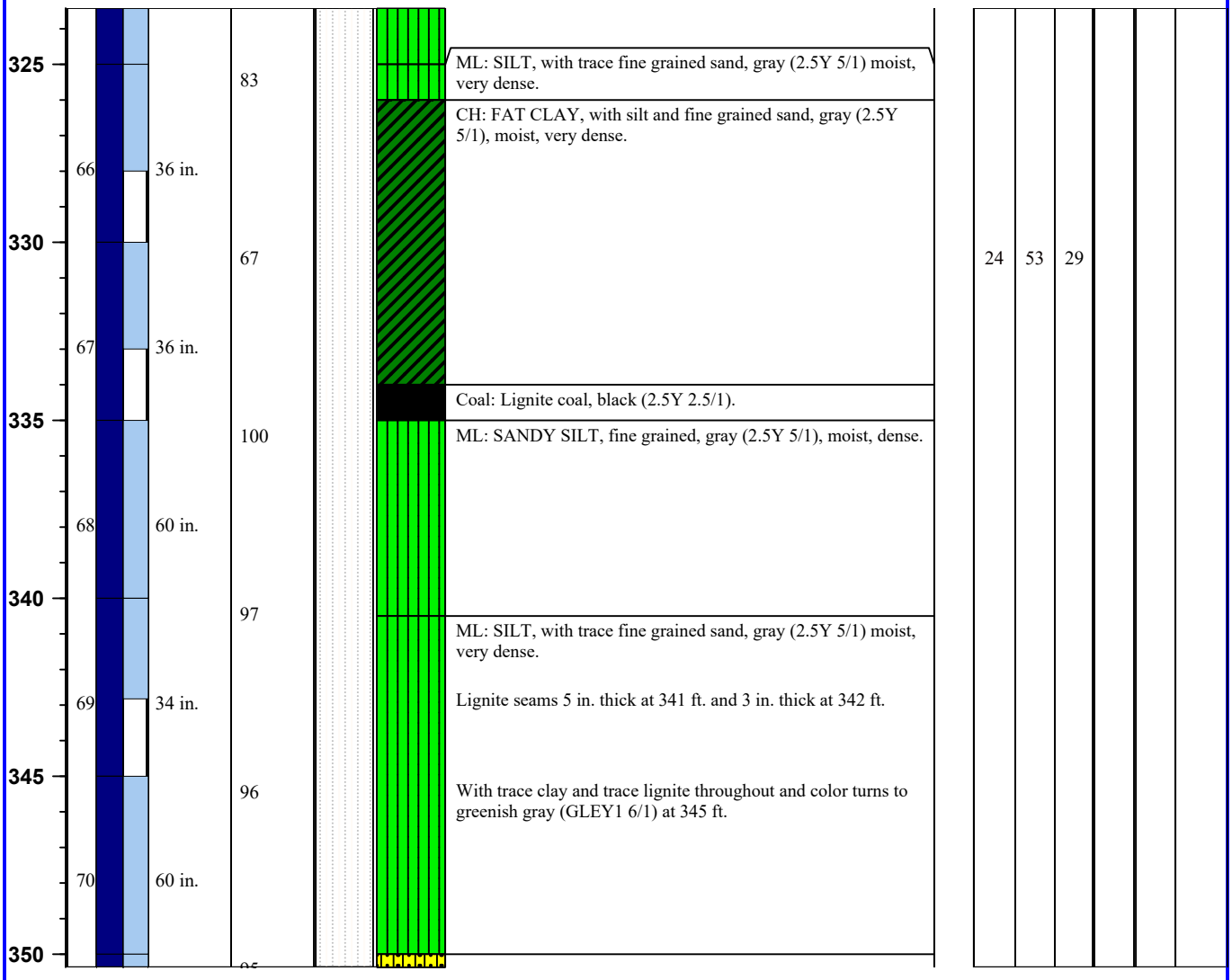
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**



Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
355	71	42 in.	100	SM: SILTY SAND, fine grained, with little clay, weakly cemented, greenish gray (GLEY1 6/1), moist, very dense.						57.7	42.3
360	72	59 in.	95								
	73	60 in.									
365			100								
	74	55 in.									
370			88								
	75	60 in.									
375			78	Coal: Lignite coal, black (2.5Y 2.5/1).							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

Lon: 103° 5' 33.40"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-2**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **4/28/19 through 5/1/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/1/19**

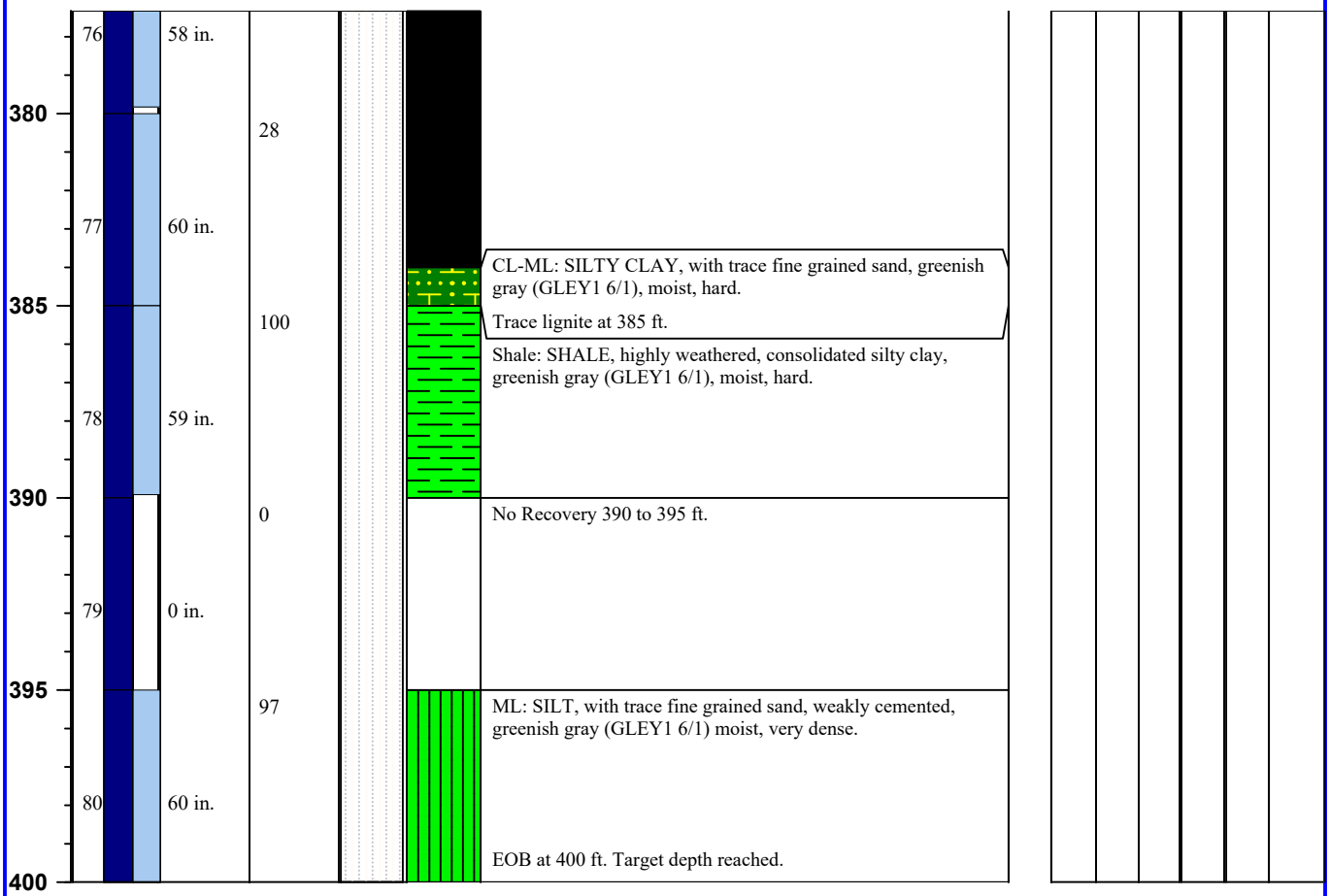
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 25 ft.), Fluid Rotary (25 to 153 ft.), NQ Rock Core (153 to 400 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,920 ft. msl** Abandonment Method: **Tremie**

Total Depth: **400 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/1/19**



Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 3.56"

Lon: 103° 5' 33.40"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
0				SP: POORLY GRADED SAND, fine to medium grained, brown (7.5YR 4/3) moist, loose.							
5	1	15 in.	3-3-2		-						
10	2	13 in.	4-3-3		-						
15	3	13 in.	3-2-2	Color turns to brown (7.5YR 5/4) and trace coarse grained sand, very loose at 14.5 ft. Trace lignite at 16 ft.	-						
20	4	16 in.	5-3-3	Trace lignite at 21 ft.	-						
25	5	18 in.	2-4-5	Color turns to brown (7.5YR 4/3) and wet at 24.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 22.10"

Lon: 103° 4' 39.62"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	6		18 in.	2-3-3	Color turns to brown (7.5YR 5/3) at 29.5 ft.	-						
35	7		18 in.	4-7-8	Color turns to brown (7.5YR 4/3) at 34.5 ft.	-					96.0	
40	8		18 in.	4-6-11		-						
45	9		18 in.	6-10-12	Lignite seam less than 1 in. thick at 46 ft.	-						
50	10		18 in.	3-3-5	SW: WELL GRADED SAND, fine to medium grained, dark brown (7.5YR 3/3) wet, loose. Gravel and sand seam, coarse grained, 4 in. thick at 50.5 ft. Trace lignite at 51 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

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SOIL BORING LOG

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ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
55	11		18 in.	3-4-7	SW: WELL GRADED SAND, fine to medium grained, brown (7.5YR 4/3) wet, medium dense.	-						
60	12		18 in.	7-5-6	Gravel and sand seam, coarse grained, 6 in. thick at 60.5 ft.	-						
65	13		12 in.	6-10-10	SPG: POORLY GRADED SAND WITH GRAVEL, coarse grained, dark brown (7.5YR 3/2), wet, medium dense.	-				19.5	72.6	7.8
70	14		18 in.	5-8-9	CL: LEAN CLAY WITH SAND, fine grained, with silt, dark grayish brown (10YR 4/2), wet, very stiff.	2.0						
75	15		18 in.	17-24-25	SM: SILTY SAND, fine grained, grayish brown (2.5Y 5/2), wet, dense.	-						
80	16		18 in.	15-21-21		-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
85	17	8 in.	12-10-16	SW: WELL GRADED SAND, fine to medium grained, gray (2.5Y 5/1) wet, medium dense.	-						
90	18	14 in.	24-33-25	SW: WELL GRADED SAND, fine to coarse grained, gray (2.5Y 5/1) wet, very dense.	-						
95	19	18 in.	33-36-50/6"	SP: POORLY GRADED SAND, fine grained, with trace silt, dark gray (2.5Y 4/1) wet, very dense.	-						
100	20	12 in.	23-50/6"	With trace lignite at 99.5 ft. Trace silty clay at 101.5 ft.	-						
105	21	11 in.	34-50/6"	SP: POORLY GRADED SAND, fine grained, dark gray (2.5Y 4/1) moist, very dense.	-						

Notes:

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

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Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

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Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

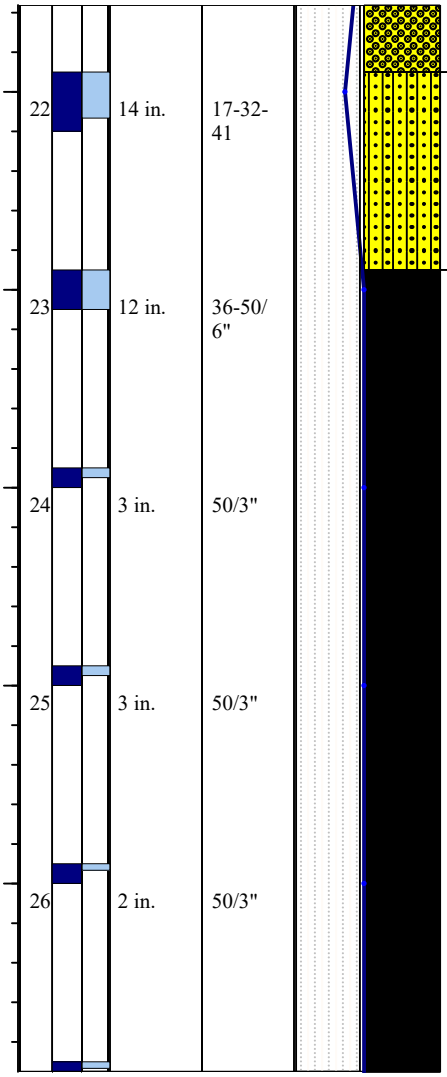
Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
110	22	14 in.	17-32-41	SM: SILTY SAND, fine grained, with trace clay, dark gray (2.5Y 4/1) moist, very dense.	-					59.1	40.4
115	23	12 in.	36-50/6"	Coal: Lignite coal, black (2.5Y 2.5/1), moist, very dense.	-						
120	24	3 in.	50/3"		-						
125	25	3 in.	50/3"		-						
130	26	2 in.	50/3"		-						



Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 22.10"

Lon: 103° 4' 39.62"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	27	2 in.	50/2"		-						
140	28	18 in.	17-33-43	ML: SILT, with trace clay, gray (2.5Y 5/1), moist, very dense.	-						
145	29	18 in.	18-26-36	CL-ML: SILTY CLAY, dark gray (2.5Y 4/1), moist, hard.	4.5						
150	30	18 in.	15-20-30	SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.	4.5						
155	31	18 in.	17-33-50/6"		-						
160	32	18 in.	16-23-28		-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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Lon: 103° 4' 39.62"

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Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
165	33	18 in.	17-24-27	CL-ML: SILTY CLAY, gray (2.5Y 5/1), moist, hard.	4.5	18	24	6			
170	34	18 in.	24-25-48	ML: SILT, with trace fine grained sand and trace clay, gray (2.5Y 5/1), moist, very dense.	3.5						
175	35	8.5 in.	59	Coal: Lignite coal, black (2.5Y 2.5/1).							
180	36	24 in.	75	CL: LEAN CLAY, with trace silt, gray (2.5Y 5/1). Lignite seam 2 in. thick at 182 ft. Lignite seam 2 in. thick at 184 ft.							
185	37	18 in.	89 40	SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

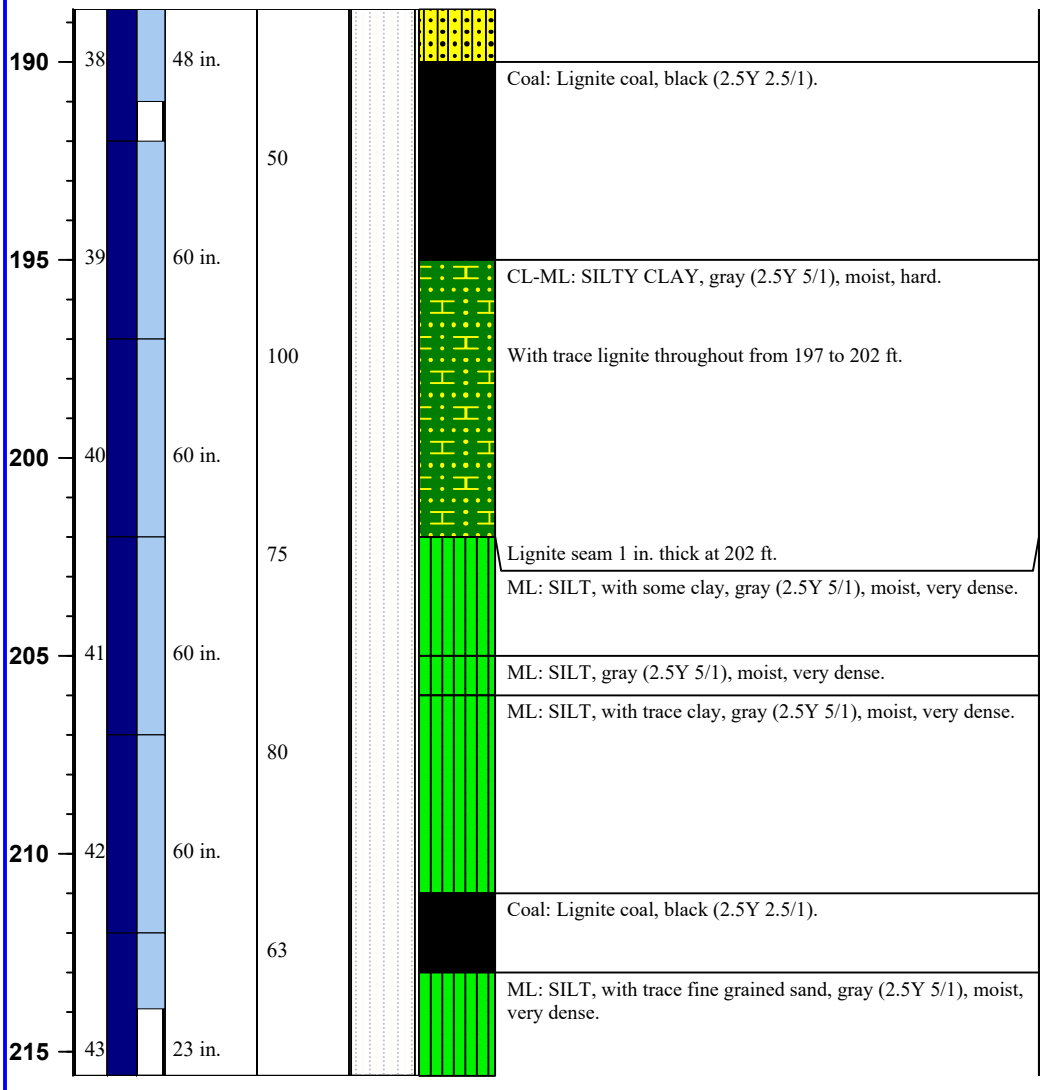
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**



Notes:

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NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

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SOIL BORING LOG

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ID NO. **LB-3**

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Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
220	44	54 in.	98	Lignite seam 1 in. thick at 219.5 ft. ML: SILT, gray (2.5Y 5/1), moist, very dense.							
			90	CL-ML: SILTY CLAY, gray (2.5Y 5/1), moist, hard.							
225	45	60 in.									
			100	ML: SILT, with trace fine grained sand, gray (2.5Y 5/1), moist, very dense.		23	24	1			
230	46	57 in.									
			84	ML: SILT, with trace clay, gray (2.5Y 5/1), moist, very dense. Shale layer 6 in. thick at 234 ft.							
235	47	56 in.									
			85	Coal: Lignite coal, black (2.5Y 2.5/1).							
240	48	54 in.		ML: SILT, with trace clay and with trace lignite, gray (2.5Y 5/1), moist, very dense.							
			100								

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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Lon: 103° 4' 39.62"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **LB-3**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

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Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
245	49	60 in.	100	ML: SANDY SILT, fine grained, weakly cemented, greenish gray (GLEY1 6/1), moist, very dense.							
250	50	60 in.	100								
255	51	60 in.	100	SM: SILTY SAND, fine grained, weakly cemented, greenish gray (GLEY1 6/1), moist, very dense.							
260	52	60 in.	100								
265	53	60 in.	70	Shale seam 1 in. thick at 267 ft.							
	54	60 in.									

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

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SOIL BORING LOG

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ID NO. **LB-3**

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Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/3/19 through 5/4/19** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
270											
			10	Coal: Lignite coal, black (2.5Y 2.5/1).							
	55	60 in.									
275				Silty clay layer 6 in. thick at 275 ft.							
			58								
				ML: SILT, with trace fine grained sand, gray (2.5Y 5/1), moist, very dense.							
280	56	48 in.									
			100	SM: SILTY SAND, fine grained, weakly cemented, greenish gray (GLEY1 6/1), moist, very dense.							
285	57	60 in.									
			95	Trace lignite less than 1 in. thick at 287 ft.							
				Trace lignite less than 1 in. thick at 289 ft.							
290	58	60 in.		Shale: SHALE, highly weathered, with trace coal, greenish gray (GLEY1 6/1), moist, hard.							
			91	Shale: SHALE, highly weathered, gray (2.5Y 5/1), moist, hard.							
295	59	60 in.									

Notes:

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Address: **NA** GES Job #: **3502056**

County: **Williams** GES Project Mgr: **Rob Jenson**

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Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
300	60	60 in.	97	Shale layer, not weathered, 2 in. thick and color turns to dark gray (2.5Y 4/1) at 297 ft.							
				Sandstone layer 8 in. thick at 301 ft.							
			83	Color turns to gray (2.5Y 5/1) at 302 ft.							
305	61	60 in.									
			100	Silty sand layer, fine grained, 6 in. thick at 307 ft.							
				Shale layer, not weathered, less than1 in. thick at 307.5 ft.							
310	62	60 in.									
			80								
315	63	60 in.									
				Lignite seam 3 in. thick at 316 ft.							
			100	SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.							
				Shale: SHALE, highly weathered, gray (2.5Y 5/1), moist, hard.							
320	64	60 in.									
				SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.							
			100	Shale: SHALE, highly weathered, with trace lignite throughout, gray (2.5Y 5/1), moist, hard.							

Notes:

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Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
325	65	60 in.	100			25	105	81			
330	66	60 in.	95								
335	67	60 in.	70	SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.							
340	68	60 in.	10	Coal: Lignite coal, black (2.5Y 2.5/1). Silty clay layer 6 in. thick at 339 ft.							
345	69	60 in.	100	Silty clay layer 6 in. thick at 344 ft.							
350	70	46 in.		SM: SILTY SAND, fine grained, weakly cemented, gray (2.5Y 5/1), moist, very dense.							

Notes:

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Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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County: **Williams** GES Project Mgr: **Rob Jenson**

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Drilling Company: **Interstate Drilling Services** Completion Date: **5/5/19**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 65 ft.), Fluid Rotary (65 to 175 ft.), NQ Rock Core (175 to 370 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,870 ft. msl** Abandonment Method: **Tremie**

Total Depth: **372 ft.** Approximate Water Depth: **24.5 ft.** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/5/19**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
355	71	58 in.	57	Shale: SHALE, highly weathered, with trace lignite, gray (2.5Y 5/1), moist, hard.							
				Coal: Lignite coal, black (2.5Y 2.5/1).							
			62	SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.							
360	72	50 in.		CL-ML: SILTY CLAY, gray (2.5Y 5/1), moist, hard.							
			94	SM: SILTY SAND, fine grained, gray (2.5Y 5/1), moist, very dense.							
365	73	54 in.									
			67								
370	74	58 in.		EOB at 372 ft. Target depth reached.							

Notes:

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M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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Appendix B – Photographic Documentation

Site Photographs

Geotechnical Investigation Report
CCI and Associates, Inc.
WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River, North Dakota

Description:
Soil Boring LB-1

Direction of View:
Looking North-northwest

Date Taken:
4/28/2019

Site Photographs

Geotechnical Investigation Report
CCI and Associates, Inc.
WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River, North Dakota

Description:
Soil Boring LB-2

Direction of View:
Looking North-northwest

Date Taken:
4/29/2019

Site Photographs

Geotechnical Investigation Report
CCI and Associates, Inc.
WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River, North Dakota

Description:
Soil Boring LB-3

Direction of View:
Looking South

Date Taken:
5/2/2019

Appendix C - Laboratory Reports

Project: **WBI N Bakken Expansion** Job Number: **G19-025** Sheet **1** of **10**

Manager: _____ Client: _____ Project Description: _____

Location: **Missouri River HDD Crossing**

Elevation Datum: _____

Borehole / Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-1 4.5							9.5						
LB-1 9.5							13.2						
LB-1 14.5							32.4						
LB-1 19.5							4.4						
LB-1 24.5							19.2						
LB-1 29.5							24.3						
LB-1 34.5	49.6	19.2	31.0				21.0						
LB-1 39.5							23.8						
LB-1 44.5							22.0						
LB-1 54.5							20.7						
LB-1 59.5							22.2						
LB-1 64.5							25.8						
LB-1 74.5							26.3						
LB-1 79.5							24.8						
LB-1 84.5							22.9						
LB-1 89.5	56.7	20.8	36.0				22.4						
LB-1 99.5							23.2						
LB-1 104.5							24.6						
LB-1 109.5							23.9						

Material Testing Services, LLC	**Summary of Material Properties**	June 6, 2019

Project: **WBI N Bakken Expansion** Job Number: **G19-025** Sheet **2** of **10**

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-1 114.5							22.0						
LB-1 119.5							24.4						
LB-1 124.5							19.1						
LB-1 129.5	36.4	20.3	16.0				20.4						
LB-1 134.5							21.2						
LB-1 139.5							21.1						
LB-1 144.5							21.9						
LB-1 149.5							28.5						
LB-1 154.5							19.4						
LB-1 159.5							21.0						
LB-1 164.5							24.9						
LB-1 169.5	47.7	19.4	29.0				19.3						
LB-1 174.5							19.5						
LB-1 179.5							22.6						
LB-1 185.0							8.5						
LB-1 189.0							13.8						
LB-1 193.0							15.4						
LB-1 198.0							16.0						
LB-1 203.0					137.7	118.7	16.0						
LB-1 208.0							16.0						
LB-1 223.0							54.1						
LB-1 228.0							60.4						

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-1 233.0							15.4						
LB-1 238.0					129.4	110.4	17.2						
LB-1 243.0							11.6						
LB-1 248.0							11.0						
LB-1 253.0							17.9						
LB-1 258.0	40.8	18.1	23.0				15.5						
LB-1 263.0							21.2						
LB-1 268.0							12.2						
LB-1 273.0							11.8						
LB-1 278.0							13.8						
LB-1 283.0							15.5						
LB-1 288.0							15.3						
LB-1 293.0							14.1						
LB-1 298.0							14.2						
LB-1 303.0					142.5	122.0	16.8						
LB-1 308.0							15.3						
LB-1 313.0							21.3						
LB-1 318.0							16.9						
LB-1 323.0							16.3						
LB-1 328.0							13.1						
LB-1 333.0							14.3						
LB-1 338.0							15.5						

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-1 343.0							15.5						
LB-1 348.0							17.6						
LB-1 353.0	196.0	23.0	173.0				18.4						
LB-1 358.0							16.0						
LB-1 363.0							18.9						
LB-1 368.0							16.2						
LB-1 373.0							20.2						
LB-1 378.0							19.8						
LB-1 388.0							18.9						
LB-1 393.0					131.4	112.1	17.2						
LB-1 398.0							19.9						
LB-2 4.5							20.5						
LB-2 9.5							17.3						
LB-2 14.5							25.5						
LB-2 19.5							22.6						
LB-2 24.5							10.4						
LB-2 29.5							27.5						
LB-2 34.5							25.8						
LB-2 39.5							32.9						
LB-2 44.5	72.9	26.4	47.0				31.4						
LB-2 49.5							33.0						
LB-2 54.5							19.5						

Project: **WBI N Bakken Expansion** Job Number: **G19-025** Sheet **5** of **10**

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-2 59.5							12.5						
LB-2 64.5							14.1						
LB-2 69.5							18.8						
LB-2 74.5							14.3						
LB-2 79.5				18.0			21.9						
LB-2 84.5							17.3						
LB-2 89.5							16.0						
LB-2 94.5							18.2						
LB-2 99.5							17.5						
LB-2 104.5							14.8						
LB-2 109.5							18.6						
LB-2 114.5							21.7						
LB-2 119.5							19.0						
LB-2 124.5							21.9						
LB-2 129.5							23.4						
LB-2 134.5	NP	NP	NP				23.9						
LB-2 139.5							20.6						
LB-2 144.5							25.8						
LB-2 149.5							23.6						
LB-2 153.0	33.5	17.1	16.0				15.4						
LB-2 158.0							15.6						
LB-2 165.0							16.1						

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-2 170.0							17.4						
LB-2 175.0							19.1						
LB-2 180.0							57.2						
LB-2 185.0							12.3						
LB-2 190.0							11.8						
LB-2 195.0							15.5						
LB-2 200.0							16.3						
LB-2 205.0					130.0	111.2	16.9						
LB-2 210.0							15.5						
LB-2 220.0							61.2						
LB-2 225.0							53.5						
LB-2 230.0							65.6						
LB-2 235.0							17.4						
LB-2 240.0							15.5						
LB-2 245.0							11.7						
LB-2 255.0							21.5						
LB-2 260.0	26.3	23.3	3.0				19.5						
LB-2 265.0					137.1	119.6	14.6						
LB-2 270.0							16.3						
LB-2 275.0							16.0						
LB-2 280.0							15.4						
LB-2 290.0							14.9						

Project: **WBI N Bakken Expansion** Job Number: **G19-025** Sheet **7** of **10**

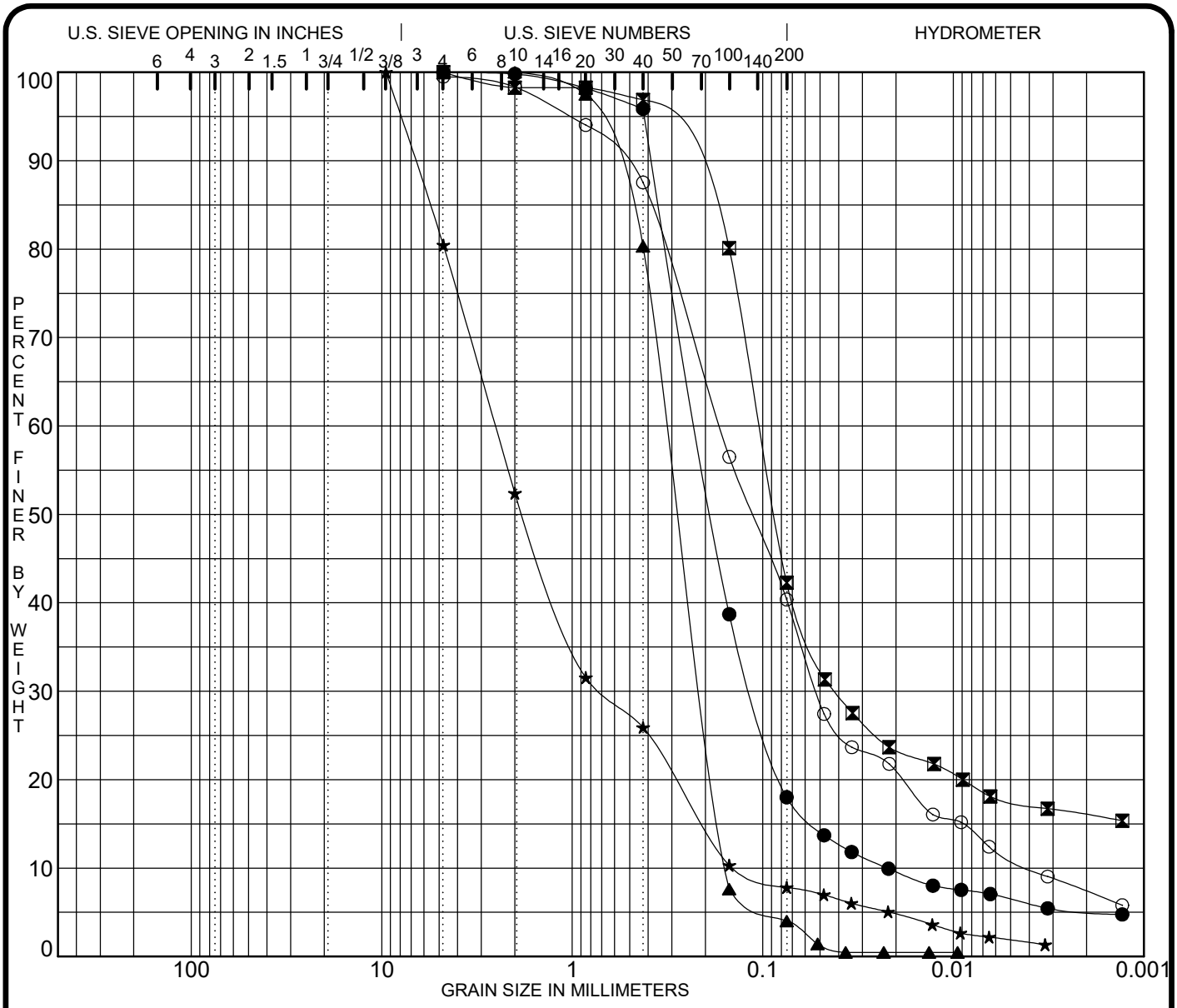
Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-2 295.0							16.0						
LB-2 300.0							17.8						
LB-2 305.0							23.1						
LB-2 310.0							20.7						
LB-2 315.0							13.6						
LB-2 320.0							11.2						
LB-2 325.0							17.9						
LB-2 330.0	52.8	23.9	29.0				18.2						
LB-2 335.0							16.9						
LB-2 340.0							16.3						
LB-2 345.0							17.5						
LB-2 350.0							16.3						
LB-2 355.0				42.3			17.9						
LB-2 360.0					135.7	114.6	18.4						
LB-2 365.0							14.2						
LB-2 370.0							15.3						
LB-2 375.0							17.2						
LB-2 380.0							15.3						
LB-2 385.0							17.2						
LB-2 390.0							16.2						
LB-2 395.0					129.3	109.5	18.1						
LB-3 4.5							4.3						

Borehole Depth / Elev.	Specimen Description	LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data: Top	Bottom	Type	Rec	'N'
LB-3 9.5								3.7						
LB-3 14.5								2.4						
LB-3 19.5								3.0						
LB-3 24.5								24.3						
LB-3 29.5								25.0						
LB-3 34.5	POORLY GRADED SAND				4.0			22.4						
LB-3 39.5								22.2						
LB-3 44.5								18.5						
LB-3 49.5								14.1						
LB-3 54.5								21.0						
LB-3 59.5								20.9						
LB-3 64.5					7.8			10.8						
LB-3 69.5								23.8						
LB-3 74.5								21.0						
LB-3 79.5								18.2						
LB-3 84.5								17.7						
LB-3 89.5								12.0						
LB-3 94.5								20.8						
LB-3 99.5								12.5						
LB-3 104.5								21.9						
LB-3 109.5					40.4			15.8						
LB-3 139.5								17.1						

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-3 144.5							22.3						
LB-3 149.5							20.2						
LB-3 154.5							21.4						
LB-3 159.5							20.4						
LB-3 164.5	23.9	18.1	6.0				20.3						
LB-3 169.5							19.5						
LB-3 175.0							32.5						
LB-3 180.0							28.4						
LB-3 185.0							51.0						
LB-3 187.0							60.3						
LB-3 197.0							20.3						
LB-3 202.0							18.9						
LB-3 207.0							15.1						
LB-3 212.0							15.4						
LB-3 217.0							13.3						
LB-3 222.0							15.9						
LB-3 227.0	24.3	23.1	1.0				13.5						
LB-3 232.0							11.1						
LB-3 237.0							18.5						
LB-3 242.0							15.6						
LB-3 247.0							17.0						
LB-3 252.0							20.2						

Project: **WBI N Bakken Expansion** Job Number: **G19-025** Sheet **10** of **10**

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
LB-3 257.0					128.2	108.8	17.8						
LB-3 262.0							19.4						
LB-3 267.0							16.9						
LB-3 277.0							18.0						
LB-3 282.0							23.8						
LB-3 287.0							17.1						
LB-3 292.0							19.2						
LB-3 297.0					134.6	113.8	18.3						
LB-3 302.0							14.8						
LB-3 307.0							15.9						
LB-3 312.0							17.4						
LB-3 317.0							16.3						
LB-3 322.0							15.8						
LB-3 327.0	105.3	24.7	80.0				23.2						
LB-3 332.0							19.5						
LB-3 337.0							17.9						
LB-3 347.0							15.8						
LB-3 357.0							16.2						
LB-3 362.0					136.1	116.1	17.2						
LB-3 367.0							18.7						



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Classification	MC%	LL	PL	PI	Cc	Cu
●	**LB-2**	**79.5**		**22**				**2.55**	**9.9**
⊠	**LB-2**	**355.0**		**18**					
▲	**LB-3**	**34.5**	**POORLY GRADED SAND SP**	**22**				**0.87**	**2.0**
★	**LB-3**	**64.5**		**11**				**1.42**	**18.4**
⊙	**LB-3**	**109.5**		**16**				**4.12**	**43.1**

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**LB-2**	**79.5**	**4.75**	**0.22**	**0.112**	**0.0223**	**0.0**	**82.0**	**11.5**	**6.5**
⊠	**LB-2**	**355.0**	**4.75**	**0.10**	**0.042**		**0.0**	**57.7**	**24.7**	**17.6**
▲	**LB-3**	**34.5**	**2.00**	**0.32**	**0.207**	**0.1552**	**0.0**	**96.0**		
★	**LB-3**	**64.5**	**9.50**	**2.53**	**0.703**	**0.1375**	**19.5**	**72.6**	**5.9**	**1.9**
⊙	**LB-3**	**109.5**	**4.75**	**0.17**	**0.052**	**0.0039**	**0.0**	**59.1**	**29.2**	**11.2**

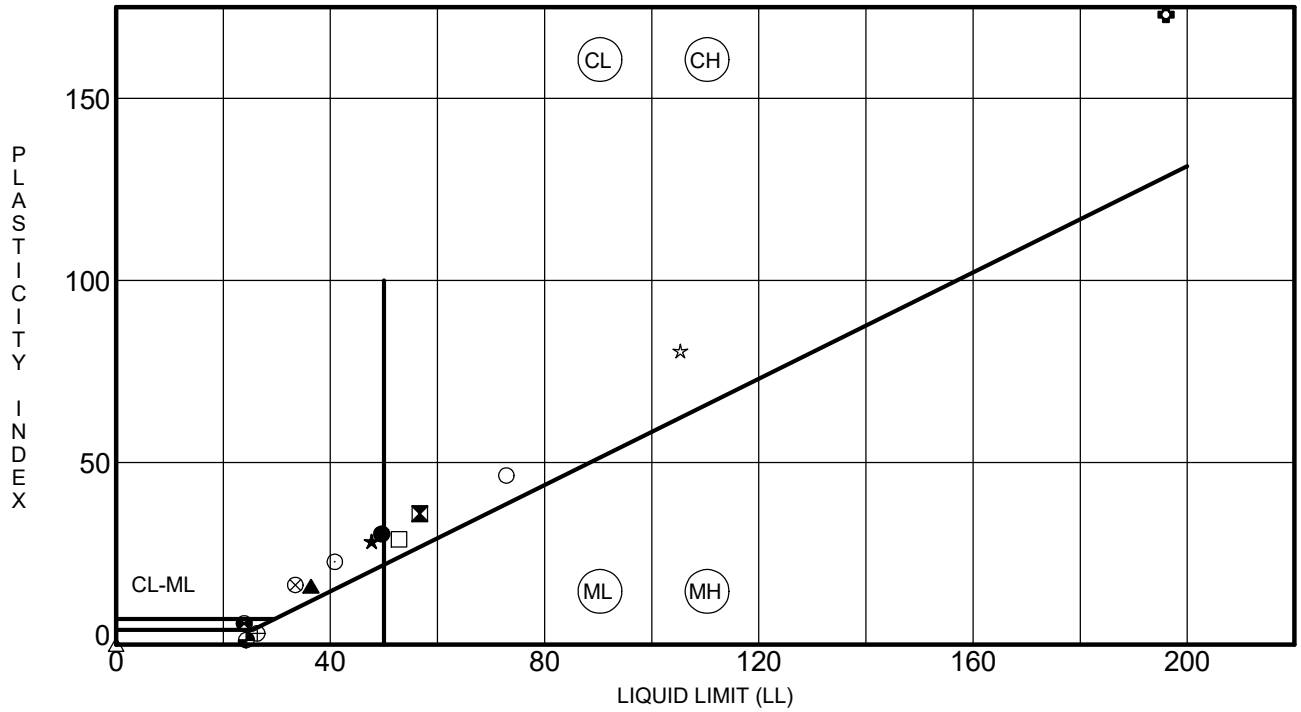
PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G19-025**

DATE **6/6/19**

PARTICLE SIZE ANALYSIS

Material Testing Services, LLC



Specimen Identification			LL	PL	PI	Fines	Classification
●	LB-1	34.5	50	19	30		
⊠	LB-1	89.5	57	21	36		
▲	LB-1	129.5	36	20	16		
★	LB-1	169.5	48	19	28		
⊙	LB-1	258.0	41	18	23		
✿	LB-1	353.0	196	23	173		
○	LB-2	44.5	73	26	46		
△	LB-2	134.5	NP	NP	NP		
⊗	LB-2	153.0	33	17	16		
⊕	LB-2	260.0	26	23	3		
□	LB-2	330.0	53	24	29		
⊛	LB-3	164.5	24	18	6		
◕	LB-3	227.0	24	23	1		
☆	LB-3	327.0	105	25	81		

PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G19-025**

DATE **6/6/19**

ATTERBERG LIMITS' RESULTS

Material Testing Services, LLC

MATERIAL TESTING SERVICES, LLC

P.O. Box 634
Minot, ND 58702
(701) 852-5553

P.O. Box 1093
Williston, ND 58802
(701) 572-4226

UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING
ZGE 15-102

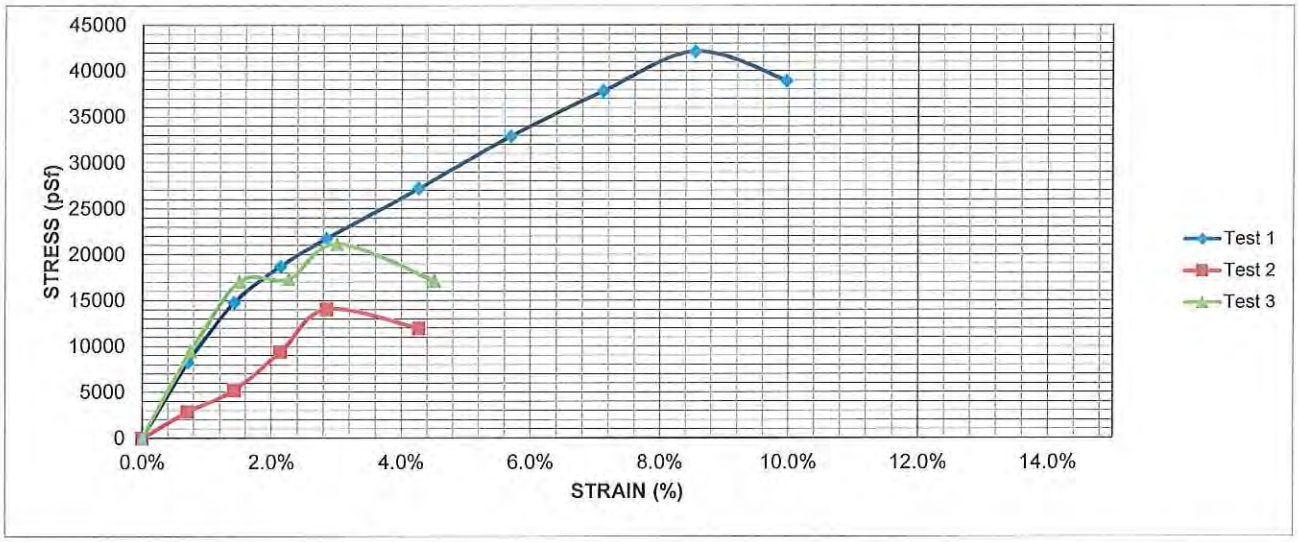
DATE: 6-Jun-19

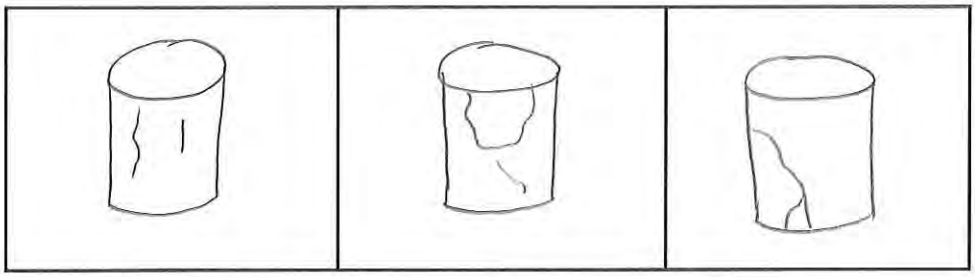
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G19-025

Specimen ID:	Test 1	Test 2	Test 3
	LB-1	LB-1	LB-1
	RC - 203-208 feet	RC - 238-243 feet	RC - 303-308 feet
Soil Class:			
Dry Density (pcf):	118.7	110.4	122.0
Water Content:	16.0%	17.2%	16.8%
Sample Dia. (mm):	42.3	45.3	42.9
Sample Ht (mm):	89.2	89.0	84.3
Height/Diameter:	2.11	1.97	1.97
Unc. Strength (psf):	**42174**	**14087**	**21196**
Strain at Failure (%):	8.5	2.9	3.0





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Material Testing Services, LLC

by

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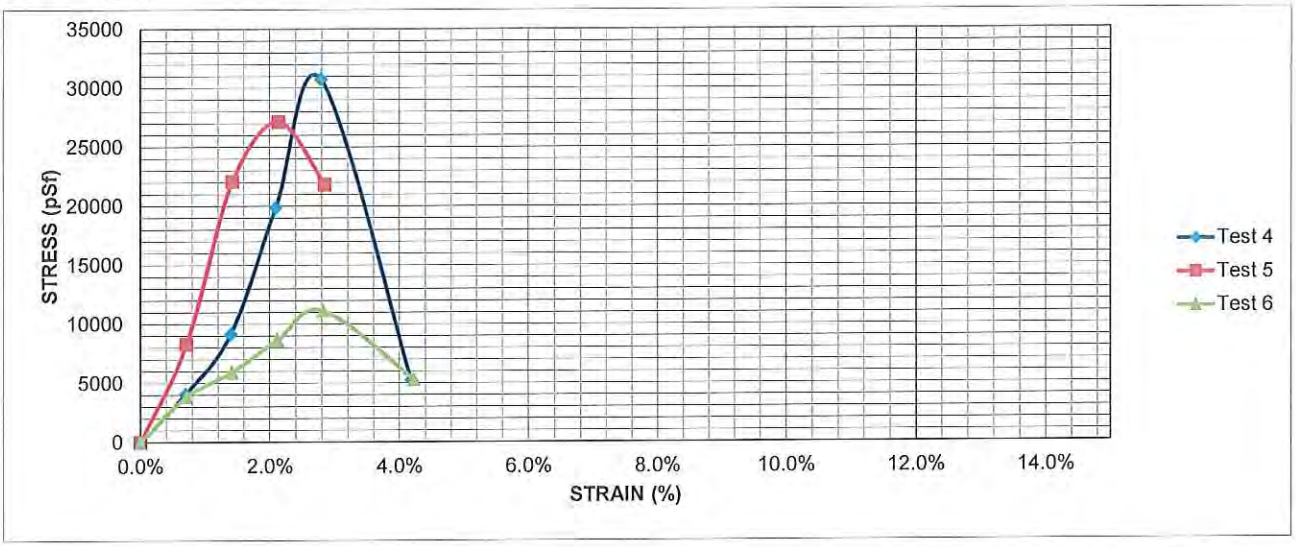
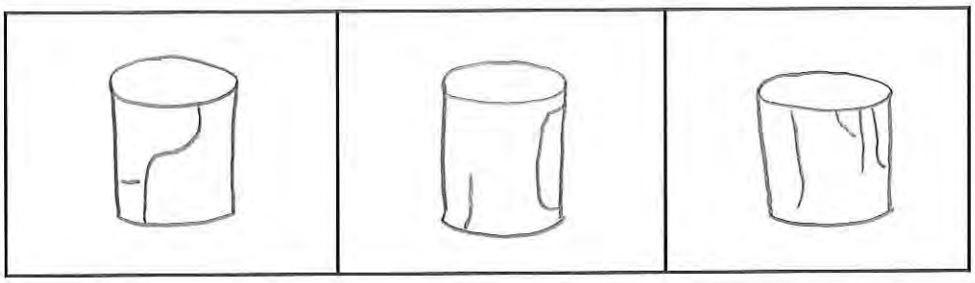
Laboratory Number G19-025

Specimen ID:	Test 4	Test 5	Test 6
	LB-1 RC - 393-398 feet	LB-2 RC - 160-165 feet	LB-2 RC - 205-210 feet
Soil Class:			
Dry Density (pcf):	112.1	115.1	111.2
Water Content:	17.2%	15.1%	16.9%
Sample Dia. (mm):	44.7	44.5	44.9
Sample Ht (mm):	91.2	89.4	90.2
Height/Diameter:	2.04	2.01	2.01
Unc. Strength (psf):	**30776**	**27159**	**11160**
Strain at Failure (%):	2.8	2.1	2.8





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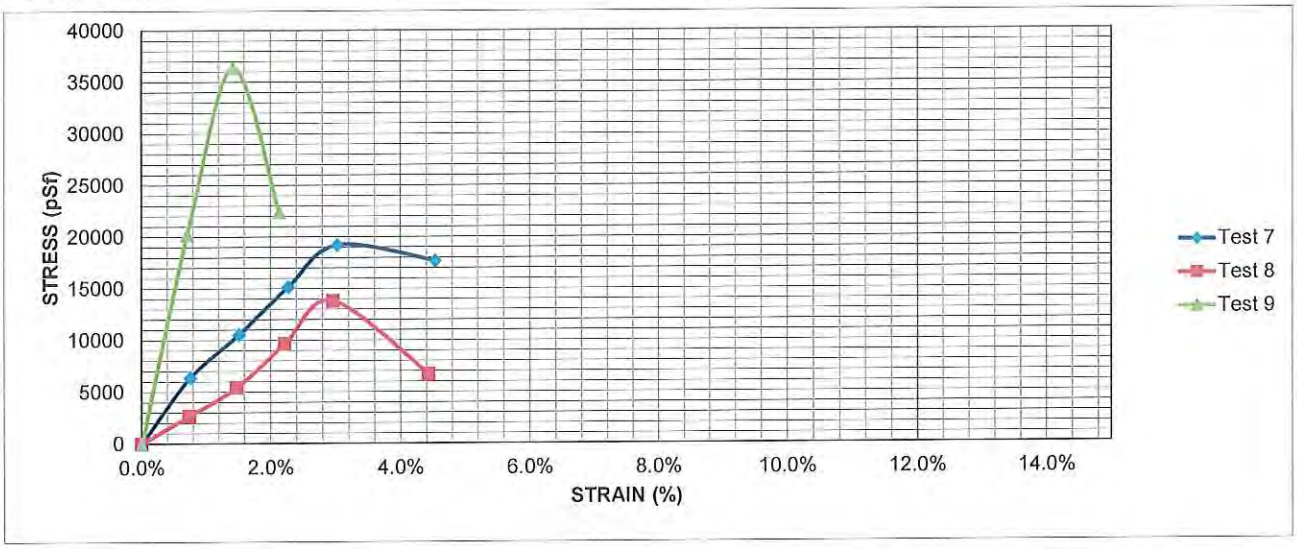
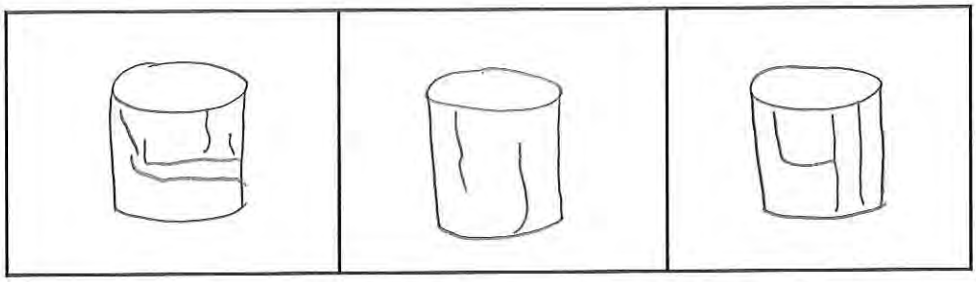
Laboratory Number G19-025

Specimen ID:	Test 7	Test 8	Test 9
	LB-2 RC - 265-270 feet	LB-2 RC - 360-365 feet	LB-2 RC - 395-400 feet
Soil Class:			
Dry Density (pcf):	119.6	114.6	109.5
Water Content:	14.6%	18.4%	18.1%
Sample Dia. (mm):	43.9	45.1	44.7
Sample Ht (mm):	84.1	86.0	89.5
Height/Diameter:	1.91	1.91	2.00
Unc. Strength (psf):	**19238**	**13841**	**36379**
Strain at Failure (%):	3.0	3.0	1.4





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DATE: 6-Jun-19

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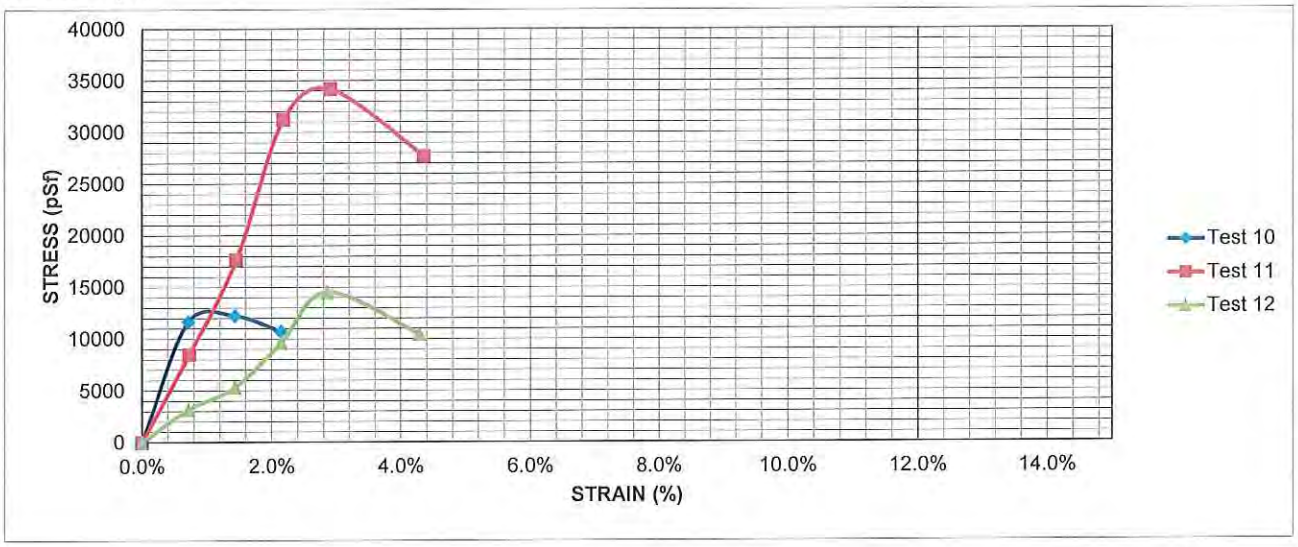
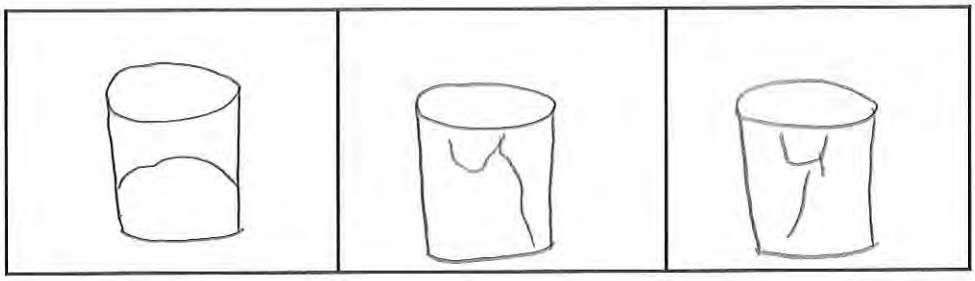
Laboratory Number G19-025

Specimen ID:	Test 10	Test 11	Test 12
	LB-3 RC -257-262 feet	LB-3 RC - 297-302 feet	LB-3 RC - 362-367 feet
Soil Class:			
Dry Density (pcf):	108.8	113.8	116.1
Water Content:	17.8%	18.3%	17.2%
Sample Dia. (mm):	45.1	43.7	45.1
Sample Ht (mm):	88.9	87.3	88.9
Height/Diameter:	1.97	2.00	1.97
Unc. Strength (psf):	**12245**	**34215**	**14547**
Strain at Failure (%):	1.4	2.9	2.9





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Material Testing Services, LLC

by

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%		ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

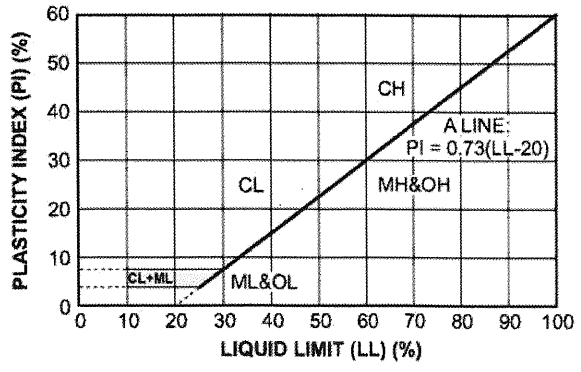
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent ..... GW, GP, SW, SP
More than 12 percent ..... GM, GC, SM, SC
5 to 12 percent ..... Borderline cases requiring dual symbols

PLASTICITY CHART



LABORATORY TEST RESULTS

Testing Scope

Laboratory testing was proposed to characterize soils index properties including Atterberg limits (liquid and plastic limits) and moisture content. Strength testing included unconfined compression testing.

Index Properties

Testing and classification of soils was performed in accordance with the Unified Soil Classification System as described in ASTM D 2487. Atterberg limits were performed according to ASTM D 4318. Moisture content was determined in accordance with ASTM D 4959 and D 4643. The dry density was determined with direct measurement procedures. Mechanical sieve analysis was done in accordance with ASTM D 422.

Strength Testing

The strength tests consisted of unconfined compression (QU) testing. The QU tests were conducted in accordance with ASTM D 2166.

CCI and Associates, Inc.

Geotechnical Investigation Report – Water-Based Borings

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Date:
July 9, 2020

Geotechnical Investigation Report – Water Based Borings

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

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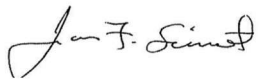

James F. Simonet
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Principal Scientist/Operations Manager

Anthony Frances, PE
Geotechnical Engineering
Material Testing Services, LLC.

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Table 1 – Soil Boring Locations

Appendices

Appendix A – Photographic Documentation Boring Logs
Appendix B – Aquatic Nuisance Species Inspection
Appendix C – Boring Logs
Appendix D – Laboratory Reports

Acronyms

ASTM	American Society for Testing and Materials
CCI	CCI and Associates, Inc.
ESC	Erickson Contract Surveying, Inc.
GES	Groundwater & Environmental Services, Inc.
HDD	horizontal directional drilling
HAS	hollow-stem auger
IDS	Interstate Drilling Services, LLP
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NDGFD	North Dakota Game and Fish Department
MTS	Material Testing Services, LLC
TGCRA	Tobacco Garden Creek Recreation Area
USACE	US Army Corp of Engineers

1 Introduction

This report presents the results of the geotechnical investigation that was performed by Groundwater and Environmental Services, Inc. (GES) for the project known as the WBI North Bakken Expansion Project in western North Dakota. Specifically, this report covers the geotechnical exploration at 6 water-based soil borings located along the proposed horizontal directional drilling (HDD) pipeline project under Lake Sakakawea/Missouri River (**Figure 1**). The proposed pipeline alignment under Lake Sakakawea is located approximately 1 mile northeast of the Tobacco Garden Creek Recreation Area (TGCRA). The TGCRA is located approximately 23 miles northeast of Watford City, North Dakota.

Services for this investigation were performed in general accordance with the April 1, 2019 Services Contract by and between CCI and Associates, Inc. (CCI) and GES.

1.1 Project Location and Scope

The objective of this phase of the geotechnical investigation is to assist CCI with evaluating the subsurface conditions at 6 water-based boring locations (WB-4 through WB-9) located along the proposed HDD pipeline alignment in Lake Sakakawea.

The scope of work included the following:

- Prepare a site-specific health and safety plan for GES employees and subcontractors for the proposed geotechnical investigation activities.
- Coordinate field activities and communication with project team and CCI.
- Participate in a pre-construction meeting with the Garrison Project Natural Resource Office of the US Army Corp of Engineers (USACE), TGCRA stakeholders, GES project team and WBI Energy representatives.
- Arrange for an inspection of all equipment entering the Lake by the North Dakota Game and Fish Department (NDGFD). Provide proof that equipment has been cleaned of aquatic nuisance species, mud, standing water and aquatic vegetation.
- Arrange for utility clearance through North Dakota One Call.
- Install crane mat protection along shoreline at barge assembly area located within the TGCRA.
- Mobilize the drilling team (Interstate Drilling Services, LLP (IDS)) and assembly and deploy the barge.
- Advance 6 water-based soil borings and collect samples at designated locations
- Clean barge sections and boats during final demobilization.

- Contract laboratory tests on soil samples obtained from the 6 water-based soil borings to evaluate physical properties.
- Provide a written geotechnical report.

Photographs taking during the project are provided in **Appendix A.**

2 Methods

2.1 Soil Borings

GES contracted with IDS of Grand Forks, North Dakota, to assemble the barge and advance the 6 water-based soil borings (**Figure 1**). IDS used a Diedrich D-50 track-mounted drill rig to advance the borings and collect soil samples.

The barge was deployed at the TGCRA at a location adjacent to the north side of the low-water boat ramp. Prior to deployment, crane mats, consisting of wood timbers were placed on the beach from the gravel driveway to approximately 5 feet from the water line in order to allow the crane to drive down to the water's edge while protecting the beach area and bank from damage. A 6" wattle was placed along the lake shore between the crane pad and water for erosion protection. The crane pad location is provided on **Figure 2**.

The crane pad was installed on May 4, 2020 and the crane, barge sections, push boat, drilling rig, equipment and supplies were mobilized to the TGCRA on May 5th.

Prior to placing into the lake, the barge sections and push-boat were power-washed and inspected for aquatic nuisance species by the NDGFD, per the USACE Permit DACW45-3-17-8010. A copy of the inspection is provided in **Appendix B**. Once approved by the NDGFD, the barge sections were placed into the lake and assembled. The barge consisted of six 10'x40' sections. Loading of the drilling rig, equipment and supplies onto the barge was completed on May 6th.

The barge was directed over the boring locations with assistance from Erickson Contract Surveying, Inc. (ECS) of Sidney, Montana. The boring locations were located via boat using a handheld GPS system and then demarcated with a 14" diameter red buoy. The buoys were deployed approximately 50 feet from the proposed pipeline alignment. Once the barge reached the buoy, ECS personnel collected a second measurement of the actual boring location. The borehole locations and mudline elevations using North Dakota – North, State Plane datum (NAD 83, 2011) are provided in **Table 1**. The water elevation for Lake Sakakawea during the project was generally stable at approximately 1,841 feet (NAVD88).

Table 1 - Borehole Locations					
Bore Hole	Easting	Northing	Mudline Elevation (feet)	Latitude	Longitude
WB-4	1335963.13	420346.33	1,811.7	N48°07'23.30"	W103°05'25.93
WB-5	1336623.75	422154.16	1,811.7	N48°07'42.24"	W103°05'15.52
WB-6	1337159.16	424253.25	1,811.9	N48°08'02.38"	W103°05'10.74
WB-7	1337758.65	425801.28	1,811.7	N48°08'17.93"	W103°05'01.65
WB-8	1338402.89	428621.66	1,812.7	N48°08'45.61"	W103°04'53.93
WB-9	1338983.19	430083.96	1,813.0	N48°09'00.54"	W103°04'45.07

Borehole advancement began on May 6, 2020 and the last boring was completed on the evening of May 16, 2020. The drilling operation consisted of 2 crews each working 12-hour shifts on the 24-hour operation. Work stoppages, due to high wind conditions occurred on May 8th, May 9th, May 12th and May 13th.

A hollow-stem auger (HSA) was used to collect soil samples while boring through soft lake sediment. Once competent sediment was encountered; a closed loop, fluid rotary drilling method was used to advance the borings through the sediments. Rock coring drilling methodology was then used to reach each boring terminus.

All borings were advanced to a total depth of 300 feet below the lake mudline except for WB-7 which was advanced to 315 feet and WB-9 which was advanced to 310 feet below the mudline. Upon completion, each boring was sealed from the boring terminus to the lake mudline with a concrete/bentonite slurry through a tremie rod.

During the fluid rotary drilling process, the spent drilling fluid was captured and run through a Mud Puppy 255 that removed drill cutting sand and grit from the drilling fluid, allowing the drilling fluid to be returned to the drilling operation. This process greatly reduced overall waste generation during the drilling process. Drilling cuttings and sediment were containerized for disposal and transported to the Grand Forks Landfill (Permit IT-202) located at 2701 North 69th Street, Grand Forks, North Dakota.

During HSA and fluid rotary methodologies, 1.5-foot samples were collected at 5 foot intervals using a split-spoon sampler in accordance with American Society for Testing and Materials (ASTM) D1586 (*Standard Test Method for Standard Penetration Test [SPT] and Split-Barrel Sampling of Soils*) using a 2-inch diameter split-spoon sampler. During rock coring drilling methodology, samples were generally collected at 5-foot sample intervals continuously in accordance with ASTM D2113 (*Standard Practice for Rock Core Drilling and Sampling of Rock for Site Exploration*) using a using a NQ3 size, triple-tube core barrel with a diamond bit.

Soils were classified in the field by a GES field geologist using ASTM Visual-Manual procedures (ASTM D2488, *Standard Practice for Description and Identification of Soils [Visual-Manual Procedure]*). The field geologist also collected samples from the split-spoon sampler and rock core sampler for geotechnical laboratory testing.

The boring logs and standard boring classification guidelines are contained in **Appendix C**.

2.2 Laboratory Testing

GES contracted with Material Testing Services, LLC (MTS) of Minot, North Dakota to provide geotechnical laboratory testing and evaluation services to aid in classifying and evaluating the physical properties of the soil/rock samples. Soil/rock sample selection and laboratory test parameters were determined by CCI.

The laboratory testing included the following:

- Moisture Content (ASTM D4959 - Standard Test Method for Determination of Water Content of Soil by Direct Heating and D4643 - Standard Test Method for Determination of Water Content of Soil and Rock by Microwave Oven Heating).
- Sieve Analysis (ASTM D422 – Test Method for Particle-size Analysis of Soils).
- Atterberg Limits (ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils).
- Unconfined Compression Testing (ASTM D2166 – Standard Test Method for Unconfined Compressive Strength of Cohesive Soils).

The laboratory data and reports are provided in **Appendix D.**

3 Site Conditions

The proposed HDD pipeline crossing traverses southwest to northeast across Lake Sakakawea approximately 1 mile northeast of the TGCRA. The physiographic regions where the proposed HDD pipeline crossing is located consist of the McKenzie Upland Unit, located south of the Missouri River and the Coteau Slope Unit, located north of the Missouri River. These units are part of the Great Plains and characterized by rolling to hilly plains with both erosional and glacial landforms. The proposed HDD crossing is located within the historic Missouri River floodplain that was flooded with the construction of the Garrison Dam in 1956 to form Lake Sakakawea. This area is located in the central portion of the Williston Basin.

The surface geology in the area consists of thin layers of glacial deposits underlain by the Paleocene-Aged Sentinel Butte Formation and the Bullion Creek Formation. The Sentinel Butte Formation consists of layers of silt, clay, sand, lignite, carbonaceous shale, and mudstone (Carlson, 1985). The Bullion Creek Formation underlies the Sentinel Butte Formation and consists of yellowish layers of silt, clay, and sand with interbedded sandstone, lignite, baked clay, and

limestone (Bluemle, 1977). Both formations are poorly lithified and form rolling topography over broad areas of Western North Dakota. The Sentinel Butte Formation outcrops along the north south shoreline of the Missouri River near WB-4 and both the Sentinel Butte and Bullion Creek Formations outcrop along the north shoreline of the Missouri River near WB-9 (Bluemle, 1977).

Soil borings WB-4 through WB-9 generally consist of silts and poorly graded sands and gravels in the upper portions of the borings, consistent with more recent alluvial deposits originating from the Missouri River. These alluvial deposits extend to approximately 45 feet below the mudline in borings WB-4 and WB-9, and to approximately 220 below the mudline at boring WB-7. Underlying the more recent alluvial deposits are deposits of the Sentinel Butte and Bullion Creek Formations.

4 Limitations

The data generated and conclusions and opinions provided are based on the scope of work performed. All work was conducted in a manner consistent with currently accepted geotechnical engineering practices exercised by members of the profession practicing under similar conditions. No other warranty, expressed or implied, is made.

The samples collected and described in this report are representative of the subsurface conditions at the sampled locations and intervals, and therefore, do not necessarily reflect strata variations that may exist between sampled intervals and locations. If variations from the subsurface conditions described in this study are noted during additional investigations and/or construction, recommendations in this report must be re-evaluated.

GES is not responsible for the independent conclusions, opinions, or recommendations made by others based on the data presented in this report. Nor can GES warrant that this report will satisfy the dictates of or provide a legal defense in connection with an environmental law or regulation.

The results reported and any opinions reached by GES are for the benefit of the CCI & Associates and their client and unless agreed to by GES in writing, are not to be disclosed to or relied upon by any third party. The results and opinions set forth by GES in this report will be valid as of the date of the report.

References

Bluemle, J.P. 1977. *Geologic Highway Map of North Dakota*. North Dakota Geological Survey Educational Series 11, Miscellaneous Map 19.

Carlson, Clarence G. 1985. *Geology of McKenzie County, North Dakota.* North Dakota Geological Survey, Bulletin 80 – Part 1 and North Dakota State Water Commission, County Groundwater Studies 37 – Part 1.

Figures

L:\Projects\CCI\GIS\CCI_Lake_Sakakawea_SBLM.mxd - Scale 1:36,000 - 7/1/2020 3:53:16 PM - dcleland - NAD 1983 StatePlane North Dakota North FIPS 3301 Feet

Water Boring Location Map

CCI and Associates, Inc.
WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Drawn **AMW**
Designed **DMC**
Approved **-**

Date **7/1/20**
Figure **1**

Scale In Feet (Approximate)
0 3,000

Groundwater & Environmental Services, Inc.

L:\Projects\CCI\GIS\CCI_Lake_Sakakawea_Barge Area.mxd - Scale 1:1,774 - 7/1/2020 5:04:52 PM - dcleland - NAD 1983 StatePlane North Dakota North FIPS 3301 Feet

Barge Assembly and Crane Location Area

CCI and Associates, Inc.
WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Drawn **AMW**
Designed **DMC**
Approved **-**

Date **7/1/20**
Figure **2**

Scale In Feet (Approximate)
0 150

Groundwater & Environmental Services, Inc.

Appendix A – Photographic Documentation Boring Logs

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
View of low-water boat ramp and location of crane mat area before mobilization

Direction of View:
Southeast

Date Taken:
04/29/2020

Description:
View of low-water boat ramp location of crane mat area before mobilization

Direction of View:
Westward

Date Taken:
04/29/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Placing crane mats in preparation of mobilizing barge

Direction of View:
Westward

Date Taken:
05/04/2020

Description:
Completion of crane pad area

Direction of View:
Southeast

Date Taken:
05/04/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Positioning of crane in preparation of barge mobilization

Direction of View:
Westward

Date Taken:
05/05/2020

Description:
Lifting first barge section to the water

Direction of View:
Westward

Date Taken:
05/05/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Placing the barge winch on the barge

Direction of View:
Northwest

Date Taken:
05/05/2020

Description:
Placement of drilling rig on barge

Direction of View:
Northwest

Date Taken:
05/05/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Placement of push boat in Lake

Direction of View:
Northeast

Date Taken:
05/05/2020

Description:
Placement of Spud on Barge

Direction of View:
Northward

Date Taken:
05/05/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
View of drilling rig and barge deck

Date Taken:
05/06/2020

Description:
Overhead view of barge

Date Taken:
05/06/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
View of barge deck and two spill kit barrels

Direction of View:
Port side of barge

Date Taken:
05/06/2020

Description:
Photo of Mud Puppy mud recycling unit and secondary containment

Direction of View:
Starboard side of barge

Date Taken:
05/06/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Barge deck and portable light towers in secondary containment

Direction of View:
At bow of barge

Date Taken:
05/07/2020

Description:
Drilling Rig preparing to begin at WB-5

Date Taken:
05/07/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Completing boring WB-9

Date Taken:
05/15/2020

Description:
Demobilization of equipment

Direction of View:
Northwest

Date Taken:
05/19/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Demobilization of drilling rig

Direction of View:
Northwest

Date Taken:
05/19/2020

Description:
Demobilization of equipment

Direction of View:
Northwest

Date Taken:
05/19/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Removal of push boat from water

Direction of View:
Northwest

Date Taken:
05/19/2020

Description:
Removal of barge sections during demobilization

Direction of View:
Eastward

Date Taken:
05/19/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Pressure washing barge sections during demobilization

Direction of View:
Eastward

Date Taken:
05/19/2020

Description:
Preparing to remove crane from crane pad during demobilization

Direction of View:
Southeast

Date Taken:
05/19/2020

Site Photographs

WBI North Bakken Expansion Project
Lake Sakakawea/Missouri River
McKenzie and Williams County, North Dakota

Description:
Low water boat ramp and crane pad area after completion of demobilization

Direction of View:
Northwest

Date Taken:
05/19/2020

Description:
Low water boat ramp and crane pad area after completion of demobilization

Direction of View:
Southeast

Date Taken:
05/19/2020

Appendix B – Aquatic Nuisance Species Inspection

ANS INSPECTION REPORT - For equipment brought into or to be used in North Dakota
NORTH DAKOTA GAME AND FISH DEPARTMENT
FISHERIES DIVISION

Company name: Interstate Drilling **Contact:** Mike Zak	**E-mail address:** mikez@interstatedrilling.com	**Phone number:** (701) 741-9951

Water body: Lake Sakakawea **Location:** Tobacco Gardens
Equipment inspected: 6 barge sections, 1 tugboat, various aquatic equipment

Where equipment was last used

Tugboat and four sections of barge last used on Missouri River near Boonville, Mo (taken out 4/20/20)
One barge section has been sitting since December of 2019 – Rock River, Rock Island, IL (taken out DEC 2019)
One barge section has been sitting since August of 2019 – Missouri River, Nebraska City, NE (take out AUG 2019)

ANS Precautions used prior to equipment entering North Dakota

All barge sections were pressure washed with hot water prior to entering North Dakota. Additionally, barge sections and tugboat were dried for 2 weeks to 8 months.

Actual physical and visual ANS inspection

Barge section 1 – few very dry byssal threads found. No limpets or ZM. Cleared for launch.
Barge section 2 – numerous dried byssal threads and 2 dead zebra mussels found, all very dry. Required additional cleaning and inspection.
Barge section 3 – some byssal threads. No mussels or limpets. Cleared for launch.
Barge section 4 slanted – very few byssal threads. Cleared for launch.
Barge section 5 – no attached organism and very few dry byssal threads. Cleared for launch.
Barge section 6 – no attached organic material. Cleared for launch.
Tugboat – no byssal threads or mussels found on the outside of the boat. Required additional cleaning because it was not washed before entering North Dakota. Inside of tugboat does not take on water. No standing water or organics found inside, so did not require additional cleaning or disinfection inside.

Additional comments or notes:

One section of barge and the tugboat were power washed under supervision and were re-inspected. These were cleared to be put into Sakakawea.
Zebra mussels observed had desiccated organs, indicating that they were not alive. It is likely that the pressure washing in Missouri utilized hot water or the two week plus drying period allowed the mussels to die.
Crane did not get put in water – no inspection required.

Status:	**NDGF representative:**	**Date:**
Approved	Ben Holen, ANS Coordinator	5/5/2020

Barge section 2 and zebra mussel that was discovered on it.

Left: Pressure washing the tugboat. Right: Inside of tugboat. No standing water was present.

Line of barges.

Appendix C – Boring Logs

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
0				CL-ML: SILTY CLAY, with trace fine grained sand, very dark gray (5Y 3/1), very moist, soft.							
15	1	6 in.	2-2-2		0.25						
20	2	8 in.	1-12	SP: POORLY GRADED SAND, fine grained, dark gray (5Y 4/1), wet, very loose.	-						
25	3	15 in.	1-1-1		-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	4	10 in.	4-6-4	With trace medium grained sand and loose at 29.5 ft.	-						
35	5	10 in.	2-2-1		-						
40	6	10 in.	7-5-6	SP: POORLY GRADED SAND, medium to coarse grained, with little fine gravel, with trace small lignite pieces, olive (5Y 4/3), wet, medium dense.	-						
45	7	7 in.	4-4-6	SPG: POORLY GRADED SAND WITH GRAVEL, coarse grained with fine gravel, olive (5Y 4/3), wet, loose.	-						5.4
50	8	6 in.	6-9-11	SP: POORLY GRADED SAND, fine to medium grained, dark gray (5Y 4/1), wet, medium dense.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

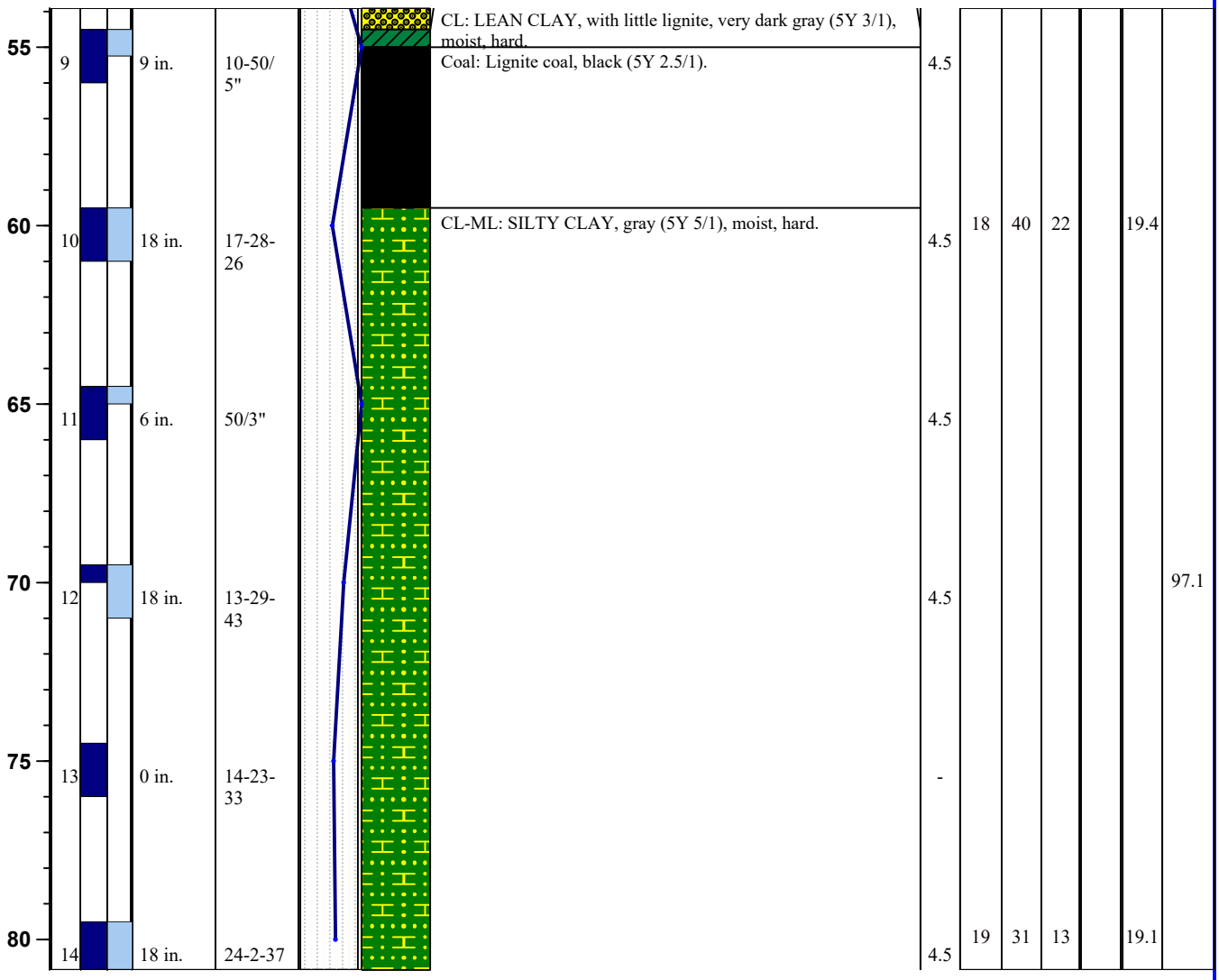
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**



Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
	9	9 in.	10-50/ 5"	CL: LEAN CLAY, with little lignite, very dark gray (5Y 3/1), moist, hard.							
				Coal: Lignite coal, black (5Y 2.5/1).	4.5						
	10	18 in.	17-28-26	CL-ML: SILTY CLAY, gray (5Y 5/1), moist, hard.	4.5	18	40	22		19.4	
	11	6 in.	50/3"		4.5						
	12	18 in.	13-29-43		4.5						97.1
	13	0 in.	14-23-33		-						
	14	18 in.	24-2-37		4.5	19	31	13		19.1	

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

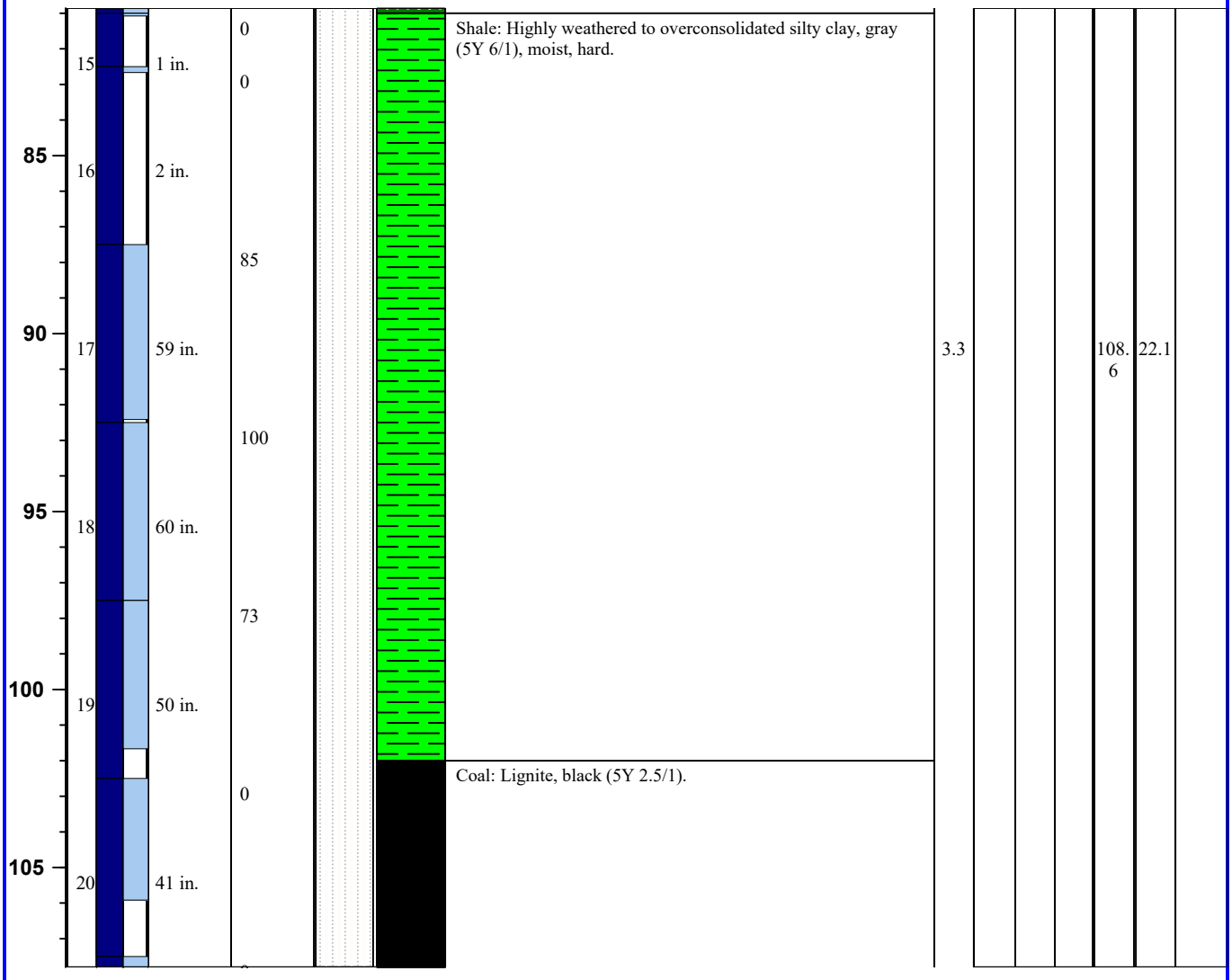
Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**



Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
85	15	1 in.	0	Shale: Highly weathered to overconsolidated silty clay, gray (5Y 6/1), moist, hard.	3.3				108.6	22.1	
	16	2 in.	0								
			85								
90	17	59 in.									
			100								
95	18	60 in.									
			73								
100	19	50 in.									
			0	Coal: Lignite, black (5Y 2.5/1).							
105	20	41 in.									

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
110	21	60 in.	0	With some coarse sand from 110.5 to 112.5 ft.							
115	22	51 in.	0								
120	23	60 in.	0								
125	24	60 in.	78	Shale: Highly weathered to overconsolidated silty clay, gray (5Y 6/1), moist, hard.							
130	25	57 in.	83		11.3				113.7	15.2	

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	26	50 in.	93								
140	27	58 in.	85	Lignite seam 3 in. thick at 143 ft.							
145	28	55 in.	87	Lignite seam 2 in. thick at 145 ft.							
150	29	60 in.	95		17.6				118.9	15.5	
155	30	60 in.	0	SP: POORLY GRADED SAND, fine grained, gray (5Y 5/1).							
160	31	0 in.									

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
165	32	0 in.	0								
			0								
170	33	0 in.									
			0								
175	34	0 in.									
			7								
180	35	38 in.		Coal: Lignite, black (5Y 2.5/1).							
			85	Shale: Highly weathered to overconsolidated clay, gray (5Y 5/1), moist, hard.							
185	36	60 in.			23.8				115.1	19.1	
				Coal: Lignite, black (5Y 2.5/1).							
			87	Shale: Highly weathered to overconsolidated clay, gray (5Y							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
190	37	60 in.	85	5/1), moist, hard. Lignite seam 6 in. thick at 192 ft.							
195	38	58 in.	83	CL: LEAN CALY, with fine grained sand, gray (5Y 5/1), moist, hard. Coal: Lignite, black (5Y 2.5/1). SM: SILTY SAND, fine grained, gray (5Y 5/1), moist, very dense. Shale: Highly weathered to overconsolidated clay, gray (5Y 5/1), moist, hard.							
200	39	57 in.	100	Coal: Lignite, black (5Y 2.5/1). CL: LEAN CLAY, with trace fine grained sand, consolidated, to highly weathered shale, gray (5Y 5/1), moist, hard.							
205	40	60 in.	27	SP: POORLY GRADED SAND, fine grained, with trace silt, gray (5Y 5/1) moist, very dense.							
210	41	24 in.	10	Seam of consolidated clay 6 in. thick at 210 ft.							
215	42	44 in.									

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
220	43	45 in.	50	Coal: Lignite, black (5Y 2.5/1).							
			93	CL: LEAN CLAY, consolidated, to highly weathered shale, gray (5Y 5/1), moist, hard.							
225	44	60 in.	97	Sandstone: Fine grained, weakly cemented, with some silt, gray (5Y 5/1), moist, very dense.							
230	45	60 in.	88								
235	46	54 in.	100	Shale: Highly weathered, gray (5Y 5/1), moist, hard. Trace lignite less than 1 in. thick at 234 ft. Color turns to dark gray (5Y 5/1) at 237.5 ft.							
240	47	60 in.		Siltstone: With trace fine grained sand, weakly cemented, dark gray (5Y 4/1), moist, very dense.	5.7				113.9	15.2	

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
245	48	60 in.	100	Sandstone: Fine grained, weakly cemented, with some silt, dark gray (5Y 4/1), moist, very dense.							
250	49	60 in.	100		4.9				107.5	19.1	
255	50	60 in.	100								
260	51	60 in.	92								
265	52	57 in.	75								

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
270	53	45 in.	100	Seam of trace thin lignite laminations less than 1 in. thick from 269.5 to 270 ft.	4.5				109.4	18.6	
275	54	60 in.	0	Coal: Lignite, black (5Y 2.5/1).							
280	55	60 in.	0								
285	56	24 in.	93	Shale: Highly weathered, dark gray (5Y 4/1), moist, hard.							
290	57	60 in.	78		12.4				107.6	20.0	
				Coal: Lignite, black (5Y 2.5/1).							
295	58	60 in.		Shale: Highly weathered, dark gray (5Y 4/1), moist, hard.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 23.30"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-4**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/9/20 through 5/10/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/10/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 81 ft.) and NQ Rock Core (81 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/10/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
300	59	30 in.	100	EOB at 300 ft. Target depth reached.	11.1				105.9	21.1	

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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Lon: 103° 5' 25.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-5**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/7/20 through 5/8/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/8/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 66 ft.), Fluid Rotary (74 to 160 ft.), NQ Rock Core (66 to 74 and 160 to 300 ft.)**

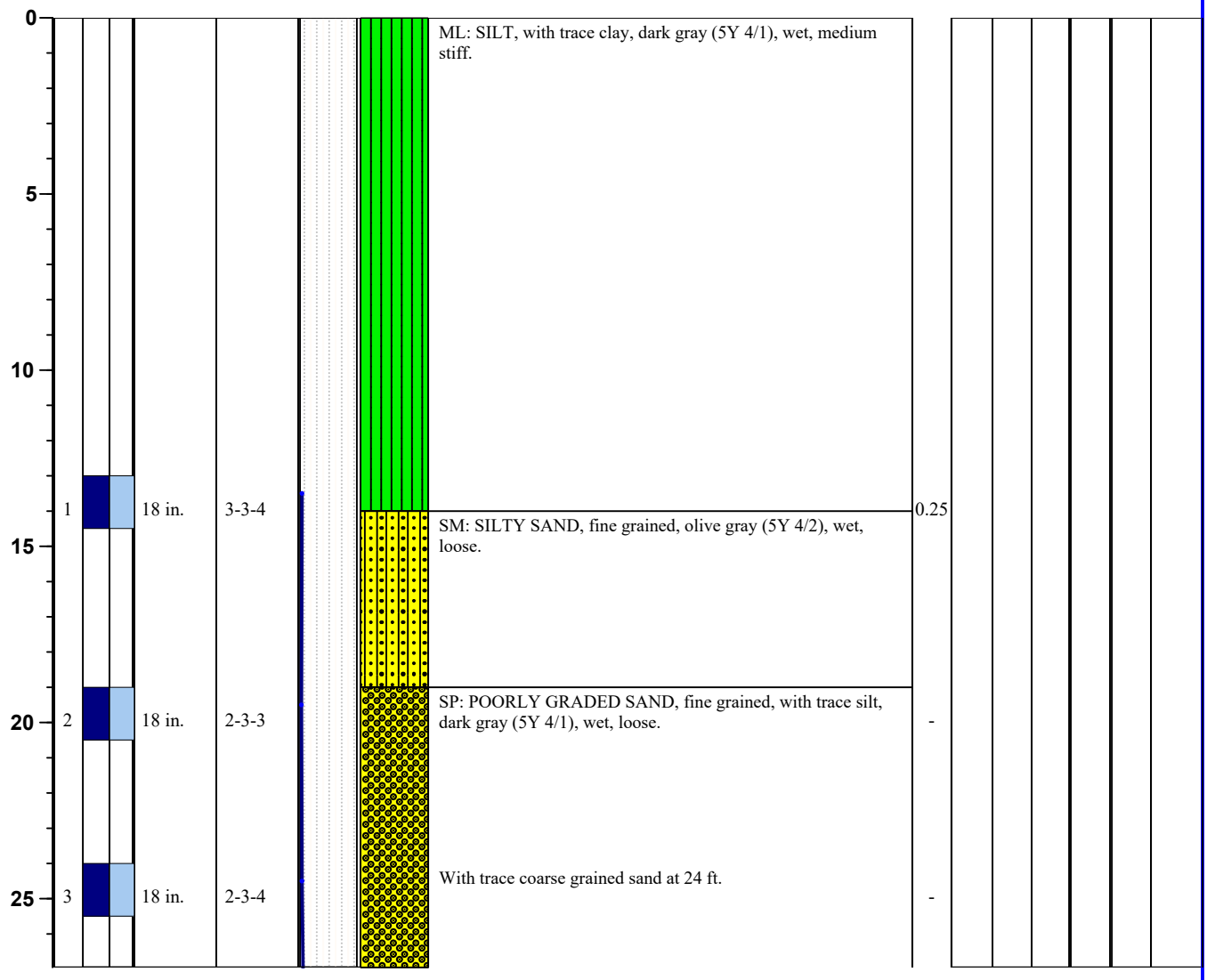
Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
0				ML: SILT, with trace clay, dark gray (5Y 4/1), wet, medium stiff.							
15	1	18 in.	3-3-4	SM: SILTY SAND, fine grained, olive gray (5Y 4/2), wet, loose.	0.25						
20	2	18 in.	2-3-3	SP: POORLY GRADED SAND, fine grained, with trace silt, dark gray (5Y 4/1), wet, loose.	-						
25	3	18 in.	2-3-4	With trace coarse grained sand at 24 ft.	-						



Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 42.24"

Lon: 103° 5' 15.52"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-5**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/7/20 through 5/8/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/8/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 66 ft.), Fluid Rotary (74 to 160 ft.), NQ Rock Core (66 to 74 and 160 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	4	18 in.	2-4-6	Fine to medium grained with trace coarse gained at 29 ft.	-						
35	5	0 in.	2-2-3	SPG: POORLY GRADED SAND WITH GRAVEL, coarse grained with fine gravel, dark gray (5Y 4/1), wet, loose.	-						
40	6	1 in.	4-4-4		-						
45	7	6 in.	10-7-6	With medium to coarse graind sand and medium dense at 44 ft.	-						7.7
50	8	4 in.	4-4-4	With trace medium to coarse graind sand and loose at 49 ft.	-						

Notes:

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Logged By: **Nick Schlagel** Date Drilled: **5/7/20 through 5/8/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/8/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 66 ft.), Fluid Rotary (74 to 160 ft.), NQ Rock Core (66 to 74 and 160 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
55	9		6 in.	9-14-14	With few medium to coarse graind sand and medium dense at 54 ft.	-						
60	10		16 in.	10-6-40	SPG: POORLY GRADED GRAVELLLY SAND, medium to coarse grained, dark gray (5Y 4/1), moist, dense.	-						
65	11		18 in.	10-13-17	CL: LEAN CLAY, consolidated, with trace silt, very dark gray (5Y 3/1), moist, very stiff.	3.75	22	47	25		28.0	
	12		16 in.	10								
70	13		24 in.	28	Coal: Lignite, black (2.5Y 2.5/1).							
75	14		0 in.	0	NO RECOVERY (suspect same noncohesive material as below) from 74 to 79 ft.							
80					SPG: POORLY GRADED GRAVELLLY SAND, fine grained, dark gray (5Y 4/1), moist, very dense.							

Notes:

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Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
85	15	12 in.	12-24-36	CL-ML: SILTY CLAY, dark gray (5Y 4/1), moist, hard.	4.5						
90	16	18 in.	20-28-33		3.0						
95	17	18 in.	15-18-13	SPG: POORLY GRADED GRAVELLLY SAND, fine grained, dark gray (5Y 4/1), moist, dense.	-						
				CL-ML: SILTY CLAY, with 2 in. thick coal seam at 95.5 ft., dark gray (5Y 4/1), moist, hard.							
100	18	18 in.	16-17-18	SC: CLAYEY SAND, fine grained, dark gray (5Y 4/1), moist, dense.	-						
				ML: SILT, with trace clay, dark gray (5Y 4/1), moist, hard.							
105	19	18 in.	13-16-26	SC: CLAYEY SAND, fine grained, with trace silt, dark gray (5Y 4/1), moist, dense.	-						

Notes:

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Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample	Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
110	20		18 in.	16-17-10		-						46.6
115	21		18 in.	9-13-14	CL-ML: SILTY CLAY, dark gray (5Y 4/1), moist, very stiff.	4.25						
120	22		11 in.	13-14-16	SP: POORLY GRADED SAND, fine to coarse grained, with trace silt, dark gray (5Y 4/1), wet, medium dense.	-						
125	23		18 in.	10-16-23	CL-ML: SILTY CLAY, dark gray (5Y 4/1), moist, hard.	4.25						
130	24		11 in.	43-50/3"	SP: POORLY GRADED SAND, fine grained, with trace silt, dark gray (5Y 4/1), wet, very dense.	-						

Notes:

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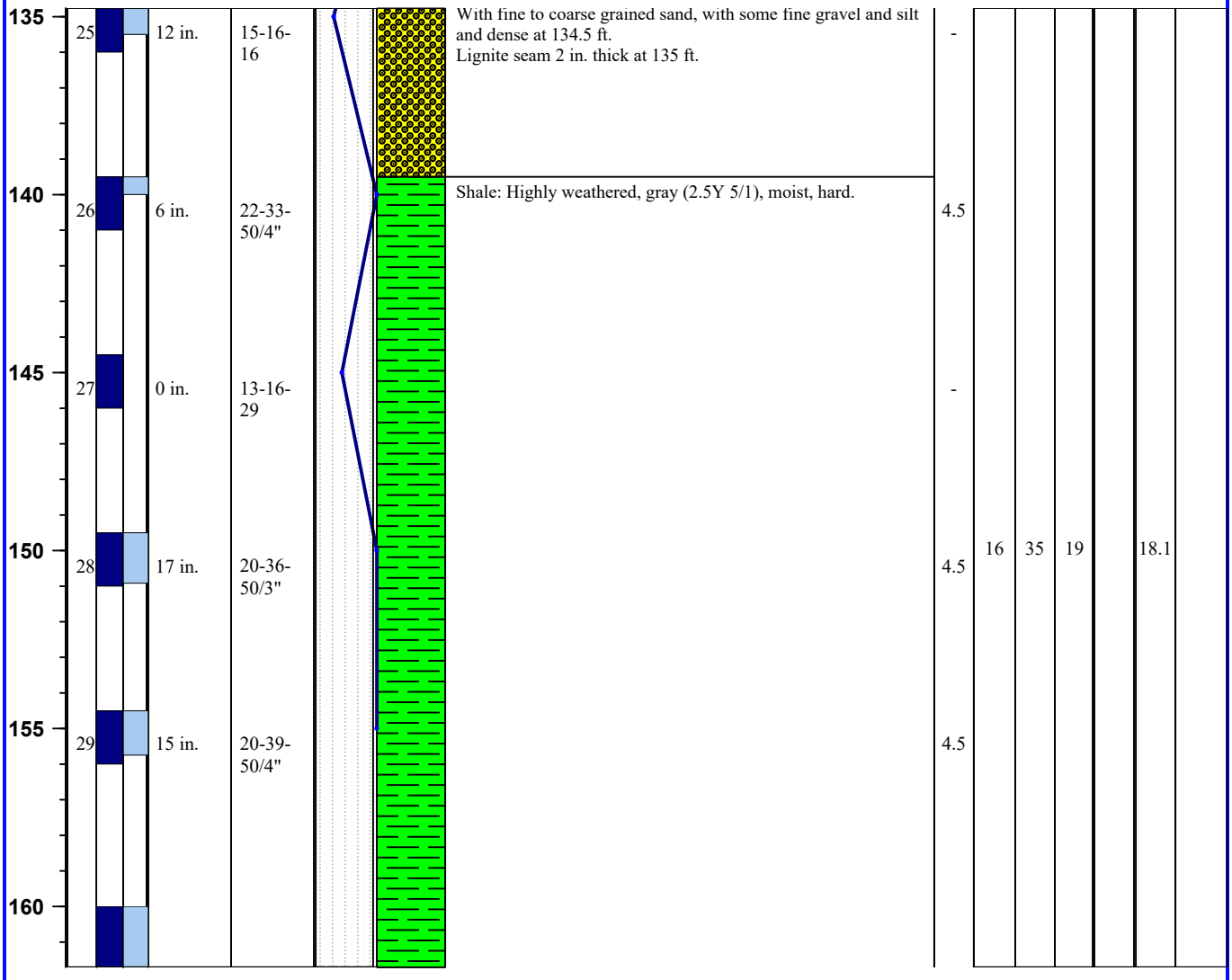
Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**



Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	25	12 in.	15-16-16	With fine to coarse grained sand, with some fine gravel and silt and dense at 134.5 ft. Lignite seam 2 in. thick at 135 ft.	-						
140	26	6 in.	22-33-50/4"	Shale: Highly weathered, gray (2.5Y 5/1), moist, hard.	4.5						
145	27	0 in.	13-16-29		-						
150	28	17 in.	20-36-50/3"		4.5	16	35	19		18.1	
155	29	15 in.	20-39-50/4"		4.5						
160											

Notes:

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Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample	Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
165	30		41 in.	53		2.5				108.2	66.2	
	31		43 in.	38								
170	32		13 in.	13	ML: SILT, gray (2.5Y 5/1), moist, very dense.							
	33		30 in.	18	Coal: Lignite, black (5Y 2.5/1).							
180	34		58 in.	85	Shale: Highly weathered, gray (2.5Y 5/1), moist, hard. Lignite seam 2 in. thick at 184 ft. Lignite seam 5 in. thick at 184.5 ft.	12.1				117.5	16.6	
185	35		60 in.	93								

Notes:

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Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
190				Color tunrs to gray (5Y 5/1) at 190 ft. Lignite seam 2 in. thick at 190.5 ft.							
	36	60 in.	97								
195				With small fine to medium grained sand seams at 195 ft.							
	37	47 in.	75								
200				Coal: Lignite, black (5Y 2.5/1).							
				Shale: Highly weathered, gray (5Y 5/1), moist, hard.							
	38	59 in.	83	Coal: Lignite, black (5Y 2.5/1).	9.6				116.3	14.2	
205				Shale: Highly weathered, gray (5Y 5/1), moist, hard.							
	39	56 in.	88								
210											
	40	60 in.	100								
215											

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Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
	41	50 in.	75								
220				Lignite seam 6 in. thick at 219.5 ft.							
	42	60 in.	90		4.1				105.8	19.2	
				Fine grained sand seam 2 in. think at 223.3 ft. Trace lignite at 224 ft.							
225				Color tunrs to dark gray (5Y 4/1) at 225 ft.							
	43	55 in.	87								
230											
	44	60 in.	100								
235											
	45	60 in.	100	With some fine grained sand from 237 ft. to 240 ft.							
240											

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Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
245				SP: POORLY GRADED SAND, fine grained, with trace silt and trace clay, dark gray (5Y 4/1), moist, very dense.							
	47	58 in.	92		3.3				107.9	17.0	
250				Slightly cohesive to weakly cemented at 250 ft. and below.							
	48	59 in.	98								
255											
	49	58 in.	97								
260											
	50	58 in.	97								
265											
	51	60 in.	97	Coal: Lignite, black (5Y 2.5/1).	2.0				108.8	20.5	

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Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
270											
	52	60 in.	20								
275											
	53	30 in.	37	SP: POORLY GRADED SAND, fine grained, with trace silt and trace clay, slighly cohesive to weakly cemented, dark gray (5Y 4/1), moist, very dense.	8.7				106.5	20.2	
				Coal: Lignite, black (5Y 2.5/1).							
280				SP: POORLY GRADED SAND, fine grained, with trace silt and trace clay, slighly cohesive to weakly cemented, dark gray (5Y 4/1), moist, very dense.							
	54	60 in.	88								
285				CL: LEAN CLAY, with trace fine grained sand, consolidated, dark gray (5Y 4/1), moist, hard.							
	55	53 in.	78								
				Coal: Lignite, black (5Y 2.5/1).							
290				CL: LEAN CLAY, with trace fine grained sand, consolidated, dark gray (5Y 4/1), moist, hard.							
	56	60 in.	100								
295											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 42.24"

Lon: 103° 5' 15.52"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-5**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/7/20 through 5/8/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/8/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 66 ft.), Fluid Rotary (74 to 160 ft.), NQ Rock Core (66 to 74 and 160 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/8/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
300	57	37 in.	62	EOB at 300 ft. Target depth reached.	6.4				106.7	21.6	

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 7' 42.24"

Lon: 103° 5' 15.52"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
0				SM: SILTY SAND, fine grained, very dark gray (2.5Y 3/1), wet, very loose.							
15	1	14 in.	1-2-1		-						
20	2	16 in.	3-9-9	Color turns to very dark grayish brown (2.5Y 3/2) and medium dense at 19.5 ft.	-						
25	3	4 in.	0-0-2	Very loose at 24.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	4		5 in.	1-1-1		-						
35	5		6 in.	2-3-5	Loose at 34.5 ft.	-						
40	6		6 in.	4-11-5	Medium dense at 39.5 ft.	-						
45	7		10 in.	2-3-3	Loose with coarse grained sand and fine gravel seam 5 in. thick at 45 ft.	-						
50	8		13 in.	8-32-24	Very dense with angular coarse sand and gravel seam 7 in. thick at 50 ft.	-						10

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

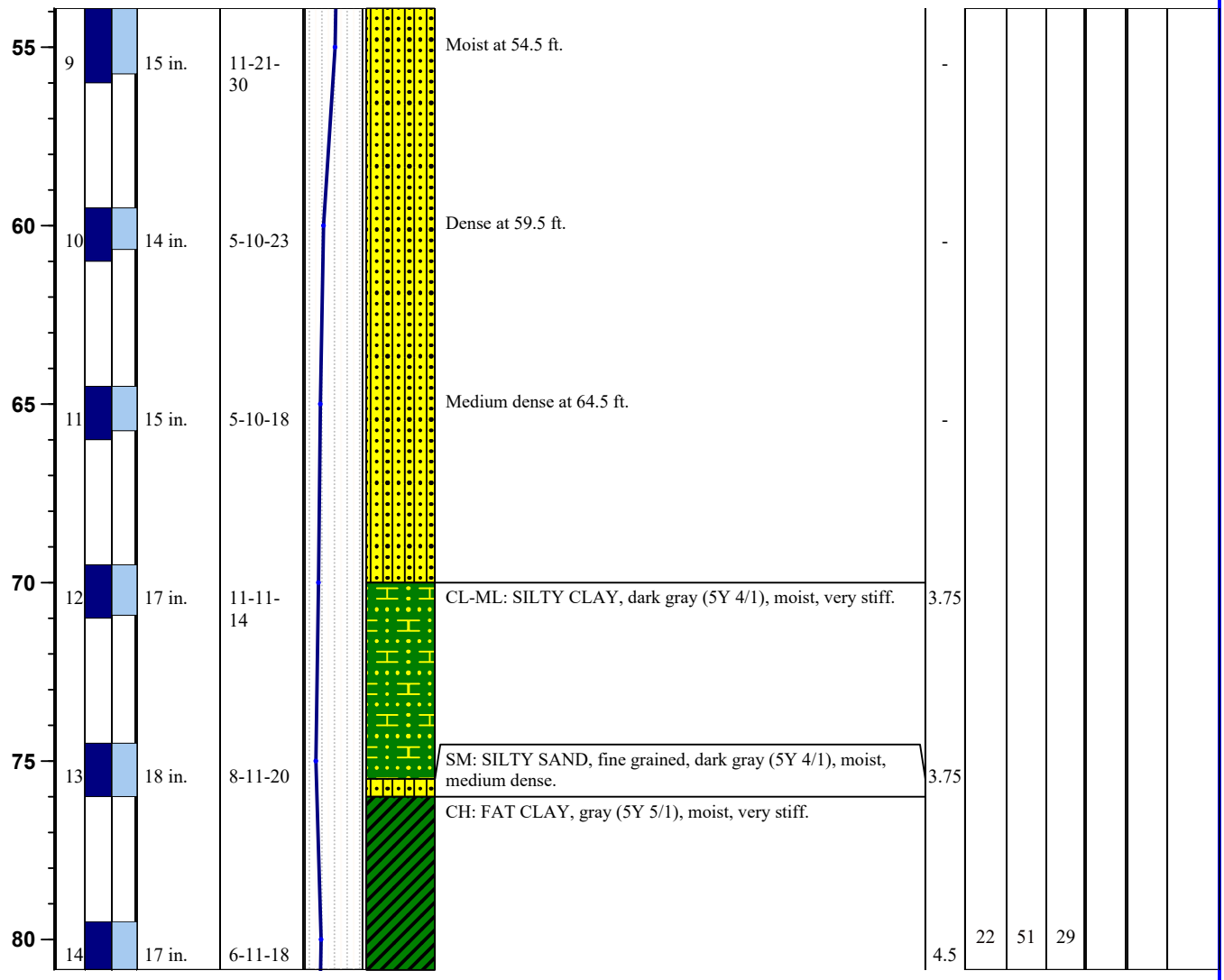
Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
55	9		15 in.	11-21-30	Moist at 54.5 ft.	-						
60	10		14 in.	5-10-23	Dense at 59.5 ft.	-						
65	11		15 in.	5-10-18	Medium dense at 64.5 ft.	-						
70	12		17 in.	11-11-14	CL-ML: SILTY CLAY, dark gray (5Y 4/1), moist, very stiff.	3.75						
75	13		18 in.	8-11-20	SM: SILTY SAND, fine grained, dark gray (5Y 4/1), moist, medium dense.	3.75						
					CH: FAT CLAY, gray (5Y 5/1), moist, very stiff.							
80	14		17 in.	6-11-18		4.5	22	51	29			



Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
85	15	18 in.	8-11-13		4.5						
90	16	18 in.	11-14-16		4.5						
95	17	18 in.	8-12-17	Color turns to dark gray (5Y 4/1) at 94.5 ft.	3.5						
100	18	18 in.	9-14-19	ML: SILT with some clay, gray (5Y 5/1), moist, dense.	3.5						
105	19	18 in.	13-18-26	SC: CLAYEY SAND, fine grained, with trace silt, dark gray (5Y 4/1), moist, dense.	1.5						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
110	20		18 in.	9-13-19	ML: SILT with trace clay, dark gray (5Y 4/1), moist, dense.	2.0	18	35	17		24.5	
115	21		14 in.	17-38-40	CL-ML: SILTY CLAY, gray (5Y 5/1), moist, hard.	4.5						
					SP: POORLY GRADED SAND, fine grained, gray (5Y 5/1), moist, very dense.							
120	22		18 in.	4-9-22	Fine to coarse grained, color turns to very dark grayish brown (2.5Y 3/2) and medium dense at 119.5 ft. Seam of lignite fragments 6 in. thick at 120.5 ft.	-						
125	23		10 in.	19-23-25	Dense at 124.5 ft.	-						
130	24		12 in.	16-24-25	With few gravel and color turns to dark olive brown (2.5Y 3/3) at 129.5 ft. and below.	-						6.4

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	25	13 in.	5-12-22	Wet at 134.5 ft. and below. Seam of lignite fragments 6 in. thick at 135.5 ft.	-						
140	26	13 in.	6-15-21		-						
145	27	18 in.	8-16-27		-						
150	28	12 in.	19-25-30	With lignite fragments and color turns to olive brown (5Y 4/2) at 149.5 ft.	-						
155	29	14 in.	23-24-28	Very dense at 154.5 ft.	-						
160	30	13 in.	29-38-38	Fine grained, color turns to gray (5Y 5/1) and very dense at 159.5 ft.	-						13.2

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
165	31	13 in.	29-31-41	With trace medium to coarse grained sand at 164.5 ft.	-						
170	32	13 in.	22-29-28		-						
175	33	12 in.	22-26-36	Fine to medium grained with trace coarse grains at 174.5 ft.	-						
180	34	8 in.	18-20-27	Medium to coarse grained with trace fine grains, color turns to olive brown (2.5Y 4/3) and dense at 179.5 ft.	-						
185	35	12 in.	22-29-37	Fine to medium grained, color turns to dark grayish brown (2.5Y 4/2) and very dense at 184.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
190	36		18 in.	22-31-29	Fine grained with trace medium grains, trace lignite fragments and color changes to dark olive gray (5Y 3/2) at 189.5 ft.	-						
195	37		9 in.	22-29-28	Fine to coarse grained with trace fine gravel and color turns to olive gray (5Y 4/2) at 194.5 ft.	-						6.7
200	38		17 in.	23-42-41	Fine to medium grained with fine grain sized lignite fragments and color turns to very dark gray (5y 3/1) at 199.5 ft. Coarse grained at 200.5 ft.	-						
205	39		10 in.	26-32-30	Fine to medium grained sand with trace fine gravel and color turns to olive (5Y 4/3) at 204.5 ft.	-						
210	40		10 in.	14-25-33	Color turns to olive gray (5Y 4/2) at 209.5 ft.	-						
215	41		14 in.	30-32-36	Fine to coarse grained with trace fine gravel and trace lignite fragments at 214.5 ft.	-						9.2

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample	Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
220	42		18 in.	16-24-30	Shale: Highly weathered, olive gray (2.5Y 4/2), moist, hard.	4.5						
225	43		18 in.	18-28-37	Color turns to dark gray (5Y 4/1) at 226 ft.	4.5					25.2	
	44		29 in.	60								
230	45		59 in.	78		8.0				102.7	23.1	
235	46		48 in.	62								
240												

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
245											
	48	58 in.	77		4.6				110.8	18.2	
250											
	49	60 in.	87								
255											
	50	58 in.	40								
260											
	51	60 in.	85								
265				Coal: Lignite, black (2.5Y 2.5/1).							
	52	56 in.	10	Highly weathered shale seam 6 in. thick at 268.5 ft.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
270											
	53	52 in.	70	Shale: Highly weathered, dark gray (5Y 4/1), moist, hard.							
275				Color turns to gray (5Y 5/1) at 275 ft.							
	54	60 in.	95								
280											
	55	60 in.	70								
				Coal: Lignite, black (5Y 2.5/1).							
285				Shale: Highly weathered, gray (5Y 5/1), moist, hard.							
	56	57 in.	95								
290											
	57	57 in.	95								
295											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-6**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/10/20 through 5/12/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/12/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 64.5 ft.), Fluid Rotary (64.5 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/12/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
300	58	59 in.	98	EOB at 300 ft. Target depth reached.	23.4				110.6	17.1	

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 02.38"

Lon: 103° 5' 10.74"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
0				SP: POORLY GRADED SAND, fine grained, with trace silt, very dark gray (2.5Y 3/1), wet, very loose.							
10	1	3 in.	0-0-1		-						
15	2	0 in.	WOH		-						
20	3	12 in.	2-1-1	Color turns to olive gray (5Y 4/2) at 19.5 ft.	-						
25	4	0 in.	WOH		-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	5	18 in.	22-14-17	Medium dense at 29.5 ft.	-						
35	6	10 in.	1-2-1	Fine to medium grained with trace coarse grains, trace fine gravel and trace lignite fragments, very loose at 34.5 ft.	-						
40	7	9 in.	2-2-3	Loose at 39.5 ft.	-						
45	8	1 in.	7-8-11	GP: POORLY GRADED GRAVEL, coarse, olive gray (5Y 4/2), wet, medium dense.	-						
50	9	11 in.	8-9-10	SP: POORLY GRADED SAND, fine to medium grained, with trace lignite fragments, olive gray (5Y 4/2), wet, medium dense.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample	Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
55	10		14 in.	13-15-12	Fine grained with thin lignite laminations, color turns to dark gray (5Y 4/1) at 54.5 ft.	3.0						
					CL: LEAN CLAY, dark gray (5Y 4/1), moist, very stiff.							
60	11		18 in.	8-10-16	SM: SILTY SAND, fine grained, with trace clay, dark gray (5Y 4/1), wet, medium dense.	-					30.3	43.2
65	12		18 in.	1-5-8	SP: POORLY GRADED SAND, fine to medium grained, dark gray (5Y 4/1), wet, medium dense.	-						
70	13		18 in.	7-10-14	CL: LEAN CLAY, dark gray (5Y 4/1), moist, very stiff.	3.5						
75	14		18 in.	8-10-13		3.75	19	35	16		21.3	
80	15		18 in.	16-20-15	Hard at 79.5 ft.	3.5						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

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PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

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ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample	Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
85	16		18 in.	8-13-15	Very stiff at 84.5 ft.	4.0						
90	17		18 in.	8-19-22	Hard at 89.5 ft. SP: POORLY GRADED SAND, fine grained, dark gray (5Y 4/1), wet, dense.	3.5						
95	18		18 in.	3-10-28	Fine to medium grained at 94.5 ft.	-					27.0	8.0
100	19		17 in.	14-15-22	With trace lignite fragments and color turns to olive gray (5Y 4/2) at 99.5 ft. CL-ML: SILTY CLAY, with trace fine grained sand, olive gray (5Y 4/2), moist, hard.	-						
105	20		18 in.	9-13-20		2.5						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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GPS Coordinates

Lat: 48° 8' 17.93"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
110	21		18 in.	10-16-19		3.5						
115	22		18 in.	10-14-18		2.75	23	36	12		24.9	
120	23		12 in.	12-20-20	SP: POORLY GRADED SAND, fine to coarse grained, trace to few fine to medium gravel, trace silt and trace lignite fragments, olive gray (5Y 4/2), wet, dense.	-						
125	24		8 in.	12-20-18		-						
130	25		10 in.	16-22-22		-					13.3	6.5

Notes:

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M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

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SOIL BORING LOG

Groundwater & Environmental Services, Inc. ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	26	11 in.	17-24-26		-						
140	27	13 in.	21-44-50/5"	Very dense at 139.5 ft.	-						
145	28	13 in.	25-31-34	Fine to medium grained with trace silt at 144.5 ft.	-					18.6	13.3
150	29	11 in.	20-35-50/4"	Fine grained with trace silt, trace lignite fragments and color changes to black (2.5Y 2.5/1) at 149.5 ft.	-						
155	30	14 in.	25-48-41	Fine grained with trace silt and color turns to olive gray (5Y 4/2) at 154.5 ft.	-						
160	31	15 in.	17-22-22	Fine to medium grained with trace silt and trace lignite fragments and dense at 159.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

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Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
165	32	16 in.	25-33-34	Fine grained with trace silt and very dense at 164.5 ft.	-					18.2	11.0
170	33	14 in.	21-32-38		-						
175	34	14 in.	19-23-36	Fine to coarse grained with trace silt and little lignite fragments at 174.5 ft.	-						
180	35	14 in.	26-30-30	Fine grained with trace silt at 179.5 ft.	-						
185	36	8 in.	30-50/6"	Fine to coarse grained with trace clay at 184.5 ft. Lignite lens 4 in. thick at 185 ft.	17.4				110.8	23.7	12.1

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

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GPS Coordinates

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
190	37		5 in.	20-25-34	Fine grained with trace silt and color changes to very dark gray (5Y 3/1) at 189.5 ft.	-						
195	38		6 in.	21-30-46		-						
200	39		14 in.	21-34-41	With trace lignite fragments at 199.5 ft.	-	23	37	14		13.1	
205	40		9 in.	49-50/6"		-						14.8
210	41		4 in.	50/4"	Shale: Highly weathered fragments, gray (2.5Y 6/1), moist, hard.	-						
215	42		0 in.	-	GP: NO RECOVERY, but drill cuttings appear to be angular	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

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Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

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Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
				fine gravel.							
220	43	8 in.	15-20-26	CH: FAT CLAY, with trace fine grained sand, gray (2.5Y 6/1), moist, hard.	4.5	17	57	40		21.6	
225	44	6 in.	18-23-27		4.5						
	45	12 in.	0	ML: SILT, with fine grained sand, non-cohesive, dark gray (5Y 4/1), moist.							
230	46	0 in.	-	NO RECOVERY, suspect same material as above.							
235	47	0 in.	-								
240											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
245	49	18 in.	0	Coal: Lignite, black (5Y 2.5/1). Trace large gravel at 245 ft.							
250	50	22 in.	32	Shale: Highly weathered, dark gray (5Y 4/1), moist, hard.	0.8				102.0	21.4	
255	51	60 in.	100	Siltstone to weathered shale with trace lignite at 255 ft.							
260	52	59 in.	93	With some siltstone layers and a lignite lens 1 in. thick at 260 ft.							
265	53	60 in.	100								

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
270											
	54	53 in.	67								
275				Lignite lens 8 in. thick at 274.5 ft.							
	55	60 in.	100		9.3				104.2	22.3	
280											
	56	48 in.	77								
285											
	57	55 in.	92								
290											
	58	60 in.	100								
295											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-7**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/14/20 through 5/15/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/15/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 35 ft.), Fluid Rotary (35 to 226 ft.), NQ Rock Core (226 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,812 ft. msl** Abandonment Method: **Tremie**

Total Depth: **315 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/15/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
300	59	60 in.	60	Coal: Lignite, black (5Y 2.5/1).	7.3				103.8	27.3	
	60	45 in.	0								
305	61	60 in.	38	Shale: Highly weathered, dark gray (5Y 4/1), moist, hard. Lignite lens 1 in. thick at 309 ft.							
310	62	60 in.	100							19.5	
315				EOB at 315 ft. Target depth reached.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 17.93"

Lon: 103° 5' 1.65"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
0				CL: LEAN CLAY, dark grayish brown (2.5Y 4/2), moist, medium stiff.							
5	1	8 in.	2-3-4		0.5						
10	2	18 in.	2-2-3		0.5						
15	3	10 in.	1-1-1	CL-ML: SILTY CLAY, olive brown (2.5Y 4/3), very moist, very soft.	0.25						
20	4	14 in.	1-1-1	ML: SILT, with trace clay, dark gray (5Y 4/1), moist, very loose.	0.25						
25	5	18 in.	1-1-1	CL-ML: SILTY CLAY, dark gray (5Y 4/1), moist, very soft.	0.25						
				ML: SILT, dark gray (5Y 4/1), moist, very loose.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

Lon: 103° 4' 53.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	6		15 in.	1-2-7	SP: POORLY GRADED SAND, fine grained, with trace silt, dark gray (5Y 4/1), wet, loose.	-						
35	7		18 in.	1-5-8	CL-ML: SILTY CLAY, very dark gray (5Y 3/1), very moist, stiff.	0.25						
40	8		11 in.	2-1-0	SM: SILTY SAND, fine grained, with trace clay, very dark gray (5Y 3/1), wet, very loose. Trace lignite fragments 1 in. thick at 40 ft.	-						
45	9		12 in.	3-5-5	SP: POORLY GRADED SAND, fine grained, with trace fine gravel, dark gray (5Y 4/1), wet, loose.	-					20.4	6.6
50	10		9 in.	7-9-6	Medium dense at 49.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
55	11	12 in.	4-6-6	Fine to medium grained with trace coarse grains at 54.5 ft.	-						
60	12	15 in.	4-9-12	Clay lens 6 in. thick at 60 ft. With thin lignite laminations at 60.5 ft.	-						
65	13	8 in.	4-7-5	SPG: POORLY GRADED SAND WITH GRAVEL, fine to medium grained with fine gravel, dark gray (5Y 4/1), wet, medium dense.	-					14.7	10.0
70	14	10 in.	3-5-5	SP: POORLY GRADED SAND, fine grained, with trace medium grains, dark gray (5Y 4/1), wet, loose.	-						
75	15	10 in.	5-9-17	Fine grained and medium dense at 74.5 ft. With a few thin lignite laminations at 75.5 ft.	-						
80	16	9 in.	15-16-18	Fine to medium grained with trace coarse grains and dense at 79.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
85	17	9 in.	11-11-13	Fine grained and medium dense at 84.5 ft.	-						
90	18	9 in.	13-12-15		-					27.7	10.1
95	19	9 in.	11-12-15		-						
100	20	10 in.	6-5-7		-						
105	21	12 in.	8-10-17	With trace lignite laminations throughout at 104.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
110	22	15 in.	23-28-37	Fine grained with trace medium grains and very dense at 109.5 ft.	-					23.7	7.0
115	23	5 in.	17-19-17	Fine to medium grained with trace coarse grains, trace fine gravel and trace lignite fragments at 114.5 ft.	-						
				GP: POORLY GRADED GRAVEL, with some fine to coarse sand, trace lignite fragments, dark gray (5Y 4/1), wet, very dense.							
120	24	12 in.	26-47-50/4"	ML: SILT, cohesive, with little fine grained sand, dark gray (5Y 4/1), wet, very dense.	0.5						
125	25	15 in.	24-47-51	SP: POORLY GRADED SAND, fine grained, with trace silt, dark gray (5Y 4/1), wet, very dense.	-						
130	26	16 in.	20-27-40		-						26.0

Notes:

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NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	27	0 in.	17-25-36		-						
140	28	18 in.	20-25-39		-						
145	29	2 in.	50/3"	Lignite lens at least 2 in. thick at 144.5 ft.	-						
150	30	18 in.	20-25-49	Shale: Highly weathered to consolidated silty clay, gray (5Y 5/1), moist, hard.	4.5	17	46	29		21.0	
155	31	18 in.	24-31-50/3"	Lignite lens 2 in. thick at 155.75 ft.	4.5						
	32	42 in.	29	Coal: Lignite, black (2.5Y 2.5/1).							
160				Shale: Highly weathered to consolidated silty clay, gray (5Y 5/1), moist, hard.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
165	33	60 in.	92		12.3				115.0	16.1	
170	34	45 in.	70								
175	35	60 in.	98	Lignite lens 1 in. thick at 174 ft.							
180	36	44 in.	63								
185	37	60 in.	93		3.5				106.9	20.1	
	38	59 in.	77	Lignite lens 6 in. thick at 188 ft.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
190				Color turns to dark gray (5Y 4/1) and lignite lens 2 in. thick at 190 ft.							
	39	56 in.	93								
195											
	40	60 in.	100								
200											
	41	55 in.	92		10.5				107.0	21.3	
205											
	42	60 in.	97								
210											
	43	59 in.	98								
215											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

Lon: 103° 4' 53.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
220	44	60 in.	100								
225	45	58 in.	97		7.7				108.9	20.3	
	46	60 in.	95								
230				Coal: Lignite, black (2.5Y 2.5/1).							
	47	60 in.	0								
235				Highly weathered shale lens 4 in. thick at 236 ft.							
	48	28 in.	7								
240				Shale: Highly weathered to consolidated silty clay, dark gray (5Y 4/1), moist, hard.							
		60 in.	85								

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

Lon: 103° 4' 53.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
245											
	50	34 in.	53		10.0				108.8	20.1	
250											
	51	27 in.	37								
255											
	52	60 in.	95								
260				Less weathered, fractured shale 1 in. thick at 260 ft.							
	53	0 in.	0								
265											
	54	60 in.	98		13.0				105.8	23.1	

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

Lon: 103° 4' 53.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
270											
	55	33 in.	38								
275											
	56	60 in.	100		23.9				107.2	20.8	
280											
	57	60 in.	100								
285											
	58	60 in.	88		6.5				106.1	24.0	
290				Coal: Lignite, black (5Y 2.5/1).							
	59	60 in.	0								
295											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

Lon: 103° 4' 53.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-8**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/13/20 through 5/14/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/14/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 75 ft.), Fluid Rotary (75 to 156 ft.), NQ Rock Core (156 to 300 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **300 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/14/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
	60	60 in.	0	EOB at 300 ft. Target depth reached.							
300											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 8' 45.61"

Lon: 103° 4' 53.93"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
0				CL-ML: SILTY CLAY, olive (5Y 4/4), very moist, very soft.							
15	1	15 in.	WOH		0						
20	2	13 in.	1-2-2	SM: SILTY SAND, fine grained with trace clay, olive gray (5Y 4/2), wet, very loose.	-						
25	3	10 in.	1-1-1	CL-ML: SILTY CLAY, with trace fine grained sand, olive gray (5Y 4/2), wet, very soft.	0						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 0.54"

Lon: 103° 4' 45.08"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
30	4	18 in.	2-2-4	SP-SC: POORLY GRADED SAND WITH CLAY, fine grained with little silt, very dark gray (5Y 3/1), wet, loose.	0						
35	5	6 in.	3-7-3	Fine to medium gravel lens 2 in. thick at 35 ft.	0						
				SM: SILTY SAND, fine to coarse grained with trace fine to medium gravel, dark olive gray (5Y 3/2), wet, medium dense.							
40	6	6 in.	4-5-7		-						
45	7	6 in.	3-3-7	SWG: WELL GRADED SAND WITH GRAVEL, fine to coarse grained with fine to medium gravel and trace silt, dark olive gray (5Y 3/2), wet, loose.	-						4.7
50	8	9 in.	11-24-18	Dense at 44.5 ft.	-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
55	9		12 in.	2-3-4	SM: SILTY SAND, fine grained, dark olive gray (5Y 3/2), wet, loose.	-						
60	10		5 in.	20-34-34	Fine to coarse grained and very dense at 59.5 ft.	-						
65	11		15 in.	6-9-10	Fine grained and medium dense at 64.5 ft.	-					29.1	29.1
70	12		12 in.	12-16-10		-						
75	13		14 in.	13-14-12		-						
80	14		12 in.	10-13-15		-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 0.54"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
85	15	12 in.	12-13-14	Fine to medium gravel lens 4 in. thick at 84.5 ft. SPG: POORLY GRADED SAND WITH GRAVEL , fine to coarse grained with fine gravel and trace silt, dark olive gray (5Y 3/2), wet, medium dense.	-						7.6
90	16	0 in.	3-4-12		-						
95	17	6 in.	8-12-12	SM: SILTY SAND, fine grained, dark olive gray (5Y 3/2), wet, medium dense.	-						
100	18	5 in.	7-7-8	Fine to coarse grained at 99.5 ft.	-						
105	19	6 in.	6-10-10	Fine grained and color turns to very dark gray (5Y 3/1) at 104.5 ft.	-						20.2

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
110	20		10 in.	7-10-10		-						
115	21		12 in.	13-13-33	Dense at 114.5 ft.	-						
120	22		14 in.	23-30-37	SP-SC: POORLY GRADED SAND WITH CLAY, fine grained with some silt, gray (2.5Y 5/1), moist, very dense.	-						
125	23		16 in.	23-30-39	SM: SILTY SAND, fine grained with trace clay, gray (2.5Y 5/1), moist, very dense.	-					23.2	21.0
130	24		15 in.	22-28-42		-						

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 0.54"

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
135	25	9 in.	32-50/3"	Lens of lignite fragments 1 in. thick at 135 ft.	-						
				Trace clay at 139.5 ft.							
140	26	12 in.	30-32-50/4"	Shale: SHALE, highly weathered to consolidated silty clay, gray (2.5Y 5/1), moist, hard.	-						
145	27	18 in.	24-28-36	Color turns to gray (5Y 6/1) at 146 ft.	4.5	17	27	10		20.5	
	28	35 in.	68								
150	29	48 in.	63	Lignite lens 1 in. thick at 152 ft.							
155				Siltstone: Gray (5Y 6/1), moist, very dense.							
	30	55 in.	80	Shale: Highly weathered to consolidated silty clay, gray (5Y 6/1), moist, hard.							
160				Lignite lens 1 in. thick at 159.5 ft.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

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SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
	31	58 in.	42	With trace lignite from 162 to 164 ft.							
165				Lignite lens 3 in. thick at 165.5 ft. Lignite lens 3 in. thick at 166 ft.							
	32	60 in.	95								
170						19	37	18			
	33	60 in.	95		12.7				108.6	20.4	
175				Lignite lens 1 in. thick at 174.5 ft.							
	34	48 in.	70								
180				Color turns to dark gray (5Y 4/1) at 180 ft.							
	35	48 in.	73								
185				Lignite lens 2 in. thick at 185 ft. Lignite lens 6 in. thick at 186 ft.							
	36	60 in.	86								

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 0.54"

Lon: 103° 4' 45.08"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD 1 100	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
190											
	37	51 in.	85		11.1				116.3	14.2	
195											
	38	60 in.	58								
200											
	39	60 in.	100								
205											
	40	48 in.	77								
210											
	41	60 in.	100		7.2				104.4	23.0	
215											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 0.54"

Lon: 103° 4' 45.08"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
220	42	56 in.	93								
225	43	60 in.	100								
				Coal: Lignite, black (5Y 2.5/1).							
230	44	60 in.	0								
235	45	30 in.	8								
				Shale: Highly weathered to consolidated silty clay, dark gray (5Y 4/1), moist, hard.							
240	46	60 in.	98		16.6				108.5	19.7	
				Coal: Lignite, black (5Y 2.5/1).							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 0.54"

Lon: 103° 4' 45.08"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	Atterbergs LL	Atterbergs PI	G	S	M/C
245				Shale: Highly weathered to consolidated silty clay, dark gray (5Y 4/1), moist, hard.							
	48	60 in.	80								
250				Siltstone lens 1 in. thick at 251 ft.							
	49	29 in.	48								
255				Silt lens 2 in. thick at 256 ft.							
	50	32 in.	28		44.3				106.3	20.2	
260				NO RECOVERY, suspect more highly weathered shale material with trace lignite seams.							
	51	0 in.	0								
265											
	52	0 in.	0		5.0				112.7	15.3	

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 0.54"

Lon: 103° 4' 45.08"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
270											
	53	0 in.	0								
275											
	54	0 in.	0								
280				Shale: Highly weathered to consolidated silty clay, with trace fine grained sand, light gray (5Y 7/1), moist, hard.							
	55	18 in.	30								
285											
	56	41 in.	55								
290				Coal: Lignite, black (5Y 2.5/1).							
	57	43 in.	0								
295											

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 0.54"

Lon: 103° 4' 45.08"

SOIL BORING LOG

Groundwater & Environmental Services, Inc.

ID NO. **WB-9**

Project: **WBI North Bakken Exp. Proj. Lake Sakakawea, ND** Client: **CCI & Associates Inc.**

Address: **NA** GES Job #: **3502056**

County: **McKenzie** GES Project Mgr: **Rob Jenson**

Logged By: **Nick Schlagel** Date Drilled: **5/15/20 through 5/16/20** Soil Classification System: **USCS**

Drilling Company: **Interstate Drilling Services** Completion Date: **5/16/20**

Drill Operator: **Jared Zak** Drilling Method: **HSA (0 to 60 ft.), Fluid Rotary (60 to 146 ft.), NQ Rock Core (146 to 310 ft.)**

Drill Rig Type: **Diedrich D50** Sampling Method: **Split Spoon & NQ Rock Core**

Borehole Diameter: **8 in. to 4 in.** Surface Elevation: **1,813 ft. msl** Abandonment Method: **Tremie**

Total Depth: **310 ft.** Approximate Water Depth: **Not Encountered** Backfill Material: **Portland Cement**

Refusal Depth: **NA** Abandonment Completion Date: **5/16/20**

Depth (feet)	Sample Interval	Recovery (inches)	Blows / RQD (1 100)	Geologic Description	Qp /Qu	Atterbergs PL	LL	PI	G	S	M/C
300	58	60 in.	15	Shale: Highly weathered to consolidated silty clay, dark gray (5Y 4/1), moist, hard.							
				Coal: Lignite with few shale lenses, black (5Y 2.5/1).							
				Shale: Highly weathered to consolidated silty clay, dark gray (5Y 4/1), moist, hard.							
	59	60 in.	25	Coal: Lignite, black (5Y 2.5/1).							
305				Shale: Highly weathered to consolidated silty clay, dark gray (5Y 4/1), moist, hard.							
	60	55 in.	65	Lignite lens 1 in. thick at 308.25 ft.	15.2				117.6	14.2	
310				Sand with clay lens 9 in. thick at 309 ft.							

Notes:

Soil Lithologies based on field observations and laboratory analysis.

NA = not applicable; fbg. = feet below grade; in. = inches; ft. = feet; msl = mean sea level

Qp/Qu = unconfined compressive strength (tons / square foot); G = Gravel Content (%)

PL = Plastic Limit (%); LL = Liquid Limit (%); PI = Plasticity Index (%); S = Sand Content (%)

M/C = Silt or Clay Content (%); Blows = blows per 6 inches; RQD = rock quality index (%)

GPS Coordinates

Lat: 48° 9' 0.54"

Lon: 103° 4' 45.08"

Appendix D – Laboratory Reports

Project: **WBI N Bakken Expansion** Job Number: **G20-045** Sheet **1** of **4**

Manager: _____ Client: _____ Project Description: _____

Location: **Missouri River HDD Crossing** _____

_____ _____

Elevation Datum: _____

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
WB4 44.5				5.4									
WB4 59.5	40.3	18.3	22.0				19.4						
WB4 69.5				97.2									
WB4 79.5	31.3	18.7	12.0				19.1						
WB4 87.5							22.1						
WB4 132.5							15.2						
WB4 147.5							15.6						
WB4 182.5							19.1						
WB4 237.5							15.2						
WB4 247.5							19.1						
WB4 262.5							18.6						
WB4 287.5	103.4	31.1	72.0				20.0						
WB4 297.5							21.1						
WB5 44.0				7.7									
WB5 64.0	46.8	22.2	25.0				28.0						
WB5 109.5				46.6									
WB5 149.5	35.5	16.1	19.0				18.1						
WB5 180.0							16.6						
WB5 200.0							14.2						

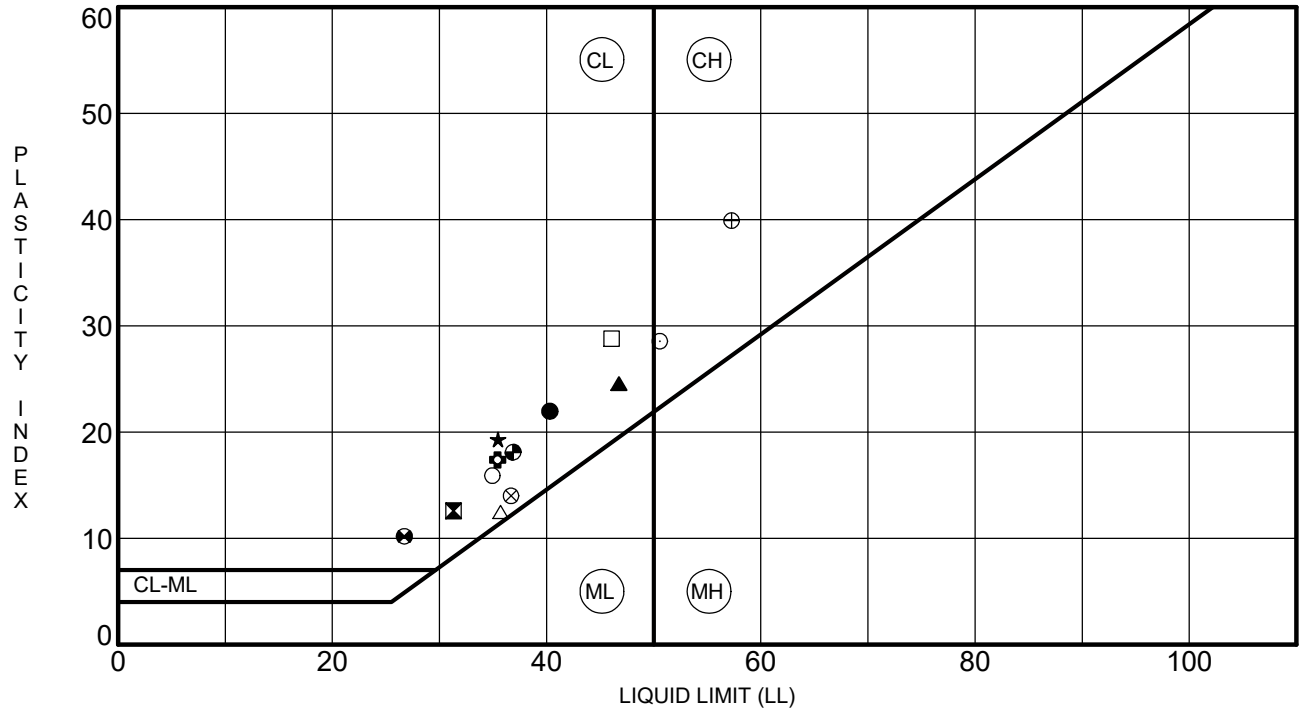
Material Testing Services, LLC	**Summary of Material Properties**	June 30, 2020

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
WB5 220.0							19.2						
WB5 245.0	90.5	26.3	65.0				17.0						
WB5 265.0							20.5						
WB5 275.0	149.2	22.3	127.0				20.2						
WB5 295.0							21.6						
WB6 49.5				10.0									
WB6 79.5	50.6	22.0	29.0										
WB6 109.5	35.4	18.0	17.0				24.5						
WB6 129.5				6.4									
WB6 159.5				13.2									
WB6 194.5				6.7									
WB6 214.5				9.2									
WB6 224.5	127.4	20.0	107.0				25.2						
WB6 230.0							23.1						
WB6 245.0							18.2						
WB6 275.0	162.4	20.6	141.0										
WB6 295.0							17.1						
WB7 59.5				43.2			30.3						
WB7 74.5	34.9	19.0	16.0				21.3						
WB7 94.5				8.0			27.0						
WB7 114.5	35.7	23.2	13.0				24.9						
WB7 129.5				6.5			13.3						

Borehole Depth / Elev.	Specimen Description LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
WB7 144.5				13.3			18.6						
WB7 164.5				11.0			18.2						
WB7 184.5				12.1			23.7						
WB7 202.5	36.7	22.7	14.0				13.1						
WB7 204.5				14.8									
WB7 219.5	57.3	17.3	40.0				21.6						
WB7 250.0							21.4						
WB7 275.0	203.2	23.7	179.0				22.3						
WB7 295.0							27.3						
WB7 310.0							19.5						
WB8 44.5				6.6			20.4						
WB8 64.5				10.0			14.7						
WB8 89.5				10.1			27.7						
WB8 109.5				6.9			23.7						
WB8 129.5				26.0									
WB8 149.5	46.1	17.3	29.0				21.0						
WB8 160.0							16.1						
WB8 180.0							20.1						
WB8 200.0							21.3						
WB8 220.0							20.3						
WB8 245.0							20.1						
WB8 265.0							23.1						

Project: **WBI N Bakken Expansion** Job Number: **G20-045** Sheet **4** of **4**

Borehole Depth / Elev.	Specimen Description	LL	PL	PI	Fines	Bulk Density	Dry Density	Water Content	Layer Code	Sample Data Top	Bottom	Type	Rec	'N'
WB8 275.0		169.4	22.6	146.0				20.8						
WB8 280.0								24.0						
WB9 44.5	WELL-GRADED SAND with GRAVEL				4.7									
WB9 64.5					29.2			29.1						
WB9 84.5					7.6									
WB9 104.5					20.2									
WB9 124.5					21.0			23.2						
WB9 144.5		26.7	16.5	10.0				20.5						
WB9 170.0		36.9	18.8	18.0				13.3						
WB9 190.0								20.4						
WB9 205.0								23.0						
WB9 235.0								19.7						
WB9 245.0		158.1	22.5	136.0				20.2						
WB9 255.0								15.3						
WB9 305.0								14.2						



Specimen Identification			LL	PL	PI	Fines	Classification
●	**WB4**	**59.5**	**40**	**18**	**22**		
⊠	**WB4**	**79.5**	**31**	**19**	**13**		
▲	**WB5**	**64.0**	**47**	**22**	**25**		
★	**WB5**	**149.5**	**35**	**16**	**19**		
⊙	**WB6**	**79.5**	**51**	**22**	**29**		
✿	**WB6**	**109.5**	**35**	**18**	**17**		
○	**WB7**	**74.5**	**35**	**19**	**16**		
△	**WB7**	**114.5**	**36**	**23**	**12**		
⊗	**WB7**	**202.5**	**37**	**23**	**14**		
⊕	**WB7**	**219.5**	**57**	**17**	**40**		
□	**WB8**	**149.5**	**46**	**17**	**29**		
⊛	**WB9**	**144.5**	**27**	**17**	**10**		
◕	**WB9**	**170.0**	**37**	**19**	**18**		

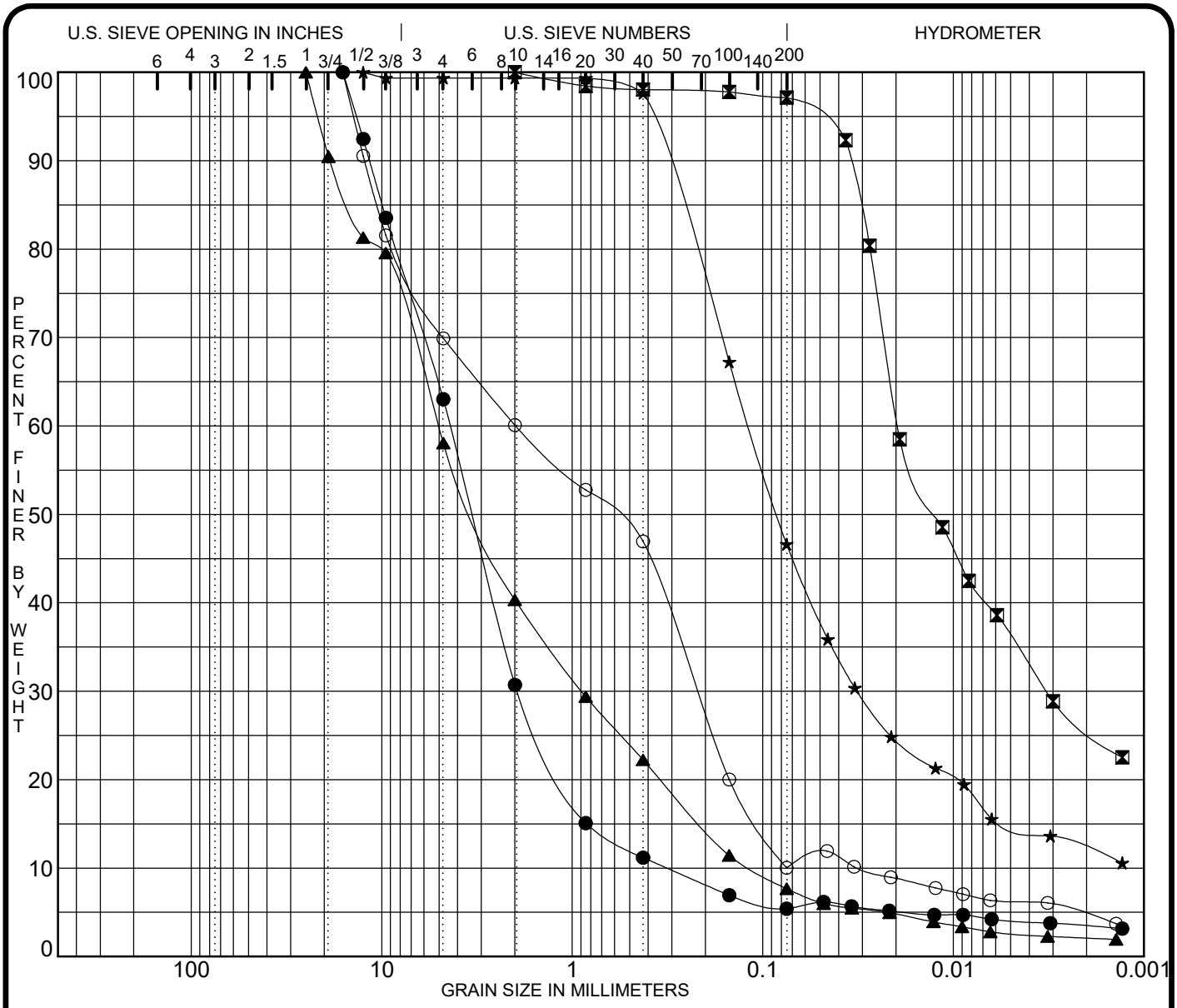
PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G20-045**

DATE **6/15/20**

ATTERBERG LIMITS' RESULTS

Material Testing Services, LLC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Classification	MC%	LL	PL	PI	Cc	Cu
●	**WB4**	**44.5**						**2.65**	**13.8**
⊠	**WB4**	**69.5**							
▲	**WB5**	**44.0**						**1.36**	**43.8**
★	**WB5**	**109.5**							
⊙	**WB6**	**49.5**						**0.34**	**27.3**

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**WB4**	**44.5**	**16.00**	**4.38**	**1.923**	**0.3184**	**37.0**	**57.6**	**1.3**	**4.1**
⊠	**WB4**	**69.5**	**2.00**	**0.02**	**0.003**		**0.0**	**2.8**	**60.9**	**36.2**
▲	**WB5**	**44.0**	**25.00**	**5.06**	**0.892**	**0.1154**	**41.9**	**50.4**	**5.1**	**2.6**
★	**WB5**	**109.5**	**12.50**	**0.12**	**0.032**		**0.6**	**52.7**	**31.7**	**14.9**
⊙	**WB6**	**49.5**	**16.00**	**1.98**	**0.221**	**0.0724**	**30.1**	**59.9**	**3.8**	**6.2**

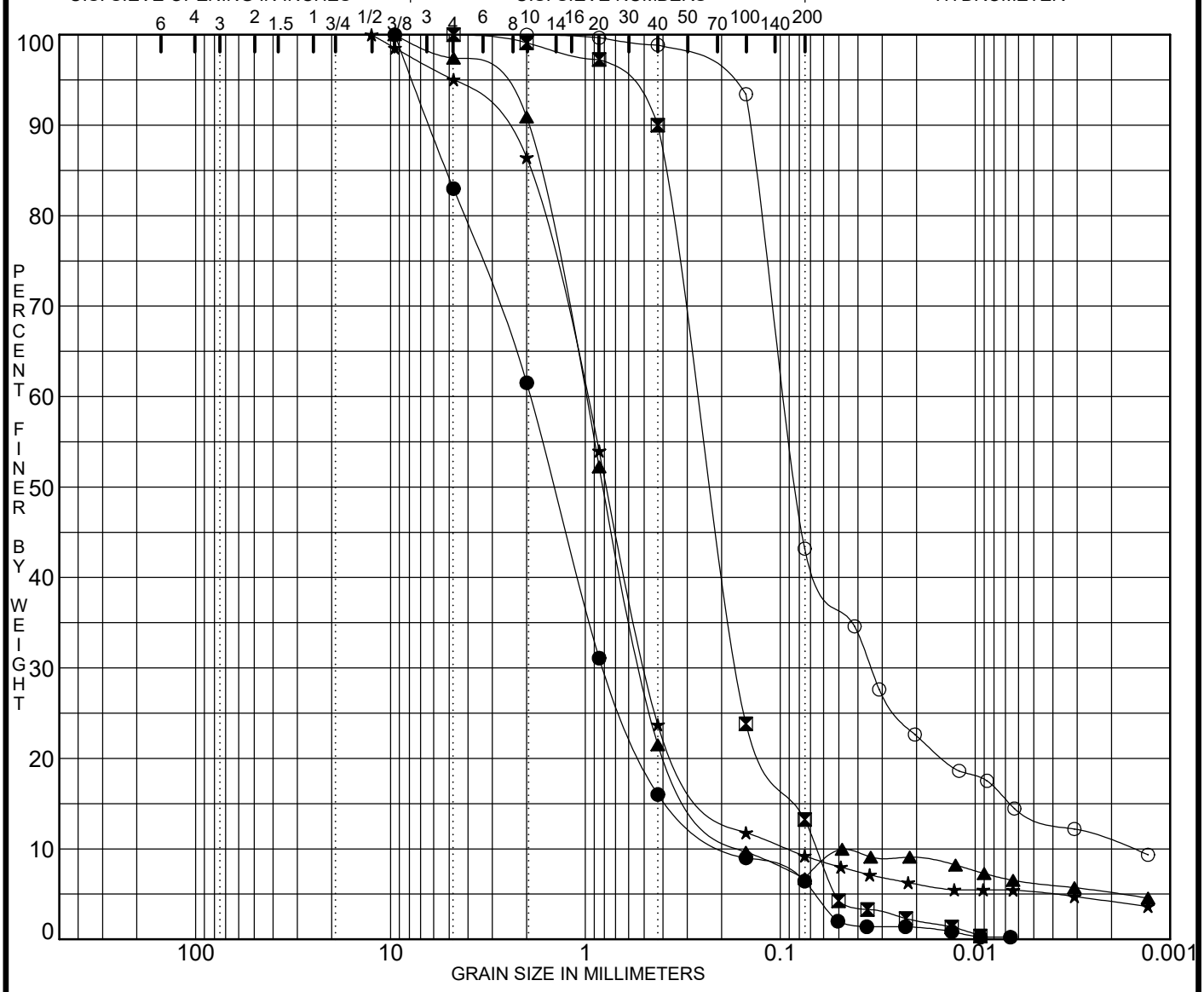
PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G20-045**

DATE **6/29/20**

PARTICLE SIZE ANALYSIS

Material Testing Services, LLC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Classification	MC%	LL	PL	PI	Cc	Cu
●	**WB6**	**129.5**						**1.96**	**11.0**
⊠	**WB6**	**159.5**						**1.59**	**4.1**
▲	**WB6**	**194.5**						**5.41**	**20.8**
★	**WB6**	**214.5**						**2.61**	**10.7**
⊙	**WB7**	**59.5**		**30**				**7.85**	**59.5**

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**WB6**	**129.5**	**9.50**	**1.92**	**0.809**	**0.1740**	**17.0**	**76.6**		
⊠	**WB6**	**159.5**	**4.75**	**0.27**	**0.165**	**0.0649**	**0.0**	**86.8**		
▲	**WB6**	**194.5**	**9.50**	**1.01**	**0.515**	**0.0486**	**2.6**	**90.7**	**0.5**	**6.2**
★	**WB6**	**214.5**	**12.50**	**1.00**	**0.491**	**0.0927**	**5.0**	**85.8**	**4.0**	**5.2**
⊙	**WB7**	**59.5**	**2.00**	**0.09**	**0.034**	**0.0016**	**0.0**	**56.8**	**29.5**	**13.7**

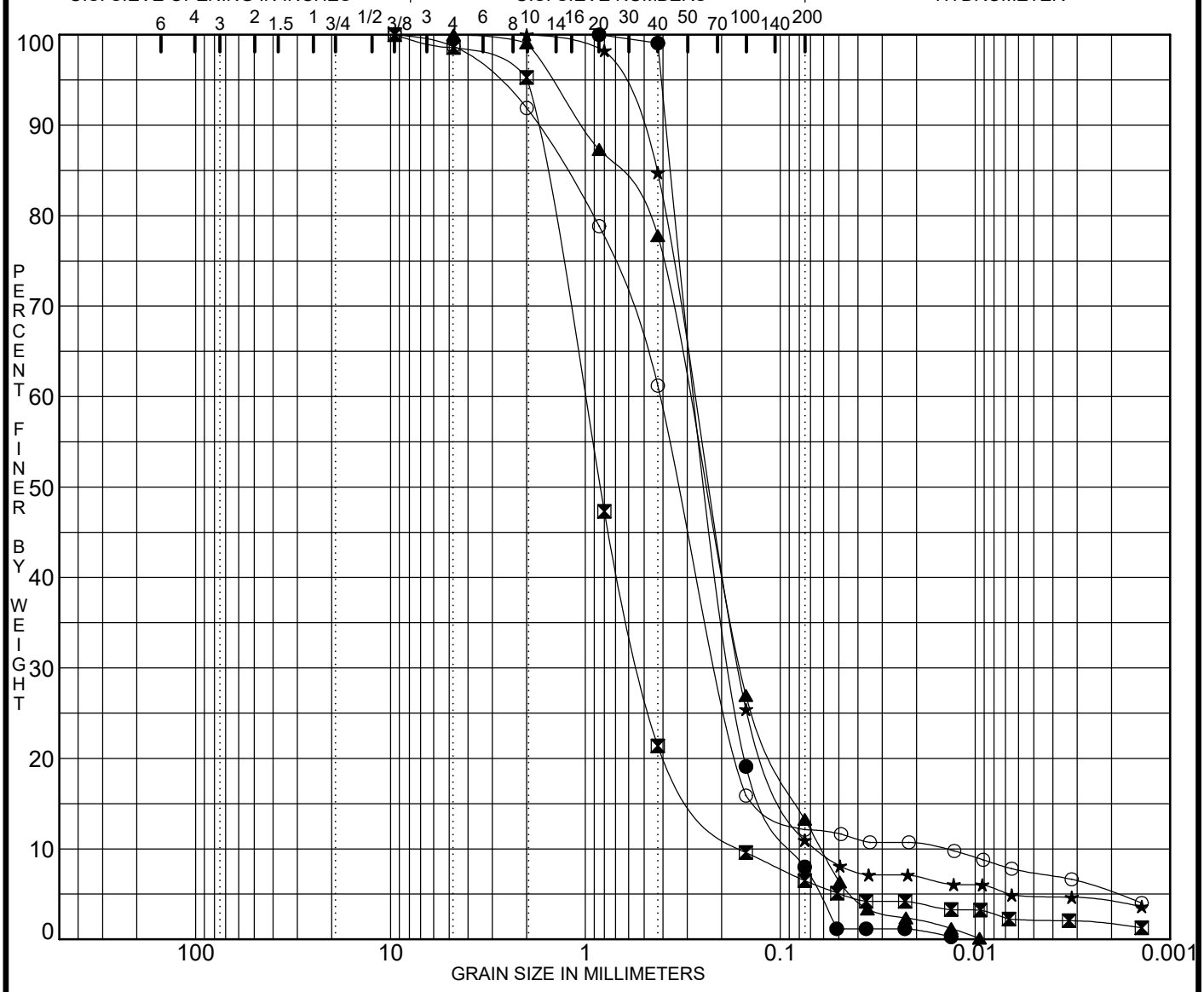
PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G20-045**

DATE **6/29/20**

PARTICLE SIZE ANALYSIS

Material Testing Services, LLC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Classification	MC%	LL	PL	PI	Cc	Cu
●	**WB7**	**94.5**		**27**				**1.38**	**3.0**
⊠	**WB7**	**129.5**		**13**				**1.73**	**6.5**
▲	**WB7**	**144.5**		**19**				**1.40**	**4.8**
★	**WB7**	**164.5**		**18**				**1.47**	**4.2**
⊙	**WB7**	**184.5**		**24**				**7.14**	**28.3**

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**WB7**	**94.5**	**0.85**	**0.26**	**0.173**	**0.0850**	**0.0**	**92.0**		
⊠	**WB7**	**129.5**	**9.50**	**1.02**	**0.524**	**0.1556**	**1.4**	**92.1**	**4.3**	**2.2**
▲	**WB7**	**144.5**	**4.75**	**0.30**	**0.160**	**0.0617**	**0.0**	**86.7**		
★	**WB7**	**164.5**	**2.00**	**0.28**	**0.163**	**0.0652**	**0.0**	**89.0**	**6.2**	**4.8**
⊙	**WB7**	**184.5**	**9.50**	**0.41**	**0.207**	**0.0146**	**1.3**	**86.6**	**4.7**	**7.4**

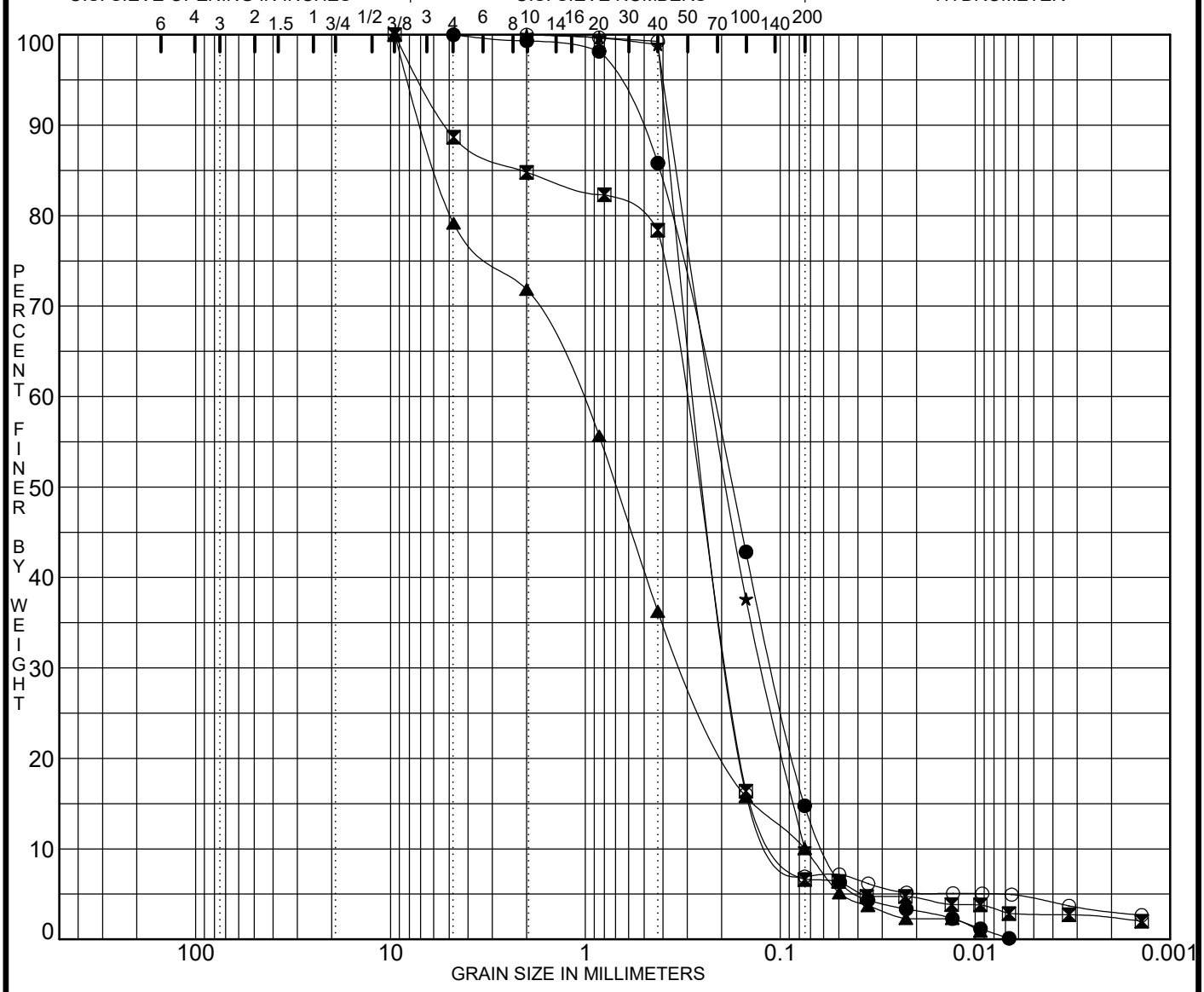
PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G20-045**

DATE **6/29/20**

PARTICLE SIZE ANALYSIS

Material Testing Services, LLC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Classification	MC%	LL	PL	PI	Cc	Cu
●	**WB7**	**204.5**						**0.88**	**3.8**
⊠	**WB8**	**44.5**		**20**				**1.19**	**3.3**
▲	**WB8**	**64.5**		**15**				**1.19**	**14.3**
★	**WB8**	**89.5**		**28**				**0.93**	**2.9**
⊙	**WB8**	**109.5**		**24**				**1.73**	**3.7**

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**WB7**	**204.5**	**4.75**	**0.23**	**0.109**	**0.0594**	**0.0**	**85.2**		
⊠	**WB8**	**44.5**	**9.50**	**0.31**	**0.189**	**0.0954**	**11.3**	**82.1**	**3.8**	**2.8**
▲	**WB8**	**64.5**	**9.50**	**1.07**	**0.309**	**0.0750**	**20.8**	**69.2**		
★	**WB8**	**89.5**	**2.00**	**0.22**	**0.124**		**0.0**	**89.9**	**10.1**	
⊙	**WB8**	**109.5**	**2.00**	**0.26**	**0.179**	**0.0709**	**0.0**	**93.1**	**2.5**	**4.5**

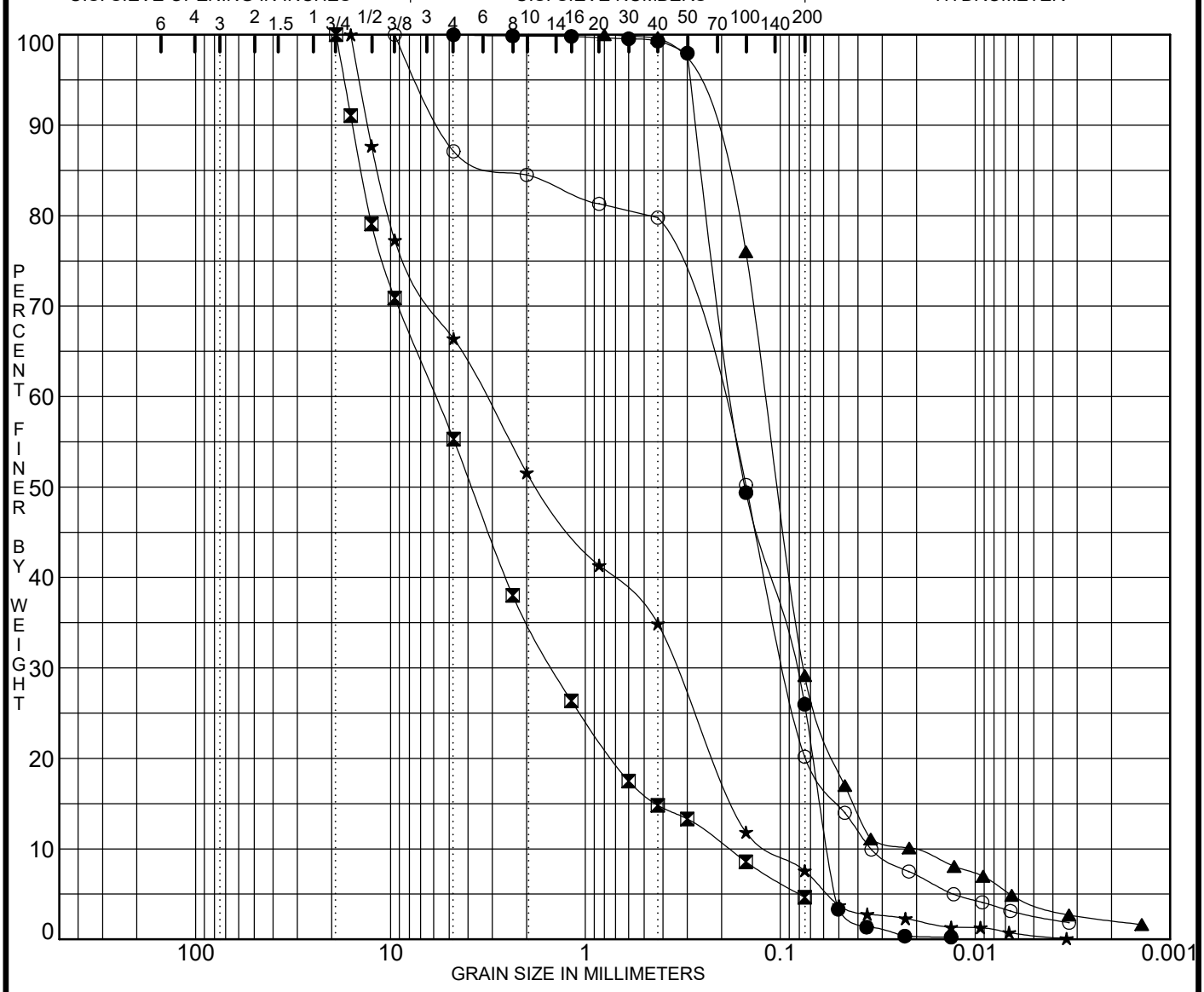
PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

JOB NO. **G20-045**

DATE **6/29/20**

PARTICLE SIZE ANALYSIS

Material Testing Services, LLC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Classification	MC%	LL	PL	PI	Cc	Cu
●	**WB8**	**129.5**						**0.72**	**3.1**
⊠	**WB9**	**44.5**	**WELL-GRADED SAND with GRAVEL SW**					**1.98**	**31.7**
▲	**WB9**	**64.5**		**29**				**2.29**	**5.6**
★	**WB9**	**84.5**						**0.32**	**29.4**
⊙	**WB9**	**104.5**						**1.22**	**6.2**

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**WB8**	**129.5**	**4.75**	**0.17**	**0.084**	**0.0567**	**0.0**	**74.0**		
⊠	**WB9**	**44.5**	**19.00**	**5.86**	**1.465**	**0.1848**	**44.7**	**50.6**	**4.7**	
▲	**WB9**	**64.5**	**0.80**	**0.12**	**0.076**	**0.0213**	**0.0**	**70.8**	**25.1**	**4.0**
★	**WB9**	**84.5**	**16.00**	**3.27**	**0.341**	**0.1112**	**33.6**	**58.8**	**7.1**	**0.5**
⊙	**WB9**	**104.5**	**9.50**	**0.21**	**0.094**	**0.0343**	**12.9**	**66.9**	**17.6**	**2.6**

PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

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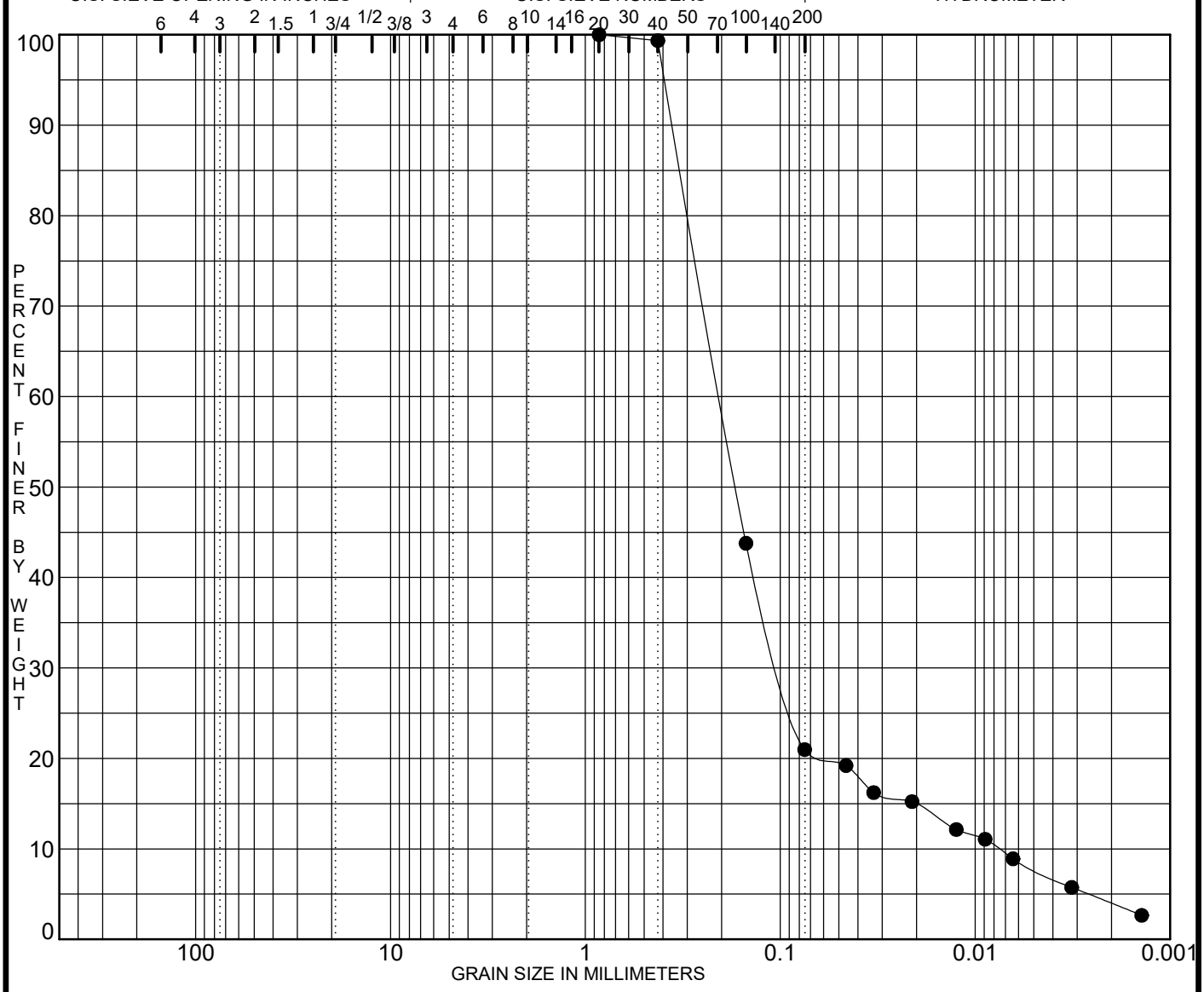
DATE **6/29/20**

PARTICLE SIZE ANALYSIS

Material Testing Services, LLC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Classification	MC%	LL	PL	PI	Cc	Cu
●	**WB9**	**124.5**		**23**				**6.33**	**26.9**

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**WB9**	**124.5**	**0.85**	**0.20**	**0.099**	**0.0076**	**0.0**	**79.0**	**13.2**	**7.8**

PROJECT **WBI N Bakken Expansion, Missouri River HDD Crossing**

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PARTICLE SIZE ANALYSIS

Material Testing Services, LLC

MATERIAL TESTING SERVICES, LLC

P.O. Box 634
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Williston, ND 58802
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UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

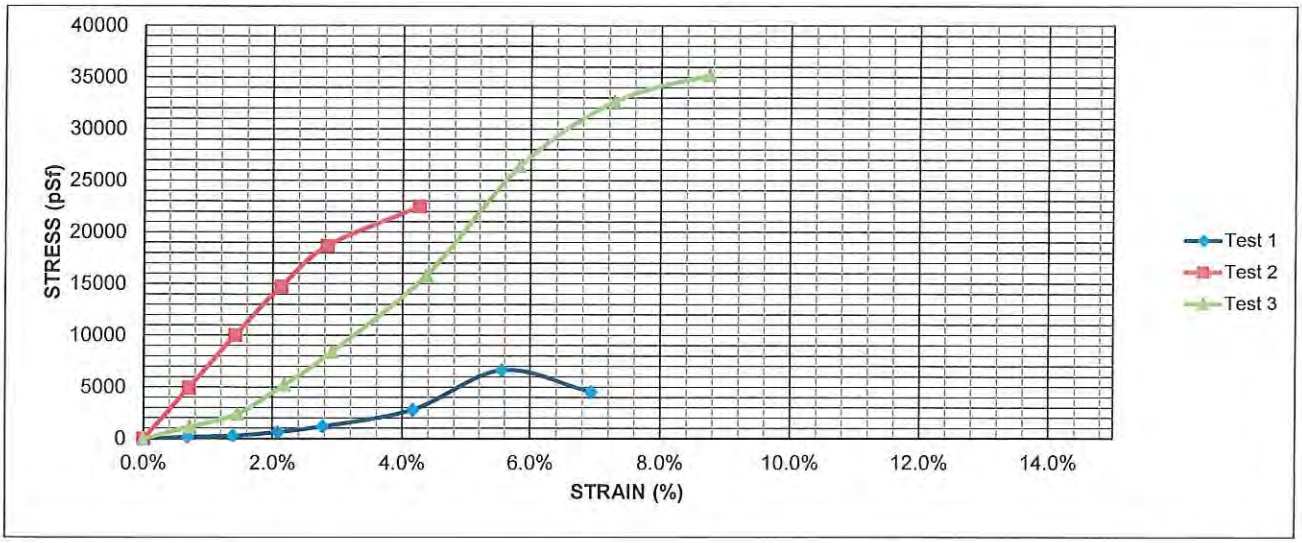
DATE: 4-Jun-20

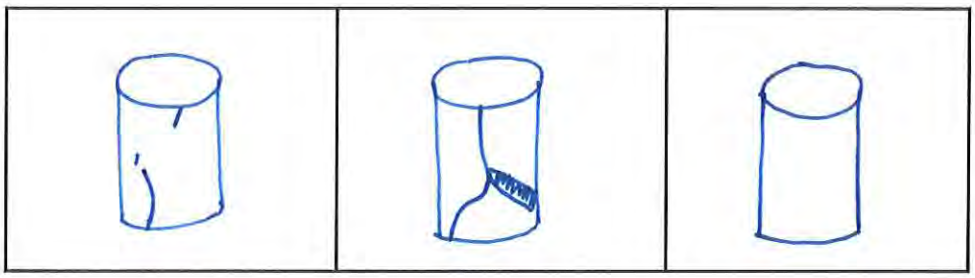
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 1	Test 2	Test 3
	WB-4 RC - 87.5-92.5 feet	WB-4 RC - 127.5-132.5 feet	WB-4 RC - 147.5-152.5 feet
Soil Class:			
Dry Density (pcf):	108.6	113.7	118.9
Water Content:	22.1%	15.2%	15.5%
Sample Dia. (mm):	45.1	44.8	44.4
Sample Ht (mm):	91.5	89.4	87.2
Height/Diameter:	2.03	2.00	1.96
Unc. Strength (psf):	**6646**	**22535**	**35246**
Strain at Failure (%):	5.6	4.3	7.3





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UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

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MISSOURI RIVER HDD CROSSING

DATE: 4-Jun-20

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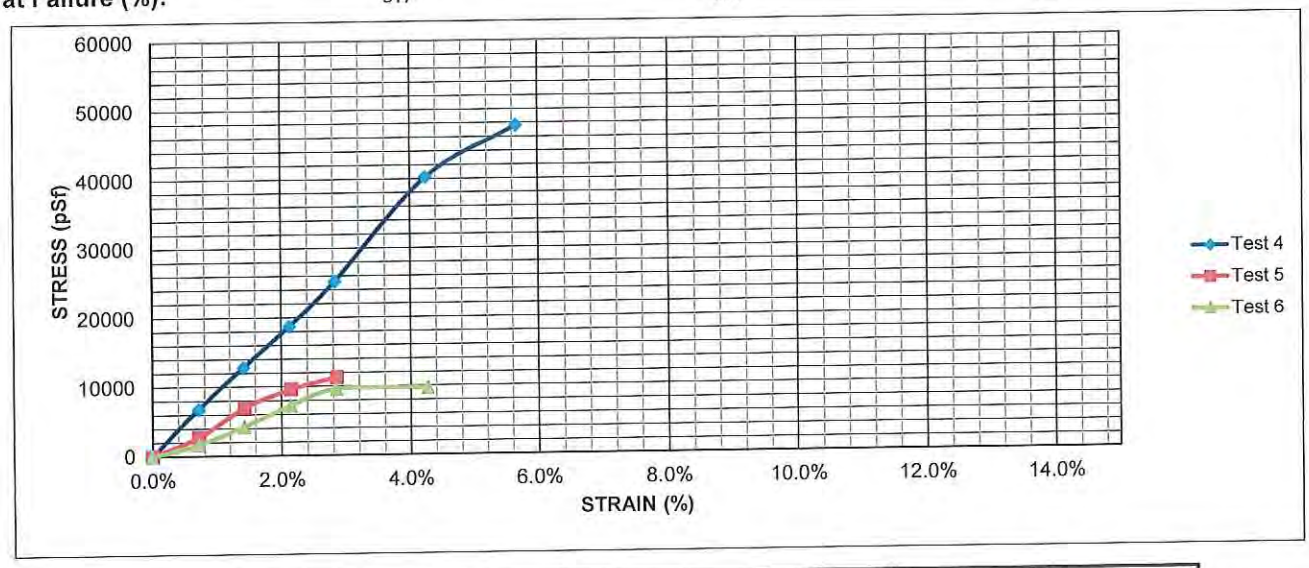
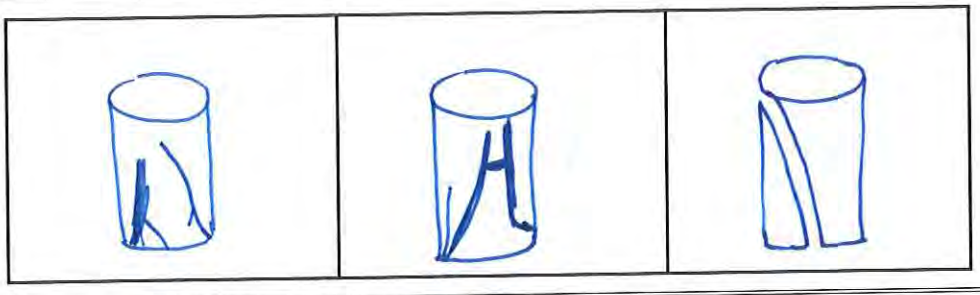
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 4 WB-4 RC - 182.5-187.5 feet	Test 5 WB-4 RC - 237.5-242.5 feet	Test 6 WB-4 RC - 247.5-252.5 feet
Soil Class:			
Dry Density (pcf):	115.1	113.9	107.5
Water Content:	19.1%	15.2%	19.1%
Sample Dia. (mm):	44.6	45.3	45.7
Sample Ht (mm):	89.7	88.9	89.2
Height/Diameter:	2.01	1.96	1.95
Unc. Strength (psf):	**47624**	**11336**	**9726**
Strain at Failure (%):	5.7	2.9	4.3





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UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

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MISSOURI RIVER HDD CROSSING

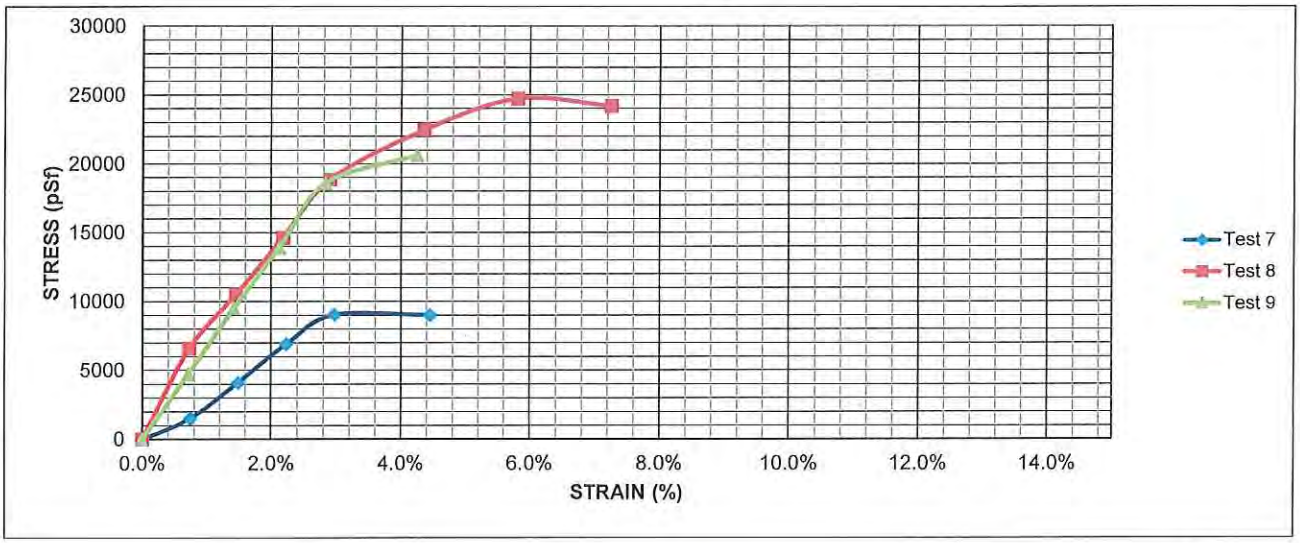
DATE: 4-Jun-20

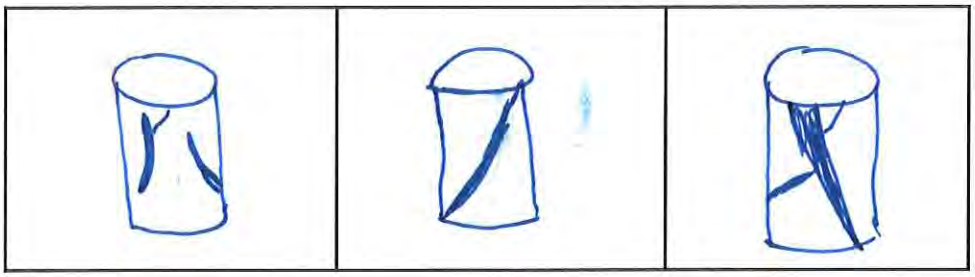
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 7	Test 8	Test 9
	WB-4 RC - 262.5-272.5 feet	WB-4 RC - 287.5-292.5 feet	WB-4 RC - 297.5-300 feet
Soil Class:			
Dry Density (pcf):	109.4	107.6	105.9
Water Content:	18.6%	20.0%	21.1%
Sample Dia. (mm):	45.7	44.4	44.6
Sample Ht (mm):	85.5	87.4	89.7
Height/Diameter:	1.87	1.97	2.01
Unc. Strength (psf):	**9054**	**24774**	**22188**
Strain at Failure (%):	3.0	5.8	4.2





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UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

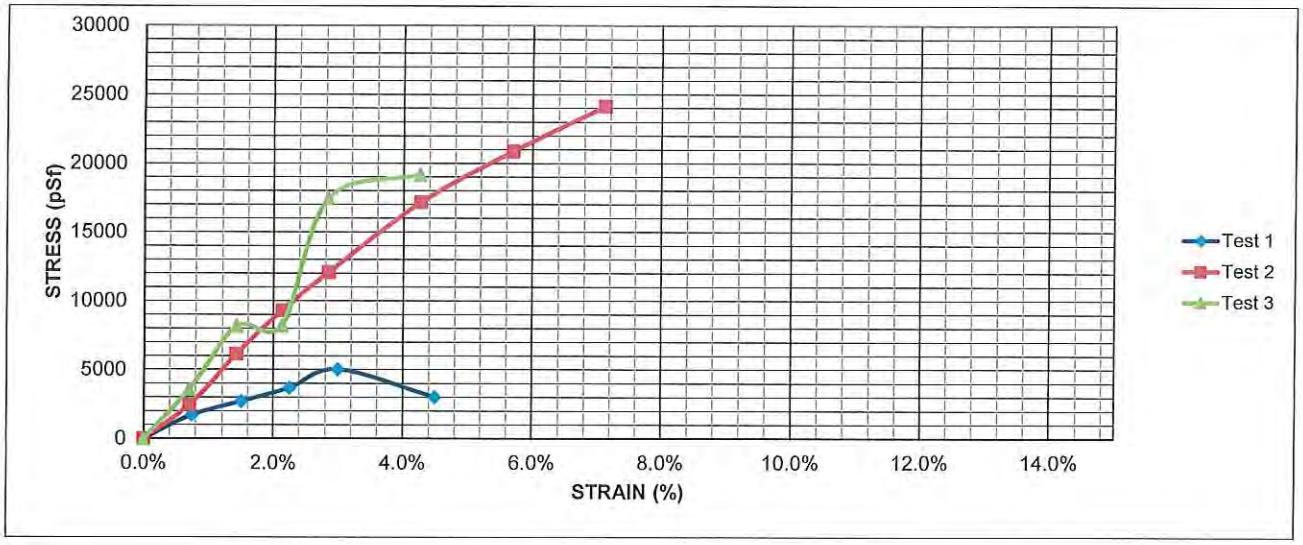
DATE: 5-Jun-20

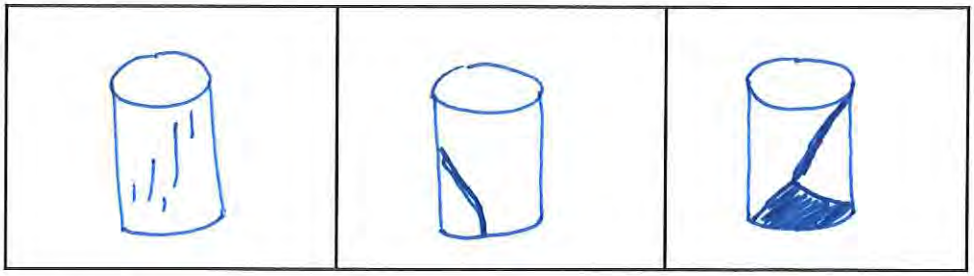
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 1	Test 2	Test 3
	WB-5	WB-5	WB-5
	RC - 160-165 feet	RC - 180-185 feet	RC - 200-205 feet
Soil Class:			
Dry Density (pcf):	108.2	117.5	116.3
Water Content:	66.2%	16.6%	14.2%
Sample Dia. (mm):	42.9	44.2	44.6
Sample Ht (mm):	84.8	89.2	89.5
Height/Diameter:	1.98	2.02	2.01
Unc. Strength (psf):	**5047**	**24258**	**19234**
Strain at Failure (%):	3.0	7.1	4.3





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UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

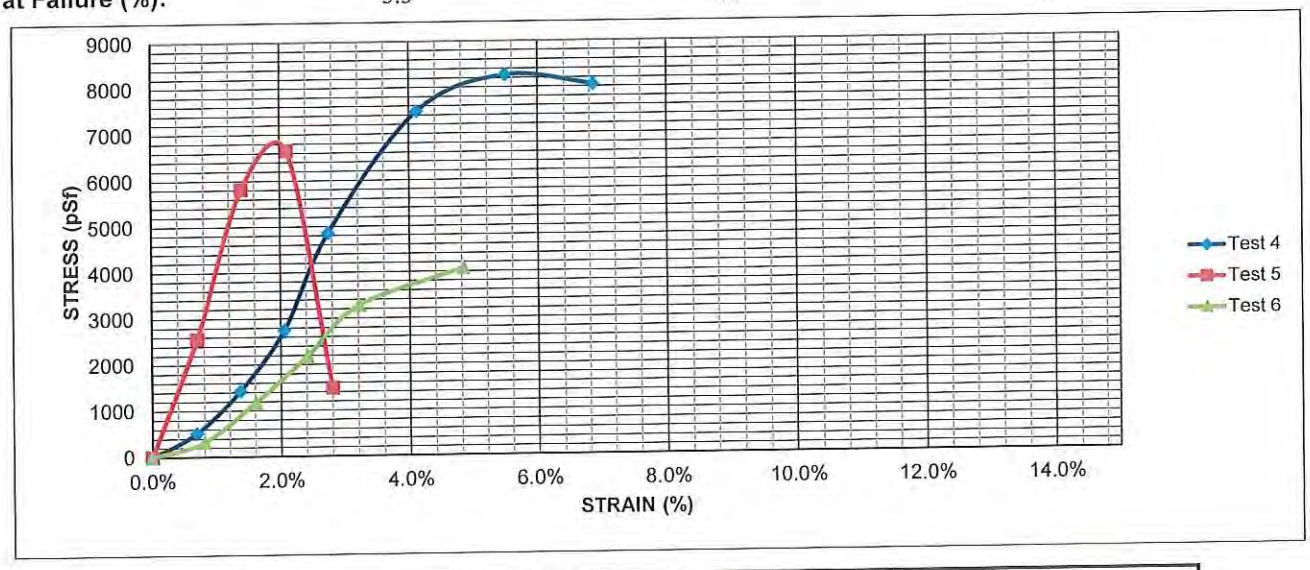
DATE: 5-Jun-20

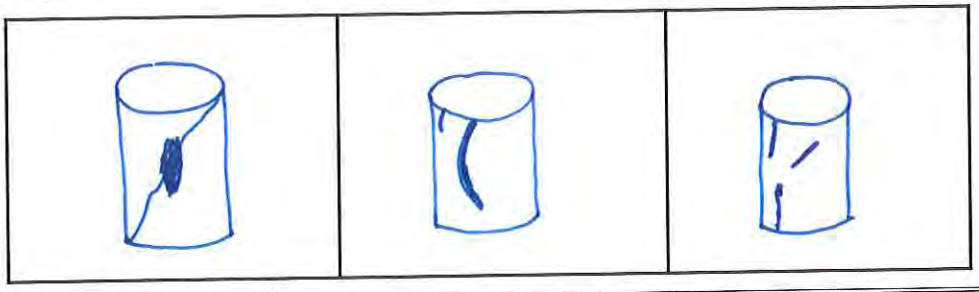
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 4 WB-5 RC - 220-225 feet	Test 5 WB-5 RC - 245-250 feet	Test 6 WB-5 RC - 265-270 feet
Soil Class:			
Dry Density (pcf):	105.8	107.9	108.8
Water Content:	19.2%	17.0%	20.5%
Sample Dia. (mm):	46.0	45.7	44.9
Sample Ht (mm):	92.5	90.5	78.9
Height/Diameter:	2.01	1.98	1.75
Unc. Strength (psf):	**8272**	**6658**	**4075**
Strain at Failure (%):	5.5	2.1	4.8





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UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

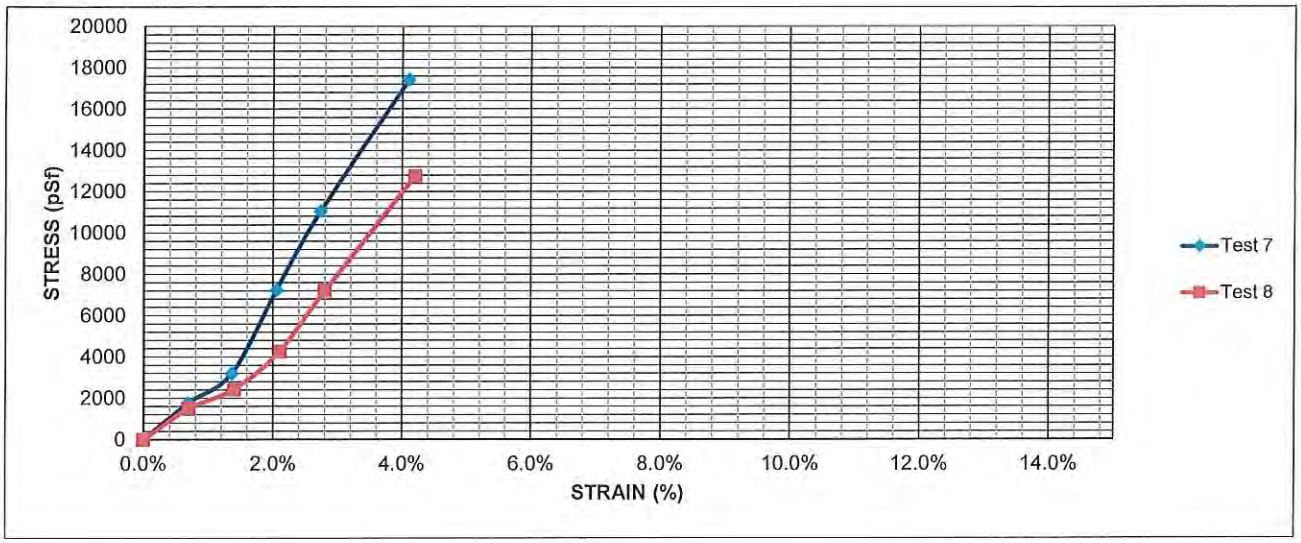
DATE: 7-Jun-20

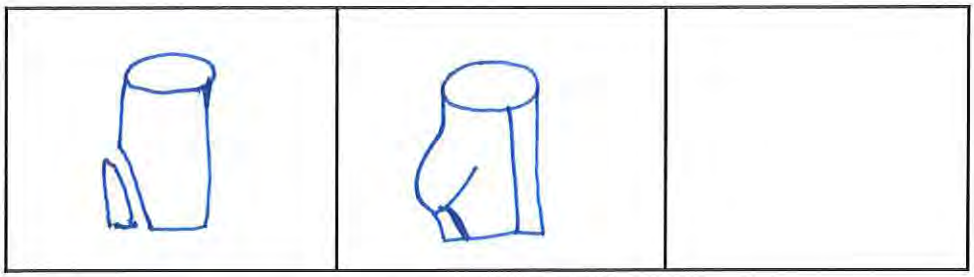
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 7	Test 8
	WB-5	WB-5
	RC - 275-280 feet	RC - 295-300 feet
Soil Class:		
Dry Density (pcf):	106.5	106.7
Water Content:	20.2%	21.6%
Sample Dia. (mm):	44.6	45.7
Sample Ht (mm):	92.9	90.7
Height/Diameter:	2.08	1.98
Unc. Strength (psf):	**17425**	**12763**
Strain at Failure (%):	4.1	4.2





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UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

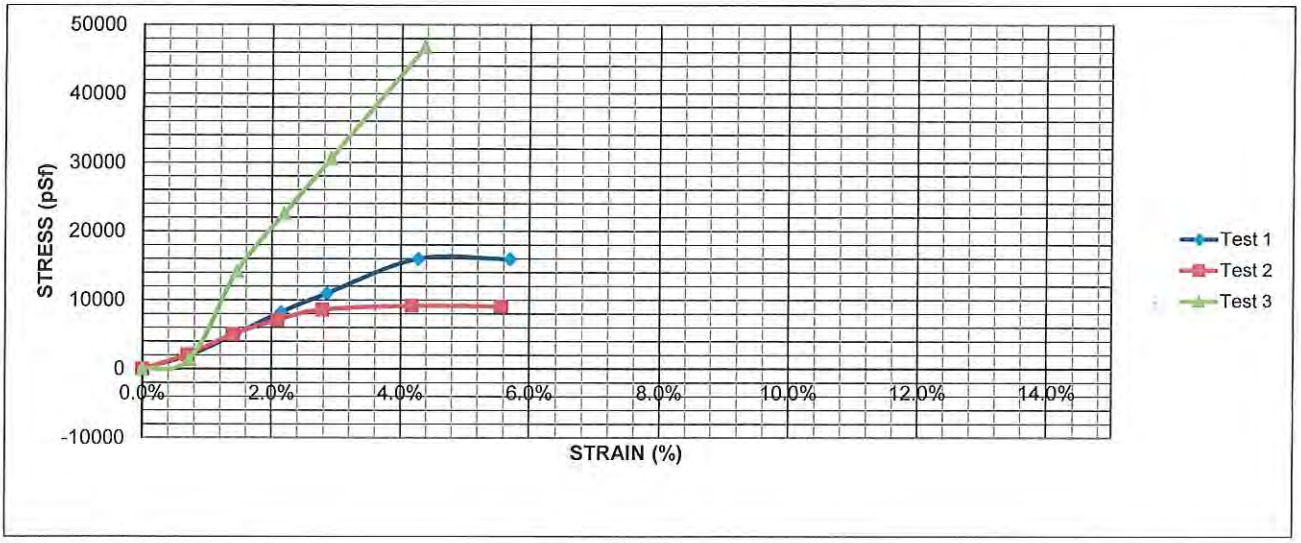
DATE: 10-Jun-20

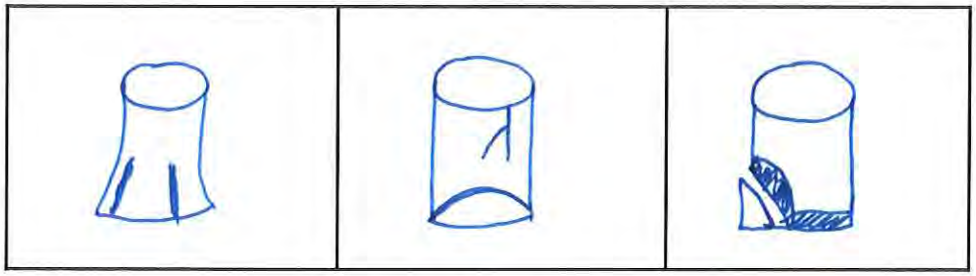
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 1	Test 2	Test 3
	WB-6 RC - 230-2355 feet	WB-6 RC - 245-250 feet	WB-6 RC - 295-300 feet
Soil Class:			
Dry Density (pcf):	102.7	110.8	110.6
Water Content:	23.1%	18.2%	17.1%
Sample Dia. (mm):	44.7	45.2	44.8
Sample Ht (mm):	89.2	91.4	87.3
Height/Diameter:	2.00	2.02	1.95
Unc. Strength (psf):	**16058**	**9230**	**46813**
Strain at Failure (%):	3.0	4.2	4.4





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UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

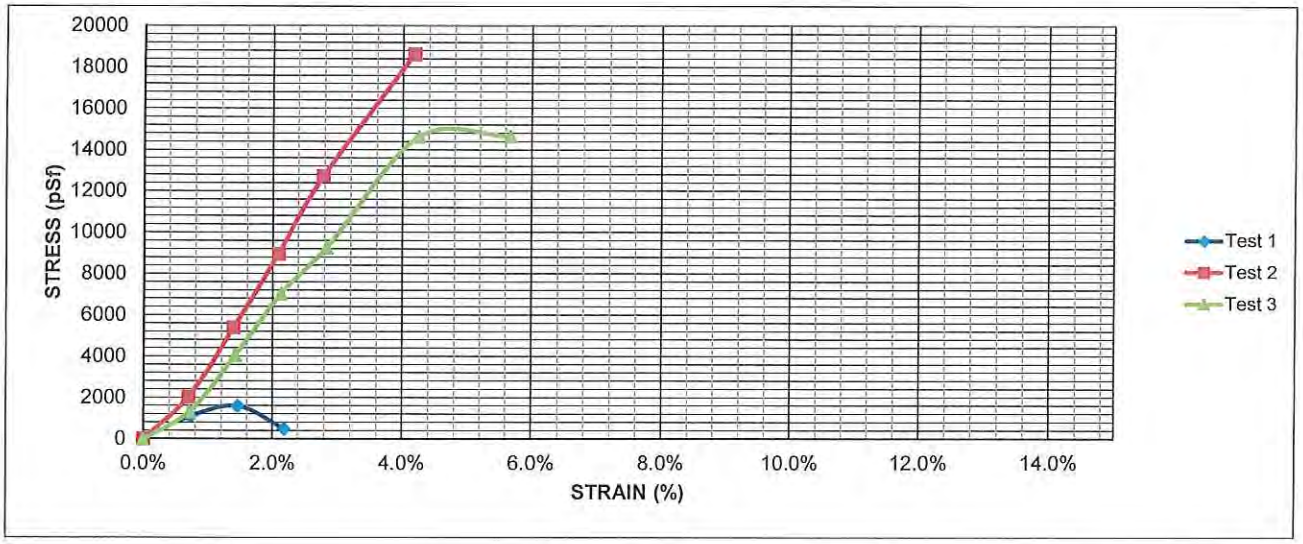
DATE: 4-Jun-20

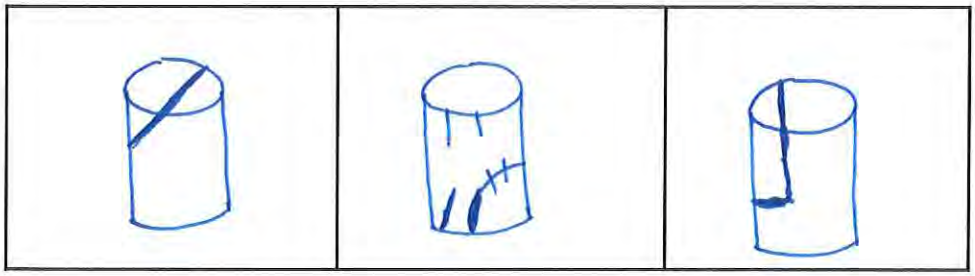
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 1	Test 2	Test 3
	WB-7	WB-7	WB-7
	RC - 250-255 feet	RC - 275-280 feet	RC - 295-300 feet
Soil Class:			
Dry Density (pcf):	102.0	104.2	103.8
Water Content:	21.4%	22.3%	27.3%
Sample Dia. (mm):	44.3	45.7	44.8
Sample Ht (mm):	87.2	91.1	89.6
Height/Diameter:	1.97	1.99	2.00
Unc. Strength (psf):	**1599**	**18637**	**14666**
Strain at Failure (%):	1.5	4.2	5.7





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Material Testing Services, LLC

by

MATERIAL TESTING SERVICES, LLC

P.O. Box 634
Minot, ND 58702
(701) 852-5553

P.O. Box 1093
Williston, ND 58802
(701) 572-4226

UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

DATE: 4-Jun-20

COPIES TO:

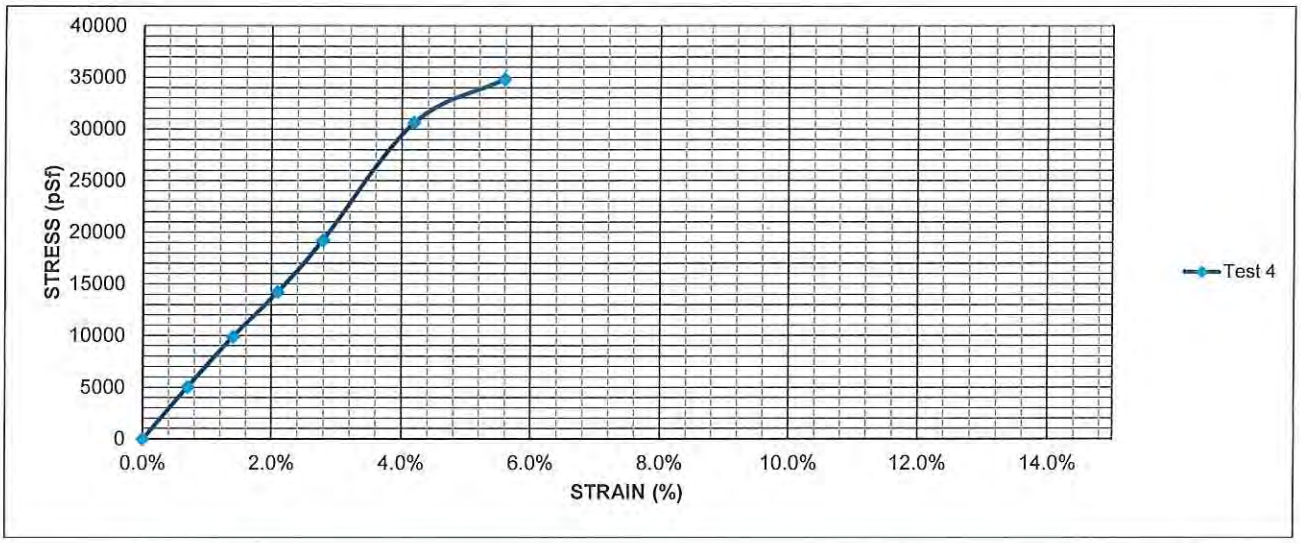
REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

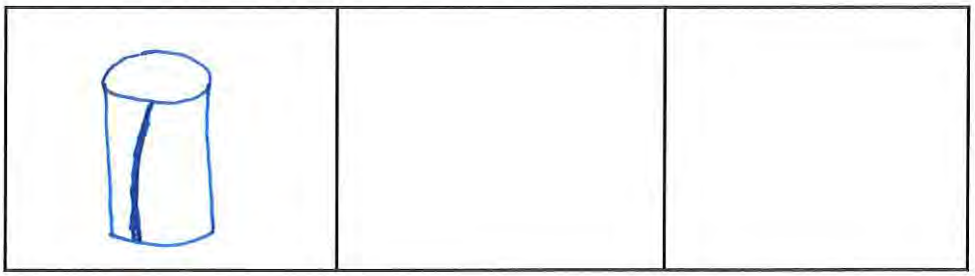
Laboratory Number G20-046

Specimen ID: **Test 4**
WB-7
RC - 182.5-187.5 feet

Soil Class:

Dry Density (pcf):	110.8
Water Content:	19.1%
Sample Dia. (mm):	45.1
Sample Ht (mm):	91.0
Height/Diameter:	2.02
Unc. Strength (psf):	**34830**
Strain at Failure (%):	5.6





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UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

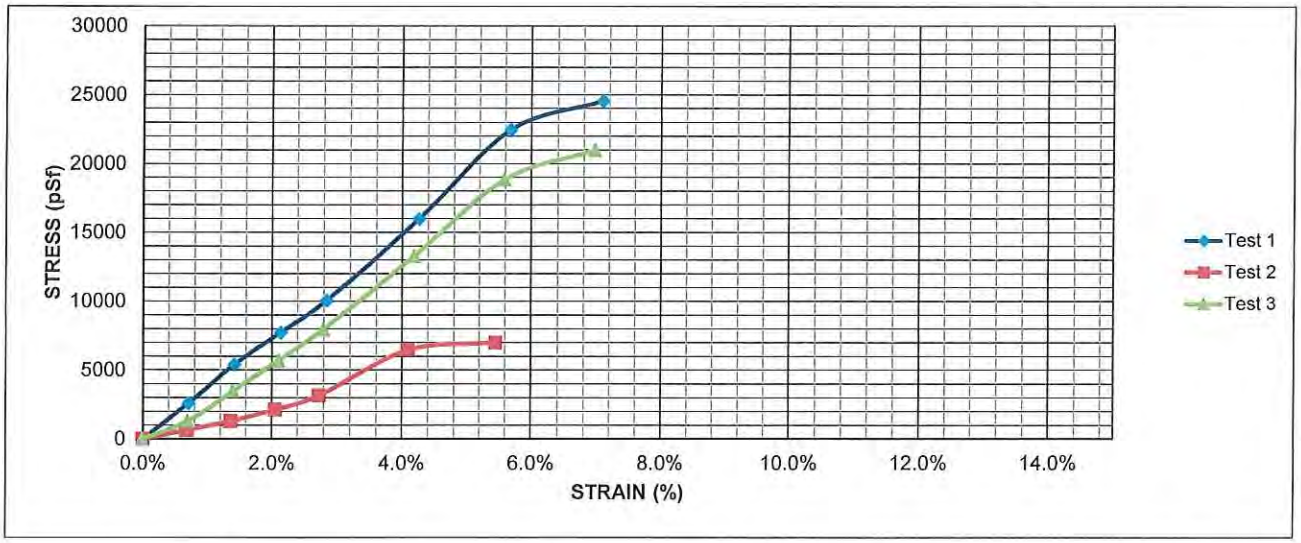
DATE: 5-Jun-20

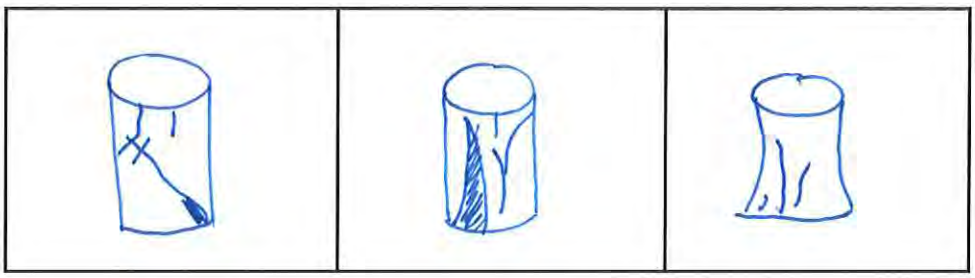
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 1	Test 2	Test 3
	WB-8 RC -160-165 feet	WB-8 RC - 180-185 feet	WB-8 RC - 200-205 feet
Soil Class:			
Dry Density (pcf):	115.0	106.9	107.0
Water Content:	16.1%	20.1%	21.3%
Sample Dia. (mm):	45.4	46.5	45.7
Sample Ht (mm):	89.4	93.2	91.0
Height/Diameter:	1.97	2.00	1.99
Unc. Strength (psf):	**24564**	**7009**	**21013**
Strain at Failure (%):	7.1	5.5	7.0





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PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

DATE: 5-Jun-20

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GES
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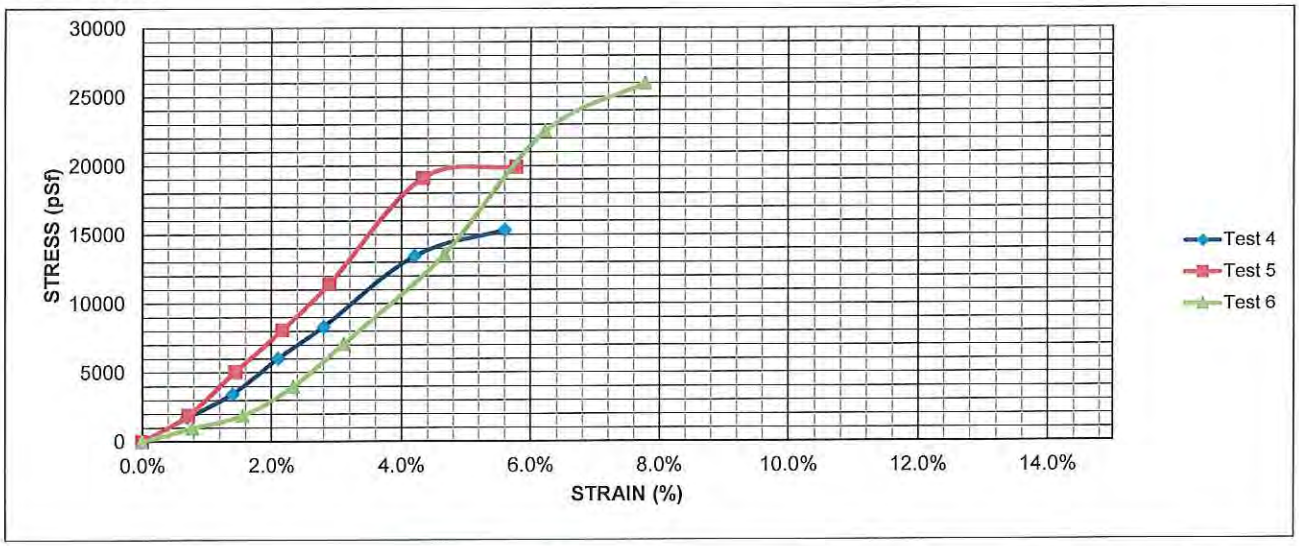
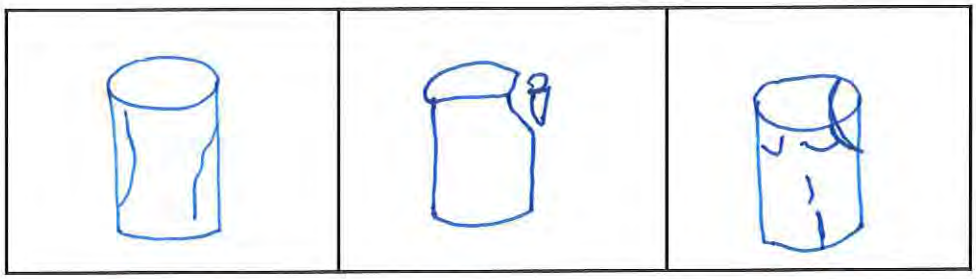
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 4	Test 5	Test 6
	WB-8 RC - 220-225 feet	WB-8 RC - 245-250 feet	WB-8 RC - 265-270 feet
Soil Class:			
Dry Density (pcf):	108.9	108.8	105.8
Water Content:	20.3%	20.1%	23.1%
Sample Dia. (mm):	45.4	45.3	44.7
Sample Ht (mm):	90.6	87.9	81.6
Height/Diameter:	1.99	1.94	1.83
Unc. Strength (psf):	**15346**	**19931**	**26024**
Strain at Failure (%):	5.6	5.8	7.8





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MISSOURI RIVER HDD CROSSING

DATE: 5-Jun-20

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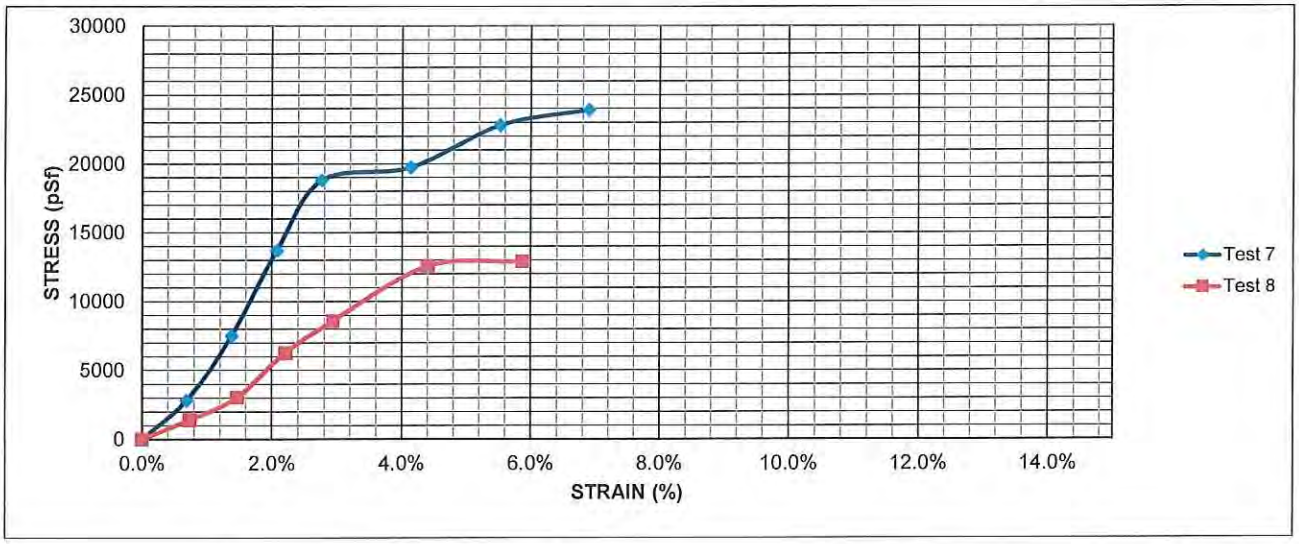
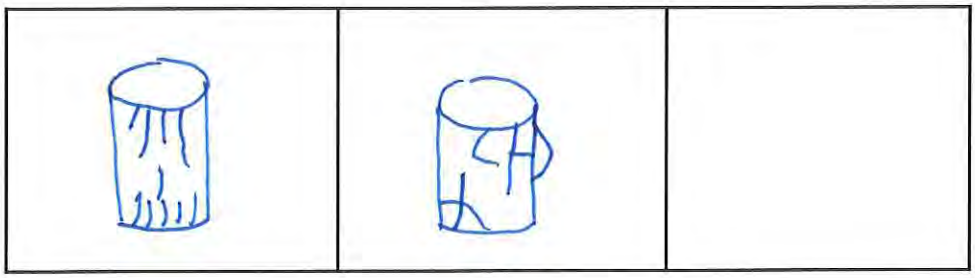
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	**Test 7**	**Test 8**
	WB-8	WB-4
	RC - 275-280 feet	RC - 287.5-292.5 feet
Soil Class:		
Dry Density (pcf):	107.2	106.1
Water Content:	20.8%	24.0%
Sample Dia. (mm):	45.3	45.0
Sample Ht (mm):	92.0	86.5
Height/Diameter:	2.03	1.92
Unc. Strength (psf):	**23927**	**12917**
Strain at Failure (%):	6.9	5.9





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UNCONFINED COMPRESSIVE STRENGTH
ASTM D 2166

PROJECT: WBI NORTH BAKKEN EXPANSION
MISSOURI RIVER HDD CROSSING

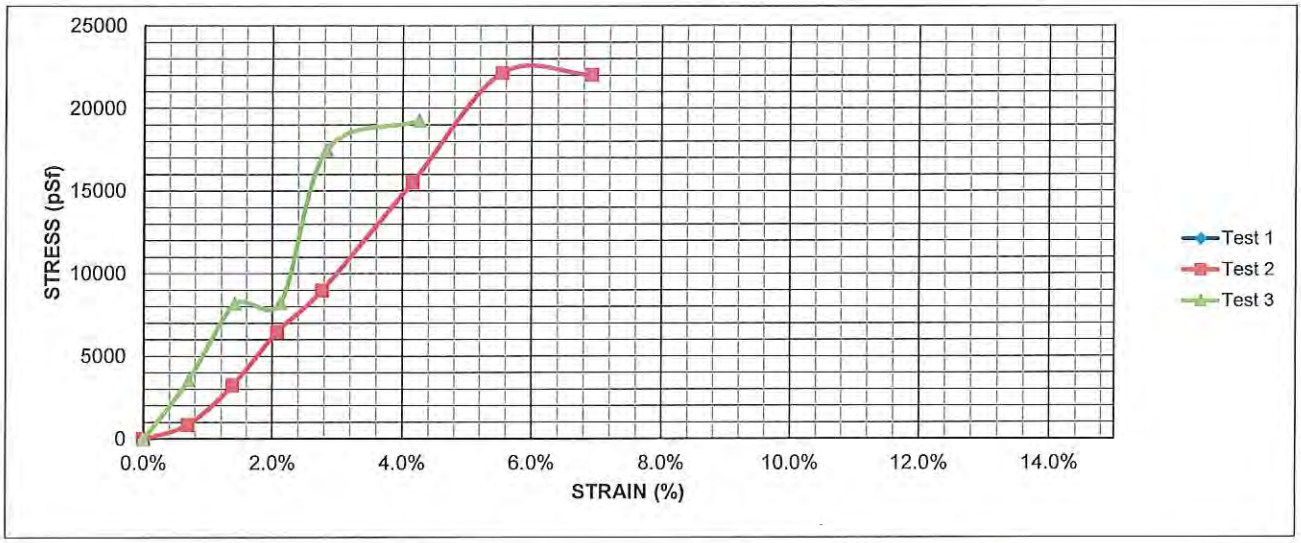
DATE: 7-Jun-20

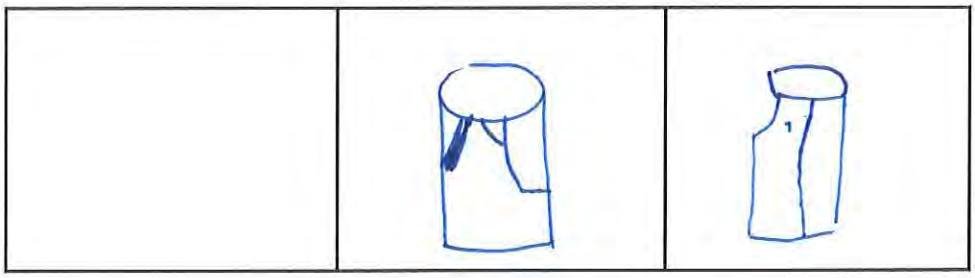
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 1	Test 2	Test 3
	WB-5	WB-9	WB-9
	RC - 87.5-92.5 feet	RC - 170-175 feet	RC - 190-195 feet
Soil Class:			
Dry Density (pcf):	Unable to Run	108.6	116.3
Water Content:		20.4%	14.2%
Sample Dia. (mm):		45.2	44.6
Sample Ht (mm):		91.7	89.5
Height/Diameter:		2.03	2.01
Unc. Strength (psf):		**25355**	**22155**
Strain at Failure (%):		4.1	5.3





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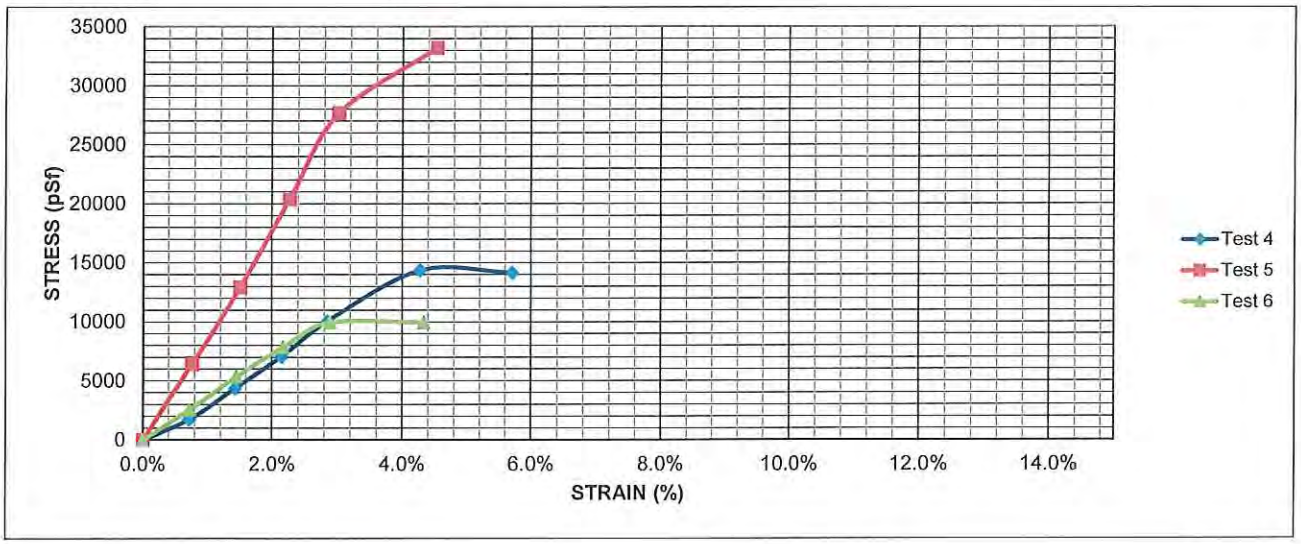
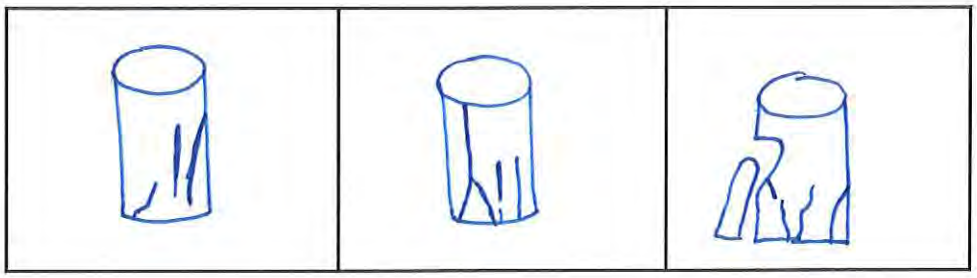
Laboratory Number G20-046

Specimen ID:	Test 4	Test 5	Test 6
	WB-9	WB-5	WB-5
	RC - 210-215 feet	RC - 235-240 feet	RC - 265-270 feet
Soil Class:			
Dry Density (pcf):	104.4	108.5	106.3
Water Content:	23.0%	19.7%	20.2%
Sample Dia. (mm):	45.6	44.5	44.5
Sample Ht (mm):	88.9	83.9	87.8
Height/Diameter:	1.95	1.89	1.97
Unc. Strength (psf):	**14375**	**33239**	**9965**
Strain at Failure (%):	4.3	4.5	4.3





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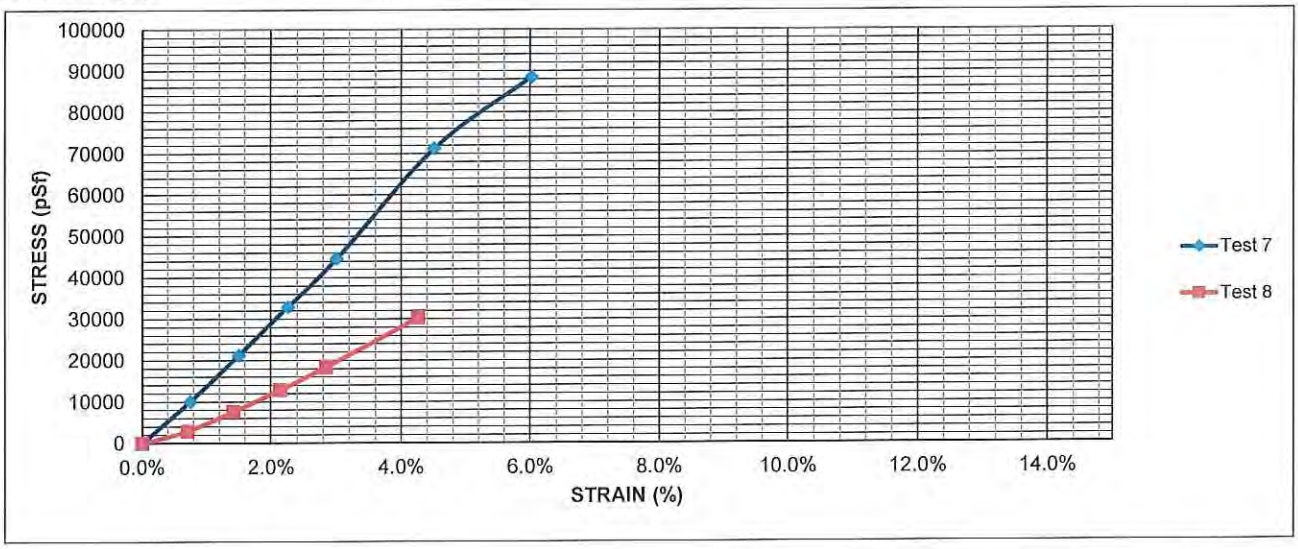
DATE: 7-Jun-20

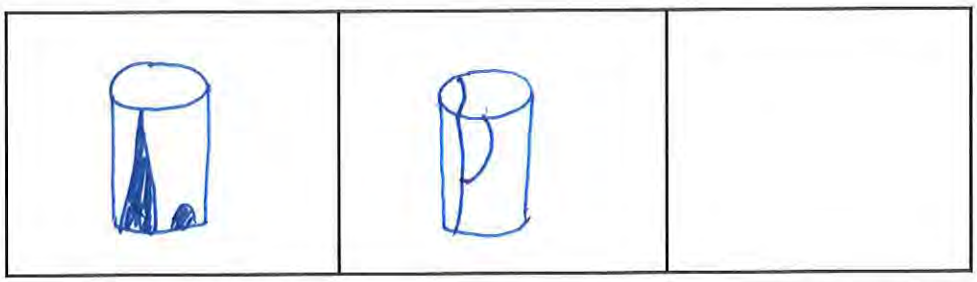
COPIES TO:

REPORTED TO: Attn: James Simonet, PG
GES
1301 Corporate Center Drive
Eagan, MN 55121

Laboratory Number G20-046

Specimen ID:	Test 7	Test 8
	WB-9 RC - 255-260 feet	WB-9 RC - 305-310 feet
Soil Class:		
Dry Density (pcf):	112.7	117.6
Water Content:	15.3%	14.2%
Sample Dia. (mm):	42.2	44.9
Sample Ht (mm):	84.3	89.2
Height/Diameter:	2.00	1.99
Unc. Strength (psf):	**88505**	**30377**
Strain at Failure (%):	6.0	4.3





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Material Testing Services, LLC

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LABORATORY TEST RESULTS

Testing Scope

Laboratory testing was proposed to characterize soils index properties including Atterberg limits (liquid and plastic limits) and moisture content. Strength testing included unconfined compression testing.

Index Properties

Testing and classification of soils was performed in accordance with the Unified Soil Classification System as described in ASTM D 2487. Atterberg limits were performed according to ASTM D 4318. Moisture content was determined in accordance with ASTM D 4959 and D 4643. The dry density was determined with direct measurement procedures. Mechanical sieve analysis was done in accordance with ASTM D 422.

Strength Testing

The strength tests consisted of unconfined compression (QU) testing. The QU tests were conducted in accordance with ASTM D 2166.

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%		ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

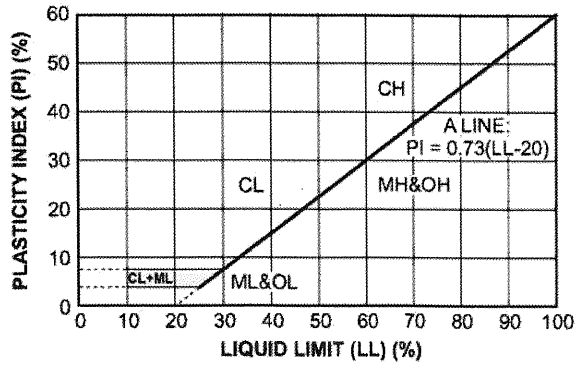
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent ..... GW, GP, SW, SP
More than 12 percent ..... GM, GC, SM, SC
5 to 12 percent ..... Borderline cases requiring dual symbols

PLASTICITY CHART



ERM

1050 SW 6th Ave
Suite 1650
Portland, OR 97204

Telephone: +1 603 488 5282

www.erm.com

Call Log

Log of Telephone Conversation

Call To/From Whom	To: Gerald Heiser
Phone number	701-328-2752
Company	North Dakota State Water Commission
ERM Contact	Andrea Thornton
Phone number	503-459-6864
Date	August 17, 2020
Time of Conversation	12:00 pm PST
Reference	North Bakken Expansion Project
Signature	

LOG OF CONVERSATION

Ms. Thornton called the North Dakota State Water Commission to speak with Gerald Heiser regarding the North Bakken Expansion Project.

Ms. Thornton called to confirm that Mr. Heiser received the updated Soverign Land Permit Application that was submitted last week. Mr. Heiser indiciated that yes the files had been received. Ms. Thornton then asked if there were any updates on the potential need for a scour analysis. Mr. Heiser noted that no decision had been made yet, and that we would raise the subject again with his supervisor for discussion this week. Ms. Thornton ask if the permit review timeframe was still 90 days, and Mr. Heiser confirmed that to be true. Ms. Thornton thanked Mr. Heiser and asked that he reach out if there are any question regarding the permit application.

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NORTH BAKKEN EXPANSION PROJECT

Agency Correspondence – State Historical Society of North Dakota (SHSND)

Pat Robblee

From: Pat Robblee
Sent: Monday, July 20, 2020 4:57 PM
To: Clark, Andrew
Subject: 32MZ3313

Hi Andy.

Hope you're doing well.

I wanted to check in and see if you had further direction with regard to whom we should send the bone fragments recovered from 32MZ3313 in 2019.

Pat

Patrick Robblee
Program Director

ERM
T+612 840 8976
E pat.robblee@erm.com I W www.erm.com

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Pat Robblee

From: Pat Robblee
Sent: Tuesday, August 11, 2020 8:33 AM
To: Clark, Andrew
Subject: North Bakken

Hi Andy.

Would you be available for a call today or tomorrow to discuss the North Bakken project? We have found or relocated a lot of stone feature sites in areas near Tioga resulting in challenging routing for the new pipeline. WBI Energy is looking at the option of installing the new pipeline within an existing corridor, such that construction would be limited to the area disturbed by the previous pipeline project. While we're still working to nail down details, this might involve construction across sites or areas immediately adjacent to sites with no buffer. I'm hoping to chat with you about what we may need to do to assess eligibility/effect on sites in this scenario.

Pat

Patrick Robblee
Program Director

ERM
T+612 840 8976
E pat.robblee@erm.com I W www.erm.com

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From: Clark, Andrew <andrewclark@nd.gov>
Sent: Friday, August 14, 2020 9:41 AM
To: Pat Robblee <Pat.Robblee@erm.com>
Subject: RE: North Bakken

That'll work. Could you send along the site numbers and maps that we will be talking about? I'll also try to track down Pete Coffey's mailing address for you. Talk to you then.

Andy

From: Pat Robblee <Pat.Robblee@erm.com>
Sent: Thursday, August 13, 2020 5:58 PM
To: Clark, Andrew <andrewclark@nd.gov>
Subject: RE: North Bakken

CAUTION: This email originated from an outside source. Do not click links or open attachments unless you know they are safe.

Hi Andy.

Just checking to see if the invite I sent for a call tomorrow at 2 central time will work for you.

Jill Linn from WBI Energy and Kevin will also be on the call.

P.

Patrick Robblee
Program Director

ERM
T+612 840 8976
E pat.robblee@erm.com I W www.erm.com

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Pat Robblee

From: Clark, Andrew <andrewclark@nd.gov>
Sent: Friday, August 14, 2020 2:26 PM
To: Pat Robblee
Subject: RE:

Hi Pat,

Thank you for gathering the rest of the bone artifacts from 32MZ3313. They can be mailed directly to MHA THPO Pete Coffey. His address is:

Pete Coffey
7226 16th Ave NW
Garrison, ND 58540

Best,

Andy

From: Clark, Andrew
Sent: Wednesday, July 1, 2020 11:15 AM
To: Pat Robblee <Pat.Robblee@erm.com>
Subject: RE:

Thanks, Pat! I look forward to seeing it.

I'll work on getting you an address for the rest of the bone. I believe we'll have you send it directly to Pete Coffey. I'll also be in touch with inadvertent discovery procedures.

Andy

Andrew Clark, PhD
Chief Archaeologist
Archaeology and Historic Preservation Division
State Historical Society of North Dakota
612 East Boulevard Avenue
Bismarck, North Dakota 58505-0830
701-328-3574

MEETING NOTES

LOG OF VIRTUAL MEETING

MEETING ATTENDEES:

Andrew Clark (North Dakota State Archaeologist), Dave Linn (WBI Energy Transmission, Inc.), Jill Linn (WBI Energy Transmission, Inc.), Pat Robblee (ERM), and Kevin Malloy (ERM)

DATE:	TIME OF CONVERSATION:
08/14/2020	2:00 cst

RE:

WBI North Bakken Expansion Project 2020

PREPARED BY:

Kevin Malloy

LOG OF CONVERSATION:

- Kevin Malloy (ERM) welcomed everyone to the meeting.
- Pat Robblee (ERM) described the challenges of routing the Line Section 25 Loop north of Tioga given the many constraints in this area, including a high density of prehistoric stone feature sites (previously recorded and newly recorded), numerous existing pipelines, and several large wetlands. While WBI Energy continues to investigate alternate routes in this area, Pat explained that it may not be feasible to avoid all of the prehistoric stone feature sites with a buffer of 50 ft (i.e., 50 ft between the site boundaries and the nearest construction workspace).
- Pat explained that WBI Energy is considering as a possible alternative a conceptual design where the new pipeline would be routed adjacent to an existing pipeline, with the construction workspace for the new pipeline (about 75-ft-wide) wholly sited within the construction corridor for the existing pipeline. The conceptual design alternative could allow WBI Energy to avoid the prehistoric stone feature sites by limiting new construction to previously disturbed areas, but not necessarily with a 50 ft buffer between workspace and the sites. Mr. Robblee asked Mr. Clark if it would be possible get to a “no adverse effect” determination for sites within 50 ft if construction is confined to a previously disturbed corridor?
- Andy Clark (SHSND) said that a “no adverse effect” determination under the alternative conceptual design would be possible, but the SHSND would want good documentation of the extent of previous disturbance based on both air photo interpretation and on-the-the-ground verification and mapping. Consultation with the tribes would also be required to get their input on the avoidance measures for the sites. Pat noted that tribal cultural specialists from several tribes have been participating in fieldwork for the Project and either have or would be visiting sites along any route proposed for the Project in the area being discussed.
- Andy said that understanding the nature of the sites will be important in assessing Project effects. He said that the SHSND has allowed work on non-contributing portions of historic properties or sites being treated as historic properties. A 50 ft buffer between sites and

construction workspace would generally result in a finding of “no historic properties affected”. For sites within 50 ft of workspace, or situations where the pipeline would cross non-contributing portions of historic properties, a finding of “no adverse effect” would be possible.

- If WBI Energy pursues the alternative conceptual design, Andy said It would be good to describe the alternatives considered and explain why they are not feasible. From a reviewer standpoint, Andy said it is often difficult to understand why a particular route is being pursued without understanding what other options have been considered.
- Andy, Pat, and Kevin discussed site forms for archaeological resources and cultural heritage sites. Andy said that findings or interpretations based solely on tribal cultural knowledge should not be included on archaeological site forms. The ethnographic context for findings should be provided on cultural heritage forms. Andy also said the Project will need to address impacts on both archaeological and cultural heritage sites.
- The meeting was concluded and Dr. Malloy thanked everyone for attending.

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Call Log

Log of Telephone Conversation

ERM

Call To/From Whom	Andrew Clark, Amy Bleier
Phone number	Teams
Company	SHSND
ERM Contact	Kevin Malloy, Jena Orlowski
Phone number	906-285-0361
Date	08/25/2020
Time of Conversation	2:30 pm
Reference	North Bakken Expansion Project (Project)
Signature	

LOG OF CONVERSATION

Jena Orlowski and I called Dr. Andrew Clark, ND State Archaeologist, and Amy Bleier with the SHSND, to review the content requirements for archaeological site forms and cultural heritage site forms. We also discussed the upcoming submission of an updated Class III archaeology report. The results of the archaeological survey and documentation of cultural heritage sites should be presented in separate reports. Also, separate avoidance plans would need to be prepared for archaeological sites and cultural heritage sites. Finally, we discussed upcoming work at 32WI976 including testing methodologies.

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Call Log

Log of Telephone Conversation

Call To/From Whom	Andrew Clark
Phone number	701.328.3574
Company	SHSND
ERM Contact	Pat Robblee
Phone number	612-840-8976
Date	8/26/20
Time of Conversation	afternoon
Reference	North Bakken Expansion Project (Project)

LOG OF CONVERSATION

I called Andy Clark to discuss reporting requirements for archaeological resources and cultural heritage sites. Andy said that documentation of cultural heritage sites should be kept separate from the documentation of archaeological sites and presented in separate reports. He said this is because of the different nature of each type of resource but also because the archaeological surveys and cultural heritage documentation have been managed by two different companies. Andy also said that separate avoidance plans for archaeological resources and cultural heritage sites should be provided for agency review. Any differences in recommendations for site avoidance for associated archaeological and cultural heritage sites would need to be reconciled.

For archaeological sites that are eligible or unevaluated, Andy confirmed that a 50 ft buffer between site boundaries and construction workspace with a commitment to fence and monitor would typically result in a “no effect” finding for those resources.

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Call Log

Log of Telephone Conversation

Call To/From Whom	Andrew Clark
Phone number	701.328.3574
Company	SHSND
ERM Contact	Kevin Malloy
Phone number	906-285-0361
Date	08/31/2020
Time of Conversation	2:47 pm
Reference	North Bakken Expansion Project (Project)
Signature	

LOG OF CONVERSATION

I called North Dakota State Archaeologist, Andy Clark, to get clarification on the methodology for unit excavation at 32WI976 with respect to feature documentation. For features that extend beyond the limits of a standard test unit, the unit should be expanded to expose entire features.

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Call Log

Log of Telephone Conversation

Call To/From Whom	Andrew Clark
Phone number	701.328.3574
Company	SHSND
ERM Contact	Kevin Malloy
Phone number	906-285-0361
Date	09/04/2020
Time of Conversation	2:32 pm
Reference	North Bakken Expansion Project (Project)
Signature	

LOG OF CONVERSATION

I called North Dakota State Archaeologist, Andy Clark, to discuss the methodology for unit excavation at 32WI976, particularly with regard to feature documentation. We agreed that the testing should aim to be as minimally invasive as possible. As a general rule, test units should not be expanded to expose an entire feature Instead, test units only need to be expanded to identify the edge of a feature, which should provide enough information to estimate the size of the feature.

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September 16, 2020

Andrew Clark, State Archaeologist
State Historic Society of North Dakota
North Dakota Heritage Center
612 East Boulevard Avenue
Bismarck, ND 58505-0830

Subject: WBI Energy Transmission, Inc.
North Bakken Expansion Project – Class III Survey Reports 2020 Field Season
McKenzie, Williams, Burke, and Mountrail Counties, North Dakota
ND SHPO Ref.: 19-5593

Dear Dr. Clark:

Please reference WBI Energy Transmission, Inc.'s (WBI Energy's) previous correspondence regarding the above referenced project. WBI Energy proposes to construct and operate the North Bakken Expansion Project (Project) in McKenzie, Williams, Burke, and Mountrail Counties, North Dakota.

The Project is regulated by the Federal Energy Regulatory Commission (FERC) under Section 7(c) of the Natural Gas Act. Under the Energy Policy Act of 2005, FERC is the lead agency for coordinating federal authorizations and complying with the National Environmental Policy Act on natural gas pipeline projects subject to its jurisdiction. FERC similarly is the lead federal agency for complying with Section 106 of the National Historic Preservation Act (NHPA) on natural gas pipeline projects under its jurisdiction. In accordance with 36 CFR 800.2(c)(4), WBI Energy is assisting the FERC in meeting its obligations under Section 106 of the NHPA by coordinating with agencies and tribes and conducting surveys to identify historic properties that may be affected by the Project.

Enclosed for your review please find Class III survey reports for the archaeological and historic structures surveys that were conducted during the 2019 and 2020 field seasons. The archaeological report includes the results provided in the original Class III report and addresses comments that were provided by the State Historical Society of North Dakota, Bureau of Land Management, U.S. Army Corps of Engineers, and the U.S. Forest Service. The attached table summarizes our response to those comments and provides the location of the relevant revisions or clarifications. A report on geomorphological investigations is also included in this submittal.

WBI Energy would appreciate your comments on the attached reports. If you have any questions or comments on the Project or the reports, please contact me at 612-840-8976 or pat.robblee@erm.com, or Dr. Kevin Malloy at 906-285-0361 or kevin.malloy@erm.com. Please direct written correspondence to Dr. Malloy's attention at:

Environmental Resources Management
1000 IDS Center
80 South 8th Street
Minneapolis, MN 55402

Sincerely,

Patrick Robblee

Program Director

Enclosures: Class III Archaeological Survey Report
Class III Historic Structures Addendum I Survey Report
Geomorphology Report

cc: Jill Linn, WBI Energy
Andrea Thornton, ERM
Kevin Malloy, ERM
Emily Laird, ERM
Andrew Clark, SHSND
Fern Swenson, SHSND
Liv Fetterman, USFS
Richard Rogers, USACE
Teanna Limpy, Northern Cheyenne Tribe
Pete Coffey, Three Affiliated Tribes of the Fort Berthold Reservation
Dyan Youpee, Assiniboine and Sioux Tribes of the Fort Peck Reservation
Ben Rhodd, Rosebud Sioux Tribe
Michael Black Wolf, Fort Belknap Indian Community
Tom Brings, Oglala Sioux Tribe
Jon Eagle, Standing Rock Sioux Tribe
Ben Ridgely, Northern Arapaho Tribe
Steven Vance, Cheyenne River Sioux
Erich Longie, Spirit Lake Tribe
Kip Spotted Eagle, Yankton Sioux Tribe
Jeff Desjarlais, Jr., Turtle Mountain Band of Chippewa
Dianne Desrosiers, Sisseton Wahpeton Oyate

Attachment: Table summarizing agency comments on the original Class III archaeology report

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Comments from the State Historical Society of North Dakota		
General comments:		
o Provide more background information on sites with previous work. Focus on methods and reasoning for previous eligibility recommendation.	Additional information on previous investigations has been added to site descriptions, as applicable.	Sections 5.3 through 5.7
o Map symbology has item named “Shovel test – No Dig”. Are these shovel probes that were planned, but not excavated for some reason? If so provide explanation.	These are planned but unexcavated shovel tests. Site descriptions have been updated, as applicable, to explain why some planned shovel tests were not excavated. Typical reasons for not excavating shovel tests include the presence of buried utilities (documented through One-Call markings) or slope.	Sections 5.3 through 5.5
Avoidance, 50 ft buffer minimum, fence, and monitor:		
o Private land: 32BK277, 32BK279, 32BK280, 32BK282, 32MZ3308, 32MZ3309, 32MZ3310, 32MZ3311, 32MZ3325, 32MZ3327, 32WI1494, 32WI1630, 32WI2144, 32WI2388, 32WI2389, 32WI2391, 32WI2392, 32WI2393, 32WI2394, 32WI2398, 32WI2406, 32WI2408.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.3
o US Forest Service Sites: 32MZ3301, 32MZ3314, 32MZ3315, 32MZ3319, 32MZ3320, 32MZ3322, 32MZ3324.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.5
Formally evaluate with site delineation and at least one 1x1 m TU. Submit evaluation plan prior to fieldwork:		
o Private Land: 32BK278, 32MZ3302, 32MZ3306, 32MZ3307, 32MZ3318, 32MZ3323, 32MZ3326, 32MZ3328, 32MZ3329, 32MZ3331, 32WI2390, 32WI2405, 32WI2407, 32WI2409, 32WI2410.	Additional testing (shovel testing and/or the excavation of at least one, 1 x 1 m test unit) was completed at each of these sites in accordance with a testing plan approved by the SHSND. Testing at sites 32WI2390 and 32MZ3328 was suspended following the identification of stone features at these sites; however, the pipeline route has been adjusted to avoid these sites with a minimum 50-ft buffer.	Section 5.3
o US Forest Service Site: 32MZ2346.	While ERM planned to conduct additional testing at this site, the pipeline route was modified prior to this work such that the site is now avoided by the Project with a buffer greater than 100 ft.	Section 5.5
Isolated finds:		
o Discuss subsurface potential on all IFs on a case-by-case basis. If the finds are in a good depositional context, STPs may be necessary to show that these are truly isolates. Minimal site recording may be enough to get a site number for database purposes, but more information is needed to verify that these are truly part of a category that can be written-off as not eligible.	Individual descriptions of isolated finds have been added to the text, including the results of shovel testing or an explanation for why shovel tests were not excavated.	Section 5.7

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Site-by-site comments, private land:		
o 32BK168 – Expand reasoning for Not Eligible Determination both previously and now. Newly recorded site boundary included previously unidentified features. Perhaps site should be unevaluated. Consider formal evaluation and provide updated management recommendations.	ERM conducted site testing at 32BK168 in 2020. Evidence of intact cultural deposits and features was identified during testing and the site is now recommended as eligible for listing in the NRHP. The pipeline route has been modified to avoid this site with a buffer of 57 ft.	Section 5.3
o 32MZ3323 – Discussion mentions "Better Examples" of homesteads. Provide examples.	The description for 32MZ3323 has been updated to incorporate the results of additional testing (shovel testing and the excavation of a 1 x 1 m test unit) in the updated Class III report.	Section 5.3
o 32WI1495 – Actual well shown in Figure 5.3-81 may be visible in figure 5.3-80. Is this location impacted by project? Consider site lead.	The location of the well (which is no longer extant) is discussed in the updated Class III report in conjunction with 32WI1495. ERM has submitted a site lead form for this resource. The suggested boundary of the site lead is 19 ft from Project workspace. The actual location of the well is about 235 ft from Project workspace.	Section 5.3
o 32WI2404 – How is this identified as prehistoric? Could it be a result of natural glacial and/or historic or modern field clearing? Provide evidence. Fence and monitor as necessary.	The interpretation of the feature at 32WI2404 as prehistoric is conservative and based on best professional judgement. Tribal cultural specialists who visited the site with ERM concurred with this interpretation.	Section 5.3
o 32WI2408 – Workspace is extremely close to possible graves. Is the planned route fixed?	The pipeline route has been modified to avoid this site with a buffer of 213 ft.	Section 5.3
Site-by-site comments, US Army Corps of Engineers land:		
o 32MZ976 – Drilling under site is not avoidance as leaks and emergency repairs do consider cultural resources. Formal testing or horizontal avoidance is necessary.	The trajectory of the HDD will be 160 to 180 ft below ground surface where it passes beneath 32WI976. The pipeline will carry gas, not a liquid; the gas would migrate to the surface and dissipate into the air in the event of a leak. Given the depth of the HDD installation, daylighting of the pipeline for repair would not be feasible. If repair is required in the future, the most likely course of action would be to re-install a new segment via HDD, which would require federal authorizations, thereby triggering review of the action under Section 106 of the NHPA. A description of the HDD method has been added to the description of 32WI976 in Section 5.4 of the report. Additional testing at the site is pending and scheduled to be completed this fall. The results will be discussed in an addendum report.	Section 5.4
o 32MZ976 – Show bore location and HDD line on map	A figure showing the HDD alignment with entry and exit points has been added to the description of this site as has a construction alignment sheet. The alignment sheet depicts the HDD in plan and profile.	Section 5.4

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o 32MZ976 – Clarify and provide more evidence for geomorphological hypothesis of A horizon being related to flood deposits. Typically, A horizons show stability rather than accretional or erosional events. Provide more information on why artifacts are interpreted as disturbed rather than in primary context.	The text in the updated Class III report has been updated to address this comment. As noted above, additional testing is planned to occur at 32WI976 this fall, which will provide additional information on the soils present at the site.	Section 5.4
o 32MZ976 – Did cut bank provide additional information on buried soils? Were artifacts identified in cut bank?	The cut bank was examined during the initial survey. As noted above, additional testing is planned to occur at the site this fall with results to be discussed in an addendum report.	Section 5.4
o 32WI976 – Given size and shape of site, additional TUs recommended.		
Comments from the Bureau of Land Management		
o The recommended protection/avoidance measures for unevaluated and eligible archaeological sites in the Class III report are inadequate, particularly regarding stone feature sites. The usual avoidance distance requested/required by the BLM is 100 feet. More than 100 feet is preferred for stone feature sites. Revise protection/avoidance measures buffers for archaeological sites.	WBI Energy has routed the pipeline to avoid unevaluated and eligible sites with a minimum buffer of 50 ft as directed by the SHSND.	Sections 5.3 through 5.5
o Why were indirect effects to archaeological sites not considered? Setting is an important aspect of integrity for stone feature sites. There are numerous archaeological sites within and near the survey corridor that should be analyzed for indirect effects. Revise the report to address indirect effects to archaeological sites.	The report has been updated to include an assessment of physical and non-physical impacts on unevaluated and eligible sites.	Sections 4 and 5.5 through 5.5
o WBI Energy needs to develop a cultural resource monitoring plan for construction.	WBI Energy commits to preparing a monitoring plan for construction.	Sections 5.3 through 5.5
o Update site form for all sites, site leads, and isolated finds regardless of whether they were relocated. Even if a cultural resource could not be relocated, that is still valuable information for the next project/site visit.	Site form updates have been submitted for all sites, isolated finds, and site leads discussed in the updated Class III report	N/A
o WBI Energy should make additional efforts to involve tribes in upcoming 2020 fieldwork and field reviews.	As discussed in more detail in Section 4 of the updated Class III report, WBI Energy retained Beaver Creek Archaeology to coordinate tribal participation in fieldwork in 2020. BCA worked with tribes to document sites as cultural heritage resources. The results of that work will be presented in a separate report. Information on tribal participation in the surveys also is provided in Sections 4 and 5.3 through 5.5 of ERM's updated Class III report	Sections 4 and 5.3 through 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Comments from U.S. Army Corps of Engineers		
o In section 5.4.2, remove figures for 32MZ0598 and move to the previous section.	This comment is addressed in the updated Class III report	Section 5.4
o Figure 5.4-5: Map of Site 32WI976, provide contour lines on this map to show the slope. This information would help to explain why the shovel testing pattern appears the way it does.	Contour lines are provided on Figure 5.4-9 in the updated Class III report.	Section 5.4
o ERM, on behalf of WBI [Energy], identified a second concentration of artifacts in the western side of site 32WI0976 after they started excavating the test unit. Some additional testing is needed here as USACE cannot agree with the recommended determination for this site given the data presented in this report.	Additional testing will be completed at this site in the fall of 2020 with the results presented in an addendum report.	Section 5.4
o USACE recommends that WBI [Energy] conduct a remote sensing evaluation (gradiometer or conductivity) at site 32WI0976. This would be the best way to produce measurable data regarding the presence/absence of subsurface features at the site.	A remote sensing survey of the site was completed in the summer of 2020. The results of the survey were used to prepare a testing plan for 32WI976. Additional testing at the site will occur this fall with the results presented in an addendum report.	Section 5.4
Comments from the U.S. Forest Service		
o The map showing previously recorded cultural resources within a one-mile radius is only included in the overall Class III and not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Figure 1.1-2 shows the Forest Service surface and differentiates between the survey corridor and the survey corridor on Forest Service surface; however, the survey corridor on Forest Service surface and the actual Forest Service surface displayed don't match.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Sites 32MZ2347 (Historical Archaeological) and 32MZ3278 (Cairn) are located immediately adjacent to the survey corridor but are not discussed. Please discuss.	Based on route modifications, 32MZ3278 was visited in 2020 and the site boundary expanded based on the findings. A discussion of the site is provided in the updated Class III report. 32MZ2347 is outside the inventory corridor for the Project; however, we have included a discussion of this site in the Class III inventory report.	Section 5.5
o Site 32MZ145 site form update does not appear to have been performed. Why? Was an attempt made to actually relocate the site? Also, according to the site form, a THPO representative requested avoidance in 2013. More work on this site is probably needed.	When 32MZ145 was first recorded in 1979, it was characterized as two stone cairns. Subsequent investigations described the site as consisting of a single historic rock clearing pile on the west side of Highway 1806, noting that the second pile was likely destroyed by construction of the highway. ERM's survey in 2019 was limited to the east side of Highway 1806, which explains why we did not relocate the site at that time. In 2020, ERM conducted additional survey on USFS lands, examining a corridor on the west side of Highway 1806. 32MZ145 was relocated as a result of this work. The site is discussed in the updated Class III report. Tribal cultural specialists who accompanied ERM during the 2020 field investigation concurred that 32MZ145 is historic rock clearing pile.	Section 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o Site 32MZ2346 and 32MZ144: it is very improbable and therefore suspicious that there are zero artifacts and one artifact respectively at sites with historic dumps.	Sites 32MZ2346 and 32MZ144 are both previously recorded historic sites which ERM revisited and recorded during the survey for the Project. Cultural material was observed at both sites as described in the updated Class III report. ERM expanded the boundaries of 32MZ2346 to encompass two previously unreported features at the site. One artifact–a commemorative coin–was collected from 32MZ2346 because of its uniqueness. No artifacts were collected from 32MZ144. Expanded descriptions of both sites are provided in the updated Class III report.	Section 5.5
o Additional survey is shown as needed near site 32MZ3278 on the maps in the overall Class III report but not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	Additional survey was completed in 2020 on USFS lands in the vicinity of 32MZ3278, which was relocated. A description of the site is provided in the updated Class III report.	Section 5.5
o The recommended avoidance and fencing measures are inadequate, especially for stone feature sites.	All stone feature sites have been avoided with a minimum buffet of 50 ft. Additionally, for sites between 50 and 100 ft of Project workspace WBI Energy commits to fencing and monitoring the sites during construction. WBI Energy will provide a monitoring plan for agency review.	Section 5.5
o A monitoring plan is needed.	WBI Energy commits to providing a construction monitoring plan as discussed in the updated Class III report.	
o Updates should have been conducted for all sites, site leads, and IFs [isolated finds] regardless of whether or not they were relocated.	Site form updates have been submitted for all applicable sites, isolated finds, and site leads discussed in the report	N/A
o The discussion of site leads during fieldwork is inadequate.	Site leads are discussed in Section 5.6 of the updated Class III report.	Section 5.6
o Provide specific distances between site boundaries and the edge of the workspace.	Distances between sites and Project workspaces have been added to summary tables and site descriptions throughout the updated Class III report.	Sections 5.3 through 5.5
o Provide a map of shovel testing performed outside of site boundaries. The report explains the testing strategy during survey but never discusses or shows specifics except within site boundaries.	The route maps provided as Appendix B depict survey methodology in addition to survey coverage and results.	Appendix B
o Identify the level of tribal involvement in the survey.	Tribal participation in field surveys is discussed in Sections 4 and 5.3 through 5.5 of the updated Class III report.	Sections 4 and 5.3 through 5.5
o Discuss whether indirect effects to archaeological sites were considered.	For unevaluated sites, we have added an assessment of non-physical impacts on setting.	Sections 5.3 through 5.5

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September 16, 2020

Fern Swenson, Director
State Historic Society of North Dakota
North Dakota Heritage Center
612 East Boulevard Avenue
Bismarck, ND 58505-0830

Subject: WBI Energy Transmission, Inc.
North Bakken Expansion Project – Class III Survey Reports 2020 Field Season
McKenzie, Williams, Burke, and Mountrail Counties, North Dakota
ND SHPO Ref.: 19-5593

Dear Director Swenson:

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WBI Energy would appreciate your comments on the attached reports. If you have any questions or comments on the Project or the reports, please contact me at 612-840-8976 or pat.robblee@erm.com, or Dr. Kevin Malloy at 906-285-0361 or kevin.malloy@erm.com. Please direct written correspondence to Dr. Malloy's attention at:

Environmental Resources Management
1000 IDS Center
80 South 8th Street
Minneapolis, MN 55402

Sincerely,

Patrick Robblee
Program Director

Enclosures: Class III Archaeological Survey Report
Class III Historic Structures Addendum I Survey Report
Geomorphology Report

cc: Jill Linn, WBI Energy
Andrea Thornton, ERM
Kevin Malloy, ERM
Emily Laird, ERM
Andrew Clark, SHSND
Fern Swenson, SHSND
Liv Fetterman, USFS
Richard Rogers, USACE
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Michael Black Wolf, Fort Belknap Indian Community
Tom Brings, Oglala Sioux Tribe
Jon Eagle, Standing Rock Sioux Tribe
Ben Ridgely, Northern Arapaho Tribe
Steven Vance, Cheyenne River Sioux
Erich Longie, Spirit Lake Tribe
Kip Spotted Eagle, Yankton Sioux Tribe
Jeff Desjarlais, Jr., Turtle Mountain Band of Chippewa
Dianne Desrosiers, Sisseton Wahpeton Oyate

Attachment: Table summarizing agency comments on the original Class III archaeology report

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
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o Map symbology has item named “Shovel test – No Dig”. Are these shovel probes that were planned, but not excavated for some reason? If so provide explanation.	These are planned but unexcavated shovel tests. Site descriptions have been updated, as applicable, to explain why some planned shovel tests were not excavated. Typical reasons for not excavating shovel tests include the presence of buried utilities (documented through One-Call markings) or slope.	Sections 5.3 through 5.5
Avoidance, 50 ft buffer minimum, fence, and monitor:		
o Private land: 32BK277, 32BK279, 32BK280, 32BK282, 32MZ3308, 32MZ3309, 32MZ3310, 32MZ3311, 32MZ3325, 32MZ3327, 32WI1494, 32WI1630, 32WI2144, 32WI2388, 32WI2389, 32WI2391, 32WI2392, 32WI2393, 32WI2394, 32WI2398, 32WI2406, 32WI2408.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.3
o US Forest Service Sites: 32MZ3301, 32MZ3314, 32MZ3315, 32MZ3319, 32MZ3320, 32MZ3322, 32MZ3324.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.5
Formally evaluate with site delineation and at least one 1x1 m TU. Submit evaluation plan prior to fieldwork:		
o Private Land: 32BK278, 32MZ3302, 32MZ3306, 32MZ3307, 32MZ3318, 32MZ3323, 32MZ3326, 32MZ3328, 32MZ3329, 32MZ3331, 32WI2390, 32WI2405, 32WI2407, 32WI2409, 32WI2410.	Additional testing (shovel testing and/or the excavation of at least one, 1 x 1 m test unit) was completed at each of these sites in accordance with a testing plan approved by the SHSND. Testing at sites 32WI2390 and 32MZ3328 was suspended following the identification of stone features at these sites; however, the pipeline route has been adjusted to avoid these sites with a minimum 50-ft buffer.	Section 5.3
o US Forest Service Site: 32MZ2346.	While ERM planned to conduct additional testing at this site, the pipeline route was modified prior to this work such that the site is now avoided by the Project with a buffer greater than 100 ft.	Section 5.5
Isolated finds:		
o Discuss subsurface potential on all IFs on a case-by-case basis. If the finds are in a good depositional context, STPs may be necessary to show that these are truly isolates. Minimal site recording may be enough to get a site number for database purposes, but more information is needed to verify that these are truly part of a category that can be written-off as not eligible.	Individual descriptions of isolated finds have been added to the text, including the results of shovel testing or an explanation for why shovel tests were not excavated.	Section 5.7

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Site-by-site comments, private land:		
o 32BK168 – Expand reasoning for Not Eligible Determination both previously and now. Newly recorded site boundary included previously unidentified features. Perhaps site should be unevaluated. Consider formal evaluation and provide updated management recommendations.	ERM conducted site testing at 32BK168 in 2020. Evidence of intact cultural deposits and features was identified during testing and the site is now recommended as eligible for listing in the NRHP. The pipeline route has been modified to avoid this site with a buffer of 57 ft.	Section 5.3
o 32MZ3323 – Discussion mentions "Better Examples" of homesteads. Provide examples.	The description for 32MZ3323 has been updated to incorporate the results of additional testing (shovel testing and the excavation of a 1 x 1 m test unit) in the updated Class III report.	Section 5.3
o 32WI1495 – Actual well shown in Figure 5.3-81 may be visible in figure 5.3-80. Is this location impacted by project? Consider site lead.	The location of the well (which is no longer extant) is discussed in the updated Class III report in conjunction with 32WI1495. ERM has submitted a site lead form for this resource. The suggested boundary of the site lead is 19 ft from Project workspace. The actual location of the well is about 235 ft from Project workspace.	Section 5.3
o 32WI2404 – How is this identified as prehistoric? Could it be a result of natural glacial and/or historic or modern field clearing? Provide evidence. Fence and monitor as necessary.	The interpretation of the feature at 32WI2404 as prehistoric is conservative and based on best professional judgement. Tribal cultural specialists who visited the site with ERM concurred with this interpretation.	Section 5.3
o 32WI2408 – Workspace is extremely close to possible graves. Is the planned route fixed?	The pipeline route has been modified to avoid this site with a buffer of 213 ft.	Section 5.3
Site-by-site comments, US Army Corps of Engineers land:		
o 32MZ976 – Drilling under site is not avoidance as leaks and emergency repairs do consider cultural resources. Formal testing or horizontal avoidance is necessary.	The trajectory of the HDD will be 160 to 180 ft below ground surface where it passes beneath 32WI976. The pipeline will carry gas, not a liquid; the gas would migrate to the surface and dissipate into the air in the event of a leak. Given the depth of the HDD installation, daylighting of the pipeline for repair would not be feasible. If repair is required in the future, the most likely course of action would be to re-install a new segment via HDD, which would require federal authorizations, thereby triggering review of the action under Section 106 of the NHPA. A description of the HDD method has been added to the description of 32WI976 in Section 5.4 of the report. Additional testing at the site is pending and scheduled to be completed this fall. The results will be discussed in an addendum report.	Section 5.4
o 32MZ976 – Show bore location and HDD line on map	A figure showing the HDD alignment with entry and exit points has been added to the description of this site as has a construction alignment sheet. The alignment sheet depicts the HDD in plan and profile.	Section 5.4

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o 32MZ976 – Clarify and provide more evidence for geomorphological hypothesis of A horizon being related to flood deposits. Typically, A horizons show stability rather than accretional or erosional events. Provide more information on why artifacts are interpreted as disturbed rather than in primary context.	The text in the updated Class III report has been updated to address this comment. As noted above, additional testing is planned to occur at 32WI976 this fall, which will provide additional information on the soils present at the site.	Section 5.4
o 32MZ976 – Did cut bank provide additional information on buried soils? Were artifacts identified in cut bank?	The cut bank was examined during the initial survey. As noted above, additional testing is planned to occur at the site this fall with results to be discussed in an addendum report.	Section 5.4
o 32WI976 – Given size and shape of site, additional TUs recommended.		
Comments from the Bureau of Land Management		
o The recommended protection/avoidance measures for unevaluated and eligible archaeological sites in the Class III report are inadequate, particularly regarding stone feature sites. The usual avoidance distance requested/required by the BLM is 100 feet. More than 100 feet is preferred for stone feature sites. Revise protection/avoidance measures buffers for archaeological sites.	WBI Energy has routed the pipeline to avoid unevaluated and eligible sites with a minimum buffer of 50 ft as directed by the SHSND.	Sections 5.3 through 5.5
o Why were indirect effects to archaeological sites not considered? Setting is an important aspect of integrity for stone feature sites. There are numerous archaeological sites within and near the survey corridor that should be analyzed for indirect effects. Revise the report to address indirect effects to archaeological sites.	The report has been updated to include an assessment of physical and non-physical impacts on unevaluated and eligible sites.	Sections 4 and 5.5 through 5.5
o WBI Energy needs to develop a cultural resource monitoring plan for construction.	WBI Energy commits to preparing a monitoring plan for construction.	Sections 5.3 through 5.5
o Update site form for all sites, site leads, and isolated finds regardless of whether they were relocated. Even if a cultural resource could not be relocated, that is still valuable information for the next project/site visit.	Site form updates have been submitted for all sites, isolated finds, and site leads discussed in the updated Class III report	N/A
o WBI Energy should make additional efforts to involve tribes in upcoming 2020 fieldwork and field reviews.	As discussed in more detail in Section 4 of the updated Class III report, WBI Energy retained Beaver Creek Archaeology to coordinate tribal participation in fieldwork in 2020. BCA worked with tribes to document sites as cultural heritage resources. The results of that work will be presented in a separate report. Information on tribal participation in the surveys also is provided in Sections 4 and 5.3 through 5.5 of ERM's updated Class III report	Sections 4 and 5.3 through 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Comments from U.S. Army Corps of Engineers		
o In section 5.4.2, remove figures for 32MZ0598 and move to the previous section.	This comment is addressed in the updated Class III report	Section 5.4
o Figure 5.4-5: Map of Site 32WI976, provide contour lines on this map to show the slope. This information would help to explain why the shovel testing pattern appears the way it does.	Contour lines are provided on Figure 5.4-9 in the updated Class III report.	Section 5.4
o ERM, on behalf of WBI [Energy], identified a second concentration of artifacts in the western side of site 32WI0976 after they started excavating the test unit. Some additional testing is needed here as USACE cannot agree with the recommended determination for this site given the data presented in this report.	Additional testing will be completed at this site in the fall of 2020 with the results presented in an addendum report.	Section 5.4
o USACE recommends that WBI [Energy] conduct a remote sensing evaluation (gradiometer or conductivity) at site 32WI0976. This would be the best way to produce measurable data regarding the presence/absence of subsurface features at the site.	A remote sensing survey of the site was completed in the summer of 2020. The results of the survey were used to prepare a testing plan for 32WI976. Additional testing at the site will occur this fall with the results presented in an addendum report.	Section 5.4
Comments from the U.S. Forest Service		
o The map showing previously recorded cultural resources within a one-mile radius is only included in the overall Class III and not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Figure 1.1-2 shows the Forest Service surface and differentiates between the survey corridor and the survey corridor on Forest Service surface; however, the survey corridor on Forest Service surface and the actual Forest Service surface displayed don't match.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Sites 32MZ2347 (Historical Archaeological) and 32MZ3278 (Cairn) are located immediately adjacent to the survey corridor but are not discussed. Please discuss.	Based on route modifications, 32MZ3278 was visited in 2020 and the site boundary expanded based on the findings. A discussion of the site is provided in the updated Class III report. 32MZ2347 is outside the inventory corridor for the Project; however, we have included a discussion of this site in the Class III inventory report.	Section 5.5
o Site 32MZ145 site form update does not appear to have been performed. Why? Was an attempt made to actually relocate the site? Also, according to the site form, a THPO representative requested avoidance in 2013. More work on this site is probably needed.	When 32MZ145 was first recorded in 1979, it was characterized as two stone cairns. Subsequent investigations described the site as consisting of a single historic rock clearing pile on the west side of Highway 1806, noting that the second pile was likely destroyed by construction of the highway. ERM's survey in 2019 was limited to the east side of Highway 1806, which explains why we did not relocate the site at that time. In 2020, ERM conducted additional survey on USFS lands, examining a corridor on the west side of Highway 1806. 32MZ145 was relocated as a result of this work. The site is discussed in the updated Class III report. Tribal cultural specialists who accompanied ERM during the 2020 field investigation concurred that 32MZ145 is historic rock clearing pile.	Section 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o Site 32MZ2346 and 32MZ144: it is very improbable and therefore suspicious that there are zero artifacts and one artifact respectively at sites with historic dumps.	Sites 32MZ2346 and 32MZ144 are both previously recorded historic sites which ERM revisited and recorded during the survey for the Project. Cultural material was observed at both sites as described in the updated Class III report. ERM expanded the boundaries of 32MZ2346 to encompass two previously unreported features at the site. One artifact–a commemorative coin–was collected from 32MZ2346 because of its uniqueness. No artifacts were collected from 32MZ144. Expanded descriptions of both sites are provided in the updated Class III report.	Section 5.5
o Additional survey is shown as needed near site 32MZ3278 on the maps in the overall Class III report but not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	Additional survey was completed in 2020 on USFS lands in the vicinity of 32MZ3278, which was relocated. A description of the site is provided in the updated Class III report.	Section 5.5
o The recommended avoidance and fencing measures are inadequate, especially for stone feature sites.	All stone feature sites have been avoided with a minimum buffet of 50 ft. Additionally, for sites between 50 and 100 ft of Project workspace WBI Energy commits to fencing and monitoring the sites during construction. WBI Energy will provide a monitoring plan for agency review.	Section 5.5
o A monitoring plan is needed.	WBI Energy commits to providing a construction monitoring plan as discussed in the updated Class III report.	
o Updates should have been conducted for all sites, site leads, and IFs [isolated finds] regardless of whether or not they were relocated.	Site form updates have been submitted for all applicable sites, isolated finds, and site leads discussed in the report	N/A
o The discussion of site leads during fieldwork is inadequate.	Site leads are discussed in Section 5.6 of the updated Class III report.	Section 5.6
o Provide specific distances between site boundaries and the edge of the workspace.	Distances between sites and Project workspaces have been added to summary tables and site descriptions throughout the updated Class III report.	Sections 5.3 through 5.5
o Provide a map of shovel testing performed outside of site boundaries. The report explains the testing strategy during survey but never discusses or shows specifics except within site boundaries.	The route maps provided as Appendix B depict survey methodology in addition to survey coverage and results.	Appendix B
o Identify the level of tribal involvement in the survey.	Tribal participation in field surveys is discussed in Sections 4 and 5.3 through 5.5 of the updated Class III report.	Sections 4 and 5.3 through 5.5
o Discuss whether indirect effects to archaeological sites were considered.	For unevaluated sites, we have added an assessment of non-physical impacts on setting.	Sections 5.3 through 5.5

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Call Log

Log of Telephone Conversation

Call To/From Whom	Andrew Clark
Phone number	701.328.3574
Company	SHSND
ERM Contact	Kevin Malloy
Phone number	906-285-0361
Date	09/17/2020
Time of Conversation	9:12 am
Reference	North Bakken Expansion Project (Project)
Signature	

LOG OF CONVERSATION

Andy Clark, State Archaeologist for North Dakota, returned my call from the day before. I discussed the site visits that took place on Friday 9/11/2020 with other agencies and the Assiniboine & Sioux Tribes and asked if Andy had any questions regarding the Project. Andy has some questions he will direct to FERC, but nothing for ERM or WBI Energy.

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Federally-Recognized Indian Tribes

North Bakken Expansion Project
Summary of Communications with Federally Recognized Indian Tribes

Tribe	Date	Summary	Filing Date
Standing Rock Sioux Tribe	4-15-19	Introductory letter, including a description and map of the North Bakken Expansion Project (Project), and request for comment on the Project, sent to the Chairman.	2-14-20
	4-15-19	Introductory letter, including a Project description and map, and request for comment on the Project, sent to the Tribal Historic Preservation Office (THPO).	2-14-20
	5-10-19	Follow-up phone call to the Chairman's office; voice mailbox full.	2-14-20
	5-10-19	Follow-up phone call to the THPO; voicemail message.	2-14-20
	5-15-19	Follow-up phone call to the Chairman's office and the THPO.	2-14-20
	6-27-19	Follow-up phone call to the THPO; voicemail message.	2-14-20
	6-27-19	Follow-up email to the THPO transmitting a copy of the 4-15-19 introductory letter.	2-14-20
	7-17-19	Letter inviting the Chairman to participate in WBI Energy Transmission, Inc.'s (WBI Energy) open houses.	2-14-20
	7-17-19	Letter inviting the THPO to participate in WBI Energy's open houses.	2-14-20
	7-30-19	Project update letter to the THPO, including a Project description and map, and a renewed request for comment on the Project.	2-14-20
	2-28-20	Letter to the Chairman regarding the filing of WBI Energy's application with FERC.	7-8-20
	2-28-20	Letter to the THPO regarding the filing of WBI Energy's application with FERC.	7-8-20
	9-16-20	Letter to the THPO transmitting the updated Class III Archaeological Survey Report, Geomorphology Report, and Addendum Class III Structures Report (with certified mail receipt).	*This filing*
	9-17-20	Minutes from site visits to review features identified at 32MZ3382, 32MZ3383, and 32MZ3385.	*This filing*
Sisseton-Wahpeton Oyate of the Lake Traverse Reservation	4-15-19	Introductory letter, including a Project description and map, and request for comment on the Project, sent to the Chairwoman.	2-14-20
	4-15-19	Introductory letter, including a Project description and map, and request for comment on the Project, sent to the THPO.	2-14-20
	5-10-19	Follow-up phone call to the THPO; an additional copy of the 4-15-19 introductory letter was requested.	2-14-20
	5-10-19	Follow-up email to the THPO transmitting an additional copy of the 4-15-19 introductory letter.	2-14-20
	5-15-19	Follow-up email sent to the Chairman transmitting an additional copy of the 4-15-19 introductory letter.	2-14-20
	6-27-19	Follow-up phone call to the THPO; voicemail message left.	2-14-20
	6-27-19	Follow-up email to the THPO transmitting an additional copy of the 4-15-19 introductory letter.	2-14-20
	7-17-19	Letter inviting the Chairwoman to participate in WBI Energy's open houses.	2-14-20
	7-17-19	Letter inviting the THPO to participate in WBI Energy's open houses.	2-14-20
	7-30-19	Project update letter to the THPO, including a Project description and map, and a renewed request for comment on the Project.	2-14-20
	2-28-20	Letter to the Chairman regarding the filing of WBI Energy's application with FERC.	7-8-20

North Bakken Expansion Project
Summary of Communications with Federally Recognized Indian Tribes

Tribe	Date	Summary	Filing Date
	2-28-20	Letter to the THPO regarding the filing of WBI Energy's application with FERC.	7-8-20
	9-16-20	Letter to the THPO transmitting the updated Class III Archaeological Survey Report, Geomorphology Report, and Addendum Class III Structures Report (with certified mail receipt).	*This filing*
Turtle Mountain Band of Chippewa Indians	4-15-19	Introductory letter, including a Project description and map, and request for comment on the Project, sent to the Chairman.	2-14-20
	4-15-19	Introductory letter, including a Project description and map, and request for comment on the Project, sent to the THPO.	2-14-20
	5-10-19	Follow-up phone call to the THPO; an additional copy of the 4-15-19 introductory letter was requested.	2-14-20
	5-10-19	Follow-up email to the Chairman transmitting an additional copy of the 4-15-19 introductory letter.	2-14-20
	5-10-19	Follow-up email to the THPO transmitting an additional copy of the 4-15-19 introductory letter.	2-14-20
	6-27-19	Follow up phone call to the THPO; the tribe does not plan to comment on the Project.	2-14-20
	7-17-19	Letter inviting the Chairman to participate in WBI Energy's open houses.	2-14-20
	7-17-19	Letter inviting the THPO to participate in WBI Energy's open houses.	2-14-20
	2-28-20	Letter to the Chairman regarding the filing of WBI Energy's application with FERC.	7-8-20
	2-28-20	Letter to the THPO regarding the filing of WBI Energy's application with FERC.	7-8-20
	9-16-20	Letter to the THPO transmitting the updated Class III Archaeological Survey Report, Geomorphology Report, and Addendum Class III Structures Report (with certified mail receipt and delivery confirmation).	*This filing*
Three Affiliated Tribes of the Fort Berthold Reservation	4-15-19	Introductory letter, including a Project description and map, and request for comment on the Project, sent to the Chairman.	2-14-20
	4-15-19	Introductory letter, including a Project description and map, and request for comment on the Project, sent to the THPO.	2-14-20
	5-10-19	Follow-up phone call to the Chairman's office, who confirmed receipt of the 4-15-19 introductory letter.	2-14-20
	5-10-19	Follow-up phone call to THPO; no answer.	2-14-20
	5-10-19	Follow-up phone call to THPO; no answer.	2-14-20
	5-15-19	Follow-up email to the THPO transmitting a copy of the 4-15-19 introductory letter.	2-14-20
	6-26-19	Follow-up phone call to the THPO; an additional copy of the 4-15-19 introductory letter was requested.	2-14-20
	6-26-19	Follow-up email to the THPO transmitting an additional copy of the 4-15-19 introductory letter.	2-14-20
	7-17-19	Letter inviting the Chairman to participate in WBI Energy's open houses.	2-14-20
	7-17-19	Letter inviting the THPO to participate in WBI Energy's open houses.	2-14-20
	7-30-19	Project update letter to the THPO, including a Project description and map, and a renewed request for comment on the Project.	2-14-20
	8-5-19	Phone call from the Director of the Tree Affiliated Tribes Pipeline Authority (TAT Pipeline Authority) regarding the Project.	2-14-20

North Bakken Expansion Project Summary of Communications with Federally Recognized Indian Tribes			
Tribe	Date	Summary	Filing Date
	8-6-19	Email from the Director of the TAT Pipeline Authority regarding the Project open houses.	2-14-20
	8-6-19	Email to the Director of the TAT Pipeline Authority requesting a meeting.	2-14-20
	8-7-19	Meeting with the Director of the TAT Pipeline Authority at the Project open house in Watford City, North Dakota, to discuss the Project and pipeline safety.	2-14-20
	8-23-19	Phone call to the THPO regarding tribal participation in the field survey of U.S. Army Corps of Engineers (COE) and other lands in the Project area.	2-14-20
	8-23-19	Email to the THPO regarding tribal participation in the field survey of COE and other lands in the Project area and transmitting copies of previous correspondence.	2-14-20
	9-3-19	Email from the TAT Pipeline Authority requesting plan and profile alignment sheets for the proposed crossing of the Missouri River (Lake Sakakawea).	2-14-20
	9-5-19	Email to the TAT Pipeline Authority transmitting a preliminary bore profile for the proposed crossing of the Missouri River (Lake Sakakawea).	2-14-20
	12-10-19	Email to the Director of the TAT Pipeline Authority regarding the status of the Project and the proposed HDD at the Missouri River (Lake Sakakawea).	4-20-20
	2-14-20	Letter to the THPO transmitting the Class III Archaeological Survey Report, standalone archaeological survey report for USFS lands, and Class III Historic Structures Report. (Note: The delivery receipt for this report, dated 2-19-20, was filed on 4-20-20).	2-14-20
	2-28-20	Letter to the Chairman regarding the filing of WBI Energy's application with FERC.	7-8-20
	2-28-20	Letter to the THPO regarding the filing of WBI Energy's application with FERC.	7-8-20
	3-3-20	Email to the Director of the TAT Pipeline Authority regarding the status of the Project and the proposed HDD at the Missouri River (Lake Sakakawea).	4-20-20
	3-3-20	Letter to the Director of the TAT Pipeline Authority regarding the filing of WBI Energy's application with FERC.	4-20-20
	3-3-20	Letter to the TAT Pipeline Authority regarding the filing of WBI Energy's application with FERC.	4-20-20
	3-30-20	Email to the THPO transmitting a letter regarding the status of the Project and plans for field surveys and site testing in 2020.	4-20-20
	3-30-20	Letter to the THPO providing an update on the status of the Project and plans for field surveys and site testing in 2020.	4-20-20
	3-30-20	Email from the THPO confirming the tribe's interest in participating in the 2020 field surveys.	4-20-20
	3-30-20	Emails with the THPO coordinating a call to discuss the tribe's participation in the 2020 field surveys.	4-20-20
	3-31-20	Invitation email to the THPO for a call on 4-2-20 to discuss the Project and the tribe's participation in the 2020 field surveys.	4-20-20
	3-31-20	Email accepting WBI Energy's invitation to participate in a call on 4-2-20 to discuss the Project and the tribe's participation in the 2020 field surveys.	4-20-20
	4-2-20	Call to the THPO to coordinate a meeting to discuss the Project and the tribe's participation in the 2020 field surveys; voice mail message.	4-20-20

North Bakken Expansion Project Summary of Communications with Federally Recognized Indian Tribes			
Tribe	Date	Summary	Filing Date
	4-2-20	Email to the THPO to coordinate a meeting to discuss the Project and the tribe's participation in the 2020 field surveys.	4-20-20
	4-8-20	Call to the THPO to coordinate a meeting to discuss the Project and the tribe's participation in the 2020 field surveys; voice mail message.	4-20-20
	4-8-20	Email to the THPO to coordinate a meeting to discuss the Project and the tribe's participation in the 2020 field surveys.	4-20-20
	4-22-20	Email (with read receipt) to the THPO providing an update on the survey plans for 2020.	7-8-20
	9-7-20	Email to the THPO regarding the recovery of bone fragments at 32MZ3313 in 2019.	*This filing*
	9-16-20	Letter to the THPO transmitting the updated Class III Archaeological Survey Report, Geomorphology Report, and Addendum Class III Structures Report (with Fed Ex delivery receipt).	*This filing*
Spirit Lake Sioux Tribe	4-15-19	Introductory letter, including a Project description and map, and request for comment on the Project, sent to the Chairwoman.	2-14-20
	4-15-19	Introductory letter, including a Project description and map, and request for comment on the Project, sent to the THPO.	2-14-20
	5-10-19	Follow-up phone call to the THPO; voice mailbox full.	2-14-20
	5-10-19	Follow-up phone call to the Chairwoman; voicemail unavailable.	2-14-20
	5-10-19	Follow-up email to the Chairwoman transmitting an additional copy of the 4-15-19 introductory letter.	2-14-20
	5-15-19	Follow-up phone call to THPO; an additional copy of the 4-15-19 introductory letter was requested.	2-14-20
	5-15-19	Follow-up email to the THPO transmitting an additional copy of the 4-15-19 introductory letter.	2-14-20
	6-27-19	Follow-up phone call to the THPO; voicemail message.	2-14-20
	6-27-19	Follow-up email to the THPO transmitting an additional copy of the 4-15-19 introductory letter.	2-14-20
	7-17-19	Letter inviting the Chairwoman to participate in WBI Energy's open houses.	2-14-20
	7-17-19	Letter inviting the THPO to participate in WBI Energy's open houses.	2-14-20
	7-30-19	Project update letter to the THPO, including a Project description and map, and a renewed request for comment on the Project.	2-14-20
	2-28-20	Letter to the THPO regarding the filing of WBI Energy's application with FERC.	7-8-20
	2-28-20	Letter to the THPO regarding the filing of WBI Energy's application with FERC.	7-8-20
	3-2-20	Call from the THPO; voice mail message requesting a return call.	7-8-20
	3-3-20	Return call to the THPO; voice mail message.	7-8-20
	3-4-20	Call from the THPO requesting an additional copy of WBI Energy's letter dated 2-28-28.	7-8-20
	3-4-20	Email to the THPO transmitting a copy of WBI Energy's letter dated 2-28-20.	7-8-20
	9-16-20	Letter to the THPO transmitting the updated Class III Archaeological Survey Report, Geomorphology Report, and Addendum Class III Structures Report (with certified mail receipt and confirmation of availability for pickup).	*This filing*

North Bakken Expansion Project Summary of Communications with Federally Recognized Indian Tribes			
Tribe	Date	Summary	Filing Date
Yankton Sioux Tribe	4-15-19	Introductory letter, including a Project description and map, and request for comment on the Project, sent to the Chairman.	2-14-20
	4-15-19	Introductory letter, including a Project description and map, and request for comment on the Project, sent to the THPO.	2-14-20
	5-10-19	Follow-up phone call to the THPO; voicemail message.	2-14-20
	5-10-19	Follow-up phone call to the Chairman; voicemail message.	2-14-20
	6-27-19	Follow-up phone call to the THPO; an additional copy of the 4-15-19 introductory letter was requested.	2-14-20
	6-27-19	Follow-up email to the THPO transmitting an additional copy of the 4-15-19 introductory letter.	2-14-20
	6-27-19	Phone call from THPO regarding previous email.	2-14-20
	6-27-19	Follow-up email to the THPO transmitting an additional copy of the 4-15-19 introductory letter and requesting a copy of the tribe's consultation protocols.	2-14-20
	7-17-19	Letter inviting the Chairman to participate in WBI Energy's open houses.	2-14-20
	7-17-19	Letter inviting the THPO to participate in WBI Energy's open houses.	2-14-20
	7-30-19	Project update letter to the THPO, including a Project description and map, and a renewed request for comment on the Project.	2-14-20
	2-28-20	Letter to the Chairman regarding the filing of WBI Energy's application with FERC.	7-8-20
	2-28-20	Letter to the THPO regarding the filing of WBI Energy's application with FERC.	7-8-20
	9-16-20	Letter to the THPO transmitting the updated Class III Archaeological Survey Report, Geomorphology Report, and Addendum Class III Structures Report (with certified mail receipt and confirmation of availability for pickup).	*This filing*
Northern Cheyenne Tribe	4-15-19	Introductory letter, including a Project description and map, and request for comment on the Project, sent to the President.	2-14-20
	4-15-19	Introductory letter, including a Project description and map, and request for comment on the Project, sent to the THPO.	2-14-20
	5-10-19	Follow-up phone call to the THPO; message left.	2-14-20
	5-10-19	Follow-up phone call to the President's office, voicemail message.	2-14-20
	5-14-19	Email from the THPO transmitting a response letter.	2-14-20
	5-14-19	Letter from the THPO requesting copies of survey reports for review.	2-14-20
	5-20-19	Email acknowledging receipt of the THPO's 5-14-19 letter.	2-14-20
	7-17-19	Letter inviting the President to participate in WBI Energy's open houses.	2-14-20
	7-17-19	Letter inviting the THPO to participate in WBI Energy's open houses.	2-14-20
	7-30-19	Project update letter to the THPO, including a Project description and map, and a renewed request for comment on the Project.	2-14-20
	8-30-19	Email to the THPO regarding tribal involvement in field surveys and reiterating WBI Energy's previous commitment to provide copies of reports.	2-14-20
	9-5-19	Phone call to the THPO regarding the Project and survey logistics; voice mail message. (Note: This call is documented in WBI Energy's email to the THPO on 9-5-19.)	2-14-20
	9-5-19	Email to the THPO regarding the Project and survey logistics.	2-14-20

North Bakken Expansion Project
Summary of Communications with Federally Recognized Indian Tribes

Tribe	Date	Summary	Filing Date
	9-6-19	Phone call to the THPO regarding the Project and survey logistics; message left.	2-14-20
	10-9-19	Email from the THPO regarding the status of field surveys	2-14-20
	10-9-19	Email from the THPO regarding the status of field surveys	2-14-20
	10-10-19	Email to the THPO regarding the status of field surveys	2-14-20
	2-14-20	Letter to the THPO transmitting the Class III Archaeological Survey Report, standalone archaeological survey report for USFS lands, and Class III Historic Structures Report. (Note: The delivery receipt for this report, dated 2-21-20, was filed on 4-20-20).	2-14-20
	2-28-20	Letter to the President regarding the filing of WBI Energy's application with FERC.	7-8-20
	2-28-20	Letter to the THPO regarding the filing of WBI Energy's application with FERC.	7-8-20
	3-13-20	Phone call from the THPO regarding the status of the tribe's review of the Class III Archaeological Survey Report.	4-20-20
	3-19-20	Phone call from the THPO regarding the status of the tribe's review of the Class III Archaeological Survey Report and the tribe's interest in participating in the 2020 field surveys.	4-20-20
	3-30-20	Phone call to the THPO to confirm contact information for the tribe.	4-20-20
	3-30-20	Email to the THPO transmitting a letter regarding the status of the Project and plans for field survey and site testing in 2020.	4-20-20
	3-30-20	Letter to the THPO providing an update on the status of the Project and plans for field surveys and site testing in 2020.	4-20-20
	3-31-20	Phone call to the THPO to confirm the tribe's receipt of WBI Energy's email and letter sent on 3-30-20 and to schedule a meeting to discuss the tribe's participation in the 2020 field surveys.	4-20-20
	3-31-20	Invitation email to the THPO for a call on 4-7-20 to discuss the Project and the tribe's participation in the 2020 field surveys.	4-20-20
	4-7-20	Teleconference to discuss the tribe's participation in the 2020 field surveys.	4-20-20
	4-22-20	Email (with read receipt) to the THPO providing an update on the survey plans for 2020.	7-8-20
	9-16-20	Letter to the THPO transmitting the updated Class III Archaeological Survey Report, Geomorphology Report, and Addendum Class III Structures Report (with certified mail receipt and delivery confirmation).	*This filing*
Cheyenne River Sioux Tribe	4-15-19	Introductory letter, including a Project description and map, and request for comment on the Project, sent to the Chairman.	2-14-20
	4-15-19	Introductory letter, including a Project description and map, and request for comment on the Project, sent to the THPO.	2-14-20
	5-10-19	Follow-up phone call to the THPO; message left.	2-14-20
	5-10-19	Follow-up phone call to the Chairman's office; message left.	2-14-20
	7-17-19	Letter inviting the Chairman to participate in WBI Energy's open houses.	2-14-20
	7-17-19	Letter inviting the THPO to participate in WBI Energy's open houses.	2-14-20
	7-30-19	Project update letter to the THPO, including a Project description and map, and a renewed request for comment on the Project.	2-14-20

North Bakken Expansion Project
Summary of Communications with Federally Recognized Indian Tribes

Tribe	Date	Summary	Filing Date
	2-28-20	Letter to the THPO transmitting the Class III Archaeological Survey Report, standalone archaeological survey report for USFS lands, and Class III Historic Structures Report. (Note: The delivery receipt for this report, dated 3-4-20, was filed on 4-20-20).	4-20-20
	2-28-20	Letter to the Chairman regarding the filing of WBI Energy's application with FERC.	7-8-20
	2-28-20	Letter to the THPO regarding the filing of WBI Energy's application with FERC.	7-8-20
	3-30-20	Email to the THPO transmitting a letter regarding the status of the Project and plans for field surveys and site testing in 2020.	4-20-20
	3-30-20	Letter to the THPO providing an update on the status of the Project and plans for field surveys and site testing in 2020.	4-20-20
	4-8-20	Email to the THPO to confirm the tribe's receipt of WBI Energy's email and letter sent on 3-30-20.	4-20-20
	4-13-20	Phone call to the THPO to confirm the tribe's receipt of WBI Energy's email and letter sent on 3-30-20; message left.	4-20-20
	4-22-20	Email to the THPO requesting confirmation of the THPO's receipt of WBI Energy's letter dated 3-3-20 and email sent on 4-8-20 and providing information on the survey plans for 2020.	7-8-20
	9-16-20	Letter to the THPO transmitting the updated Class III Archaeological Survey Report, Geomorphology Report, and Addendum Class III Structures Report (with certified mail receipt and delivery confirmation).	*This filing*
Assiniboine and Sioux Tribes of the Fort Peck Reservation	4-15-19	Introductory letter, including a Project description and map, and request for comment on the Project, sent to the Chairman.	2-14-20
	4-15-19	Introductory letter, including a Project description and map, and request for comment on the Project, sent to the THPO.	2-14-20
	5-10-19	Follow-up phone call to THPO.	2-14-20
	5-10-19	Follow-up email to the Chairman transmitting an additional copy of the 4-15-19 introductory letter.	2-14-20
	5-15-19	Follow-up email to the THPO transmitting an additional copy of the 4-15-19 introductory letter.	2-14-20
	5-15-19	Email from the THPO requesting additional information on the Project and a meeting with WBI Energy.	2-14-20
	5-16-19	Email to the THPO responding to the THPO's request for additional information and transmitting an updated introductory letter dated 5-16-19.	2-14-20
	5-16-19	Updated introductory letter, including a Project description and map, and request for comment on the Project; sent to the THPO.	2-14-20
	6-13-19	Meeting to discuss the Project and cultural resources field surveys. (Note: The THPO from The Fort Belknap Indian Community also participated in this meeting.)	2-14-20
	6-27-19	Email to the THPO transmitting a scope of work (letter dated 6-27-19) for tribal surveys for the Project.	2-14-20
	6-27-19	Letter to the THPO providing a scope of work for tribal surveys for the Project.	2-14-20
	7-15-19	Email from the THPO advising WBI Energy that the tribe will not participate in field surveys for the Project.	2-14-20
	7-17-19	Letter inviting the Chairman to participate in WBI Energy's open houses.	2-14-20
	7-17-19	Letter inviting the THPO to participate in WBI Energy's open houses.	2-14-20

North Bakken Expansion Project Summary of Communications with Federally Recognized Indian Tribes			
Tribe	Date	Summary	Filing Date
	7-18-19	Email to the THPO acknowledging receipt of the THPO's 7-15-19 email regarding field surveys.	2-14-20
	7-30-19	Project update letter to the THPO, including a Project description and map, and a renewed request for comment on the Project.	2-14-20
	9-4-19	Email from the THPO requesting an update on the status of the cultural resources survey.	2-14-20
	9-5-19	Email to the THPO providing an update on the status of the archaeological survey and advising the THPO of an upcoming survey of COE lands.	2-14-20
	2-14-20	Letter to the THPO transmitting the Class III Archaeological Survey Report, standalone archaeological survey report for USFS lands, and Class III Historic Structures Report. (Note: The delivery receipt for this report, dated 2-21-20, was filed on 4-20-20).	2-14-20
	2-28-20	Letter to the Chairman regarding the filing of WBI Energy's application with FERC.	7-8-20
	2-28-20	Letter to the THPO regarding the filing of WBI Energy's application with FERC.	7-8-20
	3-30-20	Email to the THPO transmitting a letter regarding the status of the Project and plans for field surveys and site testing in 2020.	4-20-20
	3-30-20	Letter to the THPO providing an update on the status of the Project and plans for field surveys and site testing in 2020.	4-20-20
	3-31-20	Phone call to the THPO to confirm the tribe's receipt of WBI Energy's email and letter sent on 3-30-20; voice mail message.	4-20-20
	4-8-20	Email to the THPO to confirm the tribe's receipt of WBI Energy's email and letter sent on 3-30-20.	4-20-20
	4-13-20	Phone call to the THPO to confirm the tribe's receipt of WBI Energy's email and letter sent on 3-30-20; voice mail message.	4-20-20
	4-22-20	Email to the THPO providing an update on the Project and survey plans for 2020.	7-8-20
	4-27-20	Call with the THPO to discuss the Class III survey reports sent to the THPO on 2-28-20 and the tribe's participation in the 2020 field surveys.	7-8-20
	9-11-20	Minutes from site visits to review features identified at 32MZ3379, 32MZ3380, 32MZ3382, 32MZ3383, and 32MZ3385.	*This filing*
	9-16-20	Letter to the THPO transmitting the updated Class III Archaeological Survey Report, Geomorphology Report, and Addendum Class III Structures Report (with certified mail receipt and delivery confirmation).	*This filing*
Rosebud Sioux Tribe	4-15-19	Introductory letter, including a Project description and map, and request for comment on the Project, sent to the President.	2-14-20
	4-15-19	Introductory letter, including a Project description and map, and request for comment on the Project, sent to the THPO.	2-14-20
	5-10-19	Follow-up phone call to the President; message left.	2-14-20
	5-10-19	Follow-up phone call to the THPO; message left.	2-14-20
	6-27-19	Follow-up phone call to the THPO; an additional copy of the 4-15-19 introductory letter was requested.	2-14-20
	6-27-19	Follow-up email to the THPO transmitting an additional copy of the 4-15-19 introductory letter.	2-14-20
	6-27-19	Email response from the THPO; the tribe is interested in the Project and will participate in future Project meetings.	2-14-20

North Bakken Expansion Project
Summary of Communications with Federally Recognized Indian Tribes

Tribe	Date	Summary	Filing Date
	6-28-19	Email acknowledging receipt of the THPO's request to participate in future meetings and expression of interest in the Project.	2-14-20
	6-28-19	Phone call from the THPO's office requesting information on the Project and an additional copy of the 4-15-19 introductory letter.	2-14-20
	6-28-19	Follow-up email to the THPO transmitting an additional copy of the 4-15-19 introductory letter.	2-14-20
	7-17-19	Letter inviting the President to participate in WBI Energy's open houses.	2-14-20
	7-17-19	Letter inviting the THPO to participate in WBI Energy's open houses.	2-14-20
	7-30-19	Project update letter to the THPO, including a Project description and map, and a renewed request for comment on the Project.	2-14-20
	8-23-19	Phone call to the THPO regarding tribal participation in the field survey of COE and other lands in the Project area; voicemail message.	2-14-20
	8-23-19	Phone call to the THPO regarding tribal participation in the field survey of COE and other lands in the Project area; voicemail message.	2-14-20
	8-29-19	Email to the THPO regarding tribal participation in the field survey of COE and other lands in the Project area.	2-14-20
	8-30-19	Email from the THPO confirming the tribe's interest in participating in the field survey of COE lands.	2-14-20
	9-4-19	Phone call from the THPO confirming the tribe's interest in participating in the field survey of COE lands.	2-14-20
	9-5-19	Phone call to the THPO to coordinate the tribe's participation in the field survey of COE lands. (Note: This call is documented in WBI Energy's email to the THPO on 9-5-19.)	2-14-20
	9-5-19	Email to the THPO to coordinate the tribe's participation in the field survey of COE lands.	2-14-20
	9-5-19	Email from the THPO to coordinate the tribe's participation in the field survey of COE lands.	2-14-20
	9-17-19	Phone call to the THPO to coordinate the tribe's participation in the field survey of COE lands.	2-14-20
	9-17-19	Email from the THPO to coordinate the tribe's participation in the field survey of COE lands.	2-14-20
	9-17-19	Email to the THPO to coordinate the tribe's participation in the field survey of COE lands.	2-14-20
	9-19-19	Email to the THPO (and COE) to coordinate the tribe's participation in the field survey of COE lands.	2-14-20
	9-19-19	Phone call from the THPO to coordinate the tribe's participation in the field survey of COE lands.	2-14-20
	9-23-19	Phone call from the THPO to coordinate the tribe's participation in the field survey of COE lands.	2-14-20
	9-23-19	Email to the THPO to coordinate the tribe's participation in the field survey of COE lands.	2-14-20
	9-23-19	Email to the THPO to coordinate the tribe's participation in the field survey of COE lands.	2-14-20
	10-9-19	Phone call to the THPO to coordinate the tribe's participation in field surveys	2-14-20
	2-14-20	Letter to the THPO transmitting the Class III Archaeological Survey Report, standalone archaeological survey report for USFS lands, and Class III Historic Structures Report. (Note: The delivery receipt for this report, dated 2-21-20, was filed on 4-20-20).	2-14-20

North Bakken Expansion Project Summary of Communications with Federally Recognized Indian Tribes			
Tribe	Date	Summary	Filing Date
	2-28-20	Letter to the President regarding the filing of WBI Energy's application with FERC.	7-8-20
	2-28-20	Letter to the THPO regarding the filing of WBI Energy's application with FERC.	7-8-20
	3-30-20	Email to the THPO transmitting a letter regarding the status of the Project and plans for field surveys and site testing in 2020.	4-20-20
	3-30-20	Letter to the THPO providing an update on the status of the Project and plans for field surveys and site testing in 2020.	4-20-20
	3-31-20	Phone call to the THPO to confirm the tribe's receipt of WBI Energy's email and letter sent on 3-30-20; voice mail message.	4-20-20
	4-8-20	Email to the THPO to confirm the tribe's receipt of WBI Energy's email and letter sent on 3-30-20.	4-20-20
	4-13-20	Phone call to the THPO to confirm the tribe's receipt of WBI Energy's email and letter sent on 3-30-20; voice mail message.	4-20-20
	4-22-2	Email to the THPO providing an update on the Project and survey plans for 2020.	7-8-20
	9-16-20	Letter to the THPO transmitting the updated Class III Archaeological Survey Report, Geomorphology Report, and Addendum Class III Structures Report (with certified mail receipt and confirmation of availability for pickup).	*This filing*
	9-17-20	Minutes from site visits to review features identified at 32MZ3382, 32MZ3383, and 32MZ3385.	*This filing*
Oglala Sioux Tribe	4-15-19	Introductory letter, including a Project description and map, and request for comment on the Project, sent to the President.	2-14-20
	4-15-19	Introductory letter, including a Project description and map, and request for comment on the Project, sent to the THPO.	2-14-20
	5-10-19	Follow-up phone call to the THPO, message left.	2-14-20
	5-10-19	Follow-up phone call to the President's office; an additional copy of the 4-15-19 introductory letter was requested.	2-14-20
	5-10-19	Follow-up email to the President transmitting an additional copy of the 4-15-19 introductory letter.	2-14-20
	6-27-19	Follow-up phone call to the THPO.	2-14-20
	6-28-19	Follow-up phone call to the THPO, who confirmed receipt of the 4-15-19 introductory letter.	2-14-20
	7-17-19	Letter inviting the President to participate in WBI Energy's open houses.	2-14-20
	7-17-19	Letter inviting the THPO to participate in WBI Energy's open houses.	2-14-20
	7-30-19	Project update letter to the THPO, including a Project description and map, and a renewed request for comment on the Project.	2-14-20
	2-14-20	Letter to the THPO transmitting the Class III Archaeological Survey Report, standalone archaeological survey report for USFS lands, and Class III Historic Structures Report. (Note: The delivery receipt for this report, dated 3-16-20, was filed on 4-20-20).	2-14-20
	2-28-20	Letter to the President regarding the filing of WBI Energy's application with FERC.	7-8-20
	2-28-20	Letter to the THPO regarding the filing of WBI Energy's application with FERC.	7-8-20
	3-13-20	Phone call to the THPO to confirm receipt of the Class III reports; voice mail message.	4-20-20

North Bakken Expansion Project Summary of Communications with Federally Recognized Indian Tribes			
Tribe	Date	Summary	Filing Date
	3-30-20	Email to the THPO transmitting a letter regarding the status of the Project and plans for field surveys and site testing in 2020.	4-20-20
	3-30-20	Letter to the THPO providing an update on the status of the Project and plans for field surveys and site testing in 2020.	4-20-20
	4-8-20	Email to the THPO to confirm the tribe's receipt of WBI Energy's email and letter sent on 3-30-20.	4-20-20
	4-13-20	Phone call to the THPO to confirm the tribe's receipt of WBI Energy's email and letter sent on 3-30-20; the was no answer and the voice mailbox was full.	4-20-20
	4-22-20	Email requesting confirmation of the THPO's receipt of WBI Energy's letter dated 3-3-20 and email send on 4-8-20, and providing information on the survey plans for 2020.	7-8-20
	9-16-20	Letter to the THPO transmitting the updated Class III Archaeological Survey Report, Geomorphology Report, and Addendum Class III Structures Report (with certified mail receipt and confirmation of availability for pickup).	*This filing*
Northern Arapaho Tribe of Wind River Indian Reservation	4-15-19	Introductory letter, including a Project description and map, and request for comment on the Project, sent to the Chairman.	2-14-20
	4-15-19	Introductory letter, including a Project description and map, and request for comment on the Project, sent to the THPO.	2-14-20
	5-10-19	Follow-up phone call to the THPO; voicemail message.	2-14-20
	6-27-19	Follow-up phone call to the THPO; an additional copy of the 4-15-19 introductory letter was requested.	2-14-20
	6-27-19	Follow-up email to the THPO transmitting an additional copy of the 4-15-19 introductory letter.	2-14-20
	7-17-19	Letter inviting the President to participate in WBI Energy's open houses.	2-14-20
	7-17-19	Letter inviting the THPO to participate in WBI Energy's open houses.	2-14-20
	7-30-19	Project update letter, including a Project description and map, and a renewed request for comment on the Project.	2-14-20
	2-28-20	Letter to the Chairman regarding the filing of WBI Energy's application with FERC.	7-8-20
	2-28-20	Letter to the THPO regarding the filing of WBI Energy's application with FERC.	7-8-20
	4-22-20	Email to the THPO providing an update on the Project and information on the survey plans for 2020.	7-8-20
	9-16-20	Letter to the THPO transmitting the updated Class III Archaeological Survey Report, Geomorphology Report, and Addendum Class III Structures Report (with certified mail receipt and confirmation of availability for pickup).	*This filing*
Fort Belknap Indian Community	6-13-19	Meeting to discuss the Project and cultural resources field surveys. (Note: This meeting was hosted by the Assiniboine and Sioux Tribes of the Fort Peck Reservation.)	2-14-20
	6-27-19	Email to the THPO transmitting a scope of work (letter dated 6-27-19) for tribal surveys for the Project.	2-14-20
	6-27-19	Letter to the THPO providing a scope of work for tribal surveys for the Project.	2-14-20
	7-29-19	Letter inviting the THPO to participate in WBI Energy's open houses.	2-14-20
	7-30-19	Project update letter, including a Project description and map, and a renewed request for comment on the Project.	2-14-20

North Bakken Expansion Project
Summary of Communications with Federally Recognized Indian Tribes

Tribe	Date	Summary	Filing Date
	2-14-20	Letter to the THPO transmitting the Class III Archaeological Survey Report, standalone archaeological survey report for USFS lands, and Class III Historic Structures Report. (Note: The delivery receipt for this report, dated 2-19-20, was filed on 4-20-20).	2-14-20
	2-28-20	Letter to the President regarding the filing of WBI Energy's application with FERC.	7-8-20
	2-28-20	Letter to the THPO regarding the filing of WBI Energy's application with FERC.	7-8-20
	3-30-20	Email to the THPO transmitting a letter regarding the status of the Project and plans for field surveys and site testing in 2020.	4-20-20
	3-30-20	Letter to the THPO providing an update on the status of the Project and plans for field surveys and site testing in 2020.	4-20-20
	4-8-20	Email to the THPO to confirm the tribe's receipt of WBI Energy's email and letter sent on 3-30-20.	4-20-20
	4-13-20	Phone call to the THPO to confirm the tribe's receipt of WBI Energy's email and letter sent on 3-30-20.	4-20-20
	4-15-20	Phone call to the THPO to confirm the tribe's receipt of WBI Energy's email and letter sent on 3-30-20.	4-20-20
	4-15-20	Email to the THPO to confirm the tribe's receipt of WBI Energy's email and letter sent on 3-30-20.	4-20-20
	4-17-20	Phone call to the THPO confirming the tribe's receipt of WBI Energy's email and letter sent on 3-30-20; the THPO said he had no questions or comments on the 2019 field surveys or Class III reports provided to the tribe in February 2020.	7-8-20
	4-22-20	Email to the THPO providing information the survey plans for 2020.	7-8-20
	9-16-20	Letter to the THPO transmitting the updated Class III Archaeological Survey Report, Geomorphology Report, and Addendum Class III Structures Report (with Fed Ex delivery receipt).	*This filing*

Standing Rock Sioux Tribe

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September 16, 2020

Jon Eagle, Tribal Historic Preservation Officer
Standing Rock Sioux Tribe
PO Box D
Fort Yates, ND 58538

Subject: WBI Energy Transmission, Inc.
North Bakken Expansion Project – Class III Survey Reports 2020 Field Season
McKenzie, Williams, Burke, and Mountrail Counties, North Dakota
ND SHPO Ref.: 19-5593

Dear Mr. Eagle:

Please reference WBI Energy Transmission, Inc.'s (WBI Energy's) previous correspondence regarding the above referenced project. WBI Energy proposes to construct and operate the North Bakken Expansion Project (Project) in McKenzie, Williams, Burke, and Mountrail Counties, North Dakota.

The Project is regulated by the Federal Energy Regulatory Commission (FERC) under Section 7(c) of the Natural Gas Act. Under the Energy Policy Act of 2005, FERC is the lead agency for coordinating federal authorizations and complying with the National Environmental Policy Act on natural gas pipeline projects subject to its jurisdiction. FERC similarly is the lead federal agency for complying with Section 106 of the National Historic Preservation Act (NHPA) on natural gas pipeline projects under its jurisdiction. In accordance with 36 CFR 800.2(c)(4), WBI Energy is assisting the FERC in meeting its obligations under Section 106 of the NHPA by coordinating with agencies and tribes and conducting surveys to identify historic properties that may be affected by the Project.

Enclosed for your review please find Class III survey reports for the archaeological and historic structures surveys that were conducted during the 2019 and 2020 field seasons. The archaeological report includes the results provided in the original Class III report and addresses comments that were provided by the State Historical Society of North Dakota, Bureau of Land Management, U.S. Army Corps of Engineers, and the U.S. Forest Service. The attached table summarizes our response to those comments and provides the location of the relevant revisions or clarifications. A report on geomorphological investigations is also included in this submittal.

WBI Energy would appreciate your comments on the attached reports. If you have any questions or comments on the Project or the reports, please contact me at 612-840-8976 or pat.robblee@erm.com, or Dr. Kevin Malloy at 906-285-0361 or kevin.malloy@erm.com. Please direct written correspondence to Dr. Malloy's attention at:

Environmental Resources Management
1000 IDS Center
80 South 8th Street
Minneapolis, MN 55402

Sincerely,

Patrick Robblee
Program Director

Enclosures: Class III Archaeological Survey Report
Class III Historic Structures Addendum I Survey Report
Geomorphology Report

cc: Jill Linn, WBI Energy
Andrea Thornton, ERM
Kevin Malloy, ERM
Emily Laird, ERM
Andrew Clark, SHSND
Fern Swenson, SHSND
Liv Fetterman, USFS
Richard Rogers, USACE
Teanna Limpy, Northern Cheyenne Tribe
Pete Coffey, Three Affiliated Tribes of the Fort Berthold Reservation
Dyan Youpee, Assiniboine and Sioux Tribes of the Fort Peck Reservation
Ben Rhodd, Rosebud Sioux Tribe
Michael Black Wolf, Fort Belknap Indian Community
Tom Brings, Oglala Sioux Tribe
Ben Ridgely, Northern Arapaho Tribe
Steven Vance, Cheyenne River Sioux
Erich Longie, Spirit Lake Tribe
Kip Spotted Eagle, Yankton Sioux Tribe
Jeff Desjarlais, Jr., Turtle Mountain Band of Chippewa
Dianne Desrosiers, Sisseton Wahpeton Oyate

Attachment: Table summarizing agency comments on the original Class III archaeology report

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Comments from the State Historical Society of North Dakota		
General comments:		
o Provide more background information on sites with previous work. Focus on methods and reasoning for previous eligibility recommendation.	Additional information on previous investigations has been added to site descriptions, as applicable.	Sections 5.3 through 5.7
o Map symbology has item named "Shovel test – No Dig". Are these shovel probes that were planned, but not excavated for some reason? If so provide explanation.	These are planned but unexcavated shovel tests. Site descriptions have been updated, as applicable, to explain why some planned shovel tests were not excavated. Typical reasons for not excavating shovel tests include the presence of buried utilities (documented through One-Call markings) or slope.	Sections 5.3 through 5.5
Avoidance, 50 ft buffer minimum, fence, and monitor:		
o Private land: 32BK277, 32BK279, 32BK280, 32BK282, 32MZ3308, 32MZ3309, 32MZ3310, 32MZ3311, 32MZ3325, 32MZ3327, 32WI1494, 32WI1630, 32WI2144, 32WI2388, 32WI2389, 32WI2391, 32WI2392, 32WI2393, 32WI2394, 32WI2398, 32WI2406, 32WI2408.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.3
o US Forest Service Sites: 32MZ3301, 32MZ3314, 32MZ3315, 32MZ3319, 32MZ3320, 32MZ3322, 32MZ3324.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.5
Formally evaluate with site delineation and at least one 1x1 m TU. Submit evaluation plan prior to fieldwork:		
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o US Forest Service Site: 32MZ2346.	While ERM planned to conduct additional testing at this site, the pipeline route was modified prior to this work such that the site is now avoided by the Project with a buffer greater than 100 ft.	Section 5.5
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o Discuss subsurface potential on all IFs on a case-by-case basis. If the finds are in a good depositional context, STPs may be necessary to show that these are truly isolates. Minimal site recording may be enough to get a site number for database purposes, but more information is needed to verify that these are truly part of a category that can be written-off as not eligible.	Individual descriptions of isolated finds have been added to the text, including the results of shovel testing or an explanation for why shovel tests were not excavated.	Section 5.7

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o 32MZ3323 – Discussion mentions "Better Examples" of homesteads. Provide examples.	The description for 32MZ3323 has been updated to incorporate the results of additional testing (shovel testing and the excavation of a 1 x 1 m test unit) in the updated Class III report.	Section 5.3
o 32WI1495 – Actual well shown in Figure 5.3-81 may be visible in figure 5.3-80. Is this location impacted by project? Consider site lead.	The location of the well (which is no longer extant) is discussed in the updated Class III report in conjunction with 32WI1495. ERM has submitted a site lead form for this resource. The suggested boundary of the site lead is 19 ft from Project workspace. The actual location of the well is about 235 ft from Project workspace.	Section 5.3
o 32WI2404 – How is this identified as prehistoric? Could it be a result of natural glacial and/or historic or modern field clearing? Provide evidence. Fence and monitor as necessary.	The interpretation of the feature at 32WI2404 as prehistoric is conservative and based on best professional judgement. Tribal cultural specialists who visited the site with ERM concurred with this interpretation.	Section 5.3
o 32WI2408 – Workspace is extremely close to possible graves. Is the planned route fixed?	The pipeline route has been modified to avoid this site with a buffer of 213 ft.	Section 5.3
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o 32MZ976 – Drilling under site is not avoidance as leaks and emergency repairs do consider cultural resources. Formal testing or horizontal avoidance is necessary.	The trajectory of the HDD will be 160 to 180 ft below ground surface where it passes beneath 32WI976. The pipeline will carry gas, not a liquid; the gas would migrate to the surface and dissipate into the air in the event of a leak. Given the depth of the HDD installation, daylighting of the pipeline for repair would not be feasible. If repair is required in the future, the most likely course of action would be to re-install a new segment via HDD, which would require federal authorizations, thereby triggering review of the action under Section 106 of the NHPA. A description of the HDD method has been added to the description of 32WI976 in Section 5.4 of the report. Additional testing at the site is pending and scheduled to be completed this fall. The results will be discussed in an addendum report.	Section 5.4
o 32MZ976 – Show bore location and HDD line on map	A figure showing the HDD alignment with entry and exit points has been added to the description of this site as has a construction alignment sheet. The alignment sheet depicts the HDD in plan and profile.	Section 5.4

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o 32MZ976 – Did cut bank provide additional information on buried soils? Were artifacts identified in cut bank?	The cut bank was examined during the initial survey. As noted above, additional testing is planned to occur at the site this fall with results to be discussed in an addendum report.	Section 5.4
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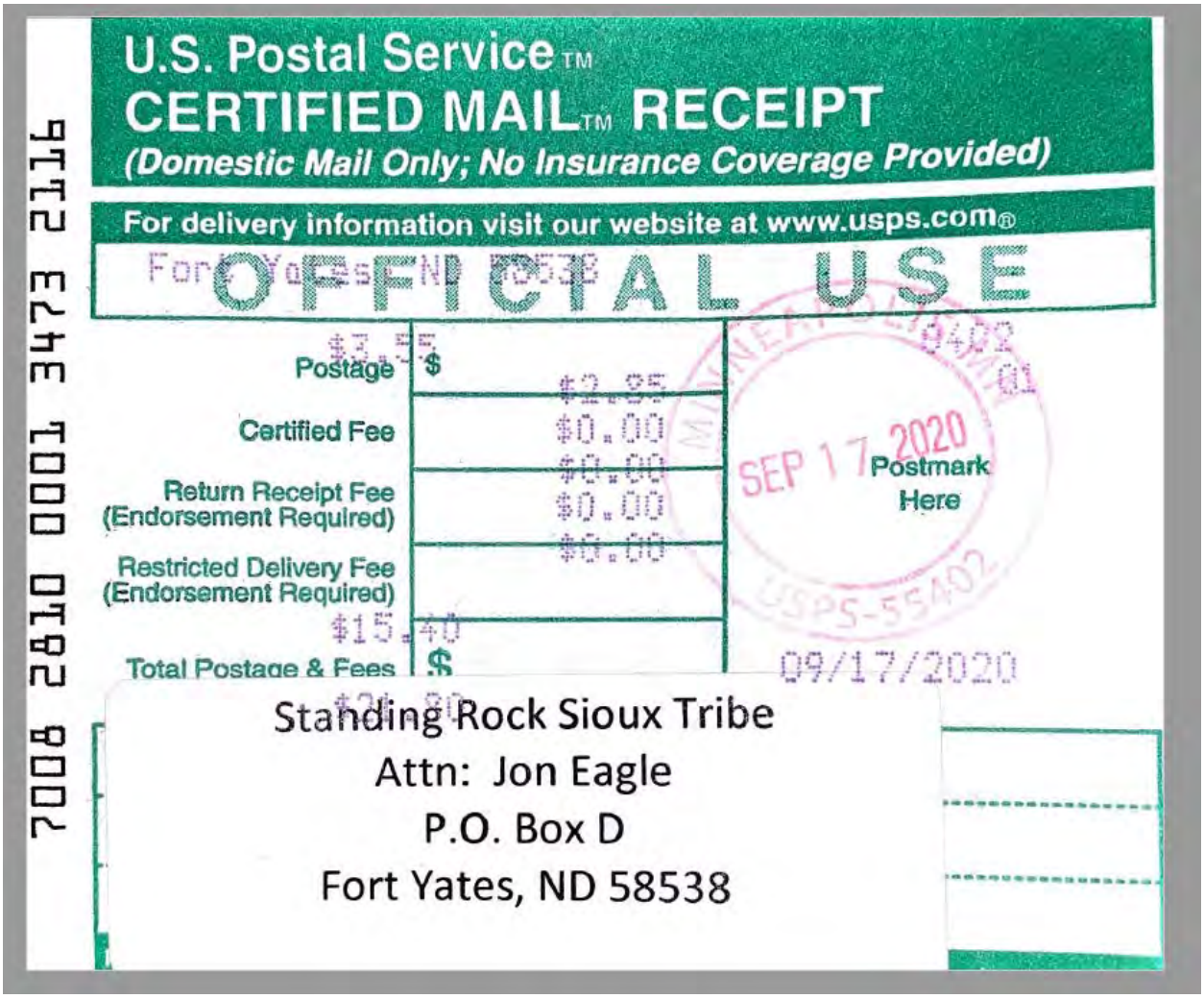
o The recommended protection/avoidance measures for unevaluated and eligible archaeological sites in the Class III report are inadequate, particularly regarding stone feature sites. The usual avoidance distance requested/required by the BLM is 100 feet. More than 100 feet is preferred for stone feature sites. Revise protection/avoidance measures buffers for archaeological sites.	WBI Energy has routed the pipeline to avoid unevaluated and eligible sites with a minimum buffer of 50 ft as directed by the SHSND.	Sections 5.3 through 5.5
o Why were indirect effects to archaeological sites not considered? Setting is an important aspect of integrity for stone feature sites. There are numerous archaeological sites within and near the survey corridor that should be analyzed for indirect effects. Revise the report to address indirect effects to archaeological sites.	The report has been updated to include an assessment of physical and non-physical impacts on unevaluated and eligible sites.	Sections 4 and 5.5 through 5.5
o WBI Energy needs to develop a cultural resource monitoring plan for construction.	WBI Energy commits to preparing a monitoring plan for construction.	Sections 5.3 through 5.5
o Update site form for all sites, site leads, and isolated finds regardless of whether they were relocated. Even if a cultural resource could not be relocated, that is still valuable information for the next project/site visit.	Site form updates have been submitted for all sites, isolated finds, and site leads discussed in the updated Class III report	N/A
o WBI Energy should make additional efforts to involve tribes in upcoming 2020 fieldwork and field reviews.	As discussed in more detail in Section 4 of the updated Class III report, WBI Energy retained Beaver Creek Archaeology to coordinate tribal participation in fieldwork in 2020. BCA worked with tribes to document sites as cultural heritage resources. The results of that work will be presented in a separate report. Information on tribal participation in the surveys also is provided in Sections 4 and 5.3 through 5.5 of ERM's updated Class III report	Sections 4 and 5.3 through 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Comments from U.S. Army Corps of Engineers		
o In section 5.4.2, remove figures for 32MZ0598 and move to the previous section.	This comment is addressed in the updated Class III report	Section 5.4
o Figure 5.4-5: Map of Site 32WI976, provide contour lines on this map to show the slope. This information would help to explain why the shovel testing pattern appears the way it does.	Contour lines are provided on Figure 5.4-9 in the updated Class III report.	Section 5.4
o ERM, on behalf of WBI [Energy], identified a second concentration of artifacts in the western side of site 32WI0976 after they started excavating the test unit. Some additional testing is needed here as USACE cannot agree with the recommended determination for this site given the data presented in this report.	Additional testing will be completed at this site in the fall of 2020 with the results presented in an addendum report.	Section 5.4
o USACE recommends that WBI [Energy] conduct a remote sensing evaluation (gradiometer or conductivity) at site 32WI0976. This would be the best way to produce measurable data regarding the presence/absence of subsurface features at the site.	A remote sensing survey of the site was completed in the summer of 2020. The results of the survey were used to prepare a testing plan for 32WI976. Additional testing at the site will occur this fall with the results presented in an addendum report.	Section 5.4
Comments from the U.S. Forest Service		
o The map showing previously recorded cultural resources within a one-mile radius is only included in the overall Class III and not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Figure 1.1-2 shows the Forest Service surface and differentiates between the survey corridor and the survey corridor on Forest Service surface; however, the survey corridor on Forest Service surface and the actual Forest Service surface displayed don't match.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Sites 32MZ2347 (Historical Archaeological) and 32MZ3278 (Cairn) are located immediately adjacent to the survey corridor but are not discussed. Please discuss.	Based on route modifications, 32MZ3278 was visited in 2020 and the site boundary expanded based on the findings. A discussion of the site is provided in the updated Class III report. 32MZ2347 is outside the inventory corridor for the Project; however, we have included a discussion of this site in the Class III inventory report.	Section 5.5
o Site 32MZ145 site form update does not appear to have been performed. Why? Was an attempt made to actually relocate the site? Also, according to the site form, a THPO representative requested avoidance in 2013. More work on this site is probably needed.	When 32MZ145 was first recorded in 1979, it was characterized as two stone cairns. Subsequent investigations described the site as consisting of a single historic rock clearing pile on the west side of Highway 1806, noting that the second pile was likely destroyed by construction of the highway. ERM's survey in 2019 was limited to the east side of Highway 1806, which explains why we did not relocate the site at that time. In 2020, ERM conducted additional survey on USFS lands, examining a corridor on the west side of Highway 1806. 32MZ145 was relocated as a result of this work. The site is discussed in the updated Class III report. Tribal cultural specialists who accompanied ERM during the 2020 field investigation concurred that 32MZ145 is historic rock clearing pile.	Section 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o Site 32MZ2346 and 32MZ144: it is very improbable and therefore suspicious that there are zero artifacts and one artifact respectively at sites with historic dumps.	Sites 32MZ2346 and 32MZ144 are both previously recorded historic sites which ERM revisited and recorded during the survey for the Project. Cultural material was observed at both sites as described in the updated Class III report. ERM expanded the boundaries of 32MZ2346 to encompass two previously unreported features at the site. One artifact–a commemorative coin–was collected from 32MZ2346 because of its uniqueness. No artifacts were collected from 32MZ144. Expanded descriptions of both sites are provided in the updated Class III report.	Section 5.5
o Additional survey is shown as needed near site 32MZ3278 on the maps in the overall Class III report but not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	Additional survey was completed in 2020 on USFS lands in the vicinity of 32MZ3278, which was relocated. A description of the site is provided in the updated Class III report.	Section 5.5
o The recommended avoidance and fencing measures are inadequate, especially for stone feature sites.	All stone feature sites have been avoided with a minimum buffet of 50 ft. Additionally, for sites between 50 and 100 ft of Project workspace WBI Energy commits to fencing and monitoring the sites during construction. WBI Energy will provide a monitoring plan for agency review.	Section 5.5
o A monitoring plan is needed.	WBI Energy commits to providing a construction monitoring plan as discussed in the updated Class III report.	
o Updates should have been conducted for all sites, site leads, and IFs [isolated finds] regardless of whether or not they were relocated.	Site form updates have been submitted for all applicable sites, isolated finds, and site leads discussed in the report	N/A
o The discussion of site leads during fieldwork is inadequate.	Site leads are discussed in Section 5.6 of the updated Class III report.	Section 5.6
o Provide specific distances between site boundaries and the edge of the workspace.	Distances between sites and Project workspaces have been added to summary tables and site descriptions throughout the updated Class III report.	Sections 5.3 through 5.5
o Provide a map of shovel testing performed outside of site boundaries. The report explains the testing strategy during survey but never discusses or shows specifics except within site boundaries.	The route maps provided as Appendix B depict survey methodology in addition to survey coverage and results.	Appendix B
o Identify the level of tribal involvement in the survey.	Tribal participation in field surveys is discussed in Sections 4 and 5.3 through 5.5 of the updated Class III report.	Sections 4 and 5.3 through 5.5
o Discuss whether indirect effects to archaeological sites were considered.	For unevaluated sites, we have added an assessment of non-physical impacts on setting.	Sections 5.3 through 5.5



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Standing Rock Sioux Tribe
Attn: Jon Eagle
P.O. Box D
Fort Yates, ND 58538

MEETING NOTES

LOG OF IN PERSON MEETING

MEETING ATTENDEES:

Jon Eagle – Standing Rock Sioux Tribe Tribal Historic Preservation Officer
Ben Rhodd – Rosebud Sioux Tribe Archaeologist
Katie West – Bureau of Land Management (BLM)
Jill Linn – WBI Energy Transmission, Inc. (WBI Energy)
Wade Burns – Beaver Creek Archaeology (BCA)
Raina Hanley – BCA
Larry Pallozzi – BCA
Jayson Zoino – Environmental Resource Group (ERM)

DATE:	TIME OF CONVERSATION:
September 17, 2020	10 am to 1 pm

RE:

North Bakken Expansion Project

LOG OF CONVERSATION:

ERM visited sites 32MZ3382, 32MZ3383, and 32MZ3385 on U.S. Forest Service lands with representatives of the Standing Rock Sioux Tribe, Rosebud Sioux Tribe, BLM, WBI Energy, and BCA.[1] ERM documented these sites in the summer of 2020 during survey for WBI Energy's North Bakken Expansion Project. Tribal cultural specialists representing the Standing Rock Sioux Tribe, Rosebud Sioux Tribe (including one specialist working on behalf of the Sisseton Wahpeton Oyate Tribe), Assiniboine & Sioux Tribes, and Turtle Mountain Band of Chippewa Indians monitored ERM's delineation of the sites; however, the specialists did not uniformly concur with the interpretation of the finds as archaeological. Some of the specialists concluded that the remains documented by ERM are non-cultural.

The visits to 32MZ3382, 32MZ3383, and 32MZ3385 allowed Mr. Eagle and Mr. Rhodd to inspect the sites and features recorded by ERM. Mr. Eagle and Mr. Rhodd each concurred with the interpretation of the finds as archaeological and agreed with a majority of ERM's feature classifications for the sites. Mr. Eagle and Mr. Rhodd provided additional interpretation of some features, which will be incorporated into the cultural heritage forms for these sites. This includes an expansion of the area at 32MZ3383 to be recorded as a cultural heritage site to encompass a cluster of Echinacea identified near the archaeological features.

[1] The U.S. Forest Service was unable to participate in the site visits.

Sisseton-Wahpeton Oyate of the Lake Traverse Reservation

ERM

1000 IDS Center
80 South Eighth Street
Minneapolis, MN 55402

Telephone: +1 612 347 6789
Fax: +1 612 347 6780

www.erm.com

September 16, 2020

Dianne Desrosiers, Tribal Historic Preservation Officer
Sisseton Wahpeton Oyate
PO Box 907
Sisseton, SD 57262

Subject: WBI Energy Transmission, Inc.
North Bakken Expansion Project – Class III Survey Reports 2020 Field Season
McKenzie, Williams, Burke, and Mountrail Counties, North Dakota
ND SHPO Ref.: 19-5593

Dear Ms. Desrosiers:

Please reference WBI Energy Transmission, Inc.'s (WBI Energy's) previous correspondence regarding the above referenced project. WBI Energy proposes to construct and operate the North Bakken Expansion Project (Project) in McKenzie, Williams, Burke, and Mountrail Counties, North Dakota.

The Project is regulated by the Federal Energy Regulatory Commission (FERC) under Section 7(c) of the Natural Gas Act. Under the Energy Policy Act of 2005, FERC is the lead agency for coordinating federal authorizations and complying with the National Environmental Policy Act on natural gas pipeline projects subject to its jurisdiction. FERC similarly is the lead federal agency for complying with Section 106 of the National Historic Preservation Act (NHPA) on natural gas pipeline projects under its jurisdiction. In accordance with 36 CFR 800.2(c)(4), WBI Energy is assisting the FERC in meeting its obligations under Section 106 of the NHPA by coordinating with agencies and tribes and conducting surveys to identify historic properties that may be affected by the Project.

Enclosed for your review please find Class III survey reports for the archaeological and historic structures surveys that were conducted during the 2019 and 2020 field seasons. The archaeological report includes the results provided in the original Class III report and addresses comments that were provided by the State Historical Society of North Dakota, Bureau of Land Management, U.S. Army Corps of Engineers, and the U.S. Forest Service. The attached table summarizes our response to those comments and provides the location of the relevant revisions or clarifications. A report on geomorphological investigations is also included in this submittal.

WBI Energy would appreciate your comments on the attached reports. If you have any questions or comments on the Project or the reports, please contact me at 612-840-8976 or pat.robblee@erm.com, or Dr. Kevin Malloy at 906-285-0361 or kevin.malloy@erm.com. Please direct written correspondence to Dr. Malloy's attention at:

Environmental Resources Management
1000 IDS Center
80 South 8th Street
Minneapolis, MN 55402

Sincerely,

Patrick Robblee
Program Director

Enclosures: Class III Archaeological Survey Report
Class III Historic Structures Addendum I Survey Report
Geomorphology Report

cc: Jill Linn, WBI Energy
Andrea Thornton, ERM
Kevin Malloy, ERM
Emily Laird, ERM
Andrew Clark, SHSND
Fern Swenson, SHSND
Liv Fetterman, USFS
Richard Rogers, USACE
Teanna Limpy, Northern Cheyenne Tribe
Pete Coffey, Three Affiliated Tribes of the Fort Berthold Reservation
Dyan Youpee, Assiniboine and Sioux Tribes of the Fort Peck Reservation
Ben Rhodd, Rosebud Sioux Tribe
Michael Black Wolf, Fort Belknap Indian Community
Tom Brings, Oglala Sioux Tribe
Jon Eagle, Standing Rock Sioux Tribe
Ben Ridgely, Northern Arapaho Tribe
Steven Vance, Cheyenne River Sioux
Erich Longie, Spirit Lake Tribe
Kip Spotted Eagle, Yankton Sioux Tribe
Jeff Desjarlais, Jr., Turtle Mountain Band of Chippewa

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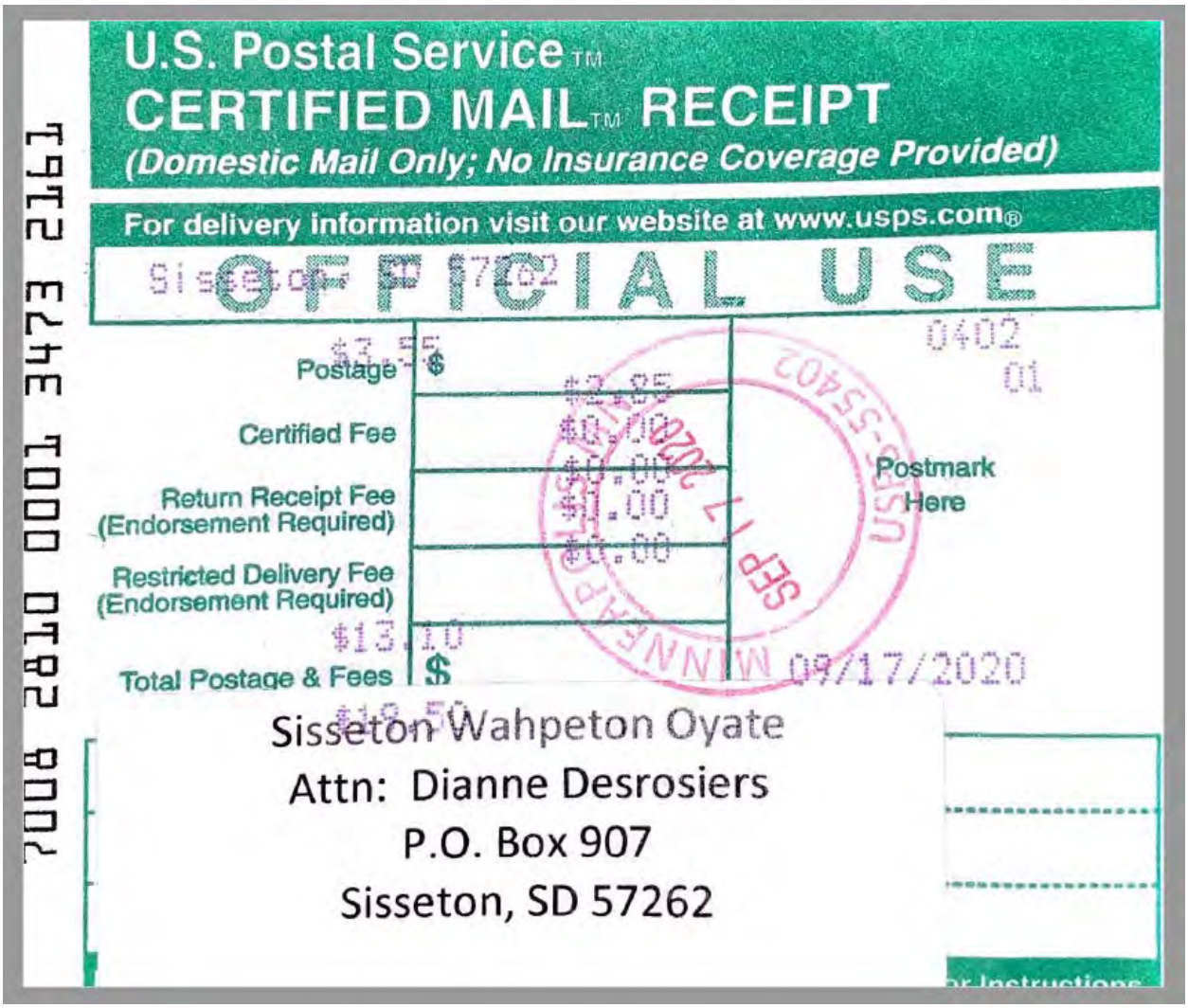
Comments from U.S. Army Corps of Engineers		
o In section 5.4.2, remove figures for 32MZ0598 and move to the previous section.	This comment is addressed in the updated Class III report	Section 5.4
o Figure 5.4-5: Map of Site 32WI976, provide contour lines on this map to show the slope. This information would help to explain why the shovel testing pattern appears the way it does.	Contour lines are provided on Figure 5.4-9 in the updated Class III report.	Section 5.4
o ERM, on behalf of WBI [Energy], identified a second concentration of artifacts in the western side of site 32WI0976 after they started excavating the test unit. Some additional testing is needed here as USACE cannot agree with the recommended determination for this site given the data presented in this report.	Additional testing will be completed at this site in the fall of 2020 with the results presented in an addendum report.	Section 5.4
o USACE recommends that WBI [Energy] conduct a remote sensing evaluation (gradiometer or conductivity) at site 32WI0976. This would be the best way to produce measurable data regarding the presence/absence of subsurface features at the site.	A remote sensing survey of the site was completed in the summer of 2020. The results of the survey were used to prepare a testing plan for 32WI976. Additional testing at the site will occur this fall with the results presented in an addendum report.	Section 5.4
Comments from the U.S. Forest Service		
o The map showing previously recorded cultural resources within a one-mile radius is only included in the overall Class III and not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Figure 1.1-2 shows the Forest Service surface and differentiates between the survey corridor and the survey corridor on Forest Service surface; however, the survey corridor on Forest Service surface and the actual Forest Service surface displayed don't match.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Sites 32MZ2347 (Historical Archaeological) and 32MZ3278 (Cairn) are located immediately adjacent to the survey corridor but are not discussed. Please discuss.	Based on route modifications, 32MZ3278 was visited in 2020 and the site boundary expanded based on the findings. A discussion of the site is provided in the updated Class III report. 32MZ2347 is outside the inventory corridor for the Project; however, we have included a discussion of this site in the Class III inventory report.	Section 5.5
o Site 32MZ145 site form update does not appear to have been performed. Why? Was an attempt made to actually relocate the site? Also, according to the site form, a THPO representative requested avoidance in 2013. More work on this site is probably needed.	When 32MZ145 was first recorded in 1979, it was characterized as two stone cairns. Subsequent investigations described the site as consisting of a single historic rock clearing pile on the west side of Highway 1806, noting that the second pile was likely destroyed by construction of the highway. ERM's survey in 2019 was limited to the east side of Highway 1806, which explains why we did not relocate the site at that time. In 2020, ERM conducted additional survey on USFS lands, examining a corridor on the west side of Highway 1806. 32MZ145 was relocated as a result of this work. The site is discussed in the updated Class III report. Tribal cultural specialists who accompanied ERM during the 2020 field investigation concurred that 32MZ145 is historic rock clearing pile.	Section 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o Site 32MZ2346 and 32MZ144: it is very improbable and therefore suspicious that there are zero artifacts and one artifact respectively at sites with historic dumps.	Sites 32MZ2346 and 32MZ144 are both previously recorded historic sites which ERM revisited and recorded during the survey for the Project. Cultural material was observed at both sites as described in the updated Class III report. ERM expanded the boundaries of 32MZ2346 to encompass two previously unreported features at the site. One artifact–a commemorative coin–was collected from 32MZ2346 because of its uniqueness. No artifacts were collected from 32MZ144. Expanded descriptions of both sites are provided in the updated Class III report.	Section 5.5
o Additional survey is shown as needed near site 32MZ3278 on the maps in the overall Class III report but not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	Additional survey was completed in 2020 on USFS lands in the vicinity of 32MZ3278, which was relocated. A description of the site is provided in the updated Class III report.	Section 5.5
o The recommended avoidance and fencing measures are inadequate, especially for stone feature sites.	All stone feature sites have been avoided with a minimum buffet of 50 ft. Additionally, for sites between 50 and 100 ft of Project workspace WBI Energy commits to fencing and monitoring the sites during construction. WBI Energy will provide a monitoring plan for agency review.	Section 5.5
o A monitoring plan is needed.	WBI Energy commits to providing a construction monitoring plan as discussed in the updated Class III report.	
o Updates should have been conducted for all sites, site leads, and IFs [isolated finds] regardless of whether or not they were relocated.	Site form updates have been submitted for all applicable sites, isolated finds, and site leads discussed in the report	N/A
o The discussion of site leads during fieldwork is inadequate.	Site leads are discussed in Section 5.6 of the updated Class III report.	Section 5.6
o Provide specific distances between site boundaries and the edge of the workspace.	Distances between sites and Project workspaces have been added to summary tables and site descriptions throughout the updated Class III report.	Sections 5.3 through 5.5
o Provide a map of shovel testing performed outside of site boundaries. The report explains the testing strategy during survey but never discusses or shows specifics except within site boundaries.	The route maps provided as Appendix B depict survey methodology in addition to survey coverage and results.	Appendix B
o Identify the level of tribal involvement in the survey.	Tribal participation in field surveys is discussed in Sections 4 and 5.3 through 5.5 of the updated Class III report.	Sections 4 and 5.3 through 5.5
o Discuss whether indirect effects to archaeological sites were considered.	For unevaluated sites, we have added an assessment of non-physical impacts on setting.	Sections 5.3 through 5.5



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Turtle Mountain Band of Chippewa Indians

ERM

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Fax: +1 612 347 6780

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September 16, 2020

Jeff Desjarlais, Jr., Tribal Historic Preservation Officer
Turtle Mountain Band of Chippewa
PO Box 900
Belcourt, ND 58316

Subject: WBI Energy Transmission, Inc.
North Bakken Expansion Project – Class III Survey Reports 2020 Field Season
McKenzie, Williams, Burke, and Mountrail Counties, North Dakota
ND SHPO Ref.: 19-5593

Dear Mr. Desjalais:

Please reference WBI Energy Transmission, Inc.'s (WBI Energy's) previous correspondence regarding the above referenced project. WBI Energy proposes to construct and operate the North Bakken Expansion Project (Project) in McKenzie, Williams, Burke, and Mountrail Counties, North Dakota.

The Project is regulated by the Federal Energy Regulatory Commission (FERC) under Section 7(c) of the Natural Gas Act. Under the Energy Policy Act of 2005, FERC is the lead agency for coordinating federal authorizations and complying with the National Environmental Policy Act on natural gas pipeline projects subject to its jurisdiction. FERC similarly is the lead federal agency for complying with Section 106 of the National Historic Preservation Act (NHPA) on natural gas pipeline projects under its jurisdiction. In accordance with 36 CFR 800.2(c)(4), WBI Energy is assisting the FERC in meeting its obligations under Section 106 of the NHPA by coordinating with agencies and tribes and conducting surveys to identify historic properties that may be affected by the Project.

Enclosed for your review please find Class III survey reports for the archaeological and historic structures surveys that were conducted during the 2019 and 2020 field seasons. The archaeological report includes the results provided in the original Class III report and addresses comments that were provided by the State Historical Society of North Dakota, Bureau of Land Management, U.S. Army Corps of Engineers, and the U.S. Forest Service. The attached table summarizes our response to those comments and provides the location of the relevant revisions or clarifications. A report on geomorphological investigations is also included in this submittal.

WBI Energy would appreciate your comments on the attached reports. If you have any questions or comments on the Project or the reports, please contact me at 612-840-8976 or pat.robblee@erm.com, or Dr. Kevin Malloy at 906-285-0361 or kevin.malloy@erm.com. Please direct written correspondence to Dr. Malloy's attention at:

Environmental Resources Management
1000 IDS Center
80 South 8th Street
Minneapolis, MN 55402

Sincerely,

Patrick Robblee
Program Director

Enclosures: Class III Archaeological Survey Report
Class III Historic Structures Addendum I Survey Report
Geomorphology Report

cc: Jill Linn, WBI Energy
Andrea Thornton, ERM
Kevin Malloy, ERM
Emily Laird, ERM
Andrew Clark, SHSND
Fern Swenson, SHSND
Liv Fetterman, USFS
Richard Rogers, USACE
Teanna Limpy, Northern Cheyenne Tribe
Pete Coffey, Three Affiliated Tribes of the Fort Berthold Reservation
Dyan Youpee, Assiniboine and Sioux Tribes of the Fort Peck Reservation
Ben Rhodd, Rosebud Sioux Tribe
Michael Black Wolf, Fort Belknap Indian Community
Tom Brings, Oglala Sioux Tribe
Jon Eagle, Standing Rock Sioux Tribe
Ben Ridgely, Northern Arapaho Tribe
Steven Vance, Cheyenne River Sioux
Erich Longie, Spirit Lake Tribe
Kip Spotted Eagle, Yankton Sioux Tribe
Dianne Desrosiers, Sisseton Wahpeton Oyate

Attachment: Table summarizing agency comments on the original Class III archaeology report

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Comments from the State Historical Society of North Dakota		
General comments:		
o Provide more background information on sites with previous work. Focus on methods and reasoning for previous eligibility recommendation.	Additional information on previous investigations has been added to site descriptions, as applicable.	Sections 5.3 through 5.7
o Map symbology has item named "Shovel test – No Dig". Are these shovel probes that were planned, but not excavated for some reason? If so provide explanation.	These are planned but unexcavated shovel tests. Site descriptions have been updated, as applicable, to explain why some planned shovel tests were not excavated. Typical reasons for not excavating shovel tests include the presence of buried utilities (documented through One-Call markings) or slope.	Sections 5.3 through 5.5
Avoidance, 50 ft buffer minimum, fence, and monitor:		
o Private land: 32BK277, 32BK279, 32BK280, 32BK282, 32MZ3308, 32MZ3309, 32MZ3310, 32MZ3311, 32MZ3325, 32MZ3327, 32WI1494, 32WI1630, 32WI2144, 32WI2388, 32WI2389, 32WI2391, 32WI2392, 32WI2393, 32WI2394, 32WI2398, 32WI2406, 32WI2408.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.3
o US Forest Service Sites: 32MZ3301, 32MZ3314, 32MZ3315, 32MZ3319, 32MZ3320, 32MZ3322, 32MZ3324.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.5
Formally evaluate with site delineation and at least one 1x1 m TU. Submit evaluation plan prior to fieldwork:		
o Private Land: 32BK278, 32MZ3302, 32MZ3306, 32MZ3307, 32MZ3318, 32MZ3323, 32MZ3326, 32MZ3328, 32MZ3329, 32MZ3331, 32WI2390, 32WI2405, 32WI2407, 32WI2409, 32WI2410.	Additional testing (shovel testing and/or the excavation of at least one, 1 x 1 m test unit) was completed at each of these sites in accordance with a testing plan approved by the SHSND. Testing at sites 32WI2390 and 32MZ3328 was suspended following the identification of stone features at these sites; however, the pipeline route has been adjusted to avoid these sites with a minimum 50-ft buffer.	Section 5.3
o US Forest Service Site: 32MZ2346.	While ERM planned to conduct additional testing at this site, the pipeline route was modified prior to this work such that the site is now avoided by the Project with a buffer greater than 100 ft.	Section 5.5
Isolated finds:		
o Discuss subsurface potential on all IFs on a case-by-case basis. If the finds are in a good depositional context, STPs may be necessary to show that these are truly isolates. Minimal site recording may be enough to get a site number for database purposes, but more information is needed to verify that these are truly part of a category that can be written-off as not eligible.	Individual descriptions of isolated finds have been added to the text, including the results of shovel testing or an explanation for why shovel tests were not excavated.	Section 5.7

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Site-by-site comments, private land:		
o 32BK168 – Expand reasoning for Not Eligible Determination both previously and now. Newly recorded site boundary included previously unidentified features. Perhaps site should be unevaluated. Consider formal evaluation and provide updated management recommendations.	ERM conducted site testing at 32BK168 in 2020. Evidence of intact cultural deposits and features was identified during testing and the site is now recommended as eligible for listing in the NRHP. The pipeline route has been modified to avoid this site with a buffer of 57 ft.	Section 5.3
o 32MZ3323 – Discussion mentions "Better Examples" of homesteads. Provide examples.	The description for 32MZ3323 has been updated to incorporate the results of additional testing (shovel testing and the excavation of a 1 x 1 m test unit) in the updated Class III report.	Section 5.3
o 32WI1495 – Actual well shown in Figure 5.3-81 may be visible in figure 5.3-80. Is this location impacted by project? Consider site lead.	The location of the well (which is no longer extant) is discussed in the updated Class III report in conjunction with 32WI1495. ERM has submitted a site lead form for this resource. The suggested boundary of the site lead is 19 ft from Project workspace. The actual location of the well is about 235 ft from Project workspace.	Section 5.3
o 32WI2404 – How is this identified as prehistoric? Could it be a result of natural glacial and/or historic or modern field clearing? Provide evidence. Fence and monitor as necessary.	The interpretation of the feature at 32WI2404 as prehistoric is conservative and based on best professional judgement. Tribal cultural specialists who visited the site with ERM concurred with this interpretation.	Section 5.3
o 32WI2408 – Workspace is extremely close to possible graves. Is the planned route fixed?	The pipeline route has been modified to avoid this site with a buffer of 213 ft.	Section 5.3
Site-by-site comments, US Army Corps of Engineers land:		
o 32MZ976 – Drilling under site is not avoidance as leaks and emergency repairs do consider cultural resources. Formal testing or horizontal avoidance is necessary.	The trajectory of the HDD will be 160 to 180 ft below ground surface where it passes beneath 32WI976. The pipeline will carry gas, not a liquid; the gas would migrate to the surface and dissipate into the air in the event of a leak. Given the depth of the HDD installation, daylighting of the pipeline for repair would not be feasible. If repair is required in the future, the most likely course of action would be to re-install a new segment via HDD, which would require federal authorizations, thereby triggering review of the action under Section 106 of the NHPA. A description of the HDD method has been added to the description of 32WI976 in Section 5.4 of the report. Additional testing at the site is pending and scheduled to be completed this fall. The results will be discussed in an addendum report.	Section 5.4
o 32MZ976 – Show bore location and HDD line on map	A figure showing the HDD alignment with entry and exit points has been added to the description of this site as has a construction alignment sheet. The alignment sheet depicts the HDD in plan and profile.	Section 5.4

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o 32MZ976 – Clarify and provide more evidence for geomorphological hypothesis of A horizon being related to flood deposits. Typically, A horizons show stability rather than accretional or erosional events. Provide more information on why artifacts are interpreted as disturbed rather than in primary context.	The text in the updated Class III report has been updated to address this comment. As noted above, additional testing is planned to occur at 32WI976 this fall, which will provide additional information on the soils present at the site.	Section 5.4
o 32MZ976 – Did cut bank provide additional information on buried soils? Were artifacts identified in cut bank?	The cut bank was examined during the initial survey. As noted above, additional testing is planned to occur at the site this fall with results to be discussed in an addendum report.	Section 5.4
o 32WI976 – Given size and shape of site, additional TUs recommended.		
Comments from the Bureau of Land Management		
o The recommended protection/avoidance measures for unevaluated and eligible archaeological sites in the Class III report are inadequate, particularly regarding stone feature sites. The usual avoidance distance requested/required by the BLM is 100 feet. More than 100 feet is preferred for stone feature sites. Revise protection/avoidance measures buffers for archaeological sites.	WBI Energy has routed the pipeline to avoid unevaluated and eligible sites with a minimum buffer of 50 ft as directed by the SHSND.	Sections 5.3 through 5.5
o Why were indirect effects to archaeological sites not considered? Setting is an important aspect of integrity for stone feature sites. There are numerous archaeological sites within and near the survey corridor that should be analyzed for indirect effects. Revise the report to address indirect effects to archaeological sites.	The report has been updated to include an assessment of physical and non-physical impacts on unevaluated and eligible sites.	Sections 4 and 5.5 through 5.5
o WBI Energy needs to develop a cultural resource monitoring plan for construction.	WBI Energy commits to preparing a monitoring plan for construction.	Sections 5.3 through 5.5
o Update site form for all sites, site leads, and isolated finds regardless of whether they were relocated. Even if a cultural resource could not be relocated, that is still valuable information for the next project/site visit.	Site form updates have been submitted for all sites, isolated finds, and site leads discussed in the updated Class III report	N/A
o WBI Energy should make additional efforts to involve tribes in upcoming 2020 fieldwork and field reviews.	As discussed in more detail in Section 4 of the updated Class III report, WBI Energy retained Beaver Creek Archaeology to coordinate tribal participation in fieldwork in 2020. BCA worked with tribes to document sites as cultural heritage resources. The results of that work will be presented in a separate report. Information on tribal participation in the surveys also is provided in Sections 4 and 5.3 through 5.5 of ERM's updated Class III report	Sections 4 and 5.3 through 5.5

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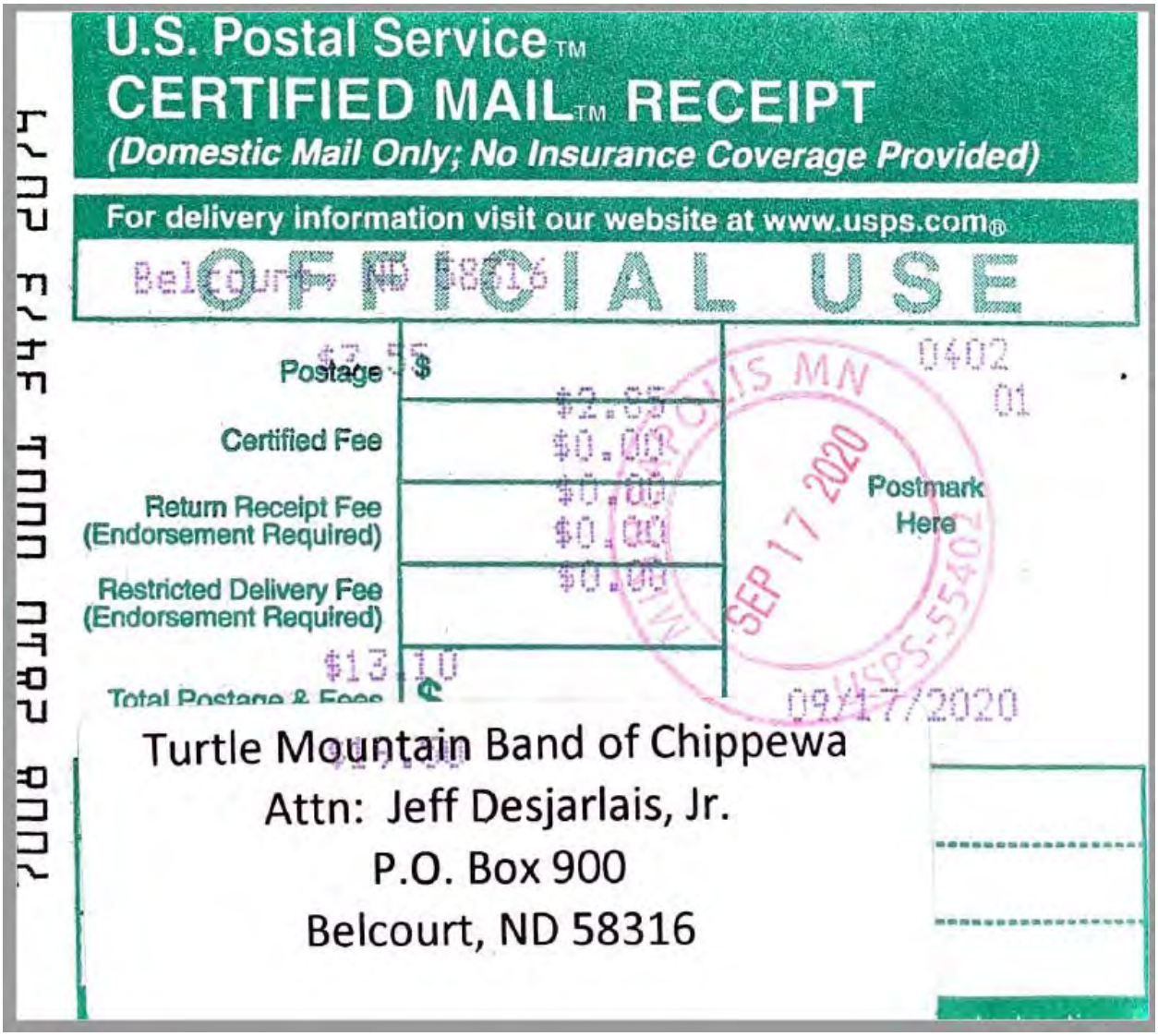

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Turtle Mountain Band of Chippewa
Attn: Jeff Desjarlais, Jr.
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Three Affiliated Tribes of the Fort Berthold Reservation

Pat Robblee

From: Pat Robblee
Sent: Monday, September 7, 2020 6:39 AM
To: pcoffey@mhanation.com
Cc: Jayson Zoino
Subject: North Bakken Project - Site 32MZ3313

Mr. Coffey,

Andy Clark at the SHSND has directed ERM to send you the bone fragments recovered from 32MZ3313 in 2019 for reburial at the site. An ERM survey team will be mobilizing to the project area at the end of next week for an approximately two week deployment. Would you be available the week of 9/14 or 9/21 for us to hand deliver the bone fragments to your office? Alternatively, we could Fed Ex the fragments to your office. We also have all of the lithic artifacts recovered from the site.

Thank you.

Pat

Patrick Robblee
Program Director

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September 16, 2020

Pete Coffey, Tribal Historic Preservation Officer
Three Affiliated Tribes of the Fort Berthold Reservation
404 Frontage Road
New Town, ND 5863-9404

Subject: WBI Energy Transmission, Inc.
North Bakken Expansion Project – Class III Survey Reports 2020 Field Season
McKenzie, Williams, Burke, and Mountrail Counties, North Dakota
ND SHPO Ref.: 19-5593

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WBI Energy would appreciate your comments on the attached reports. If you have any questions or comments on the Project or the reports, please contact me at 612-840-8976 or pat.robblee@erm.com, or Dr. Kevin Malloy at 906-285-0361 or kevin.malloy@erm.com. Please direct written correspondence to Dr. Malloy's attention at:

Environmental Resources Management
1000 IDS Center
80 South 8th Street
Minneapolis, MN 55402

Sincerely,

Patrick Robblee
Program Director

Enclosures: Class III Archaeological Survey Report
Class III Historic Structures Addendum I Survey Report
Geomorphology Report

cc: Jill Linn, WBI Energy
Andrea Thornton, ERM
Kevin Malloy, ERM
Emily Laird, ERM
Andrew Clark, SHSND
Fern Swenson, SHSND
Liv Fetterman, USFS
Richard Rogers, USACE
Teanna Limpy, Northern Cheyenne Tribe
Dyan Youpee, Assiniboine and Sioux Tribes of the Fort Peck Reservation
Ben Rhodd, Rosebud Sioux Tribe
Michael Black Wolf, Fort Belknap Indian Community
Tom Brings, Oglala Sioux Tribe
Jon Eagle, Standing Rock Sioux Tribe
Ben Ridgely, Northern Arapaho Tribe
Steven Vance, Cheyenne River Sioux
Erich Longie, Spirit Lake Tribe
Kip Spotted Eagle, Yankton Sioux Tribe
Jeff Desjarlais, Jr., Turtle Mountain Band of Chippewa
Dianne Desrosiers, Sisseton Wahpeton Oyate

Attachment: Table summarizing agency comments on the original Class III archaeology report

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Comments from the State Historical Society of North Dakota		
General comments:		
o Provide more background information on sites with previous work. Focus on methods and reasoning for previous eligibility recommendation.	Additional information on previous investigations has been added to site descriptions, as applicable.	Sections 5.3 through 5.7
o Map symbology has item named "Shovel test – No Dig". Are these shovel probes that were planned, but not excavated for some reason? If so provide explanation.	These are planned but unexcavated shovel tests. Site descriptions have been updated, as applicable, to explain why some planned shovel tests were not excavated. Typical reasons for not excavating shovel tests include the presence of buried utilities (documented through One-Call markings) or slope.	Sections 5.3 through 5.5
Avoidance, 50 ft buffer minimum, fence, and monitor:		
o Private land: 32BK277, 32BK279, 32BK280, 32BK282, 32MZ3308, 32MZ3309, 32MZ3310, 32MZ3311, 32MZ3325, 32MZ3327, 32WI1494, 32WI1630, 32WI2144, 32WI2388, 32WI2389, 32WI2391, 32WI2392, 32WI2393, 32WI2394, 32WI2398, 32WI2406, 32WI2408.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.3
o US Forest Service Sites: 32MZ3301, 32MZ3314, 32MZ3315, 32MZ3319, 32MZ3320, 32MZ3322, 32MZ3324.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.5
Formally evaluate with site delineation and at least one 1x1 m TU. Submit evaluation plan prior to fieldwork:		
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o 32MZ3323 – Discussion mentions "Better Examples" of homesteads. Provide examples.	The description for 32MZ3323 has been updated to incorporate the results of additional testing (shovel testing and the excavation of a 1 x 1 m test unit) in the updated Class III report.	Section 5.3
o 32WI1495 – Actual well shown in Figure 5.3-81 may be visible in figure 5.3-80. Is this location impacted by project? Consider site lead.	The location of the well (which is no longer extant) is discussed in the updated Class III report in conjunction with 32WI1495. ERM has submitted a site lead form for this resource. The suggested boundary of the site lead is 19 ft from Project workspace. The actual location of the well is about 235 ft from Project workspace.	Section 5.3
o 32WI2404 – How is this identified as prehistoric? Could it be a result of natural glacial and/or historic or modern field clearing? Provide evidence. Fence and monitor as necessary.	The interpretation of the feature at 32WI2404 as prehistoric is conservative and based on best professional judgement. Tribal cultural specialists who visited the site with ERM concurred with this interpretation.	Section 5.3
o 32WI2408 – Workspace is extremely close to possible graves. Is the planned route fixed?	The pipeline route has been modified to avoid this site with a buffer of 213 ft.	Section 5.3
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o 32MZ976 – Drilling under site is not avoidance as leaks and emergency repairs do consider cultural resources. Formal testing or horizontal avoidance is necessary.	The trajectory of the HDD will be 160 to 180 ft below ground surface where it passes beneath 32WI976. The pipeline will carry gas, not a liquid; the gas would migrate to the surface and dissipate into the air in the event of a leak. Given the depth of the HDD installation, daylighting of the pipeline for repair would not be feasible. If repair is required in the future, the most likely course of action would be to re-install a new segment via HDD, which would require federal authorizations, thereby triggering review of the action under Section 106 of the NHPA. A description of the HDD method has been added to the description of 32WI976 in Section 5.4 of the report. Additional testing at the site is pending and scheduled to be completed this fall. The results will be discussed in an addendum report.	Section 5.4
o 32MZ976 – Show bore location and HDD line on map	A figure showing the HDD alignment with entry and exit points has been added to the description of this site as has a construction alignment sheet. The alignment sheet depicts the HDD in plan and profile.	Section 5.4

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o 32MZ976 – Did cut bank provide additional information on buried soils? Were artifacts identified in cut bank?	The cut bank was examined during the initial survey. As noted above, additional testing is planned to occur at the site this fall with results to be discussed in an addendum report.	Section 5.4
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Comments from the Bureau of Land Management		
o The recommended protection/avoidance measures for unevaluated and eligible archaeological sites in the Class III report are inadequate, particularly regarding stone feature sites. The usual avoidance distance requested/required by the BLM is 100 feet. More than 100 feet is preferred for stone feature sites. Revise protection/avoidance measures buffers for archaeological sites.	WBI Energy has routed the pipeline to avoid unevaluated and eligible sites with a minimum buffer of 50 ft as directed by the SHSND.	Sections 5.3 through 5.5
o Why were indirect effects to archaeological sites not considered? Setting is an important aspect of integrity for stone feature sites. There are numerous archaeological sites within and near the survey corridor that should be analyzed for indirect effects. Revise the report to address indirect effects to archaeological sites.	The report has been updated to include an assessment of physical and non-physical impacts on unevaluated and eligible sites.	Sections 4 and 5.5 through 5.5
o WBI Energy needs to develop a cultural resource monitoring plan for construction.	WBI Energy commits to preparing a monitoring plan for construction.	Sections 5.3 through 5.5
o Update site form for all sites, site leads, and isolated finds regardless of whether they were relocated. Even if a cultural resource could not be relocated, that is still valuable information for the next project/site visit.	Site form updates have been submitted for all sites, isolated finds, and site leads discussed in the updated Class III report	N/A
o WBI Energy should make additional efforts to involve tribes in upcoming 2020 fieldwork and field reviews.	As discussed in more detail in Section 4 of the updated Class III report, WBI Energy retained Beaver Creek Archaeology to coordinate tribal participation in fieldwork in 2020. BCA worked with tribes to document sites as cultural heritage resources. The results of that work will be presented in a separate report. Information on tribal participation in the surveys also is provided in Sections 4 and 5.3 through 5.5 of ERM's updated Class III report	Sections 4 and 5.3 through 5.5

Comments on the Draft Class III Inventory Report		
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Comments from U.S. Army Corps of Engineers		
o In section 5.4.2, remove figures for 32MZ0598 and move to the previous section.	This comment is addressed in the updated Class III report	Section 5.4
o Figure 5.4-5: Map of Site 32WI976, provide contour lines on this map to show the slope. This information would help to explain why the shovel testing pattern appears the way it does.	Contour lines are provided on Figure 5.4-9 in the updated Class III report.	Section 5.4
o ERM, on behalf of WBI [Energy], identified a second concentration of artifacts in the western side of site 32WI0976 after they started excavating the test unit. Some additional testing is needed here as USACE cannot agree with the recommended determination for this site given the data presented in this report.	Additional testing will be completed at this site in the fall of 2020 with the results presented in an addendum report.	Section 5.4
o USACE recommends that WBI [Energy] conduct a remote sensing evaluation (gradiometer or conductivity) at site 32WI0976. This would be the best way to produce measurable data regarding the presence/absence of subsurface features at the site.	A remote sensing survey of the site was completed in the summer of 2020. The results of the survey were used to prepare a testing plan for 32WI976. Additional testing at the site will occur this fall with the results presented in an addendum report.	Section 5.4
Comments from the U.S. Forest Service		
o The map showing previously recorded cultural resources within a one-mile radius is only included in the overall Class III and not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Figure 1.1-2 shows the Forest Service surface and differentiates between the survey corridor and the survey corridor on Forest Service surface; however, the survey corridor on Forest Service surface and the actual Forest Service surface displayed don't match.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Sites 32MZ2347 (Historical Archaeological) and 32MZ3278 (Cairn) are located immediately adjacent to the survey corridor but are not discussed. Please discuss.	Based on route modifications, 32MZ3278 was visited in 2020 and the site boundary expanded based on the findings. A discussion of the site is provided in the updated Class III report. 32MZ2347 is outside the inventory corridor for the Project; however, we have included a discussion of this site in the Class III inventory report.	Section 5.5
o Site 32MZ145 site form update does not appear to have been performed. Why? Was an attempt made to actually relocate the site? Also, according to the site form, a THPO representative requested avoidance in 2013. More work on this site is probably needed.	When 32MZ145 was first recorded in 1979, it was characterized as two stone cairns. Subsequent investigations described the site as consisting of a single historic rock clearing pile on the west side of Highway 1806, noting that the second pile was likely destroyed by construction of the highway. ERM's survey in 2019 was limited to the east side of Highway 1806, which explains why we did not relocate the site at that time. In 2020, ERM conducted additional survey on USFS lands, examining a corridor on the west side of Highway 1806. 32MZ145 was relocated as a result of this work. The site is discussed in the updated Class III report. Tribal cultural specialists who accompanied ERM during the 2020 field investigation concurred that 32MZ145 is historic rock clearing pile.	Section 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o Site 32MZ2346 and 32MZ144: it is very improbable and therefore suspicious that there are zero artifacts and one artifact respectively at sites with historic dumps.	Sites 32MZ2346 and 32MZ144 are both previously recorded historic sites which ERM revisited and recorded during the survey for the Project. Cultural material was observed at both sites as described in the updated Class III report. ERM expanded the boundaries of 32MZ2346 to encompass two previously unreported features at the site. One artifact–a commemorative coin–was collected from 32MZ2346 because of its uniqueness. No artifacts were collected from 32MZ144. Expanded descriptions of both sites are provided in the updated Class III report.	Section 5.5
o Additional survey is shown as needed near site 32MZ3278 on the maps in the overall Class III report but not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	Additional survey was completed in 2020 on USFS lands in the vicinity of 32MZ3278, which was relocated. A description of the site is provided in the updated Class III report.	Section 5.5
o The recommended avoidance and fencing measures are inadequate, especially for stone feature sites.	All stone feature sites have been avoided with a minimum buffet of 50 ft. Additionally, for sites between 50 and 100 ft of Project workspace WBI Energy commits to fencing and monitoring the sites during construction. WBI Energy will provide a monitoring plan for agency review.	Section 5.5
o A monitoring plan is needed.	WBI Energy commits to providing a construction monitoring plan as discussed in the updated Class III report.	
o Updates should have been conducted for all sites, site leads, and IFs [isolated finds] regardless of whether or not they were relocated.	Site form updates have been submitted for all applicable sites, isolated finds, and site leads discussed in the report	N/A
o The discussion of site leads during fieldwork is inadequate.	Site leads are discussed in Section 5.6 of the updated Class III report.	Section 5.6
o Provide specific distances between site boundaries and the edge of the workspace.	Distances between sites and Project workspaces have been added to summary tables and site descriptions throughout the updated Class III report.	Sections 5.3 through 5.5
o Provide a map of shovel testing performed outside of site boundaries. The report explains the testing strategy during survey but never discusses or shows specifics except within site boundaries.	The route maps provided as Appendix B depict survey methodology in addition to survey coverage and results.	Appendix B
o Identify the level of tribal involvement in the survey.	Tribal participation in field surveys is discussed in Sections 4 and 5.3 through 5.5 of the updated Class III report.	Sections 4 and 5.3 through 5.5
o Discuss whether indirect effects to archaeological sites were considered.	For unevaluated sites, we have added an assessment of non-physical impacts on setting.	Sections 5.3 through 5.5

-----Original Message-----
From: TrackingUpdates@fedex.com <TrackingUpdates@fedex.com>
Sent: Friday, September 18, 2020 12:57 PM
To: Sean F Cullen <Sean.F.Cullen@erm.com>
Subject: FedEx Shipment 771552421079 Delivered

This tracking update has been requested by:

Company Name: ERM
Name: Sean Cullen
E-mail: sean.cullen@erm.com

Our records indicate that the following shipment has been delivered:

Reference: 0501732-06E-01
Ship date: Sep 17, 2020
Signed for by: M.FOX
Delivery location: NEW TOWN, ND
Delivered to: Receptionist/Front Desk
Delivery date: Fri, 9/18/2020 12:55 pm
Service type: FedEx Priority Overnight®
Packaging type: Your Packaging
Number of pieces: 1
Weight: 7.00 lb.
Special handling/Services Deliver Weekday
Standard transit: 9/18/2020 by 4:30 pm

Tracking number: 771552421079

Shipper Information	Recipient Information
Sean Cullen	Pete Coffey
ERM	Three Affiliated Tribes of [...]
222 South 9th Street	404 Frontage Road
Suite 2900	NEW TOWN
MINNEAPOLIS	ND
MN	US
US	58763
55402	

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Thank you for your business.

Spirit Lake Sioux Tribe

ERM

1000 IDS Center
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Minneapolis, MN 55402

Telephone: +1 612 347 6789
Fax: +1 612 347 6780

www.erm.com

September 16, 2020

Dr. Erich Longie, Tribal Historic Preservation Officer
Spirit Lake Tribe
PO Box 76
Fort Totten, ND 58335

Subject: WBI Energy Transmission, Inc.
North Bakken Expansion Project – Class III Survey Reports 2020 Field Season
McKenzie, Williams, Burke, and Mountrail Counties, North Dakota
ND SHPO Ref.: 19-5593

Dear Dr. Longie:

Please reference WBI Energy Transmission, Inc.'s (WBI Energy's) previous correspondence regarding the above referenced project. WBI Energy proposes to construct and operate the North Bakken Expansion Project (Project) in McKenzie, Williams, Burke, and Mountrail Counties, North Dakota.

The Project is regulated by the Federal Energy Regulatory Commission (FERC) under Section 7(c) of the Natural Gas Act. Under the Energy Policy Act of 2005, FERC is the lead agency for coordinating federal authorizations and complying with the National Environmental Policy Act on natural gas pipeline projects subject to its jurisdiction. FERC similarly is the lead federal agency for complying with Section 106 of the National Historic Preservation Act (NHPA) on natural gas pipeline projects under its jurisdiction. In accordance with 36 CFR 800.2(c)(4), WBI Energy is assisting the FERC in meeting its obligations under Section 106 of the NHPA by coordinating with agencies and tribes and conducting surveys to identify historic properties that may be affected by the Project. A report on geomorphological investigations is also included in this submittal.

Enclosed for your review please find Class III survey reports for the archaeological and historic structures surveys that were conducted during the 2019 and 2020 field seasons. The archaeological report includes the results provided in the original Class III report and addresses comments that were provided by the State Historical Society of North Dakota, Bureau of Land Management, U.S. Army Corps of Engineers, and the U.S. Forest Service. The attached table summarizes our response to those comments and provides the location of the relevant revisions or clarifications.

WBI Energy would appreciate your comments on the attached reports. If you have any questions or comments on the Project or the reports, please contact me at 612-840-8976 or pat.robblee@erm.com, or Dr. Kevin Malloy at 906-285-0361 or kevin.malloy@erm.com. Please direct written correspondence to Dr. Malloy's attention at:

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Patrick Robblee
Program Director

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o Why were indirect effects to archaeological sites not considered? Setting is an important aspect of integrity for stone feature sites. There are numerous archaeological sites within and near the survey corridor that should be analyzed for indirect effects. Revise the report to address indirect effects to archaeological sites.	The report has been updated to include an assessment of physical and non-physical impacts on unevaluated and eligible sites.	Sections 4 and 5.5 through 5.5
o WBI Energy needs to develop a cultural resource monitoring plan for construction.	WBI Energy commits to preparing a monitoring plan for construction.	Sections 5.3 through 5.5
o Update site form for all sites, site leads, and isolated finds regardless of whether they were relocated. Even if a cultural resource could not be relocated, that is still valuable information for the next project/site visit.	Site form updates have been submitted for all sites, isolated finds, and site leads discussed in the updated Class III report	N/A
o WBI Energy should make additional efforts to involve tribes in upcoming 2020 fieldwork and field reviews.	As discussed in more detail in Section 4 of the updated Class III report, WBI Energy retained Beaver Creek Archaeology to coordinate tribal participation in fieldwork in 2020. BCA worked with tribes to document sites as cultural heritage resources. The results of that work will be presented in a separate report. Information on tribal participation in the surveys also is provided in Sections 4 and 5.3 through 5.5 of ERM's updated Class III report	Sections 4 and 5.3 through 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Comments from U.S. Army Corps of Engineers		
o In section 5.4.2, remove figures for 32MZ0598 and move to the previous section.	This comment is addressed in the updated Class III report	Section 5.4
o Figure 5.4-5: Map of Site 32WI976, provide contour lines on this map to show the slope. This information would help to explain why the shovel testing pattern appears the way it does.	Contour lines are provided on Figure 5.4-9 in the updated Class III report.	Section 5.4
o ERM, on behalf of WBI [Energy], identified a second concentration of artifacts in the western side of site 32WI0976 after they started excavating the test unit. Some additional testing is needed here as USACE cannot agree with the recommended determination for this site given the data presented in this report.	Additional testing will be completed at this site in the fall of 2020 with the results presented in an addendum report.	Section 5.4
o USACE recommends that WBI [Energy] conduct a remote sensing evaluation (gradiometer or conductivity) at site 32WI0976. This would be the best way to produce measurable data regarding the presence/absence of subsurface features at the site.	A remote sensing survey of the site was completed in the summer of 2020. The results of the survey were used to prepare a testing plan for 32WI976. Additional testing at the site will occur this fall with the results presented in an addendum report.	Section 5.4
Comments from the U.S. Forest Service		
o The map showing previously recorded cultural resources within a one-mile radius is only included in the overall Class III and not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Figure 1.1-2 shows the Forest Service surface and differentiates between the survey corridor and the survey corridor on Forest Service surface; however, the survey corridor on Forest Service surface and the actual Forest Service surface displayed don't match.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Sites 32MZ2347 (Historical Archaeological) and 32MZ3278 (Cairn) are located immediately adjacent to the survey corridor but are not discussed. Please discuss.	Based on route modifications, 32MZ3278 was visited in 2020 and the site boundary expanded based on the findings. A discussion of the site is provided in the updated Class III report. 32MZ2347 is outside the inventory corridor for the Project; however, we have included a discussion of this site in the Class III inventory report.	Section 5.5
o Site 32MZ145 site form update does not appear to have been performed. Why? Was an attempt made to actually relocate the site? Also, according to the site form, a THPO representative requested avoidance in 2013. More work on this site is probably needed.	When 32MZ145 was first recorded in 1979, it was characterized as two stone cairns. Subsequent investigations described the site as consisting of a single historic rock clearing pile on the west side of Highway 1806, noting that the second pile was likely destroyed by construction of the highway. ERM's survey in 2019 was limited to the east side of Highway 1806, which explains why we did not relocate the site at that time. In 2020, ERM conducted additional survey on USFS lands, examining a corridor on the west side of Highway 1806. 32MZ145 was relocated as a result of this work. The site is discussed in the updated Class III report. Tribal cultural specialists who accompanied ERM during the 2020 field investigation concurred that 32MZ145 is historic rock clearing pile.	Section 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o Site 32MZ2346 and 32MZ144: it is very improbable and therefore suspicious that there are zero artifacts and one artifact respectively at sites with historic dumps.	Sites 32MZ2346 and 32MZ144 are both previously recorded historic sites which ERM revisited and recorded during the survey for the Project. Cultural material was observed at both sites as described in the updated Class III report. ERM expanded the boundaries of 32MZ2346 to encompass two previously unreported features at the site. One artifact–a commemorative coin–was collected from 32MZ2346 because of its uniqueness. No artifacts were collected from 32MZ144. Expanded descriptions of both sites are provided in the updated Class III report.	Section 5.5
o Additional survey is shown as needed near site 32MZ3278 on the maps in the overall Class III report but not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	Additional survey was completed in 2020 on USFS lands in the vicinity of 32MZ3278, which was relocated. A description of the site is provided in the updated Class III report.	Section 5.5
o The recommended avoidance and fencing measures are inadequate, especially for stone feature sites.	All stone feature sites have been avoided with a minimum buffet of 50 ft. Additionally, for sites between 50 and 100 ft of Project workspace WBI Energy commits to fencing and monitoring the sites during construction. WBI Energy will provide a monitoring plan for agency review.	Section 5.5
o A monitoring plan is needed.	WBI Energy commits to providing a construction monitoring plan as discussed in the updated Class III report.	
o Updates should have been conducted for all sites, site leads, and IFs [isolated finds] regardless of whether or not they were relocated.	Site form updates have been submitted for all applicable sites, isolated finds, and site leads discussed in the report	N/A
o The discussion of site leads during fieldwork is inadequate.	Site leads are discussed in Section 5.6 of the updated Class III report.	Section 5.6
o Provide specific distances between site boundaries and the edge of the workspace.	Distances between sites and Project workspaces have been added to summary tables and site descriptions throughout the updated Class III report.	Sections 5.3 through 5.5
o Provide a map of shovel testing performed outside of site boundaries. The report explains the testing strategy during survey but never discusses or shows specifics except within site boundaries.	The route maps provided as Appendix B depict survey methodology in addition to survey coverage and results.	Appendix B
o Identify the level of tribal involvement in the survey.	Tribal participation in field surveys is discussed in Sections 4 and 5.3 through 5.5 of the updated Class III report.	Sections 4 and 5.3 through 5.5
o Discuss whether indirect effects to archaeological sites were considered.	For unevaluated sites, we have added an assessment of non-physical impacts on setting.	Sections 5.3 through 5.5

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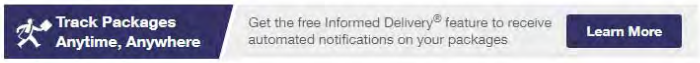

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Fax: +1 612 347 6780

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September 16, 2020

Kip Spotted Eagle, Tribal Historic Preservation Officer
Yankton Sioux Tribe
Box 1153 / 800 Main Avenue SW
Wagner, SD 57380

Subject: WBI Energy Transmission, Inc.
North Bakken Expansion Project – Class III Survey Reports 2020 Field Season
McKenzie, Williams, Burke, and Mountrail Counties, North Dakota
ND SHPO Ref.: 19-5593

Dear Mr. Spotted Eagle:

Please reference WBI Energy Transmission, Inc.'s (WBI Energy's) previous correspondence regarding the above referenced project. WBI Energy proposes to construct and operate the North Bakken Expansion Project (Project) in McKenzie, Williams, Burke, and Mountrail Counties, North Dakota.

The Project is regulated by the Federal Energy Regulatory Commission (FERC) under Section 7(c) of the Natural Gas Act. Under the Energy Policy Act of 2005, FERC is the lead agency for coordinating federal authorizations and complying with the National Environmental Policy Act on natural gas pipeline projects subject to its jurisdiction. FERC similarly is the lead federal agency for complying with Section 106 of the National Historic Preservation Act (NHPA) on natural gas pipeline projects under its jurisdiction. In accordance with 36 CFR 800.2(c)(4), WBI Energy is assisting the FERC in meeting its obligations under Section 106 of the NHPA by coordinating with agencies and tribes and conducting surveys to identify historic properties that may be affected by the Project. A report on geomorphological investigations is also included in this submittal.

Enclosed for your review please find Class III survey reports for the archaeological and historic structures surveys that were conducted during the 2019 and 2020 field seasons. The archaeological report includes the results provided in the original Class III report and addresses comments that were provided by the State Historical Society of North Dakota, Bureau of Land Management, U.S. Army Corps of Engineers, and the U.S. Forest Service. The attached table summarizes our response to those comments and provides the location of the relevant revisions or clarifications.

WBI Energy would appreciate your comments on the attached reports. If you have any questions or comments on the Project or the reports, please contact me at 612-840-8976 or pat.robblee@erm.com, or Dr. Kevin Malloy at 906-285-0361 or kevin.malloy@erm.com. Please direct written correspondence to Dr. Malloy's attention at:

Environmental Resources Management
1000 IDS Center
80 South 8th Street
Minneapolis, MN 55402

Sincerely,

Patrick Robblee
Program Director

Enclosures: Class III Archaeological Survey Report
Class III Historic Structures Addendum I Survey Report
Geomorphology Report

cc: Jill Linn, WBI Energy
Andrea Thornton, ERM
Kevin Malloy, ERM
Emily Laird, ERM
Andrew Clark, SHSND
Fern Swenson, SHSND
Liv Fetterman, USFS
Richard Rogers, USACE
Teanna Limpy, Northern Cheyenne Tribe
Pete Coffey, Three Affiliated Tribes of the Fort Berthold Reservation
Dyan Youpee, Assiniboine and Sioux Tribes of the Fort Peck Reservation
Ben Rhodd, Rosebud Sioux Tribe
Michael Black Wolf, Fort Belknap Indian Community
Tom Brings, Oglala Sioux Tribe
Jon Eagle, Standing Rock Sioux Tribe
Ben Ridgely, Northern Arapaho Tribe
Steven Vance, Cheyenne River Sioux
Erich Longie, Spirit Lake Tribe
Jeff Desjarlais, Jr., Turtle Mountain Band of Chippewa
Dianne Desrosiers, Sisseton Wahpeton Oyate

Attachment: Table summarizing agency comments on the original Class III archaeology report

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Comments from the State Historical Society of North Dakota		
General comments:		
o Provide more background information on sites with previous work. Focus on methods and reasoning for previous eligibility recommendation.	Additional information on previous investigations has been added to site descriptions, as applicable.	Sections 5.3 through 5.7
o Map symbology has item named "Shovel test – No Dig". Are these shovel probes that were planned, but not excavated for some reason? If so provide explanation.	These are planned but unexcavated shovel tests. Site descriptions have been updated, as applicable, to explain why some planned shovel tests were not excavated. Typical reasons for not excavating shovel tests include the presence of buried utilities (documented through One-Call markings) or slope.	Sections 5.3 through 5.5
Avoidance, 50 ft buffer minimum, fence, and monitor:		
o Private land: 32BK277, 32BK279, 32BK280, 32BK282, 32MZ3308, 32MZ3309, 32MZ3310, 32MZ3311, 32MZ3325, 32MZ3327, 32WI1494, 32WI1630, 32WI2144, 32WI2388, 32WI2389, 32WI2391, 32WI2392, 32WI2393, 32WI2394, 32WI2398, 32WI2406, 32WI2408.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.3
o US Forest Service Sites: 32MZ3301, 32MZ3314, 32MZ3315, 32MZ3319, 32MZ3320, 32MZ3322, 32MZ3324.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.5
Formally evaluate with site delineation and at least one 1x1 m TU. Submit evaluation plan prior to fieldwork:		
o Private Land: 32BK278, 32MZ3302, 32MZ3306, 32MZ3307, 32MZ3318, 32MZ3323, 32MZ3326, 32MZ3328, 32MZ3329, 32MZ3331, 32WI2390, 32WI2405, 32WI2407, 32WI2409, 32WI2410.	Additional testing (shovel testing and/or the excavation of at least one, 1 x 1 m test unit) was completed at each of these sites in accordance with a testing plan approved by the SHSND. Testing at sites 32WI2390 and 32MZ3328 was suspended following the identification of stone features at these sites; however, the pipeline route has been adjusted to avoid these sites with a minimum 50-ft buffer.	Section 5.3
o US Forest Service Site: 32MZ2346.	While ERM planned to conduct additional testing at this site, the pipeline route was modified prior to this work such that the site is now avoided by the Project with a buffer greater than 100 ft.	Section 5.5
Isolated finds:		
o Discuss subsurface potential on all IFs on a case-by-case basis. If the finds are in a good depositional context, STPs may be necessary to show that these are truly isolates. Minimal site recording may be enough to get a site number for database purposes, but more information is needed to verify that these are truly part of a category that can be written-off as not eligible.	Individual descriptions of isolated finds have been added to the text, including the results of shovel testing or an explanation for why shovel tests were not excavated.	Section 5.7

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Site-by-site comments, private land:		
o 32BK168 – Expand reasoning for Not Eligible Determination both previously and now. Newly recorded site boundary included previously unidentified features. Perhaps site should be unevaluated. Consider formal evaluation and provide updated management recommendations.	ERM conducted site testing at 32BK168 in 2020. Evidence of intact cultural deposits and features was identified during testing and the site is now recommended as eligible for listing in the NRHP. The pipeline route has been modified to avoid this site with a buffer of 57 ft.	Section 5.3
o 32MZ3323 – Discussion mentions "Better Examples" of homesteads. Provide examples.	The description for 32MZ3323 has been updated to incorporate the results of additional testing (shovel testing and the excavation of a 1 x 1 m test unit) in the updated Class III report.	Section 5.3
o 32WI1495 – Actual well shown in Figure 5.3-81 may be visible in figure 5.3-80. Is this location impacted by project? Consider site lead.	The location of the well (which is no longer extant) is discussed in the updated Class III report in conjunction with 32WI1495. ERM has submitted a site lead form for this resource. The suggested boundary of the site lead is 19 ft from Project workspace. The actual location of the well is about 235 ft from Project workspace.	Section 5.3
o 32WI2404 – How is this identified as prehistoric? Could it be a result of natural glacial and/or historic or modern field clearing? Provide evidence. Fence and monitor as necessary.	The interpretation of the feature at 32WI2404 as prehistoric is conservative and based on best professional judgement. Tribal cultural specialists who visited the site with ERM concurred with this interpretation.	Section 5.3
o 32WI2408 – Workspace is extremely close to possible graves. Is the planned route fixed?	The pipeline route has been modified to avoid this site with a buffer of 213 ft.	Section 5.3
Site-by-site comments, US Army Corps of Engineers land:		
o 32MZ976 – Drilling under site is not avoidance as leaks and emergency repairs do consider cultural resources. Formal testing or horizontal avoidance is necessary.	The trajectory of the HDD will be 160 to 180 ft below ground surface where it passes beneath 32WI976. The pipeline will carry gas, not a liquid; the gas would migrate to the surface and dissipate into the air in the event of a leak. Given the depth of the HDD installation, daylighting of the pipeline for repair would not be feasible. If repair is required in the future, the most likely course of action would be to re-install a new segment via HDD, which would require federal authorizations, thereby triggering review of the action under Section 106 of the NHPA. A description of the HDD method has been added to the description of 32WI976 in Section 5.4 of the report. Additional testing at the site is pending and scheduled to be completed this fall. The results will be discussed in an addendum report.	Section 5.4
o 32MZ976 – Show bore location and HDD line on map	A figure showing the HDD alignment with entry and exit points has been added to the description of this site as has a construction alignment sheet. The alignment sheet depicts the HDD in plan and profile.	Section 5.4

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o 32MZ976 – Clarify and provide more evidence for geomorphological hypothesis of A horizon being related to flood deposits. Typically, A horizons show stability rather than accretional or erosional events. Provide more information on why artifacts are interpreted as disturbed rather than in primary context.	The text in the updated Class III report has been updated to address this comment. As noted above, additional testing is planned to occur at 32WI976 this fall, which will provide additional information on the soils present at the site.	Section 5.4
o 32MZ976 – Did cut bank provide additional information on buried soils? Were artifacts identified in cut bank?	The cut bank was examined during the initial survey. As noted above, additional testing is planned to occur at the site this fall with results to be discussed in an addendum report.	Section 5.4
o 32WI976 – Given size and shape of site, additional TUs recommended.		
Comments from the Bureau of Land Management		
o The recommended protection/avoidance measures for unevaluated and eligible archaeological sites in the Class III report are inadequate, particularly regarding stone feature sites. The usual avoidance distance requested/required by the BLM is 100 feet. More than 100 feet is preferred for stone feature sites. Revise protection/avoidance measures buffers for archaeological sites.	WBI Energy has routed the pipeline to avoid unevaluated and eligible sites with a minimum buffer of 50 ft as directed by the SHSND.	Sections 5.3 through 5.5
o Why were indirect effects to archaeological sites not considered? Setting is an important aspect of integrity for stone feature sites. There are numerous archaeological sites within and near the survey corridor that should be analyzed for indirect effects. Revise the report to address indirect effects to archaeological sites.	The report has been updated to include an assessment of physical and non-physical impacts on unevaluated and eligible sites.	Sections 4 and 5.5 through 5.5
o WBI Energy needs to develop a cultural resource monitoring plan for construction.	WBI Energy commits to preparing a monitoring plan for construction.	Sections 5.3 through 5.5
o Update site form for all sites, site leads, and isolated finds regardless of whether they were relocated. Even if a cultural resource could not be relocated, that is still valuable information for the next project/site visit.	Site form updates have been submitted for all sites, isolated finds, and site leads discussed in the updated Class III report	N/A
o WBI Energy should make additional efforts to involve tribes in upcoming 2020 fieldwork and field reviews.	As discussed in more detail in Section 4 of the updated Class III report, WBI Energy retained Beaver Creek Archaeology to coordinate tribal participation in fieldwork in 2020. BCA worked with tribes to document sites as cultural heritage resources. The results of that work will be presented in a separate report. Information on tribal participation in the surveys also is provided in Sections 4 and 5.3 through 5.5 of ERM's updated Class III report	Sections 4 and 5.3 through 5.5

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o Provide a map of shovel testing performed outside of site boundaries. The report explains the testing strategy during survey but never discusses or shows specifics except within site boundaries.	The route maps provided as Appendix B depict survey methodology in addition to survey coverage and results.	Appendix B
o Identify the level of tribal involvement in the survey.	Tribal participation in field surveys is discussed in Sections 4 and 5.3 through 5.5 of the updated Class III report.	Sections 4 and 5.3 through 5.5
o Discuss whether indirect effects to archaeological sites were considered.	For unevaluated sites, we have added an assessment of non-physical impacts on setting.	Sections 5.3 through 5.5

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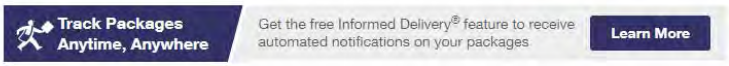

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Fax: +1 612 347 6780

www.erm.com

September 16, 2020

Teanna Limpy Tribal Historic Preservation Officer
Northern Cheyenne Tribe
PO Box 128
Lame Deer, MT 59043

Subject: WBI Energy Transmission, Inc.
North Bakken Expansion Project – Class III Survey Reports 2020 Field Season
McKenzie, Williams, Burke, and Mountrail Counties, North Dakota
ND SHPO Ref.: 19-5593

Dear Ms. Limpy:

Please reference WBI Energy Transmission, Inc.'s (WBI Energy's) previous correspondence regarding the above referenced project. WBI Energy proposes to construct and operate the North Bakken Expansion Project (Project) in McKenzie, Williams, Burke, and Mountrail Counties, North Dakota.

The Project is regulated by the Federal Energy Regulatory Commission (FERC) under Section 7(c) of the Natural Gas Act. Under the Energy Policy Act of 2005, FERC is the lead agency for coordinating federal authorizations and complying with the National Environmental Policy Act on natural gas pipeline projects subject to its jurisdiction. FERC similarly is the lead federal agency for complying with Section 106 of the National Historic Preservation Act (NHPA) on natural gas pipeline projects under its jurisdiction. In accordance with 36 CFR 800.2(c)(4), WBI Energy is assisting the FERC in meeting its obligations under Section 106 of the NHPA by coordinating with agencies and tribes and conducting surveys to identify historic properties that may be affected by the Project.

Enclosed for your review please find Class III survey reports for the archaeological and historic structures surveys that were conducted during the 2019 and 2020 field seasons. The archaeological report includes the results provided in the original Class III report and addresses comments that were provided by the State Historical Society of North Dakota, Bureau of Land Management, U.S. Army Corps of Engineers, and the U.S. Forest Service. The attached table summarizes our response to those comments and provides the location of the relevant revisions or clarifications. A report on geomorphological investigations is also included in this submittal.

WBI Energy would appreciate your comments on the attached reports. If you have any questions or comments on the Project or the reports, please contact me at 612-840-8976 or pat.robblee@erm.com, or Dr. Kevin Malloy at 906-285-0361 or kevin.malloy@erm.com. Please direct written correspondence to Dr. Malloy's attention at:

Environmental Resources Management
1000 IDS Center
80 South 8th Street
Minneapolis, MN 55402

Sincerely,

Patrick Robblee
Program Director

Enclosures: Class III Archaeological Survey Report
Class III Historic Structures Addendum I Survey Report
Geomorphology Report

cc: Jill Linn, WBI Energy
Andrea Thornton, ERM
Kevin Malloy, ERM
Emily Laird, ERM
Andrew Clark, SHSND
Fern Swenson, SHSND
Liv Fetterman, USFS
Richard Rogers, USACE
Pete Coffey, Three Affiliated Tribes of the Fort Berthold Reservation
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Attachment: Table summarizing agency comments on the original Class III archaeology report

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
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General comments:		
o Provide more background information on sites with previous work. Focus on methods and reasoning for previous eligibility recommendation.	Additional information on previous investigations has been added to site descriptions, as applicable.	Sections 5.3 through 5.7
o Map symbology has item named "Shovel test – No Dig". Are these shovel probes that were planned, but not excavated for some reason? If so provide explanation.	These are planned but unexcavated shovel tests. Site descriptions have been updated, as applicable, to explain why some planned shovel tests were not excavated. Typical reasons for not excavating shovel tests include the presence of buried utilities (documented through One-Call markings) or slope.	Sections 5.3 through 5.5
Avoidance, 50 ft buffer minimum, fence, and monitor:		
o Private land: 32BK277, 32BK279, 32BK280, 32BK282, 32MZ3308, 32MZ3309, 32MZ3310, 32MZ3311, 32MZ3325, 32MZ3327, 32WI1494, 32WI1630, 32WI2144, 32WI2388, 32WI2389, 32WI2391, 32WI2392, 32WI2393, 32WI2394, 32WI2398, 32WI2406, 32WI2408.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.3
o US Forest Service Sites: 32MZ3301, 32MZ3314, 32MZ3315, 32MZ3319, 32MZ3320, 32MZ3322, 32MZ3324.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.5
Formally evaluate with site delineation and at least one 1x1 m TU. Submit evaluation plan prior to fieldwork:		
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o US Forest Service Site: 32MZ2346.	While ERM planned to conduct additional testing at this site, the pipeline route was modified prior to this work such that the site is now avoided by the Project with a buffer greater than 100 ft.	Section 5.5
Isolated finds:		
o Discuss subsurface potential on all IFs on a case-by-case basis. If the finds are in a good depositional context, STPs may be necessary to show that these are truly isolates. Minimal site recording may be enough to get a site number for database purposes, but more information is needed to verify that these are truly part of a category that can be written-off as not eligible.	Individual descriptions of isolated finds have been added to the text, including the results of shovel testing or an explanation for why shovel tests were not excavated.	Section 5.7

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o 32MZ3323 – Discussion mentions "Better Examples" of homesteads. Provide examples.	The description for 32MZ3323 has been updated to incorporate the results of additional testing (shovel testing and the excavation of a 1 x 1 m test unit) in the updated Class III report.	Section 5.3
o 32WI1495 – Actual well shown in Figure 5.3-81 may be visible in figure 5.3-80. Is this location impacted by project? Consider site lead.	The location of the well (which is no longer extant) is discussed in the updated Class III report in conjunction with 32WI1495. ERM has submitted a site lead form for this resource. The suggested boundary of the site lead is 19 ft from Project workspace. The actual location of the well is about 235 ft from Project workspace.	Section 5.3
o 32WI2404 – How is this identified as prehistoric? Could it be a result of natural glacial and/or historic or modern field clearing? Provide evidence. Fence and monitor as necessary.	The interpretation of the feature at 32WI2404 as prehistoric is conservative and based on best professional judgement. Tribal cultural specialists who visited the site with ERM concurred with this interpretation.	Section 5.3
o 32WI2408 – Workspace is extremely close to possible graves. Is the planned route fixed?	The pipeline route has been modified to avoid this site with a buffer of 213 ft.	Section 5.3
Site-by-site comments, US Army Corps of Engineers land:		
o 32MZ976 – Drilling under site is not avoidance as leaks and emergency repairs do consider cultural resources. Formal testing or horizontal avoidance is necessary.	The trajectory of the HDD will be 160 to 180 ft below ground surface where it passes beneath 32WI976. The pipeline will carry gas, not a liquid; the gas would migrate to the surface and dissipate into the air in the event of a leak. Given the depth of the HDD installation, daylighting of the pipeline for repair would not be feasible. If repair is required in the future, the most likely course of action would be to re-install a new segment via HDD, which would require federal authorizations, thereby triggering review of the action under Section 106 of the NHPA. A description of the HDD method has been added to the description of 32WI976 in Section 5.4 of the report. Additional testing at the site is pending and scheduled to be completed this fall. The results will be discussed in an addendum report.	Section 5.4
o 32MZ976 – Show bore location and HDD line on map	A figure showing the HDD alignment with entry and exit points has been added to the description of this site as has a construction alignment sheet. The alignment sheet depicts the HDD in plan and profile.	Section 5.4

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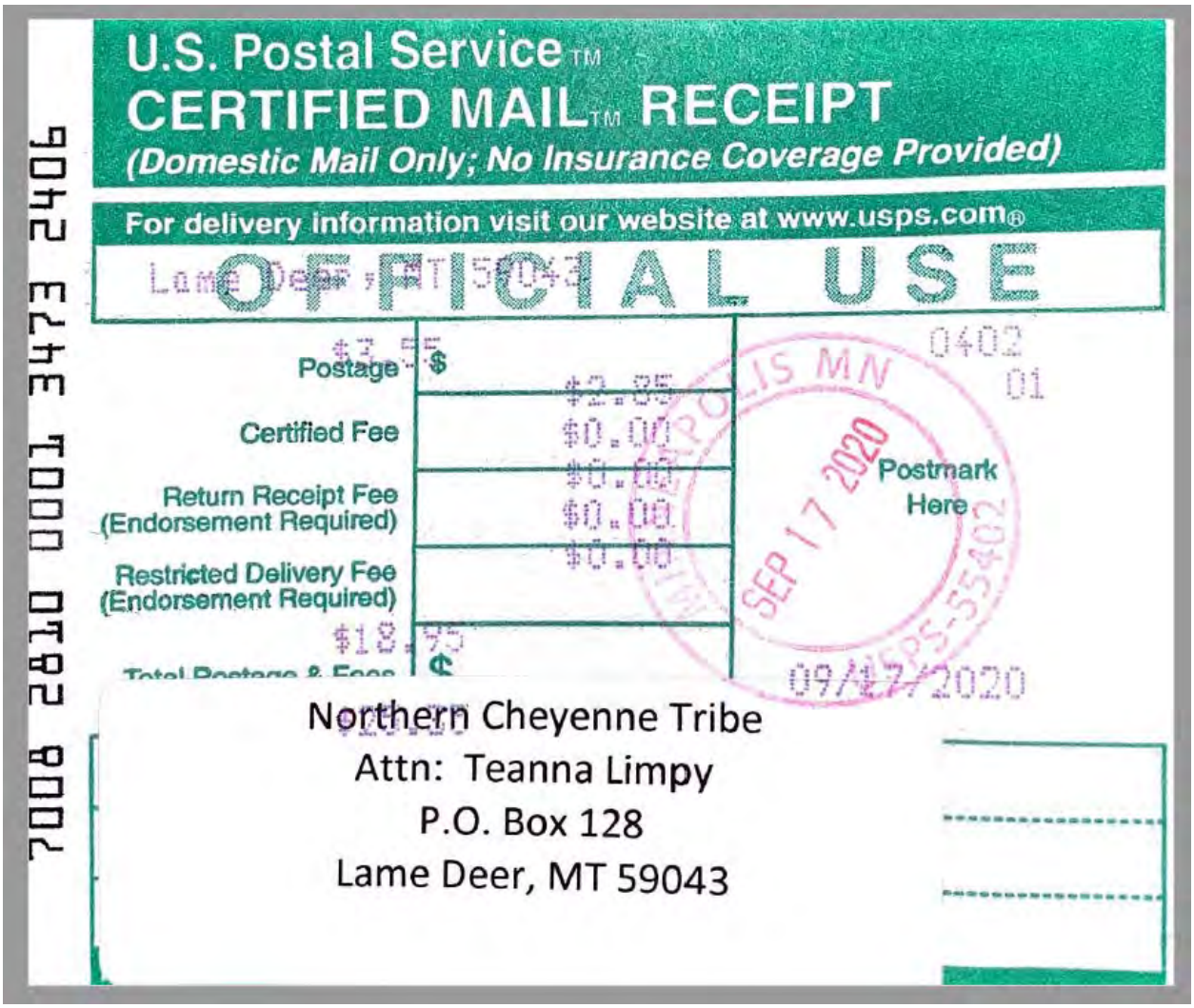
o 32MZ976 – Did cut bank provide additional information on buried soils? Were artifacts identified in cut bank?	The cut bank was examined during the initial survey. As noted above, additional testing is planned to occur at the site this fall with results to be discussed in an addendum report.	Section 5.4
o 32WI976 – Given size and shape of site, additional TUs recommended.		
Comments from the Bureau of Land Management		
o The recommended protection/avoidance measures for unevaluated and eligible archaeological sites in the Class III report are inadequate, particularly regarding stone feature sites. The usual avoidance distance requested/required by the BLM is 100 feet. More than 100 feet is preferred for stone feature sites. Revise protection/avoidance measures buffers for archaeological sites.	WBI Energy has routed the pipeline to avoid unevaluated and eligible sites with a minimum buffer of 50 ft as directed by the SHSND.	Sections 5.3 through 5.5
o Why were indirect effects to archaeological sites not considered? Setting is an important aspect of integrity for stone feature sites. There are numerous archaeological sites within and near the survey corridor that should be analyzed for indirect effects. Revise the report to address indirect effects to archaeological sites.	The report has been updated to include an assessment of physical and non-physical impacts on unevaluated and eligible sites.	Sections 4 and 5.5 through 5.5
o WBI Energy needs to develop a cultural resource monitoring plan for construction.	WBI Energy commits to preparing a monitoring plan for construction.	Sections 5.3 through 5.5
o Update site form for all sites, site leads, and isolated finds regardless of whether they were relocated. Even if a cultural resource could not be relocated, that is still valuable information for the next project/site visit.	Site form updates have been submitted for all sites, isolated finds, and site leads discussed in the updated Class III report	N/A
o WBI Energy should make additional efforts to involve tribes in upcoming 2020 fieldwork and field reviews.	As discussed in more detail in Section 4 of the updated Class III report, WBI Energy retained Beaver Creek Archaeology to coordinate tribal participation in fieldwork in 2020. BCA worked with tribes to document sites as cultural heritage resources. The results of that work will be presented in a separate report. Information on tribal participation in the surveys also is provided in Sections 4 and 5.3 through 5.5 of ERM's updated Class III report	Sections 4 and 5.3 through 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Comments from U.S. Army Corps of Engineers		
o In section 5.4.2, remove figures for 32MZ0598 and move to the previous section.	This comment is addressed in the updated Class III report	Section 5.4
o Figure 5.4-5: Map of Site 32WI976, provide contour lines on this map to show the slope. This information would help to explain why the shovel testing pattern appears the way it does.	Contour lines are provided on Figure 5.4-9 in the updated Class III report.	Section 5.4
o ERM, on behalf of WBI [Energy], identified a second concentration of artifacts in the western side of site 32WI0976 after they started excavating the test unit. Some additional testing is needed here as USACE cannot agree with the recommended determination for this site given the data presented in this report.	Additional testing will be completed at this site in the fall of 2020 with the results presented in an addendum report.	Section 5.4
o USACE recommends that WBI [Energy] conduct a remote sensing evaluation (gradiometer or conductivity) at site 32WI0976. This would be the best way to produce measurable data regarding the presence/absence of subsurface features at the site.	A remote sensing survey of the site was completed in the summer of 2020. The results of the survey were used to prepare a testing plan for 32WI976. Additional testing at the site will occur this fall with the results presented in an addendum report.	Section 5.4
Comments from the U.S. Forest Service		
o The map showing previously recorded cultural resources within a one-mile radius is only included in the overall Class III and not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Figure 1.1-2 shows the Forest Service surface and differentiates between the survey corridor and the survey corridor on Forest Service surface; however, the survey corridor on Forest Service surface and the actual Forest Service surface displayed don't match.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Sites 32MZ2347 (Historical Archaeological) and 32MZ3278 (Cairn) are located immediately adjacent to the survey corridor but are not discussed. Please discuss.	Based on route modifications, 32MZ3278 was visited in 2020 and the site boundary expanded based on the findings. A discussion of the site is provided in the updated Class III report. 32MZ2347 is outside the inventory corridor for the Project; however, we have included a discussion of this site in the Class III inventory report.	Section 5.5
o Site 32MZ145 site form update does not appear to have been performed. Why? Was an attempt made to actually relocate the site? Also, according to the site form, a THPO representative requested avoidance in 2013. More work on this site is probably needed.	When 32MZ145 was first recorded in 1979, it was characterized as two stone cairns. Subsequent investigations described the site as consisting of a single historic rock clearing pile on the west side of Highway 1806, noting that the second pile was likely destroyed by construction of the highway. ERM's survey in 2019 was limited to the east side of Highway 1806, which explains why we did not relocate the site at that time. In 2020, ERM conducted additional survey on USFS lands, examining a corridor on the west side of Highway 1806. 32MZ145 was relocated as a result of this work. The site is discussed in the updated Class III report. Tribal cultural specialists who accompanied ERM during the 2020 field investigation concurred that 32MZ145 is historic rock clearing pile.	Section 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o Site 32MZ2346 and 32MZ144: it is very improbable and therefore suspicious that there are zero artifacts and one artifact respectively at sites with historic dumps.	Sites 32MZ2346 and 32MZ144 are both previously recorded historic sites which ERM revisited and recorded during the survey for the Project. Cultural material was observed at both sites as described in the updated Class III report. ERM expanded the boundaries of 32MZ2346 to encompass two previously unreported features at the site. One artifact–a commemorative coin–was collected from 32MZ2346 because of its uniqueness. No artifacts were collected from 32MZ144. Expanded descriptions of both sites are provided in the updated Class III report.	Section 5.5
o Additional survey is shown as needed near site 32MZ3278 on the maps in the overall Class III report but not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	Additional survey was completed in 2020 on USFS lands in the vicinity of 32MZ3278, which was relocated. A description of the site is provided in the updated Class III report.	Section 5.5
o The recommended avoidance and fencing measures are inadequate, especially for stone feature sites.	All stone feature sites have been avoided with a minimum buffet of 50 ft. Additionally, for sites between 50 and 100 ft of Project workspace WBI Energy commits to fencing and monitoring the sites during construction. WBI Energy will provide a monitoring plan for agency review.	Section 5.5
o A monitoring plan is needed.	WBI Energy commits to providing a construction monitoring plan as discussed in the updated Class III report.	
o Updates should have been conducted for all sites, site leads, and IFs [isolated finds] regardless of whether or not they were relocated.	Site form updates have been submitted for all applicable sites, isolated finds, and site leads discussed in the report	N/A
o The discussion of site leads during fieldwork is inadequate.	Site leads are discussed in Section 5.6 of the updated Class III report.	Section 5.6
o Provide specific distances between site boundaries and the edge of the workspace.	Distances between sites and Project workspaces have been added to summary tables and site descriptions throughout the updated Class III report.	Sections 5.3 through 5.5
o Provide a map of shovel testing performed outside of site boundaries. The report explains the testing strategy during survey but never discusses or shows specifics except within site boundaries.	The route maps provided as Appendix B depict survey methodology in addition to survey coverage and results.	Appendix B
o Identify the level of tribal involvement in the survey.	Tribal participation in field surveys is discussed in Sections 4 and 5.3 through 5.5 of the updated Class III report.	Sections 4 and 5.3 through 5.5
o Discuss whether indirect effects to archaeological sites were considered.	For unevaluated sites, we have added an assessment of non-physical impacts on setting.	Sections 5.3 through 5.5



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September 16, 2020

Steven Vance, Tribal Historic Preservation Officer
Cheyenne River Sioux Tribe
PO Box 590
Eagle Butte, SD 57625

Subject: WBI Energy Transmission, Inc.
North Bakken Expansion Project – Class III Survey Reports 2020 Field Season
McKenzie, Williams, Burke, and Mountrail Counties, North Dakota
ND SHPO Ref.: 19-5593

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o The recommended protection/avoidance measures for unevaluated and eligible archaeological sites in the Class III report are inadequate, particularly regarding stone feature sites. The usual avoidance distance requested/required by the BLM is 100 feet. More than 100 feet is preferred for stone feature sites. Revise protection/avoidance measures buffers for archaeological sites.	WBI Energy has routed the pipeline to avoid unevaluated and eligible sites with a minimum buffer of 50 ft as directed by the SHSND.	Sections 5.3 through 5.5
o Why were indirect effects to archaeological sites not considered? Setting is an important aspect of integrity for stone feature sites. There are numerous archaeological sites within and near the survey corridor that should be analyzed for indirect effects. Revise the report to address indirect effects to archaeological sites.	The report has been updated to include an assessment of physical and non-physical impacts on unevaluated and eligible sites.	Sections 4 and 5.5 through 5.5
o WBI Energy needs to develop a cultural resource monitoring plan for construction.	WBI Energy commits to preparing a monitoring plan for construction.	Sections 5.3 through 5.5
o Update site form for all sites, site leads, and isolated finds regardless of whether they were relocated. Even if a cultural resource could not be relocated, that is still valuable information for the next project/site visit.	Site form updates have been submitted for all sites, isolated finds, and site leads discussed in the updated Class III report	N/A
o WBI Energy should make additional efforts to involve tribes in upcoming 2020 fieldwork and field reviews.	As discussed in more detail in Section 4 of the updated Class III report, WBI Energy retained Beaver Creek Archaeology to coordinate tribal participation in fieldwork in 2020. BCA worked with tribes to document sites as cultural heritage resources. The results of that work will be presented in a separate report. Information on tribal participation in the surveys also is provided in Sections 4 and 5.3 through 5.5 of ERM's updated Class III report	Sections 4 and 5.3 through 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Comments from U.S. Army Corps of Engineers		
o In section 5.4.2, remove figures for 32MZ0598 and move to the previous section.	This comment is addressed in the updated Class III report	Section 5.4
o Figure 5.4-5: Map of Site 32WI976, provide contour lines on this map to show the slope. This information would help to explain why the shovel testing pattern appears the way it does.	Contour lines are provided on Figure 5.4-9 in the updated Class III report.	Section 5.4
o ERM, on behalf of WBI [Energy], identified a second concentration of artifacts in the western side of site 32WI0976 after they started excavating the test unit. Some additional testing is needed here as USACE cannot agree with the recommended determination for this site given the data presented in this report.	Additional testing will be completed at this site in the fall of 2020 with the results presented in an addendum report.	Section 5.4
o USACE recommends that WBI [Energy] conduct a remote sensing evaluation (gradiometer or conductivity) at site 32WI0976. This would be the best way to produce measurable data regarding the presence/absence of subsurface features at the site.	A remote sensing survey of the site was completed in the summer of 2020. The results of the survey were used to prepare a testing plan for 32WI976. Additional testing at the site will occur this fall with the results presented in an addendum report.	Section 5.4
Comments from the U.S. Forest Service		
o The map showing previously recorded cultural resources within a one-mile radius is only included in the overall Class III and not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Figure 1.1-2 shows the Forest Service surface and differentiates between the survey corridor and the survey corridor on Forest Service surface; however, the survey corridor on Forest Service surface and the actual Forest Service surface displayed don't match.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Sites 32MZ2347 (Historical Archaeological) and 32MZ3278 (Cairn) are located immediately adjacent to the survey corridor but are not discussed. Please discuss.	Based on route modifications, 32MZ3278 was visited in 2020 and the site boundary expanded based on the findings. A discussion of the site is provided in the updated Class III report. 32MZ2347 is outside the inventory corridor for the Project; however, we have included a discussion of this site in the Class III inventory report.	Section 5.5
o Site 32MZ145 site form update does not appear to have been performed. Why? Was an attempt made to actually relocate the site? Also, according to the site form, a THPO representative requested avoidance in 2013. More work on this site is probably needed.	When 32MZ145 was first recorded in 1979, it was characterized as two stone cairns. Subsequent investigations described the site as consisting of a single historic rock clearing pile on the west side of Highway 1806, noting that the second pile was likely destroyed by construction of the highway. ERM's survey in 2019 was limited to the east side of Highway 1806, which explains why we did not relocate the site at that time. In 2020, ERM conducted additional survey on USFS lands, examining a corridor on the west side of Highway 1806. 32MZ145 was relocated as a result of this work. The site is discussed in the updated Class III report. Tribal cultural specialists who accompanied ERM during the 2020 field investigation concurred that 32MZ145 is historic rock clearing pile.	Section 5.5

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o Site 32MZ2346 and 32MZ144: it is very improbable and therefore suspicious that there are zero artifacts and one artifact respectively at sites with historic dumps.	Sites 32MZ2346 and 32MZ144 are both previously recorded historic sites which ERM revisited and recorded during the survey for the Project. Cultural material was observed at both sites as described in the updated Class III report. ERM expanded the boundaries of 32MZ2346 to encompass two previously unreported features at the site. One artifact–a commemorative coin–was collected from 32MZ2346 because of its uniqueness. No artifacts were collected from 32MZ144. Expanded descriptions of both sites are provided in the updated Class III report.	Section 5.5
o Additional survey is shown as needed near site 32MZ3278 on the maps in the overall Class III report but not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	Additional survey was completed in 2020 on USFS lands in the vicinity of 32MZ3278, which was relocated. A description of the site is provided in the updated Class III report.	Section 5.5
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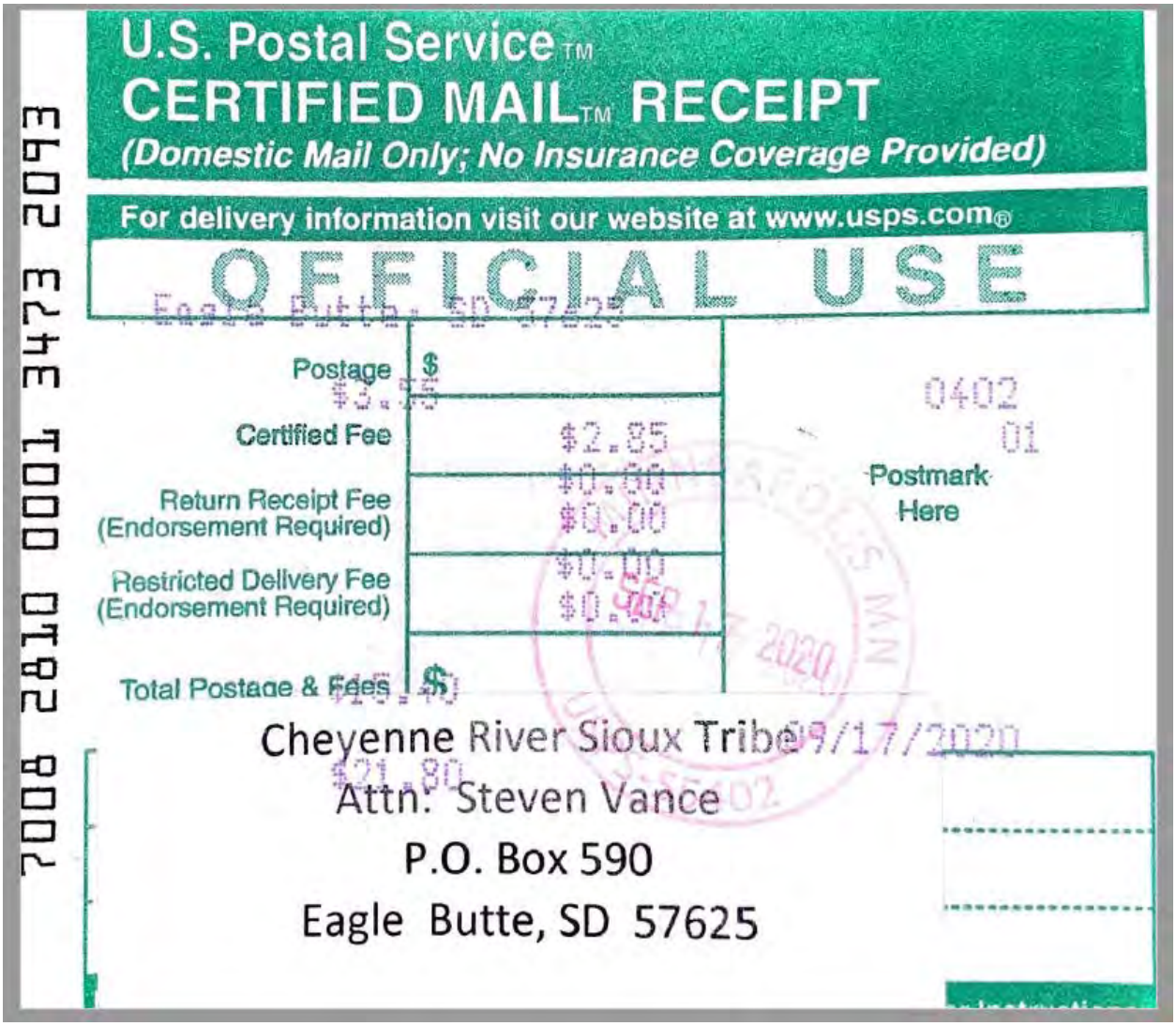
o A monitoring plan is needed.	WBI Energy commits to providing a construction monitoring plan as discussed in the updated Class III report.	
o Updates should have been conducted for all sites, site leads, and IFs [isolated finds] regardless of whether or not they were relocated.	Site form updates have been submitted for all applicable sites, isolated finds, and site leads discussed in the report	N/A
o The discussion of site leads during fieldwork is inadequate.	Site leads are discussed in Section 5.6 of the updated Class III report.	Section 5.6
o Provide specific distances between site boundaries and the edge of the workspace.	Distances between sites and Project workspaces have been added to summary tables and site descriptions throughout the updated Class III report.	Sections 5.3 through 5.5
o Provide a map of shovel testing performed outside of site boundaries. The report explains the testing strategy during survey but never discusses or shows specifics except within site boundaries.	The route maps provided as Appendix B depict survey methodology in addition to survey coverage and results.	Appendix B
o Identify the level of tribal involvement in the survey.	Tribal participation in field surveys is discussed in Sections 4 and 5.3 through 5.5 of the updated Class III report.	Sections 4 and 5.3 through 5.5
o Discuss whether indirect effects to archaeological sites were considered.	For unevaluated sites, we have added an assessment of non-physical impacts on setting.	Sections 5.3 through 5.5



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Assiniboine and Sioux Tribes of the Fort Peck Reservation

MEETING NOTES

LOG OF IN PERSON MEETING

MEETING ATTENDEES:

Dyan Youpee – Assiniboine & Sioux Tribes Tribal Historic Preservation Officer
Eugene Ryan – Assiniboine & Sioux Tribes Tribal Cultural Specialist
Andrea Kruse – U.S. Forest Service (USFS)
Lucas - USFS
Katie West – Bureau of Land Management (BLM)
Jill Linn – WBI Energy Transmission, Inc. (WBI Energy)
Andrew Clark – State Historical Society of North Dakota (SHSND)
Fern Swenson - SHSND
Wade Burns – Beaver Creek Archaeology (BCA)
Raina Hanley – BCA
Larry Pallozzi – BCA
Jayson Zoino – Environmental Resource Group (ERM)

DATE:	TIME OF CONVERSATION:
September 11, 2020	11:30 am to 4:30 pm

RE:

North Bakken Expansion Project

LOG OF CONVERSATION:

ERM visited sites 32MZ3379, 32MZ3380, 32MZ3382, 32MZ3383, and 32MZ3385 on USFS lands with representatives of the Assiniboine & Sioux Tribes, SHSND, USFS, BLM, WBI Energy, and BCA. ERM documented these sites in the summer of 2020 during survey for WBI Energy's North Bakken Expansion Project. Tribal cultural specialists representing the Assiniboine & Sioux Tribes, Standing Rock Sioux Tribe, Rosebud Sioux Tribe (including one specialist working on behalf of the Sisseton Wahpeton Oyate Tribe), and Turtle Mountain Band of Chippewa Indians monitored ERM's delineation of the sites; however, the specialists did not uniformly concur with the interpretation of the finds as archaeological. Some of the specialists concluded that the finds documented by ERM are non-cultural.

The visits to 32MZ3379, 32MZ3380, 32MZ3382, 32MZ3383, and 32MZ3385 allowed Ms. Youpee and Mr. Ryan to inspect the sites and features recorded by ERM. Ms. Youpee did not concur with the interpretation of the finds as archaeological, instead concluding that the features are either natural or the result of modern disturbances.

The meeting participants also discussed: processes for addressing sites where tribal cultural specialists do not concur with interpretations by archaeologists; the roles of the different agencies reviewing the North Bakken Expansion Project; the different expertise provided by tribal cultural specialists and archaeologists; and the qualifications of ERM's archaeologists.

ERM

1000 IDS Center
80 South Eighth Street
Minneapolis, MN 55402

Telephone: +1 612 347 6789
Fax: +1 612 347 6780

www.erm.com

September 16, 2020

Dyan Youpee, Tribal Historic Preservation Officer
Assiniboine and Sioux Tribes of the Fort Peck Reservation
PO Box 1027
Poplar, MT 59255

Subject: WBI Energy Transmission, Inc.
North Bakken Expansion Project – Class III Survey Reports 2020 Field Season
McKenzie, Williams, Burke, and Mountrail Counties, North Dakota
ND SHPO Ref.: 19-5593

Dear Ms. Youpee:

Please reference WBI Energy Transmission, Inc.'s (WBI Energy's) previous correspondence regarding the above referenced project. WBI Energy proposes to construct and operate the North Bakken Expansion Project (Project) in McKenzie, Williams, Burke, and Mountrail Counties, North Dakota.

The Project is regulated by the Federal Energy Regulatory Commission (FERC) under Section 7(c) of the Natural Gas Act. Under the Energy Policy Act of 2005, FERC is the lead agency for coordinating federal authorizations and complying with the National Environmental Policy Act on natural gas pipeline projects subject to its jurisdiction. FERC similarly is the lead federal agency for complying with Section 106 of the National Historic Preservation Act (NHPA) on natural gas pipeline projects under its jurisdiction. In accordance with 36 CFR 800.2(c)(4), WBI Energy is assisting the FERC in meeting its obligations under Section 106 of the NHPA by coordinating with agencies and tribes and conducting surveys to identify historic properties that may be affected by the Project.

Enclosed for your review please find Class III survey reports for the archaeological and historic structures surveys that were conducted during the 2019 and 2020 field seasons. The archaeological report includes the results provided in the original Class III report and addresses comments that were provided by the State Historical Society of North Dakota, Bureau of Land Management, U.S. Army Corps of Engineers, and the U.S. Forest Service. The attached table summarizes our response to those comments and provides the location of the relevant revisions or clarifications. A report on geomorphological investigations is also included in this submittal.

WBI Energy would appreciate your comments on the attached reports. If you have any questions or comments on the Project or the reports, please contact me at 612-840-8976 or pat.robblee@erm.com, or Dr. Kevin Malloy at 906-285-0361 or kevin.malloy@erm.com. Please direct written correspondence to Dr. Malloy's attention at:

Environmental Resources Management
1000 IDS Center
80 South 8th Street
Minneapolis, MN 55402

Sincerely,

Patrick Robblee
Program Director

Enclosures: Class III Archaeological Survey Report
Class III Historic Structures Addendum I Survey Report
Geomorphology Report

cc: Jill Linn, WBI Energy
Andrea Thornton, ERM
Kevin Malloy, ERM
Emily Laird, ERM
Andrew Clark, SHSND
Fern Swenson, SHSND
Liv Fetterman, USFS
Richard Rogers, USACE
Teanna Limpy, Northern Cheyenne Tribe
Pete Coffey, Three Affiliated Tribes of the Fort Berthold Reservation
Ben Rhodd, Rosebud Sioux Tribe
Michael Black Wolf, Fort Belknap Indian Community
Tom Brings, Oglala Sioux Tribe
Jon Eagle, Standing Rock Sioux Tribe
Ben Ridgely, Northern Arapaho Tribe
Steven Vance, Cheyenne River Sioux
Erich Longie, Spirit Lake Tribe
Kip Spotted Eagle, Yankton Sioux Tribe
Jeff Desjarlais, Jr., Turtle Mountain Band of Chippewa
Dianne Desrosiers, Sisseton Wahpeton Oyate

Attachment: Table summarizing agency comments on the original Class III archaeology report

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Comments from the State Historical Society of North Dakota		
General comments:		
o Provide more background information on sites with previous work. Focus on methods and reasoning for previous eligibility recommendation.	Additional information on previous investigations has been added to site descriptions, as applicable.	Sections 5.3 through 5.7
o Map symbology has item named "Shovel test – No Dig". Are these shovel probes that were planned, but not excavated for some reason? If so provide explanation.	These are planned but unexcavated shovel tests. Site descriptions have been updated, as applicable, to explain why some planned shovel tests were not excavated. Typical reasons for not excavating shovel tests include the presence of buried utilities (documented through One-Call markings) or slope.	Sections 5.3 through 5.5
Avoidance, 50 ft buffer minimum, fence, and monitor:		
o Private land: 32BK277, 32BK279, 32BK280, 32BK282, 32MZ3308, 32MZ3309, 32MZ3310, 32MZ3311, 32MZ3325, 32MZ3327, 32WI1494, 32WI1630, 32WI2144, 32WI2388, 32WI2389, 32WI2391, 32WI2392, 32WI2393, 32WI2394, 32WI2398, 32WI2406, 32WI2408.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.3
o US Forest Service Sites: 32MZ3301, 32MZ3314, 32MZ3315, 32MZ3319, 32MZ3320, 32MZ3322, 32MZ3324.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.5
Formally evaluate with site delineation and at least one 1x1 m TU. Submit evaluation plan prior to fieldwork:		
o Private Land: 32BK278, 32MZ3302, 32MZ3306, 32MZ3307, 32MZ3318, 32MZ3323, 32MZ3326, 32MZ3328, 32MZ3329, 32MZ3331, 32WI2390, 32WI2405, 32WI2407, 32WI2409, 32WI2410.	Additional testing (shovel testing and/or the excavation of at least one, 1 x 1 m test unit) was completed at each of these sites in accordance with a testing plan approved by the SHSND. Testing at sites 32WI2390 and 32MZ3328 was suspended following the identification of stone features at these sites; however, the pipeline route has been adjusted to avoid these sites with a minimum 50-ft buffer.	Section 5.3
o US Forest Service Site: 32MZ2346.	While ERM planned to conduct additional testing at this site, the pipeline route was modified prior to this work such that the site is now avoided by the Project with a buffer greater than 100 ft.	Section 5.5
Isolated finds:		
o Discuss subsurface potential on all IFs on a case-by-case basis. If the finds are in a good depositional context, STPs may be necessary to show that these are truly isolates. Minimal site recording may be enough to get a site number for database purposes, but more information is needed to verify that these are truly part of a category that can be written-off as not eligible.	Individual descriptions of isolated finds have been added to the text, including the results of shovel testing or an explanation for why shovel tests were not excavated.	Section 5.7

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Site-by-site comments, private land:		
o 32BK168 – Expand reasoning for Not Eligible Determination both previously and now. Newly recorded site boundary included previously unidentified features. Perhaps site should be unevaluated. Consider formal evaluation and provide updated management recommendations.	ERM conducted site testing at 32BK168 in 2020. Evidence of intact cultural deposits and features was identified during testing and the site is now recommended as eligible for listing in the NRHP. The pipeline route has been modified to avoid this site with a buffer of 57 ft.	Section 5.3
o 32MZ3323 – Discussion mentions "Better Examples" of homesteads. Provide examples.	The description for 32MZ3323 has been updated to incorporate the results of additional testing (shovel testing and the excavation of a 1 x 1 m test unit) in the updated Class III report.	Section 5.3
o 32WI1495 – Actual well shown in Figure 5.3-81 may be visible in figure 5.3-80. Is this location impacted by project? Consider site lead.	The location of the well (which is no longer extant) is discussed in the updated Class III report in conjunction with 32WI1495. ERM has submitted a site lead form for this resource. The suggested boundary of the site lead is 19 ft from Project workspace. The actual location of the well is about 235 ft from Project workspace.	Section 5.3
o 32WI2404 – How is this identified as prehistoric? Could it be a result of natural glacial and/or historic or modern field clearing? Provide evidence. Fence and monitor as necessary.	The interpretation of the feature at 32WI2404 as prehistoric is conservative and based on best professional judgement. Tribal cultural specialists who visited the site with ERM concurred with this interpretation.	Section 5.3
o 32WI2408 – Workspace is extremely close to possible graves. Is the planned route fixed?	The pipeline route has been modified to avoid this site with a buffer of 213 ft.	Section 5.3
Site-by-site comments, US Army Corps of Engineers land:		
o 32MZ976 – Drilling under site is not avoidance as leaks and emergency repairs do consider cultural resources. Formal testing or horizontal avoidance is necessary.	The trajectory of the HDD will be 160 to 180 ft below ground surface where it passes beneath 32WI976. The pipeline will carry gas, not a liquid; the gas would migrate to the surface and dissipate into the air in the event of a leak. Given the depth of the HDD installation, daylighting of the pipeline for repair would not be feasible. If repair is required in the future, the most likely course of action would be to re-install a new segment via HDD, which would require federal authorizations, thereby triggering review of the action under Section 106 of the NHPA. A description of the HDD method has been added to the description of 32WI976 in Section 5.4 of the report. Additional testing at the site is pending and scheduled to be completed this fall. The results will be discussed in an addendum report.	Section 5.4
o 32MZ976 – Show bore location and HDD line on map	A figure showing the HDD alignment with entry and exit points has been added to the description of this site as has a construction alignment sheet. The alignment sheet depicts the HDD in plan and profile.	Section 5.4

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o 32MZ976 – Clarify and provide more evidence for geomorphological hypothesis of A horizon being related to flood deposits. Typically, A horizons show stability rather than accretional or erosional events. Provide more information on why artifacts are interpreted as disturbed rather than in primary context.	The text in the updated Class III report has been updated to address this comment. As noted above, additional testing is planned to occur at 32WI976 this fall, which will provide additional information on the soils present at the site.	Section 5.4
o 32MZ976 – Did cut bank provide additional information on buried soils? Were artifacts identified in cut bank?	The cut bank was examined during the initial survey. As noted above, additional testing is planned to occur at the site this fall with results to be discussed in an addendum report.	Section 5.4
o 32WI976 – Given size and shape of site, additional TUs recommended.		
Comments from the Bureau of Land Management		
o The recommended protection/avoidance measures for unevaluated and eligible archaeological sites in the Class III report are inadequate, particularly regarding stone feature sites. The usual avoidance distance requested/required by the BLM is 100 feet. More than 100 feet is preferred for stone feature sites. Revise protection/avoidance measures buffers for archaeological sites.	WBI Energy has routed the pipeline to avoid unevaluated and eligible sites with a minimum buffer of 50 ft as directed by the SHSND.	Sections 5.3 through 5.5
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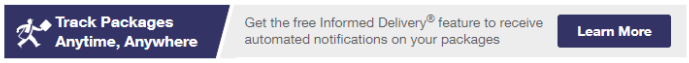

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September 16, 2020

Ben Rhodd, Tribal Historic Preservation Officer
Rosebud Sioux Tribe
PO Box 809
Rosebud, SD 57570

Subject: WBI Energy Transmission, Inc.
North Bakken Expansion Project – Class III Survey Reports 2020 Field Season
McKenzie, Williams, Burke, and Mountrail Counties, North Dakota
ND SHPO Ref.: 19-5593

Dear Mr. Rhodd:

Please reference WBI Energy Transmission, Inc.'s (WBI Energy's) previous correspondence regarding the above referenced project. WBI Energy proposes to construct and operate the North Bakken Expansion Project (Project) in McKenzie, Williams, Burke, and Mountrail Counties, North Dakota.

The Project is regulated by the Federal Energy Regulatory Commission (FERC) under Section 7(c) of the Natural Gas Act. Under the Energy Policy Act of 2005, FERC is the lead agency for coordinating federal authorizations and complying with the National Environmental Policy Act on natural gas pipeline projects subject to its jurisdiction. FERC similarly is the lead federal agency for complying with Section 106 of the National Historic Preservation Act (NHPA) on natural gas pipeline projects under its jurisdiction. In accordance with 36 CFR 800.2(c)(4), WBI Energy is assisting the FERC in meeting its obligations under Section 106 of the NHPA by coordinating with agencies and tribes and conducting surveys to identify historic properties that may be affected by the Project.

Enclosed for your review please find Class III survey reports for the archaeological and historic structures surveys that were conducted during the 2019 and 2020 field seasons. The archaeological report includes the results provided in the original Class III report and addresses comments that were provided by the State Historical Society of North Dakota, Bureau of Land Management, U.S. Army Corps of Engineers, and the U.S. Forest Service. The attached table summarizes our response to those comments and provides the location of the relevant revisions or clarifications. A report on geomorphological investigations is also included in this submittal.

WBI Energy would appreciate your comments on the attached reports. If you have any questions or comments on the Project or the reports, please contact me at 612-840-8976 or pat.robblee@erm.com, or Dr. Kevin Malloy at 906-285-0361 or kevin.malloy@erm.com. Please direct written correspondence to Dr. Malloy's attention at:

Environmental Resources Management
1000 IDS Center
80 South 8th Street
Minneapolis, MN 55402

Sincerely,

Patrick Robblee
Program Director

Enclosures: Class III Archaeological Survey Report
Class III Historic Structures Addendum I Survey Report
Geomorphology Report

cc: Jill Linn, WBI Energy
Andrea Thornton, ERM
Kevin Malloy, ERM
Emily Laird, ERM
Andrew Clark, SHSND
Fern Swenson, SHSND
Liv Fetterman, USFS
Richard Rogers, USACE
Teanna Limpy, Northern Cheyenne Tribe
Pete Coffey, Three Affiliated Tribes of the Fort Berthold Reservation
Dyan Youpee, Assiniboine and Sioux Tribes of the Fort Peck Reservation
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Tom Brings, Oglala Sioux Tribe
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Ben Ridgely, Northern Arapaho Tribe
Steven Vance, Cheyenne River Sioux
Erich Longie, Spirit Lake Tribe
Kip Spotted Eagle, Yankton Sioux Tribe
Jeff Desjarlais, Jr., Turtle Mountain Band of Chippewa
Dianne Desrosiers, Sisseton Wahpeton Oyate

Attachment: Table summarizing agency comments on the original Class III archaeology report

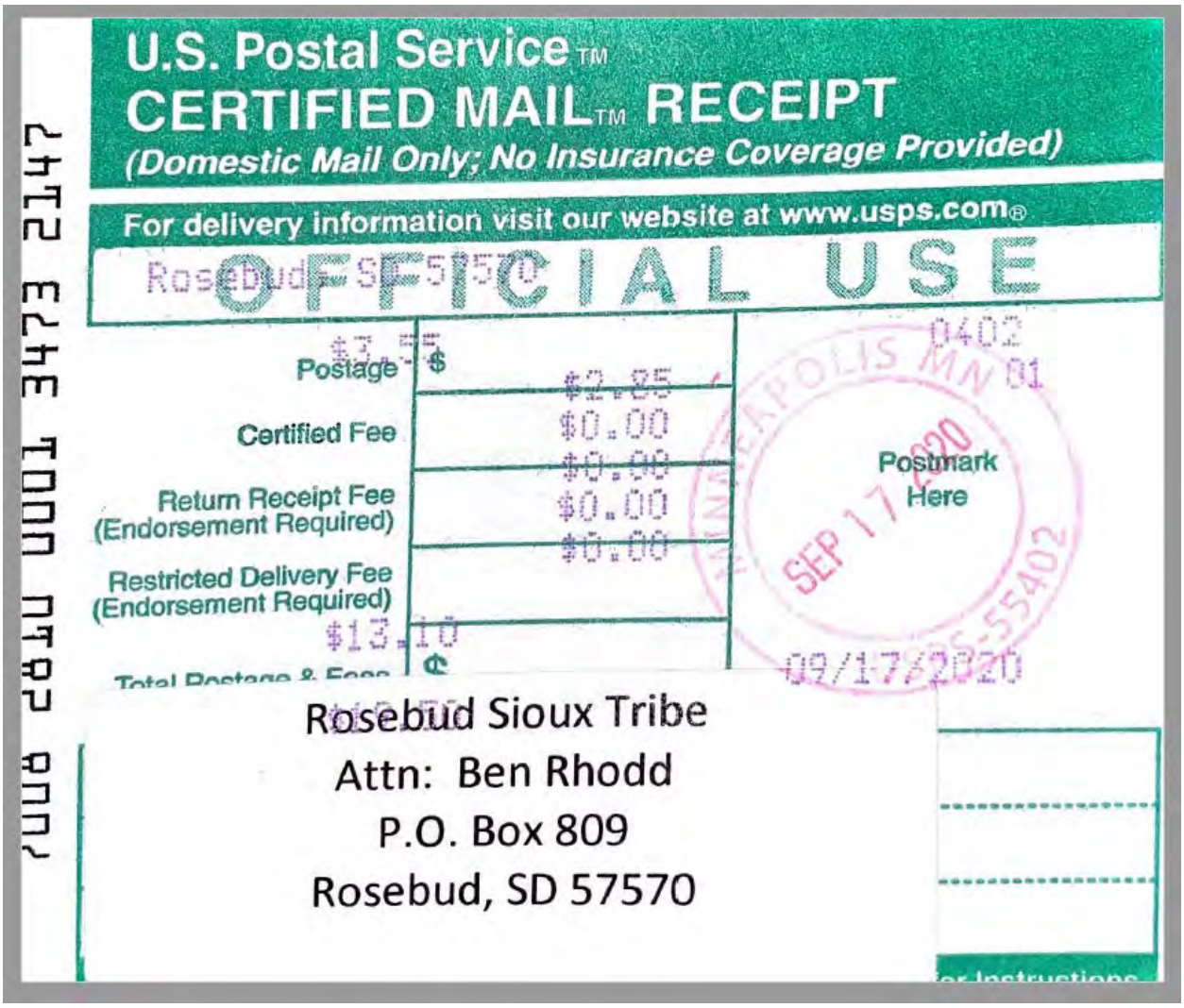
Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Comments from the State Historical Society of North Dakota		
General comments:		
o Provide more background information on sites with previous work. Focus on methods and reasoning for previous eligibility recommendation.	Additional information on previous investigations has been added to site descriptions, as applicable.	Sections 5.3 through 5.7
o Map symbology has item named "Shovel test – No Dig". Are these shovel probes that were planned, but not excavated for some reason? If so provide explanation.	These are planned but unexcavated shovel tests. Site descriptions have been updated, as applicable, to explain why some planned shovel tests were not excavated. Typical reasons for not excavating shovel tests include the presence of buried utilities (documented through One-Call markings) or slope.	Sections 5.3 through 5.5
Avoidance, 50 ft buffer minimum, fence, and monitor:		
o Private land: 32BK277, 32BK279, 32BK280, 32BK282, 32MZ3308, 32MZ3309, 32MZ3310, 32MZ3311, 32MZ3325, 32MZ3327, 32WI1494, 32WI1630, 32WI2144, 32WI2388, 32WI2389, 32WI2391, 32WI2392, 32WI2393, 32WI2394, 32WI2398, 32WI2406, 32WI2408.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.3
o US Forest Service Sites: 32MZ3301, 32MZ3314, 32MZ3315, 32MZ3319, 32MZ3320, 32MZ3322, 32MZ3324.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.5
Formally evaluate with site delineation and at least one 1x1 m TU. Submit evaluation plan prior to fieldwork:		
o Private Land: 32BK278, 32MZ3302, 32MZ3306, 32MZ3307, 32MZ3318, 32MZ3323, 32MZ3326, 32MZ3328, 32MZ3329, 32MZ3331, 32WI2390, 32WI2405, 32WI2407, 32WI2409, 32WI2410.	Additional testing (shovel testing and/or the excavation of at least one, 1 x 1 m test unit) was completed at each of these sites in accordance with a testing plan approved by the SHSND. Testing at sites 32WI2390 and 32MZ3328 was suspended following the identification of stone features at these sites; however, the pipeline route has been adjusted to avoid these sites with a minimum 50-ft buffer.	Section 5.3
o US Forest Service Site: 32MZ2346.	While ERM planned to conduct additional testing at this site, the pipeline route was modified prior to this work such that the site is now avoided by the Project with a buffer greater than 100 ft.	Section 5.5
Isolated finds:		
o Discuss subsurface potential on all IFs on a case-by-case basis. If the finds are in a good depositional context, STPs may be necessary to show that these are truly isolates. Minimal site recording may be enough to get a site number for database purposes, but more information is needed to verify that these are truly part of a category that can be written-off as not eligible.	Individual descriptions of isolated finds have been added to the text, including the results of shovel testing or an explanation for why shovel tests were not excavated.	Section 5.7

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Site-by-site comments, private land:		
o 32BK168 – Expand reasoning for Not Eligible Determination both previously and now. Newly recorded site boundary included previously unidentified features. Perhaps site should be unevaluated. Consider formal evaluation and provide updated management recommendations.	ERM conducted site testing at 32BK168 in 2020. Evidence of intact cultural deposits and features was identified during testing and the site is now recommended as eligible for listing in the NRHP. The pipeline route has been modified to avoid this site with a buffer of 57 ft.	Section 5.3
o 32MZ3323 – Discussion mentions "Better Examples" of homesteads. Provide examples.	The description for 32MZ3323 has been updated to incorporate the results of additional testing (shovel testing and the excavation of a 1 x 1 m test unit) in the updated Class III report.	Section 5.3
o 32WI1495 – Actual well shown in Figure 5.3-81 may be visible in figure 5.3-80. Is this location impacted by project? Consider site lead.	The location of the well (which is no longer extant) is discussed in the updated Class III report in conjunction with 32WI1495. ERM has submitted a site lead form for this resource. The suggested boundary of the site lead is 19 ft from Project workspace. The actual location of the well is about 235 ft from Project workspace.	Section 5.3
o 32WI2404 – How is this identified as prehistoric? Could it be a result of natural glacial and/or historic or modern field clearing? Provide evidence. Fence and monitor as necessary.	The interpretation of the feature at 32WI2404 as prehistoric is conservative and based on best professional judgement. Tribal cultural specialists who visited the site with ERM concurred with this interpretation.	Section 5.3
o 32WI2408 – Workspace is extremely close to possible graves. Is the planned route fixed?	The pipeline route has been modified to avoid this site with a buffer of 213 ft.	Section 5.3
Site-by-site comments, US Army Corps of Engineers land:		
o 32MZ976 – Drilling under site is not avoidance as leaks and emergency repairs do consider cultural resources. Formal testing or horizontal avoidance is necessary.	The trajectory of the HDD will be 160 to 180 ft below ground surface where it passes beneath 32WI976. The pipeline will carry gas, not a liquid; the gas would migrate to the surface and dissipate into the air in the event of a leak. Given the depth of the HDD installation, daylighting of the pipeline for repair would not be feasible. If repair is required in the future, the most likely course of action would be to re-install a new segment via HDD, which would require federal authorizations, thereby triggering review of the action under Section 106 of the NHPA. A description of the HDD method has been added to the description of 32WI976 in Section 5.4 of the report. Additional testing at the site is pending and scheduled to be completed this fall. The results will be discussed in an addendum report.	Section 5.4
o 32MZ976 – Show bore location and HDD line on map	A figure showing the HDD alignment with entry and exit points has been added to the description of this site as has a construction alignment sheet. The alignment sheet depicts the HDD in plan and profile.	Section 5.4

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o 32MZ976 – Clarify and provide more evidence for geomorphological hypothesis of A horizon being related to flood deposits. Typically, A horizons show stability rather than accretional or erosional events. Provide more information on why artifacts are interpreted as disturbed rather than in primary context.	The text in the updated Class III report has been updated to address this comment. As noted above, additional testing is planned to occur at 32WI976 this fall, which will provide additional information on the soils present at the site.	Section 5.4
o 32MZ976 – Did cut bank provide additional information on buried soils? Were artifacts identified in cut bank?	The cut bank was examined during the initial survey. As noted above, additional testing is planned to occur at the site this fall with results to be discussed in an addendum report.	Section 5.4
o 32WI976 – Given size and shape of site, additional TUs recommended.		
Comments from the Bureau of Land Management		
o The recommended protection/avoidance measures for unevaluated and eligible archaeological sites in the Class III report are inadequate, particularly regarding stone feature sites. The usual avoidance distance requested/required by the BLM is 100 feet. More than 100 feet is preferred for stone feature sites. Revise protection/avoidance measures buffers for archaeological sites.	WBI Energy has routed the pipeline to avoid unevaluated and eligible sites with a minimum buffer of 50 ft as directed by the SHSND.	Sections 5.3 through 5.5
o Why were indirect effects to archaeological sites not considered? Setting is an important aspect of integrity for stone feature sites. There are numerous archaeological sites within and near the survey corridor that should be analyzed for indirect effects. Revise the report to address indirect effects to archaeological sites.	The report has been updated to include an assessment of physical and non-physical impacts on unevaluated and eligible sites.	Sections 4 and 5.5 through 5.5
o WBI Energy needs to develop a cultural resource monitoring plan for construction.	WBI Energy commits to preparing a monitoring plan for construction.	Sections 5.3 through 5.5
o Update site form for all sites, site leads, and isolated finds regardless of whether they were relocated. Even if a cultural resource could not be relocated, that is still valuable information for the next project/site visit.	Site form updates have been submitted for all sites, isolated finds, and site leads discussed in the updated Class III report	N/A
o WBI Energy should make additional efforts to involve tribes in upcoming 2020 fieldwork and field reviews.	As discussed in more detail in Section 4 of the updated Class III report, WBI Energy retained Beaver Creek Archaeology to coordinate tribal participation in fieldwork in 2020. BCA worked with tribes to document sites as cultural heritage resources. The results of that work will be presented in a separate report. Information on tribal participation in the surveys also is provided in Sections 4 and 5.3 through 5.5 of ERM's updated Class III report	Sections 4 and 5.3 through 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Comments from U.S. Army Corps of Engineers		
o In section 5.4.2, remove figures for 32MZ0598 and move to the previous section.	This comment is addressed in the updated Class III report	Section 5.4
o Figure 5.4-5: Map of Site 32WI976, provide contour lines on this map to show the slope. This information would help to explain why the shovel testing pattern appears the way it does.	Contour lines are provided on Figure 5.4-9 in the updated Class III report.	Section 5.4
o ERM, on behalf of WBI [Energy], identified a second concentration of artifacts in the western side of site 32WI0976 after they started excavating the test unit. Some additional testing is needed here as USACE cannot agree with the recommended determination for this site given the data presented in this report.	Additional testing will be completed at this site in the fall of 2020 with the results presented in an addendum report.	Section 5.4
o USACE recommends that WBI [Energy] conduct a remote sensing evaluation (gradiometer or conductivity) at site 32WI0976. This would be the best way to produce measurable data regarding the presence/absence of subsurface features at the site.	A remote sensing survey of the site was completed in the summer of 2020. The results of the survey were used to prepare a testing plan for 32WI976. Additional testing at the site will occur this fall with the results presented in an addendum report.	Section 5.4
Comments from the U.S. Forest Service		
o The map showing previously recorded cultural resources within a one-mile radius is only included in the overall Class III and not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Figure 1.1-2 shows the Forest Service surface and differentiates between the survey corridor and the survey corridor on Forest Service surface; however, the survey corridor on Forest Service surface and the actual Forest Service surface displayed don't match.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Sites 32MZ2347 (Historical Archaeological) and 32MZ3278 (Cairn) are located immediately adjacent to the survey corridor but are not discussed. Please discuss.	Based on route modifications, 32MZ3278 was visited in 2020 and the site boundary expanded based on the findings. A discussion of the site is provided in the updated Class III report. 32MZ2347 is outside the inventory corridor for the Project; however, we have included a discussion of this site in the Class III inventory report.	Section 5.5
o Site 32MZ145 site form update does not appear to have been performed. Why? Was an attempt made to actually relocate the site? Also, according to the site form, a THPO representative requested avoidance in 2013. More work on this site is probably needed.	When 32MZ145 was first recorded in 1979, it was characterized as two stone cairns. Subsequent investigations described the site as consisting of a single historic rock clearing pile on the west side of Highway 1806, noting that the second pile was likely destroyed by construction of the highway. ERM's survey in 2019 was limited to the east side of Highway 1806, which explains why we did not relocate the site at that time. In 2020, ERM conducted additional survey on USFS lands, examining a corridor on the west side of Highway 1806. 32MZ145 was relocated as a result of this work. The site is discussed in the updated Class III report. Tribal cultural specialists who accompanied ERM during the 2020 field investigation concurred that 32MZ145 is historic rock clearing pile.	Section 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o Site 32MZ2346 and 32MZ144: it is very improbable and therefore suspicious that there are zero artifacts and one artifact respectively at sites with historic dumps.	Sites 32MZ2346 and 32MZ144 are both previously recorded historic sites which ERM revisited and recorded during the survey for the Project. Cultural material was observed at both sites as described in the updated Class III report. ERM expanded the boundaries of 32MZ2346 to encompass two previously unreported features at the site. One artifact–a commemorative coin–was collected from 32MZ2346 because of its uniqueness. No artifacts were collected from 32MZ144. Expanded descriptions of both sites are provided in the updated Class III report.	Section 5.5
o Additional survey is shown as needed near site 32MZ3278 on the maps in the overall Class III report but not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	Additional survey was completed in 2020 on USFS lands in the vicinity of 32MZ3278, which was relocated. A description of the site is provided in the updated Class III report.	Section 5.5
o The recommended avoidance and fencing measures are inadequate, especially for stone feature sites.	All stone feature sites have been avoided with a minimum buffet of 50 ft. Additionally, for sites between 50 and 100 ft of Project workspace WBI Energy commits to fencing and monitoring the sites during construction. WBI Energy will provide a monitoring plan for agency review.	Section 5.5
o A monitoring plan is needed.	WBI Energy commits to providing a construction monitoring plan as discussed in the updated Class III report.	
o Updates should have been conducted for all sites, site leads, and IFs [isolated finds] regardless of whether or not they were relocated.	Site form updates have been submitted for all applicable sites, isolated finds, and site leads discussed in the report	N/A
o The discussion of site leads during fieldwork is inadequate.	Site leads are discussed in Section 5.6 of the updated Class III report.	Section 5.6
o Provide specific distances between site boundaries and the edge of the workspace.	Distances between sites and Project workspaces have been added to summary tables and site descriptions throughout the updated Class III report.	Sections 5.3 through 5.5
o Provide a map of shovel testing performed outside of site boundaries. The report explains the testing strategy during survey but never discusses or shows specifics except within site boundaries.	The route maps provided as Appendix B depict survey methodology in addition to survey coverage and results.	Appendix B
o Identify the level of tribal involvement in the survey.	Tribal participation in field surveys is discussed in Sections 4 and 5.3 through 5.5 of the updated Class III report.	Sections 4 and 5.3 through 5.5
o Discuss whether indirect effects to archaeological sites were considered.	For unevaluated sites, we have added an assessment of non-physical impacts on setting.	Sections 5.3 through 5.5



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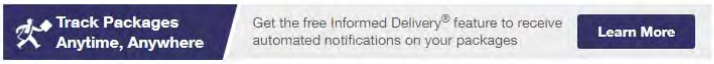

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MEETING NOTES

LOG OF IN PERSON MEETING

MEETING ATTENDEES:

Jon Eagle – Standing Rock Sioux Tribe Tribal Historic Preservation Officer
Ben Rhodd – Rosebud Sioux Tribe Archaeologist
Katie West – Bureau of Land Management (BLM)
Jill Linn – WBI Energy Transmission, Inc. (WBI Energy)
Wade Burns – Beaver Creek Archaeology (BCA)
Raina Hanley – BCA
Larry Pallozzi – BCA
Jayson Zoino – Environmental Resource Group (ERM)

DATE:	TIME OF CONVERSATION:
September 17, 2020	10 am to 1 pm

RE:

North Bakken Expansion Project

LOG OF CONVERSATION:

ERM visited sites 32MZ3382, 32MZ3383, and 32MZ3385 on U.S. Forest Service lands with representatives of the Standing Rock Sioux Tribe, Rosebud Sioux Tribe, BLM, WBI Energy, and BCA.[1] ERM documented these sites in the summer of 2020 during survey for WBI Energy's North Bakken Expansion Project. Tribal cultural specialists representing the Standing Rock Sioux Tribe, Rosebud Sioux Tribe (including one specialist working on behalf of the Sisseton Wahpeton Oyate Tribe), Assiniboine & Sioux Tribes, and Turtle Mountain Band of Chippewa Indians monitored ERM's delineation of the sites; however, the specialists did not uniformly concur with the interpretation of the finds as archaeological. Some of the specialists concluded that the remains documented by ERM are non-cultural.

The visits to 32MZ3382, 32MZ3383, and 32MZ3385 allowed Mr. Eagle and Mr. Rhodd to inspect the sites and features recorded by ERM. Mr. Eagle and Mr. Rhodd each concurred with the interpretation of the finds as archaeological and agreed with a majority of ERM's feature classifications for the sites. Mr. Eagle and Mr. Rhodd provided additional interpretation of some features, which will be incorporated into the cultural heritage forms for these sites. This includes an expansion of the area at 32MZ3383 to be recorded as a cultural heritage site to encompass a cluster of Echinacea identified near the archaeological features.

[1] The U.S. Forest Service was unable to participate in the site visits.

Oglala Sioux Tribe

ERM

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80 South Eighth Street
Minneapolis, MN 55402

Telephone: +1 612 347 6789
Fax: +1 612 347 6780

www.erm.com

September 16, 2020

Tom Brings, Tribal Historic Preservation Officer
Oglala Sioux Tribe
PO Box 320
Pine Ridge, SD 57770-2070

Subject: WBI Energy Transmission, Inc.
North Bakken Expansion Project – Class III Survey Reports 2020 Field Season
McKenzie, Williams, Burke, and Mountrail Counties, North Dakota
ND SHPO Ref.: 19-5593

Dear Mr. Brings:

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The Project is regulated by the Federal Energy Regulatory Commission (FERC) under Section 7(c) of the Natural Gas Act. Under the Energy Policy Act of 2005, FERC is the lead agency for coordinating federal authorizations and complying with the National Environmental Policy Act on natural gas pipeline projects subject to its jurisdiction. FERC similarly is the lead federal agency for complying with Section 106 of the National Historic Preservation Act (NHPA) on natural gas pipeline projects under its jurisdiction. In accordance with 36 CFR 800.2(c)(4), WBI Energy is assisting the FERC in meeting its obligations under Section 106 of the NHPA by coordinating with agencies and tribes and conducting surveys to identify historic properties that may be affected by the Project.

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WBI Energy would appreciate your comments on the attached reports. If you have any questions or comments on the Project or the reports, please contact me at 612-840-8976 or pat.robblee@erm.com, or Dr. Kevin Malloy at 906-285-0361 or kevin.malloy@erm.com. Please direct written correspondence to Dr. Malloy's attention at:

Environmental Resources Management
1000 IDS Center
80 South 8th Street
Minneapolis, MN 55402

Sincerely,

Patrick Robblee

Program Director

Enclosures: Class III Archaeological Survey Report
Class III Historic Structures Addendum I Survey Report
Geomorphology Report

cc: Jill Linn, WBI Energy
Andrea Thornton, ERM
Kevin Malloy, ERM
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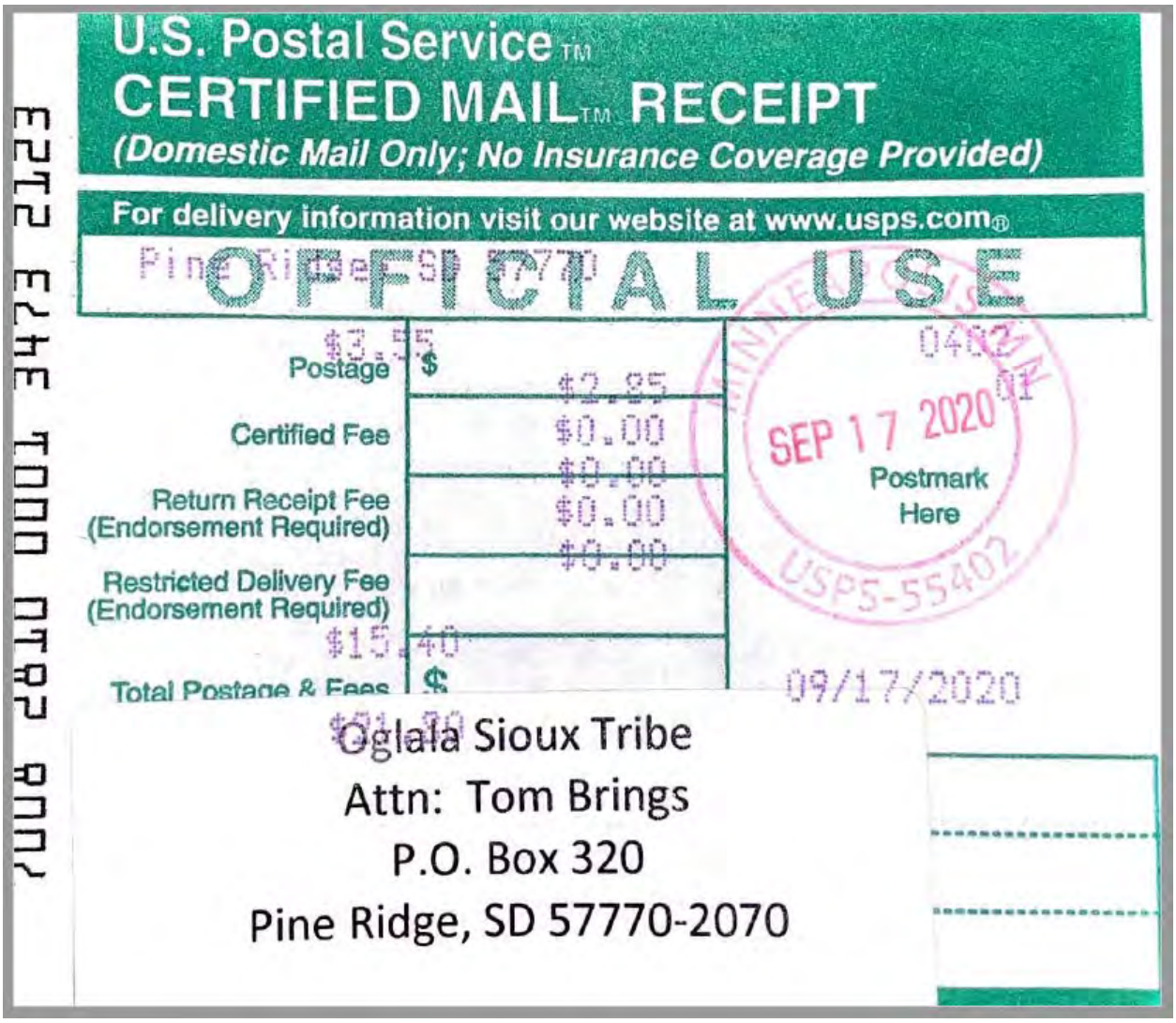
o US Forest Service Site: 32MZ2346.	While ERM planned to conduct additional testing at this site, the pipeline route was modified prior to this work such that the site is now avoided by the Project with a buffer greater than 100 ft.	Section 5.5
Isolated finds:		
o Discuss subsurface potential on all IFs on a case-by-case basis. If the finds are in a good depositional context, STPs may be necessary to show that these are truly isolates. Minimal site recording may be enough to get a site number for database purposes, but more information is needed to verify that these are truly part of a category that can be written-off as not eligible.	Individual descriptions of isolated finds have been added to the text, including the results of shovel testing or an explanation for why shovel tests were not excavated.	Section 5.7

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Site-by-site comments, private land:		
o 32BK168 – Expand reasoning for Not Eligible Determination both previously and now. Newly recorded site boundary included previously unidentified features. Perhaps site should be unevaluated. Consider formal evaluation and provide updated management recommendations.	ERM conducted site testing at 32BK168 in 2020. Evidence of intact cultural deposits and features was identified during testing and the site is now recommended as eligible for listing in the NRHP. The pipeline route has been modified to avoid this site with a buffer of 57 ft.	Section 5.3
o 32MZ3323 – Discussion mentions "Better Examples" of homesteads. Provide examples.	The description for 32MZ3323 has been updated to incorporate the results of additional testing (shovel testing and the excavation of a 1 x 1 m test unit) in the updated Class III report.	Section 5.3
o 32WI1495 – Actual well shown in Figure 5.3-81 may be visible in figure 5.3-80. Is this location impacted by project? Consider site lead.	The location of the well (which is no longer extant) is discussed in the updated Class III report in conjunction with 32WI1495. ERM has submitted a site lead form for this resource. The suggested boundary of the site lead is 19 ft from Project workspace. The actual location of the well is about 235 ft from Project workspace.	Section 5.3
o 32WI2404 – How is this identified as prehistoric? Could it be a result of natural glacial and/or historic or modern field clearing? Provide evidence. Fence and monitor as necessary.	The interpretation of the feature at 32WI2404 as prehistoric is conservative and based on best professional judgement. Tribal cultural specialists who visited the site with ERM concurred with this interpretation.	Section 5.3
o 32WI2408 – Workspace is extremely close to possible graves. Is the planned route fixed?	The pipeline route has been modified to avoid this site with a buffer of 213 ft.	Section 5.3
Site-by-site comments, US Army Corps of Engineers land:		
o 32MZ976 – Drilling under site is not avoidance as leaks and emergency repairs do consider cultural resources. Formal testing or horizontal avoidance is necessary.	The trajectory of the HDD will be 160 to 180 ft below ground surface where it passes beneath 32WI976. The pipeline will carry gas, not a liquid; the gas would migrate to the surface and dissipate into the air in the event of a leak. Given the depth of the HDD installation, daylighting of the pipeline for repair would not be feasible. If repair is required in the future, the most likely course of action would be to re-install a new segment via HDD, which would require federal authorizations, thereby triggering review of the action under Section 106 of the NHPA. A description of the HDD method has been added to the description of 32WI976 in Section 5.4 of the report. Additional testing at the site is pending and scheduled to be completed this fall. The results will be discussed in an addendum report.	Section 5.4
o 32MZ976 – Show bore location and HDD line on map	A figure showing the HDD alignment with entry and exit points has been added to the description of this site as has a construction alignment sheet. The alignment sheet depicts the HDD in plan and profile.	Section 5.4

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o 32MZ976 – Clarify and provide more evidence for geomorphological hypothesis of A horizon being related to flood deposits. Typically, A horizons show stability rather than accretional or erosional events. Provide more information on why artifacts are interpreted as disturbed rather than in primary context.	The text in the updated Class III report has been updated to address this comment. As noted above, additional testing is planned to occur at 32WI976 this fall, which will provide additional information on the soils present at the site.	Section 5.4
o 32MZ976 – Did cut bank provide additional information on buried soils? Were artifacts identified in cut bank?	The cut bank was examined during the initial survey. As noted above, additional testing is planned to occur at the site this fall with results to be discussed in an addendum report.	Section 5.4
o 32WI976 – Given size and shape of site, additional TUs recommended.		
Comments from the Bureau of Land Management		
o The recommended protection/avoidance measures for unevaluated and eligible archaeological sites in the Class III report are inadequate, particularly regarding stone feature sites. The usual avoidance distance requested/required by the BLM is 100 feet. More than 100 feet is preferred for stone feature sites. Revise protection/avoidance measures buffers for archaeological sites.	WBI Energy has routed the pipeline to avoid unevaluated and eligible sites with a minimum buffer of 50 ft as directed by the SHSND.	Sections 5.3 through 5.5
o Why were indirect effects to archaeological sites not considered? Setting is an important aspect of integrity for stone feature sites. There are numerous archaeological sites within and near the survey corridor that should be analyzed for indirect effects. Revise the report to address indirect effects to archaeological sites.	The report has been updated to include an assessment of physical and non-physical impacts on unevaluated and eligible sites.	Sections 4 and 5.5 through 5.5
o WBI Energy needs to develop a cultural resource monitoring plan for construction.	WBI Energy commits to preparing a monitoring plan for construction.	Sections 5.3 through 5.5
o Update site form for all sites, site leads, and isolated finds regardless of whether they were relocated. Even if a cultural resource could not be relocated, that is still valuable information for the next project/site visit.	Site form updates have been submitted for all sites, isolated finds, and site leads discussed in the updated Class III report	N/A
o WBI Energy should make additional efforts to involve tribes in upcoming 2020 fieldwork and field reviews.	As discussed in more detail in Section 4 of the updated Class III report, WBI Energy retained Beaver Creek Archaeology to coordinate tribal participation in fieldwork in 2020. BCA worked with tribes to document sites as cultural heritage resources. The results of that work will be presented in a separate report. Information on tribal participation in the surveys also is provided in Sections 4 and 5.3 through 5.5 of ERM's updated Class III report	Sections 4 and 5.3 through 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Comments from U.S. Army Corps of Engineers		
o In section 5.4.2, remove figures for 32MZ0598 and move to the previous section.	This comment is addressed in the updated Class III report	Section 5.4
o Figure 5.4-5: Map of Site 32WI976, provide contour lines on this map to show the slope. This information would help to explain why the shovel testing pattern appears the way it does.	Contour lines are provided on Figure 5.4-9 in the updated Class III report.	Section 5.4
o ERM, on behalf of WBI [Energy], identified a second concentration of artifacts in the western side of site 32WI0976 after they started excavating the test unit. Some additional testing is needed here as USACE cannot agree with the recommended determination for this site given the data presented in this report.	Additional testing will be completed at this site in the fall of 2020 with the results presented in an addendum report.	Section 5.4
o USACE recommends that WBI [Energy] conduct a remote sensing evaluation (gradiometer or conductivity) at site 32WI0976. This would be the best way to produce measurable data regarding the presence/absence of subsurface features at the site.	A remote sensing survey of the site was completed in the summer of 2020. The results of the survey were used to prepare a testing plan for 32WI976. Additional testing at the site will occur this fall with the results presented in an addendum report.	Section 5.4
Comments from the U.S. Forest Service		
o The map showing previously recorded cultural resources within a one-mile radius is only included in the overall Class III and not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Figure 1.1-2 shows the Forest Service surface and differentiates between the survey corridor and the survey corridor on Forest Service surface; however, the survey corridor on Forest Service surface and the actual Forest Service surface displayed don't match.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Sites 32MZ2347 (Historical Archaeological) and 32MZ3278 (Cairn) are located immediately adjacent to the survey corridor but are not discussed. Please discuss.	Based on route modifications, 32MZ3278 was visited in 2020 and the site boundary expanded based on the findings. A discussion of the site is provided in the updated Class III report. 32MZ2347 is outside the inventory corridor for the Project; however, we have included a discussion of this site in the Class III inventory report.	Section 5.5
o Site 32MZ145 site form update does not appear to have been performed. Why? Was an attempt made to actually relocate the site? Also, according to the site form, a THPO representative requested avoidance in 2013. More work on this site is probably needed.	When 32MZ145 was first recorded in 1979, it was characterized as two stone cairns. Subsequent investigations described the site as consisting of a single historic rock clearing pile on the west side of Highway 1806, noting that the second pile was likely destroyed by construction of the highway. ERM's survey in 2019 was limited to the east side of Highway 1806, which explains why we did not relocate the site at that time. In 2020, ERM conducted additional survey on USFS lands, examining a corridor on the west side of Highway 1806. 32MZ145 was relocated as a result of this work. The site is discussed in the updated Class III report. Tribal cultural specialists who accompanied ERM during the 2020 field investigation concurred that 32MZ145 is historic rock clearing pile.	Section 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o Site 32MZ2346 and 32MZ144: it is very improbable and therefore suspicious that there are zero artifacts and one artifact respectively at sites with historic dumps.	Sites 32MZ2346 and 32MZ144 are both previously recorded historic sites which ERM revisited and recorded during the survey for the Project. Cultural material was observed at both sites as described in the updated Class III report. ERM expanded the boundaries of 32MZ2346 to encompass two previously unreported features at the site. One artifact–a commemorative coin–was collected from 32MZ2346 because of its uniqueness. No artifacts were collected from 32MZ144. Expanded descriptions of both sites are provided in the updated Class III report.	Section 5.5
o Additional survey is shown as needed near site 32MZ3278 on the maps in the overall Class III report but not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	Additional survey was completed in 2020 on USFS lands in the vicinity of 32MZ3278, which was relocated. A description of the site is provided in the updated Class III report.	Section 5.5
o The recommended avoidance and fencing measures are inadequate, especially for stone feature sites.	All stone feature sites have been avoided with a minimum buffet of 50 ft. Additionally, for sites between 50 and 100 ft of Project workspace WBI Energy commits to fencing and monitoring the sites during construction. WBI Energy will provide a monitoring plan for agency review.	Section 5.5
o A monitoring plan is needed.	WBI Energy commits to providing a construction monitoring plan as discussed in the updated Class III report.	
o Updates should have been conducted for all sites, site leads, and IFs [isolated finds] regardless of whether or not they were relocated.	Site form updates have been submitted for all applicable sites, isolated finds, and site leads discussed in the report	N/A
o The discussion of site leads during fieldwork is inadequate.	Site leads are discussed in Section 5.6 of the updated Class III report.	Section 5.6
o Provide specific distances between site boundaries and the edge of the workspace.	Distances between sites and Project workspaces have been added to summary tables and site descriptions throughout the updated Class III report.	Sections 5.3 through 5.5
o Provide a map of shovel testing performed outside of site boundaries. The report explains the testing strategy during survey but never discusses or shows specifics except within site boundaries.	The route maps provided as Appendix B depict survey methodology in addition to survey coverage and results.	Appendix B
o Identify the level of tribal involvement in the survey.	Tribal participation in field surveys is discussed in Sections 4 and 5.3 through 5.5 of the updated Class III report.	Sections 4 and 5.3 through 5.5
o Discuss whether indirect effects to archaeological sites were considered.	For unevaluated sites, we have added an assessment of non-physical impacts on setting.	Sections 5.3 through 5.5



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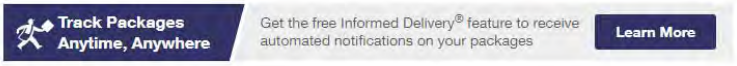

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ERM

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Fax: +1 612 347 6780

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September 16, 2020

Ben Ridgely, Tribal Historic Preservation Officer
Northern Arapaho Tribe
PO Box 67
St. Stevens, WY 82524

Subject: WBI Energy Transmission, Inc.
North Bakken Expansion Project – Class III Survey Reports 2020 Field Season
McKenzie, Williams, Burke, and Mountrail Counties, North Dakota
ND SHPO Ref.: 19-5593

Dear Mr. Ridgely:

Please reference WBI Energy Transmission, Inc.'s (WBI Energy's) previous correspondence regarding the above referenced project. WBI Energy proposes to construct and operate the North Bakken Expansion Project (Project) in McKenzie, Williams, Burke, and Mountrail Counties, North Dakota.

The Project is regulated by the Federal Energy Regulatory Commission (FERC) under Section 7(c) of the Natural Gas Act. Under the Energy Policy Act of 2005, FERC is the lead agency for coordinating federal authorizations and complying with the National Environmental Policy Act on natural gas pipeline projects subject to its jurisdiction. FERC similarly is the lead federal agency for complying with Section 106 of the National Historic Preservation Act (NHPA) on natural gas pipeline projects under its jurisdiction. In accordance with 36 CFR 800.2(c)(4), WBI Energy is assisting the FERC in meeting its obligations under Section 106 of the NHPA by coordinating with agencies and tribes and conducting surveys to identify historic properties that may be affected by the Project.

Enclosed for your review please find Class III survey reports for the archaeological and historic structures surveys that were conducted during the 2019 and 2020 field seasons. The archaeological report includes the results provided in the original Class III report and addresses comments that were provided by the State Historical Society of North Dakota, Bureau of Land Management, U.S. Army Corps of Engineers, and the U.S. Forest Service. The attached table summarizes our response to those comments and provides the location of the relevant revisions or clarifications. A report on geomorphological investigations is also included in this submittal.

WBI Energy would appreciate your comments on the attached reports. If you have any questions or comments on the Project or the reports, please contact me at 612-840-8976 or pat.robblee@erm.com, or Dr. Kevin Malloy at 906-285-0361 or kevin.malloy@erm.com. Please direct written correspondence to Dr. Malloy's attention at:

Environmental Resources Management
1000 IDS Center
80 South 8th Street
Minneapolis, MN 55402

Sincerely,

Patrick Robblee
Program Director

Enclosures: Class III Archaeological Survey Report
Class III Historic Structures Addendum I Survey Report
Geomorphology Report

cc: Jill Linn, WBI Energy
Andrea Thornton, ERM
Kevin Malloy, ERM
Emily Laird, ERM
Andrew Clark, SHSND
Fern Swenson, SHSND
Liv Fetterman, USFS
Richard Rogers, USACE
Teanna Limpy, Northern Cheyenne Tribe
Pete Coffey, Three Affiliated Tribes of the Fort Berthold Reservation
Dyan Youpee, Assiniboine and Sioux Tribes of the Fort Peck Reservation
Ben Rhodd, Rosebud Sioux Tribe
Michael Black Wolf, Fort Belknap Indian Community
Tom Brings, Oglala Sioux Tribe
Jon Eagle, Standing Rock Sioux Tribe
Steven Vance, Cheyenne River Sioux
Erich Longie, Spirit Lake Tribe
Kip Spotted Eagle, Yankton Sioux Tribe
Jeff Desjarlais, Jr., Turtle Mountain Band of Chippewa
Dianne Desrosiers, Sisseton Wahpeton Oyate

Attachment: Table summarizing agency comments on the original Class III archaeology report

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Comments from the State Historical Society of North Dakota		
General comments:		
o Provide more background information on sites with previous work. Focus on methods and reasoning for previous eligibility recommendation.	Additional information on previous investigations has been added to site descriptions, as applicable.	Sections 5.3 through 5.7
o Map symbology has item named "Shovel test – No Dig". Are these shovel probes that were planned, but not excavated for some reason? If so provide explanation.	These are planned but unexcavated shovel tests. Site descriptions have been updated, as applicable, to explain why some planned shovel tests were not excavated. Typical reasons for not excavating shovel tests include the presence of buried utilities (documented through One-Call markings) or slope.	Sections 5.3 through 5.5
Avoidance, 50 ft buffer minimum, fence, and monitor:		
o Private land: 32BK277, 32BK279, 32BK280, 32BK282, 32MZ3308, 32MZ3309, 32MZ3310, 32MZ3311, 32MZ3325, 32MZ3327, 32WI1494, 32WI1630, 32WI2144, 32WI2388, 32WI2389, 32WI2391, 32WI2392, 32WI2393, 32WI2394, 32WI2398, 32WI2406, 32WI2408.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.3
o US Forest Service Sites: 32MZ3301, 32MZ3314, 32MZ3315, 32MZ3319, 32MZ3320, 32MZ3322, 32MZ3324.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.5
Formally evaluate with site delineation and at least one 1x1 m TU. Submit evaluation plan prior to fieldwork:		
o Private Land: 32BK278, 32MZ3302, 32MZ3306, 32MZ3307, 32MZ3318, 32MZ3323, 32MZ3326, 32MZ3328, 32MZ3329, 32MZ3331, 32WI2390, 32WI2405, 32WI2407, 32WI2409, 32WI2410.	Additional testing (shovel testing and/or the excavation of at least one, 1 x 1 m test unit) was completed at each of these sites in accordance with a testing plan approved by the SHSND. Testing at sites 32WI2390 and 32MZ3328 was suspended following the identification of stone features at these sites; however, the pipeline route has been adjusted to avoid these sites with a minimum 50-ft buffer.	Section 5.3
o US Forest Service Site: 32MZ2346.	While ERM planned to conduct additional testing at this site, the pipeline route was modified prior to this work such that the site is now avoided by the Project with a buffer greater than 100 ft.	Section 5.5
Isolated finds:		
o Discuss subsurface potential on all IFs on a case-by-case basis. If the finds are in a good depositional context, STPs may be necessary to show that these are truly isolates. Minimal site recording may be enough to get a site number for database purposes, but more information is needed to verify that these are truly part of a category that can be written-off as not eligible.	Individual descriptions of isolated finds have been added to the text, including the results of shovel testing or an explanation for why shovel tests were not excavated.	Section 5.7

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Site-by-site comments, private land:		
o 32BK168 – Expand reasoning for Not Eligible Determination both previously and now. Newly recorded site boundary included previously unidentified features. Perhaps site should be unevaluated. Consider formal evaluation and provide updated management recommendations.	ERM conducted site testing at 32BK168 in 2020. Evidence of intact cultural deposits and features was identified during testing and the site is now recommended as eligible for listing in the NRHP. The pipeline route has been modified to avoid this site with a buffer of 57 ft.	Section 5.3
o 32MZ3323 – Discussion mentions "Better Examples" of homesteads. Provide examples.	The description for 32MZ3323 has been updated to incorporate the results of additional testing (shovel testing and the excavation of a 1 x 1 m test unit) in the updated Class III report.	Section 5.3
o 32WI1495 – Actual well shown in Figure 5.3-81 may be visible in figure 5.3-80. Is this location impacted by project? Consider site lead.	The location of the well (which is no longer extant) is discussed in the updated Class III report in conjunction with 32WI1495. ERM has submitted a site lead form for this resource. The suggested boundary of the site lead is 19 ft from Project workspace. The actual location of the well is about 235 ft from Project workspace.	Section 5.3
o 32WI2404 – How is this identified as prehistoric? Could it be a result of natural glacial and/or historic or modern field clearing? Provide evidence. Fence and monitor as necessary.	The interpretation of the feature at 32WI2404 as prehistoric is conservative and based on best professional judgement. Tribal cultural specialists who visited the site with ERM concurred with this interpretation.	Section 5.3
o 32WI2408 – Workspace is extremely close to possible graves. Is the planned route fixed?	The pipeline route has been modified to avoid this site with a buffer of 213 ft.	Section 5.3
Site-by-site comments, US Army Corps of Engineers land:		
o 32MZ976 – Drilling under site is not avoidance as leaks and emergency repairs do consider cultural resources. Formal testing or horizontal avoidance is necessary.	The trajectory of the HDD will be 160 to 180 ft below ground surface where it passes beneath 32WI976. The pipeline will carry gas, not a liquid; the gas would migrate to the surface and dissipate into the air in the event of a leak. Given the depth of the HDD installation, daylighting of the pipeline for repair would not be feasible. If repair is required in the future, the most likely course of action would be to re-install a new segment via HDD, which would require federal authorizations, thereby triggering review of the action under Section 106 of the NHPA. A description of the HDD method has been added to the description of 32WI976 in Section 5.4 of the report. Additional testing at the site is pending and scheduled to be completed this fall. The results will be discussed in an addendum report.	Section 5.4
o 32MZ976 – Show bore location and HDD line on map	A figure showing the HDD alignment with entry and exit points has been added to the description of this site as has a construction alignment sheet. The alignment sheet depicts the HDD in plan and profile.	Section 5.4

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o 32MZ976 – Clarify and provide more evidence for geomorphological hypothesis of A horizon being related to flood deposits. Typically, A horizons show stability rather than accretional or erosional events. Provide more information on why artifacts are interpreted as disturbed rather than in primary context.	The text in the updated Class III report has been updated to address this comment. As noted above, additional testing is planned to occur at 32WI976 this fall, which will provide additional information on the soils present at the site.	Section 5.4
o 32MZ976 – Did cut bank provide additional information on buried soils? Were artifacts identified in cut bank?	The cut bank was examined during the initial survey. As noted above, additional testing is planned to occur at the site this fall with results to be discussed in an addendum report.	Section 5.4
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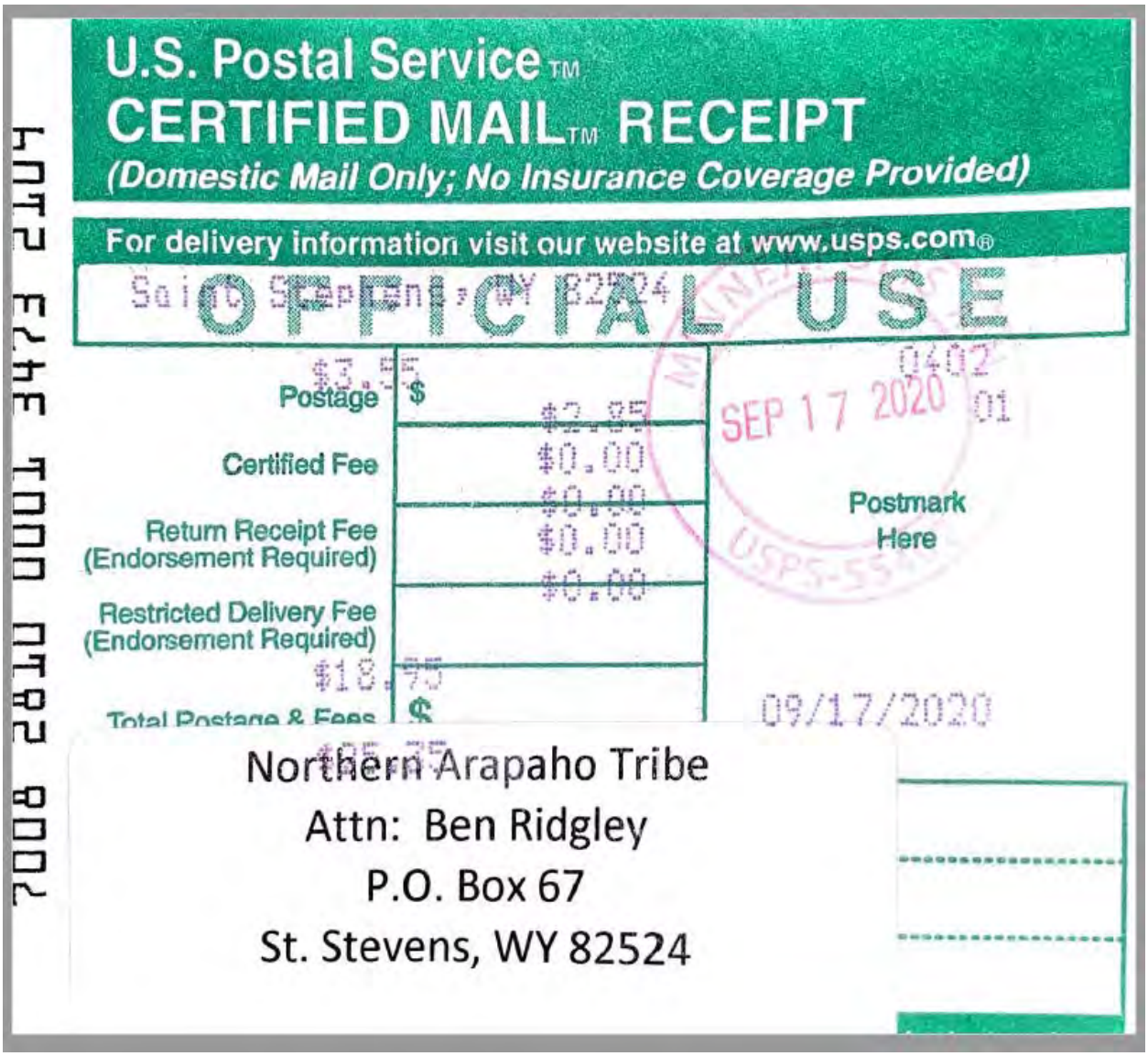
o Why were indirect effects to archaeological sites not considered? Setting is an important aspect of integrity for stone feature sites. There are numerous archaeological sites within and near the survey corridor that should be analyzed for indirect effects. Revise the report to address indirect effects to archaeological sites.	The report has been updated to include an assessment of physical and non-physical impacts on unevaluated and eligible sites.	Sections 4 and 5.5 through 5.5
o WBI Energy needs to develop a cultural resource monitoring plan for construction.	WBI Energy commits to preparing a monitoring plan for construction.	Sections 5.3 through 5.5
o Update site form for all sites, site leads, and isolated finds regardless of whether they were relocated. Even if a cultural resource could not be relocated, that is still valuable information for the next project/site visit.	Site form updates have been submitted for all sites, isolated finds, and site leads discussed in the updated Class III report	N/A
o WBI Energy should make additional efforts to involve tribes in upcoming 2020 fieldwork and field reviews.	As discussed in more detail in Section 4 of the updated Class III report, WBI Energy retained Beaver Creek Archaeology to coordinate tribal participation in fieldwork in 2020. BCA worked with tribes to document sites as cultural heritage resources. The results of that work will be presented in a separate report. Information on tribal participation in the surveys also is provided in Sections 4 and 5.3 through 5.5 of ERM's updated Class III report	Sections 4 and 5.3 through 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Comments from U.S. Army Corps of Engineers		
o In section 5.4.2, remove figures for 32MZ0598 and move to the previous section.	This comment is addressed in the updated Class III report	Section 5.4
o Figure 5.4-5: Map of Site 32WI976, provide contour lines on this map to show the slope. This information would help to explain why the shovel testing pattern appears the way it does.	Contour lines are provided on Figure 5.4-9 in the updated Class III report.	Section 5.4
o ERM, on behalf of WBI [Energy], identified a second concentration of artifacts in the western side of site 32WI0976 after they started excavating the test unit. Some additional testing is needed here as USACE cannot agree with the recommended determination for this site given the data presented in this report.	Additional testing will be completed at this site in the fall of 2020 with the results presented in an addendum report.	Section 5.4
o USACE recommends that WBI [Energy] conduct a remote sensing evaluation (gradiometer or conductivity) at site 32WI0976. This would be the best way to produce measurable data regarding the presence/absence of subsurface features at the site.	A remote sensing survey of the site was completed in the summer of 2020. The results of the survey were used to prepare a testing plan for 32WI976. Additional testing at the site will occur this fall with the results presented in an addendum report.	Section 5.4
Comments from the U.S. Forest Service		
o The map showing previously recorded cultural resources within a one-mile radius is only included in the overall Class III and not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Figure 1.1-2 shows the Forest Service surface and differentiates between the survey corridor and the survey corridor on Forest Service surface; however, the survey corridor on Forest Service surface and the actual Forest Service surface displayed don't match.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Sites 32MZ2347 (Historical Archaeological) and 32MZ3278 (Cairn) are located immediately adjacent to the survey corridor but are not discussed. Please discuss.	Based on route modifications, 32MZ3278 was visited in 2020 and the site boundary expanded based on the findings. A discussion of the site is provided in the updated Class III report. 32MZ2347 is outside the inventory corridor for the Project; however, we have included a discussion of this site in the Class III inventory report.	Section 5.5
o Site 32MZ145 site form update does not appear to have been performed. Why? Was an attempt made to actually relocate the site? Also, according to the site form, a THPO representative requested avoidance in 2013. More work on this site is probably needed.	When 32MZ145 was first recorded in 1979, it was characterized as two stone cairns. Subsequent investigations described the site as consisting of a single historic rock clearing pile on the west side of Highway 1806, noting that the second pile was likely destroyed by construction of the highway. ERM's survey in 2019 was limited to the east side of Highway 1806, which explains why we did not relocate the site at that time. In 2020, ERM conducted additional survey on USFS lands, examining a corridor on the west side of Highway 1806. 32MZ145 was relocated as a result of this work. The site is discussed in the updated Class III report. Tribal cultural specialists who accompanied ERM during the 2020 field investigation concurred that 32MZ145 is historic rock clearing pile.	Section 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o Site 32MZ2346 and 32MZ144: it is very improbable and therefore suspicious that there are zero artifacts and one artifact respectively at sites with historic dumps.	Sites 32MZ2346 and 32MZ144 are both previously recorded historic sites which ERM revisited and recorded during the survey for the Project. Cultural material was observed at both sites as described in the updated Class III report. ERM expanded the boundaries of 32MZ2346 to encompass two previously unreported features at the site. One artifact–a commemorative coin–was collected from 32MZ2346 because of its uniqueness. No artifacts were collected from 32MZ144. Expanded descriptions of both sites are provided in the updated Class III report.	Section 5.5
o Additional survey is shown as needed near site 32MZ3278 on the maps in the overall Class III report but not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	Additional survey was completed in 2020 on USFS lands in the vicinity of 32MZ3278, which was relocated. A description of the site is provided in the updated Class III report.	Section 5.5
o The recommended avoidance and fencing measures are inadequate, especially for stone feature sites.	All stone feature sites have been avoided with a minimum buffet of 50 ft. Additionally, for sites between 50 and 100 ft of Project workspace WBI Energy commits to fencing and monitoring the sites during construction. WBI Energy will provide a monitoring plan for agency review.	Section 5.5
o A monitoring plan is needed.	WBI Energy commits to providing a construction monitoring plan as discussed in the updated Class III report.	
o Updates should have been conducted for all sites, site leads, and IFs [isolated finds] regardless of whether or not they were relocated.	Site form updates have been submitted for all applicable sites, isolated finds, and site leads discussed in the report	N/A
o The discussion of site leads during fieldwork is inadequate.	Site leads are discussed in Section 5.6 of the updated Class III report.	Section 5.6
o Provide specific distances between site boundaries and the edge of the workspace.	Distances between sites and Project workspaces have been added to summary tables and site descriptions throughout the updated Class III report.	Sections 5.3 through 5.5
o Provide a map of shovel testing performed outside of site boundaries. The report explains the testing strategy during survey but never discusses or shows specifics except within site boundaries.	The route maps provided as Appendix B depict survey methodology in addition to survey coverage and results.	Appendix B
o Identify the level of tribal involvement in the survey.	Tribal participation in field surveys is discussed in Sections 4 and 5.3 through 5.5 of the updated Class III report.	Sections 4 and 5.3 through 5.5
o Discuss whether indirect effects to archaeological sites were considered.	For unevaluated sites, we have added an assessment of non-physical impacts on setting.	Sections 5.3 through 5.5



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ERM

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Fax: +1 612 347 6780

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September 16, 2020

Michael Black Wolf, Tribal Historic Preservation Officer
Fort Belknap Indian Community
656 Agency Main Street
Harlem, MT 59526

Subject: WBI Energy Transmission, Inc.
North Bakken Expansion Project – Class III Survey Reports 2020 Field Season
McKenzie, Williams, Burke, and Mountrail Counties, North Dakota
ND SHPO Ref.: 19-5593

Dear Mr. Wolf:

Please reference WBI Energy Transmission, Inc.'s (WBI Energy's) previous correspondence regarding the above referenced project. WBI Energy proposes to construct and operate the North Bakken Expansion Project (Project) in McKenzie, Williams, Burke, and Mountrail Counties, North Dakota.

The Project is regulated by the Federal Energy Regulatory Commission (FERC) under Section 7(c) of the Natural Gas Act. Under the Energy Policy Act of 2005, FERC is the lead agency for coordinating federal authorizations and complying with the National Environmental Policy Act on natural gas pipeline projects subject to its jurisdiction. FERC similarly is the lead federal agency for complying with Section 106 of the National Historic Preservation Act (NHPA) on natural gas pipeline projects under its jurisdiction. In accordance with 36 CFR 800.2(c)(4), WBI Energy is assisting the FERC in meeting its obligations under Section 106 of the NHPA by coordinating with agencies and tribes and conducting surveys to identify historic properties that may be affected by the Project.

Enclosed for your review please find Class III survey reports for the archaeological and historic structures surveys that were conducted during the 2019 and 2020 field seasons. The archaeological report includes the results provided in the original Class III report and addresses comments that were provided by the State Historical Society of North Dakota, Bureau of Land Management, U.S. Army Corps of Engineers, and the U.S. Forest Service. The attached table summarizes our response to those comments and provides the location of the relevant revisions or clarifications. A report on geomorphological investigations is also included in this submittal.

WBI Energy would appreciate your comments on the attached reports. If you have any questions or comments on the Project or the reports, please contact me at 612-840-8976 or pat.robblee@erm.com, or Dr. Kevin Malloy at 906-285-0361 or kevin.malloy@erm.com. Please direct written correspondence to Dr. Malloy's attention at:

Environmental Resources Management
1000 IDS Center
80 South 8th Street
Minneapolis, MN 55402

Sincerely,

Patrick Robblee
Program Director

Enclosures: Class III Archaeological Survey Report
Class III Historic Structures Addendum I Survey Report
Geomorphology Report

cc: Jill Linn, WBI Energy
Andrea Thornton, ERM
Kevin Malloy, ERM
Emily Laird, ERM
Andrew Clark, SHSND
Fern Swenson, SHSND
Liv Fetterman, USFS
Richard Rogers, USACE
Teanna Limpy, Northern Cheyenne Tribe
Pete Coffey, Three Affiliated Tribes of the Fort Berthold Reservation
Dyan Youpee, Assiniboine and Sioux Tribes of the Fort Peck Reservation
Ben Rhodd, Rosebud Sioux Tribe
Tom Brings, Oglala Sioux Tribe
Jon Eagle, Standing Rock Sioux Tribe
Ben Ridgely, Northern Arapaho Tribe
Steven Vance, Cheyenne River Sioux
Erich Longie, Spirit Lake Tribe
Kip Spotted Eagle, Yankton Sioux Tribe
Jeff Desjarlais, Jr., Turtle Mountain Band of Chippewa
Dianne Desrosiers, Sisseton Wahpeton Oyate

Attachment: Table summarizing agency comments on the original Class III archaeology report

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Comments from the State Historical Society of North Dakota		
General comments:		
o Provide more background information on sites with previous work. Focus on methods and reasoning for previous eligibility recommendation.	Additional information on previous investigations has been added to site descriptions, as applicable.	Sections 5.3 through 5.7
o Map symbology has item named "Shovel test – No Dig". Are these shovel probes that were planned, but not excavated for some reason? If so provide explanation.	These are planned but unexcavated shovel tests. Site descriptions have been updated, as applicable, to explain why some planned shovel tests were not excavated. Typical reasons for not excavating shovel tests include the presence of buried utilities (documented through One-Call markings) or slope.	Sections 5.3 through 5.5
Avoidance, 50 ft buffer minimum, fence, and monitor:		
o Private land: 32BK277, 32BK279, 32BK280, 32BK282, 32MZ3308, 32MZ3309, 32MZ3310, 32MZ3311, 32MZ3325, 32MZ3327, 32WI1494, 32WI1630, 32WI2144, 32WI2388, 32WI2389, 32WI2391, 32WI2392, 32WI2393, 32WI2394, 32WI2398, 32WI2406, 32WI2408.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.3
o US Forest Service Sites: 32MZ3301, 32MZ3314, 32MZ3315, 32MZ3319, 32MZ3320, 32MZ3322, 32MZ3324.	Each of these sites is avoided with a minimum 50 ft buffer. Additionally, for sites located between 50 and 100 ft of Project workspace, WBI Energy commits to fencing and monitoring at these locations.	Section 5.5
Formally evaluate with site delineation and at least one 1x1 m TU. Submit evaluation plan prior to fieldwork:		
o Private Land: 32BK278, 32MZ3302, 32MZ3306, 32MZ3307, 32MZ3318, 32MZ3323, 32MZ3326, 32MZ3328, 32MZ3329, 32MZ3331, 32WI2390, 32WI2405, 32WI2407, 32WI2409, 32WI2410.	Additional testing (shovel testing and/or the excavation of at least one, 1 x 1 m test unit) was completed at each of these sites in accordance with a testing plan approved by the SHSND. Testing at sites 32WI2390 and 32MZ3328 was suspended following the identification of stone features at these sites; however, the pipeline route has been adjusted to avoid these sites with a minimum 50-ft buffer.	Section 5.3
o US Forest Service Site: 32MZ2346.	While ERM planned to conduct additional testing at this site, the pipeline route was modified prior to this work such that the site is now avoided by the Project with a buffer greater than 100 ft.	Section 5.5
Isolated finds:		
o Discuss subsurface potential on all IFs on a case-by-case basis. If the finds are in a good depositional context, STPs may be necessary to show that these are truly isolates. Minimal site recording may be enough to get a site number for database purposes, but more information is needed to verify that these are truly part of a category that can be written-off as not eligible.	Individual descriptions of isolated finds have been added to the text, including the results of shovel testing or an explanation for why shovel tests were not excavated.	Section 5.7

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Site-by-site comments, private land:		
o 32BK168 – Expand reasoning for Not Eligible Determination both previously and now. Newly recorded site boundary included previously unidentified features. Perhaps site should be unevaluated. Consider formal evaluation and provide updated management recommendations.	ERM conducted site testing at 32BK168 in 2020. Evidence of intact cultural deposits and features was identified during testing and the site is now recommended as eligible for listing in the NRHP. The pipeline route has been modified to avoid this site with a buffer of 57 ft.	Section 5.3
o 32MZ3323 – Discussion mentions "Better Examples" of homesteads. Provide examples.	The description for 32MZ3323 has been updated to incorporate the results of additional testing (shovel testing and the excavation of a 1 x 1 m test unit) in the updated Class III report.	Section 5.3
o 32WI1495 – Actual well shown in Figure 5.3-81 may be visible in figure 5.3-80. Is this location impacted by project? Consider site lead.	The location of the well (which is no longer extant) is discussed in the updated Class III report in conjunction with 32WI1495. ERM has submitted a site lead form for this resource. The suggested boundary of the site lead is 19 ft from Project workspace. The actual location of the well is about 235 ft from Project workspace.	Section 5.3
o 32WI2404 – How is this identified as prehistoric? Could it be a result of natural glacial and/or historic or modern field clearing? Provide evidence. Fence and monitor as necessary.	The interpretation of the feature at 32WI2404 as prehistoric is conservative and based on best professional judgement. Tribal cultural specialists who visited the site with ERM concurred with this interpretation.	Section 5.3
o 32WI2408 – Workspace is extremely close to possible graves. Is the planned route fixed?	The pipeline route has been modified to avoid this site with a buffer of 213 ft.	Section 5.3
Site-by-site comments, US Army Corps of Engineers land:		
o 32MZ976 – Drilling under site is not avoidance as leaks and emergency repairs do consider cultural resources. Formal testing or horizontal avoidance is necessary.	The trajectory of the HDD will be 160 to 180 ft below ground surface where it passes beneath 32WI976. The pipeline will carry gas, not a liquid; the gas would migrate to the surface and dissipate into the air in the event of a leak. Given the depth of the HDD installation, daylighting of the pipeline for repair would not be feasible. If repair is required in the future, the most likely course of action would be to re-install a new segment via HDD, which would require federal authorizations, thereby triggering review of the action under Section 106 of the NHPA. A description of the HDD method has been added to the description of 32WI976 in Section 5.4 of the report. Additional testing at the site is pending and scheduled to be completed this fall. The results will be discussed in an addendum report.	Section 5.4
o 32MZ976 – Show bore location and HDD line on map	A figure showing the HDD alignment with entry and exit points has been added to the description of this site as has a construction alignment sheet. The alignment sheet depicts the HDD in plan and profile.	Section 5.4

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o 32MZ976 – Clarify and provide more evidence for geomorphological hypothesis of A horizon being related to flood deposits. Typically, A horizons show stability rather than accretional or erosional events. Provide more information on why artifacts are interpreted as disturbed rather than in primary context.	The text in the updated Class III report has been updated to address this comment. As noted above, additional testing is planned to occur at 32WI976 this fall, which will provide additional information on the soils present at the site.	Section 5.4
o 32MZ976 – Did cut bank provide additional information on buried soils? Were artifacts identified in cut bank?	The cut bank was examined during the initial survey. As noted above, additional testing is planned to occur at the site this fall with results to be discussed in an addendum report.	Section 5.4
o 32WI976 – Given size and shape of site, additional TUs recommended.		
Comments from the Bureau of Land Management		
o The recommended protection/avoidance measures for unevaluated and eligible archaeological sites in the Class III report are inadequate, particularly regarding stone feature sites. The usual avoidance distance requested/required by the BLM is 100 feet. More than 100 feet is preferred for stone feature sites. Revise protection/avoidance measures buffers for archaeological sites.	WBI Energy has routed the pipeline to avoid unevaluated and eligible sites with a minimum buffer of 50 ft as directed by the SHSND.	Sections 5.3 through 5.5
o Why were indirect effects to archaeological sites not considered? Setting is an important aspect of integrity for stone feature sites. There are numerous archaeological sites within and near the survey corridor that should be analyzed for indirect effects. Revise the report to address indirect effects to archaeological sites.	The report has been updated to include an assessment of physical and non-physical impacts on unevaluated and eligible sites.	Sections 4 and 5.5 through 5.5
o WBI Energy needs to develop a cultural resource monitoring plan for construction.	WBI Energy commits to preparing a monitoring plan for construction.	Sections 5.3 through 5.5
o Update site form for all sites, site leads, and isolated finds regardless of whether they were relocated. Even if a cultural resource could not be relocated, that is still valuable information for the next project/site visit.	Site form updates have been submitted for all sites, isolated finds, and site leads discussed in the updated Class III report	N/A
o WBI Energy should make additional efforts to involve tribes in upcoming 2020 fieldwork and field reviews.	As discussed in more detail in Section 4 of the updated Class III report, WBI Energy retained Beaver Creek Archaeology to coordinate tribal participation in fieldwork in 2020. BCA worked with tribes to document sites as cultural heritage resources. The results of that work will be presented in a separate report. Information on tribal participation in the surveys also is provided in Sections 4 and 5.3 through 5.5 of ERM's updated Class III report	Sections 4 and 5.3 through 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
Comments from U.S. Army Corps of Engineers		
o In section 5.4.2, remove figures for 32MZ0598 and move to the previous section.	This comment is addressed in the updated Class III report	Section 5.4
o Figure 5.4-5: Map of Site 32WI976, provide contour lines on this map to show the slope. This information would help to explain why the shovel testing pattern appears the way it does.	Contour lines are provided on Figure 5.4-9 in the updated Class III report.	Section 5.4
o ERM, on behalf of WBI [Energy], identified a second concentration of artifacts in the western side of site 32WI0976 after they started excavating the test unit. Some additional testing is needed here as USACE cannot agree with the recommended determination for this site given the data presented in this report.	Additional testing will be completed at this site in the fall of 2020 with the results presented in an addendum report.	Section 5.4
o USACE recommends that WBI [Energy] conduct a remote sensing evaluation (gradiometer or conductivity) at site 32WI0976. This would be the best way to produce measurable data regarding the presence/absence of subsurface features at the site.	A remote sensing survey of the site was completed in the summer of 2020. The results of the survey were used to prepare a testing plan for 32WI976. Additional testing at the site will occur this fall with the results presented in an addendum report.	Section 5.4
Comments from the U.S. Forest Service		
o The map showing previously recorded cultural resources within a one-mile radius is only included in the overall Class III and not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Figure 1.1-2 shows the Forest Service surface and differentiates between the survey corridor and the survey corridor on Forest Service surface; however, the survey corridor on Forest Service surface and the actual Forest Service surface displayed don't match.	This comment is no longer applicable. Survey results for USFS lands are included in the updated Class III inventory report in Section 5.5.	N/A
o Sites 32MZ2347 (Historical Archaeological) and 32MZ3278 (Cairn) are located immediately adjacent to the survey corridor but are not discussed. Please discuss.	Based on route modifications, 32MZ3278 was visited in 2020 and the site boundary expanded based on the findings. A discussion of the site is provided in the updated Class III report. 32MZ2347 is outside the inventory corridor for the Project; however, we have included a discussion of this site in the Class III inventory report.	Section 5.5
o Site 32MZ145 site form update does not appear to have been performed. Why? Was an attempt made to actually relocate the site? Also, according to the site form, a THPO representative requested avoidance in 2013. More work on this site is probably needed.	When 32MZ145 was first recorded in 1979, it was characterized as two stone cairns. Subsequent investigations described the site as consisting of a single historic rock clearing pile on the west side of Highway 1806, noting that the second pile was likely destroyed by construction of the highway. ERM's survey in 2019 was limited to the east side of Highway 1806, which explains why we did not relocate the site at that time. In 2020, ERM conducted additional survey on USFS lands, examining a corridor on the west side of Highway 1806. 32MZ145 was relocated as a result of this work. The site is discussed in the updated Class III report. Tribal cultural specialists who accompanied ERM during the 2020 field investigation concurred that 32MZ145 is historic rock clearing pile.	Section 5.5

Comments on the Draft Class III Inventory Report		
Comments:	**Responses:**	**Location in Updated Report:**
o Site 32MZ2346 and 32MZ144: it is very improbable and therefore suspicious that there are zero artifacts and one artifact respectively at sites with historic dumps.	Sites 32MZ2346 and 32MZ144 are both previously recorded historic sites which ERM revisited and recorded during the survey for the Project. Cultural material was observed at both sites as described in the updated Class III report. ERM expanded the boundaries of 32MZ2346 to encompass two previously unreported features at the site. One artifact–a commemorative coin–was collected from 32MZ2346 because of its uniqueness. No artifacts were collected from 32MZ144. Expanded descriptions of both sites are provided in the updated Class III report.	Section 5.5
o Additional survey is shown as needed near site 32MZ3278 on the maps in the overall Class III report but not in the Forest Service stand-alone report. Please include this in the stand-alone Forest Service report.	Additional survey was completed in 2020 on USFS lands in the vicinity of 32MZ3278, which was relocated. A description of the site is provided in the updated Class III report.	Section 5.5
o The recommended avoidance and fencing measures are inadequate, especially for stone feature sites.	All stone feature sites have been avoided with a minimum buffet of 50 ft. Additionally, for sites between 50 and 100 ft of Project workspace WBI Energy commits to fencing and monitoring the sites during construction. WBI Energy will provide a monitoring plan for agency review.	Section 5.5
o A monitoring plan is needed.	WBI Energy commits to providing a construction monitoring plan as discussed in the updated Class III report.	
o Updates should have been conducted for all sites, site leads, and IFs [isolated finds] regardless of whether or not they were relocated.	Site form updates have been submitted for all applicable sites, isolated finds, and site leads discussed in the report	N/A
o The discussion of site leads during fieldwork is inadequate.	Site leads are discussed in Section 5.6 of the updated Class III report.	Section 5.6
o Provide specific distances between site boundaries and the edge of the workspace.	Distances between sites and Project workspaces have been added to summary tables and site descriptions throughout the updated Class III report.	Sections 5.3 through 5.5
o Provide a map of shovel testing performed outside of site boundaries. The report explains the testing strategy during survey but never discusses or shows specifics except within site boundaries.	The route maps provided as Appendix B depict survey methodology in addition to survey coverage and results.	Appendix B
o Identify the level of tribal involvement in the survey.	Tribal participation in field surveys is discussed in Sections 4 and 5.3 through 5.5 of the updated Class III report.	Sections 4 and 5.3 through 5.5
o Discuss whether indirect effects to archaeological sites were considered.	For unevaluated sites, we have added an assessment of non-physical impacts on setting.	Sections 5.3 through 5.5

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Packaging type: Your Packaging
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Shipper Information	Recipient Information
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ERM	Fort Belknap Indian Community
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Thank you for your business.

Correspondence between Beaver Creek Archaeology and Tribal Historic Preservation Officers and/or Agencies Regarding Tribal Participation in Field Surveys

Correspondence Logs with Tribal Historic Preservation Officers

Communications with Standing Rock Sioux Tribe

Date	Summary
7/23/2020	
	At 12:25 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing all state and federal agencies (excluding FERC). In the email, Raina attached the 6th weekly update for the project. Included in the email were some special notes regarding the planned end date for the project as well as providing updates with respect to the Hartel property and BCA20-1313-CHFMSite15.
7/31/2020	
	At 2:19 pm, Raina sent and email to all project-specific applicable THPOS, cc'ing Wade. The email included the weekly update for the week of July 20 through July 25. In addition was special notes and updates that included the extension of the project date. The fieldwork should now be complete August 7. She continued by saying that the Hartel parcel has been completed. She finished by alerting the THPOs to the fact that the site that ERM archaeologists and TCSs had disagreements regarding will continue to be recorded while submitting appropriate paperwork describing the TCSs disagreement. Raina closed out the email by saying that arrangements were being made to accommodate the extension of fieldwork and that if any TCSs needed swapped out for the new time frame to let BCA know.
	At 3:15 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing Wade. She explained that she just received the most updated version of the survey schedule by ERM. Raina told the THPOs that she will keep them up to date to all changes as soon as she learned of them, noting that TCSs may know of changes sooner directly from ERM field crew.
8/7/2020	
	At 10:24 am CST, Raina sent an email to all project-specific applicable THPOs. The email contained the weekly update for July 27 through August 1. In the email she updating the THPOs to the extended completion date being August 14. This is because of a large stone feature that was discovered. TCS and ERM archaeologists continue to disagree over the validity of a site as well. Raina closed out the email by saying that BCA will be keeping THPOs and TCSs updated as much as possible.
8/10/2020	
	At 9:35 am CST, Raina sent an email to all project-specific applicable THPOs. The email came as a confirmation that fieldwork should be completed sometime this week. She said that TCSs will be released as soon as fieldwork is completed.

8/11/2020	
	At 11:44 am CST, Raina emailed all project-specific applicable THPOs. The email contained the ninth weekly update (August 3 through August 8). Raina added that fieldwork will be completed on the tenth week and that BCA and participating TCSs will be returning to the Hartel property to survey a reroute. She closed the email out by explaining that the TCSs sentiments regarding the stone features in the site revisits had been outlined in the attached update.
	At 6:29 pm CST, Raina emailed all project-specific applicable THPOs. In the email she outlined that she had received confirmation of the reroute touch-up survey. She explained that the survey will most-likely occur on Thursday of that week and will cover less than five acres of primarily plowed agricultural field. Raina closed by saying that they are on track to release the TCSs on Friday or Saturday of that week.
8/14/2020	
	At 3:11 pm CST, Raina emailed all project-specific applicable THPOs with the final weekly update for the second mobilization of the project. The attached document covered August 10 through August 13. She included in the email that fieldwork has ceased pending fields being harvested and that the Hartel reroute touch-up survey came up as no cultural material. Lastly she concluded that there had been two more sites discovered that were disagreed upon by TCSs and ERM archaeologists. She said that the same protocols will be followed for these new sites as the first site that was disagreed upon.
8/31/2020	
	At 3:01 pm CST, Raina emailed all project-specific applicable THPOs letting them know that BCA has been mapping and documenting the sites and features recorded by TCSs. BCA will be getting shapefiles data over to WBI and ERM that week for review and avoidance planning. Raina explained that ERM and WBI will plan to avoid site boundaries for stone feature sites on private and/or state surface by a 50' minimum as well as fencing off the project's ROW corridor. She continued by saying that BCA is working on completing the North Dakota Heritage Forms for SHPO though the information provided in those forms will have no affect archaeologically but will reflect the feature/site details provided by TCSs that has been approved to be documented and shared. Raina concluded by saying that during a call with ERM and WBI the previous Friday that ERM plans on resuming the remaining fieldwork starting September 9th and that it should take approximately 4 weeks. She requested that any THPO that can send TCS for the second mobilization of fieldwork let her know as soon as possible.

9/2/2020	
	At 10:29 am CST, Jon Eagle emailed all project-specific applicable THPOs and BCA staff. He expressed his concern regarding the disagreements between ERM archaeologists and TCSs. He requested site visits and contact information for the lead federal agency of the project.
	At 10:41 am CST, Raina emailed Jon Eagle and all project-specific applicable THPOs. In the email, she lists the contact information for FERC's Dawn Ramsey.
	At 10:55 am CST, Jeremy emailed Raina, cc'ing Hoksila White Mountain and Jon Eagle. He said that SRST had a TCS available and gave her Hoksila's contact information.
	At 11:08 am CST, Raina emailed Jeremy, cc'ing Hoksila and Jon. She explained that there will be a hotel room for Hoksila in Williston and that onboarding can be completed the evening that he arrives or the following morning.
	At 11:08 am CST, Jon Eagle emailed applicable BCA staff and all project-specific applicable THPOs. He followed up on his earlier request for site visits.
	At 11:18 am CST, Raina emailed all project-specific applicable THPOs. She explained that BCA has no issues with Jon's request but state and federal agencies would have to speak to the request. Raina said that she had forwarded the request on to the appropriate individuals at ERM and WBI. She let them know that she will let them know when she gets a response.
	At 11:43 am CST, Jon emailed all project-specific applicable THPOs and applicable BCA staff. He asked who the delegated federal authority would be.
	At 11:55 am CST, Raina emailed all project-specific applicable THPOs. She answered Jon's question by saying that WBI would be that authority.
	At 11:55 am CST, Jon emailed all project-specific applicable THPOs and applicable BCA staff. He asked who would be the contact he can consult within WBI.
	At 2:40 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing Jill and Pat. In her email she listed the contacts for WBI and ERM (Jill Linn and Pat Robblee, respectively). She also explained who would be best to address certain questions.
	At 2:40 pm CST, Jon emailed all project-specific applicable THPOs, cc'ing Jill Linn of WBI, Pat Robblee of ERM and applicable BCA Staff. Jon thanked Raina for the information and said he had reached out to Dawn Ramsey of FERC who said she will contact WBI and ERM. Jon says he is waiting to hear from WBI.
9/3/2020	
	At 5:51 pm CST, Raina emailed all project-specific applicable THPOs. The email was a reminder of the second mobilization starting the following week. She provided the current travel date and asked that any THPOs that can send a TCS let her know. She also mentioned the two documents that she had attached that listed the known and new CHF interpretations for their review.

9/4/2020	
	At 8:02 am CST, Raina emailed all project-specific applicable THPOs that the start date for the second mobilization had been moved back to September 11 and that the travel day will be September 10th.
	At 8:03 am CST, Raina emailed Jeremy, cc'ing Jon and Hoksila. The email contained an update that the start date for the second mobilization had been moved back to September 11 and that the travel day will be September 10.
	At 1:25 pm CST, Raina emailed all project-specific applicable THPOs and applicable BCA staff. The email was a reminder of dates and that THPOs should let BCA know if they plan on sending a TCS for the mobilization.
	At 1:26 pm CST, Raina emailed Jeremy, cc'ing Hoksila and Jon. The email was a reminder of dates and that THPOs should let BCA know if they plan on sending a TCS for the mobilization.
	At 3:29 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing applicable BCA staff. She attached a pdf of the combined known and new CHF sites. She tells them to let her know if they have any questions or concerns about the mobilization.
9/8/2020	
	At 9:32 am CST, Raina emailed all project-specific applicable THPOs. She provided them an update to the fieldwork scheduling from ERM. She also let them know that all THPOs that have confirmed a TCS will be getting a phone call.
	At 9:34 am CST, Raina emailed Jeremy, Hoksila and Jon. She provided them an update to the fieldwork scheduling from ERM. She also let them know that all THPOs that have confirmed a TCS will be getting a phone call.
	At 1:47 pm CST, Raina emailed Jeremy, Hoksila and Jon. She provided them the address for the hotel the TCSs will be staying at in Williston.
9/9/2020	
	At 8:50 am CST, Jon emailed Jill Linn, Raina, and all project-specific applicable THPOs, CC'ing BCA staff, Pat Robblee and Andrea Thornton of ERM. He thanked Jill for her response and suggested site visits with the archaeologists.
	At 9:40 am CST, Raina attempted to call Hoksila White Mountain's cell phone. There was no answer so Raina left a voicemail. She alerted him to ERM's change of field schedule.
	At 9:42 am CST, Raina called Jeremy Freeman's cell phone. She alerted him to the email she sent and to let him know that she had tried to get a hold of TCS Hoksila White Mountain. She also went over the new hire paperwork information.
	At 11:45 am CST, Hoksila called the BCA office to talk to Raina. He let Raina know that he will be in Williston that Thursday per the updated ERM schedule. Raina gave Hoksila the details for the hotel accommodations. She took down the town that he will be leaving from for the mileage check.
	At 3:50 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat Robblee, Andrea Thornton, and Kevin Malloy. In her email she explains that efforts were being made to look at the site specified by Ft. Peck on September 11. She said that if anyone wanted to participate to let Raina know. She also said that more details on the meeting will come later. Raina addressed the inquiries regarding CHFM 5 and that after some digging, the feature will stay recorded and that the PDF will be updated.
	At 3:55 pm CST, Jon Eagle emailed Jill Linn, Raina, and all project-specific applicable THPOs, cc'ing applicable BCA staff, Kevin Malloy, Pat Robblee and Andrea Thornton of ERM. Jon said that he will be attending the site visit and requested to have logistics to the meeting passed along.

9/9/2020	
	At 4:45 pm CST, Jill emailed Raina and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat , Andrea and Kevin. She let everyone know that logistics were being finalized and they will be informed of them as soon as possible.
	At 5:00 pm CST, Raina emailed all project-specific applicable THPOs, and Jill, cc'ing applicable BCA staff, Pat, Andrea and Kevin. She shared the meeting date, time and location with everyone
9/10/2020	
	At 10:30 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was a list of the currently confirmed attendants and the meeting time, date and location of the meeting.
	At 10:34 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was an additional participant that wasn't listed in the previous email.
	At 11:44 am CST, Jon emailed Raina, Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. Jon stated that he will not be able to participate in the site visit.
	At 11:55 am CST, Raina responded to Jon via email and included all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. She thanked Jon for letting her know he won't be able to attend and let him know that she will keep him updated.
	At 4:18 pm CST, Jon emails Raina, Jill, all project-specific-applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. He said that he is in contact with WBI for a future site visit.
	At 4:33 pm CST, Raina emails Jon, Jill, all project-specific-applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. She made sure that he knew that any of the sites found on public land (USFS and BLM) are open to visits whenever.
9/14/2020	
	At 11:10 am CST, Raina emailed all project-specific applicable THPOS. She gave an update on the first week of the second mobilization for the project as well as the site visit form September 11.
	At 11:47 am CST, Raina emailed all project-specific applicable THPOs. She resent the first weekly update for the second mobilization.
9/15/2020	
	At 12:16 pm CST, Raina emailed all project-specific applicable THPOs with a confirmation email of a second site visit as well as meeting details.
9/16/2020	
	At 11:39 am CST, Raina emailed Jeremy and Jon. She was touching base with them to see if Jon was planning on heading to Watford City, North Dakota that night or the next day so she could possibly set up a hotel room for him.
	At 11:59 am CST, Jon emailed Raina and Jeremy letting them know that he will be traveling to Watford City that night and that he had already made plans for accommodations.

9/14/2020	
	At ~11 am CST, Eric called Hoksila regarding whether he will be participating as an independent contractor or as an employee of BCA. Eric explained the details of both options. The explanation of the independent contractor option came from an email that Jill Linn of WBI sent to Raina Hanley regarding the matter. Hoksila opted to work as a BCA employee.
	At 11:47 am CST, Raina emailed all project-specific applicable THPOs. She resent the first weekly update for the second mobilization.
9/18/2020	
	At 9:48 am CST, Raina emailed all project- specific applicable THPOs. She provided an update regarding the site visit the day before.

Communications with the Sisseton - Wahpeton Oyate

Date	Summary
7/23/2020	
	At 12:25 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing all state and federal agencies (excluding FERC). In the email, Raina attached the 6th weekly update for the project. Included in the email were some special notes regarding the planned end date for the project as well as providing updates with respect to the Hartel property and BCA20-1313-CHFMSite15.
7/31/2020	
	At 2:19 pm CST, Raina sent and email to all project-specific applicable THPOS, cc'ing Wade. The email included the weekly update for the week of July 20 through July 25. In addition was special notes and updates that included the extension of the project date. The fieldwork should now be complete August 7. She continued by saying that the Hartel parcel has been completed. She finished by alerting the THPOs to the fact that the site that ERM archaeologists and TCSs had disagreements regarding will continue to be recorded while submitting appropriate paperwork describing the TCSs disagreement. Raina closed out the email by saying that arrangements were being made to accommodate the extension of fieldwork and that if any TCSs needed swapped out for the new time frame to let BCA know.
	At 3:15 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing Wade. She explained that she just received the most updated version of the survey schedule by ERM. Raina told the THPOs that she will keep them up to date to all changes as soon as she learned of them, noting that TCSs may know of changes sooner directly from ERM field crew.
8/7/2020	
	At 10:24 am CST, Raina sent an email to all project-specific applicable THPOs. The email contained the weekly update for July 27 through August 1. In the email she updating the THPOs to the extended completion date being August 14. This is because of a large stone feature that was discovered. TCS and ERM archaeologists continue to disagree over the validity of a site as well. Raina closed out the email by saying that BCA will be keeping THPOs and TCSs updated as much as possible.
8/10/2020	
	At 9:35 am CST, Raina sent an email to all project-specific applicable THPOs. The email came as a confirmation that fieldwork should be completed sometime this week. She said that TCSs will be released as soon as fieldwork is completed.

8/11/2020	
	At 11:44 am CST, Raina emailed all project-specific applicable THPOs. The email contained the weekly update for week 9 (August 3 through August 8). Raina added that fieldwork will be completed on the tenth week and that BCA and participating TCSs will be returning to the Hartel property to survey a reroute. She closed the email out by explaining that the TCSs sentiments regarding the stone features in the site revisits had been outlined in the attached update.
	At 6:29 pm CST, Raina emailed all project-specific applicable THPOs. In the email she outlined that she had received confirmation of the reroute touch-up survey. She explained that the survey will most-likely occur on Thursday of that week and will cover less than 5 acres of primarily plowed agricultural field. Raina closed by saying that they are on track to release the TCSs on Friday or Saturday of that week.
8/14/2020	
	At 3:11 pm CST, Raina emailed all project-specific applicable THPOs with the final weekly update for the project. The attached document covered August 10 through August 13. She included in the email that fieldwork has ceased pending fields being harvested and that the Hartel reroute touch-up survey came up as no cultural material. Lastly she concluded that there had been two more sites discovered that were disagreed upon by TCSs and ERM archaeologists. She said that the same protocols will be followed for these new sites as the first site that was disagreed upon.
8/31/2020	
	At 3:01 pm CST, Raina emailed all project-specific applicable THPOs letting them know that BCA has been mapping and documenting the sites and features recorded by TCSs. BCA will be getting shapefiles data over to WBI and ERM that week for review and avoidance planning. Raina explained that ERM and WBI will plan to avoid site boundaries for stone feature sites on private and/or state surface by a 50' minimum as well as fencing off the project's ROW corridor. She continued by saying that BCA is working on completing the North Dakota Heritage Forms for SHPO though the information provided in those forms will have no affect archaeologically but will reflect the feature/site details provided by TCSs that has been approved to be documented and shared. Raina concluded by saying that during a call with ERM and WBI the previous Friday that ERM plans on resuming the remaining fieldwork starting September 9th and that it should take approximately 4 weeks. She requested that any THPO that can send TCss for the second mobilization of fieldwork let her know as soon as possible.

9/2/2020	
	At 10:41 am CST, Raina emailed all project-specific applicable THPOS. In the email she lists the contact information for FERC's Dawn Ramsey.
	At 11:00 am CST, Dianne emailed all project-specific applicable THPOS and BCA staff. She stated that SWO supports Jon Eagle of SRST's request for site visits.
	At 11:22 am CST, Raina emailed all project-specific applicable THPOs, CC'ing BCA staff. She said that Dianne's response has been noted and forwarded to the appropriate individuals at ERM and WBI.
	At 11:18 am CST, Raina emailed all project-specific applicable THPOs. She explained that BCA has no issues with Jon's request but state and federal agencies would have to speak to the request. Raina said that she had forwarded the request on to the appropriate individuals at ERM and WBI. She let them know that she will let them know when she gets a response.
	At 11:55 am CST, Raina emailed all project-specific applicable THPOs. She answered Jon's question by saying that WBI would be that authority.
	At 2:40 pm CST, Raina emailed all project-specific applicable THPOs. In her email she listed the contacts for WBI and ERM (Jill Linn and Pat Robblee, respectively). She also explained who would be best to address certain questions.
9/3/2020	
	At 4:03 pm CST, Jill Linn emailed all project-specific applicable THPOs, Raina and CC'd Pat Robblee and Andrea Thornton of ERM. She addressed Jon saying that she left a voice mail at his office. She then goes on to address his concerns by explaining that WBI contracted ERM for the archaeological work therefore all discussions of sites and the reasons for recording should be addressed by ERM. She says that Pat Robblee had been copied on the email thread so that he can address the concerns as well. She addresses the site visits by saying that WBI, ERM and BCA will be working together to talk to landowners and land management for access to the sites.
	At 5:51 pm CST, Raina emailed all project-specific applicable THPOs. The email was a reminder of the second mobilization starting the following week. She provided the current travel date and asked that any THPOs that can send a TCS let her know. She also mentioned the two documents that she had attached that listed the known and new CHF interpretations for their review.
9/4/2020	
	At 8:02 am CST, Raina emailed all project-specific applicable THPOs that the start date for the second mobilization had been moved back to September 11 and that the travel day will be September 10th.
	At 1:25 pm CST, Raina emailed all project-specific applicable THPOs and applicable BCA staff. The email was a reminder of dates and that THPOs should let BCA know if they plan on sending a TCS for the mobilization.
	At 3:29 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing applicable BCA staff. She attached a PDF of the combined known and new CHF sites. She tells them to let her know if they have any questions or concerns about the mobilization.
9/8/2020	
	At 9:32 am CST, Raina emailed all project-specific applicable THPOs. She provided them an update to the fieldwork scheduling from ERM. She also let them know that all THPOs that have confirmed a TCS will be getting a phone call.

9/9/2020	
	At 3:50 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat Robblee, Andrea Thornton, and Kevin Malloy. In her email, she explains that efforts were being made to look at the site specified by Ft. Peck on September 11. She said that if anyone wanted to participate to let Raina know. She also said that more details on the meeting will come later. Raina addressed the inquiries regarding CHFM 5 and that after some digging, the feature will stay recorded and that the PDF will be updated.
9/10/2020	
	At 10:30 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was a list of the currently confirmed attendants and the meeting time, date and location of the meeting.
	At 10:34 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was an additional participant that wasn't listed in the previous email.
	At 10:54 am CST, Dianne emailed Raina, Jill, all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea, and Kevin. She stated that SWO will not be able to attend the site visit but requests to be kept up to date on the results.
	At 10:57 am CST, Raina emailed Jill, all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea, and Kevin. She stated that BCA will keep everyone up to date.
9/14/2020	
	At 11:10 am CST, Raina emailed all project-specific applicable THPOS. She gave an update on the first week of the second mobilization for the project as well as the site visit form September 11.
	At 11:47 am CST, Raina emailed all project-specific applicable THPOs. She resent the first weekly update for the second mobilization.
9/18/2020	
	At 9:48 am CST, Raina emailed all project- specific applicable THPOs. She provided an update regarding the site visit the day before.

Communications with Turtle Mountain Band of Chippewa

Date	Summary
7/22/2020	
	At 8:45 pm CST, Raina emailed Jeff alerting him to an issue that a BCA representative alerted her to regarding a TCS. Raina said that they will need to discuss it tomorrow (July 23).
7/23/2020	
	At 10:52 am CST, Raina attempted to call Jeff's office. A woman answered and said that Jeff was in a meeting. Raina left a message to have Jeff call her. The call lasted until 10:53 am CST.
	At 10:58 am CST, Raina emailed Jeff saying that she attempted to call his office number. She said that she lefts a massage with the girl that answered the phone and told him to give her a call at the office or her cell phone.
	At 11:29 am CST, Jeff called the BCA office and asked for Raina. During their conversation, Raina filled Jeff in to the incident involving TCS Mike McCloud as well as updating him to what has happened since it occurred. Raina also followed up with Jeff on the site he was interested. Raina had talked to ERM to contact the landowner to gain access to the site but the landowner denied access. She also explained the rumors of ERM demobilizing from the field which is that ERM is only partially demobilizing and that the TCSs should expect to be there next week for 2019 site review. Raina told Jeff that she will keep him up to date.
	At 12:25 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing all state and federal agencies (excluding FERC). In the email, Raina attached the 6th weekly update for the project. Included in the email were some special notes regarding the planned end date for the project as well as providing updates with respect to the Hartel property and BCA20-1313-CHFMSite15.
7/31/2020	
	At 2:19 pm CST, Raina sent and email to all project-specific applicable THPOS, cc'ing Wade. The email included the weekly update for the week of July 20 through July 25. In addition was special notes and updates that included the extension of the project date. The fieldwork should now be complete August 7. She continued by saying that the Hartel parcel has been completed. She finished by alerting the THPOs to the fact that the site that ERM archaeologists and TCSs had disagreements regarding will continue to be recorded while submitting appropriate paperwork describing the TCSs disagreement. Raina closed out the email by saying that arrangements were being made to accommodate the extension of fieldwork and that if any TCSs needed swapped out for the new time frame to let BCA know.
	At 3:15 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing Wade. She explained that she just received the most updated version of the survey schedule by ERM. Raina told the THPOs that she will keep them up to date to all changes as soon as she learned of them, noting that TCSs may know of changes sooner directly from ERM field crew.
8/7/2020	
	At 10:24 am CST, Raina sent an email to all project-specific applicable THPOs. The email contained the weekly update for July 27 through August 1. In the email, she updated the THPOs to the extended completion date being August 14. This is because of a large stone feature that was discovered. TCS and ERM archaeologists continue to disagree over the validity of a site as well. Raina closed out the email by saying that BCA will be keeping THPOs and TCSs updated as much as possible.
8/10/2020	
	At 9:35 am CST, Raina sent an email to all project-specific applicable THPOs. The email came as a confirmation that fieldwork should be completed sometime this week. She said that TCSs will be released as soon as fieldwork is completed.

8/11/2020	
	At 11:44 am CST, Raina emailed all project-specific applicable THPOs. The email contained the ninth weekly update (August 3 through August 8). Raina added that fieldwork will be completed on the tenth week and that BCA and participating TCSs will be returning to the Hartel property to survey a reroute. She closed the email out by explaining that the TCSs sentiments regarding the stone features in the site revisits had been outlined in the attached update.
	At 6:29 pm CST, Raina emailed all project-specific applicable THPOs. In the email she outlined that she had received confirmation of the reroute touch-up survey. She explained that the survey will most-likely occur on Thursday of that week and will cover less than 5 acres of primarily plowed agricultural field. Raina closed by saying that they are on track to release the TCSs on Friday or Saturday of that week.
8/14/2020	
	At 3:11 pm CST, Raina emailed all project-specific applicable THPOs with the final weekly update for the project. The attached document covered August 10 through August 13. She included in the email that fieldwork has ceased pending fields being harvested and that the Hartel reroute touch-up survey came up as no cultural material. Lastly she concluded that there had been two more sites discovered that were disagreed upon by TCSs and ERM archaeologists. She said that the same protocols will be followed for these new sites as the first site that was disagreed upon.
8/31/2020	
	At 3:01 pm CST, Raina emailed all project-specific applicable THPOs letting them know that BCA has been mapping and documenting the sites and features recorded by TCSs. BCA will be getting shapefiles data over to WBI and ERM that week for review and avoidance planning. Raina explained that ERM and WBI will plan to avoid site boundaries for stone feature sites on private and/or state surface by a 50' minimum as well as fencing off the project's ROW corridor. She continued by saying that BCA is working on completing the North Dakota Heritage Forms for SHPO though the information provided in those forms will have no affect archaeologically but will reflect the feature/site details provided by TCSs that has been approved to be documented and shared. Raina concluded by saying that during a call with ERM and WBI the previous Friday that ERM plans on resuming the remaining fieldwork starting September 9th and that it should take approximately 4 weeks. She requested that any THPO that can send TCSs for the second mobilization of fieldwork let her know as soon as possible.
9/2/2020	
	At 10:41 am CST, Raina emailed Jon Eagle and all project-specific applicable THPOS. In the email, she lists the contact information for FERC's Dawn Ramsey.
	At 11:18 am CST, Raina emailed all project-specific applicable THPOs. She explained that BCA has no issues with Jon's request but state and federal agencies would have to speak to the request. Raina said that she had forwarded the request on to the appropriate individuals at ERM and WBI. She let them know that she will let them know when she gets a response.
	At 11:55 am CST, Raina emailed all project-specific applicable THPOs. She answered Jon's question by saying that WBI would be that authority.
	At 2:40 pm CST, Raina emailed all project-specific applicable THPOs. In her email, she listed the contacts for WBI and ERM (Jill Linn and Pat Robblee, respectively). She also explained who would be best to address certain questions.
9/3/2020	
	At 5:51 pm CST, Raina emailed all project-specific applicable THPOs. The email was a reminder of the second mobilization starting the following week. She provided the current travel date and asked that any THPOs that can send a TCS let her know. She also mentioned the two documents that she had attached that listed the known and new CHF interpretations for their review.

9/4/2020	
	At 8:02 am CST, Raina emailed all project-specific applicable THPOs that the start date for the second mobilization had been moved back to September 11 and that the travel day will be September 10th.
	At 1:25 pm CST, Raina emailed all project-specific applicable THPOs and applicable BCA staff. The email was a reminder of dates and that THPOs should let BCA know if they plan on sending a TCS for the mobilization.
	At 3:29 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing applicable BCA staff. She attached a PDF of the combined known and new CHF sites. She tells them to let her know if they have any questions or concerns about the second mobilization.
9/8/2020	
	At 9:32 am CST, Raina emailed all project-specific applicable THPOs. She provided them an update to the fieldwork scheduling from ERM. She also let them know that all THPOs that have confirmed a TCS will be getting a phone call.
9/9/2020	
	At 3:30 pm CST, Eric Lillestrand called Jeffery Desjarlais, Jr. at his office. He asked if TMBC will be sending a TCS for the second mobilization for the project. Jeff said that they would. Eric asked if the TCS would be Michael McCloud again. Jeff said no, that he will be sending Ron Keplin. Eric let Jeff know that he will be sending an email with more information regarding the second mobilization.
	At 3:43 pm CST, Eric emailed Jeff. The email was to confirm that Ron Kepline will be the TCS representing TMBC. The email contained the hotel details and new hire paperwork and the new hire paperwork.
	At 3:50 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat Robblee, Andrea Thornton, and Kevin Malloy. In her email, she explains that efforts were being made to look at the site specified by Ft. Peck on September 11. She said that if anyone wanted to participate to let Raina know. She also said that more details on the meeting will come later. Raina addressed the inquiries regarding CHFM 5 and that after some digging, the feature will stay recorded and that the PDF will be updated.
9/10/2020	
	At 10:30 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was a list of the currently confirmed attendants and the meeting time, date and location of the meeting.
	At 10:34 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was an additional participant that wasn't listed in the previous email.
	At 1:05 pm CST, Ron Keplin called the BCA office to talk to Eric Lillestrand. He asked for more project related information. Eric gave him hotel information, BCA's Aaron Kidwell's contact information and what time to meet in the mornings for fieldwork. Eric asked if Ron had received the email he sent to Jeff Desjarlais, Jr. to which Ron confirmed he did.
9/14/2020	
	At 11:10 am CST, Raina emailed all project-specific applicable THPOS. She gave an update on the first week of the second mobilization for the project as well as the site visit form September 11.
	At 11:47 am CST, Raina emailed all project-specific applicable THPOs. She resent the first weekly update for the second mobilization.
9/15/2020	
	At 9:10 am CST, Raina emailed Jeff. She reached out to let him know of a personal health concern of TCS Ron Keplin's. She asked Jeff if there was a different TCS he would be able to send.

9/18/2020	
	At 9:48 am CST, Raina emailed all project- specific applicable THPOs. She provided an update regarding the site visit the day before.

Communications with the Three Affiliated Tribes

Date	Summary
7/23/2020	
	At 12:25 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing all state and federal agencies (excluding FERC). In the email, Raina attached the sixth weekly update for the project. Included in the email were some special notes regarding the planned end date for the project as well as providing updates with respect to the Hartel property and BCA20-1313-CHFMSite15.
7/31/2020	
	At 2:19 pm CST, Raina sent and email to all project-specific applicable THPOS, cc'ing Wade. The email included the weekly update for the week of July 20 through July 25. In addition was special notes and updates that included the extension of the project date. The fieldwork should now be complete August 7. She continued by saying that the Hartel parcel has been completed. She finished by alerting the THPOs to the fact that the site that ERM archaeologists and TCSs had disagreements regarding will continue to be recorded while submitting appropriate paperwork describing the TCSs disagreement. Raina closed out the email by saying that arrangements were being made to accommodate the extension of fieldwork and that if any TCSs needed swapped out for the new time frame to let BCA know.
	At 3:15 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing Wade. She explained that she just received the most updated version of the survey schedule by ERM. Raina told the THPOs that she will keep them up to date to all changes as soon as she learned of them, noting that TCSs may know of changes sooner directly from ERM field crew.
8/7/2020	
	At 10:24 am CST, Raina sent an email to all project-specific applicable THPOs. The email contained the weekly update for July 27 through August 1. In the email she updating the THPOs to the extended completion date being August 14. This is because of a large stone feature that was discovered. TCS and ERM archaeologists continue to disagree over the validity of a site as well. Raina closed out the email by saying that BCA will be keeping THPOs and TCSs updated as much as possible.
8/10/2020	
	At 9:35 am CST, Raina sent an email to all project-specific applicable THPOs. The email came as a confirmation that fieldwork should be completed sometime this week. She said that TCSs will be released as soon as fieldwork is completed.
8/11/2020	
	At 11:44 am CST, Raina emailed all project-specific applicable THPOs. The email contained the ninth weekly update (August 3 through August 8). Raina added that fieldwork will be completed on the tenth week and that BCA and participating TCSs will be returning to the Hartel property to survey a reroute. She closed the email out by explaining that the TCSs sentiments regarding the stone features in the site revisits had been outlined in the attached update.
	At 6:29 pm CST, Raina emailed all project-specific applicable THPOs. In the email, she outlined that she had received confirmation of the reroute touch-up survey. She explained that the survey will most-likely occur on Thursday of that week and will cover less than five acres of primarily plowed agricultural field. Raina closed by saying that they are on track to release the TCSs on Friday or Saturday of that week.

8/14/2020	
	At 3:11 pm CST, Raina emailed all project-specific applicable THPOs with the final weekly update for the project. The attached document covered August 10 through August 13. She included in the email that fieldwork has ceased pending fields being harvested and that the Hartel reroute touch-up survey came up as no cultural material. Lastly she concluded that there had been two more sites discovered that were disagreed upon by TCSs and ERM archaeologists. She said that the same protocols will be followed for these new sites as the first site that was disagreed upon.
8/31/2020	
	At 3:01 pm CST, Raina emailed all project-specific applicable THPOs letting them know that BCA has been mapping and documenting the sites and features recorded by TCSs. BCA will be getting shapefiles data over to WBI and ERM that week for review and avoidance planning. Raina explained that ERM and WBI will plan to avoid site boundaries for stone feature sites on private and/or state surface by a 50' minimum as well as fencing off the project's ROW corridor. She continued by saying that BCA is working on completing the North Dakota Heritage Forms for SHPO though the information provided in those forms will have no affect archaeologically but will reflect the feature/site details provided by TCSs that has been approved to be documented and shared. Raina concluded by saying that during a call with ERM and WBI the previous Friday that ERM plans on resuming the remaining fieldwork starting September 9th and that it should take approximately 4 weeks. She requested that any THPO that can send TCSs for the second mobilization of fieldwork let her know as soon as possible.
9/2/2020	
	At 10:41 am CST, Raina emailed all project-specific applicable THPOS. In the email she lists the contact information for FERC's Dawn Ramsey.
	At 11:18 am CST, Raina emailed all project-specific applicable THPOs. She explained that BCA has no issues with Jon's request but state and federal agencies would have to speak to the request. Raina said that she had forwarded the request on to the appropriate individuals at ERM and WBI. She let them know that she will let them know when she gets a response.
	At 11:55 am CST, Raina emailed all project-specific applicable THPOs. She answered Jon's question by saying that WBI would be that authority.
	At 2:40 pm CST, Raina emailed all project-specific applicable THPOs. In her email, she listed the contacts for WBI and ERM (Jill Linn and Pat Robblee, respectively). She also explained who would be best to address certain questions.
9/3/2020	
	At 5:51 pm CST, Raina emailed all project-specific applicable THPOs. The email was a reminder of the second mobilization starting the following week. She provided the current travel date and asked that any THPOs that can send a TCS let her know. She also mentioned the two documents that she had attached that listed the known and new CHF interpretations for their review.
9/4/2020	
	At 8:02 am CST, Raina emailed all project-specific applicable THPOs that the start date for the second mobilization had been moved back to September 11 and that the travel day will be September 10th.
	At 1:25 pm CST, Raina emailed all project-specific applicable THPOs and applicable BCA staff. The email was a reminder of dates and that THPOs should let BCA know if they plan on sending a TCS for the mobilization.
	At 3:29 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing applicable BCA staff. She attached a pdf of the combined known and new CHF sites. She tells them to let her know if they have any questions or concerns about the mobilization.

9/8/2020	
	At 9:32 am CST, Raina emailed app project-specific applicable THPOs. She provided them an update to the fieldwork scheduling from ERM. She also let them know that all THPOs that have confirmed a TCS will be getting a phone call.
9/9/2020	
	At 3:50 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat Robblee, Andrea Thornton, and Kevin Malloy. In her email, she explains that efforts were being made to look at the site specified by Ft. Peck on September 11. She said that if anyone wanted to participate to let Raina know. She also said that more details on the meeting will come later. Raina addressed the inquiries regarding CHFM 5 and that after some digging, the feature will stay recorded and that the PDF will be updated.
	At 4:45 pm CST, Jill Linn, emailed all project-specific applicable THPOs and Raina, cc'ing BCA staff, ERM and WBI.
9/10/2020	
	At 10:30 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was a list of the currently confirmed attendants and the meeting time, date and location of the meeting.
	At 10:34 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was an additional participant that wasn't listed in the previous email.
	At 12:36 pm CST, Pete Coffey explained that a death in the family will prevent him from participating in the site visit.
	At 1:04 pm CST, Raina emailed Pete Coffey. She gave her condolences and said that BCA will keep him updated.
	At 4:39 pm CST, Raina emailed Pete letting him know that it looked like Jon Eagle was trying to set up a site visit on 9/17.
	At 5:36 pm CST, Pete emailed Raina. He suggested postponing site visits out at least a week as he will be unavailable toward the end of September.
	At 5:58 pm CST, Raina explained several reasons why the site visit would still happen on September 11. She assures him that everyone will be kept up to date with anything that happens at the sites.
9/11/2020	
	At 7:36 am CST, Raina emailed all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. She lets everyone know that another site visit is being planned for next week. She explains why they are going forward with the site visit without SRST.
9/14/2020	
	At 11:10 am CST, Raina emailed all project-specific applicable THPOS. She gave an update on the first week of the second mobilization for the project as well as the site visit form September 11.
	At 11:47 am CST, Raina emailed all project-specific applicable THPOs and re-sent the first weekly update for the second mobilization.
9/16/2020	
	At ~3:30 pm CST, Raina Hanley called Pete Coffey to see if he is planning to attend the site visit on September 17. Pete said he will not be able to attend but would like an update following the visit. Raina said that she will provide a similar type of update as from the last visit and suggested that he reach out to SRST, RST and Ft. Peck for any specific details. Raina explained the disagreement between TCSs and ERM archaeologists to which Pete suggested an arbitrator, like SHPO, might be needed.
9/18/2020	
	At 9:48 am CST, Raina emailed all project- specific applicable THPOs. She provided an update regarding the site visit the day before.

Communications with Spirit Lake Tribe of Fort Totten

Date	Summary
7/23/2020	
	At 12:25 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing all state and federal agencies (excluding FERC). In the email, Raina attached the 6th weekly update for the project. Included in the email were some special notes regarding the planned end date for the project as well as providing updates with respect to the Hartel property and BCA20-1313-CHFMSite15.
7/31/2020	
	At 2:19 pm, Raina sent and email to all project-specific applicable THPOS, cc'ing Wade. The email included the weekly update for the week of July 20 through July 25. In addition was special notes and updates that included the extension of the project date. The fieldwork should now be complete August 7. She continued by saying that the Hartel parcel has been completed. She finished by alerting the THPOs to the fact that the site that ERM archaeologists and TCSs had disagreements regarding will continue to be recorded while submitting appropriate paperwork describing the TCSs disagreement. Raina closed out the email by saying that arrangements were being made to accommodate the extension of fieldwork and that if any TCSs needed swapped out for the new time frame to let BCA know.
	At 3:15 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing Wade. She explained that she just received the most updated version of the survey schedule by ERM. Raina told the THPOs that she will keep them up to date to all changes as soon as she learned of them, noting that TCSs may know of changes sooner directly from ERM field crew.
8/7/2020	
	At 10:24 am CST, Raina sent an email to all project-specific applicable THPOs. The email contained the weekly update for July 27 through August 1. In the email she updating the THPOs to the extended completion date being August 14th. This is because of a large stone feature that was discovered. TCS and ERM archaeologists continue to disagree over the validity of a site as well. Raina closed out the email by saying that BCA will be keeping THPOs and TCSs updated as much as possible.
8/10/2020	
	At 9:35 am CST, Raina sent an email to all project-specific applicable THPOs. The email came as a confirmation that fieldwork should be completed sometime this week. She said that TCSs will be released as soon as fieldwork is completed.
8/11/2020	
	At 11:44 am CST, Raina emailed all project-specific applicable THPOs. The email contained the ninth weekly update (August 3 through August 8). Raina added that fieldwork will be completed on the tenth week and that BCA and participating TCSs will be returning to the Hartel property to survey a reroute. She closed the email out by explaining that the TCSs sentiments regarding the stone features in the site revisits had been outlined in the attached update.
	At 6:29 pm CST, Raina emailed all project-specific applicable THPOs. In the email she outlined that she had received confirmation of the reroute touch-up survey. She explained that the survey will most-likely occur on Thursday of that week and will cover less than five acres of primarily plowed agricultural field. Raina closed by saying that they are on track to release the TCSs on Friday or Saturday of that week.

8/14/2020	
	At 3:11 pm CST, Raina emailed all project-specific applicable THPOs with the final weekly update for the project. The attached document covered August 10 through August 13. She included in the email that fieldwork has ceased pending fields being harvested and that the Hartel reroute touch-up survey came up as no cultural material. Lastly she concluded that there had been two more sites discovered that were disagreed upon by TCSs and ERM archaeologists. She said that the same protocols will be followed for these new sites as the first site that was disagreed upon.
8/31/2020	
	At 3:01 pm CST, Raina emailed all project-specific applicable THPOs letting them know that BCA has been mapping and documenting the sites and features recorded by TCSs. BCA will be getting shapefiles data over to WBI and ERM that week for review and avoidance planning. Raina explained that ERM and WBI will plan to avoid site boundaries for stone feature sites on private and/or state surface by a 50' minimum as well as fencing off the project's ROW corridor. She continued by saying that BCA is working on completing the North Dakota Heritage Forms for SHPO though the information provided in those forms will have no affect archaeologically but will reflect the feature/site details provided by TCSs that has been approved to be documented and shared. Raina concluded by saying that during a call with ERM and WBI the previous Friday that ERM plans on resuming the remaining fieldwork starting September 9th and that it should take approximately 4 weeks. She requested that any THPO that can send Tus for the second mobilization of fieldwork let her know as soon as possible.
9/2/2020	
	At 10:41 am CST, Raina emailed Jon Eagle and all project-specific applicable THPOS. In the email she lists the contact information for FERC's Dawn Ramsey.
	At 11:08 am CST, Raina emailed Jeremy, cc'ing Hoksila and Jon. She explained that there will be a hotel room for Hoksila in Williston and that onboarding can be completed the evening that he arrives or the following morning.
	At 11:18 am CST, Raina emailed all project-specific applicable THPOs. She explained that BCA has no issues with Jon's request but state and federal agencies would have to speak to the request. Raina said that she had forwarded the request on to the appropriate individuals at ERM and WBI. She let them know that she will let them know when she gets a response.
	At 11:55 am CST, Raina emailed all project-specific applicable THPOs. She answered Jon's question by saying that WBI would be that authority.
9/2/2020	
	At 2:40 pm CST, Raina emailed all project-specific applicable THPOs. In her email she listed the contacts for WBI and ERM (Jill Linn and Pat Robblee, respectively). She also explained who would be best to address certain questions.

9/3/2020	
	At 4:03 pm CST, Jill Linn emailed all project-specific applicable THPOs, Raina and cc'd Pat Robblee and Andrea Thornton of ERM. She addressed Jon saying that she left a voice mail at his office. She then goes on to address his concerns by explaining that WBI contracted ERM for the archaeological work therefore all discussions of sites and the reasons for recording should be addressed by ERM. She says that Pat Robblee had been copied on the email thread so that he can address the concerns as well. She addresses the site visits by saying that WBI, ERM and BCA will be working together to talk to landowners and land management for access to the sites.
	At 5:51 pm CST, Raina emailed all project-specific applicable THPOs. The email was a reminder of the second mobilization starting the following week. She provided the current travel date and asked that any THPOs that can send a TCS let her know. She also mentioned the two documents that she had attached that listed the known and new CHF interpretations for their review.
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	At 11:47 am CST, Raina emailed all project-specific applicable THPOs. She resent the first weekly update for the second mobilization.
9/18/2020	
	At 9:48 am CST, Raina emailed all project- specific applicable THPOs. She provided an update regarding the site visit the day before.

Communications with the Yankton Sioux Tribe

Date	Summary
7/23/2020	
	At 12:25 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing all state and federal agencies (excluding FERC). In the email, Raina attached the sixth weekly update for the project. Included in the email were some special notes regarding the planned end date for the project as well as providing updates with respect to the Hartel property and BCA20-1313-CHFMSite15.
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	At 3:15 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing Wade. She explained that she just received the most updated version of the survey schedule by ERM. Raina told the THPOs that she will keep them up to date to all changes as soon as she learned of them, noting that TCSs may know of changes sooner directly from ERM field crew.
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	At 6:29 pm CST, Raina emailed all project-specific applicable THPOs. In the email she outlined that she had received confirmation of the reroute touch-up survey. She explained that the survey will most-likely occur on Thursday of that week and will cover less than 5 acres of primarily plowed agricultural field. Raina closed by saying that they are on track to release the TCSs on Friday or Saturday of that week.
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	At 3:11 pm CST, Raina emailed all project-specific applicable THPOs with the final weekly update for the project. The attached document covered August 10 through August 13. She included in the email that fieldwork has ceased pending fields being harvested and that the Hartel reroute touch-up survey came up as no cultural material. Lastly, she concluded that there had been two more sites discovered that were disagreed upon by TCSs and ERM arcaheologists. She said that the same protocols will be followed for these new sites as the first site that was disagreed upon.
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	At 3:01 pm CST, Raina emailed all project-specific applicable THPOs letting them know that BCA has been mapping and documenting the sites and features recorded by TCSs. BCA will be getting shapefiles data over to WBI and ERM that week for review and avoidance planning. Raina explained that ERM and WBI will plan to avoid site boundaries for stone feature sites on private and/or state surface by a 50' minimum as well as fencing off the project's ROW corridor. She continued by saying that BCA is working on completing the North Dakota Heritage Forms for SHPO though the information provided in those forms will have no affect archaeologically but will reflect the feature/site details provided by TCSs that has been approved to be doumented and shared. Raina concluded by saying that during a call with ERM and WBI the previous Friday that ERM plans on resuming the remaining fieldwork starting September 9th and that it should take approximately 4 weeks. She requested that any THPO that can send TCss for the second mobilization of fieldwork let her know as soon as possible.
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	At 11:18 am CST, Raina emailed all project-specific applicable THPOs. She explained that BCA has no issues with Jon's request but state and federal agencies would have to speak to the request. Raina said that she had forwarded the request on to the appropriate individuals at ERM and WBI. She let them know that she will let them know when she gets a response.
	At 11:55 am CST, Raina emailed all project-specific applicable THPOs. She answered Jon's question by saying that WBI would be that authority.
	At 2:40 pm CST, Raina emailed all project-specific applicable THPOs. In her email she listed the contacts for WBI and ERM (Jill Linn and Pat Robblee, respectively). She also explained who would be best to address certain questions.

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	At 4:03 pm CST, Jill Linn emailed all project-specific applicable THPOs, Raina and cc'd Pat Robblee and Andrea Thornton of ERM. She addressed Jon saying that she left a voice mail at his office. She then goes on to address his concerns by explaining that WBI contracted ERM for the archaeological work therefore all discussions of sites and the reasons for recording should be addressed by ERM. She says that Pat Robblee had been copied on the email thread so that he can adress the concerns as well. She addresses the site visits by saying that WBI, ERM and BCA will be working together to talk to landowners and land management for access to the sites.
	At 5:51 pm CST, Raina emailed all project-specific applicable THPOs. The email was a reminder of the second mobilization starting the following week. She provided the current travel date and asked that any THPOs that can send a TCS let her know. She also mentioned the two documents that she had attached that listed the known and new CHF interpretations for their review.
9/4/2020	
	At 8:02 am CST, Raina emailed all project-specific applicable THPOs that the start date for the second mobilization had been moved back to September 11 and that the travel day will be September 10th.
	At 1:25 pm CST, Raina emailed all project-specific applicable THPOs and BCA staff. The email was a reminder of dates and that THPOs should let BCA know if they plan on sending a TCS for the mobilization.
	At 3:29 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing applicable BCA staff. She attached a pdf of the combined known and new CHF sites. She tells them to let her know if they have any questions or concerns about the mobilization.
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	At 9:32 am CST, Raina emailed all project-specific applicable THPOs. She provided them an update to the fieldwork scheduling from ERM. She also let them know that all THPOs that have confirmed a TCS will be getting a phone call.
9/9/2020	
	At 3:50 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat Robblee, Andrea Thornton, and Kevin Malloy. In her email she explains that efforts were being made to look at the site specified by Ft. Peck on September 11. She said that if anyone wanted to participate to let Raina know. She also said that more details on the meeting will come later. Raina addressed the inquiries regarding CHFM 5 and that after some digging, the feature will stay recorded and that the PDF will be updated.
9/10/2020	
	At 10:30 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was a list of the currently confirmed attendants and the meeting time, date and location of the meeting.
	At 10:34 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was an additional participant that wasn't listed in the previous email.

9/14/2020	
	At 11:10 am CST, Raina emailed all project-specific applicable THPOS. She gave an update on the first week of the second mobilization for the project as well as the site visit form September 11.
	At 11:47 am CST, Raina emailed all project-specific applicable THPOs. She resent the first weekly update for the second mobilization.
9/18/2020	
	At 9:48 am CST, Raina emailed all project- specific applicable THPOs. She provided an update regarding the site visit the day before.

Communications with the Northern Cheyenne Tribe

Date	Summary
7/23/2020	
	At 12:25 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing all state and federal agencies (excluding FERC). In the email, Raina attached the sixth weekly update for the project. Included in the email were some special notes regarding the planned end date for the project as well as providing updates with respect to the Hartel property and BCA20-1313-CHFMSite15.
7/31/2020	
	At 2:19 pm CST, Raina sent and email to all project-specific applicable THPOS, cc'ing Wade. The email included the weekly update for the week of July 20 through July 25. In addition was special notes and updates that included the extension of the project date. The fieldwork should now be complete August 7. She continued by saying that the Hartel parcel has been completed. She finished by alerting the THPOs to the fact that the site that ERM archaeologists and TCSs had disagreements regarding will continue to be recorded while submitting appropriate paperwork describing the TCSs disagreement. Raina closed out the email by saying that arrangements were being made to accommodate the extension of fieldwork and that if any TCSs needed swapped out for the new time frame to let BCA know.
	At 3:15 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing Wade. She explained that she just received the most updated version of the survey schedule by ERM. Raina told the THPOs that she will keep them up to date to all changes as soon as she learned of them, noting that TCSs may know of changes sooner directly from ERM field crew.
8/7/2020	
	At 10:24 am CST, Raina sent an email to all project-specific applicable THPOs. The email contained the weekly update for July 27 through August 1. In the email she updating the THPOs to the extended completion date being August 14th. This is because of a large stone feature that was discovered. TCS and ERM archaeologists continue to disagree over the validity of a site as well. Raina closed out the email by saying that BCA will be keeping THPOs and TCSs updated as much as possible.
8/10/2020	
	At 9:35 am CST, Raina sent an email to all project-specific applicable THPOs. The email came as a confirmation that fieldwork should be completed sometime this week. She said that TCSs will be released as soon as fieldwork is completed.

8/11/2020	
	At 11:44 am CST, Raina emailed all project-specific applicable THPOs. The email contained the weekly update for week 9 (August 3, 2020 through August 8, 2020). Raina added that fieldwork will be completed on the tenth week and that BCA and participating TCSs will be returning to the Hartel property to survey a reroute. She closed the email out by explaining that the TCSs sentiments regarding the stone features in the site revisits had been outlined in the attached update.
	At 6:29 pm CST, Raina emailed all project-specific applicable THPOs. In the email she outlined that she had received confirmation of the reroute touch-up survey. She explained that the survey will most-likely occur on Thursday of that week and will cover less than 5 acres of primarily plowed agricultural field. Raina closed by saying that they are on track to release the TCSs on Friday or Saturday of that week.
8/14/2020	
	At 3:11 pm CST, Raina emailed all project-specific applicable THPOs with the final weekly update for the project. The attached document covered August 10, 2020 through August 13, 2020. She included in the email that fieldwork has ceased pending fields being harvested and that the Hartel reroute touch-up survey came up as no cultural material. Lastly she concluded that there had been two more sites discovered that were disagreed upon by TCSs and ERM archaeologists. She said that the same protocols will be followed for these new sites as the first site that was disagreed upon.
8/31/2020	
	At 3:01 pm CST, Raina emailed all project-specific applicable THPOs letting them know that BCA has been mapping and documenting the sites and features recorded by TCSs. BCA will be getting shapefiles data over to WBI and ERM that week for review and avoidance planning. Raina explained that ERM and WBI will plan to avoid site boundaries for stone feature sites on private and/or state surface by a 50' minimum as well as fencing off the project's ROW corridor. She continued by saying that BCA is working on completing the North Dakota Heritage Forms for SHPO though the information provided in those forms will have no affect archaeologically but will reflect the feature/site details provided by TCSs that has been approved to be documented and shared. Raina concluded by saying that during a call with ERM and WBI the previous Friday that ERM plans on resuming the remaining fieldwork starting September 9th and that it should take approximately 4 weeks. She requested that any THPO that can send Tus for the second mobilization of fieldwork let her know as soon as possible.
9/2/2020	
	At 10:41 am CST, Raina emailed all project-specific applicable THPOs. In the email, she lists the contact information for FERC's Dawn Ramsey.
	At 11:18 am CST, Raina emailed all project-specific applicable THPOs. She explained that BCA has no issues with Jon's request but state and federal agencies would have to speak to the request. Raina said that she had forwarded the request on to the appropriate individuals at ERM and WBI. She let them know that she will let them know when she gets a response.
	At 11:55 am CST, Raina emailed all project-specific applicable THPOs. She answered Jon's question by saying that WBI would be that authority.
	At 2:40 pm CST, Raina emailed all project-specific applicable THPOs. In her email, she listed the contacts for WBI and ERM (Jill Linn and Pat Robblee, respectively). She also explained who would be best to address certain questions.

9/3/2020	
	At 5:51 pm CST, Raina emailed all project-specific applicable THPOs. The email was a reminder of the second mobilization starting the following week. She provided the current travel date and asked that any THPOs that can send a TCS let her know. She also mentioned the two documents that she had attached that listed the known and new CHF interpretations for their review.
9/4/2020	
	At 8:02 am CST, Raina emailed all project-specific applicable THPOs that the start date for the second mobilization had been moved back to September 11 and that the travel day will be September 10th.
	At 1:25 pm CST, Raina emailed all project-specific applicable THPOs and applicable BCA staff. The email was a reminder of dates and that THPOs should let BCA know if they plan on sending a TCS for the mobilization.
	At 3:29 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing applicable BCA staff. She attached a PDF of the combined known and new CHF sites. She tells them to let her know if they have any questions or concerns about the mobilization.
9/8/2020	
	At 9:32 am CST, Raina emailed app project-specific applicable THPOs. She provided them an update to the fieldwork scheduling from ERM. She also let them know that all THPOs that have confirmed a TCS will be getting a phone call.
9/9/2020	
	At 3:50 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat Robblee, Andrea Thornton, and Kevin Malloy. In her email, she explains that efforts were being made to look at the site specified by Ft. Peck on September 11. She said that if anyone wanted to participate to let Raina know. She also said that more details on the meeting will come later. Raina addressed the inquiries regarding CHFM 5 and that after some digging, the feature will stay recorded and that the PDF will be updated.
9/10/2020	
	At 10:30 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was a list of the currently confirmed attendants and the meeting time, date and location of the meeting.
	At 10:34 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was an additional participant that wasn't listed in the previous email.
9/14/2020	
	At 11:10 am CST, Raina emailed all project-specific applicable THPOS. She gave an update on the first week of the second mobilization for the project as well as the site visit form September 11.
	At 11:47 am CST, Raina emailed all project-specific applicable THPOs. She resent the first weekly update for the second mobilization.
9/18/2020	
	At 9:48 am CST, Raina emailed all project- specific applicable THPOs. She provided an update regarding the site visit the day before.

Communications with the Cheyenne River Sioux Tribe

Date	Summary
7/23/2020	
	At 12:25 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing all state and federal agencies (excluding FERC). In the email, Raina attached the sixth weekly update for the project. Included in the email were some special notes regarding the planned end date for the project as well as providing updates with respect to the Hartel property and BCA20-1313-CHFMSite15.
7/31/2020	
	At 2:19 pm CST, Raina sent and email to all project-specific applicable THPOS, cc'ing Wade. The email included the weekly update for the week of July 20 through July 25. In addition was special notes and updates that included the extension of the project date. The fieldwork should now be complete August 7. She continued by saying that the Hartel parcel has been completed. She finished by alerting the THPOs to the fact that the site that ERM archaeologists and TCSs had disagreements regarding will continue to be recorded while submitting appropriate paperwork describing the TCSs disagreement. Raina closed out the email by saying that arrangements were being made to accommodate the extension of fieldwork and that if any TCSs needed swapped out for the new time frame to let BCA know.
	At 3:15 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing Wade. She explained that she just received the most updated version of the survey schedule by ERM. Raina told the THPOs that she will keep them up to date to all changes as soon as she learned of them, noting that TCSs may know of changes sooner directly from ERM field crew.
8/7/2020	
	At 10:24 am CST, Raina sent an email to all project-specific applicable THPOs. The email contained the weekly update for July 27 through August 1. In the email she updating the THPOs to the extended completion date being August 14. This is because of a large stone feature that was discovered. TCSs and ERM archaeologists continue to disagree over the validity of a site as well. Raina closed out the email by saying that BCA will be keeping THPOs and TCSs updated as much as possible.
8/10/2020	
	At 9:35 am CST, Raina sent an email to all project-specific applicable THPOs. The email came as a confirmation that fieldwork should be completed sometime this week. She said that TCSs will be released as soon as fieldwork is completed.

8/11/2020	
	At 11:44 am CST, Raina emailed all project-specific applicable THPOs. The email contained the ninth weekly update (August 3 through August 8). Raina added that fieldwork will be completed on the tenth week and that BCA and participating TCSs will be returning to the Hartel property to survey a reroute. She closed the email out by explaining that the TCSs sentiments regarding the stone features in the site revisits had been outlined in the attached update.
	At 6:29 pm CST, Raina emailed all project-specific applicable THPOs. In the email she outlined that she had received confirmation of the reroute touch-up survey. She explained that the survey will most-likely occur on Thursday of that week and will cover less than five acres of primarily plowed agricultural field. Raina closed by saying that they are on track to release the TCSs on Friday or Saturday of that week.
8/14/2020	
	At 3:11 pm CST, Raina emailed all project-specific applicable THPOs with the final weekly update for the second mobilization of the project. The attached document covered August 10 through August 13. She included in the email that fieldwork has ceased pending fields being harvested and that the Hartel reroute touch-up survey came up as no cultural material. Lastly she concluded that there had been two more sites discovered that were disagreed upon by TCSs and ERM archaeologists. She said that the same protocols will be followed for these new sites as the first site that was disagreed upon.
8/31/2020	
	At 3:01 pm CST, Raina emailed all project-specific applicable THPOs letting them know that BCA has been mapping and documenting the sites and features recorded by TCSs. BCA will be getting shapefiles data over to WBI and ERM that week for review and avoidance planning. Raina explained that ERM and WBI will plan to avoid site boundaries for stone feature sites on private and/or state surface by a 50' minimum as well as fencing off the project's ROW corridor. She continued by saying that BCA is working on completing the North Dakota Heritage Forms for SHPO though the information provided in those forms will have no affect archaeologically but will reflect the feature/site details provided by TCSs that has been approved to be documented and shared. Raina concluded by saying that during a call with ERM and WBI the previous Friday that ERM plans on resuming the remaining fieldwork starting September 9th and that it should take approximately 4 weeks. She requested that any THPO that can send TCSs for the second mobilization of fieldwork let her know as soon as possible.

9/2/2020	
	At 10:41 am CST, Raina emailed all project-specific applicable THPOs. In the email, she lists the contact information for FERC's Dawn Ramsey.
	At 11:18 am CST, Raina emailed all project-specific applicable THPOs. She explained that BCA has no issues with Jon's request but state and federal agencies would have to speak to the request. Raina said that she had forwarded the request on to the appropriate individuals at ERM and WBI. She let them know that she will let them know when she gets a response.
	At 11:55 am CST, Raina emailed all project-specific applicable THPOs. She answered Jon's question by saying that WBI would be that authority.
	At 2:40 pm CST, Raina emailed all project-specific applicable THPOs. In her email, she listed the contacts for WBI and ERM (Jill Linn and Pat Robblee, respectively). She also explained who would be best to address certain questions.
9/3/2020	
	At 4:03 pm CST, Jill Linn emailed all project-specific applicable THPOs, Raina and cc'd Pat Robblee and Andrea Thornton of ERM. She addressed Jon saying that she left a voice mail at his office. She then goes on to address his concerns by explaining that WBI contracted ERM for the archaeological work therefore all discussions of sites and the reasons for recording should be addressed by ERM. She says that Pat Robblee had been copied on the email thread so that he can address the concerns as well. She addresses the site visits by saying that WBI, ERM and BCA will be working together to talk to landowners and land management for access to the sites.
	At 5:51 pm CST, Raina emailed all project-specific applicable THPOs. The email was a reminder of the second mobilization starting the following week. She provided the current travel date and asked that any THPOs that can send a TCS let her know. She also mentioned the two documents that she had attached that listed the known and new CHF interpretations for their review.
9/4/2020	
	At 8:02 am CST, Raina emailed all project-specific applicable THPOs that the start date for the second mobilization had been moved back to September 11 and that the travel day will be September 10.
	At 1:25 pm CST, Raina emailed all project-specific applicable THPOs and applicable BCA staff. The email was a reminder of dates and that THPOs should let BCA know if they plan on sending a TCS for the second mobilization.
	At 3:29 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing applicable BCA staff. She attached a pdf of the combined known and new CHF sites. She tells them to let her know if they have any questions or concerns about the second mobilization.
9/8/2020	
	At 9:32 am CST, Raina emailed all project-specific applicable THPOs. She provided them an update to the fieldwork scheduling from ERM. She also let them know that all THPOs that have confirmed a TCS will be getting a phone call.

9/9/2020	
	At 3:50 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat Robblee, Andrea Thornton, and Kevin Malloy. In her email she explains that efforts were being made to look at the site specified by Ft. Peck on September 11. She said that if anyone wanted to participate to let Raina know. She also said that more details on the meeting will come later. Raina addressed the inquiries regarding CHFM 5 and that after some digging, the feature will stay recorded and that the PDF will be updated.
9/10/2020	
	At 10:30 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was a list of the currently confirmed attendants and the meeting time, date and location of the meeting.
	At 10:30 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was an additional participant that wasn't listed in the previous email.
9/14/2020	
	At 11:10 am CST, Raina emailed all project-specific applicable THPOS. She gave an update on the first week of the second mobilization for the project as well as the site visit form September 11.
	At 11:47 am CST, Raina emailed all project-specific applicable THPOs. She resent the first weekly update for the second mobilization.
9/18/2020	
	At 9:48 am CST, Raina emailed all project- specific applicable THPOs. She provided an update regarding the site visit the day before.

Communications with the Fort Peck Tribe

Date	Summary
7/23/2020	
	At 12:25 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing all state and federal agencies (excluding FERC). In the email, Raina attached the sixth weekly update for the project. Included in the email were some special notes regarding the planned end date for the project as well as providing updates with respect to the Hartel property and BCA20-1313-CHFMSite15.
7/31/2020	
	At 2:19 pm CST, Raina sent and email to all project-specific applicable THPOS, cc'ing Wade. The email included the weekly update for the week of July 20 through July 25. In addition was special notes and updates that included the extension of the project date. The fieldwork should now be complete August 7. She continued by saying that the Hartel parcel has been completed. She finished by alerting the THPOs to the fact that the site that ERM archaeologists and TCSs had disagreements regarding will continue to be recorded while submitting appropriate paperwork describing the TCSs disagreement. Raina closed out the email by saying that arrangements were being made to accommodate the extension of fieldwork and that if any TCSs needed swapped out for the new time frame to let BCA know.
	At 3:15 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing Wade. She explained that she just received the most updated version of the survey schedule by ERM. Raina told the THPOs that she will keep them up to date to all changes as soon as she learned of them, noting that TCSs may know of changes sooner directly from ERM field crew.
	At 4:20 pm CST, Dyan Youpee emailed Raina cc'ing all project-specific applicable THPOs, acknowledging Rina's update and stating that FT. Peck will be able to keep their TCSs throughout the rest of the project.
8/7/2020	
	At 10:24 am CST, Raina sent an email to all project-specific applicable THPOs. The email contained the weekly update for July 27 through August 1. In the email, she updating the THPOs to the extended completion date being August 14th. This is because of a large stone feature that was discovered. TCS and ERM archaeologists continue to disagree over the validity of a site as well. Raina closed out the email by saying that BCA will be keeping THPOs and TCSs updated as much as possible.
8/10/2020	
	At 9:35 am CST, Raina sent an email to all project-specific applicable THPOs. The email came as a confirmation that fieldwork should be completed sometime this week. She said that TCSs will be released as soon as fieldwork is completed.

8/11/2020	
	At 11:44 am CST, Raina emailed all project-specific applicable THPOs. The email contained the ninth weekly update (August 3 through August 8). Raina added that fieldwork will be completed on the tenth week and that BCA and participating TCSs will be returning to the Hartel property to survey a reroute. She closed the email out by explaining that the TCSs sentiments regarding the stone features in the site revisits had been outlined in the attached update.
	At 6:29 pm CST, Raina emailed all project-specific applicable THPOs. In the email she outlined that she had received confirmation of the reroute touch-up survey. She explained that the survey will most-likely occur on Thursday of that week and will cover less than five acres of primarily plowed agricultural field. Raina closed by saying that they are on track to release the TCSs on Friday or Saturday of that week.
8/14/2020	
	At 3:11 pm CST, Raina emailed all project-specific applicable THPOs with the final weekly update for the first mobilization of the project. The attached document covered August 10 through August 13. She included in the email that fieldwork has ceased pending fields being harvested and that the Hartel reroute touch-up survey came up as no cultural material. Lastly, she concluded that there had been two more sites discovered that were disagreed upon by TCSs and ERM archaeologists. She said that the same protocols will be followed for these new sites as the first site that was disagreed upon.
8/31/2020	
	At 3:01 pm CST, Raina emailed all project-specific applicable THPOs letting them know that BCA has been mapping and documenting the sites and features recorded by TCSs. BCA will be getting shapefiles data over to WBI and ERM that week for review and avoidance planning. Raina explained that ERM and WBI will plan to avoid site boundaries for stone feature sites on private and/or state surface by a 50' minimum as well as fencing off the project's ROW corridor. She continued by saying that BCA is working on completing the North Dakota Heritage Forms for SHPO though the information provided in those forms will have no affect archaeologically but will reflect the feature/site details provided by TCSs that has been approved to be documented and shared. Raina concluded by saying that during a call with ERM and WBI the previous Friday that ERM plans on resuming the remaining fieldwork starting September 9th and that it should take approximately 4 weeks. She requested that any THPO that can send Tus for the second mobilization of fieldwork let her know as soon as possible.
9/2/2020	
	At 10:41 am CST, Raina emailed all project-specific applicable THPOS. In the email she lists the contact information for FERC's Dawn Ramsey.
	At 11:18 am CST, Raina emailed all project-specific applicable THPOs. She explained that BCA has no issues with Jon's request but state and federal agencies would have to speak to the request. Raina said that she had forwarded the request on to the appropriate individuals at ERM and WBI. She let them know that she will let them know when she gets a response.
	At 11:55 am CST, Raina emailed all project-specific applicable THPOs. She answered Jon's question by saying that WBI would be that authority.
	At 2:40 pm CST, Raina emailed all project-specific applicable THPOs. In her email she listed the contacts for WBI and ERM (Jill Linn and Pat Robblee, respectively). She also explained who would be best to address certain questions.

9/3/2020	
	At 5:51 pm CST, Raina emailed all project-specific applicable THPOs. The email was a reminder of the second mobilization starting the following week. She provided the current travel date and asked that any THPOs that can send a TCS let her know. She also mentioned the two documents that she had attached that listed the known and new CHF interpretations for their review.
9/4/2020	
	At 8:02 am CST, Raina emailed all project-specific applicable THPOs that the start date for the second mobilization had been moved back to September 11 and that the travel day will be September 10th.
	At 1:25 pm CST, Raina emailed all project-specific applicable THPOs and BCA staff. The email was a reminder of dates and that THPOs should let BCA know if they plan on sending a TCS for the mobilization.
	At 3:29 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing BCA staff. She attached a pdf of the combined known and new CHF sites. She tells them to let her know if they have any questions or concerns about the mobilization.
9/8/2020	
	At 9:32 am CST, Raina emailed all project-specific applicable THPOs. She provided them an update to the fieldwork scheduling from ERM. She also let them know that all THPOs that have confirmed a TCS will be getting a phone call.
	At 9:48 am CST, Raina called Dyan. Dyan let Raina know that she is unsure if a TCS will be available for the second mobilization. She expressed her concerns over site recording and expressed interest in doing a site visit.
	At 5:43 pm CST, Dyan emailed Pat Robblee, Jill Linn, Raina, Andrew Clark of SHPO, Floyd Azure of Fort Peck, Ben Rhodd of Rosebud, Jon Eagle of SRST and Dianne Desrosiers of SWO. She expressed her concerns over the recording of sites and the disagreement between TCSs and ERM archaeologist. She explained which CHF she had an issue with.
9/9/2020	
	At ~3:00 pm Raina and Wade called Dyan. They alerted her to an issue with CHFM 5 and discussed the site visit on September 11.
	At 3:50 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing applicableBCA staff, Pat Robblee, Andrea Thornton, and Kevin Malloy. In her email she explains that efforts were being made to look at the site specified by Ft. Peck on September 11. She said that if anyone wanted to participate to let Raina know. She also said that more details on the meeting will come later. Raina addressed the inquiries regarding CHFM 5 and that after some digging, the feature will stay recorded and that the PDF will be updated.
9/10/2020	
	At 10:30 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was a list of the currently confirmed attendants and the meeting time, date and location of the meeting.
	At 10:34 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was an additional participant that wasn't listed in the previous email.

9/14/2020	
	At 11:10 am CST, Raina emailed all project-specific applicable THPOS. She gave an update on the first week of the second mobilization for the project as well as the site visit form September 11.
	At 11:47 am CST, Raina emailed all project-specific applicable THPOs. She resent the first weekly update for the second mobilization.
9/18/2020	
	At 9:48 am CST, Raina emailed all project- specific applicable THPOs. She provided an update regarding the site visit the day before.
	At ~1 pm and 3 pm CST, Raina spoke to Dyan In both phone calls Dyan instructed Raina to remove her from all THPO weekly updates as she is no longer interested in receiving them. She clarified that she will be keeping her TCS in the field and that she would like to receive the report to review and comment on.

Communications with the Rosebud Sioux Tribe

Date	Summary
7/21/2020	
	At 11:44 am CST, Ben Young emailed Raina. He asked if the project is demobilizing or if just ERM staff were demobilizing.
	At 12:34 pm CST, Raina emailed Ben Young to let him know that she is reaching out to ERM to find out their plans.
	At 12:37 pm CST, Raina emailed Ben Young to clarify her earlier email. She explained that she knew that the surveys were finishing up this week and that site reviews for sites found in 2019 would occur next week.
7/23/2020	
	At 12:25 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing all state and federal agencies (excluding FERC). In the email, Raina attached the sixth weekly update for the project. Included in the email were some special notes regarding the planned end date for the project as well as providing updates with respect to the Hartel property and BCA20-1313-CHFMSite15.
7/31/2020	
	At 2:19 pm CST, Raina sent and email to all project-specific applicable THPOs, cc'ing Wade. The email included the weekly update for the week of July 20 through July 25. In addition was special notes andupdates that included the extension of the project date. The fieldwork should now be complete August 7. She continued by saying that the Hartel parcel has been completed. She finished by alerting the THPOs to the fact thatthe site that ERM arcaheologists and TCSs had disagreements regarding will continue to be recorded while submitting approapriate paperwork describing the TCSs disagreement. Raina closed out the email by saying that arrangements were being made to accommadate the extension of fieldwork and that if any TCSs needed swapped out for the new time frame to let BCA know.
	At 3:15 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing Wade. She explained that she just received the most updated version of the survey schedule by ERM. Raina told the THPOs that she will keep them up to date to all changes as soon as she learned of them, noting that TCSs may know of changes sooner directly from ERM field crew.
8/7/2020	
	At 10:24 am CST, Raina sent an email to all project-specific applicable THPOs. The email contained the weekly update for July 27 through August 1. In the email she updating the THPOs to the extended completion date being August 14th. This is because of a large stone feature that was discovered. TCS and ERM arcaheologists continue to disagree over the validity of a site as well. Raina closed out the email by saying that BCA will be keeping THPOs and TCSs updated as much as possible.
8/10/2020	
	At 9:35 am CST, Raina sent an email to all project-specific applicable THPOs. The email came as a onfirmation that fieldwork should be completed sometime this week. She said that TCSs will be released as soon as fieldwork is completed.

8/11/2020	
	At 11:44 am CST, Raina emailed all project-specific applicable THPOs. The email contained the ninth weekly update (August 3 through August 8). Raina added that fieldwork will be completed on the tenth week and that BCA and participating TCSs will be returning to the Hartel property to survey a reroute. She closed the email out by explaining that the TCSs sentiments regarding the stone features in the site revisits had been outlined in the attached update.
	At 6:29 pm CST, Raina emailed all project-specific applicable THPOs. In the email she outlined that she had received confirmation of the reroute touch-up survey. She explained that the survey will most-likely occur on Thursday of that week and will cover less than five acres of primarily plowed agricultural field. Raina closed by saying that they are on track to release the TCSs on Friday or Saturday of that week.
8/14/2020	
	At 3:11 pm CST, Raina emailed all project-specific applicable THPOs with the final weekly update for the project. The attached document covered August 10 through August 13. She included in the email that fieldwork has ceased pending fields being harvested and that the Hartel reroute touch-up survey came up as no cultural material. Lastly she concluded that there had been two more sites discovered that were disagreed upon by TCSs and ERM arcaheologists. She said that the same protocols will be followed for these new sites as the first site that was disagreed upon.
8/31/2020	
	At 3:01 pm CST, Raina emailed all project-specific applicable THPOs letting them know that BCA has been mapping and documenting the sites and features recorded by TCSs. BCA will be getting shapefiles data over to WBI and ERM that week for review and avoidance planning. Raina explained that ERM and WBI will plan to avoid site boundaries for stone feature sites on private and/or state surface by a 50' minimum as well as fencing off the project's ROW corridor. She continued by saying that BCA is working on completing the North Dakota Heritage Forms for SHPO though the information provided in those forms will have no affect archaeologically but will reflect the feature/site details provided by TCSs that has been approved to be doumented and shared. Raina concluded by saying that during a call with ERM and WBI the previous Friday that ERM plans on resuming the remaining fieldwork starting September 9th and that it should take approximately 4 weeks. She requested that any THPO that can send TCss for the second mobilization of fieldwork let her know as soon as possible.
	At 3:42 pm CST, Benjamin Young emailed Raina saying that RST will be sending a TCS.
	At 4:51 pm CST, Raina responded to Ben Young by letting him know when to have his TCS in Williston, North Dakota.

9/2/2020

	At 9:06 am CST, Ben Young emailed Raina saying that Mary Waln will be the TCS to represent Rosebud.
	At 9:08 am CST, Raina emailed Ben Young letting him know that BCA will have a hotel room in Williston, North Dakota set up for Mary.
	At 10:41 am CST, Raina emailed all project-specific applicable THPOS. In the email she lists the contact information for FERC's Dawn Ramsey.
	At 11:18 am CST, Raina emailed all project-specific applicable THPOs. She explained that BCA has no issues with Jon's request but state and federal agencies would have to speak to the request. Raina said that she had forwarded the request on to the appropriate individuals at ERM and WBI. She let them know that she will let them know when she gets a response.
	At 11:55 am CST, Raina emailed all project-specific applicable THPOs. She answered Jon's question by saying that WBI would be that authority.
	At 2:40 pm CST, Raina emailed all project-specific applicable THPOs. In her email she listed the contacts for WBI and ERM (Jill Linn and Pat Robblee, respectively). She also explained who would be best to address certain questions.
9/3/2020	
	At 5:51 pm CST, Raina emailed all project-specific applicable THPOs. The email was a reminder of the second mobilization starting the following week. She provided the current travel date and asked that any THPOs that can send a TCS let her know. She also mentioned the two documents that she had attached that listed the known and new CHF interpretations for their review.
9/4/2020	
	At 8:02 am CST, Raina emailed all project-specific applicable THPOs that the start date for the second mobilization had been moved back to September 11 and that the travel day will be September 10th.
	At 1:25 pm CST, Raina emailed all project-specific applicable THPOs and BCA staff. The email was a reminder of dates and that THPOs should let BCA know if they plan on sending a TCS for the mobilization.
	At 1:30 pm CST, Raina emailed Ben Young to provide the update on the schedule for the second mobilization for him and Mary Waln.
	At 3:29 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing applicable BCA staff. She attached a PDF of the combined known and new CHF sites. She tells them to let her know if they have any questions or concerns about the mobilization.
9/8/2020	
	At 9:32 am CST, Raina emailed all project-specific applicable THPOs. She provided them an update to the fieldwork scheduling from ERM. She also let them know that all THPOs that have confirmed a TCS will be getting a phone call.

9/9/2020	

	At 10:27 am CST, Ben Young emailed Raina asking if SWO was planning on sending a TCS.
	At 1:42 pm CST, Raina emailed Ben Young that SWO has not alerted BCA of them sending a TCS.
	At 3:50 pm CST, Raina emailed all project-specific applicable THPOs, CC'ing BCA staff, Pat Robblee, Andrea Thornton, and Kevin Malloy. In her email she explains that efforts were being made to look at the site specified by Ft. Peck on September 11. She said that if anyone wanted to participate to let Raina know. She also said that more details on the meeting will come later. Raina addressed the inquiries regarding CHFM 5 and that after some digging, the feature will stay recorded and that the PDF will be updated.
9/10/2020	
	At 9:02 am CST, Ben Young called the BCA office to talk to Raina. She was unavailable so he left a message for her. He asked for her to call back to the office to speak to him or Ben Rhodd and he left the office number.
	At 9:12 am CST, Ben Rhodd emailed Raina. He explained that Rosebud will send an extra TCS on behalf of SWO and to expect a confirmation email from SWO in that regard.
	At 9:55 am CST, Raina emailed Ben Rhodd. She thanked him for letting her know and asked if there was a specific TCS in mind to send for SWO.
	At 10:04 am CST, Ben Rhodd emailed Raina saying that Mary Waln will be sent as a TCS.
	At 10:05 am CST, Raina emailed Ben Rhodd. She clarified her earlier question specifying who will be sent on SWO's behalf.
	At ~10:10 am CST, Raina called the THPO office to talk to Ben Young. He was unavailable so she left a message for him. She asked for him to call her back at the office number.
	At 10:30 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was a list of the currently confirmed attendants and the meeting time, date and location of the meeting.
	At 10:34 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was an additional participant that wasn't listed in the previous email.
	At 11:25 am CST, Ben Rhodd emailed Raina clarifying that Mary Waln will participate on behalf of SWO.
	At 11:51 am CST, Raina emailed Ben Rhodd. She clarified that she has Mary Waln down for SWO and Chris Boyd for Rosebud
	At 2:26 pm CST, Ben Rhodd emailed Raina asking if there was a possibility of having a site visit on September 18th. He also suggested this to Jon Eagle
	At 3:05 pm CST, Raina emailed Ben Rhodd, cc'ing Jill and Wade. She said that she will pass his request on to Jill to see when a site visit will be plausible.
	At 5:09 pm CST, Ben Rhodd emailed Raina. He said that Rosebud would participate in the site visit on Thursday September 17th.
	At 5:13 pm CST, Raina emailed Ben Rhodd. Raina asked Ben if there was any sites in particular that he would like to visit.

9/14/2020

	At 11:10 am CST, Raina emailed all project-specific applicable THPOS. She gave an update on the first week of the second mobilization for the project as well as the site visit form September 11.
	At 11:47 am CST, Raina emailed all project-specific applicable THPOs. She resent the first weekly update for the second mobilization.
9/15/2020	
	At 2:30 pm CST, Ben Young called Raina and asked if BCA/WBI will pay for Ben Rhodd's travel expenses for the site visit September 17 or else he would not be able to attend.
	At 2:35 pm CST, Raina called Ben Young. She let him know that BCA will get everything figured out to that Ben Rhodd will be able to attend.
	At 2:52 pm CST, Raina emailed Ben Young and Ben Rhodd, cc'ing applicable BCA Staff. The email contained the hotel room confirmation for Ben Rhodd.
	At 3:28 pm CST, Ben Rhodd emailed Raina. He thanked her for setting up the hotel. He told her that he just talked to Jill regarding mileage and per diem.
	At 5:19 pm CST, Raina emailed Ben Rhodd and Ben Young, cc'ing Jill. She said that There will be a check for Ben ready at the meeting and provided as breakdown of the components of the check.
9/17/2020	
	At 7:46 am CST, Ben Rhodd emailed Raina. He let her know he was in Watford. He was making sure that they were meeting at Tobacco Gardens at 10 am.
9/18/2020	
	At 9:48 am CST, Raina emailed all project- specific applicable THPOs. She provided an update regarding the site visit the day before.

Communications with the Oglala Sioux Tribe

Date	Summary
7/23/2020	
	At 12:25 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing all state and federal agencies (excluding FERC). In the email, Raina attached the 6th weekly update for the project. Included in the email were some special notes regarding the planned end date for the project as well as providing updates with respect to the Hartel property and BCA20-1313-CHFMSite15.
7/31/2020	
	At 2:19 pm CST, Raina sent and email to all project-specific applicable THPOs, cc'ing Wade. The email included the weekly update for the week of July 20 through July 25. In addition was special notes and updates that included the extension of the project date. The fieldwork should now be complete August 7. She continued by saying that the Hartel parcel has been completed. She finished by alerting the THPOs to the fact that the site that ERM archaeologists and TCSs had disagreements regarding will continue to be recorded while submitting appropriate paperwork describing the TCSs disagreement. Raina closed out the email by saying that arrangements were being made to accommodate the extension of fieldwork and that if any TCSs needed swapped out for the new time frame to let BCA know.
	At 3:15 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing Wade. She explained that she just received the most updated version of the survey schedule by ERM. Raina told the THPOs that she will keep them up to date to all changes as soon as she learned of them, noting that TCSs may know of changes sooner directly from ERM field crew.
8/7/2020	
	At 10:24 am CST, Raina sent an email to all project-specific applicable THPOs. The email contained the weekly update for July 27 through August 1. In the email she updating the THPOs to the extended completion date being August 14. This is because of a large stone feature that was discovered. TCS and ERM archaeologists continue to disagree over the validity of a site as well. Raina closed out the email by saying that BCA will be keeping THPOs and TCSs updated as much as possible.
8/10/2020	
	At 9:35 am CST, Raina sent an email to all project-specific applicable THPOs. The email came as a confirmation that fieldwork should be completed sometime this week. She said that TCSs will be released as soon as fieldwork is completed.

8/11/2020	
	At 11:44 am CST, Raina emailed all project-specific applicable THPOs. The email contained the ninth weekly update (August 3 through August 8). Raina added that fieldwork will be completed on the tenth week and that BCA and participating TCSs will be returning to the Hartel property to survey a reroute. She closed the email out by explaining that the TCSs sentiments regarding the stone features in the site revisits had been outlined in the attached update.
	At 6:29 pm CST, Raina emailed all project-specific applicable THPOs. In the email she outlined that she had received confirmation of the reroute touch-up survey. She explained that the survey will most-likely occur on Thursday of that week and will cover less than five acres of primarily plowed agricultural field. Raina closed by saying that they are on track to release the TCSs on Friday or Saturday of that week.
8/14/2020	
	At 3:11 pm CST, Raina emailed all project-specific applicable THPOs with the final weekly update for the first mobalization of the project. The attached document covered August 10 through August 13. She included in the email that fieldwork has ceased pending fields being harvested and that the Hartel reroute touch-up survey came up as no cultural material. Lastly she concluded that there had been two more sites discovered that were disagreed upon by TCSs and ERM archaeologists. She said that the same protocols will be followed for these new sites as the first site that was disagreed upon.
8/31/2020	
	At 3:01 pm CST, Raina emailed all project-specific applicable THPOs letting them know that BCA has been mapping and documenting the sites and features recorded by TCSs. BCA will be getting shapefiles data over to WBI and ERM that week for review and avoidance planning. Raina explained that ERM and WBI will plan to avoid site boundaries for stone feature sites on private and/or state surface by a 50' minimum as well as fencing off the project's ROW corridor. She continued by saying that BCA is working on completing the North Dakota Heritage Forms for SHPO though the information provided in those forms will have no affect archaeologically but will reflect the feature/site details provided by TCSs that has been approved to be documented and shared. Raina concluded by saying that during a call with ERM and WBI the previous Friday that ERM plans on resuming the remaining fieldwork starting September 9th and that it should take approximately 4 weeks. She requested that any THPO that can send TCSs for the second mobilization of fieldwork let her know as soon as possible.
9/2/2020	
	At 10:41 am CST, Raina emailed all project-specific applicable THPOS. In the email, she lists the contact information for FERC's Dawn Ramsey.
	At 11:18 am CST, Raina emailed all project-specific applicable THPOs. She explained that BCA has no issues with Jon's request but state and federal agencies would have to speak to the request. Raina said that she had forwarded the request on to the appropriate individuals at ERM and WBI. She let them know that she will let them know when she gets a response.
	At 11:55 am CST, Raina emailed all project-specific applicable THPOs. She answered Jon's question by saying that WBI would be that authority.
	At 2:40 pm CST, Raina emailed all project-specific applicable THPOs. In her email she listed the contacts for WBI and ERM (Jill Linn and Pat Robblee, respectively). She also explained who would be best to address certain questions.

9/3/2020	
	At 4:03 pm CST, Jill Linn emailed all project-specific applicable THPOs, Raina and cc'd Pat Robblee and Andrea Thornton of ERM. She addressed Jon saying that she left a voice mail at his office. She then goes on to address his concerns by explaining that WBI contracted ERM for the archaeological work therefore all discussions of sites and the reasons for recording should be addressed by ERM. She says that Pat Robblee had been copied on the email thread so that he can address the concerns as well. She addresses the site visits by saying that WBI, ERM and BCA will be working together to talk to landowners and land management for access to the sites.
	At 5:51 pm CST, Raina emailed all project-specific applicable THPOs. The email was a reminder of the second mobilization starting the following week. She provided the current travel date and asked that any THPOs that can send a TCS let her know. She also mentioned the two documents that she had attached that listed the known and new CHF interpretations for their review.
9/4/2020	
	At 8:02 am CST, Raina emailed all project-specific applicable THPOs that the start date for the second mobilization had been moved back to September 11 and that the travel day will be September 10th.
	At 1:25 pm CST, Raina emailed all project-specific applicable THPOs and applicable BCA staff. The email was a reminder of dates and that THPOs should let BCA know if they plan on sending a TCS for the mobilization.
	At 3:29 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing applicable BCA staff. She attached a pdf of the combined known and new CHF sites. She tells them to let her know if they have any questions or concerns about the mobilization.
9/8/2020	
	At 9:32 am CST, Raina emailed all project-specific applicable THPOs. She provided them an update to the fieldwork scheduling from ERM. She also let them know that all THPOs that have confirmed a TCS will be getting a phone call.
9/9/2020	
	At 8:50 am CST, Jon emailed Jill Linn, Raina, and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat Robblee and Andrea Thornton of ERM. He tanked Jill for her response and suggested site visits with the archaeologists.
	At 3:50 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat Robblee, Andrea Thornton, and Kevin Malloy. In her email she explains that efforts were being made to look at the site specified by Ft. Peck on September 11. She said that if anyone wanted to participate to let Raina know. She also said that more details on the meeting will come later. Raina addressed the inquiries regarding CHFM 5 and that after some digging, the feature will stay recorded and that the PDF will be updated.

9/10/2020	
	At 10:30 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was a list of the currently confirmed attendants and the meeting time, date and location of the meeting.
	At 10:30 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was an additional participant that wasn't listed in the previous email.
	At 1:43 pm CST, Raina received an automatic email claiming that the delivery of an email to Thomas was delayed.
	At 6:04 pm CST, Raina received an automatic email saying that the delayed email had been delivered.
9/14/2020	
	At 11:10 am CST, Raina emailed all project-specific applicable THPOS. She gave an update on the first week of the second mobilization for the project as well as the site visit form September 11.
	At 11:47 am CST, Raina emailed all project-specific applicable THPOs. She resent the first weekly update for the second mobilization.
	At 3:04 pm CST, Raina received an automatic email claiming that the delivery of an email to Thomas was successful.
9/18/2020	
	At 9:48 am CST, Raina emailed all project- specific applicable THPOs. She provided an update regarding the site visit the day before.

Communications with the Northern Arapaho

Date	Summary
7/23/2020	
	At 12:25 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing all state and federal agencies (excluding FERC). In the email, Raina attached the 6th weekly update for the project. Included in the email were some special notes regarding the planned end date for the project as well as providing updates with respect to the Hartel property and BCA20-1313-CHFMSite15.
	At 12:25 pm CST, Raina received an automated email response from the Northern Arapaho THPO regarding office closures due to COVID-19. The email provided an urgent number (999-999-2903) and non urgent number (999-999-1628) for immediate and eventual responses as Northern Arapaho checks their voice messages.
7/31/2020	
	At 2:19 pm CST, Raina sent and email to all project-specific applicable THPOS, cc'ing Wade. The email included the weekly update for the week of July 20 through July 25. In addition was special notes and updates that included the extension of the project date. The fieldwork should now be complete August 7. She continued by saying that the Hartel parcel has been completed. She finished by alerting the THPOs to the fact that the site that ERM archaeologists and TCSs had disagreements regarding will continue to be recorded while submitting appropriate paperwork describing the TCSs disagreement. Raina closed out the email by saying that arrangements were being made to accommodate the extension of fieldwork and that if any TCSs needed swapped out for the new time frame to let BCA know.
	At 2:22 pm CST, Raina received an automated email response from the Northern Arapaho THPO regarding office closures due to COVID-19. The email provided an urgent number (999-999-2903) and non urgent number (999-999-1628) for immediate and eventual responses as Northern Arapaho checks their voice messages.
	At 3:15 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing Wade. She explained that she just received the most updated version of the survey schedule by ERM. Raina told the THPOs that she will keep them up to date to all changes as soon as she learned of them, noting that TCSs may know of changes sooner directly from ERM field crew.
8/7/2020	
	At 10:24 am CST, Raina sent an email to all project-specific applicable THPOs. The email contained the weekly update for July 27 through August 1. In the email she updating the THPOs to the extended completion date being August 14. This is because of a large stone feature that was discovered. TCSs and ERM archaeologists continue to disagree over the validity of a site as well. Raina closed out the email by saying that BCA will be keeping THPOs and TCSs updated as much as possible.
	At 10:24 am CST, Raina received an automated email response from the Northern Arapaho THPO regarding office closures due to COVID-19. The email provided an urgent number (999-999-2903) and non urgent number (999-999-1628) for immediate and eventual responses as Northern Arapaho checks their voice messages.

8/10/2020	
	At 9:35 am CST, Raina sent an email to all project-specific applicable THPOs. The email came as a confirmation that fieldwork should be completed sometime this week. She said that TCSs will be released as soon as fieldwork is completed.
8/11/2020	
	At 11:44 am CST, Raina emailed all project-specific applicable THPOs. The email contained the ninth weekly update (August 3 through August 8). Raina added that fieldwork will be completed on the tenth week and that BCA and participating TCSs will be returning to the Hartel property to survey a reroute. She closed the email out by explaining that the TCSs sentiments regarding the stone features in the site revisits had been outlined in the attached update.
	At 11:45 am CST, Raina received an automated email response from the Northern Arapaho THPO regarding office closures due to COVID-19. The email provided an urgent number (999-999-2903) and non urgent number (999-999-1628) for immediate and eventual responses as Northern Arapaho checks their voice messages.
	At 6:29 pm CST, Raina emailed all project-specific applicable THPOs. In the email she outlined that she had received confirmation of the reroute touch-up survey. She explained that the survey will most-likely occur on Thursday of that week and will cover less than five acres of primarily plowed agricultural field. Raina closed by saying that they are on track to release the TCSs on Friday or Saturday of that week.
8/14/2020	
	At 3:11 pm CST, Raina emailed all project-specific applicable THPOs with the final weekly update for the project. The attached document covered August 10 through August 13. She included in the email that fieldwork has ceased pending fields being harvested and that the Hartel reroute touch-up survey came up as no cultural material. Lastly, she concluded that there had been two more sites discovered that were disagreed upon by TCSs and ERM archaeologists. She said that the same protocols will be followed for these new sites as the first site that was disagreed upon.
8/31/2020	
	At 3:01 pm CST, Raina emailed all project-specific applicable THPOs letting them know that BCA has been mapping and documenting the sites and features recorded by TCSs. BCA will be getting shapefiles data over to WBI and ERM that week for review and avoidance planning. Raina explained that ERM and WBI will plan to avoid site boundaries for stone feature sites on private and/or state surface by a 50' minimum as well as fencing off the project's ROW corridor. She continued by saying that BCA is working on completing the North Dakota Heritage Forms for SHPO though the information provided in those forms will have no affect archaeologically but will reflect the feature/site details provided by TCSs that has been approved to be documented and shared. Raina concluded by saying that during a call with ERM and WBI the previous Friday that ERM plans on resuming the remaining fieldwork starting September 9th and that it should take approximately 4 weeks. She requested that any THPO that can send TCSs for the second mobilization of fieldwork let her know as soon as possible.

9/2/2020	
	At 10:41 am CST, Raina emailed all project-specific applicable THPOs. In the email, she lists the contact information for FERC's Dawn Ramsey.
	At 11:18 am CST, Raina emailed all project-specific applicable THPOs. She explained that BCA has no issues with Jon's request but state and federal agencies would have to speak to the request. Raina said that she had forwarded the request on to the appropriate individuals at ERM and WBI. She let them know that she will let them know when she gets a response.
	At 11:55 am CST, Raina emailed all project-specific applicable THPOs. She answered Jon's question by saying that WBI would be that authority.
9/2/2020	
	At 2:40 pm CST, Raina emailed all project-specific applicable THPOs. In her email she listed the contacts for WBI and ERM (Jill Linn and Pat Robblee, respectively). She also explained who would be best to address certain questions.
9/3/2020	
	At 4:03 pm CST, Jill Linn emailed all project-specific applicable THPOs, Raina and cc'd Pat Robblee and Andrea Thornton of ERM. She addressed Jon saying that she left a voice mail at his office. She then goes on to address his concerns by explaining that WBI contracted ERM for the archaeological work therefore all discussions of sites and the reasons for recording should be addressed by ERM. She says that Pat Robblee had been copied on the email thread so that he can address the concerns as well. She addresses the site visits by saying that WBI, ERM and BCA will be working together to talk to landowners and land management for access to the sites.
	At 5:51 pm CST, Raina emailed all project-specific applicable THPOs. The email was a reminder of the second mobilization starting the following week. She provided the current travel date and asked that any THPOs that can send a TCS let her know. She also mentioned the two documents that she had attached that listed the known and new CHF interpretations for their review.
9/4/2020	
	At 8:02 am CST, Raina emailed all project-specific applicable THPOs that the start date for the second mobilization had been moved back to September 11 and that the travel day will be September 10.
	At 1:25 pm CST, Raina emailed all project-specific applicable THPOs and applicable BCA staff. The email was a reminder of dates and that THPOs should let BCA know if they plan on sending a TCS for the mobilization.
	At 3:29 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing applicable BCA staff. She attached a pdf of the combined known and new CHF sites. She tells them to let her know if they have any questions or concerns about the mobilization.
9/8/2020	
	At 9:32 am CST, Raina emailed all project-specific applicable THPOs. She provided them an update to the fieldwork scheduling from ERM. She also let them know that all THPOs that have confirmed a TCS will be getting a phone call.

9/9/2020	
	At 3:50 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing BCA staff, Pat Robblee, Andrea Thornton, and Kevin Malloy. In her email she explains that efforts were being made to look at the site specified by Ft. Peck on September 11. She said that if anyone wanted to participate to let Raina know. She also said that more details on the meeting will come later. Raina addressed the inquiries regarding CHFM 5 and that after some digging, the feature will stay recorded and that the PDF will be updated.
9/10/2020	
	At 10:30 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was a list of the currently confirmed attendants and the meeting time, date and location of the meeting.
	At 10:34 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was an additional participant that wasn't listed in the previous email.
9/14/2020	
	At 11:10 am CST, Raina emailed all project-specific applicable THPOS. She gave an update on the first week of the second mobilization for the project as well as the site visit form September 11.
	At 11:47 am CST, Raina emailed all project-specific applicable THPOs. She resent the first weekly update for the second mobilization.
9/18/2020	
	At 9:48 am CST, Raina emailed all project- specific applicable THPOs. She provided an update regarding the site visit the day before.

Communication with Fort Belknap Indian Reservation

Date	Summary
7/23/2020	
	At 12:25 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing all state and federal agencies (excluding FERC). In the email, Raina attached the 6th weekly update for the project. Included in the email were some special notes regarding the planned end date for the project as well as providing updates with respect to the Hartel property and BCA20-1313-CHFMSite15.
7/31/2020	
	At 2:19 pm CST, Raina sent and email to all project-specific applicable THPOS, cc'ing Wade. The email included the weekly update for the week of July 20 through July 25. In addition was special notes and updates that included the extension of the project date. The fieldwork should now be complete August 7. She continued by saying that the Hartel parcel has been completed. She finished by alerting the THPOs to the fact that the site that ERM archaeologists and TCSs had disagreements regarding will continue to be recorded while submitting appropriate paperwork describing the TCSs disagreement. Raina closed out the email by saying that arrangements were being made to accommodate the extension of fieldwork and that if any TCSs needed swapped out for the new time frame to let BCA know.
	At 3:15 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing Wade. She explained that she just received the most updated version of the survey schedule by ERM. Raina told the THPOs that she will keep them up to date to all changes as soon as she learned of them, noting that TCSs may know of changes sooner directly from ERM field crew.
8/7/2020	
	At 10:24 am CST, Raina sent an email to all project-specific applicable THPOs. The email contained the weekly update for July 27 through August 1. In the email she updating the THPOs to the extended completion date being August 14. This is because of a large stone feature that was discovered. TCS and ERM archaeologists continue to disagree over the validity of a site as well. Raina closed out the email by saying that BCA will be keeping THPOs and TCSs updated as much as possible.
8/10/2020	
	At 9:35 am CST, Raina sent an email to all project-specific applicable THPOs. The email came as a confirmation that fieldwork should be completed sometime this week. She said that TCSs will be released as soon as fieldwork is completed.
8/11/2020	
	At 11:44 am CST, Raina emailed all project-specific applicable THPOs. The email contained the ninth weekly update (August 3 through August 8). Raina added that fieldwork will be completed on the tenth week and that BCA and participating TCSs will be returning to the Hartel property to survey a reroute. She closed the email out by explaining that the TCSs sentiments regarding the stone features in the site revisits had been outlined in the attached update.
	At 6:29 pm CST, Raina emailed all project-specific applicable THPOs. In the email, she outlined that she had received confirmation of the reroute touch-up survey. She explained that the survey will most-likely occur on Thursday of that week and will cover less than five acres of primarily plowed agricultural field. Raina closed by saying that they are on track to release the TCSs on Friday or Saturday of that week.

8/14/2020	
	At 3:11 pm CST, Raina emailed all project-specific applicable THPOs with the final weekly update for the project. The attached document covered August 10 through August 13. She included in the email that fieldwork has ceased pending fields being harvested and that the Hartel reroute touch-up survey came up as no cultural material. Lastly, she concluded that there had been two more sites discovered that were disagreed upon by TCSs and ERM archaeologists. She said that the same protocols will be followed for these new sites as the first site that was disagreed upon.
8/31/2020	
	At 3:01 pm CST, Raina emailed all project-specific applicable THPOs letting them know that BCA has been mapping and documenting the sites and features recorded by TCSs. BCA will be getting shapefiles data over to WBI and ERM that week for review and avoidance planning. Raina explained that ERM and WBI will plan to avoid site boundaries for stone feature sites on private and/or state surface by a 50' minimum as well as fencing off the project's ROW corridor. She continued by saying that BCA is working on completing the North Dakota Heritage Forms for SHPO though the information provided in those forms will have no affect archaeologically but will reflect the feature/site details provided by TCSs that has been approved to be documented and shared. Raina concluded by saying that during a call with ERM and WBI the previous Friday that ERM plans on resuming the remaining fieldwork starting September 9th and that it should take approximately 4 weeks. She requested that any THPO that can send Tus for the second mobilization of fieldwork let her know as soon as possible.
	At 3:33 pm CST, Michael Black Wolf emailed Raina thinking her for the update but letting her know that Fort Belknap will not be able to send a TCS.
	At 4:55 pm CST, Raina responded to Michael thanking him for letting her know and that BCA will keep him up to date.
9/2/2020	
	At 10:41 am CST, Raina emailed all project-specific applicable THPOs. In the email she lists the contact information for FERC's Dawn Ramsey.
	At 11:18 am CST, Raina emailed all project-specific applicable THPOs. She explained that BCA has no issues with Jon's request but state and federal agencies would have to speak to the request. Raina said that she had forwarded the request on to the appropriate individuals at ERM and WBI. She let them know that she will let them know when she gets a response.
	At 11:55 am CST, Raina emailed all project-specific applicable THPOs. She answered Jon's question by saying that WBI would be that authority.
	At 2:40 pm CST, Raina emailed all project-specific applicable THPOs. In her email, she listed the contacts for WBI and ERM (Jill Linn and Pat Robblee, respectively). She also explained who would be best to address certain questions.

9/3/2020	
	At 4:03 pm CST, Jill Linn emailed all project-specific applicable THPOs, Raina and cc'd Pat Robblee and Andrea Thornton of ERM. She addressed Jon saying that she left a voice mail at his office. She then goes on to address his concerns by explaining that WBI contracted ERM for the archaeological work therefore all discussions of sites and the reasons for recording should be addressed by ERM. She says that Pat Robblee had been copied on the email thread so that he can address the concerns as well. She addresses the site visits by saying that WBI, ERM and BCA will be working together to talk to landowners and land management for access to the sites.
	At 5:51 pm CST, Raina emailed all project-specific applicable THPOs. The email was a reminder of the second mobilization starting the following week. She provided the current travel date and asked that any THPOs that can send a TCS let her know. She also mentioned the two documents that she had attached that listed the known and new CHF interpretations for their review.
9/4/2020	
	At 8:02 am CST, Raina emailed all project-specific applicable THPOs that the start date for the second mobilization had been moved back to September 11 and that the travel day will be September 10th.
	At 1:25 pm CST, Raina emailed all project-specific applicable THPOs and applicable BCA staff. The email was a reminder of dates and that THPOs should let BCA know if they plan on sending a TCS for the mobilization.
	At 3:29 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing applicable BCA staff. She attached a pdf of the combined known and new CHF sites. She tells them to let her know if they have any questions or concerns about the mobilization.
9/8/2020	
	At 9:32 am CST, Raina emailed all project-specific applicable THPOs. She provided them an update to the fieldwork scheduling from ERM. She also let them know that all THPOs that have confirmed a TCS will be getting a phone call.
9/9/2020	
	At 3:50 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat Robblee, Andrea Thornton, and Kevin Malloy. In her email, she explains that efforts were being made to look at the site specified by Ft. Peck on September 11. She said that if anyone wanted to participate to let Raina know. She also said that more details on the meeting will come later. Raina addressed the inquiries regarding CHFM 5 and that after some digging, the feature will stay recorded and that the PDF will be updated.
9/10/2020	
	At 10:30 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was a list of the currently confirmed attendants and the meeting time, date and location of the meeting.
	At 10:34 am CST, Raina emailed Jill and all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea and Kevin. The email was a reminder of the site visit the next day. Included in the the email was an additional participant that wasn't listed in the previous email.
	At 2:12 pm CST, Michael emailed Raina, Jill, all project-specific applicable THPOs, cc'ing applicable BCA staff, Pat, Andrea, and Kevin. He explained that Ft. Belknap will not be able to participate in the site visit.

9/14/2020	
	At 11:10 am CST, Raina emailed all project-specific applicable THPOS. She gave an update on the first week of the second mobilization for the project as well as the site visit form September 11.
	At 11:47 am CST, Raina emailed all project-specific applicable THPOs. She resent the first weekly update for the second mobilization.
9/18/2020	
	At 9:48 am CST, Raina emailed all project- specific applicable THPOs. She provided an update regarding the site visit the day before.

Emails with Tribal Historic Preservation Officers

From: Raina Hanley
Sent: Thursday, July 23, 2020 12:25 PM
To: 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dianned@swo-nsn.gov' <dianned@swo-nsn.gov>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; 'jeremy.freeman@standingrock.org' <jeremy.freeman@standingrock.org>; 'Jon Eagle (j.eagle@standingrock.org)' <j.eagle@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; 'Rogers, Richard R II CIV USARMY CENWO (USA)' <Richard.R.Rogers@usace.army.mil>; 'Liv Fetterman (lfetterman@fs.fed.us)' <lfetterman@fs.fed.us>; 'West, Katherine J' <kwest@blm.gov>; 'Clark, Andrew' <andrewclark@nd.gov>; Irene Altieri <ialtieri@bcarch.org>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Good Afternoon,

Attached please find the weekly update for the sixth week of work done during the project.

Special Notes and Updates:

1. We are still planning for the project to end on/right around Saturday, August 1st.
    a. Your TCS may notice and have alerted you that the ERM archaeologists may have less of a presence/be demobilizing, but that is due to project needs as the fieldwork for the project begins to wind down and the number of archaeologists to be on the project not as great.
        i. At this time, the TCSs should continue planning on being needed into next week. We will keep you all posted if there are any significant changes to the anticipated end date.
2. The Hartel survey has begun and is on-going. The fieldwork occurs in the afternoon after the ERM field plans for the day are completed.
    a. In order to keep the archaeological fieldwork methodology consistent for the project, BCA is working with ERM to complete the archaeological fieldwork under the same methodological approach as ERM.
3. During one of the surveys last week, another site was recorded by the ERM archaeologists that the TCS did not believe to be a cultural site. The area in question has been documented by BCA as BCA20-1313-CHFMSite15 and is thought to, by the ERM archaeologists, to consist of one stone circle.
    a. We will plan to follow the same approach as what was and will be done for BCA20-1313-CHFMSite9, specifically:
        i. Accordingly, BCA will plan to submit paperwork, as appropriate and necessary, to reflect the TCSs' sentiments on the item being recorded as a feature and a cultural site.
            1. For our records, at this time, BCA is referring to the area in question as BCA20-1313-CHFMsite15.

a. The area in question is located on Private Property.
b. The ERM archaeologists are recording the location as a stone feature site, and the TCSs are in agreement that it is not a site. The ERM archaeological site form is to note the TCSs disagreement.

b. Both BCA20-1313-CHFMSite9 and BCA20-1313-CHFMSite15 are discussed in the attached Weekly Update PDF.

Thank you,

Raina Hanley
Chief Operating Officer

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Note: The attachment referenced in this email has been filed under separate cover and is labelled "CUI//PRIV – DO NOT RELEASE".

From: Raina Hanley
Sent: Friday, July 31, 2020 2:19 PM
To: 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dianned@swo-nsn.gov' <dianned@swo-nsn.gov>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; 'jeremy.freeman@standingrock.org' <jeremy.freeman@standingrock.org>; 'Jon Eagle (j.eagle@standingrock.org)' <j.eagle@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Good Afternoon,

Attached please find the weekly update for the seventh week of work done during the project.

Special Notes and Updates:

1. **I have just been made aware the project is now planned to extend into next week.** At this time, I have not been provided a definitive end date.
    - **a.** For all of our planning purposes, I will **estimate the tentative completion to be on Friday, August 7th**.
        - **i.** Part of this delay comes from alignment reroutes that had recently come in and needed to be surveyed. It sounds like some of the survey has already occurred but that there is still a bit more needed.
    - b. I have requested to be provided with an updated schedule so that we may all be aware of any changes to the planned fieldwork and the planned fieldwork dates.
2. The Hartel Parcel survey by BCA archaeologists and TCS has been completed.
    - a. The update on the survey is provided in the attached weekly update.
        - i. One historic cultural resource was documented, BCA20-1080-Site1.
3. During one of the surveys last week, another site was recorded by the ERM archaeologists that the TCS did not believe to be a cultural site. The area in question has been documented by BCA as BCA20-1313-CHFMSite17 and is thought to, by the ERM archaeologists, to consist of an arc, two stone circles (one with a possible cairn/hearth), and two cairns.
    - a. We will plan to follow the same approach as what was and will be done for BCA20-1313-CHFMSite9 and BCA20-1313-CHFMSite15, specifically:
        - i. Accordingly, BCA will plan to submit paperwork, as appropriate and necessary, to reflect the TCSs' sentiments on the item being recorded as a feature and a cultural site.
            1. For our records, at this time, BCA is referring to the area in question as BCA20-1313-CHFMsite17.
                - a. The area in question is located on Private Property.
                - b. The ERM archaeologists are recording the location as a stone feature site, and the TCSs are in agreement that it is

not a site. The ERM archaeological site form is to note the TCSs disagreement.

b. BCA20-1313-CHFMSite17 is discussed in the attached Weekly Update PDF.

I know some of the TCSs have already alerted their THPOs as to the extended scheduling, and arrangements are being made. Please let me know if any TCSs need to be swapped out for next week's work or if you will not be able to have a TCS on location.

Thank you,

Raina Hanley
Chief Operating Officer

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Note: The attachment referenced in this email has been filed under separate cover and is labelled "CUI//PRIV – DO NOT RELEASE".

From: Raina Hanley
Sent: Friday, August 07, 2020 10:24 AM
To: 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dianned@swo-nsn.gov' <dianned@swo-nsn.gov>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; 'jeremy.freeman@standingrock.org' <jeremy.freeman@standingrock.org>; 'Jon Eagle (j.eagle@standingrock.org)' <j.eagle@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Good Morning,

Attached please find the weekly update for the eighth week of work on WBI's North Bakken Pipeline project.

Special Notes and Updates:

1. **Due to the discovery of a large stone feature site earlier this week and the crews attempts to look for a clear reroute option, the project is now planned to extend into next week.** At this time, I do not have an anticipated end date. For all of our planning purposes, I will **estimate the tentative completion to be on Friday, August 14th.**
2. The site reviews have been on-going. There has been one adjustment to one of the sites that the TCSs disagreed with the ERM archaeologists on, BCA20-1313-CHFMSITE9, during the site review one of the TCSs documented an arc. The other reviewing TCSs agreed with the documentation. All of the TCSs continue to disagree with the remainder of the features documented by the ERM archaeologists.
3. The attached weekly update details the reviewing TCSs sentiments on the features documented at stone feature sites discovered in 2019 and 2020 within the projects planned right-of-way (ROW).

NOTE: Given the recent cultural findings and reroute alignment changes to accommodate the newly documented stone feature sites as well as other alignment change variables, the final date I estimate above is subject to change, either shortened or extended, depending on finalized routing tweaks and adjustments.

I will do my best to provide you and the TCSs with as much advance notice as possible as to the updated end date. The TCSs may end up with the most current and real-time information.

Thank you,
Raina Hanley
Chief Operating Officer

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Note: The attachment referenced in this email has been filed under separate cover and is labelled "CUI//PRIV – DO NOT RELEASE".

From: Raina Hanley
Sent: Tuesday, August 11, 2020 11:44 AM
To: Steve Vance <stevev.crstpres@outlook.com>; Michael Black Wolf <mblackwolf@ftbelknap.org>; Dyan Youpee <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; bsr007.nathpo@gmail.com; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; Ben Rhodd <brhodd1@yahoo.com>; rst.thpo@rst-nsn.gov; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dianned@swo-nsn.gov' <dianned@swo-nsn.gov>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; Erich Longie <thpo@gondtc.com>; 'jeremy.freeman@standingrock.org' <jeremy.freeman@standingrock.org>; 'Jon Eagle (j.eagle@standingrock.org)' <j.eagle@standingrock.org>; Pete Coffey <pcoffey@mhanation.com>; Jeffrey Desjarlais Jr. <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Good Morning,

Attached please find the weekly update for the ninth week of work on WBI's North Bakken Pipeline project.

Special Notes and Updates:

1.) As discussed in the email below, the project is anticipated to be completed this week.
2.) Earlier today, I was alerted that the BCA archaeologists and participating TCSs will need to return to the Hartel property to survey a reroute corridor in order to avoid a Dakota Skipper habitat area.
    a. We have received a preliminary reroute alignment and hope to have more information from ERM/WBI for a more finalized survey time by tomorrow (Wednesday, 8/12).
    b. We hope to have this completed this week before releasing the remaining TCSs from the project.
3.) The attached weekly update details the reviewing TCSs sentiments on the features documented at stone feature sites discovered in 2019 and 2020 within the projects planned right-of-way (ROW).

Thank you,

Raina Hanley
Chief Operating Officer

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Note: The attachment referenced in this email has been filed under separate cover and is labelled "CUI//PRIV – DO NOT RELEASE".

From: Raina Hanley
Sent: Friday, August 14, 2020 3:11 PM
To: 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dianned@swo-nsn.gov' <dianned@swo-nsn.gov>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; 'jeremy.freeman@standingrock.org' <jeremy.freeman@standingrock.org>; 'Jon Eagle (j.eagle@standingrock.org)' <j.eagle@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Good Afternoon,

Attached please find the weekly update for the tenth and final week of work on WBI's North Bakken Pipeline project.

Special Notes and Updates:

1.) For the time being, fieldwork for the project has ceased pending fields being harvested.
2.) Hartel Touch-up survey, with the BCA archaeologists, has been completed. No cultural resources were encountered.
    a. BCA will plan to write our own report about the Hartel surveys that will be incorporated into the full ERM report.
3.) During the surveys this week, another two sites were recorded by the ERM archaeologists that the TCS did not believe to be a cultural feature or site. The areas in question have been documented by BCA as BCA20 1313 CHFMSite26 and BCA20 1313 CHFMSite27. Both areas were documented by the ERM archaeologists as single stone circle feature sites.
    a. BCA will plan to follow the same protocols as previously detailed in my earlier updates for instances such as these.

Thank you,

Raina Hanley
Chief Operating Officer

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Note: The attachment referenced in this email has been filed under separate cover and is labelled "CUI//PRIV – DO NOT RELEASE".

From: Raina Hanley
Sent: Monday, August 31, 2020 3:01 PM
To: 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dianned@swo-nsn.gov' <dianned@swo-nsn.gov>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; 'jeremy.freeman@standingrock.org' <jeremy.freeman@standingrock.org>; 'Jon Eagle (j.eagle@standingrock.org)' <j.eagle@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Good Afternoon,

I hope everyone has been well and having a pleasant field season. While away from the fieldwork efforts for the subject line project, we have been working on the mapping and documentation of the features and sites documented by the participating TCSs. We will get our shapefile data over to ERM and WBI this week for their review and avoidance planning efforts. Per the guidance provided by the SHPO during the review of the report detailing ERM's 2019 fieldwork efforts, ERM and WBI plan to avoid the site boundaries for the stone features sites on private and/or state surface by a minimum of 50'. If I understood correctly, it also sounded like ERM and WBI plan to fence the project ROW corridor as a part of their avoidance measures too. In the meantime, and as these items are being discussed, we are also working on completing the North Dakota Heritage Forms for submission to the SHPO. The information we submit as a part of the cultural heritage documentation will include no influence of archaeological thought; the information will merely reflect the feature and/or site details that BCA was provided by the participating TCSs, that is approved to be documented and shared with the agencies, and other THPOs.

Finally, during a call with ERM and WBI last Friday afternoon, we were informed that **ERM plans to resume the remaining fieldwork efforts starting on/around Wednesday, September 9th**. The additional fieldwork would include survey of additional alignment touchups, surveys of the segments of the line in agricultural fields that ERM wanted to be harvested prior to survey, as well as the evaluative test excavation work to occur to the site on USACE surface. The fieldwork efforts are approximated to take a few weeks, as such I would say **the additional fieldwork should take approximately 4 weeks**.

At your earliest convenience, **please let us know if your THPO is willing and able to send one TCS to participate in the remaining 2020 fieldwork efforts** for WBI's North Bakken Pipeline Expansion project. Also, *if you have the name and contact information of the TCS you plan to send, that would be helpful and greatly appreciated* for our planning and scheduling efforts.

Thank you and take care,

Raina Hanley
Chief Operating Officer

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From: Jon Eagle <j.eagle@standingrock.org>
Sent: Wednesday, September 2, 2020 10:29 AM
To: Raina Hanley <RHanley@bcarch.org>; 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dianned@swo-nsn.gov' <dianned@swo-nsn.gov>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; Jeremy Freeman <jeremy.freeman@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Good morning,

I'm concerned that ERM archaeologists are recording a site that Tribal Cultural Specialist believe not to be a cultural feature. When I think about the difference between an archaeologist and I, and our abilities to identity a site, I think about it like this. An archaeologist is drawing from a different data base than I am. They are drawing from their education, training and experience, where as I am drawing from a way of life, that includes my people's oral history and sacred knowledge. I would like to request a site visit to see for myself what ERM has identified.

I would also like to know who the lead federal agency is and am requesting their contact information.

Jon Eagle Sr.,
Tribal Historic Preservation Officer
Standing Rock Sioux Tribe

"Tokata wicoicage ki wacinniyapi"

From: Raina Hanley [mailto:RHanley@bcarch.org]
Sent: Wednesday, September 2, 2020 10:41 AM
To: Jon Eagle <j.eagle@standingrock.org>; 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dianned@swo-nsn.gov' <dianned@swo-nsn.gov>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; Jeremy Freeman <jeremy.freeman@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Hi Jon,

The lead federal agency continues to be the Federal Energy Regulatory Commission (FERC). You may speak with Dawn Ramsey at FERC. Her contact information is:

Dawn Ramsey
Federal Energy Regulatory Commission
Dawn.Ramsey@ferc.gov
202-502-6856

Raina Hanley
Chief Operating Officer

Beaver Creek Archaeology
1632 Capitol Way
Bismarck, ND 58501
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Ph: (701) 663-5521 | Fx: (701) 663-5589

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From: Dianne Desrosiers <DianneD@SWO-NSN.GOV>
Sent: Wednesday, September 2, 2020 11:00 AM
To: Raina Hanley <RHanley@bcarch.org>; Jon Eagle <j.eagle@standingrock.org>; 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; Jeremy Freeman <jeremy.freeman@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Good morning,
The Sisseton Wahpeton Oyate supports Jon Eagle SRST request.

From: Jon Eagle <j.eagle@standingrock.org>
Sent: Wednesday, September 2, 2020 11:08 AM
To: Raina Hanley <RHanley@bcarch.org>; 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dianned@swo-nsn.gov' <dianned@swo-nsn.gov>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; Jeremy Freeman <jeremy.freeman@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Thank you Raina,

And what about my request? I think other tribes should be afforded the opportunity to conduct a site visit to see for ourselves.

Jon Eagle Sr.,
Tribal Historic Preservation Officer
Standing Rock Sioux Tribe

“Tokata wicoicage ki wacinniyapi”

From: Raina Hanley [mailto:RHanley@bcarch.org]
Sent: Wednesday, September 2, 2020 11:18 AM
To: Jon Eagle <j.eagle@standingrock.org>; 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dianned@swo-nsn.gov' <dianned@swo-nsn.gov>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; Jeremy Freeman <jeremy.freeman@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Hi Jon,

While we have no issues with your request, as we are not a state or federal agency that is something that I cannot ultimately speak to or otherwise mandate for you. However, I have passed your email, with your request, on to the appropriate individuals at ERM and WBI. At this time, I have not received a response. I will alert you all when a response has been provided to me.

Thank you,

Raina Hanley
Chief Operating Officer

Beaver Creek Archaeology
1632 Capitol Way
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Cell: (701) 595-0588
Ph: (701) 663-5521 | Fx: (701) 663-5589

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From: Raina Hanley
Sent: Wednesday, September 2, 2020 11:22 AM
To: Dianne Desrosiers <DianneD@SWO-NSN.GOV>; Jon Eagle <j.eagle@standingrock.org>; 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; Jeremy Freeman <jeremy.freeman@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Hi Dianne,

Your response has been noted and forwarded on to the appropriate individuals at ERM and WBI.

Raina Hanley
Chief Operating Officer

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From: Jon Eagle <j.eagle@standingrock.org>
Sent: Wednesday, September 2, 2020 11:43 AM
To: Raina Hanley <RHanley@bcarch.org>; 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dianned@swo-nsn.gov' <dianned@swo-nsn.gov>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; Jeremy Freeman <jeremy.freeman@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Thank you Raina,

Do you know who has been delegated federal authority to consult?

Jon Eagle Sr.,
Tribal Historic Preservation Officer
Standing Rock Sioux Tribe

“Tokata wicoicage ki wacinniyapi”

From: Raina Hanley [mailto:RHanley@bcarch.org]
Sent: Wednesday, September 2, 2020 11:55 AM
To: Jon Eagle <j.eagle@standingrock.org>; 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dianned@swo-nsn.gov' <dianned@swo-nsn.gov>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; Jeremy Freeman <jeremy.freeman@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Yes, Jon. It continues to be WBI.

Raina Hanley
Chief Operating Officer

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From: Jon Eagle <j.eagle@standingrock.org>
Sent: Wednesday, September 2, 2020 11:55 AM
To: Raina Hanley <RHanley@bcarch.org>; 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dianned@swo-nsn.gov' <dianned@swo-nsn.gov>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; Jeremy Freeman <jeremy.freeman@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Thank you. And who is the contact at WBI with responsibility to consult? I appreciate you help by the way.

Jon Eagle Sr.,
Tribal Historic Preservation Officer
Standing Rock Sioux Tribe

“Tokata wicoicage ki wacinniyapi”

From: Raina Hanley <RHanley@bcarch.org>
Sent: Wednesday, September 2, 2020 3:40 PM
To: Jon Eagle <j.eagle@standingrock.org>; 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dianned@swo-nsn.gov' <dianned@swo-nsn.gov>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; Jeremy Freeman <jeremy.freeman@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>; Linn, Jill <Jill.Linn@wbienergy.com>; Pat Robblee <Pat.Robblee@erm.com>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Hi Jon,

I have been able to get the following information for you:

For any cultural resource items such as survey efforts, survey methodology, FERC processes, or lining up potential visits to specific cultural sites, then you would speak to Pat Robblee at ERM, he has been included to this email.

Patrick Robblee
Program Director

ERM
T+612 840 8976

For any company and/or project-specific items you would speak to Jill Linn at WBI, she has been included to this email.

Jill Linn
Environmental Manager

WBI*ENERGY*
TRANSMISSION

Office: 406-359-7332

Raina Hanley
Chief Operating Officer

Beaver Creek Archaeology
1632 Capitol Way
Bismarck, ND 58501
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Sent: Wednesday, September 2, 2020 1:40 PM
To: Raina Hanley <RHanley@bcarch.org>; 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dianned@swo-nsn.gov' <dianned@swo-nsn.gov>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; Jeremy Freeman <jeremy.freeman@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>; Linn, Jill <Jill.Linn@wbienergy.com>; Pat Robblee <Pat.Robblee@erm.com>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

** WARNING: EXTERNAL SENDER. NEVER click links or open attachments without positive sender verification of purpose. DO NOT provide your user ID or password on sites or forms linked from this email. **

Thank you but I reached out to Dawn Ramsey who said they would be contacting WBI and ERM. Keep in mind that this is a federal action which requires federal consultation. It is my understanding that WBI was delegated that responsibility so I will be waiting on a response from them.

Jon Eagle Sr.,
Tribal Historic Preservation Officer
Standing Rock Sioux Tribe

"Tokata wicoicage ki wacinniyapi"

From: Linn, Jill <Jill.Linn@wbienergy.com>
Sent: Thursday, September 3, 2020 4:02:56 PM
To: Jon Eagle; Raina Hanley; 'Steve Vance'; 'Michael Black Wolf'; 'Dyan Youpee'; 'cbearing.nathpo@gmail.com'; 'bsr007.nathpo@gmail.com'; 'Teanna Limpy'; 't.brings@oglala.org'; 'Ben Rhodd'; 'rst.thpo@rst-nsn.gov'; 'Benjamin Young'; 'dianned@swo-nsn.gov'; 'dyandancer@yahoo.com'; 'Erich Longie'; Jeremy Freeman; 'Pete Coffey'; 'Jeffrey Desjarlais Jr.'; 'Kip Spotted Eagle'
Cc: Wade Burns; Irene Altieri; Pat Robblee; Andrea Thornton
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Good afternoon Mr. Eagle,

I left a voice message at your office but wanted to follow up in an e-mail as well. Based on the e-mail chain below, I understand you have concerns with ERM archaeologists recording sites that Tribal Cultural Specialists believe not to be a cultural feature. As you know, WBI Energy has contracted ERM to complete the archaeological work for this proposed project route. Therefore, I will defer any discussion of the individual sites and the reasons for recording them to ERM representatives. As such, Pat Roblee with ERM, who is copied on this e-mail, will be reaching out to you as well to discuss your concerns.

You also requested access to sites so that you, and other THPOs that would like to, are able to review them. WBI Energy, together with ERM and BCA, will certainly work with landowners and land management agencies to accommodate this request for any that are interested in participating.

Please feel free to call me with any additional questions or concerns regarding the project. As I said, Pat will be reaching out to discuss the sites in question and establish a list of sites you are interested in visiting.

Thank you,

Jill Linn
Environmental Manager

WBIENERGY
TRANSMISSION

Office: 406-359-7332
Mobile: 406-939-5437

From: Raina Hanley
Sent: Thursday, September 3, 2020 5:51 PM
To: 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dianned@swo-nsn.gov' <dianned@swo-nsn.gov>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; 'jeremy.freeman@standingrock.org' <jeremy.freeman@standingrock.org>; 'Jon Eagle (j.eagle@standingrock.org)' <j.eagle@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Good Evening,

I have received some responses and some confirmations regarding TCS involvement for the planned second mobilization next week. Please let this email serve as a reminder of the upcoming planned second mobilization occurring next week. The details are in the email below. I currently have the travel day as Tuesday, 9/8. At your earliest convenience, please let me know if you are willing and/or able to send a TCS to participate in the second mobilization.

Also, as we prepare and review the field data from the first mobilization, we have compiled this information into two documents with the information presented in tabular format. Attached please find the detailed and comprehensive lists regarding feature/site interpretations. I have attached two documents. One document for newly recorded sites with CHF interpretations and one document with known sites and the CHF interpretations. NOTE: The lists of interpretations account for the interpretations from the various project components (including the site visits that occurred at the very end of the testing and survey work).

Thank you,

Raina Hanley
Chief Operating Officer

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Note: The attachment referenced in this email has been filed under separate cover and is labelled "CUI//PRIV – DO NOT RELEASE".

From: Raina Hanley
Sent: Friday, September 04, 2020 3:29 PM
To: 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dianned@swo-nsn.gov' <dianned@swo-nsn.gov>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; 'jeremy.freeman@standingrock.org' <jeremy.freeman@standingrock.org>; 'Jon Eagle (j.eagle@standingrock.org)' <j.eagle@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Good Afternoon,

Please let me know if anyone has any questions or concerns regarding the start date for the second mobilization. We can of course be flexible as to TCS arrival due to the confusion and various project components.

Also, for your ease of reference and review, I have attached a PDF document that combines and that hopefully more clearly and easily details the New versus Known/Previously Recorded CHF documentation. I hope you all find this document more helpful and easier to use. Please let me know if you have any issues using the PDF. I can always send the Word document of this, if that is easier.

Thank you,

Raina Hanley
Chief Operating Officer

Beaver Creek Archaeology
1632 Capitol Way
Bismarck, ND 58501
Cell: (701) 595-0588
Ph: (701) 663-5521 | Fx: (701) 663-5589

Beaver Creek Archaeology
712 West Quay Avenue
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Beaver Creek
ARCHAEOLOGY

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Note: The attachment referenced in this email has been filed under separate cover and is labelled "CUI//PRIV – DO NOT RELEASE".

From: Jon Eagle [mailto:j.eagle@standingrock.org]
Sent: Wednesday, September 09, 2020 8:50 AM
To: Linn, Jill <Jill.Linn@wbienergy.com>; Raina Hanley <RHanley@bcarch.org>; 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dianned@swo-nsn.gov' <dianned@swo-nsn.gov>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; Jeremy Freeman <jeremy.freeman@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>; Pat Robblee <Pat.Robblee@erm.com>; Andrea Thornton <Andrea.Thornton@erm.com>
Subject: Re: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Good morning,

Thank you for your response. I think the best way forward would be to conduct the site visit with the archaeologist who identified the sites. At that time Tribal Historic Preservation Officers can discuss our concerns regarding identification of Tribal Cultural Properties.

Jon Eagle Sr., Tribal Historic Preservation Officer

Standing Rock Sioux Tribe

"Tokata wicoicage ki hena wacinniyapi!"

From: Raina Hanley [mailto:RHanley@bcarch.org]
Sent: Wednesday, September 9, 2020 3:50 PM
To: Jon Eagle <j.eagle@standingrock.org>; Linn, Jill <Jill.Linn@wbienergy.com>; 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dianned@swo-nsn.gov' <dianned@swo-nsn.gov>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; Jeremy Freeman <jeremy.freeman@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
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Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Good Afternoon,

As I understand it, efforts are being made to look at the specific CHFM sites the THPO from Ft. Peck requested, and that we have access to, this coming Friday, 9/11. Anyone else who is interested is welcome to join and just needs to let us know. I do not believe we have a specific time set but we're looking at meeting in Williston around 10 AM Central. Please let us know if you plan to be in attendance. I will get some additional meeting details emailed out tomorrow.

With that said, upon receiving additional inquiries regarding CHFM 5, we did some additional digging into the notes and with the representing BCA field staff. As such, we came to the following conclusion; it seems as though the cairn was agreed upon by ERM and the TCS; however, the TCSs were exploring another potential feature that was determined to be a non-feature. As such, CHFM 5 will continue to be recorded by us as a cultural cairn as agreed upon by ERM and TCSs. We will not be including the other potential feature that was determined not to be a feature. The updated PDF list reflecting this correction is attached to this email.
Also, for everyone's knowledge, CHFM 5 is located just outside of the survey corridor for the project. Nonetheless, we will continue to record it as a CHFM.

I apologize for any confusion we may have caused.

Raina Hanley
Chief Operating Officer

Beaver Creek Archaeology
1632 Capitol Way
Bismarck, ND 58501
Cell: (701) 595-0588
Ph: (701) 663-5521 | Fx: (701) 663-5589

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Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>; Pat Robblee <Pat.Robblee@erm.com>; Andrea Thornton <Andrea.Thornton@erm.com>; 'Kevin Malloy' <Kevin.Malloy@erm.com>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

** WARNING: EXTERNAL SENDER. NEVER click links or open attachments without positive sender verification of purpose. DO NOT provide your user ID or password on sites or forms linked from this email. **

Good afternoon,

I will also be attending the site visit. Please relay logistics on where I can meet up with everyone.

Thank you,

Jon Eagle Sr.,
Tribal Historic Preservation Officer
Standing Rock Sioux Tribe

"Tokata wicoicage ki wacinniyapi"

From: Linn, Jill [mailto:Jill.Linn@wbienergy.com]
Sent: Wednesday, September 09, 2020 4:45 PM
To: Jon Eagle <j.eagle@standingrock.org>; Raina Hanley <RHanley@bcarch.org>; 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dianned@swo-nsn.gov' <dianned@swo-nsn.gov>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; Jeremy Freeman <jeremy.freeman@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>; Pat Robblee <Pat.Robblee@erm.com>; Andrea Thornton <Andrea.Thornton@erm.com>; 'Kevin Malloy' <Kevin.Malloy@erm.com>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Thank you,
We are working through the logistics and will relay the plan as soon as it's in place.

Sincerely,

Jill Linn
Environmental Manager

WBIENERGY
TRANSMISSION

Office: 406-359-7332
Mobile: 406-939-5437

From: Raina Hanley
Sent: Wednesday, September 09, 2020 5:00 PM
To: Linn, Jill <Jill.Linn@wbienergy.com>; Jon Eagle <j.eagle@standingrock.org>; 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dianned@swo-nsn.gov' <dianned@swo-nsn.gov>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; Jeremy Freeman <jeremy.freeman@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
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Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Please plan to meet Wade and me this coming Friday, September 11, 2020, at 11 AM Central/10 AM Mountain at the Tobacco Garden Bay Resort & Marina Recreational Area. We can caravan from there. The meeting point is located at:

Tobacco Gardens Resort & Marina.
4781 ND-1806
Watford City, ND 58854

Raina Hanley
Chief Operating Officer

Beaver Creek Archaeology
1632 Capitol Way
Bismarck, ND 58501
Cell: (701) 595-0588
Ph: (701) 663-5521 | Fx: (701) 663-5589

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From: Raina Hanley [mailto:RHanley@bcarch.org]
Sent: Thursday, September 10, 2020 10:30 AM
To: 'Linn, Jill' <Jill.Linn@wbienergy.com>; 'Jon Eagle' <j.eagle@standingrock.org>; 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; Dianne Desrosiers <DianneD@SWO-NSN.GOV>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; 'Jeremy Freeman' <jeremy.freeman@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>; 'Pat Robblee' <Pat.Robblee@erm.com>; 'Andrea Thornton' <Andrea.Thornton@erm.com>; 'Kevin Malloy' <Kevin.Malloy@erm.com>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Good Morning,

I just wanted to follow-up and see if any of the other THPOs had intentions of participating in tomorrow's field reviews? As of now I have Fort Peck and Standing Rock confirmed for participation. At your earliest convenience, please let me know if you plan to be in attendance.

As for non-tribal participants I currently have the following: Wade, myself and one of our field reps from the project for BCA, Jill with WBI will be present. Also, as of this morning, the USFS, SHPO, and BLM have been invited to participate in the field review. I have received a confirmation thus far from one of the USFS archaeologists and one of the BLM archaeologists that they will be in attendance tomorrow.

Meeting Day and Time Reminder:

Tomorrow, Friday, September 11, 2020, at 11 AM Central/10 AM Mountain at the Tobacco Garden Bay Resort & Marina Recreational Area. We can caravan from there. The meeting point is located at:

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4781 ND-1806
Watford City, ND 58854

Thank you,

Raina Hanley
Chief Operating Officer

Beaver Creek Archaeology
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Bismarck, ND 58501
Cell: (701) 595-0588

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From: Dianne Desrosiers [mailto:DianneD@SWO-NSN.GOV]
Sent: Thursday, September 10, 2020 10:54 AM
To: Raina Hanley <RHanley@bcarch.org>; 'Linn, Jill' <Jill.Linn@wbienergy.com>; 'Jon Eagle' <j.eagle@standingrock.org>; 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; 'Jeremy Freeman' <jeremy.freeman@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
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Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Good morning,
The Sisseton Wahpeton Oyate will not be able to attend the site visit. Please keep us apprised of the outcome. We trust Ft Peck and Standing Rock THPO to act in our best interest. Thank you.

From: Raina Hanley [mailto:RHanley@bcarch.org]
Sent: Thursday, September 10, 2020 10:57 AM
To: Dianne Desrosiers <DianneD@SWO-NSN.GOV>; 'Linn, Jill' <Jill.Linn@wbienergy.com>; Jon Eagle <j.eagle@standingrock.org>; 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; Jeremy Freeman <jeremy.freeman@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
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Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Thank you for the update Dianne. We will be sure to keep everyone posted.

Raina Hanley
Chief Operating Officer

Beaver Creek Archaeology
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Bismarck, ND 58501
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Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

My apologies as I forgot to list one of the confirmed non-tribal participants for tomorrow's field review. ERM will have Jayson Zoino present. Again,

Meeting Day and Time Reminder:

Tomorrow, Friday, September 11, 2020, at 11 AM Central/10 AM Mountain at the Tobacco Garden Bay Resort & Marina Recreational Area. We can caravan from there. The meeting point is located at:

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Raina Hanley
Chief Operating Officer

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Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Good morning,

Unfortunately I cannot be a part of this site visit either. Not enough time for me to get all the appropriate signatures to authorize travel.

Jon Eagle Sr.,
Tribal Historic Preservation Officer
Standing Rock Sioux Tribe

"Tokata wicoicage ki wacinniyapi"

From: Raina Hanley [mailto:RHanley@bcarch.org]
Sent: Thursday, September 10, 2020 11:55 AM
To: Jon Eagle <j.eagle@standingrock.org>; Dianne Desrosiers <DianneD@SWO-NSN.GOV>; 'Linn, Jill' <Jill.Linn@wbienergy.com>; 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; Jeremy Freeman <jeremy.freeman@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
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Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Thank you for the update, Jon. We are sorry to hear that but will be sure to keep you updated and please let us know if things change for you by the end of today or tomorrow morning.

Raina Hanley
Chief Operating Officer

Beaver Creek Archaeology
1632 Capitol Way
Bismarck, ND 58501
Cell: (701) 595-0588
Ph: (701) 663-5521 | Fx: (701) 663-5589

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From: Jon Eagle [mailto:j.eagle@standingrock.org]
Sent: Thursday, September 10, 2020 4:18 PM
To: Raina Hanley <RHanley@bcarch.org>; Dianne Desrosiers <DianneD@SWO-NSN.GOV>; 'Linn, Jill' <Jill.Linn@wbienergy.com>; 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; Jeremy Freeman <jeremy.freeman@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>; 'Pat Robblee' <Pat.Robblee@erm.com>; 'Andrea Thornton' <Andrea.Thornton@erm.com>; 'Kevin Malloy' <Kevin.Malloy@erm.com>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Thank you Raina. I'm in contact with WBI. Sounds like they're open to scheduling a site visit for Rosebud, Sisseton Wahpeton Oyate and Standing Rock.

Jon Eagle Sr.,
Tribal Historic Preservation Officer
Standing Rock Sioux Tribe

"Tokata wicoicage ki wacinniyapi"

From: Raina Hanley
Sent: Thursday, September 10, 2020 4:33 PM
To: Jon Eagle <j.eagle@standingrock.org>; Dianne Desrosiers <DianneD@SWO-NSN.GOV>; 'Linn, Jill' <Jill.Linn@wbienergy.com>; 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; Jeremy Freeman <jeremy.freeman@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>; 'Pat Robblee' <Pat.Robblee@erm.com>; 'Andrea Thornton' <Andrea.Thornton@erm.com>; 'Kevin Malloy' <Kevin.Malloy@erm.com>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Glad to hear it, Jon! Also, just a reminder, for sites located on public lands such as USFS and BLM managed surfaces you are always welcome to go at your convenience and leisure.

Raina Hanley
Chief Operating Officer

Beaver Creek Archaeology
1632 Capitol Way
Bismarck, ND 58501
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Ph: (701) 663-5521 | Fx: (701) 663-5589

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From: Raina Hanley
Sent: Friday, September 11, 2020 7:36 AM
To: 'Jon Eagle' <j.eagle@standingrock.org>; 'Dianne Desrosiers' <DianneD@SWO-NSN.GOV>; 'Linn, Jill' <Jill.Linn@wbienergy.com>; 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; 'Jeremy Freeman' <jeremy.freeman@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>; 'Pat Robblee' <Pat.Robblee@erm.com>; 'Andrea Thornton' <Andrea.Thornton@erm.com>; 'Kevin Malloy' <Kevin.Malloy@erm.com>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Good Morning,

We will be heading out shortly for today's site visit with Ft. Peck and any of the other THPOs that are interested and able to attend. We will keep everyone updated regarding today's visit. As a second visit is being potentially planned for next week, I wanted to make sure it didn't conflict with next weeks TCC meeting hosted by the NDDOT. As I understand it, the TCC meeting is to be the mornings of Tuesday, 9/15 through Thursday, 9/17.

Also, to address any potential concerns regarding today's visit without SRST, we are continuing with today's review for multiple reasons. One is because WBI/ERM is trying to coordinate a call with the FERC project manager so that the tribes can talk to the FERC project manager. As I understand it, and as I believe she informed some of the THPOs already, Dyan at Ft. Peck wanted to see some of the sites around/before the time that ERM submits their report of the work completed thus far to the FERC (they will be submitting the report to FERC tomorrow). Dyan also wanted to make sure she saw some of the areas in question before any call is had between the tribes and the FERC project manager. Her schedule does not allow for next week between the TCC meeting and her TCSs field projects. Additionally, Dyan had also mentioned to me that she was hoping that by conducting a review earlier rather than later that everyone would be able catch things and/or correct things before reports and forms are officially submitted and filed with the various state and federal agencies. Point-in-Case, our conversations on CHFMs versus Archaeological Site Forms below.

As far as additional field visits, it sounds to me like WBI plans to be very accommodating to the THPOs that are interested in seeing specific locations. Jon at Standing Rock is working for a second field visit next week. If everyone that has an interest is able to agree upon a day, time, and location(s), We should be able to accommodate to the best of our abilities. For any of the THPOs wanting to see any specific areas they need to let Jill at WBI know a list of locations that they would like to see as well as a day and time to see them.

Raina Hanley
Chief Operating Officer

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From: Raina Hanley
Sent: Monday, September 14, 2020 11:10 AM
To: 'Jon Eagle' <j.eagle@standingrock.org>; 'Dianne Desrosiers' <DianneD@SWO-NSN.GOV>; 'Linn, Jill' <Jill.Linn@wbienergy.com>; 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; 'Jeremy Freeman' <jeremy.freeman@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Good Morning,

As you are aware, the fieldwork for the second field mobilization began on Friday. I have attached a PDF document with the update for the field efforts conducted on Friday and Saturday by the ERM archaeologists and TCSs.

As discussed below, on Friday, September 11, 2020, representatives from the USFS, BLM, SHPO, ERM, and BCA attended a field review of some of the areas where the ERM archaeologists encountered disagreements as to cultural features. Our meeting was meaningful and enlightening, as Dyan gave us all a lot to think about and opened up a group conversation for all participants to be heard. While no formal decisions were made, it certainly gave all participants a lot to think about and consider for these locations, this project, and in future.

Raina Hanley
Chief Operating Officer

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Note: The attachment referenced in this email has been filed under separate cover and is labelled "CUI//PRIV – DO NOT RELEASE".

From: Raina Hanley
Sent: Monday, September 14, 2020 11:47 AM
To: 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dianned@swo-nsn.gov' <dianned@swo-nsn.gov>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; 'jeremy.freeman@standingrock.org' <jeremy.freeman@standingrock.org>; 'Jon Eagle (j.eagle@standingrock.org)' <j.eagle@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Good Morning,

For email string and recipient consistency, I am re-sending the first weekly update for the second field mobilization of WBI's North Bakken Expansion project. Attached is a PDF document with the update for the field efforts conducted on Friday, 9/11, and Saturday, 9/12, by the ERM archaeologists and TCSs.

Also, as a part of the updating efforts and uniformity in information distribution, on Friday, September 11, 2020, representatives from the USFS, BLM, SHPO, ERM, BCA, and the Fort Peck THPO attended a field review of some of the areas where the ERM archaeologists encountered disagreements as to cultural features. Our meeting was meaningful and enlightening, as Dyan from the Fort Peck THPO gave us all a lot to think about and opened up a group conversation for all participants to be heard. While no formal decisions were made, it certainly gave all participants a lot to think about and consider for these locations, this project, and in future.

Raina Hanley
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Beaver Creek
ARCHAEOLOGY

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Note: The attachment referenced in this email has been filed under separate cover and is labelled "CUI//PRIV – DO NOT RELEASE".

From: Raina Hanley
Sent: Tuesday, September 15, 2020 12:16 PM
To: 'Steve Vance' <stevev.crstpres@outlook.com>; 'Michael Black Wolf' <mblackwolf@ftbelknap.org>; 'Dyan Youpee' <d.youpee@fortpecktribes.net>; 'cbearing.nathpo@gmail.com' <cbearing.nathpo@gmail.com>; 'bsr007.nathpo@gmail.com' <bsr007.nathpo@gmail.com>; 'Teanna Limpy' <teanna.limpy@cheyennenation.com>; 't.brings@oglala.org' <t.brings@oglala.org>; 'Ben Rhodd' <brhodd1@yahoo.com>; 'rst.thpo@rst-nsn.gov' <rst.thpo@rst-nsn.gov>; 'Benjamin Young' <benjamin1011young@gmail.com>; 'dianned@swo-nsn.gov' <dianned@swo-nsn.gov>; 'dyandancer@yahoo.com' <dyandancer@yahoo.com>; 'Erich Longie' <thpo@gondtc.com>; 'jeremy.freeman@standingrock.org' <jeremy.freeman@standingrock.org>; 'Jon Eagle (j.eagle@standingrock.org)' <j.eagle@standingrock.org>; 'Pete Coffey' <pcoffey@mhanation.com>; 'Jeffrey Desjarlais Jr.' <desjarlaisjr.jeffrey@yahoo.com>; 'Kip Spotted Eagle' <yst.thpo@gmail.com>
Cc: Wade Burns <WBurns@bcarch.org>; Irene Altieri <ialtieri@bcarch.org>
Subject: RE: BCA20-1313: THPO/TCS N. Bakken Field Details Update

Good Afternoon,

I have received confirmation from Jill at WBI that we are to be meeting with Jon from SRST and Ben from RST this coming **Thursday (9/17) at 10:00 AM Central/9:00 AM Mountain**. We will plan to meet at the same location and review the same areas as we did last week. We will also plan to review the same locations that we did last week. These areas are all on USFS surface and in close proximity to each other. The locales to be reviewed are discussed in the weekly update emails and communications as: CHF 7, CHF 9, CHF 11, CHF 17, and CHF 18. For your schedule planning, you can assume that the review will take a few hours.

Also, to note is that as of this morning, I have had correspondence with the USFS archaeologist for the area (Andrea) that has indicated that she will be out of the office and, as such unavailable to attend. I am not sure if the USFS will be able to send anyone else in her absence, and I am not sure if any of the other agency representatives can be in attendance. Please note that I just alerted the agencies to this event. As I believe that they are to be a part of the TCC meeting that will be continuing on Thursday morning, I am not sure they would be able to make it.

Again, we will be meeting at the Tobacco Garden Bay Resort & Marina Recreational Area. We can caravan from there. The meeting point is located at:

Tobacco Gardens Resort & Marina.
4781 ND-1806
Watford City, ND 58854

At your earliest convenience, please let me know if you plan to be in attendance.

Thank you,

Raina Hanley
Chief Operating Officer

Beaver Creek Archaeology

1632 Capitol Way
Bismarck, ND 58501
Cell: (701) 595-0588
Ph: (701) 663-5521 | Fx: (701) 663-5589

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Notes from Field Meetings

North Bakken Pipeline 2020 Tribal Coordination | MINUTES

9/11/2020 | ~11:00 am- 1:30 pm CST | Site Visit

Meeting called by: Dyan Youpee

Type of meeting: Site Visitation and Discussion

Facilitator: Jill Linn

Attendees:

1. *Beaver Creek Archaeology (BCA)*
   a. Wade Burns
   b. Raina Hanley
   c. Larry Pallozzi
2. *WBI Energy, Inc.*
   a. Jill Linn
3. *United States Forest Service*
   a. Andrea Kruse
   b. Lucas Graf
4. *North Dakota State Historic Preservation Office*
   a. Andrew Clark
   b. Fern Swenson
5. *Bureau of Land Management*
   a. Katherine West
6. *Environmental Resources Management (ERM)*
   a. Jayson Zoino
7. *Fort Peck Tribal Historic Preservation Office*
   a. Dyan Youpee
   b. Eugene Ryan

AGENDA TOPICS

11 am – 1:30 pm CST | *Time* | Agenda topic: Field Review

Summary:

Representatives from the USFS, BLM, WBI, SHPO, ERM, BCA, and representatives from Fort. Peck attended a field review of some of the areas where the ERM archaeologists encountered disagreements as to cultural features. The meeting was meaningful and enlightening, as Dyan from Fort. Peck gave the other participants a lot to think about and opened up a group conversation for all participants to be heard. While no formal decisions were made, it certainly gave all participants a lot to think about and consider for these locations, this project, and in future.

North Bakken Pipeline 2020 Tribal Coordination | MINUTES

9/17/2020 | ~10:00 am- 1:00 pm CST | Site Visit

Meeting called by	Jon Eagle Sr.
Type of meeting	Site Visitation and Discussion
Facilitator	Jill Linn

Attendees:

1. *Beaver Creek Archaeology (BCA)*
   a. Wade Burns
   b. Raina Hanley
   c. Larry Pollazzi
2. *Bureau of Land Management*
   a. Katherine West
3. *Environmental Resources Management (ERM)*
   a. Jayson Zoino
4. *Standing Rock Sioux Tribe Tribal Historic Preservation Office*
   a. Jon Eagle Sr.
5. *Rosebud Sioux Tribe Tribal Historic Preservation Office*
   a. Ben Rhodd
6. *WBI Energy, Inc.*
   a. Jill Linn

AGENDA TOPICS

~10:00 am – 1:00 pm CST | *Time* | Agenda topic: Field Review

Summary:

Representatives from the BLM, WBI, ERM, BCA, and representatives from Standing Rock and Rosebud attended a field review of some of the areas where the ERM archaeologists encountered disagreements as to cultural features. It was determined that one of the CHF boundaries will be expanded after discussion. The meeting was meaningful and enlightening, as both Jon from SRST and Ben from RST gave the other participants a lot to think about. Their perspective(s) gave all of the participants a lot to think about and consider for these locations, this project, and in the future.

Correspondence Log with Agencies

Communications with All Agencies

Date	Summary of Communications
7/23/2020	
BLM, SHPO, USACE, USFS	At 12:25 pm CST, Raina emailed all project-specific applicable THPOs, cc'ing all involved state and federal agencies (excluding FERC). The email had the sixth weekly update for the project. Included in the email were some special notes regarding the planned end date for the project as well as providing updates with respect to the Hartel property and BCA20-1313-CHFMSite15.
9/10/2020	
BLM, SHPO, USFS, WBI *on behalf of FERC*	At 10:06 am CST, Raina emailed Liv, Beth, Troy, Andrea, Andy, and Katie, cc'ing Wade and Jill. Raina apologized for the last minute notice then gave them the run down of the site visit happening the next day.
USFS	At 10:24 am CST, Andrea emailed Raina letting her know that she plans on attending the site visit for sites on USFS land.
	At 10:25 am CST, Raina emailed Andrea and asked whether Troy will be attending.
BLM	At 10:28 am CST, Katie emailed Raina letting her know that she will be in attendance.
USFS	At 10:30 am CST, Andrea emailed Raina and said that Troy will not be attending at that time.
BLM, SHPO, USFS, WBI *on behalf of FERC*	At 12:35 pm CST, Andy emailed Liv, Beth, Troy, Andrea, Katie, cc'ing Wade and Jill. He asked if Raina can provide the site numbers for the site visit on September 11.
	At 12:57 pm CST, Raina emailed Liv, Beth, Troy, Andrea, Andy, and Katie, cc'ing Wade and Jill. Raina let them know that there is currently no site numbers as the site forms had not been submitted.
	At 1:06 pm CST, Andy emailed Liv, Beth, Troy, Andrea, Katie, cc'ing Wade and Jill and Fern. Andy asked for descriptions and location information for the sites and clarification on the nature of the disagreements between TCSs and ERM Archaeologists.
	At 1:11 pm CST, Raina emailed Liv, Beth, Troy, Andrea, Andy, and Katie, cc'ing Wade, Fern and Jill. She let them know that she followed up the earlier message with additional information regarding the sites in question. She also explained the nature of disagreements between TCSs and ERM Archaeologists as well as the main purpose of the site visit.
	At 1:16 pm CST, Raina emailed Liv, Beth, Troy, Andrea, Andy, and Katie, cc'ing Wade, Fern and Jill. Attached to the email was a general locations map for the sites. She explained that there will be information packets available for the site visit. She also reiterated the reason and purpose of he site visit.
	At 1:39 pm CST, Andy emailed Liv, Beth, Troy, Andrea, Katie, cc'ing Wade and Jill and Fern. Andy voiced a question for discussion regarding the types of forms that could be submitted.
	At 1:43 pm CST, Raina emailed Liv, Beth, Troy, Andrea, Andy, and Katie, cc'ing Wade, Fern and Jill. Raina explained why the areas were to be documented as they were.
	At 2:05 pm CST, Raina emailed Liv, Beth, Troy, Andrea, Andy, and Katie, cc'ing Wade, Fern and Jill. Raina explained why the areas were to be documented as they were and that it still may not relieve the concerns of the tribes.

9/10/2020	
BLM, SHPO, USFS, WBI *on behalf of FERC*	At 6:08 pm CST, Raina emailed Liv, Beth, Troy, Andrea, Andy, and Katie, cc'ing Wade, Fern and Jill. Raina provided an update that SRST and some other THPOs will not be able to participate in the site visit and the reasons why the site visit will continue.
9/14/2020	
BLM, SHPO, USFS, WBI *on behalf of FERC*	At 11:16 am CST, Raina emailed Liv, Beth, Troy, Andrea, Andy and Katie, cc'ing Wade, Fern and Jill. She provided a snippet from an email that was sent to the THPOs regarding the results for the September 11 site visit.
9/15/2020	
BLM, SHPO, USFS, WBI *on behalf of FERC*	At 11:34 am CST, Raina emailed Liv, Beth, Troy, Andrea, Andy and Katie, cc'ing Wade, Fern and Jill. She provided confirmation from Jill that there will be a second site visit including Jon of SRST and Ben from RST and provided the meeting details for it.
BLM	At 4:54 pm CST, Katie emailed Raina letting her know that she will be in attendance.
9/18/2020	
BLM, SHPO, USFS, WBI *on behalf of FERC*	At 8:56 am CST, Raina emailed Andy, Liv, Beth, Troy, Andrea, and Katie, cc'ing Wade, Fern and Jill. She said that she would suggest reaching out to ERM for the answer to his question.
	At 9:49 am CST, Raina emailed Liv, Beth, Troy, Andrea, Andy and Katie, cc'ing Wade, Fern and Jill. She provided an update regarding the site visit from the day before.
	At 9:52 am CST, Andy emailed Raina, Liv, Beth, Troy, Andrea, Katie, cc'ing Wade and Jill. He asked if anyone had contacted Dawn from FERC regarding the meetings.
	At 9:56 am CST, Raina emailed Andy, Liv, Beth, Troy, Andrea, and Katie, cc'ing Wade, Jill and Fern. She let them know that she is unsure if Dawn had been contacted and suggested reaching out to ERM on the subject.
	At 9:57 am CST, Raina emailed Andy, Liv, Beth, Troy, Andrea, and Katie, cc'ing Wade, Jill and Fern. Raina addressed Jill suggesting that she might be able to help him on his question regarding FERC.
	At 9:58 am CST, Jill emailed Raina, Andy, Liv, Beth, Troy, Andrea, and Katie, cc'ing Wade and Fern. She informed them that Dawn was made aware of them verbally and that an update is on the docket for a meeting that will include minutes from the meetings.
	At 10:08 am CST, Beth emailed Raina, Andy, Liv, Troy, Andrea, and Katie, cc'ing Wade, Jill and Fern. In her email, Beth stated that that while the issues are of importance to all associated agencies and tribes, the areas in question are on USFS land and are therefore under the purview of the USFS. As such discussions regarding documentation need to be through USFS. She continued by saying that she would like a call from the ERM archaeologist that had documented the areas in question to discuss them. Beth provided her phone number saying that is is best to text her first to make sure she isn't in a meeting.
	At 10:11 am CST, Raina emailed Beth, Andy, Liv, Troy, Andrea, and Katie, cc'ing Wade, Jill and Fern. She addressed Beth saying tht ERM will have to talk to her about their findings. As far as BCA is concerned the areas in question will be documented as CHFs. She closed the email by extending the invitation for a phone disussion.

9/18/2020	
BLM, SHPO, USFS, WBI *on behalf of FERC*	At 10:25 am CST, Beth emailed Raina, Andy, Liv, Troy, Andrea and Katie, cc'ing Wade, Jill and Fern. Beth addressed Raina says that she understood how BCA was documenting the areas in question. She then stated that as the agency legally responsible for the property management any final disposition of documentation needs to be discussed with USFS. She closed with reiterating that she would like a call from the ERM archaeologist working to document the areas.
	At 10:31 am CST, Raina emailed Beth, Andy, Liv, Troy, Andrea, and Katie, cc'ing Wade, Jill and Fern. She acknowledged her last email and said that she will let ERM now to give her a call.
	At ~11:00 am CST, Wade called Beth to discuss the process of documentation.
	At 11:06 am CST, Wade emailed Beth,cc'ing Raina, Andy, Liv, Troy, Andrea, Katie, Jill and Fern. He addressed Beth saying that BCA is in charge of the CHF forms while ERM is in charge of the archaeological forms. He had intended to go over he boundary change on the CHF forms with Andrea when she returned from vacation. He explained that there should be no change in the archaeological form's boundary as SHPO only wanted tribal features documented on CHF forms and not the archaeological forms. He stated that he tried to call her and asked her to give him a call.

Emails with Agencies

From: Raina Hanley <RHanley@bcarch.org>
Sent: Thursday, September 10, 2020 10:06 AM
To: 'Liv Fetterman (lfetterman@fs.fed.us)' <lfetterman@fs.fed.us>; Bigelow, Elizabeth E -FS <elizabeth.e.bigelow@usda.gov>; Price, Troy - FS <troy.price@usda.gov>; Kruse, Andrea - FS <Andrea.Kruse@usda.gov>; Clark, Andrew <andrewclark@nd.gov>; West, Katherine J <KWest@blm.gov>
Cc: Wade Burns <WBurns@bcarch.org>; 'Linn, Jill' <Jill.Linn@wbienergy.com>
Subject: upcoming BCA20-1313: CHFM Site Visit(s) for WBI's N. Bakken Pipeline
Importance: High

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Good Morning,

I apologize for the last-minute notice; however, later yesterday afternoon we were able to coordinate a requested CHFM site visit with at least two of the THPOs participating in the subject line project. Kevin at ERM may have already reached out to you about this. We plan to review three sites that archaeologists and TCSs disagreed upon located north of Watford City on USFS surface. If interest remains and time and access allow, then we will also plan to visit two similar sites on Private surface located north of Tioga. The sites being reviewed were specifically requested to be reviewed by the Ft. Peck THPO.

The meeting location information is as follows:

Tomorrow, Friday, September 11, 2020, at 11 AM Central/10 AM Mountain at the Tobacco Garden Bay Resort & Marina Recreational Area. We can caravan from there. The meeting point is located at:

Tobacco Gardens Resort & Marina.
4781 ND-1806
Watford City, ND 58854

Raina Hanley
Chief Operating Officer

Beaver Creek Archaeology
1632 Capitol Way
Bismarck, ND 58501
Cell: (701) 595-0588
Ph: (701) 663-5521 | Fx: (701) 663-5589

Beaver Creek Archaeology
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From: Clark, Andrew [mailto:andrewclark@nd.gov]
Sent: Thursday, September 10, 2020 12:35 PM
To: Raina Hanley <RHanley@bcarch.org>; 'Liv Fetterman (lfetterman@fs.fed.us)' <lfetterman@fs.fed.us>; Bigelow, Elizabeth E -FS <elizabeth.e.bigelow@usda.gov>; Price, Troy - FS <troy.price@usda.gov>; Kruse, Andrea - FS <Andrea.Kruse@usda.gov>; West, Katherine J <KWest@blm.gov>
Cc: Wade Burns <WBurns@bcarch.org>; 'Linn, Jill' <Jill.Linn@wbienergy.com>
Subject: RE: upcoming BCA20-1313: CHFM Site Visit(s) for WBI's N. Bakken Pipeline

Hi Raina,

Could you provide the site numbers for the visit tomorrow. We would like to have information on the sites before seeing them in person.

Andy

Andrew Clark, PhD
Chief Archaeologist
Archaeology and Historic Preservation Division
State Historical Society of North Dakota
612 East Boulevard Avenue
Bismarck, North Dakota 58505-0830
701-328-3574

From: Raina Hanley <RHanley@bcarch.org>
Sent: Thursday, September 10, 2020 12:57 PM
To: Clark, Andrew <andrewclark@nd.gov>; 'Liv Fetterman (lfetterman@fs.fed.us)' <lfetterman@fs.fed.us>; Bigelow, Elizabeth E -FS <elizabeth.e.bigelow@usda.gov>; Price, Troy - FS <troy.price@usda.gov>; Kruse, Andrea - FS <Andrea.Kruse@usda.gov>; West, Katherine J <KWest@blm.gov>
Cc: Wade Burns <WBurns@bcarch.org>; 'Linn, Jill' <Jill.Linn@wbienergy.com>
Subject: RE: upcoming BCA20-1313: CHFM Site Visit(s) for WBI's N. Bakken Pipeline

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There are no site numbers just CHFM numbers. The forms are not yet submitted.

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From: Clark, Andrew [mailto:andrewclark@nd.gov]
Sent: Thursday, September 10, 2020 1:06 PM
To: Raina Hanley <RHanley@bcarch.org>; 'Liv Fetterman (lfetterman@fs.fed.us)' <lfetterman@fs.fed.us>; Bigelow, Elizabeth E -FS <elizabeth.e.bigelow@usda.gov>; Price, Troy - FS <troy.price@usda.gov>; Kruse, Andrea - FS <Andrea.Kruse@usda.gov>; West, Katherine J <KWest@blm.gov>
Cc: Wade Burns <WBurns@bcarch.org>; 'Linn, Jill' <Jill.Linn@wbienergy.com>; Swenson, Fern E. <fswenson@nd.gov>
Subject: RE: upcoming BCA20-1313: CHFM Site Visit(s) for WBI's N. Bakken Pipeline

Could you provide descriptions and location of each site early this afternoon? I would like have some information prior to field visits.

I'm a little confused. Since we are visiting cultural heritage sites, what is the nature of the disagreement? Was ERM disagreeing with the recordation of these?

Andy

From: Raina Hanley
Sent: Thursday, September 10, 2020 1:11 PM
To: Clark, Andrew <andrewclark@nd.gov>; 'Liv Fetterman (lfetterman@fs.fed.us)' <lfetterman@fs.fed.us>; Bigelow, Elizabeth E -FS <elizabeth.e.bigelow@usda.gov>; Price, Troy - FS <troy.price@usda.gov>; Kruse, Andrea - FS <Andrea.Kruse@usda.gov>; West, Katherine J <KWest@blm.gov>
Cc: Wade Burns <WBurns@bcarch.org>; 'Linn, Jill' <Jill.Linn@wbienergy.com>; Swenson, Fern E. <fswenson@nd.gov>
Subject: RE: upcoming BCA20-1313: CHFM Site Visit(s) for WBI's N. Bakken Pipeline

I followed up the email I sent out below with some additional information that should be able to get you on the right path for the field visit.

The majority of the locations we will be reviewing are because the TCSs did not agree with the features recorded by ERM. As Dyan emailed you and Jill about, she has some concerns about what is being documented as features and subsequently archaeological sites by ERM and what sort of precedent that will be setting. There should be some details on that in some of the weekly updates you would have received.

The main purpose of the visit is for Dyan and any of the other interested THPOs to personally review the areas in disagreement to determine for themselves if they would agree with the participating TCSs or the ERM archaeologists. From there I presume they would have the necessary conversations of their thoughts with the appropriate agency individuals.

Hope this helps and I take it you plan to be in attendance tomorrow.

Raina Hanley
Chief Operating Officer

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From: Raina Hanley <RHanley@bcarch.org>
Sent: Thursday, September 10, 2020 1:16 PM
To: Clark, Andrew <andrewclark@nd.gov>; 'Liv Fetterman (lfetterman@fs.fed.us)' <lfetterman@fs.fed.us>; Bigelow, Elizabeth E -FS <elizabeth.e.bigelow@usda.gov>; 'Price, Troy - FS' <troy.price@usda.gov>; 'Kruse, Andrea - FS' <Andrea.Kruse@usda.gov>; West, Katherine J <KWest@blm.gov>
Cc: Wade Burns <WBurns@bcarch.org>; 'Linn, Jill' <Jill.Linn@wbienergy.com>; Swenson, Fern E. <fswenson@nd.gov>
Subject: RE: upcoming BCA20-1313: CHFM Site Visit(s) for WBI's N. Bakken Pipeline

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General Location maps attached. As I stated in one of my follow-up emails, that is not shown in the string of emails below:

"Per Dyan's request, we will be looking at CHFM 7, CHFM 9, CHFM 11, and if interest, time, and access allow CHFM 26 and CHFM 27.
Information provided thus far regarding those specific CHFMs to the THPOs, WBI, and ERM is detailed below. The Parcel numbers are detailed, if they were provided to us. It looks like the parcels coincide with TRS information. Accordingly, that should be helpful as far as location information.

We will have information packets prepared for distribution to all attendees of tomorrow's meeting.

BCA20-1313-CHFMSite7 **One cairn** [redacted] **None of the TCSs agreed it was a CHF**

BCA20-1313-CHFMSite9 **One crescent** [redacted] **ERM identified 6 stone circles that the TCSs said were not cultural; however, one of the TCSs found one feature (a crescent) that was identified as a CHF during the second site visit**

BCA20-1313-CHFMSite11 **Five cairns and three stone circles** [redacted] **None of the TCSs agreed it was a CHF**

BCA20-1313-CHFMSite26 **One stone circle** [redacted] **None of the TCSs agreed it was a CHF**
BCA20-1313-CHFMSite27 **One stone circle** **None of the TCSs agreed it was a CHF**
"

Also, to reiterate my email below: "The majority of the locations we will be reviewing are because the TCSs did not agree with the features recorded by ERM. As Dyan emailed you and Jill about, she has some concerns about what is being documented as features and subsequently archaeological sites by ERM and what sort of precedent that will be setting. There should be some details on that in some of the weekly updates you would have received.

The main purpose of the visit is for Dyan and any of the other interested THPOs to personally review the areas in disagreement to determine for themselves if they would agree with the participating TCSs or the ERM archaeologists. From there I presume they would have the necessary conversations of their thoughts with the appropriate agency individuals. “

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From: Clark, Andrew [mailto:andrewclark@nd.gov]
Sent: Thursday, September 10, 2020 1:39 PM
To: Raina Hanley <RHanley@bcarch.org>; 'Liv Fetterman (lfetterman@fs.fed.us)' <lfetterman@fs.fed.us>; Bigelow, Elizabeth E -FS <elizabeth.e.bigelow@usda.gov>; 'Price, Troy - FS' <troy.price@usda.gov>; 'Kruse, Andrea - FS' <Andrea.Kruse@usda.gov>; West, Katherine J <KWest@blm.gov>
Cc: Wade Burns <WBurns@bcarch.org>; 'Linn, Jill' <Jill.Linn@wbienergy.com>; Swenson, Fern E. <fswenson@nd.gov>
Subject: RE: upcoming BCA20-1313: CHFM Site Visit(s) for WBI's N. Bakken Pipeline

Thanks for the info Raina.

I do have a question that we can discuss tomorrow. If none of the TCSs thought that a few were not cultural heritage sites, why were they recorded that way? If ERM felt they were archaeological, they should be recorded on an archaeological site form. If the TCSs didn't agree that they were sites, they should not have a corresponding Cultural Heritage Form. ERM has stated that it was their intent to put the TCS disagreement in the archaeological site form.

Andy

From: Raina Hanley
Sent: Thursday, September 10, 2020 1:43 PM
To: Clark, Andrew <andrewclark@nd.gov>; 'Liv Fetterman (lfetterman@fs.fed.us)' <lfetterman@fs.fed.us>; Bigelow, Elizabeth E -FS <elizabeth.e.bigelow@usda.gov>; 'Price, Troy - FS' <troy.price@usda.gov>; 'Kruse, Andrea - FS' <Andrea.Kruse@usda.gov>; West, Katherine J <KWest@blm.gov>
Cc: Wade Burns <WBurns@bcarch.org>; 'Linn, Jill' <Jill.Linn@wbienergy.com>; Swenson, Fern E. <fswenson@nd.gov>
Subject: RE: upcoming BCA20-1313: CHFM Site Visit(s) for WBI's N. Bakken Pipeline

They are being recorded as a CHFM to document the tribal interpretation that they are not cultural sites at all and the fact that the participating TCSs had issues with ERM documenting them as archaeological sites.

Thanks.

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From: Raina Hanley
Sent: Thursday, September 10, 2020 2:05 PM
To: 'Clark, Andrew' <andrewclark@nd.gov>; 'Liv Fetterman (lfetterman@fs.fed.us)' <lfetterman@fs.fed.us>; 'Bigelow, Elizabeth E -FS' <elizabeth.e.bigelow@usda.gov>; 'Price, Troy - FS' <troy.price@usda.gov>; 'Kruse, Andrea - FS' <Andrea.Kruse@usda.gov>; 'West, Katherine J' <KWest@blm.gov>
Cc: Wade Burns <WBurns@bcarch.org>; 'Linn, Jill' <Jill.Linn@wbienergy.com>; 'Swenson, Fern E.' <fswenson@nd.gov>
Subject: RE: upcoming BCA20-1313: CHFM Site Visit(s) for WBI's N. Bakken Pipeline

Also, in regards to the statement about ERM including anything pertaining to tribal opinions and perspectives regarding what they are documenting as archaeological thoughts, I was under the impression from our original conversations for this project that our role, as the firm that was coordinating the tribal involvement, that tribal opinion was not to be included in the archaeology site forms and our archaeological opinion was not to be in the cultural heritage forms.

Irrespective of the documentation protocol, I do not think that, in any way, alleviates the concerns that have been raised by the tribes about the field disagreement and subsequent documentation. I can say with certainty in all my years working here, this situation has never been encountered, and as such, no protocol ever developed.

I am sure once we all get together tomorrow, we can discuss all of our opinions and concerns and come to a common understanding and agreement as to the best way to move forward with documenting the areas in question.

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From: Raina Hanley
Sent: Thursday, September 10, 2020 6:08 PM
To: 'Clark, Andrew' <andrewclark@nd.gov>; 'Liv Fetterman (lfetterman@fs.fed.us)' <lfetterman@fs.fed.us>; 'Bigelow, Elizabeth E -FS' <elizabeth.e.bigelow@usda.gov>; 'Price, Troy - FS' <troy.price@usda.gov>; 'Kruse, Andrea - FS' <Andrea.Kruse@usda.gov>; 'West, Katherine J' <KWest@blm.gov>
Cc: Wade Burns <WBurns@bcarch.org>; 'Linn, Jill' <Jill.Linn@wbienergy.com>; 'Swenson, Fern E.' <fswenson@nd.gov>
Subject: RE: upcoming BCA20-1313: CHFM Site Visit(s) for WBI's N. Bakken Pipeline

UPDATE:

Standing Rock and some of the other THPOs will not be able to make tomorrow's field review. Some are proposing an alternative day and time later next week.

We are continuing with tomorrow's review for multiple reasons. One is because WBI/ERM is trying to coordinate a call with the FERC project manager so that the tribes can talk to the FERC project manager. As I understand it, Dyan at Ft. Peck wanted to see some of the sites around/before the time that ERM submits their report of the work completed thus far to the FERC (they will be submitting the report to FERC tomorrow). Dyan also wanted make sure she saw some of the areas in question before any call is had between the tribes and the FERC project manager. Her schedule does not allow for next week between the TCC meeting and her TCSs field projects. Additionally, Dyan had also mentioned to me that she was hoping that by conducting a review earlier rather than later that everyone would be able catch things and/or correct things before reports and forms are officially submitted and filed with the various state and federal agencies. Point-in-Case, our conversations on CHFMs versus Archaeological Site Forms below.

As far as additional field visits, it sounds to me like WBI plans to be very accommodating to the THPOs that are interested in seeing specific locations. Jon at Standing Rock is working for a second field visit next week. If everyone that has an interest is able to agree upon a day, time, and location(s), I think we will all be willing and able to accommodate to the best of our abilities. Unfortunately, Wade would not be available next week.

For any of the THPOs wanting to see any specific areas they need to let Jill at WBI know a list of locations that they would like to see as well as a day and time to see them. I have also reminded the THPOs for sites located on public lands such as USFS and BLM managed surfaces you are always welcome to go at your convenience and leisure.

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From: Raina Hanley
Sent: Monday, September 14, 2020 11:16 AM
To: 'Clark, Andrew' <andrewclark@nd.gov>; 'Liv Fetterman (lfetterman@fs.fed.us)' <lfetterman@fs.fed.us>; 'Bigelow, Elizabeth E -FS' <elizabeth.e.bigelow@usda.gov>; 'Price, Troy - FS' <troy.price@usda.gov>; 'Kruse, Andrea - FS' <Andrea.Kruse@usda.gov>; 'West, Katherine J' <KWest@blm.gov>
Cc: Wade Burns <WBurns@bcarch.org>; 'Linn, Jill' <Jill.Linn@wbienergy.com>; 'Swenson, Fern E.' <fswenson@nd.gov>
Subject: RE: upcoming BCA20-1313: CHFM Site Visit(s) for WBI's N. Bakken Pipeline

Below is the update that was sent out to the THPOs regarding our meeting on Friday.

As discussed below, on Friday, September 11, 2020, representatives from the USFS, BLM, SHPO, ERM, and BCA attended a field review of some of the areas where the ERM archaeologists encountered disagreements as to cultural features. Our meeting was meaningful and enlightening, as Dyan gave us all a lot to think about and opened up a group conversation for all participants to be heard. While no formal decisions were made, it certainly gave all participants a lot to think about and consider for these locations, this project, and in future.

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Chief Operating Officer

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From: Raina Hanley
Sent: Tuesday, September 15, 2020 11:34 AM
To: 'Clark, Andrew' <andrewclark@nd.gov>; 'Liv Fetterman (lfetterman@fs.fed.us)' <lfetterman@fs.fed.us>; 'Bigelow, Elizabeth E -FS' <elizabeth.e.bigelow@usda.gov>; 'Price, Troy - FS' <troy.price@usda.gov>; 'Kruse, Andrea - FS' <Andrea.Kruse@usda.gov>; 'West, Katherine J' <KWest@blm.gov>
Cc: Wade Burns <WBurns@bcarch.org>; 'Linn, Jill' <Jill.Linn@wbienergy.com>; 'Swenson, Fern E.' <fswenson@nd.gov>
Subject: RE: upcoming BCA20-1313: CHFM Site Visit(s) for WBI's N. Bakken Pipeline

Good Morning,

I have received confirmation from Jill at WBI that we will be meeting with Jon from SRST and Ben from RST this coming Thursday (9/17) at 10:00 AM Central/9:00 AM Mountain.
We will plan to meet at the same location and review the same areas as we did last week, on USFS surface. I have had correspondence with Andrea today that has indicated that she will be out of the office and as such unavailable to attend.

Again, we will be meeting at the Tobacco Garden Bay Resort & Marina Recreational Area. We can caravan from there. The meeting point is located at:

Tobacco Gardens Resort & Marina.
4781 ND-1806
Watford City, ND 58854

At your earliest convenience, please let me know if you will be able to be in attendance.

Thank you,

Raina Hanley
Chief Operating Officer

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From: Raina Hanley <RHanley@bcarch.org>
Sent: Friday, September 18, 2020 9:49 AM
To: Clark, Andrew <andrewclark@nd.gov>; 'Liv Fetterman (lfetterman@fs.fed.us)' <lfetterman@fs.fed.us>; Bigelow, Elizabeth E -FS <elizabeth.e.bigelow@usda.gov>; 'Price, Troy - FS' <troy.price@usda.gov>; 'Kruse, Andrea - FS' <Andrea.Kruse@usda.gov>; West, Katherine J <KWest@blm.gov>
Cc: Wade Burns <WBurns@bcarch.org>; 'Linn, Jill' <Jill.Linn@wbienergy.com>; Swenson, Fern E. <fswenson@nd.gov>
Subject: RE: upcoming BCA20-1313: CHFM Site Visit(s) for WBI's N. Bakken Pipeline

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Good Morning,

Your agency update for yesterday's meeting is below. It is the same update I sent out to the THPOs.

As you may be aware, yesterday Thursday, September 17, 2020, representatives from the BLM, ERM, BCA, and the Standing Rock and Rosebud THPOs attended a field review of some of the areas where the ERM archaeologists encountered disagreements as to cultural features. Our meeting was meaningful and enlightening, as both Jon from SRST and Ben from RST gave us all a lot to think about. Their perspective(s) gave all of the participants a lot to think about and consider for these locations, this project, and in future.

Have a nice day.

Raina Hanley
Chief Operating Officer

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From: Clark, Andrew [mailto:andrewclark@nd.gov]
Sent: Friday, September 18, 2020 9:52 AM
To: Raina Hanley <RHanley@bcarch.org>; 'Liv Fetterman (lfetterman@fs.fed.us)' <lfetterman@fs.fed.us>; Bigelow, Elizabeth E -FS <elizabeth.e.bigelow@usda.gov>; 'Price, Troy - FS' <troy.price@usda.gov>; 'Kruse, Andrea - FS' <Andrea.Kruse@usda.gov>; West, Katherine J <KWest@blm.gov>
Cc: Wade Burns <WBurns@bcarch.org>; 'Linn, Jill' <Jill.Linn@wbienergy.com>; Swenson, Fern E. <fswenson@nd.gov>
Subject: RE: upcoming BCA20-1313: CHFM Site Visit(s) for WBI's N. Bakken Pipeline

Hi Raina,

Has anyone contacted Dawn Ramsey at FERC regarding these meetings?

Andy

Andrew Clark, PhD
Chief Archaeologist
Archaeology and Historic Preservation Division
State Historical Society of North Dakota
612 East Boulevard Avenue
Bismarck, North Dakota 58505-0830
701-328-3574

From: Raina Hanley [mailto:RHanley@bcarch.org]
Sent: Friday, September 18, 2020 7:57 AM
To: 'Clark, Andrew' <andrewclark@nd.gov>; Fetterman, Liv K -FS <liv.fetterman@usda.gov>; Bigelow, Elizabeth E -FS <elizabeth.e.bigelow@usda.gov>; Price, Troy - FS <troy.price@usda.gov>; Kruse, Andrea - FS <Andrea.Kruse@usda.gov>; 'West, Katherine J' <KWest@blm.gov>
Cc: Wade Burns <WBurns@bcarch.org>; 'Linn, Jill' <Jill.Linn@wbienergy.com>; 'Swenson, Fern E.' <fswenson@nd.gov>
Subject: RE: upcoming BCA20-1313: CHFM Site Visit(s) for WBI's N. Bakken Pipeline

Jill- perhaps you can help Andy out some with his question below as WBI has been delegated the task of compliance from the FERC as you have been present at both meetings.

Raina Hanley
Chief Operating Officer

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From: Bigelow, Elizabeth E -FS [mailto:elizabeth.e.bigelow@usda.gov]
Sent: Friday, September 18, 2020 10:08 AM
To: Raina Hanley <RHanley@bcarch.org>; 'Clark, Andrew' <andrewclark@nd.gov>; Fetterman, Liv K -FS <liv.fetterman@usda.gov>; Price, Troy - FS <troy.price@usda.gov>; Kruse, Andrea - FS <Andrea.Kruse@usda.gov>; 'West, Katherine J' <KWest@blm.gov>
Cc: Wade Burns <WBurns@bcarch.org>; 'Linn, Jill' <Jill.Linn@wbienergy.com>; 'Swenson, Fern E.' <fswenson@nd.gov>
Subject: RE: upcoming BCA20-1313: CHFM Site Visit(s) for WBI's N. Bakken Pipeline

All:

While the issues covered are of importance to all of the associated agencies and Tribes, the sites in question are all on FS/Grasslands managed properties and therefore under the purview of this office. As such, the discussion of how we will be moving forward concerning the documentation types, etc. need to be with this office. FERC should be kept up to date through the contractor and any questions or concerns can be addressed to this office.

My understanding of the two site visits is that the discussions resulted in a more definitive – all though differing – view from all of the Tribes than was presented earlier in this email chain.

I would like a call from the archaeologist documenting these areas to discuss how those sites on FS/Grasslands managed properties will be documented as based on the archaeologists findings and the extremely important Tribal information provided during those meetings (as well as our on-going consultation).

I am available by phone: 775-389-0125. It is best to text first to make sure that I'm not in a meeting.

Thank you,

Beth Bigelow, Acting Forest Archaeologist, DPG

<image002.png>

Beth Bigelow
North Zone Archaeologist

Forest Service
Idaho Panhandle National Forests,
Sandpoint, Bonners Ferry, Priest Lake Ranger Districts

p: 208-267-6721
elizabeth.e.bigelow@usda.gov
6286 Main Street
Bonners Ferry, ID 83805
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<image003.png>
<image004.png>
<image005.png>

Caring for the land and serving people

From: Raina Hanley [mailto:RHanley@bcarch.org]
Sent: Friday, September 18, 2020 8:11 AM
To: Bigelow, Elizabeth E -FS <elizabeth.e.bigelow@usda.gov>; 'Clark, Andrew' <andrewclark@nd.gov>; Fetterman, Liv K -FS <liv.fetterman@usda.gov>; Price, Troy - FS <troy.price@usda.gov>; Kruse, Andrea - FS <Andrea.Kruse@usda.gov>; 'West, Katherine J' <KWest@blm.gov>
Cc: Wade Burns <WBurns@bcarch.org>; 'Linn, Jill' <Jill.Linn@wbienergy.com>; 'Swenson, Fern E.' <fswenson@nd.gov>
Subject: RE: upcoming BCA20-1313: CHFM Site Visit(s) for WBI's N. Bakken Pipeline

Hi Beth,

ERM will have to talk to you about their archaeological findings. They do have their site forms on file at SHPO so their take on the locales should be ready for your review unless you are looking for more information.

As far as our firm being involved with the tribal coordination, it sounds like the areas in question will be being documented as CHFs.

If you would like to schedule a call to further discuss, we can.

Raina Hanley
Chief Operating Officer

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On Sep 18, 2020, at 10:25 AM, Bigelow, Elizabeth E -FS <elizabeth.e.bigelow@usda.gov> wrote:

Good morning Raina,

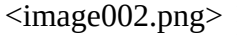
Yes, I understand that the sites are already documented and with the SHPO and the sites will be documented as CHFs.

Regardless, as the agency who is responsible for the management of these properties, any final disposition of documentation – including possible updates to the existing sites form currently at the SHPO's office as based on the most recent in-field consultation – needs to be discussed with the agency who is legally responsible for the management of those properties.

I am not in the Dakotas and do not have the contact information readily available, so as stated below I would like a call from whomever is working to document the archaeological sites, the full report, whichever. I need to assure that the information we need is included in that reporting as this is not just a simple "what form do we use" issue.

Thank you,

Beth



Beth Bigelow
North Zone Archaeologist

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Caring for the land and serving people

From: Wade Burns
Sent: Friday, September 18, 2020 11:06 AM
To: Bigelow, Elizabeth E -FS <elizabeth.e.bigelow@usda.gov>
Cc: Raina Hanley <RHanley@bcarch.org>; Clark, Andrew <andrewclark@nd.gov>; Fetterman, Liv K -FS <liv.fetterman@usda.gov>; Price, Troy - FS <troy.price@usda.gov>; Kruse, Andrea - FS <Andrea.Kruse@usda.gov>; West, Katherine J <kwest@blm.gov>; Linn, Jill <Jill.Linn@wbienergy.com>; Swenson, Fern E. <fswenson@nd.gov>
Subject: Re: upcoming BCA20-1313: CHFM Site Visit(s) for WBI's N. Bakken Pipeline

Beth,
BCA is in charge of the CHF forms while ERM is in charge of the archaeological forms. I had intended to go over the boundary change on the CHF forms with Andrea when she returns from vacation. There should be no change in the archaeologist form for their boundary as SHPO has indicated they want tribal features only documented on CHF forms and not on the archaeologist form. I tried giving you a call to discuss how you want to proceed. Please give me a call when you have a moment and we can discuss further.
Thanks,
Wade

Wade Burns
President

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