

Subsurface Investigation Report

Enbridge Line 5 Reroute

MP 6 HDD Crossing – Deer Creek

Location 3WB-A, West of Wilson Road, North of Deer Creek

Location 3WB-B, West of Wilson Road, North of Deer Creek

Location 3-DC-A, North of Schwiesow Road, South of Deer Creek

Location 3-DC-B, North of Schwiesow Road, South of Deer Creek

Town of White River, Ashland County, Wisconsin

Prepared for

Enbridge Energy

Professional Certification:

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly licensed Professional Engineer under the laws of the State of Wisconsin.

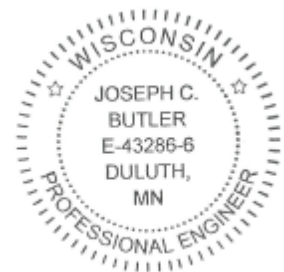


Joseph C. Butler, PE

Business Unit Manager / Senior Engineer

License Number: E-43286-6

September 17, 2020



Project B2001991

Braun Intertec Corporation

September 17, 2020

Project B2001991

Mr. Adam Erickson
Enbridge Energy, Limited Partnership
Manulife Place, 10180-101 Street
Edmonton, AB T5J 3S4

Re: Subsurface Investigation
Enbridge Line 5 Reroute
MP 6 HDD Crossing – Deer Creek
Location 3WB-A, West of Wilson Road, North of Deer Creek
Location 3WB-B, West of Wilson Road, North of Deer Creek
Location 3-DC-A, North of Schwiesow Road, South of Deer Creek
Location 3-DC-B, North of Schwiesow Road, South of Deer Creek
Town of White River, Ashland County, Wisconsin

Dear Mr. Erickson:

We are pleased to present this Subsurface Investigation Report for the Line 5 Reroute Project at the MP 6 HDD Crossing under Deer Creek in Town of White River, Ashland County, Wisconsin.

Thank you for making Braun Intertec your geotechnical consultant for this project. If you have questions about this report, or if there are other services that we can provide in support of our work to date, please contact Kyle Warmuth (kwarmuth@brauninterte.com) or David Morrison (dmorrison@braunintertec.com) at 218.624.4967.

Sincerely,

BRAUN INTERTEC CORPORATION



Kyle P. Warmuth
Staff Consultant



David E. Morrison
Project Consultant



Joseph C. Butler, PE
Business Unit Manager / Senior Engineer

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Appendix

Log of Boring Sheets 3WB-A, 3WB-B, 3-DC-A, and 3-DC-B

HDD Alignment Profile

Descriptive Terminology of Soil

Geotechnical Testing Reports: 320579

Sieve Analysis Reports: 315524, 318311, 318312, 318314, 321580, 321583 through 321585, 330739, 330743, 328491, 328492, and 328496

Moisture Content Reports: 315524, 318311, 318312, 318314, 321580, 321583 through 321585, 330739, 330743, 328491, 328492, and 328496

A. Introduction

A.1. Project Description

Enbridge Energy plans to relocate Line 5 around the Bad River Indian Reservation, as part of that project, a geotechnical investigation and evaluation is being completed. We are providing subsurface investigation services as part of this effort.

This report provides factual data obtained at Borehole Locations 3WB-A, 3WB-B, 3-DC-A, and 3-DC-B for the HDD crossing under Deer Creek which is located at MP 30 in the proposed pipeline alignment in Town of White River, Ashland County, Wisconsin.

A.2. Purpose

The purpose of our subsurface investigation is to characterize subsurface geologic conditions at the selected exploration locations.

A.3. Background Information and Reference Documents

We reviewed the following information:

- Wisconsin Geologic Map, "Soils of Wisconsin", prepared by F. D. Hole, M.T Beatty, C.J. Milfred, G.B. Lee, and A.J Klingelhoets, dated 1968.
- Aerial photos from Google Earth Pro®.

A.4. Scope of Services

We performed our scope of services for the project in accordance with our Quote to Mr. Jonathan Underland of Enbridge Energy, under the terms of the Work Order (132013839) provided by Enbridge Energy. The following list describes the geotechnical tasks completed in accordance with our authorized scope of services.

- Reviewing the background information and reference documents previously cited.

- Lake Superior Consulting selected and staked the boring locations and we cleared the exploration locations of underground utilities. The Soil Boring Location Sketch included in the Appendix shows the approximate locations of the borings.
- Performing two (2) standard penetration test (SPT) borings with coring denoted as 3WB-A and 3-DC-A with the offset borings of 3WB-B and 3-DC-B, to nominal depths ranging from 140 to 141 feet below grade across the site.
- Performing laboratory testing on select samples as selected by Lake Superior Consulting.
- Preparing this report containing a boring location sketch, exploration logs, laboratory tests, and a summary of the geologic materials encountered.

Our scope of services did not include environmental services or testing and our geotechnical personnel performing this evaluation are not trained to provide environmental services or testing. We can provide environmental services or testing at your request.

B. Results

B.1. Geologic Overview

We based the geologic origins used in this report on the soil types, in-situ and laboratory testing, and available common knowledge of the geological history of the site. Because of the complex depositional history, geologic origins can be difficult to ascertain. We did not perform a detailed investigation of the geologic history for the site.

B.2. Geologic Materials

B.2.a. Soil Encountered

The general geologic profile of the soils encountered between the two (2) borings consisted (proceeding down from the ground surface) of 9 to 13 feet of lacustrine deposits, underlain by layers of glacial till and outwash. The soils contained in the layers consisted of silty sands, poorly graded sand with silt, fat clay, and silt to the termination depth in each boring, the encountered soils contained variable amounts of gravel. Table 1 in section B.3 contains more information on each material encountered.

B.3. Estimated Soil Properties

Estimated soil properties for each significant strata change are presented below in Table 1.

Table 1: Estimated Soil Properties

Soil Strata and Elevations (ft)	Soil Type	Blow Count per foot Range (BPF)	Dry Unit Weight Range (pcf)	Undrained Unit Weight Range (pcf)	Drained Friction Angle Range (degrees)	Undrained Friction Angle (degrees)	Undrained Cohesion Range (ksf)	Drained Cohesion Range (ksf)	Modulus of Elasticity Range* (tsf)
Upper Soils (828 to 812)	Silty Sand (SM)	4	105 - 115	115 - 117	28 - 29	10	0.75	0.4 – 0.8	23 - 28
	Fat Clay (CH)	9 - 15	95 - 99	112 - 117	22 - 25	0	1.0 – 3.6	0.6 – 2.1	36 - 86
Middle Soils (812 to 725)	Poorly Graded Sand with Silt (SP-SM)	49 - 50 blows per 5 inches of penetration	98 - 115	122 - 127	38 - 40	36	0	0	343 - 360
	Silty Sand (SM)	41 - 93	118 - 123	125 - 130	35 - 37	25	2.5	4.1+	236 - 490
	Silt (ML)	64	100 - 125	125 - 127	35	34 - 36	0	0	256 - 276
Lower Soils (724 to 685)	Silty Sand (SM)	68 - 50 blows per 3 inches of penetration	102 - 114	125 - 130	35 - 37	25	2.5	4.1+	403 - 490
	Silt (ML)	110 - 50 blows per 1 inches of penetration	100 - 125	125 - 127	35	34 - 36	0	0	490 - 504

*Sustained Young's Modulus values

B.4. Groundwater

We encountered groundwater at a depth of 42 feet below the ground surface in boring 3WB-A while advancing the boring.

We did not observe groundwater while advancing borings 3WB-B, 3-DC-A and 3-DC-B.

Project planning should anticipate seasonal and annual fluctuations of groundwater. Mud-rotary drilling techniques were used to advance the borings, hindering the ability to observe groundwater.

B.5. Laboratory Test Results

The boring logs show the results of the sieve analysis, moisture testing, and Atterberg Limits that were requested. The Appendix contains the results of these tests.

C. Procedures

C.1. Penetration Test Borings

The penetration test borings were drilled with a vehicle -mounted core and auger drill equipped with hollow-stem auger. We performed the borings in general accordance with ASTM D6151 taking penetration test samples at 2 1/2- or 5-foot intervals in general accordance to ASTM D1586. We collected thin-walled tube samples in general accordance with ASTM D1587 at selected depths. The boring logs show the actual sample intervals and corresponding depths. We also collected bulk samples of auger cuttings at selected locations for laboratory testing.

C.2. Exploration Logs

C.2.a. Log of Boring Sheets

The Appendix includes Log of Boring sheets for our penetration test borings. The logs identify and describe the penetrated geologic materials, and present the results of penetration resistance and other in-situ tests performed. The logs also present the results of laboratory tests performed on penetration test samples, and groundwater measurements. The Appendix also includes a Fence Diagram intended to provide a summarized cross-sectional view of the soil profile across the site.

We inferred strata boundaries from changes in the penetration test samples and the auger cuttings. Because we did not perform continuous sampling, the strata boundary depths are only approximate. The boundary depths likely vary away from the boring locations, and the boundaries themselves may occur as gradual rather than abrupt transitions.

C.2.b. Geologic Origins

We assigned geologic origins to the materials shown on the logs and referenced within this report, based on: (1) a review of the background information and reference documents cited above, (2) visual classification of the various geologic material samples retrieved during the course of our subsurface exploration, (3) penetration resistance and other in-situ testing performed for the project, (4) laboratory test results, and (5) available common knowledge of the geologic processes and environments that have impacted the site and surrounding area in the past.

C.3. Material Classification and Testing

C.3.a. Visual and Manual Classification

We visually and manually classified the geologic materials encountered based on ASTM D2488. When we performed laboratory classification tests, we used the results to classify the geologic materials in accordance with ASTM D2487. The Appendix includes a chart explaining the classification system we used.

C.3.b. Laboratory Testing

The exploration logs in the Appendix note most of the results of the laboratory tests performed on geologic material samples. The remaining laboratory test results follow the exploration logs. We performed the tests in general accordance with ASTM or AASHTO procedures.

C.4. Groundwater Measurements

The drillers checked for groundwater while advancing the penetration test borings, and again after auger withdrawal. We then filled the boreholes, as noted on the boring logs.

D. Qualifications

D.1. Variations in Subsurface Conditions

D.1.a. Material Strata

We developed our evaluation, analyses and recommendations from a limited amount of site and subsurface information. It is not standard engineering practice to retrieve material samples from exploration locations continuously with depth. Therefore, we must infer strata boundaries and thicknesses to some extent. Strata boundaries may also be gradual transitions, and project planning should expect the strata to vary in depth, elevation and thickness, away from the exploration locations.

Variations in subsurface conditions present between exploration locations may not be revealed until performing additional exploration work, or starting construction. If future activity for this project reveals any such variations, you should notify us so that we may reevaluate our recommendations. Such variations could increase construction costs, and we recommend including a contingency to accommodate them.

D.1.b. Groundwater Levels

We made groundwater measurements under the conditions reported herein and shown on the exploration logs, and interpreted in the text of this report. Note that the observation periods were relatively short, and project planning can expect groundwater levels to fluctuate in response to rainfall, flooding, irrigation, seasonal freezing and thawing, surface drainage modifications and other seasonal and annual factors.

D.2. Continuity of Professional Responsibility

D.2.a. Plan Review

We based this report on a limited amount of information, and we made a number of assumptions to help us develop our recommendations. We should be retained to review the geotechnical aspects of the designs and specifications. This review will allow us to evaluate whether we anticipated the design correctly, if any design changes affect the validity of our recommendations, and if the design and specifications correctly interpret and implement our recommendations.

D.2.b. Construction Observations and Testing

We recommend retaining us to perform the required observations and testing during construction as part of the ongoing geotechnical evaluation. This will allow us to correlate the subsurface conditions exposed during construction with those encountered by the borings and provide professional continuity from the design phase to the construction phase. If we do not perform observations and testing during construction, it becomes the responsibility of others to validate the assumption made during the preparation of this report and to accept the construction-related geotechnical engineer-of-record responsibilities.

D.3. Use of Report

This report is for the exclusive use of the addressed parties. Without written approval, we assume no responsibility to other parties regarding this report. Our evaluation, analyses and recommendations may not be appropriate for other parties or projects.

D.4. Standard of Care

In performing its services, Braun Intertec used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.

Appendix

Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin					BORING: 3WB-A		
					LOCATION: See attached sketch		
					LATITUDE: 46.47563	LONGITUDE: -90.89992	
DRILLER: EPC		LOGGED BY: A. Hillerurd		START DATE: 05/23/20	END DATE: 05/28/20		
SURFACE ELEVATION: 824.9 ft		RIG: Subcontractor	METHOD: 4 1/4" HSA	SURFACING:		WEATHER:	

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
811.9 13.0		FAT CLAY (CH), trace Gravel, reddish brown, moist, stiff (LACUSTRINE)		4-7-5-4 (12) 14"			Thinwall
				3-3-6-9 (9) 16"			
			5	TW			
				3-6-9-12 (15) 22"			
			10	4-5-10-77 (15) 22"			
				4-10-26-31 (36) 20"			
			15	14-19-30-31 (49) 14"			
				18-25-33-41 (58) 14"			
			20	16-26-46-50/ 5" (72) 18"			
			25	19-31-48-50/ 4" (79) 20"			
		POORLY GRADED SAND with SILT (SP-SM), fine-grained, with Gravel, brown, moist to wet, dense to very dense (GLACIAL OUTWASH)				10	Test results are in the attached lab report.

Continued on next page

Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin					BORING: 3WB-A	
					LOCATION: See attached sketch	
					LATITUDE: 46.47563	LONGITUDE: -90.89992
DRILLER: EPC		LOGGED BY: A. Hillerurd		START DATE: 05/23/20	END DATE: 05/28/20	
SURFACE ELEVATION: 824.9 ft		RIG: Subcontractor	METHOD: 4 1/4" HSA	SURFACING:		WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
		POORLY GRADED SAND with SILT (SP-SM), fine-grained, with Gravel, brown, moist to wet, dense to very dense (GLACIAL OUTWASH)		15-25-46-50/ 5" (71) 15"		12	Test results are in the attached lab report.
			35				
				16-24-44-50/ 4" (68) 16"			
			40				
				9-25-50/5" (REF) 9"			
			45				
				12-21-39-50/ 5" (60) 12"			Test results are in the attached lab report.
			50				
				25-42-49-50/ 5" (91) 16"		12	
			55				
				30-31-42-48 (73) 18"			
			60				
				24-33-38-43 (71) 20"			

Continued on next page

Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin					BORING: 3WB-A	
					LOCATION: See attached sketch	
					LATITUDE: 46.47563	LONGITUDE: -90.89992
DRILLER: EPC		LOGGED BY: A. Hillerurd		START DATE: 05/23/20	END DATE: 05/28/20	
SURFACE ELEVATION: 824.9 ft		RIG: Subcontractor	METHOD: 4 1/4" HSA	SURFACING:		WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
		POORLY GRADED SAND with SILT (SP-SM), fine-grained, with Gravel, brown, moist to wet, dense to very dense (GLACIAL OUTWASH)					
			65	26-42-50/5" (REF) 10"			
			70	33-43-50/5" (REF) 14"			
			75	34-42-50/5" (REF) 16"		24	Test results are in the attached lab report.
			80	25-33-35-36 (68) 18"			
			85	26-35-38-29 (73) 18"			
734.9			90	23-31-34-44 (65) 20"			
90.0		SILT (ML), with Sand, reddish brown, wet, very dense (GLACIAL TILL)					
729.9		SILTY SAND (SM), fine-grained, reddish brown,	95				
95.0							

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Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin					BORING: 3WB-A		
					LOCATION: See attached sketch		
					LATITUDE: 46.47563	LONGITUDE: -90.89992	
DRILLER: EPC		LOGGED BY: A. Hillerurd		START DATE: 05/23/20	END DATE: 05/28/20		
SURFACE ELEVATION: 824.9 ft		RIG: Subcontractor	METHOD: 4 1/4" HSA	SURFACING:		WEATHER:	
Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
		SILTY SAND (SM), fine-grained, reddish brown, wet, very dense (GLACIAL TILL)		42-50/5" (REF) 8"			Water observed at 42.0 feet while drilling.
724.0			100	30-50/5" (REF) 6"			
100.9		END OF BORING					
		Boring then backfilled with cement/bentonite grout					
			105				
			110				
			115				
			120				
			125				

Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin					BORING: 3WB-B	
					LOCATION: See attached sketch	
					LATITUDE: 46.47563	LONGITUDE: -90.89992
DRILLER: M. Swenson		LOGGED BY: P. Moe		START DATE: 08/03/20	END DATE: 08/03/20	
SURFACE ELEVATION: 824.9 ft		RIG: 8502	METHOD: 4 1/4" HSA	SURFACING:		WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
		<i>Borehole advanced with auger and mud rotary drilling techniques to 100 feet</i>					
			5				
			10				
			15				
			20				
			25				
			30				

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Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin					BORING: 3WB-B	
					LOCATION: See attached sketch	
					LATITUDE: 46.47563	LONGITUDE: -90.89992
DRILLER: M. Swenson		LOGGED BY: P. Moe		START DATE: 08/03/20	END DATE: 08/03/20	
SURFACE ELEVATION: 824.9 ft		RIG: 8502	METHOD: 4 1/4" HSA	SURFACING:		WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
724.9							
100.0		SILTY SAND (SM), fine to medium-grained, brown, moist, very dense (GLACIAL TILL)	100	25-41-48 (89) 13"		22	Test results are in the attached lab report
			105	24-31-37 (68) 0"			No recovery
714.9							
110.0		SANDY SILT (ML), fine to medium-grained, brown, moist, very dense (GLACIAL TILL)	110	47-50/4" (REF) 0"			No recovery
			115	39-49-61 (110) 15"			
704.9							
120.0		SILTY SAND with GRAVEL (SM), fine to medium-grained, brown, moist, very dense (GLACIAL TILL)	120	32-45-49 (94) 0"			No recovery
			125	34-52-50/3" (REF) 12"		14	Test results are in the attached lab report

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Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin					BORING: 3WB-B	
					LOCATION: See attached sketch	
					LATITUDE: 46.47563	LONGITUDE: -90.89992
DRILLER: M. Swenson		LOGGED BY: P. Moe		START DATE: 08/03/20	END DATE: 08/03/20	
SURFACE ELEVATION: 824.9 ft		RIG: 8502	METHOD: 4 1/4" HSA	SURFACING:		WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
		SILTY SAND with GRAVEL (SM), fine to medium-grained, brown, moist, very dense (GLACIAL TILL)					
			130	X			
			135	X			
684.9			140	X			
140.0		END OF BORING					
		Boring then backfilled with cement/bentonite grout					
			145				
			150				
			155				

Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin					BORING: 3-DC-A		
					LOCATION: See attached sketch		
					LATITUDE: 46.47203	LONGITUDE: -90.89855	
DRILLER: EPC		LOGGED BY: A. Hillerud		START DATE: 06/24/20	END DATE: 06/24/20		
SURFACE ELEVATION: 827.9 ft		RIG: Subcontractor	METHOD: 4 1/4" HSA	SURFACING:		WEATHER:	

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
825.9		SILTY SAND (SM), fine-grained, with roots, brown, moist, very loose (LACUSTRINE)		2-2-2-5 (4) 18"			Test results are in the attached lab report.
2.0		FAT CLAY (CH), with Sand, trace Gravel, reddish brown, moist, stiff (LACUSTRINE)		2-4-7-10 (11) 18"			
			5	3-4-5-7 (9) 24"			
				4-5-6-9 (11) 24"			
818.9		SILTY SAND (SM), fine to medium-grained, little Gravel, reddish brown, moist, hard (GLACIAL TILL)	10	15-43-50 (93) 18"		6	
9.0				13-27-32 (59) 18"			Test results are in the attached lab report.
815.4		POORLY GRADED SAND with SILT (SP-SM), fine to medium-grained, reddish brown, moist, very dense (GLACIAL OUTWASH)		28-46-50/5" (REF) 17"			
12.5			15				
			20	17-31-50 (81) 18"			
			25	25-50/5" (REF) 11"		14	
799.9		SILT with SAND (ML), reddish brown, moist, very dense (GLACIAL TILL)	30	23-24-40 (64) 18"			
28.0							

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Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin					BORING: 3-DC-A	
					LOCATION: See attached sketch	
					LATITUDE: 46.47203	LONGITUDE: -90.89855
DRILLER: EPC		LOGGED BY: A. Hillerud		START DATE: 06/24/20	END DATE: 06/24/20	
SURFACE ELEVATION: 827.9 ft		RIG: Subcontractor	METHOD: 4 1/4" HSA	SURFACING:		WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
794.9		SILT with SAND (ML), reddish brown, moist, very dense (GLACIAL TILL) POORLY GRADED SAND with SILT (SP-SM), fine-grained, reddish brown, moist, very dense (GLACIAL OUTWASH)					
33.0							
			35	18-29-40 (69) 18"			
			40	30-50/5" (REF) 11"			
			45	27-46-50/5" (REF) 17"			
			50	27-39-50 (89) 18"		19	Test results are in the attached lab report.
774.9		SILTY SAND (SM), fine-grained, reddish brown, moist, very dense (GLACIAL TILL)					
53.0							
			55	35-37-39 (76) 18"			
			60	28-34-39 (73) 18"			

Continued on next page

Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin					BORING: 3-DC-A		
					LOCATION: See attached sketch		
					LATITUDE: 46.47203	LONGITUDE: -90.89855	
DRILLER: EPC		LOGGED BY: A. Hillerud		START DATE: 06/24/20	END DATE: 06/24/20		
SURFACE ELEVATION: 827.9 ft		RIG: Subcontractor	METHOD: 4 1/4" HSA	SURFACING:		WEATHER:	

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
		SILTY SAND (SM), fine-grained, reddish brown, moist, very dense (GLACIAL TILL)	65	9-22-29 (51) 18"			
			70	13-13-28 (41) 18"			
			75	9-19-22 (41) 18"			
749.9		POORLY GRADED SAND with SILT (SP-SM), fine-grained, reddish brown, moist, very dense (GLACIAL OUTWASH)	80	25-37-39 (76) 18"		21	Test results are in the attached lab report.
			85	26-34-36 (70) 18"			
739.9		SILTY SAND (SM), fine-grained, reddish brown, moist, dense (GLACIAL TILL)	90	15-16-27 (43) 18"			
734.9		POORLY GRADED SAND with SILT (SP-SM), fine-grained, trace Gravel, reddish brown, moist, very dense (GLACIAL OUTWASH)	95	50/5" (REF) 5"			

Continued on next page

Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin					BORING: 3-DC-A		
					LOCATION: See attached sketch		
					LATITUDE: 46.47203	LONGITUDE: -90.89855	
DRILLER: EPC		LOGGED BY: A. Hillerud		START DATE: 06/24/20	END DATE: 06/24/20		
SURFACE ELEVATION: 827.9 ft		RIG: Subcontractor	METHOD: 4 1/4" HSA	SURFACING:		WEATHER:	
Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
		POORLY GRADED SAND with SILT (SP-SM), fine-grained, trace Gravel, reddish brown, moist, very dense (GLACIAL OUTWASH)					
724.9			100	50/5" (REF) 5"			
103.0		SILTY SAND (SM), fine-grained, reddish brown, moist, very dense (GLACIAL TILL)					
722.4			105	50/6" (REF) 6"			
105.5		END OF BORING					Water not observed while drilling.
		Boring then backfilled with cement/bentonite grout					
			110				
			115				
			120				
			125				

Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin					BORING: 3-DC-B	
					LOCATION: See attached sketch	
					LATITUDE: 46.47203	LONGITUDE: -90.89855
DRILLER: EPC		LOGGED BY: P. Moe		START DATE: 07/27/20	END DATE: 07/28/20	
SURFACE ELEVATION: 827.9 ft		RIG: Subcontractor	METHOD: 4 1/4" HSA	SURFACING:		WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
		<i>Borehole advanced with auger and mud rotary drilling techniques to 107 feet</i>					
			5				
			10				
			15				
			20				
			25				
			30				

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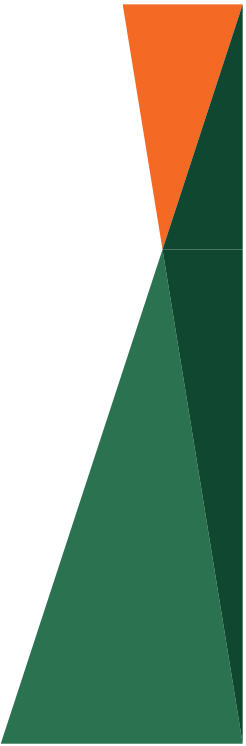
Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin					BORING: 3-DC-B		
					LOCATION: See attached sketch		
					LATITUDE: 46.47203	LONGITUDE: -90.89855	
DRILLER: EPC		LOGGED BY: P. Moe		START DATE: 07/27/20	END DATE: 07/28/20		
SURFACE ELEVATION: 827.9 ft		RIG: Subcontractor	METHOD: 4 1/4" HSA	SURFACING:		WEATHER:	
Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
			65				
			70				
			75				
			80				
			85				
			90				
			95				

Continued on next page

Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin					BORING: 3-DC-B		
					LOCATION: See attached sketch		
					LATITUDE: 46.47203	LONGITUDE: -90.89855	
DRILLER: EPC		LOGGED BY: P. Moe		START DATE: 07/27/20	END DATE: 07/28/20		
SURFACE ELEVATION: 827.9 ft		RIG: Subcontractor	METHOD: 4 1/4" HSA	SURFACING:		WEATHER:	
Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
720.9							
107.0		SILTY SAND (SM), fine to medium-grained, trace Gravel, brown, moist, very dense (GLACIAL TILL)	50/5" (REF) 3"				
			50/4" (REF) 3"			22	Test results are in the attached lab report.
			50/5" (REF) 4"				
			50/5" (REF) 5"			19	Test results are in the attached lab report.
			50/5" (REF) 3"				

Continued on next page

Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin					BORING: 3-DC-B		
					LOCATION: See attached sketch		
					LATITUDE: 46.47203	LONGITUDE: -90.89855	
DRILLER: EPC		LOGGED BY: P. Moe		START DATE: 07/27/20	END DATE: 07/28/20		
SURFACE ELEVATION: 827.9 ft		RIG: Subcontractor	METHOD: 4 1/4" HSA	SURFACING:		WEATHER:	
Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
		SILTY SAND (SM), fine to medium-grained, trace Gravel, brown, moist, very dense (GLACIAL TILL)	130				
			44-50/3" (REF) 6"				
			135				
690.9							
137.0		SANDY SILT with GRAVEL (ML), rock fragments, brown, moist, very dense (GLACIAL TILL)	140	50/3" (REF) 3"		10	Test results are in the attached lab report.
686.9							
141.0		END OF BORING		50/1" (REF) 0"			No recovery Water not observed while drilling.
		Boring then backfilled with cement/bentonite grout					
			145				
			150				
			155				



Drawing Information

Project No:
32001991

Drawing No. B2001991_MP6_DEER-CREEK

Drawn By:	BJB
Date Drawn:	7/22/20
Checked By:	DM
Last Modified:	8/14/20

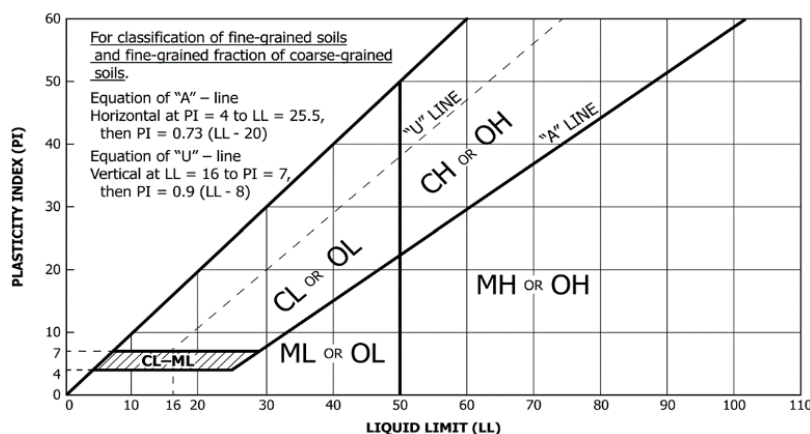
Project Information

Enbridge Line 5 Re-route

MP 6 - Deer Creek Crossing

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A				Soil Classification	
				Group Symbol	Group Name ^B
Coarse-grained Soils (more than 50% retained on No. 200 sieve)	Gravels (More than 50% of coarse fraction retained on No. 4 sieve)	Clean Gravels (Less than 5% fines ^C)	$C_u \geq 4$ and $1 \leq C_c \leq 3^D$	GW	Well-graded gravel ^E
			$C_u < 4$ and/or ($C_c < 1$ or $C_c > 3$) ^D	GP	Poorly graded gravel ^E
		Gravels with Fines (More than 12% fines ^C)	Fines classify as ML or MH	GM	Silty gravel ^{EFG}
			Fines Classify as CL or CH	GC	Clayey gravel ^{EFG}
	Sands (50% or more coarse fraction passes No. 4 sieve)	Clean Sands (Less than 5% fines ^H)	$C_u \geq 6$ and $1 \leq C_c \leq 3^D$	SW	Well-graded sand ^I
			$C_u < 6$ and/or ($C_c < 1$ or $C_c > 3$) ^D	SP	Poorly graded sand ^I
		Sands with Fines (More than 12% fines ^H)	Fines classify as ML or MH	SM	Silty sand ^{FGI}
			Fines classify as CL or CH	SC	Clayey sand ^{FGI}
Fine-grained Soils (50% or more passes the No. 200 sieve)	Silts and Clays (Liquid limit less than 50)	Inorganic	PI > 7 and plots on or above "A" line ^J	CL	Lean clay ^{KLM}
			PI < 4 or plots below "A" line ^J	ML	Silt ^{KLM}
		Organic	Liquid Limit – oven dried Liquid Limit – not dried <0.75	OL	Organic clay ^{KLMN} Organic silt ^{KLM O}
	Silts and Clays (Liquid limit 50 or more)	Inorganic	PI plots on or above "A" line	CH	Fat clay ^{KLM}
			PI plots below "A" line	MH	Elastic silt ^{KLM}
		Organic	Liquid Limit – oven dried Liquid Limit – not dried <0.75	OH	Organic clay ^{KLM P} Organic silt ^{KLM Q}
Highly Organic Soils		Primarily organic matter, dark in color, and organic odor		PT	Peat

- Based on the material passing the 3-inch (75-mm) sieve.
- If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
- Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay
- $C_u = D_{60} / D_{10}$ $C_c = (D_{30})^2 / (D_{10} \times D_{60})$
- If soil contains $\geq 15\%$ sand, add "with sand" to group name.
- If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
- If fines are organic, add "with organic fines" to group name.
- Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay
- If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.
- If Atterberg limits plot in hatched area, soil is CL-ML, silty clay.
- If soil contains 15 to < 30% plus No. 200, add "with sand" or "with gravel", whichever is predominant.
- If soil contains $\geq 30\%$ plus No. 200, predominantly sand, add "sandy" to group name.
- If soil contains $\geq 30\%$ plus No. 200 predominantly gravel, add "gravelly" to group name.
- PI ≥ 4 and plots on or above "A" line.
- PI plots on or above "A" line.
- PI plots below "A" line.



DD Dry density, pcf
WD Wet density, pcf
P200 % Passing #200 sieve

Laboratory Tests
OC Organic content, %
q_p Pocket penetrometer strength, tsf
MC Moisture content, %
q_u Unconfined compression test, tsf

LL Liquid limit
PL Plastic limit
PI Plasticity index

Particle Size Identification

Boulders..... over 12"
Cobbles..... 3" to 12"
Gravel
Coarse..... 3/4" to 3" (19.00 mm to 75.00 mm)
Fine..... No. 4 to 3/4" (4.75 mm to 19.00 mm)
Sand
Coarse..... No. 10 to No. 4 (2.00 mm to 4.75 mm)
Medium..... No. 40 to No. 10 (0.425 mm to 2.00 mm)
Fine..... No. 200 to No. 40 (0.075 mm to 0.425 mm)
Silt..... No. 200 (0.075 mm) to .005 mm
Clay..... < .005 mm

Relative Proportions^{L, M}

trace..... 0 to 5%
little..... 6 to 14%
with..... $\geq 15\%$

Inclusion Thicknesses

lens..... 0 to 1/8"
seam..... 1/8" to 1"
layer..... over 1"

Apparent Relative Density of Cohesionless Soils

Very loose 0 to 4 BPF
Loose 5 to 10 BPF
Medium dense..... 11 to 30 BPF
Dense..... 31 to 50 BPF
Very dense..... over 50 BPF

Consistency of Cohesive Soils Blows Per Foot Approximate Unconfined Compressive Strength

Very soft..... 0 to 1 BPF..... < 0.25 tsf
Soft..... 2 to 4 BPF..... 0.25 to 0.5 tsf
Medium..... 5 to 8 BPF 0.5 to 1 tsf
Stiff..... 9 to 15 BPF..... 1 to 2 tsf
Very Stiff..... 16 to 30 BPF..... 2 to 4 tsf
Hard..... over 30 BPF..... > 4 tsf

Moisture Content:

Dry: Absence of moisture, dusty, dry to the touch.
Moist: Damp but no visible water.
Wet: Visible free water, usually soil is below water table.

Drilling Notes:




Blows/N-value: Blows indicate the driving resistance recorded for each 6-inch interval. The reported N-value is the blows per foot recorded by summing the second and third interval in accordance with the Standard Penetration Test, ASTM D1586.

Partial Penetration: If the sampler could not be driven through a full 6-inch interval, the number of blows for that partial penetration is shown as #/x" (i.e. 50/2"). The N-value is reported as "REF" indicating refusal.

Recovery: Indicates the inches of sample recovered from the sampled interval. For a standard penetration test, full recovery is 18", and is 24" for a thinwall/shelby tube sample.

WOH: Indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

WOR: Indicates the sampler penetrated soil under weight of rods alone; hammer weight and driving not required.

Water Level: Indicates the water level measured by the drillers either while drilling (, at the end of drilling (, or at some time after drilling ().

4511 West First Street
Suite 4
Duluth, MN 55807
Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

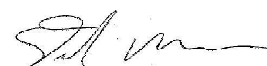
Metafield ID: 320579 **Sampled By:** Drill Crew
Sample Date: 06/16/2020
Received Date: 07/08/2020 **Lab:** 11001 Hampshire Ave S, Bloomington, MN
Completed Date: 07/08/2020 **Tested By:** Streier, Jim

Laboratory Results Summary

Boring	Sample	Depth (ft)	MC (%)	Wash Loss (%)	LL	PL	PI	Organic Content %	Wet Density (pcf)	Dry Density (pcf)	Resistivity (ohm-cm)	Q _u (tsf)
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3WB	5	9.5	17.8		50	16	34					
-----	---	-----	------	--	----	----	----	--	--	--	--	--

General



4511 West First Street
Suite 4
Duluth, MN 55807
Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

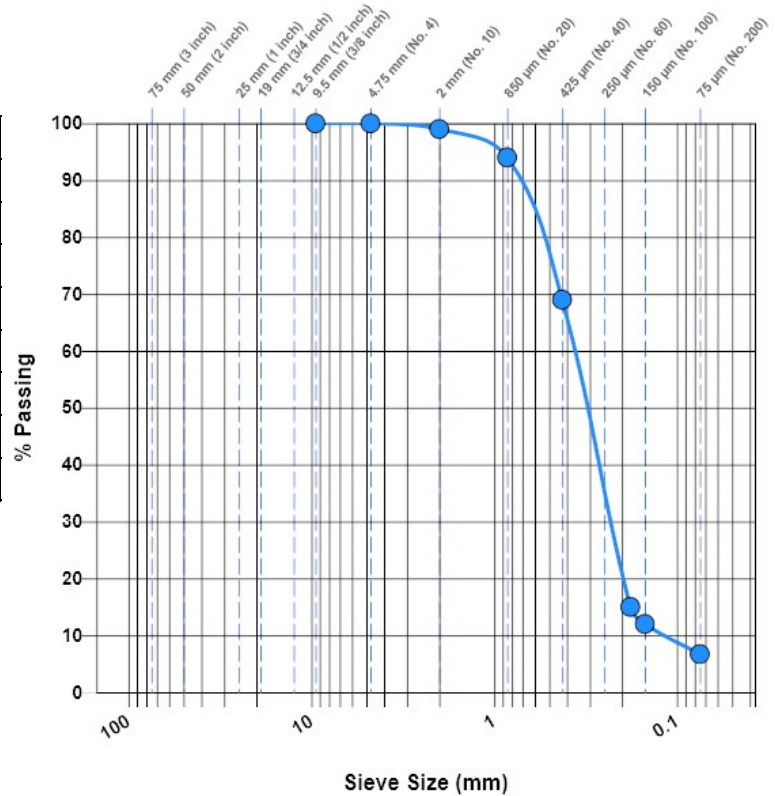
Sample Information

Sample Number: 315524 **Alternate ID:** 3WB Sample 9 17'-19'
Sampling Method: Auger Boring ASTM D1452 **Depth (ft):** 17'
Boring Number: 3WB **Sampled By:** Drill Crew
Location: In-place
Location Details: Boring 3WB Sample 9 17'-19'
Sample Date: 05/22/2020
Received Date: 06/15/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 06/17/2020

Laboratory Data

Sieve Size	% Passing	Specification
9.5 mm (3/8 inch)	100	
4.75 mm (No. 4)	100	
2 mm (No. 10)	99	
850 µm (No. 20)	94	
425 µm (No. 40)	69	
180 µm (No. 80)	15	
150 µm (No. 100)	12	
75 µm (No. 200)	6.7	

Test Method: Method A (Composite Sieving)
Dispersion Apparatus: Shaking
Specimen Obtained: Oven Dry



Classification: SP-SM Poorly graded sand with silt

General

Results: The test is for informational purposes.
Remarks: Total weight of dry sample 261.2 grams

[Signature]

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Suite 4
Duluth, MN 55807
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Client:

Enbridge Energy, Limited Partnership
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Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

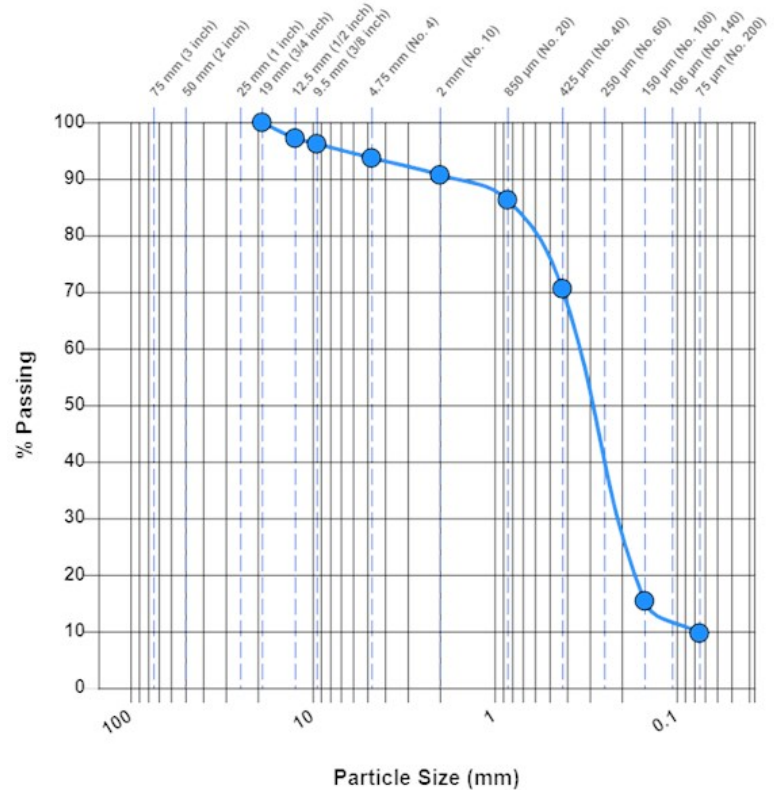
Sample Information

Sample Number:	318311	Alternate ID:	3-WB 12 32'
Sampling Method:	Auger Boring ASTM D1452	Depth (ft):	32
Boring Number:	3-WB	Sampled By:	Drill Crew
Location:	In-place		
Location Details:	Boring 3-WB 12 32'		
Sample Date:	05/22/2020		
Received Date:	06/25/2020	Lab:	4511 West First Street, Suite 4, Duluth, MN
Tested Date:	06/25/2020	Tested By:	Patterson, Gregg

Laboratory Data

Sieve Size	Passing (%)	Specification
19 mm (3/4 inch)	100.0	
12.5 mm (1/2 inch)	97.2	
9.5 mm (3/8 inch)	96.2	
4.75 mm (No. 4)	93.7	
2 mm (No. 10)	90.7	
850 µm (No. 20)	86.3	
425 µm (No. 40)	70.6	
150 µm (No. 100)	15.4	
75 µm (No. 200)	9.7	

Gravel (%)	Sand (%)	Silt & Clay (%)
6.3	84.0	9.7
D10	D30	D60
0.077	0.176	0.231
C_u	C_c	
3.00	1.74	



Classification: SP-SM Poorly graded sand with silt

Specimen Obtained: Oven Dry

Test Method: Method A (Composite Sieving)

Dispersion Apparatus: Shaking

General

Results: The test is for informational purposes.

Remarks: Total weight of the dry sample 247.6 grams

Gregg Patterson

4511 West First Street
Suite 4
Duluth, MN 55807
Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

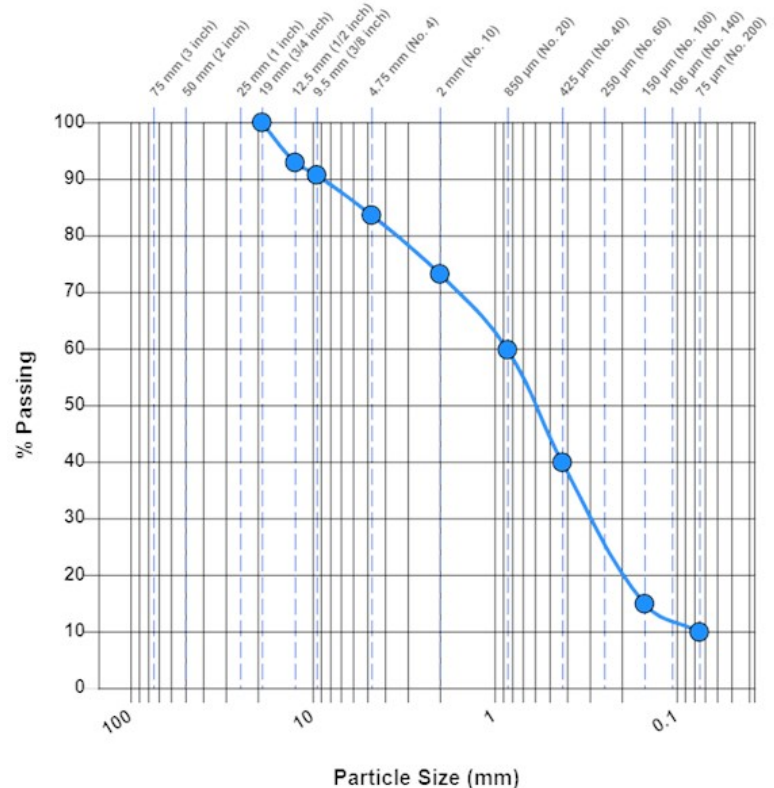
Sample Information

Sample Number:	318312	Alternate ID:	3-WB 16 52'
Sampling Method:	Auger Boring ASTM D1452	Depth (ft):	52
Boring Number:	3-WB	Sampled By:	Drill Crew
Location:	In-place		
Location Details:	Boring 3-WB 16 52'		
Sample Date:	05/22/2020		
Received Date:	06/25/2020	Lab:	4511 West First Street, Suite 4, Duluth, MN
Tested Date:	06/26/2020	Tested By:	Nelson, Brennan

Laboratory Data

Sieve Size	Passing (%)	Specification
19 mm (3/4 inch)	100.0	
12.5 mm (1/2 inch)	92.9	
9.5 mm (3/8 inch)	90.7	
4.75 mm (No. 4)	83.6	
2 mm (No. 10)	73.2	
850 µm (No. 20)	59.8	
425 µm (No. 40)	39.9	
150 µm (No. 100)	14.9	
75 µm (No. 200)	9.9	

Gravel (%)	Sand (%)	Silt & Clay (%)
16.4	73.7	9.9
D10	D30	D60
0.076	0.210	0.867
C_u	C_c	
11.41	0.67	



Classification: SP-SM Poorly graded sand with silt and gravel

Specimen Obtained: Oven Dry

Test Method: Method A (Composite Sieving)

Dispersion Apparatus: Shaking

General

Results: The test is for informational purposes.

Remarks: Total dry weight of sample 280.1 grams

[Signature]

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Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number:	318314	Alternate ID:	3-WB 21 77'
Sampling Method:	Auger Boring ASTM D1452	Depth (ft):	77
Boring Number:	3-WB	Sampled By:	Drill Crew
Location:	In-place		
Location Details:	Boring 3-WB 21 77'		
Sample Date:	05/22/2020		
Received Date:	06/25/2020	Lab:	4511 West First Street, Suite 4, Duluth, MN
Tested Date:	06/26/2020	Tested By:	Nelson, Brennan

Laboratory Data

Sieve Size	Passing (%)	Specification
4.75 mm (No. 4)	100.0	
2 mm (No. 10)	99.9	
850 µm (No. 20)	99.1	
425 µm (No. 40)	95.7	
150 µm (No. 100)	18.7	
75 µm (No. 200)	5.4	

Sand (%)

94.6

Silt & Clay (%)

5.4

D10

0.086

D30

0.165

D60

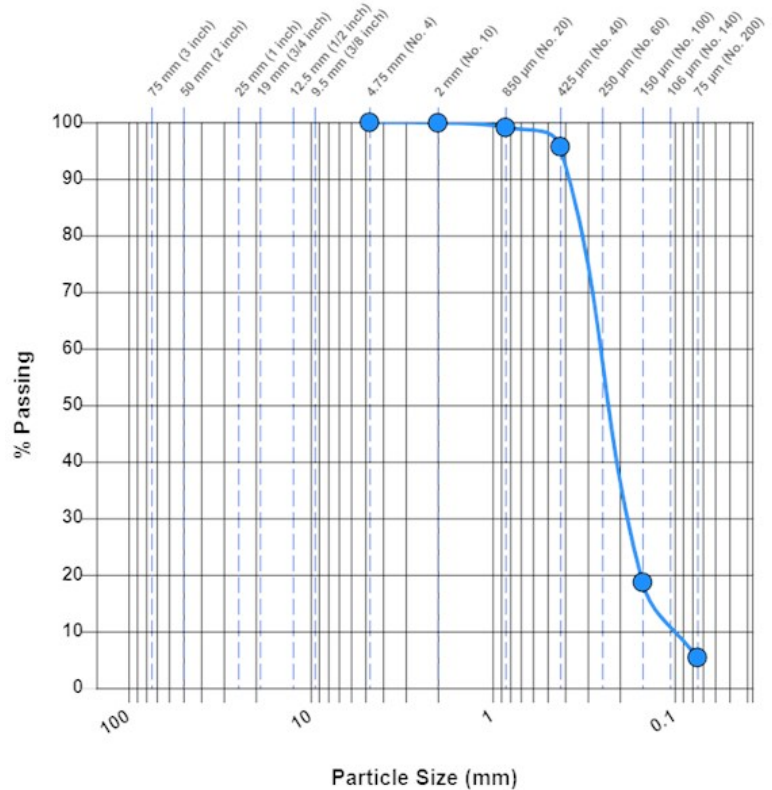
0.204

C_u

2.37

C_c

1.55



Specimen Obtained: Oven Dry

Test Method: Method A (Composite Sieving)

Dispersion Apparatus: Shaking

General

Results: The test is for informational purposes.

Remarks: Total dry weight of sample 208.5 grams

[Signature]

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Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

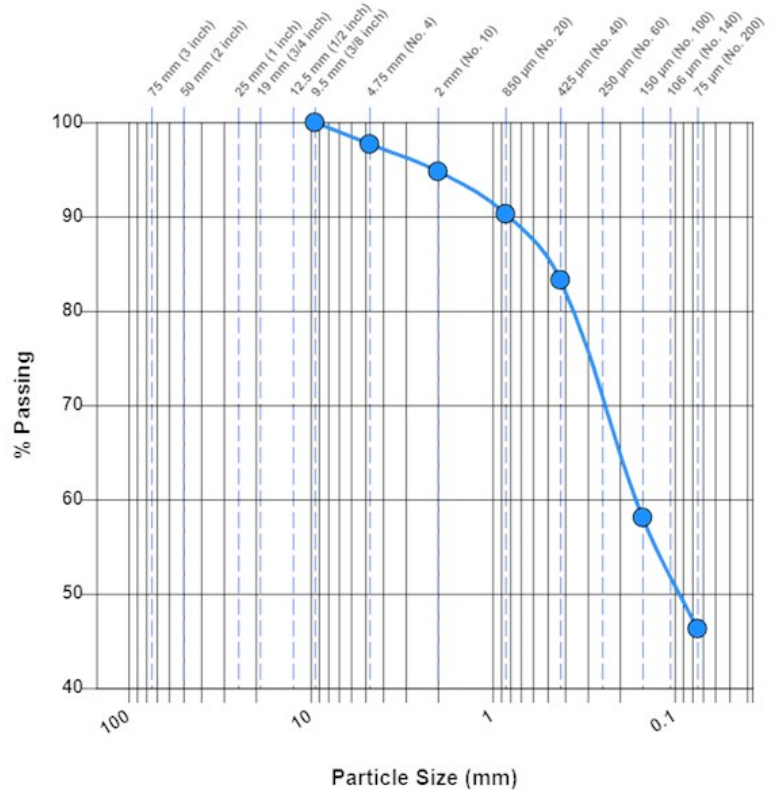
Sample Information

Sample Number:	321580	Alternate ID:	3-DC 5 9'
Sampling Method:	Auger Boring ASTM D1452	Depth (ft):	9
Boring Number:	3-DC	Sampled By:	Drill Crew
Location:	In-place		
Location Details:	Boring 3-DC Sample 5 9'		
Sample Date:	06/24/2020		
Received Date:	07/13/2020	Lab:	4511 West First Street, Suite 4, Duluth, MN
Tested Date:	07/15/2020	Tested By:	Nelson, Brennan

Laboratory Data

Sieve Size	Passing (%)	Specification
4.75 mm (No. 4)	97.7	
2 mm (No. 10)	94.8	
850 µm (No. 20)	90.3	
425 µm (No. 40)	83.3	
150 µm (No. 100)	58.1	
75 µm (No. 200)	46.3	

Gravel (%)	Sand (%)	Silt & Clay (%)
2.3	51.4	46.3
D60		
0.158		



Classification: SM Silty sand
Specimen Obtained: Oven Dry
Dispersion Apparatus: Shaking

Test Method: Method A (Composite Sieving)

General

Results: The test is for informational purposes.
Remarks: Total dry weight of sample is 220.3 grams.

[Signature]

4511 West First Street
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Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number:	321583	Alternate ID:	3-DC 10 25'
Sampling Method:	Auger Boring ASTM D1452	Depth (ft):	25
Boring Number:	3-DC	Sampled By:	Drill Crew
Location:	In-place		
Location Details:	Boring 3-DC Sample 10 25'		
Sample Date:	06/24/2020		
Received Date:	07/13/2020	Lab:	4511 West First Street, Suite 4, Duluth, MN
Tested Date:	07/15/2020	Tested By:	Nelson, Brennan

Laboratory Data

Sieve Size	Passing (%)	Specification
850 µm (No. 20)	99.8	
425 µm (No. 40)	89.3	
150 µm (No. 100)	11.5	
75 µm (No. 200)	5.6	

Sand (%)
94.4

Silt & Clay (%)
5.6

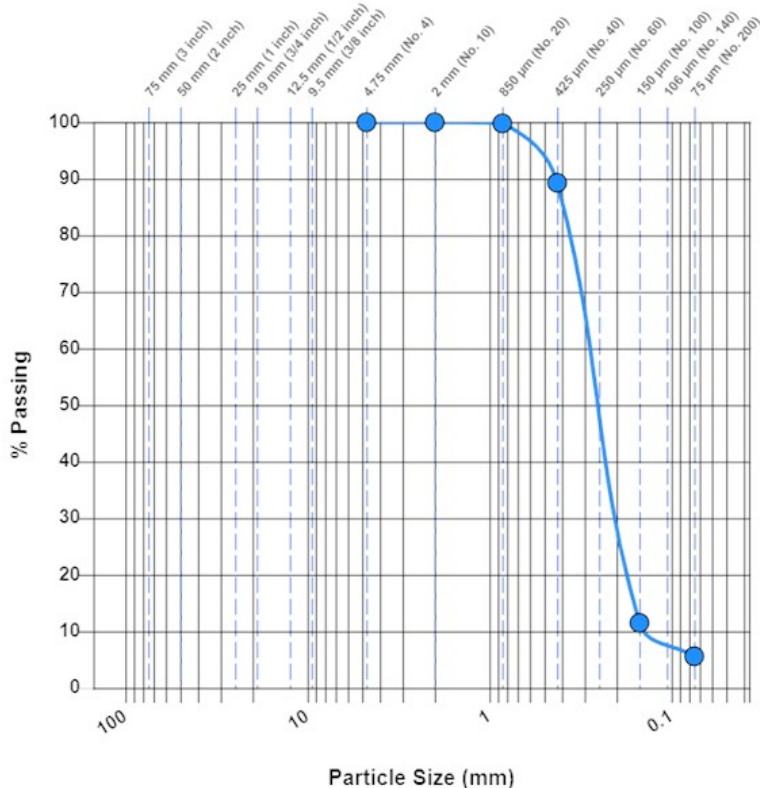
D10
0.098

D30
0.174

D60
0.212

C_u
2.16

C_c
1.46



Classification: SP-SM Poorly graded sand with silt

Specimen Obtained: Oven Dry

Test Method: Method A (Composite Sieving)

Dispersion Apparatus: Shaking

General

Results: The test is for informational purposes.

Remarks: Total dry weight of sample is 301.3 grams.

[Signature]

4511 West First Street
Suite 4
Duluth, MN 55807
Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number:	321584	Alternate ID:	3-DC 15 50'
Sampling Method:	Auger Boring ASTM D1452	Depth (ft):	50
Boring Number:	3-DC	Sampled By:	Drill Crew
Location:	In-place		
Location Details:	Boring 3-DC Sample 15 50'		
Sample Date:	06/24/2020		
Received Date:	07/13/2020	Lab:	4511 West First Street, Suite 4, Duluth, MN
Tested Date:	07/15/2020	Tested By:	Nelson, Brennan

Laboratory Data

Sieve Size	Passing (%)	Specification
4.75 mm (No. 4)	100.0	
2 mm (No. 10)	100.0	
850 µm (No. 20)	99.9	
425 µm (No. 40)	93.8	
150 µm (No. 100)	19.0	
75 µm (No. 200)	7.3	

Sand (%)

92.7

Silt & Clay (%)

7.3

D10

0.092

D30

0.190

D60

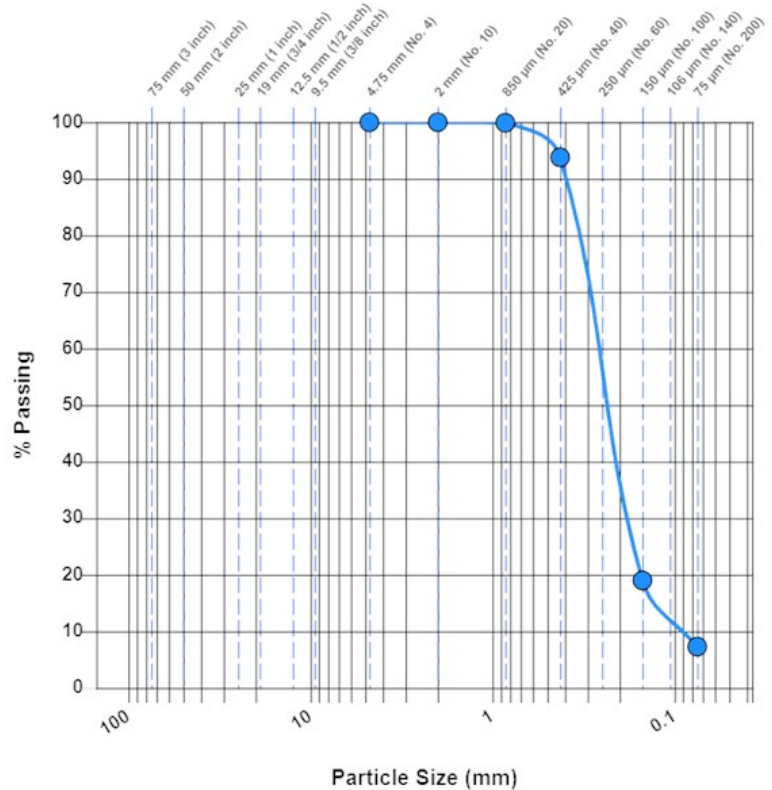
0.301

C_U

3.27

C_C

1.30



Classification: SP-SM Poorly graded sand with silt

Specimen Obtained: Oven Dry

Test Method: Method A (Composite Sieving)

Dispersion Apparatus: Shaking

General

Results: The test is for informational purposes.

Remarks: Total dry weight of sample is 274.1 grams.

[Signature]

4511 West First Street
Suite 4
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Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable 5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

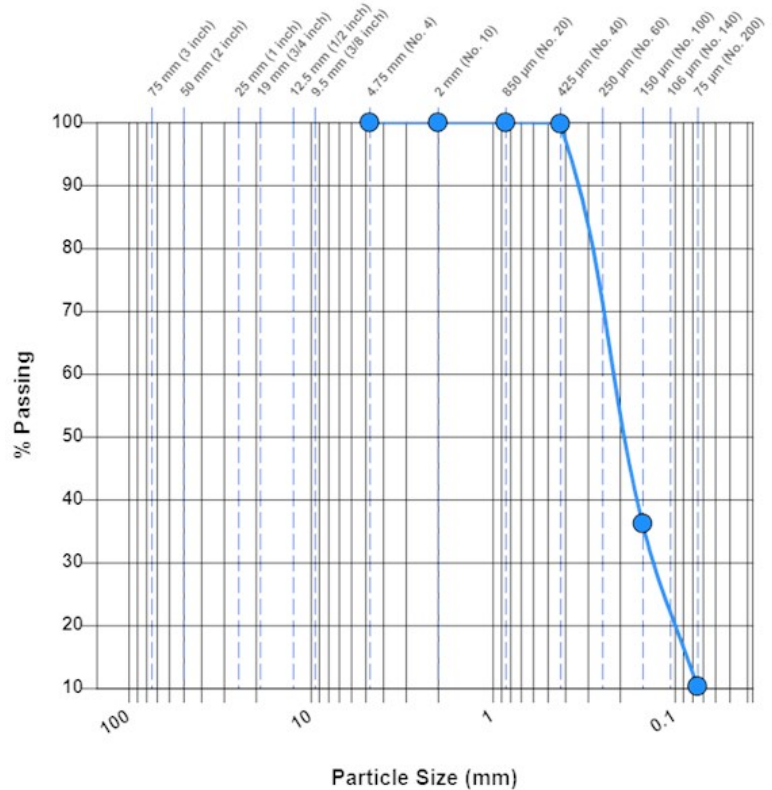
Sample Information

Sample Number:	321585	Alternate ID:	3-DC 21 80'
Sampling Method:	Auger Boring ASTM D1452	Depth (ft):	80
Boring Number:	3-DC	Sampled By:	Drill Crew
Location:	In-place		
Location Details:	Boring 3-DC Sample 21 80'		
Sample Date:	06/25/2020		
Received Date:	07/13/2020	Lab:	4511 West First Street, Suite 4, Duluth, MN
Tested Date:	07/15/2020	Tested By:	Nelson, Brennan

Laboratory Data

Sieve Size	Passing (%)	Specification
4.75 mm (No. 4)	100.0	
2 mm (No. 10)	100.0	
850 µm (No. 20)	100.0	
425 µm (No. 40)	99.8	
150 µm (No. 100)	36.2	
75 µm (No. 200)	10.3	

Sand (%)	Silt & Clay (%)
89.7	10.3
D30	D60
0.099	0.187



Classification: SP-SM Poorly graded sand with silt
Specimen Obtained: Oven Dry
Dispersion Apparatus: Shaking

Test Method: Method A (Composite Sieving)

General

Results: The test is for informational purposes.
Remarks: Total dry weight of sample is 227.6 grams.

[Signature]

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Phone: 218-624-4967

Client:

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Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number:	330739	Alternate ID:	Sample #6
Sampling Method:	Auger Boring ASTM D1452	Depth (ft):	125
Boring Number:	3WB	Sampled By:	Drill Crew
Location:	Other		
Location Details:	Boring Sample		
Sample Date:	08/20/2020		
Received Date:	08/20/2020	Lab:	4511 West First Street, Suite 4, Duluth, MN
Tested Date:	08/20/2020	Tested By:	Falwey, Shane

Laboratory Data

Sieve Size	Passing (%)	Specification
19 mm (3/4 inch)	100.0	
12.5 mm (1/2 inch)	91.6	
9.5 mm (3/8 inch)	87.2	
4.75 mm (No. 4)	81.7	
2 mm (No. 10)	75.9	
850 µm (No. 20)	69.8	
425 µm (No. 40)	58.5	
150 µm (No. 100)	24.2	
75 µm (No. 200)	15.3	

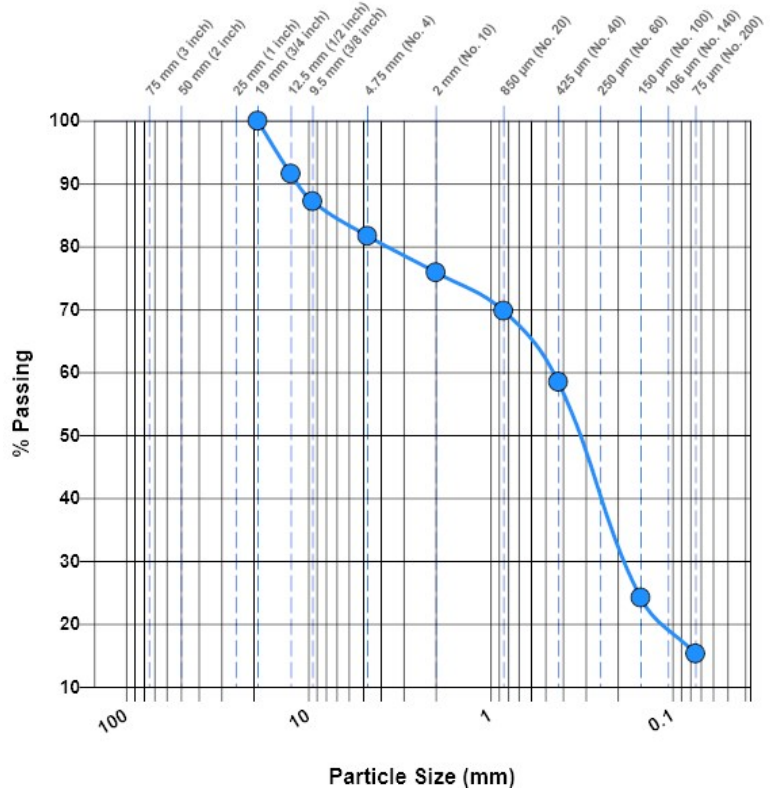
Gravel (%)
18.3

Sand (%)
66.4

Silt & Clay (%)
15.3

D30
0.197

D60
0.481



Specimen Obtained: Oven Dry

Test Method: Method B (Single Sieve Set)

Dispersion Apparatus: Shaking

General

Results: The test is for informational purposes.

Remarks: Total dry weight of sample is 240.5 grams.

Shane Falwey

4511 West First Street
Suite 4
Duluth, MN 55807
Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number:	330743	Alternate ID:	Sample #1
Sampling Method:	Auger Boring ASTM D1452	Depth (ft):	100
Boring Number:	3WB	Sampled By:	Drill Crew
Location:	Other		
Location Details:	Boring sample		
Sample Date:	08/20/2020		
Received Date:	08/20/2020	Lab:	4511 West First Street, Suite 4, Duluth, MN
Tested Date:	08/20/2020	Tested By:	Falwey, Shane

Laboratory Data

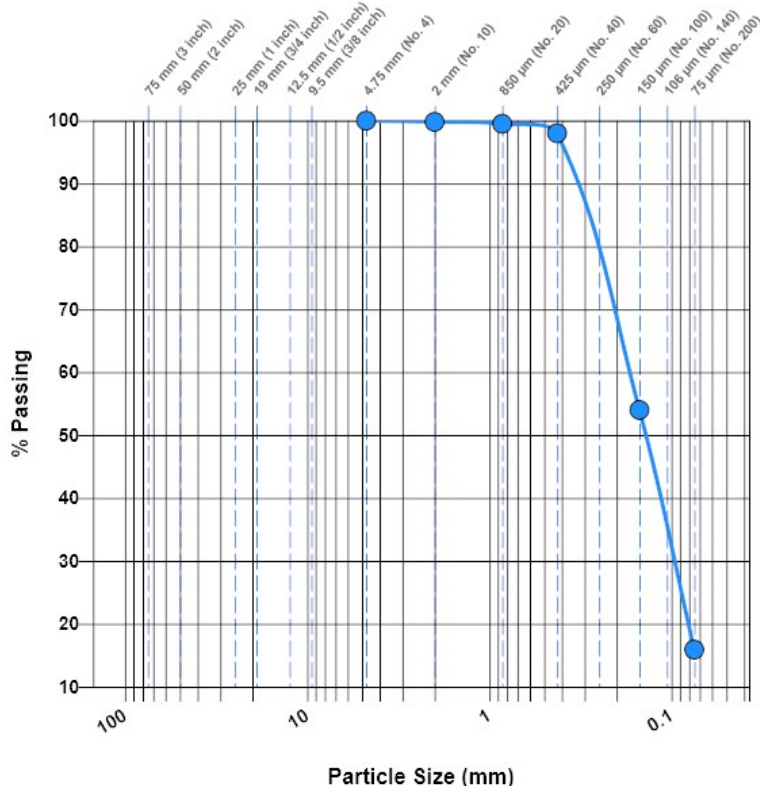
Sieve Size	Passing (%)	Specification
4.75 mm (No. 4)	100.0	
2 mm (No. 10)	99.8	
850 µm (No. 20)	99.5	
425 µm (No. 40)	98.0	
150 µm (No. 100)	54.0	
75 µm (No. 200)	15.9	

Sand (%)
84.1

Silt & Clay (%)
15.9

D30
0.086

D60
0.164



Specimen Obtained: Oven Dry

Test Method: Method B (Single Sieve Set)

Dispersion Apparatus: Shaking

General

Results: The test is for informational purposes.

Remarks: Total dry weight of sample is 227.6 grams.

Shane Falwey

4511 West First Street
Suite 4
Duluth, MN 55807
Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

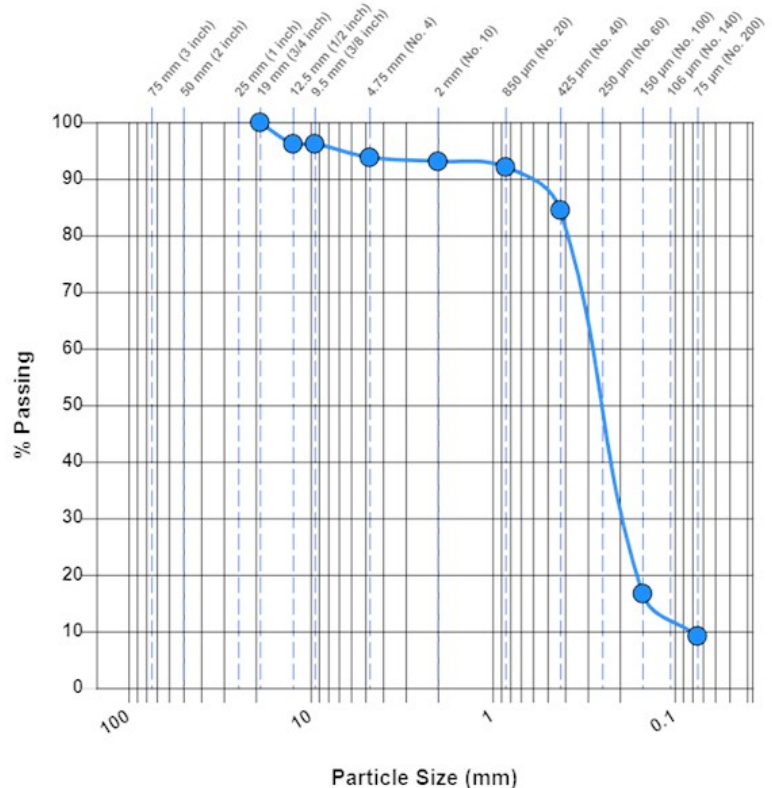
Sample Information

Sample Number:	328491	Alternate ID:	3-DC B 112'-112'-4"
Sampling Method:	Auger Boring ASTM D1452	Depth (ft):	112-112'-4"
Boring Number:	3-DC	Sampled By:	Drill Crew
Location:	In-place		
Location Details:	Boring 3-DC Sample B 112'-112'-4"		
Sample Date:	07/27/2020		
Received Date:	08/07/2020	Lab:	4511 West First Street, Suite 4, Duluth, MN
Tested Date:	08/11/2020	Tested By:	Nelson, Brennan

Laboratory Data

Sieve Size	Passing (%)	Specification
19 mm (3/4 inch)	100.0	
12.5 mm (1/2 inch)	96.2	
4.75 mm (No. 4)	93.8	
2 mm (No. 10)	93.1	
850 µm (No. 20)	92.1	
425 µm (No. 40)	84.5	
150 µm (No. 100)	16.7	
75 µm (No. 200)	9.2	

Gravel (%)	Sand (%)	Silt & Clay (%)
6.2	84.6	9.2
D10	D30	D60
0.078	0.170	0.214
C_u	C_c	
2.74	1.73	



Classification: SP-SM Poorly graded sand with silt

Specimen Obtained: Oven Dry

Test Method: Method A (Composite Sieving)

Dispersion Apparatus: Shaking

General

Results: The test is for informational purposes.

Remarks: Total Dry Weight of sample is 118.2 grams.

[Signature]

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Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number:	328492	Alternate ID:	3-DC D 122'-122.5'
Sampling Method:	Auger Boring ASTM D1452	Depth (ft):	122-122.5
Boring Number:	3-DC	Sampled By:	Drill Crew
Location:	In-place		
Location Details:	Boring 3-DC Sample D 122'-122.5'		
Sample Date:	07/28/2020		
Received Date:	08/07/2020	Lab:	4511 West First Street, Suite 4, Duluth, MN
Tested Date:	08/11/2020	Tested By:	Nelson, Brennan

Laboratory Data

Sieve Size	Passing (%)	Specification
4.75 mm (No. 4)	100.0	
2 mm (No. 10)	99.5	
850 µm (No. 20)	97.7	
425 µm (No. 40)	77.9	
150 µm (No. 100)	17.1	
75 µm (No. 200)	9.8	

Sand (%)

90.2

Silt & Clay (%)

9.8

D10

0.076

D30

0.171

D60

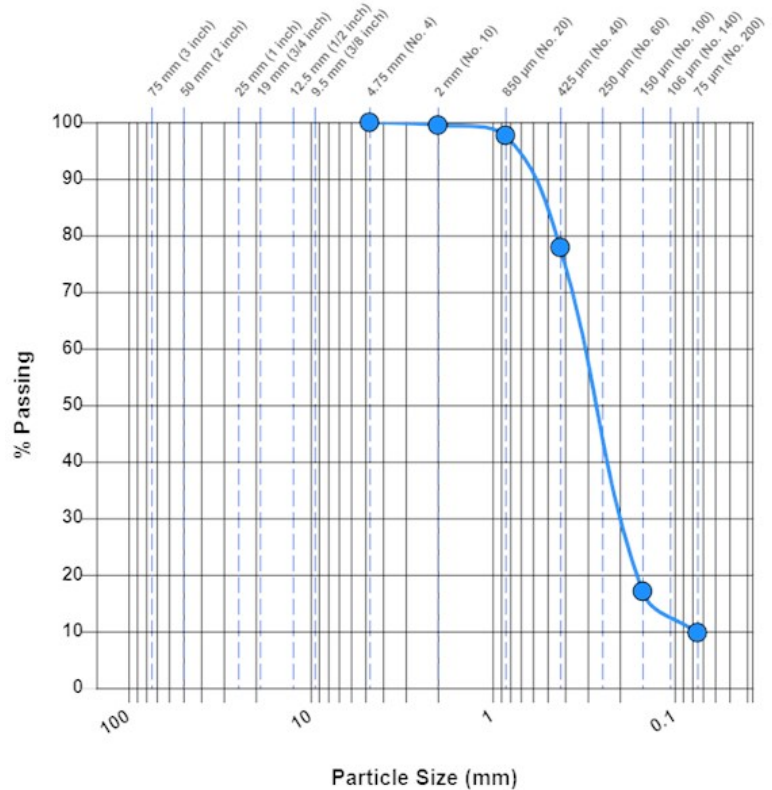
0.221

C_u

2.91

C_c

1.74



Classification: SP-SM Poorly graded sand with silt

Specimen Obtained: Oven Dry

Test Method: Method A (Composite Sieving)

Dispersion Apparatus: Shaking

General

Results: The test is for informational purposes.

Remarks: Total dry weight of sample is 194.1 grams.

[Signature]

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Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number:	328496	Alternate ID:	3-DC G 37'
Sampling Method:	Auger Boring ASTM D1452	Depth (ft):	137
Boring Number:	3-DC	Sampled By:	Drill Crew
Location:	In-place		
Location Details:	Boring 3-DC Sample G 137'		
Sample Date:	07/28/2020		
Received Date:	08/07/2020	Lab:	4511 West First Street, Suite 4, Duluth, MN
Tested Date:	08/11/2020	Tested By:	Nelson, Brennan

Laboratory Data

Sieve Size	Passing (%)	Specification
19 mm (3/4 inch)	100.0	
12.5 mm (1/2 inch)	63.8	
9.5 mm (3/8 inch)	60.3	
4.75 mm (No. 4)	55.5	
2 mm (No. 10)	51.0	
850 µm (No. 20)	46.2	
425 µm (No. 40)	40.7	
150 µm (No. 100)	29.2	
75 µm (No. 200)	23.2	

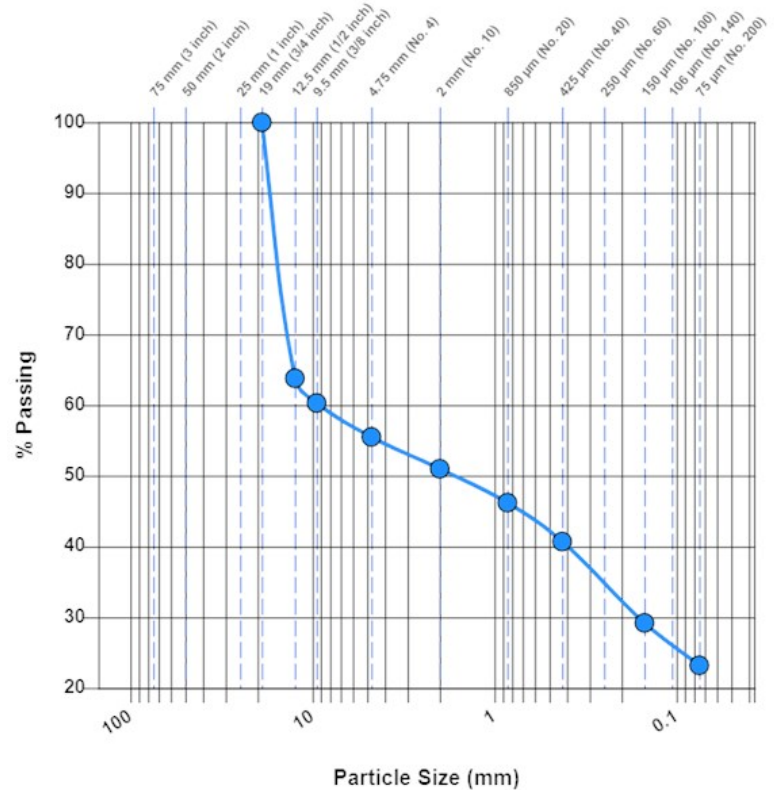
Gravel (%)
44.5

Sand (%)
32.3

Silt & Clay (%)
23.2

D30
0.157

D60
0.203



Classification: SM Silty sand with gravel

Specimen Obtained: Oven Dry

Test Method: Method A (Composite Sieving)

Dispersion Apparatus: Shaking

General

Results: The test is for informational purposes.

Remarks: Total dry weight of sample is 110.9 grams.

[Signature]

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Suite 4
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Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number: 315524 **Alternate ID:** 3WB Sample 9 17'-19'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Drill Crew
Location: In-place
Location Details: Boring 3WB Sample 9 17'-19'
Sample Date: 05/22/2020
Received Date: 06/15/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 06/17/2020 **Tested By:** Nelson, Brennan

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
3-WB	9	18.0	9.8

General

Results: The test is for informational purposes.



4511 West First Street
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Duluth, MN 55807
Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number: 318311 **Alternate ID:** 3-WB 12 32'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Drill Crew
Location: In-place
Location Details: Boring 3-WB 12 32'
Sample Date: 05/22/2020
Received Date: 06/25/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 06/25/2020 **Tested By:** Patterson, Gregg

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
3-WB	12	32.0	12.0

General

Results: The test is for informational purposes.



4511 West First Street
Suite 4
Duluth, MN 55807
Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number: 318312 **Alternate ID:** 3-WB 16 52'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Drill Crew
Location: In-place
Location Details: Boring 3-WB 16 52'
Sample Date: 05/22/2020
Received Date: 06/25/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 06/26/2020 **Tested By:** Nelson, Brennan

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
3-WB	16	52.0	11.9

General

Results: The test is for informational purposes.



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Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number: 318314 **Alternate ID:** 3-WB 21 77'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Drill Crew
Location: In-place
Location Details: Boring 3-WB 21 77'
Sample Date: 05/22/2020
Received Date: 06/25/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 06/26/2020 **Tested By:** Nelson, Brennan

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
3-WB	21	77.0	24.2

General

Results: The test is for informational purposes.



4511 West First Street
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Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number: 321580 **Alternate ID:** 3-DC 5 9'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Drill Crew
Location: In-place
Location Details: Boring 3-DC Sample 5 9'
Sample Date: 06/24/2020
Received Date: 07/13/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 07/14/2020 **Tested By:** Nelson, Brennan

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
3-DC	5	9.0	6.0

General

Results: The test is for informational purposes.



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Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number: 321583 **Alternate ID:** 3-DC 10 25'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Drill Crew
Location: In-place
Location Details: Boring 3-DC Sample 10 25'
Sample Date: 06/24/2020
Received Date: 07/13/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 07/14/2020 **Tested By:** Nelson, Brennan

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
3-DC	10	25.0	14.4

General

Results: The test is for informational purposes.



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Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number: 321584 **Alternate ID:** 3-DC 15 50'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Drill Crew
Location: In-place
Location Details: Boring 3-DC Sample 15 50'
Sample Date: 06/24/2020
Received Date: 07/13/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 07/14/2020 **Tested By:** Nelson, Brennan

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
3-DC	15	50.0	19.0

General

Results: The test is for informational purposes.



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Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number: 321585 **Alternate ID:** 3-DC 21 80'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Drill Crew
Location: In-place
Location Details: Boring 3-DC Sample 21 80'
Sample Date: 06/25/2020
Received Date: 07/13/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 07/14/2020 **Tested By:** Nelson, Brennan

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
3-DC	21	80.0	21.4

General

Results: The test is for informational purposes.



4511 West First Street
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Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number: 330739 **Sampled By:** Nelson, Brennan
Sample From: Boring
Sample Date: 08/20/2020
Received Date: 08/20/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 08/20/2020 **Tested By:** Nelson, Brennan

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
3WB	6	125.0	13.7

General

Results: The test is for informational purposes.



4511 West First Street
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Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number: 330743 **Sampled By:** Nelson, Brennan
Sample From: Boring
Sample Date: 08/20/2020
Received Date: 08/20/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 08/20/2020 **Tested By:** Nelson, Brennan

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
3WB	1	100.0	21.5

General

Results: The test is for informational purposes.



4511 West First Street
Suite 4
Duluth, MN 55807
Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number: 328491 **Alternate ID:** 3-DC B 112'-112'-4"
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Drill Crew
Location: In-place
Location Details: Boring 3-DC Sample B 112'-112'-4"
Sample Date: 07/27/2020
Received Date: 08/07/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 08/11/2020 **Tested By:** Nelson, Brennan

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
3-DC	13	112.0	21.6

General

Results: The test is for informational purposes.



4511 West First Street
Suite 4
Duluth, MN 55807
Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number: 328492 **Alternate ID:** 3-DC D 122'-122.5'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Drill Crew
Location: In-place
Location Details: Boring 3-DC Sample D 122'-122.5'
Sample Date: 07/28/2020
Received Date: 08/07/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 08/11/2020 **Tested By:** Nelson, Brennan

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
3-DC	D	122.0	19.0

General

Results: The test is for informational purposes.



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Client:

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Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number: 328496 **Alternate ID:** 3-DC G 37'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Drill Crew
Location: In-place
Location Details: Boring 3-DC Sample G 137'
Sample Date: 07/28/2020
Received Date: 08/07/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 08/11/2020 **Tested By:** Nelson, Brennan

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
3-DC	G	137.0	9.9

General

Results: The test is for informational purposes.

