

Subsurface Investigation Report

Enbridge Line 5 Reroute
MP 15 HDD Crossing - Highway 13
Location 27-C-1, Northwest of Somppi Road, at Highway 13
Location 29-C-1, Northwest of Bass Lake Road, at Wisconsin Central
LTD
Location 31-C, North of Highway 13, at Bass Lake Road
Ashland Town, Ashland County, Wisconsin

Prepared for

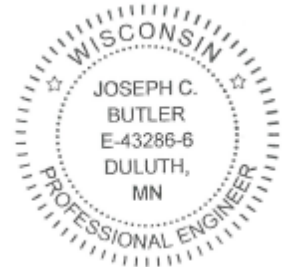
Enbridge Energy

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
October 5, 2020



October 5, 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 15 HDD Crossing - Highway 13
Location 27-C-1, Northwest of Somppi Road, at Highway 13
Location 29-C-1, Northwest of Bass Lake Road, at **Wisconsin Central LTD**
Location 31-C, North of Highway 13, at Bass Lake Road
Ashland Town, Ashland County, Wisconsin

Dear Mr. Erickson:

We are pleased to present this Subsurface Investigation Report for the Line 5 Reroute Project at the MP 15 HDD Crossing under Highway 13 in Ashland Town, 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 27-C-1, 29-C-1, 31-C

HDD Alignment Profile

Descriptive Terminology of Soil

Descriptive Terminology of Bedrock

Hydrometer & Sieve Analysis Reports 302823 through 302826, 302842, and 302843, 306138, 306140, 306141, 306149, 306147, 306148, 307518, 307519 through 307521, 307723, 307724

Sieve Analysis Reports 300520, 300521, 302835, and 302836, 303582, 303584 through 303589, 303592 through 303594, and 303793

Moisture Testing Reports 300520 and 300521, 303582, 303584 through 303589, 303592 through 303594, and 303793

Geotechnical Reports 302818, 6187383, and 6203756

Unconfined Compression Test Reports 29-C-1 Sample 1 and 29-C-1 sample 2

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 surfaces as part of this effort.

This report provides a factual data obtained at Borehole Locations 27-C-1, 29-C-1, and 31-C for the HDD crossing under Highway 13 which is located at MP 15 in the proposed pipeline alignment in Ashland Town, Ashland County, Wisconsin.

A.2. Purpose

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

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 location and we cleared the exploration location of underground utilities. The Soil Boring Location Sketch included in the Appendix shows the approximate location of the boring.
- Performing three (3) standard penetration test (SPT) borings, denoted as 27-C-1, 29-C-1, 31-C to a nominal depths ranging from 110 to 118 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, an exploration log, laboratory tests, 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. Soils Encountered

The general geologic profile of the soils encountered between the 3 borings generally consisted (proceeding down from the ground surface) of 2 feet of silty sand topsoil, underlain by lacustrine (lake deposited) and glacial deposited fat clays, lean clays, silty clay, silts, and silty sands to the termination depth of 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)	Wet Unit Weight Range (pcf)	Effective Friction Angle Range (degrees)	Undrained Friction Angle (degrees)	Effective Cohesion Range (ksf)	Modulus of Elasticity Range* (tsf)
Upper Soils (834 1/2 to 774)	Lean Clay (CL)	9 - 15	122 - 125	27 - 28	5	0.9 – 1.5	48 - 69
	Fat Clay (CH)	4 - 14	110 - 112	20 - 22	0	0.35 - 1.0	36 - 52
	Fat Clay (CH)	14 - 32	115 - 125	25 - 27	0	1.1 – 4.2	92 – 132
	Silt (ML)	57	125 - 127	33 - 35	35	0	228 - 246
	Silty Sand (SM)	50 - 62	125 - 130	35 - 37	25	4.1+	323 - 392
Middle Soils (803 to 739 1/2)	Silt (ML)	13 -30	112 - 122	28 - 31	29 - 31	0	88 - 95
	Silt (ML)	31 - 55	122 - 127	32 - 36	33 - 35	0	172 - 186
	Lean Clay (CL)	34 - 55	130 - 132	31 - 32	10	3.1 – 6.0	180 - 259
	Silty Clay with Sand (CL-ML)	32	120 - 125	27	0	2.2 – 4.2	128 - 184
	Fat Clay (CH)	32	120 -125	27	0	2.2 – 4.2	128 - 184

Soil Strata and Elevations (ft)	Soil Type	Blow Count per foot Range (BPF)	Wet Unit Weight Range (pcf)	Effective Friction Angle Range (degrees)	Undrained Friction Angle (degrees)	Effective Cohesion Range (ksf)	Modulus of Elasticity Range* (tsf)
Lower Soils (752 1/2 to 717)	Silt (ML)	23 - 50 blows for 4 inches of penetration	120 - 127	31 - 36	31 - 35	0	172 - 186
	Lean Clay (CL)	80 blows for 11 inches of penetration	133 - 135	33 - 35	35	6.1+	200 - 288
	Silty Sand (SM)	88 - 50 blows for 3 inches of penetration	125 - 130	35 - 37	25	4.1+	518 - 630

*Sustained Young's Modulus values

B.4. Groundwater

We did not observe groundwater while advancing borings 29-C-1 and 31-C. Groundwater may take days or longer to reach equilibrium in the boreholes and we immediately backfilled the boreholes, in accordance with our scope of work.

We did encounter groundwater at a depth of 50 feet in boring 27-C-1 while advancing the boring.

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 hydrometer with sieve analysis, moisture testing, soil density testing, Atterberg limits, and unconfined compressive strength of soil that was requested. The Appendix contains the results of these tests.

C. Design and Construction Considerations

C.1. Underground Pipe Installations

The subsurface conditions are generally conducive to trenchless construction. We recommend the project team follow industry best practices and applicable codes/standards for design and construction. We understand a Detailed Work Plan for trenchless design considerations and mitigation measures, will be provided separately, by others.

C.2. Excavation and Shoring

The excavations associated with the HDD are limited to the pits at each end of the crossing, are planned to be approximately 4 feet deep, and will be located outside of the CN-defined zone of influence. We recommend excavation comply with the requirements of OSHA and with the project's Environmental Protection Plan.

D. Procedures

D.1. Penetration Test Borings

We drilled the penetration test borings with a float tire-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.

D.2. Exploration Logs

D.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.

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.

D.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.

D.3. Material Classification and Testing

D.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.

D.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.

D.4. Groundwater Measurements

The drillers checked for groundwater while advancing the penetration test borings, and again after auger withdrawal. We then filled the boreholes or allowed them to remain open for an extended period of observation, as noted on the boring logs.

E. Qualifications

E.1. Variations in Subsurface Conditions

E.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.

E.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.

E.2. Continuity of Professional Responsibility

E.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.

E.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.

E.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.

E.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: 27-C-1	
					LOCATION: See attached sketch	
					LATITUDE: 46.40012	LONGITUDE: -90.79573
DRILLER: M. Swenson		LOGGED BY: S. Sullivan		START DATE: 04/13/20	END DATE: 04/15/20	
SURFACE ELEVATION: 836.4 ft		RIG: Subcontractor	METHOD: 3 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
834.4		SILTY SAND (SM), fine to medium-grained Sand, with roots, brown, moist (TOPSOIL)		1-3-2-3 (5) 14"			Drilling method switched to mud rotary at 6 feet
2.0		LEAN CLAY (CL), reddish brown, moist, stiff (LACUSTRINE)		1-4-7-10 (11) 12"			
			5	SH 21"			
				3-6-9-9 (15) 24"			
			10	3-4-5-8 (9) 24"			
				SH 24"			
822.4		FAT CLAY (CH), reddish brown, moist, soft to stiff (LACUSTRINE)	15	2-3-3-4 (6) 24"			
14.0			20	0-1-3-2 (4) WOH/6" 24"			
			25	SH 24"			
			30	2-5-9-11 (14) 18"			

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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	
802.9		FAT CLAY (CH), reddish brown, moist, soft to stiff (LACUSTRINE)						
33.5		SANDY SILT (ML), fine to medium-grained, brown, moist, very dense (GLACIAL TILL)	35	19-29-28-33 (57) 18"		20	Gradation result is in the attached lab report	
797.9								
38.5		SILT (ML), reddish brown, moist, very stiff (GLACIAL TILL)	40	15-15-15-18 (30) 18"				
				45	11-11-18-14 (29) 20"		21	Gradation result is in the attached lab report
				50	11-12-13-13 (25) 18"			
			55	7-11-15-14 (26) 22"				
777.9		SILT (ML), reddish brown, wet, very stiff (GLACIAL TILL)	60	7-8-8-9 (16) 22"			Estimated water at 50 feet while drilling - no final reading due to mud rotary	
58.5								

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SURFACE ELEVATION: 836.4 ft		RIG: Subcontractor	METHOD: 3 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
		SILT (ML), reddish brown, wet, very stiff (GLACIAL TILL)	65	14-17-15-13 (32) 18"		24	Gradation result is in the attached lab report
			70	6-9-9-14 (18) 24"			
			75	9-17-22-25 (39) 22"		16	Gradation result is in the attached lab report
			80	11-13-18-20 (31) 22"			
752.4 84.0		SANDY SILT (ML), fine to medium-grained, brown, moist, dense to very dense (GLACIAL TILL)	85	6-9-25-34 (34) 24"		14	Gradation result is in the attached lab report
			90	26-39-46-50/ 5" (85) 18"			
			95	18-34-46-50/ 4"		11	Gradation result is in the attached lab report

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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
		SANDY SILT (ML), fine to medium-grained, brown, moist, dense to very dense (GLACIAL TILL)	△	(80) 22"			
			100 X	50/5" (REF) 4"			
			105 X	42-50/4" (REF) 10"		14	Gradation result is in the attached lab report
			110 X	44-50/5" (REF) 11"			
722.4							
114.0		SILTY SAND (SM), fine to medium-grained Sand, brown, moist, very dense (GLACIAL TILL)	115 X	50-50/5" (REF) 11"		17	Gradation result is in the attached lab report
718.4			X	25-50/4" (REF) 9"			Water observed at 50.0 feet while drilling.
118.0		END OF BORING					
		Boring then backfilled with cement/bentonite grout	20				
			125				

Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin					BORING: 29-C-1	
					LOCATION: See attached sketch	
					LATITUDE: 46.39999	LONGITUDE: -90.79209
DRILLER: M. Heinzen		LOGGED BY: S. Sullivan		START DATE: 03/20/20	END DATE: 03/24/20	
SURFACE ELEVATION: 833.2 ft		RIG: 7505	METHOD: 3 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
831.2		SILTY SAND (SM), fine to medium-grained Sand, with organic, roots, brown, moist (TOPSOIL)		AU			
2.0		FAT CLAY (CH), trace Gravel, reddish brown, moist, stiff (LACUSTRINE)		1-4-6 (10) 14"			
			5	2-4-7 (11) 13"			
				2-5-6 (11) 13"			
821.7			10	2-4-9 (13) 12"		18	Hydrometer and Sieve Analysis results are in the attached lab report
11.5		FAT CLAY (CH), brown, moist, stiff to hard (LACUSTRINE)		5-15-21 (36) 14"			
			15	3-5-5 (10) 13"		26	Hydrometer and Sieve Analysis results are in the attached lab report
815.7		FAT CLAY (CH), reddish brown, moist to wet, very soft to stiff (LACUSTRINE)		2-2-4 (6) 17"			
17.5			20	1-2-3 (5) 16"		27	Hydrometer and Sieve Analysis results are in the attached lab report
			25				
			30	0-1-3 (4) WOH/6" 18"		34	Hydrometer and Sieve Analysis results are in the attached lab report

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DRILLER: M. Heinzen		LOGGED BY: S. Sullivan		START DATE: 03/20/20	END DATE: 03/24/20	
SURFACE ELEVATION: 833.2 ft		RIG: 7505	METHOD: 3 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
		FAT CLAY (CH), reddish brown, moist to wet, very soft to stiff (LACUSTRINE)					
			35	0-2-3 (5) WOH/6" 18"			
			40	4-4-10 (14) 13"			
			45	6-8-10 (18) 12"		22	Gradation result is in the attached lab report
			50	3-6-8 (14) 12"			
			55	4-9-10 (19) 16"			
774.2							
59.0		SILT (ML), trace Gravel, brown, moist, medium dense to dense (LACUSTRINE)	60	5-11-14 (25) 13"		21	Gradation result is in the attached lab report

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SURFACE ELEVATION: 833.2 ft		RIG: 7505	METHOD: 3 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
764.2		SILT (ML), trace Gravel, brown, moist, medium dense to dense (LACUSTRINE)	65	4-4-9 (13) 12"			
69.0		SILTY CLAY (CL-ML), with Sand, trace Gravel, brown, moist, hard (LACUSTRINE)	70	TW 22"		14	Thinwall - Hydrometer, Sieve Analysis, Unconfined Compression, Wet and Dry Density Test results are in the attached lab reports LL=20, PL=16, PI=4
755.7		FAT CLAY (CH), reddish brown, moist, hard (LACUSTRINE)	75	8-14-18 (32) 13"			
77.5		FAT CLAY (CH), reddish brown, moist, hard (LACUSTRINE)	80	TW 18"		34	Thinwall - Hydrometer, Sieve Analysis, Unconfined Compression, Wet and Dry Density Test results are in the attached lab reports
750.7		SILTY SAND (SM), fine to medium-grained, with Gravel, reddish brown, moist, hard (GLACIAL TILL)	85	48-50/4" (REF) 7"			
82.5		SILTY SAND (SM), fine to medium-grained, with Gravel, reddish brown, moist, hard (GLACIAL TILL)	90	41-50/4" (REF) 8"			
			95	98-50/3" (REF) 7"		11	Gradation result is in the attached lab report

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See Descriptive Terminology sheet for explanation of abbreviations

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DRILLER: M. Heinzen		LOGGED BY: S. Sullivan		START DATE: 03/20/20	END DATE: 03/24/20		
SURFACE ELEVATION: 833.2 ft		RIG: 7505	METHOD: 3 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, with Gravel, reddish brown, moist, hard (GLACIAL TILL)					
			100	34-50/3" (REF) 5"			
			105	50-50-38 (88) 12"		12	Gradation result is in the attached lab report
			110	22-50/4" (REF) 7"			
717.8			115	48-50/5" (REF) 10"			Water not observed while drilling.
115.4		END OF BORING					
		Boring immediately backfilled with bentonite grout					
			120				
			125				

Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin					BORING: 31-C		
					LOCATION: See attached sketch		
					LATITUDE: 46.40002	LONGITUDE: -90.78802	
DRILLER: C. Coffindaffer		LOGGED BY: S. Sullivan		START DATE: 04/14/20	END DATE: 04/16/20		
SURFACE ELEVATION: 827.1 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
825.1		SILTY SAND (SM), fine to medium-grained Sand, with organic, brownish gray, moist (TOPSOIL)		3-8-10 (18) 17"			
2.0		FAT CLAY (CH), trace roots, reddish brown, moist, stiff (LACUSTRINE)		3-5-8 (13) 16"			
			5	SH 19"		33	Hydrometer and Sieve Analysis results are in the attached lab report LL=68, PL=21, PI=47
				4-5-7 (12) 18"			
816.1			10	3-5-5 (10) 18"		32	Hydrometer and Sieve Analysis results are in the attached lab report LL=64, PL=21, PI=43 Drilling method switched to mud rotary at 11 feet
11.0		FAT CLAY (CH), reddish brown, moist, medium to hard (LACUSTRINE)		3-3-4 (7) 18"			
			15	SH 22"		41	Hydrometer and Sieve Analysis results are in the attached lab report LL=49, PL=18, PI=31
				3-12-20 (32) 17"			
808.1		SANDY LEAN CLAY (CL), reddish brown, moist, medium (LACUSTRINE)	20	5-4-2 (6) 6"		32	Hydrometer and Sieve Analysis results are in the attached lab report
803.1		SILTY SAND (SM), fine to medium-grained, trace Gravel, brown, moist, very dense (LACUSTRINE)	25	SH 18"		26	Hydrometer and Sieve Analysis results are in the attached lab report Nonplastic
24.0							
			30	18-23-27 (50) 16"			

Continued on next page

Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin					BORING: 31-C	
					LOCATION: See attached sketch	
					LATITUDE: 46.40002	LONGITUDE: -90.78802
DRILLER: C. Coffindaffer		LOGGED BY: S. Sullivan		START DATE: 04/14/20	END DATE: 04/16/20	
SURFACE ELEVATION: 827.1 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
788.6 38.5		SILTY SAND (SM), fine to medium-grained, trace Gravel, brown, moist, very dense (LACUSTRINE)	35	23-32-30 (62) 17"		15	Gradation result is in the attached lab report
783.6 43.5		FAT CLAY (CH), with Gravel, reddish brown, moist, medium (LACUSTRINE)	40	3-3-5 (8) 15"			
		SANDY LEAN CLAY (CL), reddish brown, moist, hard (GLACIAL TILL)	45	6-15-19 (34) 16"		18	Hydrometer and Sieve Analysis results are in the attached lab report LL=22, PL=18, PI=4
			50	SH 15"		15	Hydrometer and Sieve Analysis results are in the attached lab report LL=20, PL=16, PI=4
			55	14-18-28 (46) 13"			
763.6 63.5			60	17-23-32 (55) 14"		19	Hydrometer and Sieve Analysis results are in the attached lab report
Continued on next page							

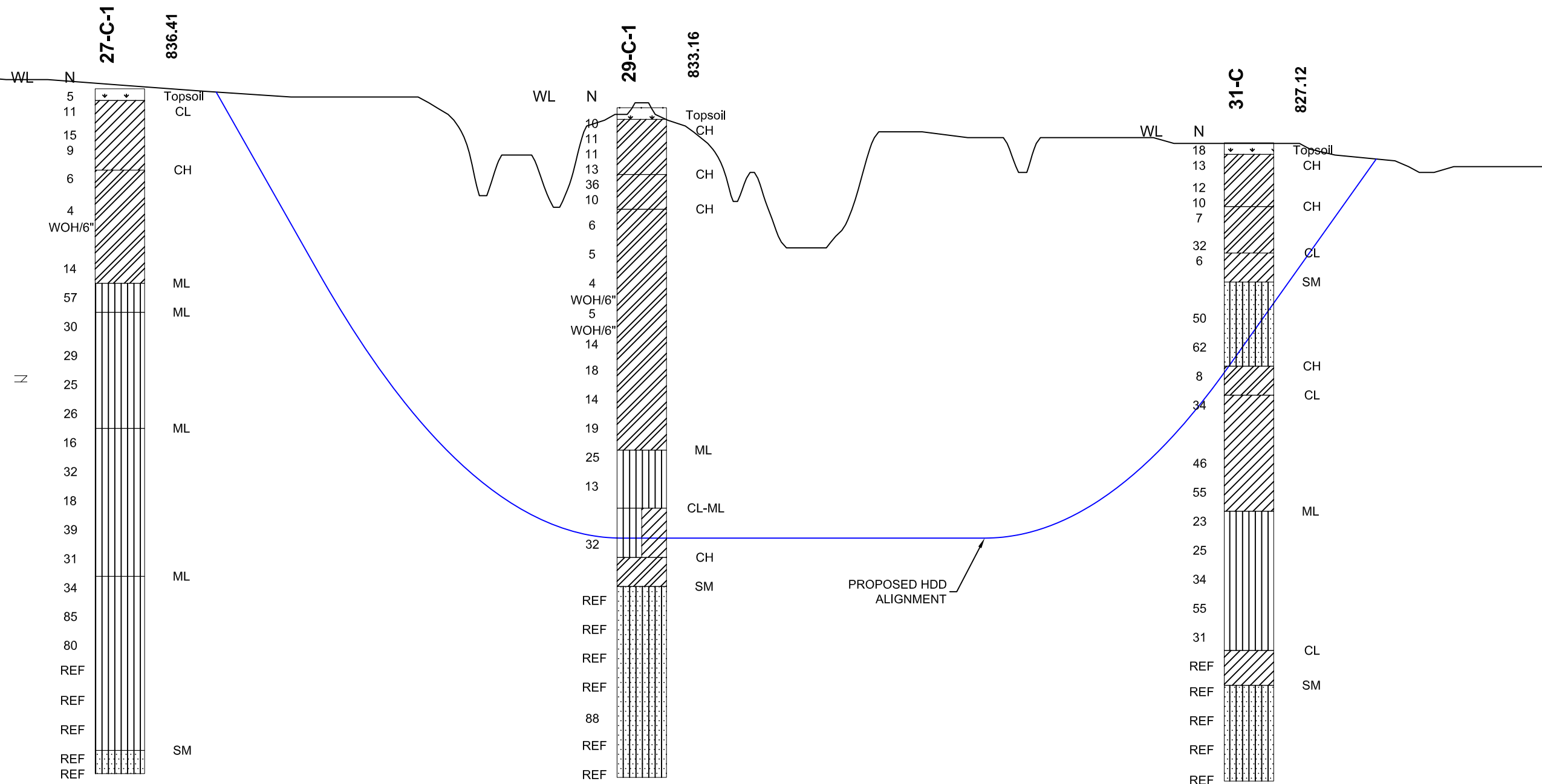
Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin					BORING: 31-C		
					LOCATION: See attached sketch		
					LATITUDE: 46.40002	LONGITUDE: -90.78802	
DRILLER: C. Coffindaffer		LOGGED BY: S. Sullivan		START DATE: 04/14/20	END DATE: 04/16/20		
SURFACE ELEVATION: 827.1 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
		SILT (ML), trace Gravel, reddish brown, moist, medium dense to very dense (GLACIAL TILL)	65	9-13-10 (23) 17"			
			70	11-12-13 (25) 18"		30	LL=27, PL=19, PI=8
			75	18-14-20 (34) 8"			
			80	16-25-30 (55) 15"		21	Hydrometer and Sieve Analysis results are in the attached lab report
			85	14-12-19 (31) 15"			
739.6 87.5		SANDY LEAN CLAY (CL), with Gravel, reddish brown, moist, hard (GLACIAL TILL)	90	18-30-50/5" (REF) 5"		11	Hydrometer and Sieve Analysis results are in the attached lab report
733.6 93.5		SILTY SAND (SM), fine to medium-grained Sand, with Gravel, brown, wet, very dense (GLACIAL TILL)	95	50/3" (REF) 3"			

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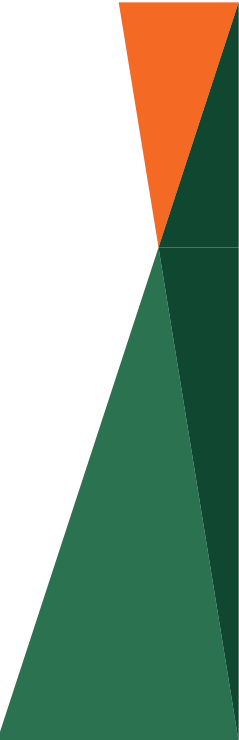
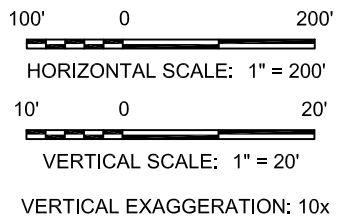
Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin					BORING: 31-C	
					LOCATION: See attached sketch	
					LATITUDE: 46.40002	LONGITUDE: -90.78802
DRILLER: C. Coffindaffer		LOGGED BY: S. Sullivan		START DATE: 04/14/20	END DATE: 04/16/20	
SURFACE ELEVATION: 827.1 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 (SM), fine to medium-grained Sand, with Gravel, brown, wet, very dense (GLACIAL TILL)					
			100	50/3" (REF) 3"		20	Gradation result is in the attached lab report
			105	50/3" (REF) 3"			
717.1			110	50/3" (REF) 3"		19	
110.0		END OF BORING					Gradation result is in the attached lab report Water not observed while drilling.
		Boring then backfilled with cement/bentonite grout					
			115				
			120				
			125				

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PROPOSED HDD
ALIGNMENT



Drawing Information	
Project No:	B2001991
Drawing No:	B2001991_MP15_HWY-13
Drawn By:	BJB
Date Drawn:	5/27/20
Checked By:	DM
Last Modified:	5/27/20

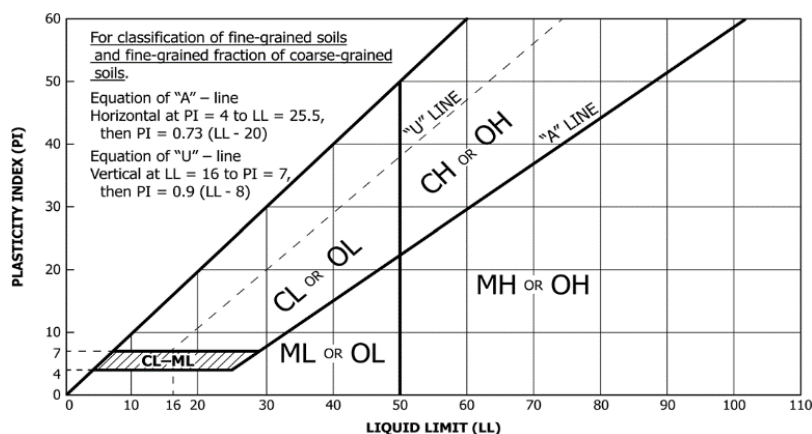
Project Information

Enbridge Line 5 Re-route

**MP 15 - Highway
13 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 ^{KLMQ}
	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 ^{KLMP} Organic silt ^{KLMQ}
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.

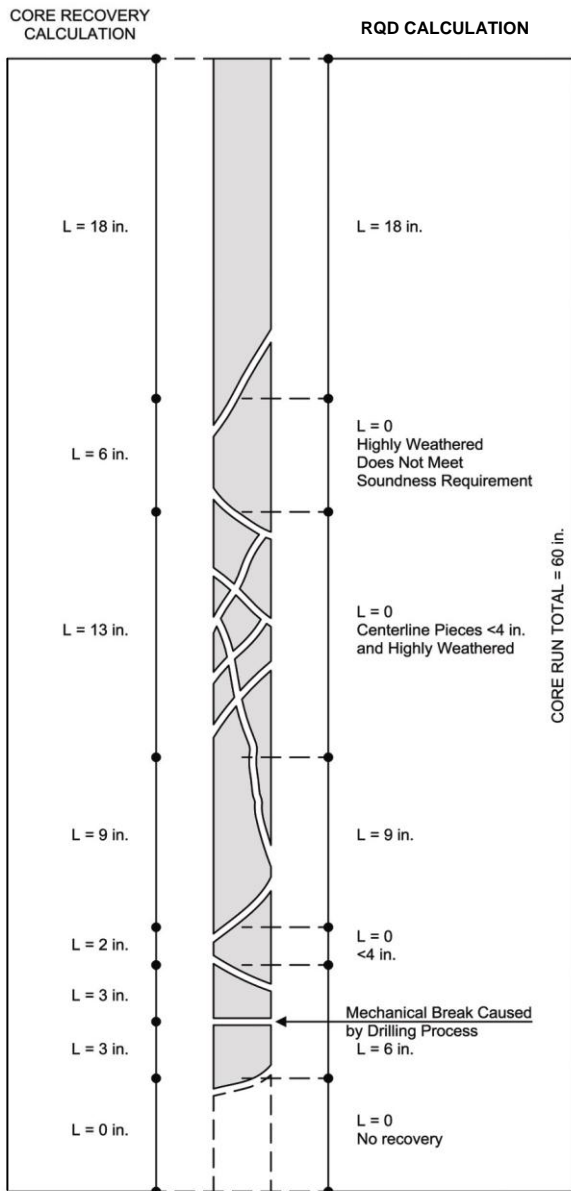
Partial Penetration: If the sampler could not be driven through a full 6-inch interval, the number of blows for that partial penetration is shown as #/x" (i.e. 50/2"). The N-value is reported as "REF" indicating refusal.

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 ().



Example Calculations

Core Recovery, CR = $\frac{\text{Total length of rock recovered}}{\text{Total core run length}}$

Example: $CR = \frac{(18 + 6 + 13 + 9 + 2 + 3 + 3)}{(60)}$

CR = 90%

RQD = $\frac{\text{Sum of sound pieces 4 inches or larger}}{\text{Total core run length}}$

RQD Percent	Rock Quality
< 25	very poor
25 < 50	poor
50 < 75	fair
75 < 90	good
90 < 100	excellent

Example: $RQD = \frac{(18 + 9 + 6)}{(60)}$

RQD = 55%

Weathering

Unweathered: No evidence of chemical or mechanical alteration.

Slightly weathered: Slight discoloration on surface, slight alteration along discontinuities, less than 10% of rock volume altered.

Moderately Weathered: Discoloration evident, surface pitted and altered with alteration penetrating well below rock surfaces, weathering halos evident, 10% to 50% of the rock altered.

Highly Weathered: Entire mass discolored, alteration pervading nearly all of the rock, with some pockets of slightly weathered rock noticeable, some mineral leached away.

Decomposed: Rock reduced to a soil consistency with relict rock texture, generally molded and crumbled by hand.

Hardness

<i>Very soft:</i>	Can be deformed by hand
<i>Soft:</i>	Can be scratched with a fingernail
<i>Moderately hard:</i>	Can be scratched easily with a knife
<i>Hard:</i>	Can be scratched with difficulty with a knife
<i>Very hard:</i>	Cannot be scratched with a knife

Texture

Sedimentary Rocks:	Grain Size
Coarse grained	2 – 5 mm
Medium grained	0.4 – 2 mm
Fine grained	0.1 – 0.4 mm
Very fine grained	< 0.1 mm

Igneous and Metamorphic Rocks:

Coarse grained	5 mm
Medium grained	1 – 5 mm
Fine grained	0.1 – 1 mm
Aphanitic	< 0.1 mm

Thickness of Bedding

<i>Massive:</i>	3 ft. thick or greater
<i>Thick bedded:</i>	1 to 3 ft. thick
<i>Medium bedded:</i>	4 in. to 1 ft. thick
<i>Thin bedded:</i>	4 in. thick or less

Degree of Fracturing (Jointing)

<i>Unfractured:</i>	Fracture spacing 6 ft. or more
<i>Slightly fractured:</i>	Fracture spacing 2 to 6 ft.
<i>Moderately fractured:</i>	Fracture spacing 8 in. to 2 ft.
<i>Highly fractured:</i>	Fracture spacing 2 in. to 8 in.
<i>Intensely fractured:</i>	Fracture spacing 2 in. or less

11001 Hampshire Avenue S
Minneapolis, MN 55438
Phone: 952-995-2000

Client:

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

Project:

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Enbridge Line 5 Re-route
Enbridge Line 5
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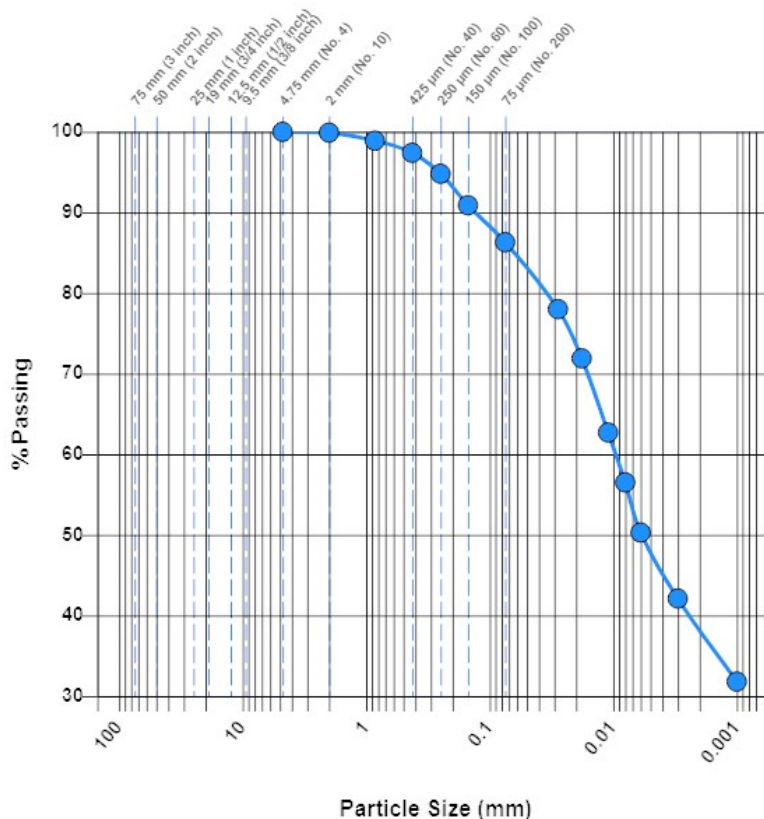
Sample Information

Sample Number:	302823	Depth (ft):	9.5
Boring Number:	29-C-1	Sampled By:	Drill Crew
Sample Date:	04/20/2020		
Received Date:	04/20/2020	Lab:	11001 Hampshire Ave S, Bloomington, MN
Tested Date:	04/20/2020	Tested By:	Streier, Jim

Laboratory Data

Sieve-Hydrometer Analysis

Particle Size	% Passing	Specification
4.75 mm (No. 4)	100.0	-
2 mm (No. 10)	99.9	-
850 µm (No. 20)	98.9	-
425 µm (No. 40)	97.4	-
250 µm (No. 60)	94.8	-
150 µm (No. 100)	90.9	-
75 µm (No. 200)	86.3	-
28.1 (µm)	78.0	-
18.3 (µm)	71.9	-
10.9 (µm)	62.7	-
7.9 (µm)	56.5	-
5.7 (µm)	50.3	-
2.9 (µm)	42.1	-
1.3 (µm)	31.8	-



Soil Classification: CH Fat clay

Gravel (%):	0.0	Sand (%):	13.7	Silt (%):	38.7	Clay (%):	47.6
D₆₀ (µm):	9.7						

General

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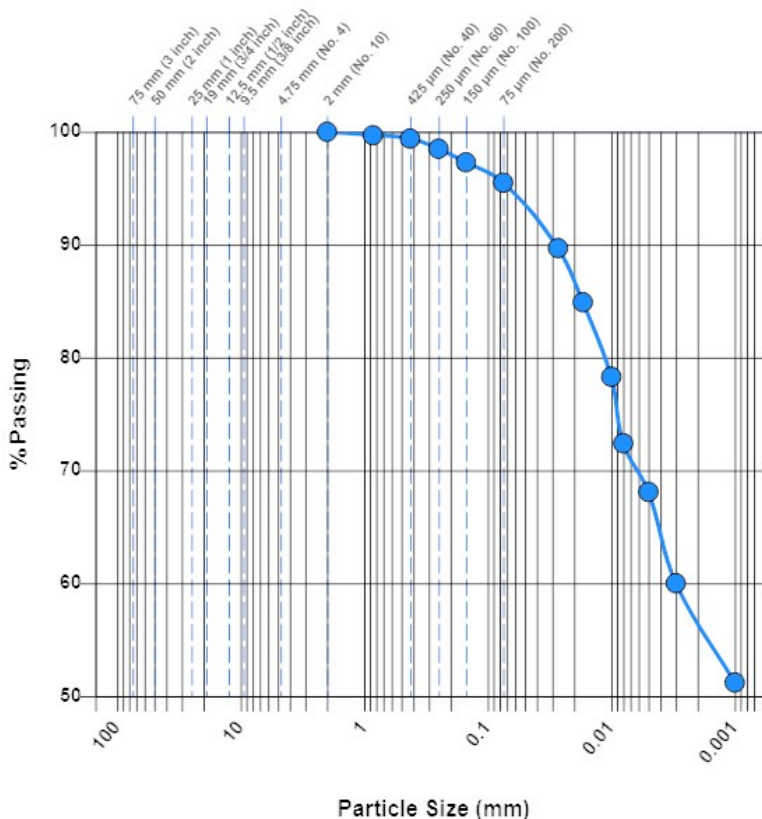
Sample Information

Sample Number:	302824	Depth (ft):	14.5
Boring Number:	29-C-1	Sampled By:	Drill Crew
Sample Date:	04/20/2020		
Received Date:	04/20/2020	Lab:	11001 Hampshire Ave S, Bloomington, MN
Tested Date:	04/20/2020	Tested By:	Streier, Jim

Laboratory Data

Sieve-Hydrometer Analysis

Particle Size	% Passing	Specification
2 mm (No. 10)	100.0	-
850 µm (No. 20)	99.7	-
425 µm (No. 40)	99.4	-
250 µm (No. 60)	98.5	-
150 µm (No. 100)	97.3	-
75 µm (No. 200)	95.5	-
26.9 (µm)	89.7	-
17.4 (µm)	84.9	-
10.3 (µm)	78.3	-
7.5 (µm)	72.4	-
5.4 (µm)	68.1	-
2.7 (µm)	60.0	-
1.2 (µm)	51.2	-



Soil Classification: CH Fat clay

Gravel (%):	0	Sand (%):	4.5	Silt (%):	27.4	Clay (%):	68.1
D₆₀ (µm):	3.0						

General

Streier, Jim

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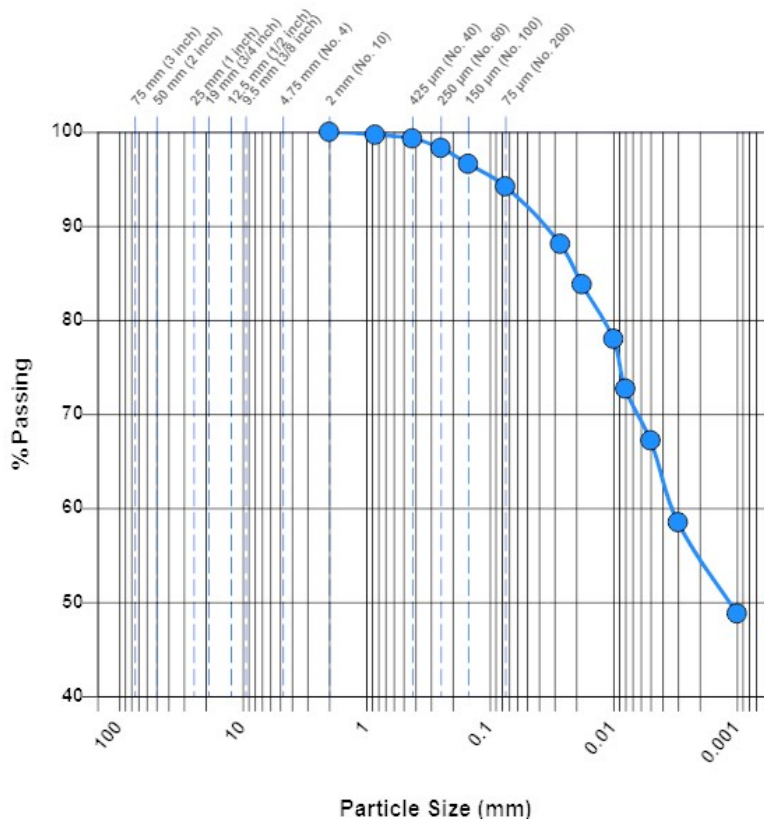
Sample Information

Sample Number:	302825	Depth (ft):	19.5
Boring Number:	29-C-1	Sampled By:	Drill Crew
Sample Date:	04/20/2020		
Received Date:	04/20/2020	Lab:	11001 Hampshire Ave S, Bloomington, MN
Tested Date:	04/20/2020	Tested By:	Streier, Jim

Laboratory Data

Sieve-Hydrometer Analysis

Particle Size	% Passing	Specification
2 mm (No. 10)	100.0	-
850 µm (No. 20)	99.7	-
425 µm (No. 40)	99.3	-
250 µm (No. 60)	98.3	-
150 µm (No. 100)	96.6	-
75 µm (No. 200)	94.2	-
27.4 (µm)	88.1	-
17.7 (µm)	83.8	-
10.4 (µm)	78.0	-
7.5 (µm)	72.7	-
5.4 (µm)	67.2	-
2.7 (µm)	58.5	-
1.2 (µm)	48.8	-



Soil Classification: CH Fat clay

Gravel (%):	0	Sand (%):	5.8	Silt (%):	27.0	Clay (%):	67.2
D₆₀ (µm):	3.3						

General

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Project:

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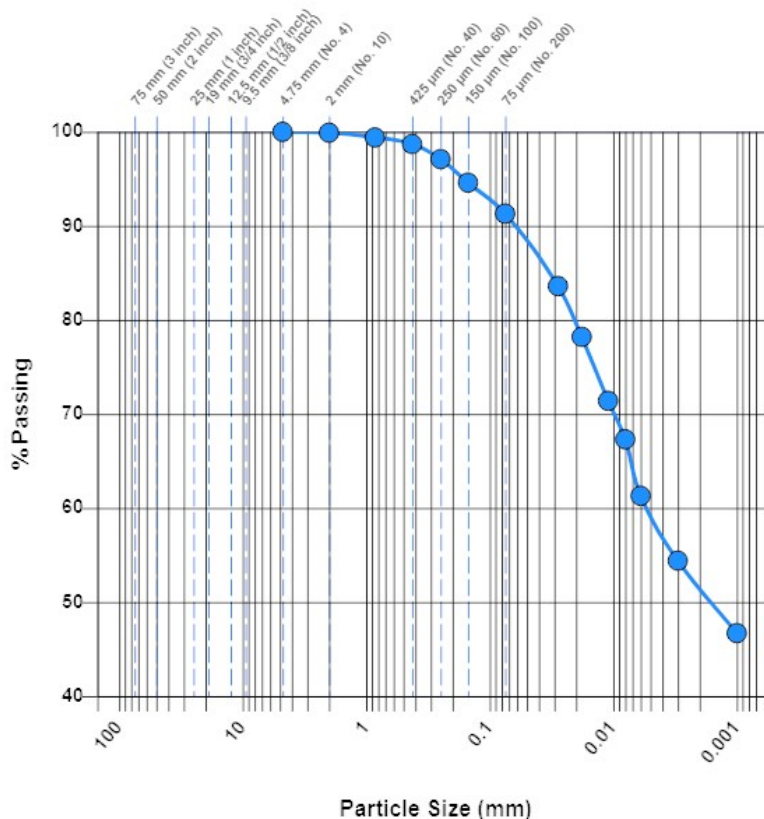
Sample Information

Sample Number:	302826	Depth (ft):	29.5
Boring Number:	29-C-1	Sampled By:	Drill Crew
Sample Date:	04/20/2020		
Received Date:	04/20/2020	Lab:	11001 Hampshire Ave S, Bloomington, MN
Tested Date:	04/20/2020	Tested By:	Streier, Jim

Laboratory Data

Sieve-Hydrometer Analysis

Particle Size	% Passing	Specification
4.75 mm (No. 4)	100.0	-
2 mm (No. 10)	99.9	-
850 µm (No. 20)	99.4	-
425 µm (No. 40)	98.7	-
250 µm (No. 60)	97.1	-
150 µm (No. 100)	94.6	-
75 µm (No. 200)	91.3	-
27.5 (µm)	83.6	-
17.8 (µm)	78.2	-
10.6 (µm)	71.4	-
7.6 (µm)	67.3	-
5.5 (µm)	61.3	-
2.7 (µm)	54.4	-
1.2 (µm)	46.7	-



Soil Classification: CH Fat clay

Gravel (%):	0.0	Sand (%):	8.7	Silt (%):	32.3	Clay (%):	59.0
D₆₀ (µm):	5.4						

General

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Enbridge Line 5
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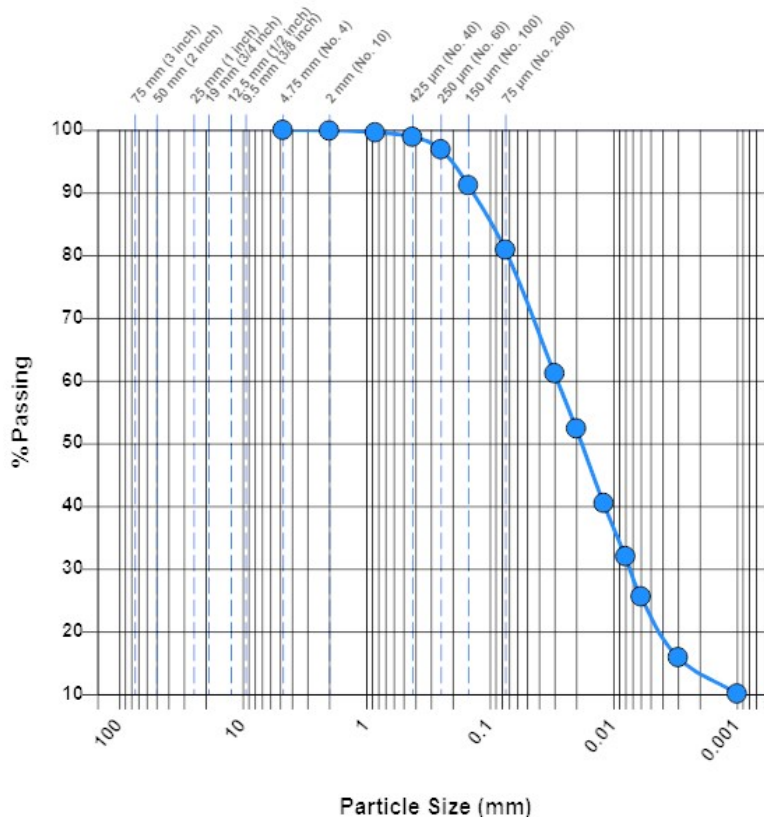
Sample Information

Sample Number:	302842	Depth (ft):	69.5
Boring Number:	29-C-1	Sampled By:	Drill Crew
Sample Date:	04/20/2020		
Received Date:	04/20/2020	Lab:	11001 Hampshire Ave S, Bloomington, MN
Tested Date:	04/20/2020	Tested By:	Streier, Jim

Laboratory Data

Sieve-Hydrometer Analysis

Particle Size	% Passing	Specification
4.75 mm (No. 4)	100.0	-
2 mm (No. 10)	99.9	-
850 µm (No. 20)	99.6	-
425 µm (No. 40)	98.9	-
250 µm (No. 60)	96.9	-
150 µm (No. 100)	91.2	-
75 µm (No. 200)	80.9	-
30.2 (µm)	61.2	-
19.8 (µm)	52.4	-
11.9 (µm)	40.5	-
8.2 (µm)	32.0	-
6.0 (µm)	25.6	-
3.1 (µm)	15.9	-
1.3 (µm)	10.1	-



Soil Classification: CL-ML Silty clay with sand

Gravel (%):	0.0	Sand (%):	19.1	Silt (%):	58.5	Clay (%):	22.4
D₆₀ (µm):	28.6	D₃₀ (µm):	7.4				

General

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Minneapolis, MN 55438
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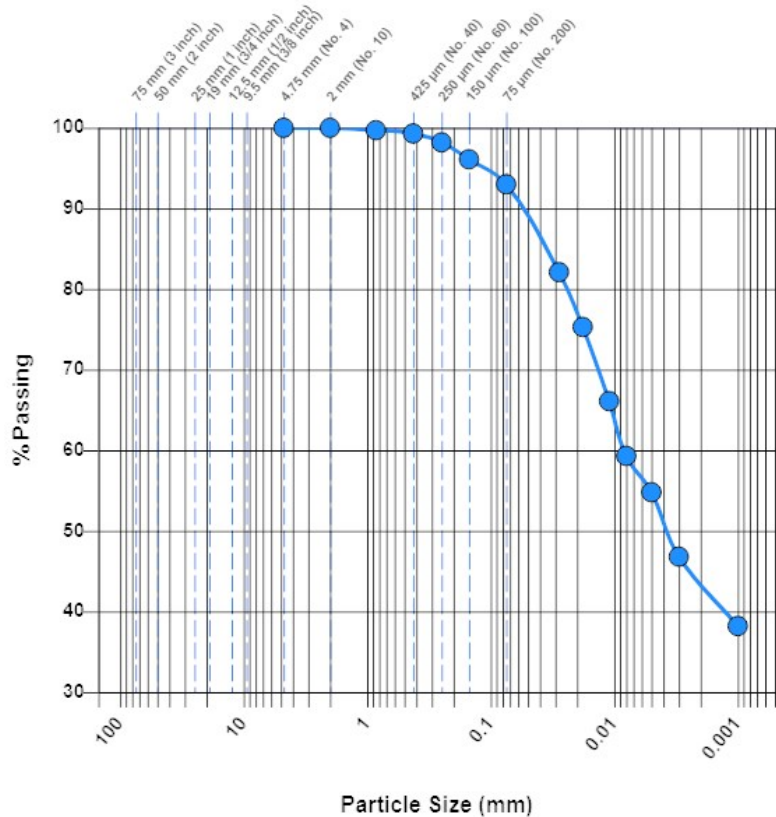
Sample Information

Sample Number:	302843	Depth (ft):	79.5
Boring Number:	29-C-1	Sampled By:	Drill Crew
Sample Date:	04/20/2020		
Received Date:	04/20/2020	Lab:	11001 Hampshire Ave S, Bloomington, MN
Tested Date:	04/20/2020	Tested By:	Streier, Jim

Laboratory Data

Sieve-Hydrometer Analysis

Particle Size	% Passing	Specification
4.75 mm (No. 4)	100.0	-
2 mm (No. 10)	100.0	-
850 µm (No. 20)	99.7	-
425 µm (No. 40)	99.3	-
250 µm (No. 60)	98.2	-
150 µm (No. 100)	96.1	-
75 µm (No. 200)	93.0	-
27.7 (µm)	82.1	-
18.0 (µm)	75.3	-
10.8 (µm)	66.1	-
7.5 (µm)	59.3	-
5.4 (µm)	54.8	-
2.8 (µm)	46.8	-
1.2 (µm)	38.2	-



Soil Classification: CH Fat clay

Gravel (%):	0.0	Sand (%):	7.0	Silt (%):	38.2	Clay (%):	54.8
D₆₀ (µm):	8.3						

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Minneapolis, MN 55438
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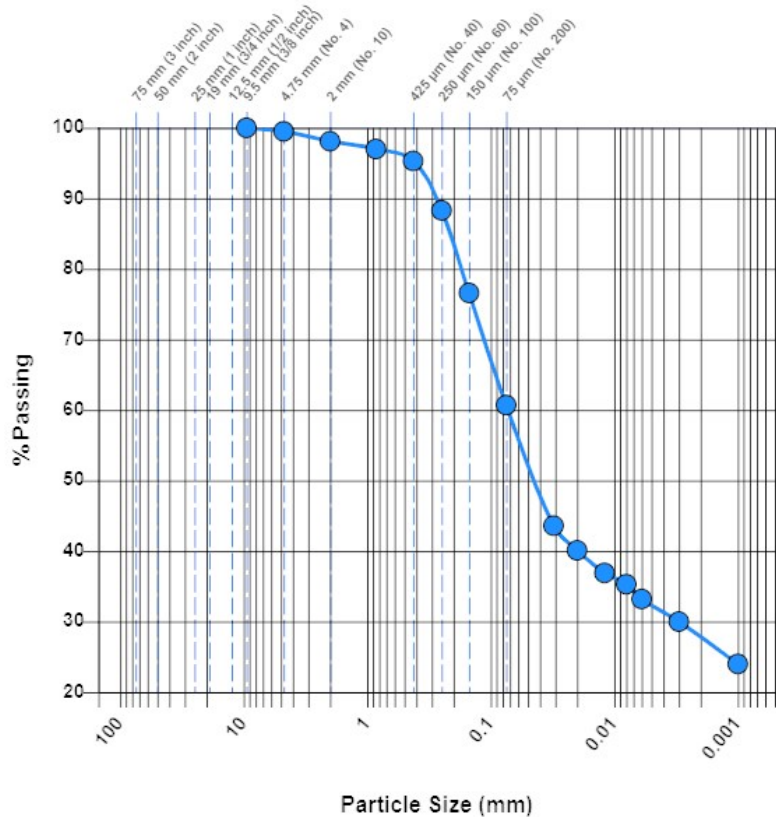
Sample Information

Sample Number:	306138	Depth (ft):	20
Boring Number:	31-C	Sampled By:	Drill Crew
Sample Date:	04/24/2020		
Received Date:	05/05/2020	Lab:	11001 Hampshire Ave S, Bloomington, MN
Tested Date:	05/05/2020	Tested By:	Streier, Jim

Laboratory Data

Sieve-Hydrometer Analysis

Particle Size	% Passing	Specification
9.5 mm (3/8 inch)	100.0	-
4.75 mm (No. 4)	99.5	-
2 mm (No. 10)	98.1	-
850 µm (No. 20)	97.0	-
425 µm (No. 40)	95.3	-
250 µm (No. 60)	88.3	-
150 µm (No. 100)	76.6	-
75 µm (No. 200)	60.7	-
30.7 (µm)	43.6	-
19.7 (µm)	40.1	-
11.5 (µm)	36.9	-
8.2 (µm)	35.3	-
5.8 (µm)	33.2	-
2.9 (µm)	30.0	-
1.3 (µm)	24.0	-



Soil Classification: CL Sandy lean clay

Gravel (%):	0.5	Sand (%):	38.8	Silt (%):	28.6	Clay (%):	32.1
D₆₀ (µm):	73.2	D₃₀ (µm):	3.0				

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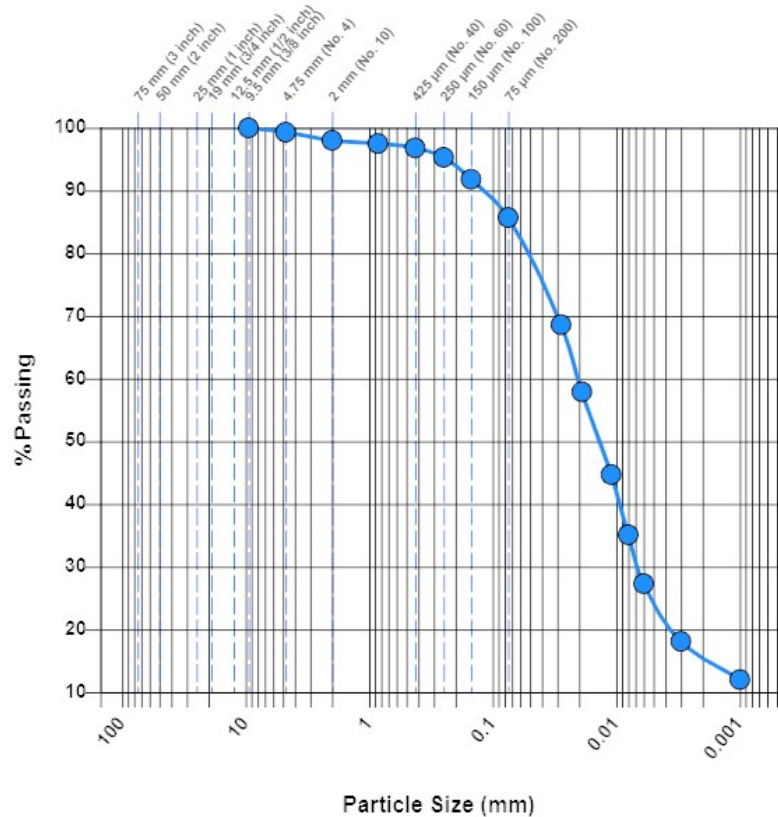
Sample Information

Sample Number:	306145	Depth (ft):	45
Boring Number:	31-C	Sampled By:	Drill Crew
Sample Date:	04/24/2020		
Received Date:	05/05/2020	Lab:	11001 Hampshire Ave S, Bloomington, MN
Tested Date:	05/05/2020	Tested By:	Streier, Jim

Laboratory Data

Sieve-Hydrometer Analysis

Particle Size	% Passing	Specification
9.5 mm (3/8 inch)	100.0	-
4.75 mm (No. 4)	99.3	-
2 mm (No. 10)	98.0	-
850 µm (No. 20)	97.5	-
425 µm (No. 40)	96.8	-
250 µm (No. 60)	95.3	-
150 µm (No. 100)	91.8	-
75 µm (No. 200)	85.7	-
27.9 µm	68.6	-
18.6 µm	57.9	-
11.3 µm	44.7	-
8.3 µm	35.1	-
6.0 µm	27.3	-
3.0 µm	18.1	-
1.3 µm	12.0	-



Soil Classification: CL Lean clay

Gravel (%):	0.7	Sand (%):	13.6	Silt (%):	61.5	Clay (%):	24.2
D₆₀ (µm):	20.8	D₃₀ (µm):	6.7				

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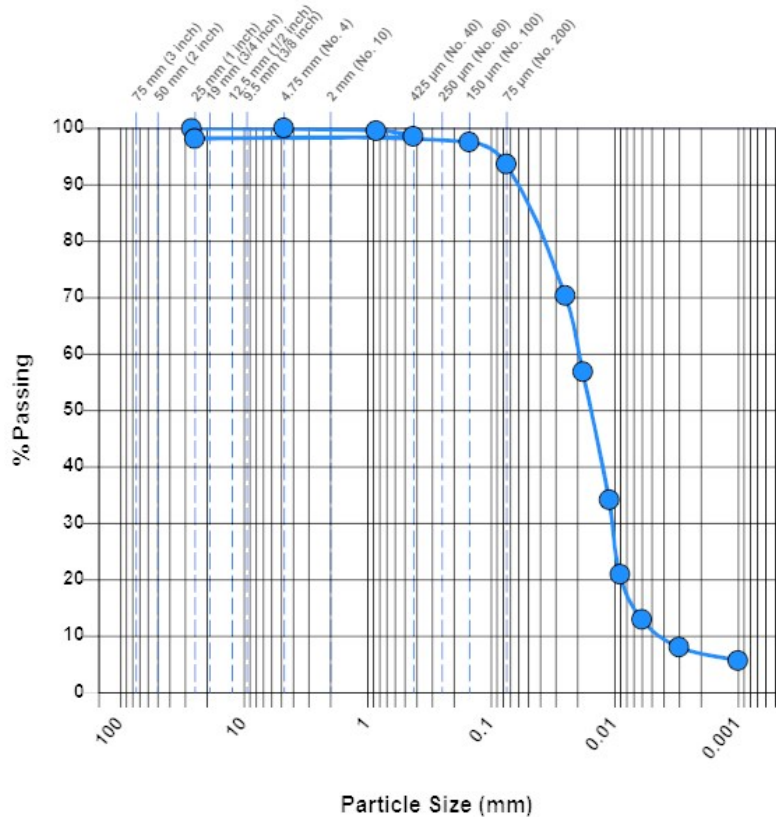
Sample Information

Sample Number:	306141	Depth (ft):	80
Boring Number:	31-C	Sampled By:	Drill Crew
Sample Date:	04/24/2020		
Received Date:	05/05/2020	Lab:	11001 Hampshire Ave S, Bloomington, MN
Tested Date:	05/05/2020	Tested By:	Streier, Jim

Laboratory Data

Sieve-Hydrometer Analysis

Particle Size	% Passing	Specification
4.75 mm (No. 4)	100.0	-
2 mm (No. 10)	99.9	-
850 µm (No. 20)	99.5	-
425 µm (No. 40)	98.5	-
250 µm (No. 60)	98.1	-
150 µm (No. 100)	97.5	-
75 µm (No. 200)	93.6	-
25.2 (µm)	70.3	-
17.5 (µm)	56.8	-
11.4 (µm)	34.1	-
8.6 (µm)	20.9	-
6.3 (µm)	12.9	-
3.1 (µm)	8.0	-
1.3 (µm)	5.6	-



Soil Classification: ML Silt

Gravel (%):	0.0	Sand (%):	6.4	Silt (%):	82.3	Clay (%):	11.3		
D₆₀ (µm):	19.7	D₃₀ (µm):	10.4	D₁₀ (µm):	4.2	C_u:	4.69	C_c:	1.31

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Minneapolis, MN 55438
Phone: 952-995-2000

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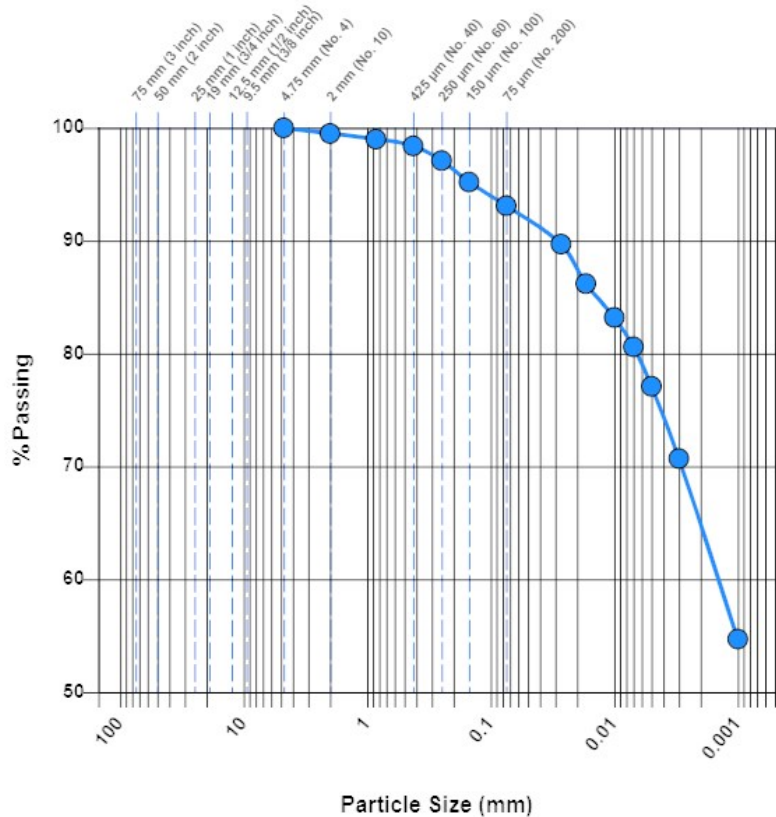
Sample Information

Sample Number:	306149	Depth (ft):	10
Boring Number:	31-C	Sampled By:	Drill Crew
Sample Date:	04/24/2020		
Received Date:	05/05/2020	Lab:	11001 Hampshire Ave S, Bloomington, MN
Tested Date:	05/05/2020	Tested By:	Streier, Jim

Laboratory Data

Sieve-Hydrometer Analysis

Particle Size	% Passing	Specification
4.75 mm (No. 4)	100.0	-
2 mm (No. 10)	99.5	-
850 µm (No. 20)	99.0	-
425 µm (No. 40)	98.4	-
250 µm (No. 60)	97.1	-
150 µm (No. 100)	95.2	-
75 µm (No. 200)	93.1	-
27.2 (µm)	89.7	-
17.4 (µm)	86.2	-
10.2 (µm)	83.2	-
7.3 (µm)	80.6	-
5.2 (µm)	77.1	-
2.6 (µm)	70.7	-
1.2 (µm)	54.7	-



Gravel (%):	0.0	Sand (%):	6.9	Silt (%):	16.0	Clay (%):	77.1
D₆₀ (µm):	1.7						

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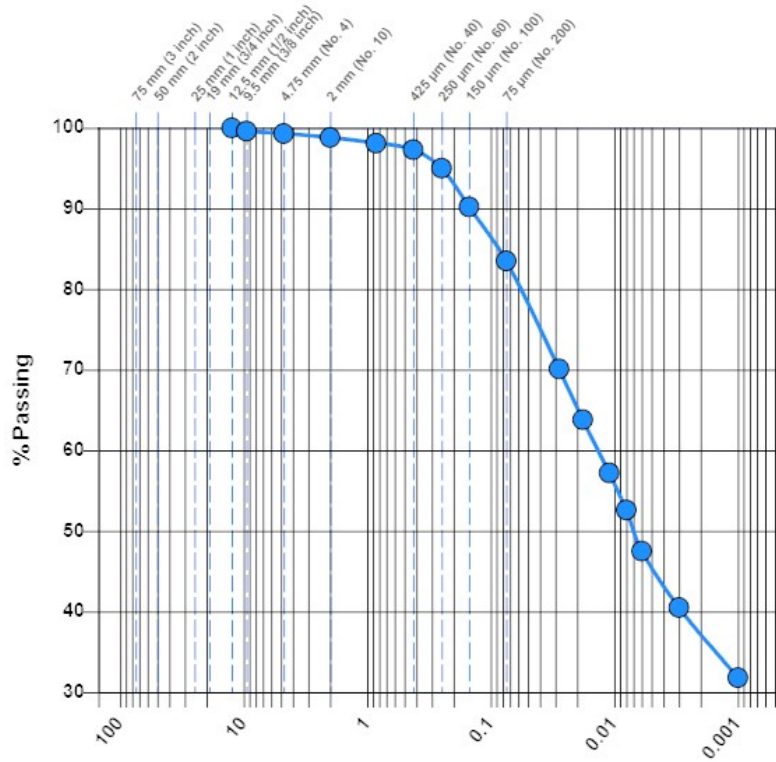
Sample Information

Sample Number:	306147	Depth (ft):	7-9.5
Boring Number:	27-C-1	Sampled By:	Drill Crew
Sample Date:	04/24/2020		
Received Date:	05/05/2020	Lab:	11001 Hampshire Ave S, Bloomington, MN
Tested Date:	05/05/2020	Tested By:	Streier, Jim

Laboratory Data

Sieve-Hydrometer Analysis

Particle Size	% Passing	Specification
12.5 mm (1/2 inch)	100.0	-
9.5 mm (3/8 inch)	99.6	-
4.75 mm (No. 4)	99.3	-
2 mm (No. 10)	98.8	-
850 µm (No. 20)	98.1	-
425 µm (No. 40)	97.3	-
250 µm (No. 60)	95.0	-
150 µm (No. 100)	90.2	-
75 µm (No. 200)	83.5	-
28.1 (µm)	70.1	-
18.3 (µm)	63.8	-
10.9 (µm)	57.2	-
7.8 (µm)	52.6	-
5.6 (µm)	47.5	-
2.8 (µm)	40.5	-
1.2 (µm)	31.8	-



Particle Size (mm)

Soil Classification: CL Lean clay with sand

Gravel (%):	0.7	Sand (%):	15.8	Silt (%):	38.3	Clay (%):	45.2
D₆₀ (µm):	14.0						

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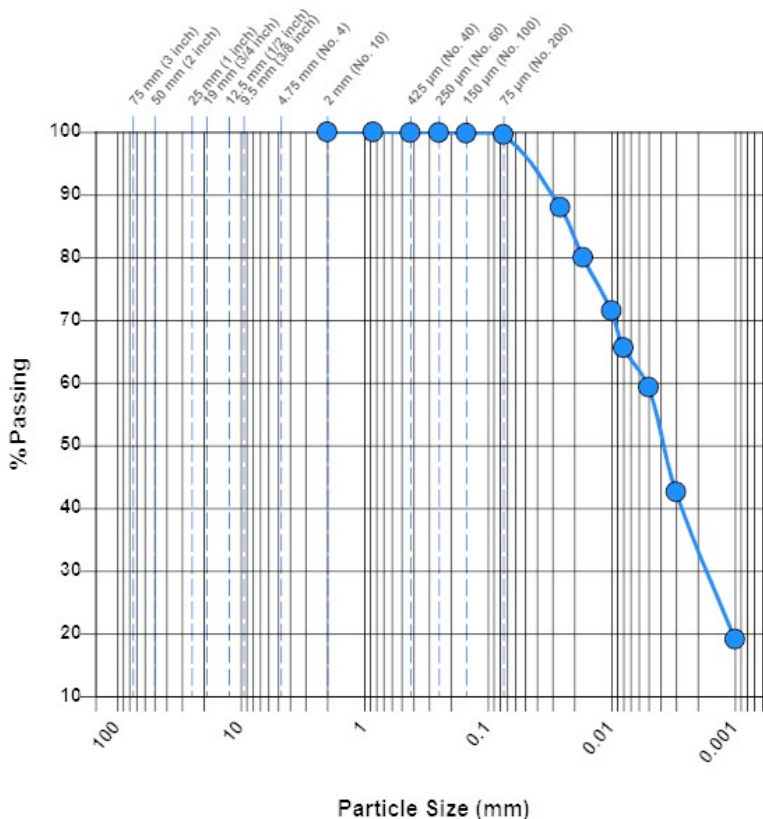
Sample Information

Sample Number: 306148 **Depth (ft):** 55
Boring Number: 27-C-1 **Sampled By:** Drill Crew
Sample Date: 04/24/2020
Received Date: 05/05/2020 **Lab:** 11001 Hampshire Ave S, Bloomington, MN
Tested Date: 05/05/2020 **Tested By:** Streier, Jim

Laboratory Data

Sieve-Hydrometer Analysis

Particle Size	% Passing	Specification
2 mm (No. 10)	100.0	-
850 µm (No. 20)	100.0	-
425 µm (No. 40)	99.9	-
250 µm (No. 60)	99.9	-
150 µm (No. 100)	99.8	-
75 µm (No. 200)	99.6	-
26.2 (µm)	88.0	-
17.3 (µm)	80.0	-
10.3 (µm)	71.5	-
7.5 (µm)	65.6	-
5.4 (µm)	59.3	-
2.8 (µm)	42.6	-
1.3 (µm)	19.1	-



Soil Classification: CL Lean clay

Gravel (%): 0 **Sand (%):** 0.4 **Silt (%):** 40.3 **Clay (%):** 59.3
D₆₀ (µm): 5.3 **D₃₀ (µm):** 1.9

General

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Phone: 952-995-2000

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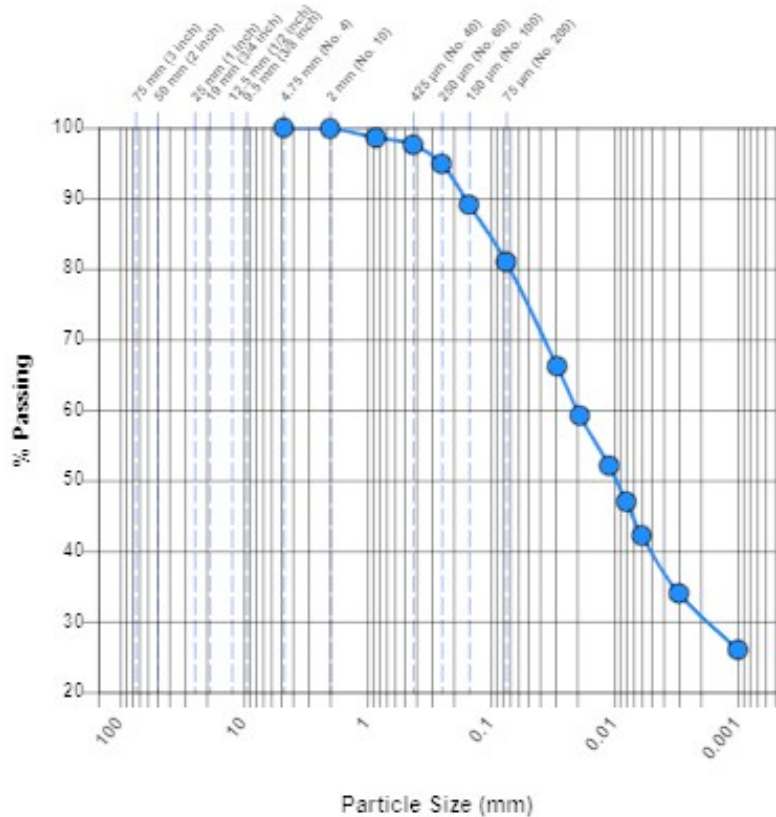
Sample Information

Sample Number:	307518	Depth (ft):	12
Boring Number:	27-C-1	Sampled By:	Drill Crew
Sample Date:	05/12/2020		
Received Date:	05/12/2020	Lab:	11001 Hampshire Ave S, Bloomington, MN
Tested Date:	05/12/2020	Tested By:	Streier, Jim

Laboratory Data

Sieve-Hydrometer Analysis

Particle Size	% Passing	Specification
4.75 mm (No. 4)	100.0	-
2 mm (No. 10)	99.9	-
850 µm (No. 20)	98.6	-
425 µm (No. 40)	97.6	-
250 µm (No. 60)	94.9	-
150 µm (No. 100)	89.1	-
75 µm (No. 200)	81.0	-
29.2 (µm)	66.2	-
19.0 (µm)	59.2	-
11.2 (µm)	52.1	-
8.1 (µm)	47.0	-
5.8 (µm)	42.2	-
2.9 (µm)	34.0	-
1.3 (µm)	26.0	-



Soil Classification: CH Fat clay with sand

Gravel (%):	0.0	Sand (%):	19.0	Silt (%):	41.5	Clay (%):	39.5
D₆₀ (µm):	20.1	D₃₀ (µm):	2.0				

General

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Minneapolis, MN 55438
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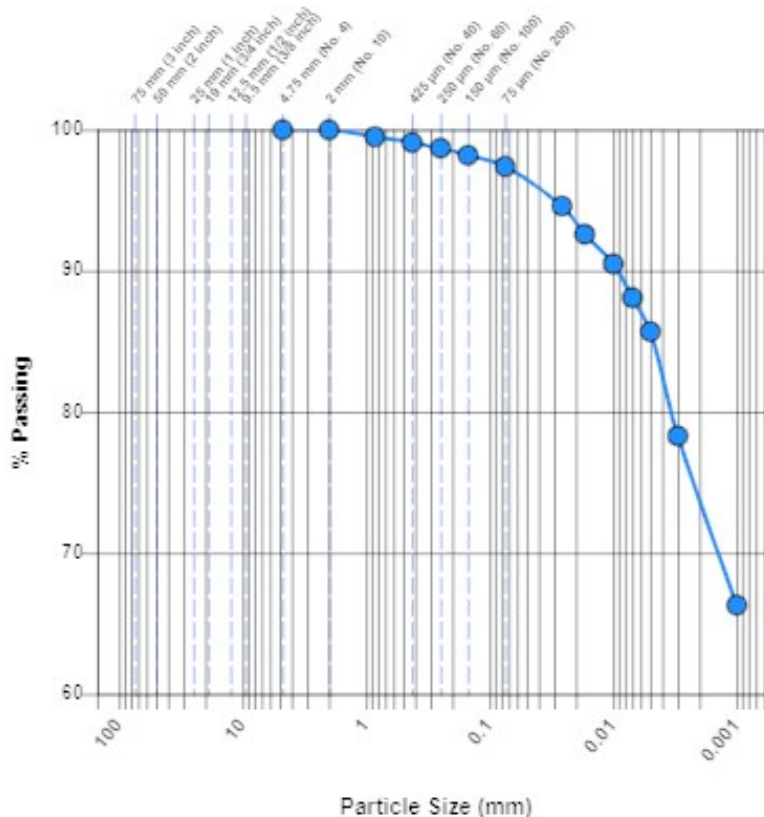
Sample Information

Sample Number:	307519	Depth (ft):	5
Boring Number:	31-C	Sampled By:	Drill Crew
Sample Date:	05/12/2020		
Received Date:	05/12/2020	Lab:	11001 Hampshire Ave S, Bloomington, MN
Tested Date:	05/12/2020	Tested By:	Streier, Jim

Laboratory Data

Sieve-Hydrometer Analysis

Particle Size	% Passing	Specification
4.75 mm (No. 4)	100.0	-
2 mm (No. 10)	100.0	-
850 µm (No. 20)	99.5	-
425 µm (No. 40)	99.1	-
250 µm (No. 60)	98.7	-
150 µm (No. 100)	98.2	-
75 µm (No. 200)	97.4	-
26.3 (µm)	94.6	-
16.8 (µm)	92.6	-
9.8 (µm)	90.5	-
7.0 (µm)	88.1	-
5.0 (µm)	85.7	-
2.5 (µm)	78.3	-
1.1 (µm)	66.3	-



Soil Classification: CH Fat clay

Gravel (%): 0.0 **Sand (%):** 2.6 **Silt (%):** 11.7 **Clay (%):** 85.7

General

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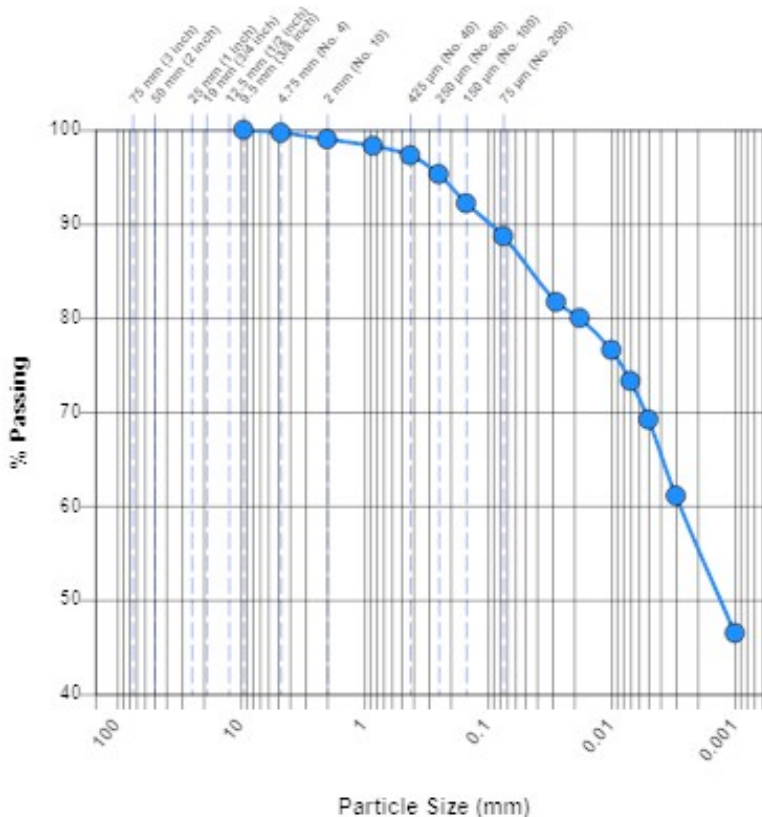
Sample Information

Sample Number:	307724	Depth (ft):	15
Boring Number:	31-C	Sampled By:	Drill Crew
Sample Date:	05/12/2020		
Received Date:	05/12/2020	Lab:	11001 Hampshire Ave S, Bloomington, MN
Tested Date:	05/12/2020	Tested By:	Streier, Jim

Laboratory Data

Sieve-Hydrometer Analysis

Particle Size	% Passing	Specification
9.5 mm (3/8 inch)	100.0	-
4.75 mm (No. 4)	99.7	-
2 mm (No. 10)	99.0	-
850 µm (No. 20)	98.3	-
425 µm (No. 40)	97.3	-
250 µm (No. 60)	95.3	-
150 µm (No. 100)	92.2	-
75 µm (No. 200)	88.7	-
27.5 µm	81.7	-
17.5 µm	80.0	-
10.3 µm	76.6	-
7.3 µm	73.3	-
5.3 µm	69.2	-
2.7 µm	61.1	-
1.2 µm	46.5	-



Soil Classification: CH Fat clay

Gravel (%):	0.3	Sand (%):	11.0	Silt (%):	19.5	Clay (%):	69.2
D₆₀ (µm):	2.8						

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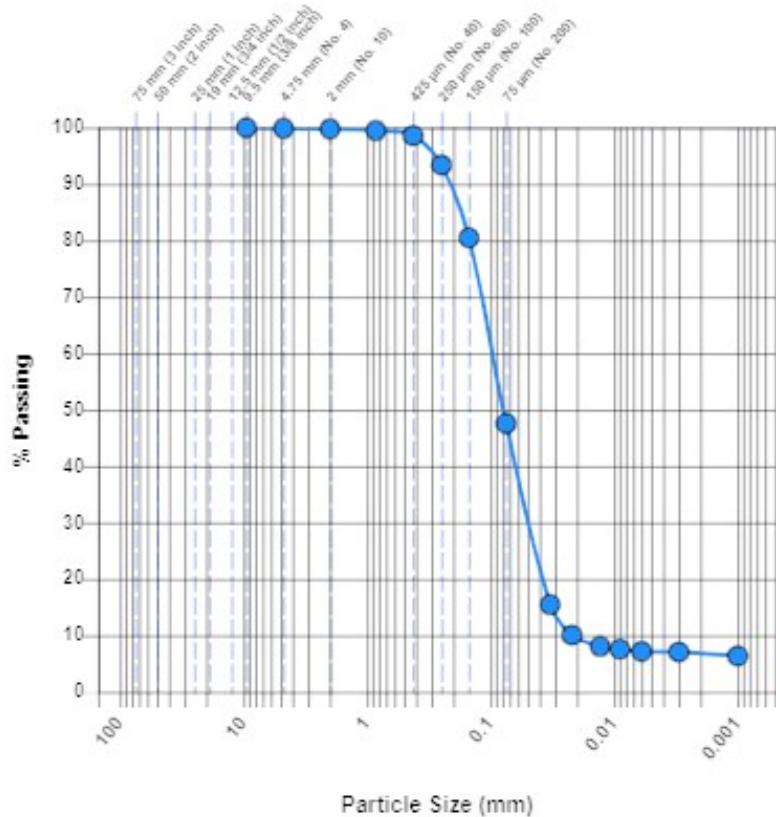
Sample Information

Sample Number:	307520	Depth (ft):	25
Boring Number:	31-C	Sampled By:	Drill Crew
Sample Date:	05/12/2020		
Received Date:	05/12/2020	Lab:	11001 Hampshire Ave S, Bloomington, MN
Tested Date:	05/12/2020	Tested By:	Streier, Jim

Laboratory Data

Sieve-Hydrometer Analysis

Particle Size	% Passing	Specification
9.5 mm (3/8 inch)	100.0	-
4.75 mm (No. 4)	99.9	-
2 mm (No. 10)	99.8	-
850 µm (No. 20)	99.5	-
425 µm (No. 40)	98.6	-
250 µm (No. 60)	93.4	-
150 µm (No. 100)	80.5	-
75 µm (No. 200)	47.6	-
32.8 (µm)	15.5	-
21.5 (µm)	10.1	-
12.6 (µm)	8.1	-
8.9 (µm)	7.6	-
6.3 (µm)	7.2	-
3.1 (µm)	7.1	-
1.3 (µm)	6.4	-



Soil Classification: SM Silty sand

Gravel (%):	0.1	Sand (%):	52.3	Silt (%):	40.4	Clay (%):	7.2		
D₆₀ (µm):	103.3	D₃₀ (µm):	52.0	D₁₀ (µm):	21.6	C_u:	4.78	C_c:	1.21

General

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Minneapolis, MN 55438
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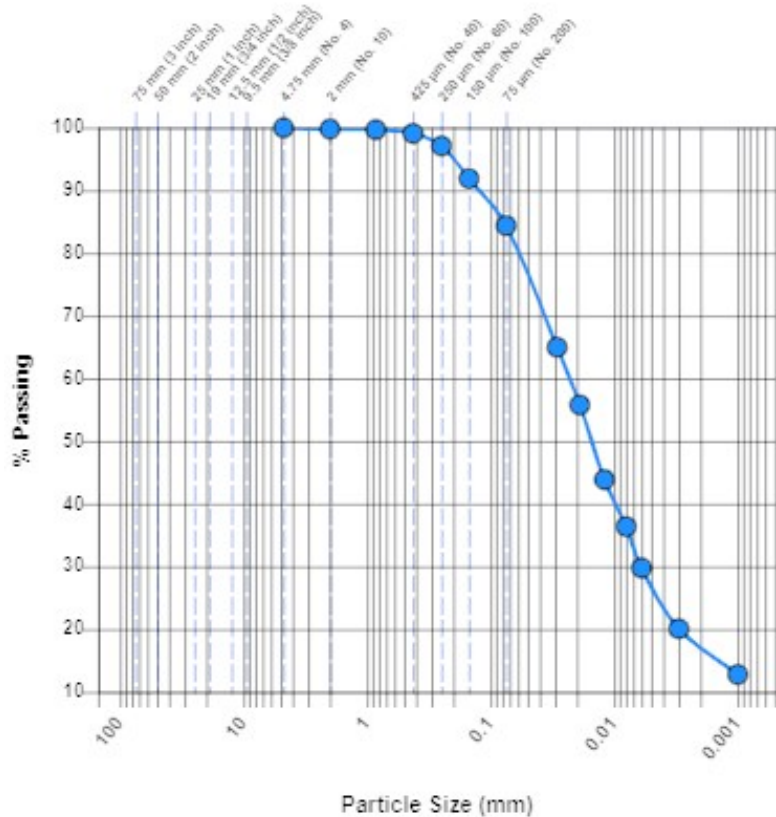
Sample Information

Sample Number:	307521	Depth (ft):	50
Boring Number:	31-C	Sampled By:	Drill Crew
Sample Date:	05/12/2020		
Received Date:	05/12/2020	Lab:	11001 Hampshire Ave S, Bloomington, MN
Tested Date:	05/12/2020	Tested By:	Streier, Jim

Laboratory Data

Sieve-Hydrometer Analysis

Particle Size	% Passing	Specification
4.75 mm (No. 4)	100.0	-
2 mm (No. 10)	99.8	-
850 µm (No. 20)	99.7	-
425 µm (No. 40)	99.1	-
250 µm (No. 60)	97.1	-
150 µm (No. 100)	91.9	-
75 µm (No. 200)	84.4	-
29.4 (µm)	65.0	-
19.3 (µm)	55.8	-
11.6 (µm)	43.9	-
8.4 (µm)	36.4	-
6.1 (µm)	29.8	-
3.1 (µm)	20.1	-
1.3 (µm)	12.8	-



Soil Classification: CL Lean clay with sand

Gravel (%):	0.0	Sand (%):	15.6	Silt (%):	57.8	Clay (%):	26.6
D₆₀ (µm):	23.6	D₃₀ (µm):	6.1				

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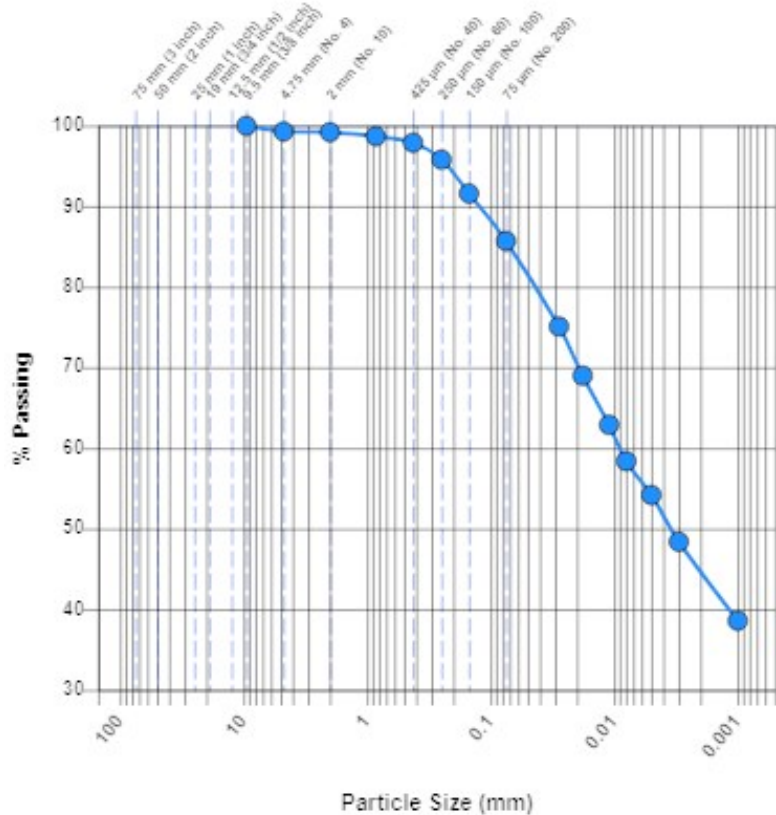
Sample Information

Sample Number:	307723	Depth (ft):	25
Boring Number:	27-C-1	Sampled By:	Drill Crew
Sample Date:	05/12/2020		
Received Date:	05/12/2020	Lab:	11001 Hampshire Ave S, Bloomington, MN
Tested Date:	05/12/2020	Tested By:	Streier, Jim

Laboratory Data

Sieve-Hydrometer Analysis

Particle Size	% Passing	Specification
9.5 mm (3/8 inch)	100.0	-
4.75 mm (No. 4)	99.3	-
2 mm (No. 10)	99.2	-
850 µm (No. 20)	98.7	-
425 µm (No. 40)	97.9	-
250 µm (No. 60)	95.8	-
150 µm (No. 100)	91.6	-
75 µm (No. 200)	85.7	-
28.2 (µm)	75.1	-
18.3 (µm)	69.0	-
10.8 (µm)	62.9	-
7.8 (µm)	58.4	-
5.4 (µm)	54.2	-
2.8 (µm)	48.4	-
1.2 (µm)	38.6	-



Soil Classification: CH Fat clay

Gravel (%):	0.7	Sand (%):	13.6	Silt (%):	31.5	Clay (%):	54.2
D₆₀ (µm):	9.1						

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Minneapolis, MN 55438
Phone: 952-995-2000

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Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5

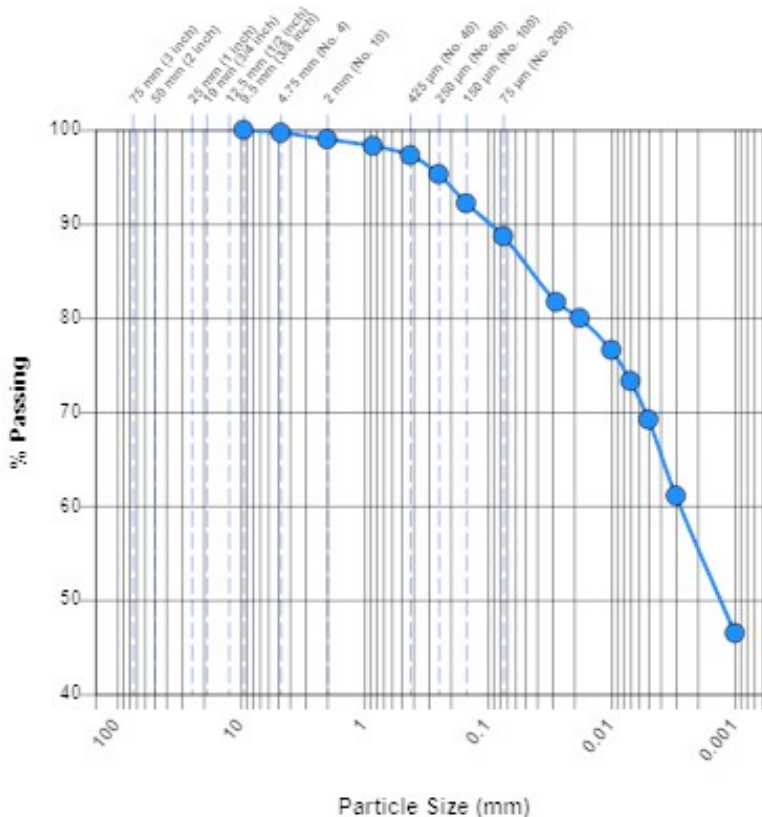
Sample Information

Sample Number:	307724	Depth (ft):	15
Boring Number:	31-C	Sampled By:	Drill Crew
Sample Date:	05/12/2020		
Received Date:	05/12/2020	Lab:	11001 Hampshire Ave S, Bloomington, MN
Tested Date:	05/12/2020	Tested By:	Streier, Jim

Laboratory Data

Sieve-Hydrometer Analysis

Particle Size	% Passing	Specification
9.5 mm (3/8 inch)	100.0	-
4.75 mm (No. 4)	99.7	-
2 mm (No. 10)	99.0	-
850 µm (No. 20)	98.3	-
425 µm (No. 40)	97.3	-
250 µm (No. 60)	95.3	-
150 µm (No. 100)	92.2	-
75 µm (No. 200)	88.7	-
27.5 µm	81.7	-
17.5 µm	80.0	-
10.3 µm	76.6	-
7.3 µm	73.3	-
5.3 µm	69.2	-
2.7 µm	61.1	-
1.2 µm	46.5	-



Soil Classification: CH Fat clay

Gravel (%):	0.3	Sand (%):	11.0	Silt (%):	19.5	Clay (%):	69.2
D₆₀ (µm):	2.8						

General

Streier, Jim

4511 West First Street
Suite 4
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Phone: 218-624-4967

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Project:

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Sample Information

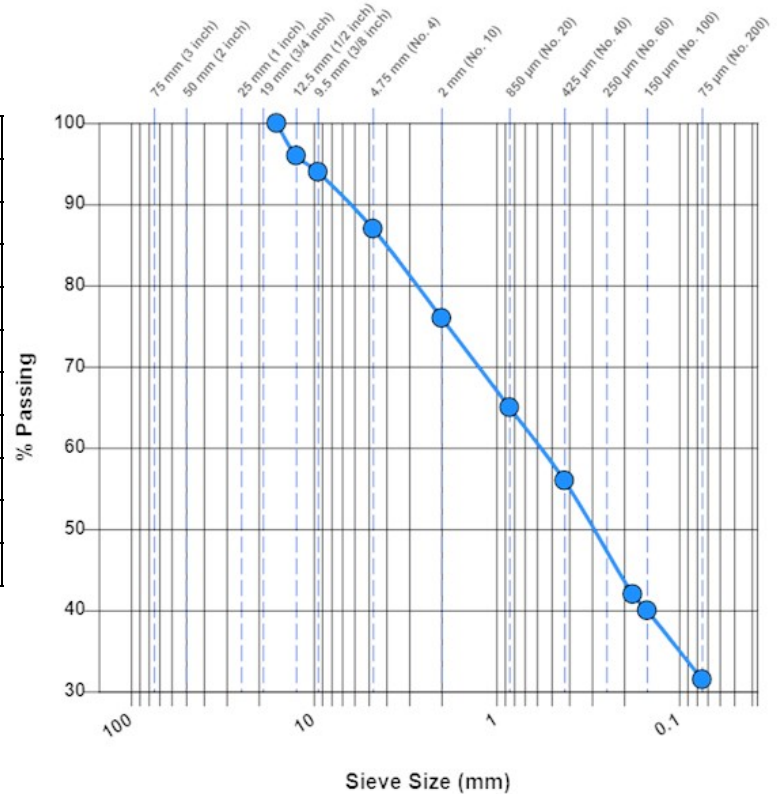
Sample Number: 300520 **Alternate ID:** 29-C-1 94.5'-99.5'
Sampling Method: Auger Boring ASTM D1452 **Depth (ft):** 94.5-99.5
Boring Number: 29-C-1 **Sampled By:** Patterson, Gregg
Location: In-place
Location Details: Boring 29-C-1 94.5'-99.5'
Sample Date: 04/03/2020
Received Date: 04/06/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 04/06/2020

Laboratory Data

Sieve Size	% Passing	Specification
16 mm (5/8 inch)	100	
12.5 mm (1/2 inch)	96	
9.5 mm (3/8 inch)	94	
4.75 mm (No. 4)	87	
2 mm (No. 10)	76	
850 µm (No. 20)	65	
425 µm (No. 40)	56	
180 µm (No. 80)	42	
150 µm (No. 100)	40	
75 µm (No. 200)	31.5	

Test Method: Method A (Composite Sieving)

Specimen Obtained: Oven Dry



Classification: SM Silty sand

General

Results: The test is for informational purposes.

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Project:

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Enbridge Line 5
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Sample Information

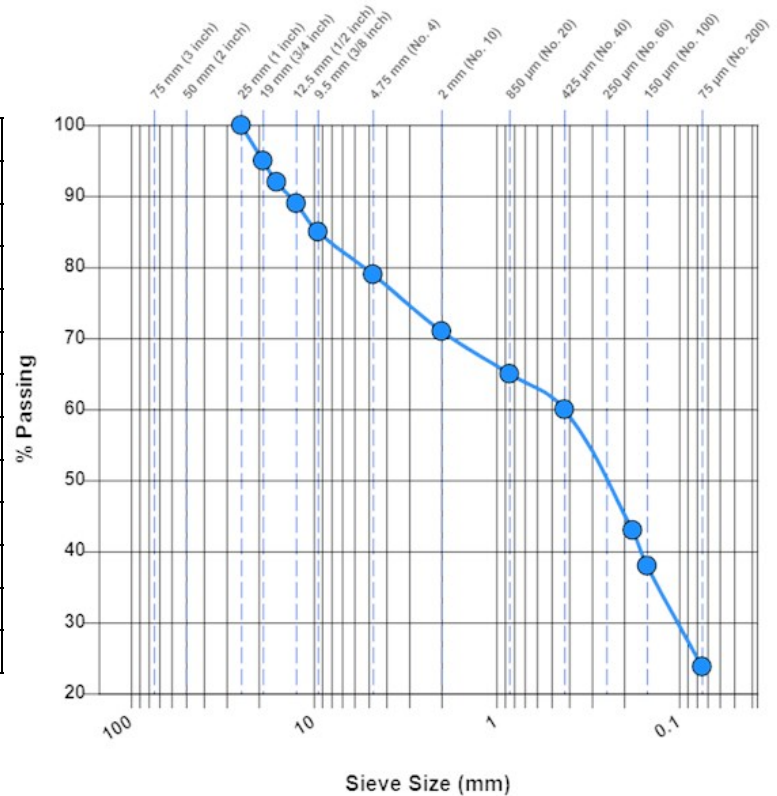
Sample Number: 300521 **Alternate ID:** 29-C-1 105'-115'
Sampling Method: Auger Boring ASTM D1452 **Depth (ft):** 105'-115'
Boring Number: 29-C-1 **Sampled By:** Patterson, Gregg
Location: In-place
Location Details: Boring 29-C-1 105'-115'
Sample Date: 04/03/2020
Received Date: 04/06/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 04/06/2020

Laboratory Data

Sieve Size	% Passing	Specification
25 mm (1 inch)	100	
19 mm (3/4 inch)	95	
16 mm (5/8 inch)	92	
12.5 mm (1/2 inch)	89	
9.5 mm (3/8 inch)	85	
4.75 mm (No. 4)	79	
2 mm (No. 10)	71	
850 µm (No. 20)	65	
425 µm (No. 40)	60	
180 µm (No. 80)	43	
150 µm (No. 100)	38	
75 µm (No. 200)	23.8	

Test Method: Method A (Composite Sieving)

Specimen Obtained: Oven Dry



Classification: SM Silty sand with gravel

General

Results: The test is for informational purposes.

[Signature]

11001 Hampshire Avenue S
Minneapolis, MN 55438
Phone: 952-995-2000

Client:

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Houston, TX 77056

Project:

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Enbridge Line 5 Re-route
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Sample Information

Sample Number:	302835	Depth (ft):	44.5-49.5
Boring Number:	29-C-1	Sampled By:	Drill Crew
Sample Date:	04/20/2020		
Received Date:	04/20/2020	Lab:	11001 Hampshire Ave S, Bloomington, MN
Tested Date:	04/20/2020	Tested By:	Streier, Jim

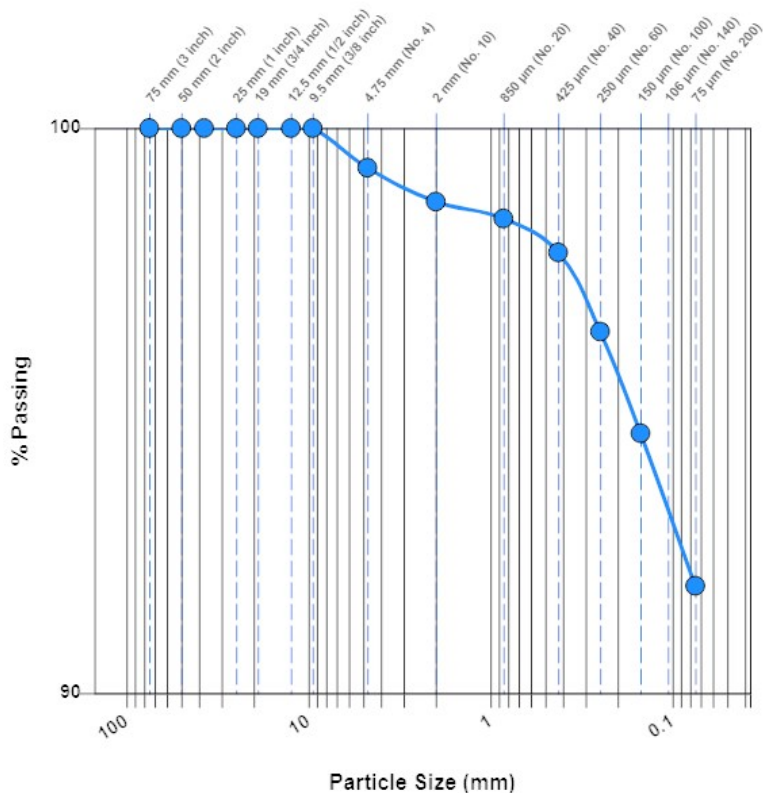
Laboratory Data

Sieve Size	Passing (%)	Specification
9.5 mm (3/8 inch)	100.0	
4.75 mm (No. 4)	99.3	
2 mm (No. 10)	98.7	
850 µm (No. 20)	98.4	
425 µm (No. 40)	97.8	
250 µm (No. 60)	96.4	
150 µm (No. 100)	94.6	
75 µm (No. 200)	91.9	

Gravel (%)
0.7

Sand (%)
7.4

Silt & Clay (%)
91.9



Classification: CH Fat clay

General

Results: The test is for informational purposes.

Streier, Jim

11001 Hampshire Avenue S
Minneapolis, MN 55438
Phone: 952-995-2000

Client:

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

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
<Blank>, <Blank>

Sample Information

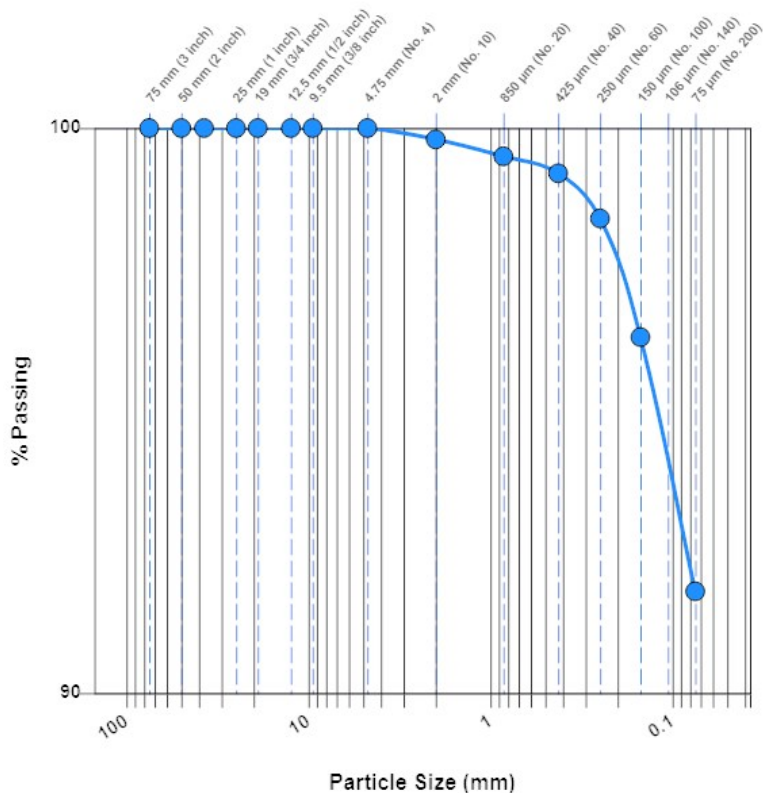
Sample Number: 302836 **Depth (ft):** 59.5-64.5
Boring Number: 29-C-1 **Sampled By:** Drill Crew
Sample Date: 04/20/2020
Received Date: 04/20/2020 **Lab:** 11001 Hampshire Ave S, Bloomington, MN
Tested Date: 04/20/2020 **Tested By:** Streier, Jim

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)	99.2	
250 µm (No. 60)	98.4	
150 µm (No. 100)	96.3	
75 µm (No. 200)	91.8	

Sand (%)
8.2

Silt & Clay (%)
91.8



Classification: ML Silt

General

Results: The test is for informational purposes.

Streier, Jim

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Project:

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Enbridge Line 5 Re-route
Enbridge Line 5
<Blank>, <Blank>

Sample Information

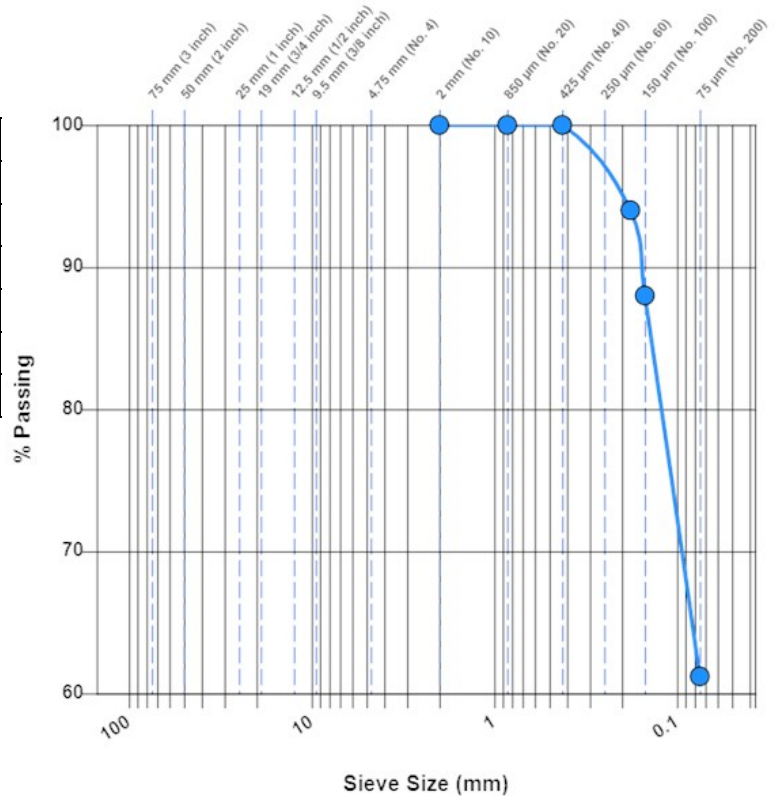
Sample Number: 303582 **Alternate ID:** 27-C-1 35'-37'
Sampling Method: Auger Boring ASTM D1452 **Depth (ft):** 35-37
Boring Number: 27-C-1 **Sampled By:** Patterson, Gregg
Location: In-place
Location Details: Boring 27-C-1 35'-37'
Sample Date: 04/14/2020
Received Date: 04/23/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 04/23/2020

Laboratory Data

Sieve Size	% Passing	Specification
2 mm (No. 10)	100	
850 µm (No. 20)	100	
425 µm (No. 40)	100	
180 µm (No. 80)	94	
150 µm (No. 100)	88	
75 µm (No. 200)	61.2	

Test Method: Method A (Composite Sieving)

Specimen Obtained: Oven Dry



Classification: ML Sandy silt

General

Results: The test is for informational purposes.

Remarks: Total dry weight of sample 214.0 grams

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Sample Information

Sample Number: 303584 **Alternate ID:** 27-C-1 65'-66'

Sampling Method: Auger Boring ASTM D1452 **Depth (ft):** 65-66

Boring Number: 27-C-1 **Sampled By:** Patterson, Gregg

Location: In-place

Location Details: Boring 27-C-1 65'-66'

Sample Date: 04/14/2020

Received Date: 04/23/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN

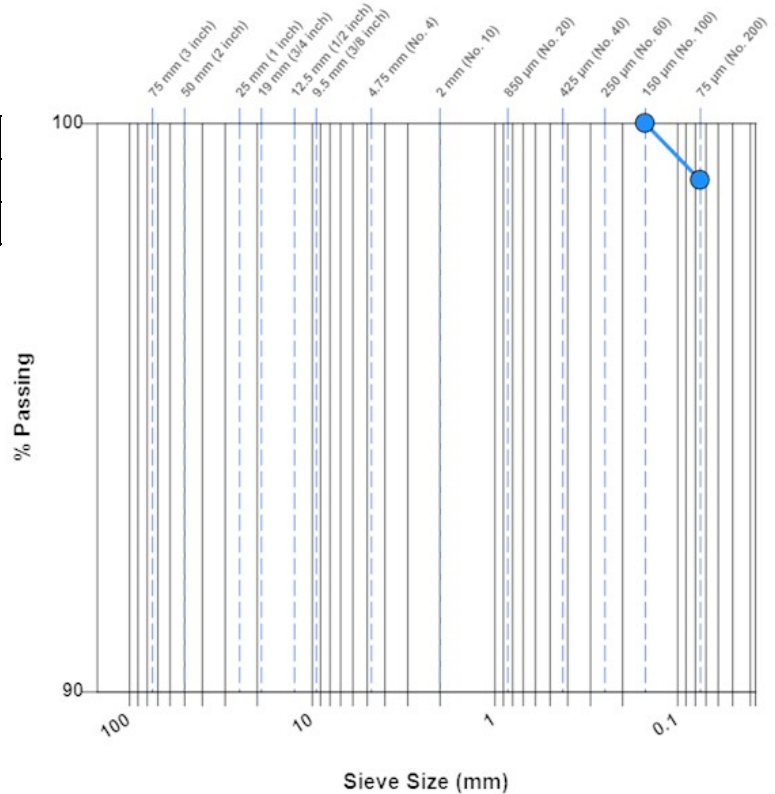
Tested Date: 04/23/2020

Laboratory Data

Sieve Size	% Passing	Specification
150 µm (No. 100)	100	
75 µm (No. 200)	99.0	

Test Method: Method A (Composite Sieving)

Specimen Obtained: Oven Dry



Classification: ML Silt

General

Results: The test is for informational purposes.

Remarks: Total dry weight of sample 195.0 grams

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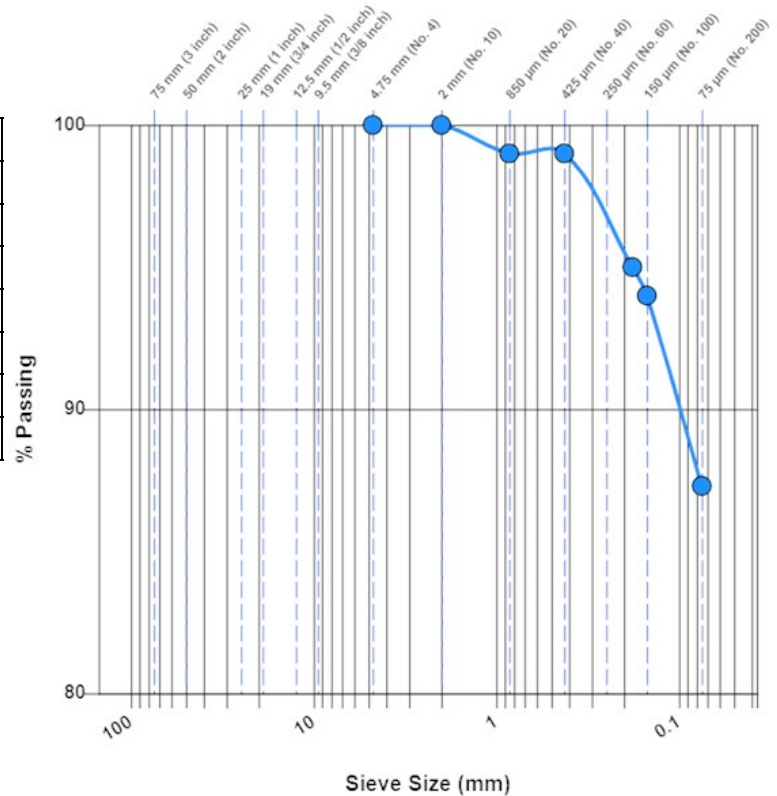
Sample Information

Sample Number: 303585 **Alternate ID:** 27-C-1 75'-77'
Sampling Method: Auger Boring ASTM D1452 **Depth (ft):** 75-77
Boring Number: 27-C-1 **Sampled By:** Patterson, Gregg
Location: In-place
Location Details: Boring 27-C-1 75'-77'
Sample Date: 04/14/2020
Received Date: 04/23/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 04/23/2020

Laboratory Data

Sieve Size	% Passing	Specification
4.75 mm (No. 4)	100	
2 mm (No. 10)	100	
850 µm (No. 20)	99	
425 µm (No. 40)	99	
180 µm (No. 80)	95	
150 µm (No. 100)	94	
75 µm (No. 200)	87.3	

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



Classification: ML Silt

General

Results: The test is for informational purposes.

Remarks: Total dry weight of sample 231.5 grams

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Sample Information

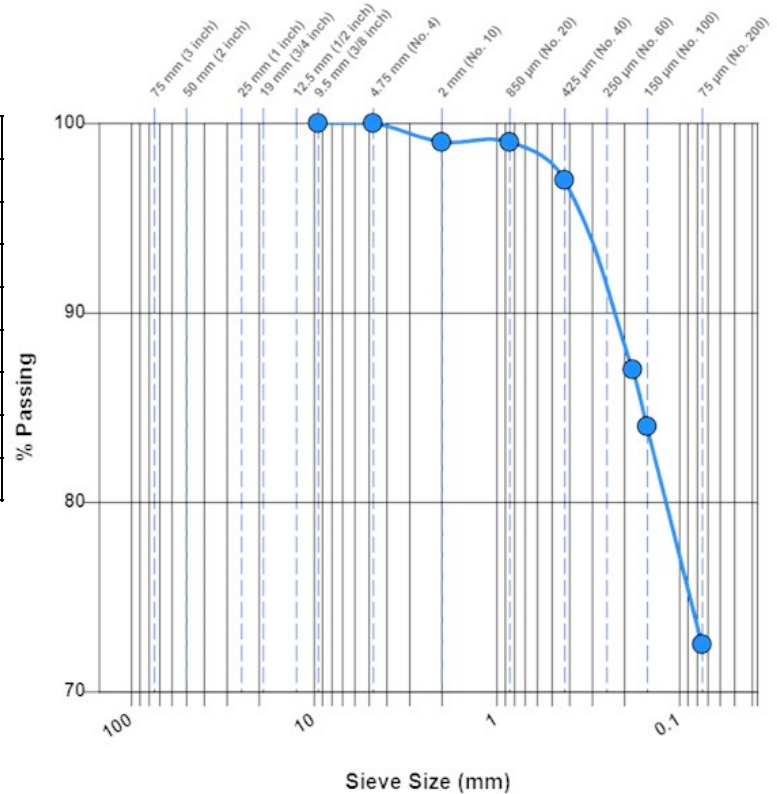
Sample Number: 303586 **Alternate ID:** 27-C-1 85'-87'
Sampling Method: Auger Boring ASTM D1452 **Depth (ft):** 85-87
Boring Number: 27-C-1 **Sampled By:** Patterson, Gregg
Location: In-place
Location Details: Boring 27-C-1 85'-87'
Sample Date: 04/14/2020
Received Date: 04/23/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 04/23/2020

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)	99	
425 µm (No. 40)	97	
180 µm (No. 80)	87	
150 µm (No. 100)	84	
75 µm (No. 200)	72.5	

Test Method: Method A (Composite Sieving)

Specimen Obtained: Oven Dry



Classification: ML Sandy silt

General

Results: The test is for informational purposes.

Remarks: Total dry weight of sample 238.9 grams

[Signature]

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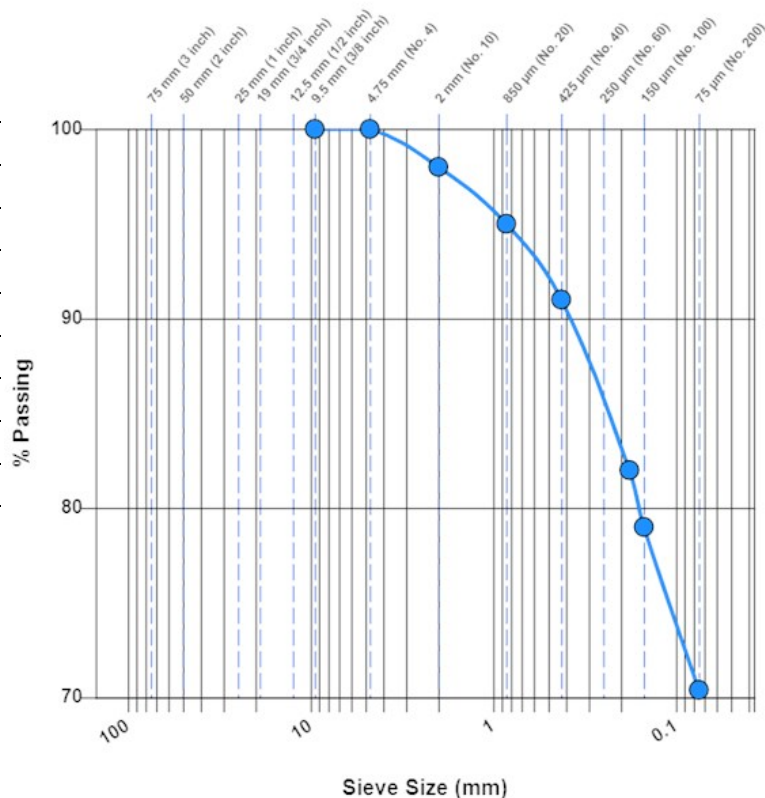
Sample Information

Sample Number: 303587 **Alternate ID:** 27-C-1 95'-96.83'
Sampling Method: Auger Boring ASTM D1452 **Depth (ft):** 95-96.83
Boring Number: 27-C-1 **Sampled By:** Patterson, Gregg
Location: In-place
Location Details: Boring 27-C-1 95'-96.83'
Sample Date: 04/14/2020
Received Date: 04/23/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 04/23/2020

Laboratory Data

Sieve Size	% Passing	Specification
9.5 mm (3/8 inch)	100	
4.75 mm (No. 4)	100	
2 mm (No. 10)	98	
850 µm (No. 20)	95	
425 µm (No. 40)	91	
180 µm (No. 80)	82	
150 µm (No. 100)	79	
75 µm (No. 200)	70.4	

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



Classification: ML Sandy silt

General

Results: The test is for informational purposes.

Remarks: Total dry weight of sample 213.2 grams

[Signature]

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Project:

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Enbridge Line 5
<Blank>, <Blank>

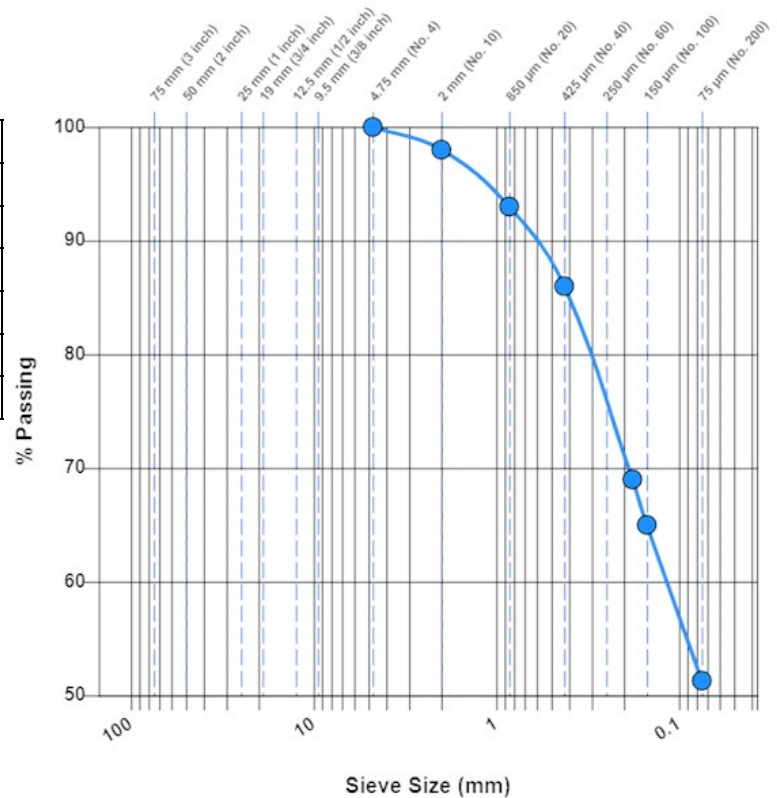
Sample Information

Sample Number: 303588 **Alternate ID:** 27-C-1 105'-105.83'
Sampling Method: Auger Boring ASTM D1452 **Depth (ft):** 105-105.83
Boring Number: 27-C-1 **Sampled By:** Patterson, Gregg
Location: In-place
Location Details: Boring 27-C-1 105'-105.83'
Sample Date: 04/14/2020
Received Date: 04/23/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 04/24/2020

Laboratory Data

Sieve Size	% Passing	Specification
2 mm (No. 10)	98	
850 µm (No. 20)	93	
425 µm (No. 40)	86	
180 µm (No. 80)	69	
150 µm (No. 100)	65	
75 µm (No. 200)	51.3	

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



Classification: ML Sandy silt

General

Results: The test is for informational purposes.
Remarks: Total dry weight of sample 214.7 grams

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Project:

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Sample Information

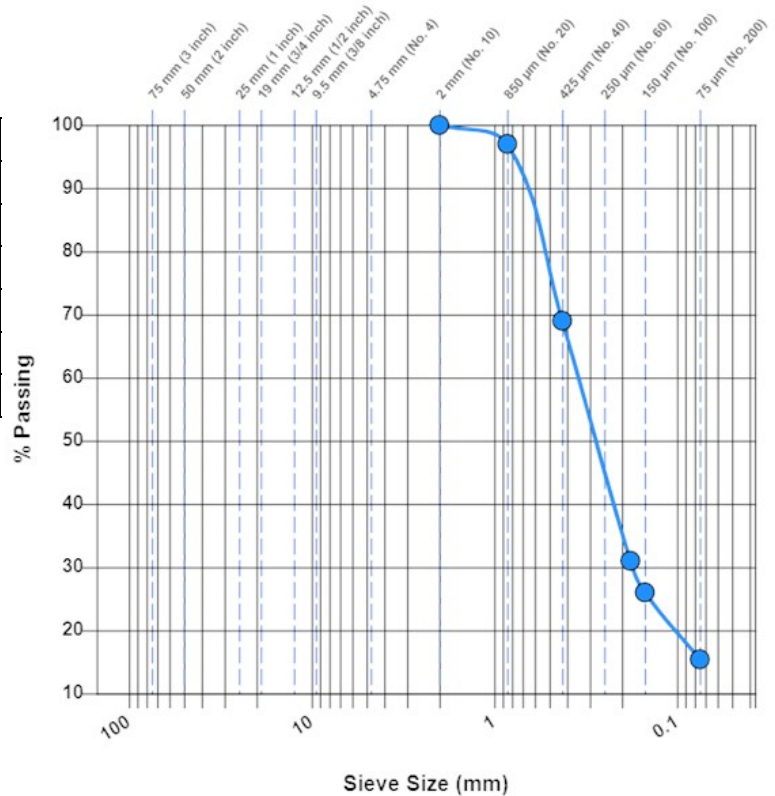
Sample Number: 303589 **Alternate ID:** 27-C-1 115'-118.92'
Sampling Method: Auger Boring ASTM D1452 **Depth (ft):** 115'-118.92'
Boring Number: 27-C-1 **Sampled By:** Patterson, Gregg
Location: In-place
Location Details: Boring 27-C-1 115'-118.92'
Sample Date: 04/15/2020
Received Date: 04/23/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 04/23/2020

Laboratory Data

Sieve Size	% Passing	Specification
2 mm (No. 10)	100	
850 µm (No. 20)	97	
425 µm (No. 40)	69	
180 µm (No. 80)	31	
150 µm (No. 100)	26	
75 µm (No. 200)	15.4	

Test Method: Method A (Composite Sieving)

Specimen Obtained: Oven Dry



Classification: SM Silty sand

General

Results: The test is for informational purposes.

Remarks: Total dry weight of sample 180.4 grams

[Signature]

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Project:

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Enbridge Line 5 Re-route
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Sample Information

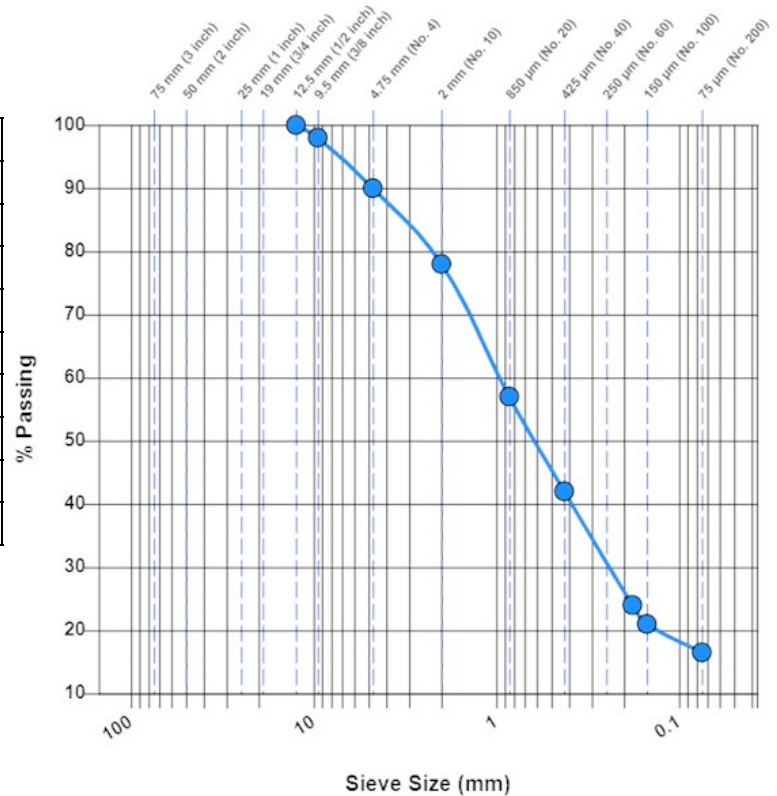
Sample Number: 303592 **Alternate ID:** 31-C 35'
Sampling Method: Auger Boring ASTM D1452 **Depth (ft):** 35
Boring Number: 31-C **Sampled By:** Patterson, Gregg
Location: In-place
Location Details: Boring 31-C 35'
Sample Date: 04/15/2020
Received Date: 04/23/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 04/23/2020

Laboratory Data

Sieve Size	% Passing	Specification
12.5 mm (1/2 inch)	100	
9.5 mm (3/8 inch)	98	
4.75 mm (No. 4)	90	
2 mm (No. 10)	78	
850 µm (No. 20)	57	
425 µm (No. 40)	42	
180 µm (No. 80)	24	
150 µm (No. 100)	21	
75 µm (No. 200)	16.5	

Test Method: Method A (Composite Sieving)

Specimen Obtained: Oven Dry



Classification: SM Silty sand

General

Results: The test is for informational purposes.

Remarks: Total dry weight of sample 305.9 grams

[Signature]

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Project:

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<Blank>, <Blank>

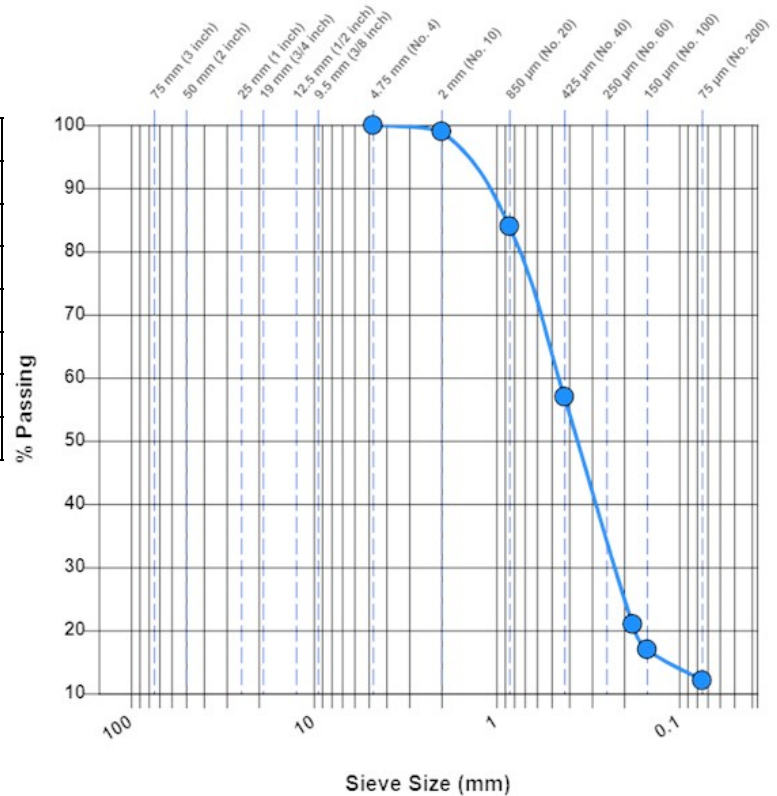
Sample Information

Sample Number: 303593 **Alternate ID:** 31-C 100'
Sampling Method: Auger Boring ASTM D1452 **Depth (ft):** 100
Boring Number: 31-C **Sampled By:** Patterson, Gregg
Location: In-place
Location Details: Boring 31-C 100'
Sample Date: 04/16/2020
Received Date: 04/23/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 04/23/2020

Laboratory Data

Sieve Size	% Passing	Specification
4.75 mm (No. 4)	100	
2 mm (No. 10)	99	
850 µm (No. 20)	84	
425 µm (No. 40)	57	
180 µm (No. 80)	21	
150 µm (No. 100)	17	
75 µm (No. 200)	12.1	

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



Classification: SM Silty sand

General

Results: The test is for informational purposes.

Remarks: Total dry weight of sample 216.2

[Signature]

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Project:

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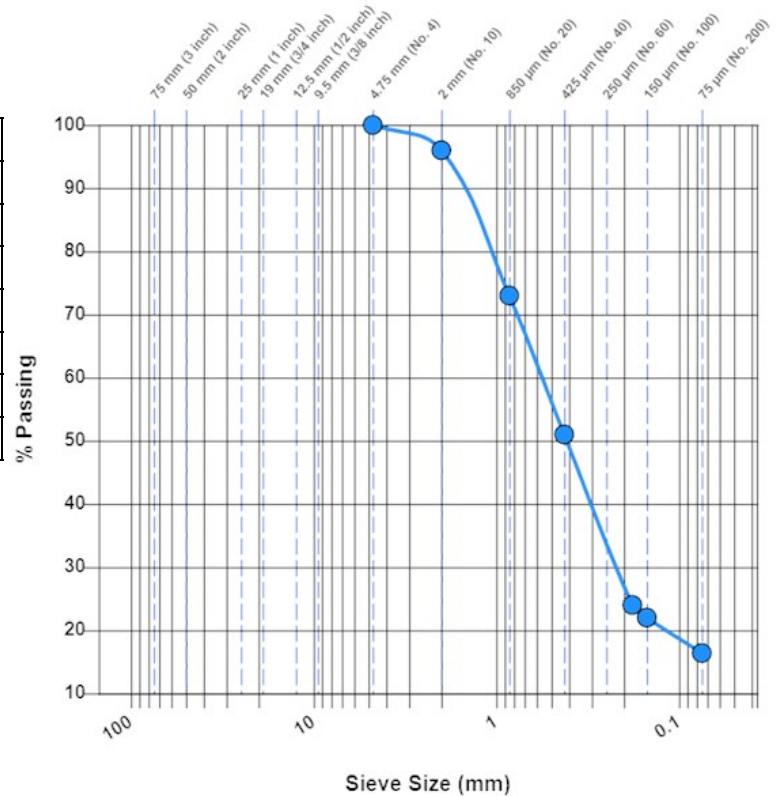
Sample Information

Sample Number: 303594 **Alternate ID:** 31-C 110'
Sampling Method: Auger Boring ASTM D1452 **Depth (ft):** 110
Boring Number: 31-C **Sampled By:** Patterson, Gregg
Location: In-place
Location Details: Boring 31-C 110'
Sample Date: 04/16/2020
Received Date: 04/23/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 04/23/2020

Laboratory Data

Sieve Size	% Passing	Specification
4.75 mm (No. 4)	100	
2 mm (No. 10)	96	
850 µm (No. 20)	73	
425 µm (No. 40)	51	
180 µm (No. 80)	24	
150 µm (No. 100)	22	
75 µm (No. 200)	16.4	

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



Classification: SM Silty sand

General

Results: The test is for informational purposes.

Remarks: Total dry weight of sample 220.6 grams

[Signature]

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Project:

B2001991
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<Blank>, <Blank>

Sample Information

Sample Number: 303793 **Alternate ID:** 27-C-1 45'-47'

Sampling Method: Auger Boring ASTM D1452 **Depth (ft):** 45-47

Boring Number: 27-C-1 **Sampled By:** Patterson, Gregg

Location: In-place

Location Details: Boring 27-C-1 45'-47'

Sample Date: 04/23/2020

Received Date: 04/23/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN

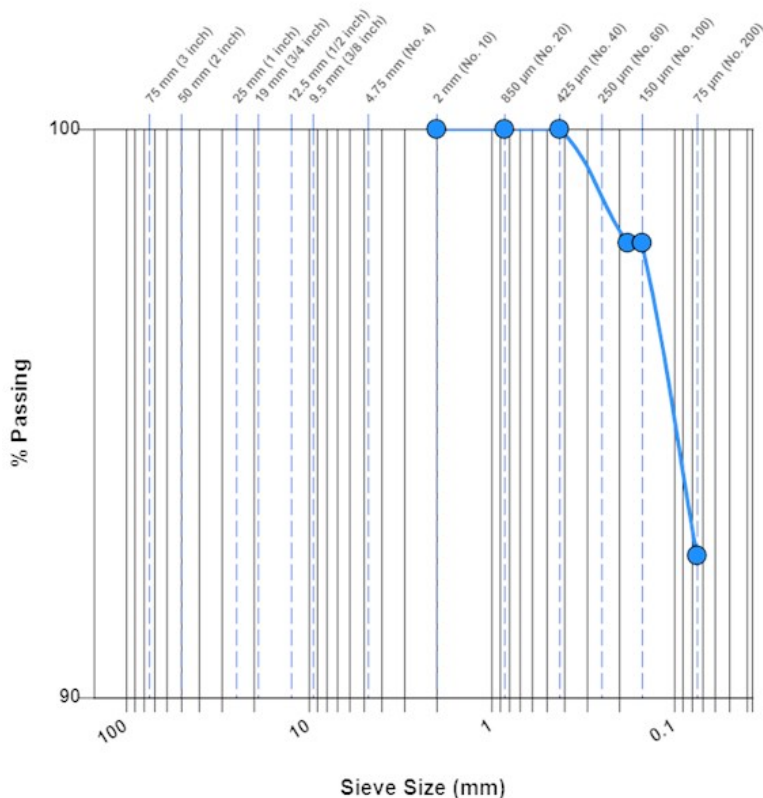
Tested Date: 04/23/2020

Laboratory Data

Sieve Size	% Passing	Specification
2 mm (No. 10)	100	
850 µm (No. 20)	100	
425 µm (No. 40)	100	
180 µm (No. 80)	98	
150 µm (No. 100)	98	
75 µm (No. 200)	92.5	

Test Method: Method A (Composite Sieving)

Specimen Obtained: Oven Dry



Classification: ML Silt

General

Results: The test is for informational purposes.

Remarks: Total dry weight of sample 220.9 grams

[Signature]

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Enbridge Line 5 Re-route
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Sample Information

Sample Number: 300520 **Alternate ID:** 29-C-1 94.5'-99.5'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Patterson, Gregg
Location: In-place
Location Details: Boring 29-C-1 94.5'-99.5'
Sample Date: 04/03/2020
Received Date: 04/06/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 04/06/2020 **Tested By:** Falwey, Shane

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
29-C-1	24 & 25	97.0	10.9

General

Results: The test is for informational purposes.



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Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
<Blank>, <Blank>

Sample Information

Sample Number: 300521 **Alternate ID:** 29-C-1 105'-115'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Patterson, Gregg
Location: In-place
Location Details: Boring 29-C-1 105'-115'
Sample Date: 04/03/2020
Received Date: 04/06/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 04/06/2020 **Tested By:** Falwey, Shane

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
29-C-1	26-28	110.0	12.1

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
<Blank>, <Blank>

Sample Information

Sample Number: 303582 **Alternate ID:** 27-C-1 35'-37'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Patterson, Gregg
Location: In-place
Location Details: Boring 27-C-1 35'-37'
Sample Date: 04/14/2020
Received Date: 04/23/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 04/23/2020 **Tested By:** Patterson, Gregg

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
27-C-1	11	36.0	20.0

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
<Blank>, <Blank>

Sample Information

Sample Number: 303584 **Alternate ID:** 27-C-1 65'-66'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Patterson, Gregg
Location: In-place
Location Details: Boring 27-C-1 65'-66'
Sample Date: 04/14/2020
Received Date: 04/23/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 04/23/2020 **Tested By:** Patterson, Gregg

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
27-C-1	17	65.0	23.8

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
<Blank>, <Blank>

Sample Information

Sample Number: 303585 **Alternate ID:** 27-C-1 75'-77'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Patterson, Gregg
Location: In-place
Location Details: Boring 27-C-1 75'-77'
Sample Date: 04/14/2020
Received Date: 04/23/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 04/23/2020 **Tested By:** Patterson, Gregg

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
27-C-1	19	76.0	16.0

General

Results: The test is for informational purposes.



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Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
<Blank>, <Blank>

Sample Information

Sample Number: 303586 **Alternate ID:** 27-C-1 85'-87'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Patterson, Gregg
Location: In-place
Location Details: Boring 27-C-1 85'-87'
Sample Date: 04/14/2020
Received Date: 04/23/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 04/23/2020 **Tested By:** Patterson, Gregg

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
27-C-1	21	86.0	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
<Blank>, <Blank>

Sample Information

Sample Number: 303587 **Alternate ID:** 27-C-1 95'-96.83'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Patterson, Gregg
Location: In-place
Location Details: Boring 27-C-1 95'-96.83'
Sample Date: 04/14/2020
Received Date: 04/23/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 04/23/2020 **Tested By:** Patterson, Gregg

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
27-C-1	23	95.0	10.9

General

Results: The test is for informational purposes.



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Client:

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Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
<Blank>, <Blank>

Sample Information

Sample Number: 303588 **Alternate ID:** 27-C-1 105'-105.83'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Patterson, Gregg
Location: In-place
Location Details: Boring 27-C-1 105'-105.83'
Sample Date: 04/14/2020
Received Date: 04/23/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 04/23/2020 **Tested By:** Patterson, Gregg

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
27-C-1	25	105.0	14.0

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
<Blank>, <Blank>

Sample Information

Sample Number: 303589 **Alternate ID:** 27-C-1 115'-118.92'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Patterson, Gregg
Location: In-place
Location Details: Boring 27-C-1 115'-118.92'
Sample Date: 04/15/2020
Received Date: 04/23/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 04/23/2020 **Tested By:** Patterson, Gregg

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
27-C-1	27	117.0	16.6

General

Results: The test is for informational purposes.



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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
<Blank>, <Blank>

Sample Information

Sample Number: 303592 **Alternate ID:** 31-C 35'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Patterson, Gregg
Location: In-place
Location Details: Boring 31-C 35'
Sample Date: 04/15/2020
Received Date: 04/23/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 04/23/2020 **Tested By:** Patterson, Gregg

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
31-C	12	35.0	14.5

General

Results: The test is for informational purposes.



4511 West First Street
Suite 4
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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
<Blank>, <Blank>

Sample Information

Sample Number: 303593 **Alternate ID:** 31-C 100'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Patterson, Gregg
Location: In-place
Location Details: Boring 31-C 100'
Sample Date: 04/16/2020
Received Date: 04/23/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 04/23/2020 **Tested By:** Patterson, Gregg

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
31-C	25	100.0	19.8

General

Results: The test is for informational purposes.



4511 West First Street
Suite 4
Duluth, MN 55807
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
<Blank>, <Blank>

Sample Information

Sample Number: 303594 **Alternate ID:** 31-C 110'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Patterson, Gregg
Location: In-place
Location Details: Boring 31-C 110'
Sample Date: 04/16/2020
Received Date: 04/23/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 04/23/2020 **Tested By:** Patterson, Gregg

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
31-C	27	110.0	18.5

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
<Blank>, <Blank>

Sample Information

Sample Number: 303793 **Alternate ID:** 27-C-1 45'-47'

Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Patterson, Gregg

Location: In-place

Location Details: Boring 27-C-1 45'-47'

Sample Date: 04/23/2020

Received Date: 04/23/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN

Tested Date: 04/23/2020 **Tested By:** Patterson, Gregg

Laboratory Data

Boring #	Sample #	Depth (ft)	Moisture Content (%)
27-C-1	13	46.0	20.6

General

Results: The test is for informational purposes.



11001 Hampshire Avenue S
Minneapolis, MN 55438
Phone: 952-995-2000

Client:

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

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
<Blank>, <Blank>

Sample Information

Metafield ID: 302818

Completed Date: 04/20/2020

Prepared By: Streier, Jim

Laboratory Results Summary

Boring	Sample	Depth (ft)	MC (%)	Wash Loss (%)	LL	PL	PI	Organic Content %	Dry Density (pcf)	Resistivity (ohm-cm)	Q _u (tsf)	Specific Gravity
29-C-1	5	9.5	17.5									
29-C-1	7	14.5	26.2									
29-C-1	8	19.5	26.7									
29-C-1	10	29.5	34.4									
29-C-1	13,14	44.5	22.4									
29-C-1	16,17	59.5	20.6									
29-C-1	18	69.5	14.4		20	16	4					
29-C-1	20	79.5	34.4									

General

11001 Hampshire Avenue S
Minneapolis, MN 55438
Phone: 952-995-2000

Client:

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

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
<Blank>, <Blank>

Sample Information

Metafield ID: 307017

Completed Date: 05/08/2020

Prepared By: Streier, Jim

Laboratory Results Summary

Boring	Sample	Depth (ft)	MC (%)	Wash Loss (%)	LL	PL	PI	Organic Content %	Dry Density (pcf)	Resistivity (ohm-cm)	Q _u (tsf)	Specific Gravity
27-C-1	4&5	7.0	17.9		38	16	22					
27-C-1		12.0	20.8									
27-C-1		25.0	26.5									
27-C-1	15	55.0	27.0									
31-C		5.0	32.6									
31-C	5	10.0	31.9		64	21	43					
31-C		15.0	40.5									
31-C	9	20.0	32.1									
31-C		25.0	26.2									
31-C	14	45.0	17.9		22	18	4					
31-C		50.0	15.3									
31-C	17	60.0	19.0									
31-C	19	70.0	29.6		27	19	8					
31-C	21	80.0	21.3									
31-C	23	90.0	10.6									

General

11001 Hampshire Avenue S
Minneapolis, MN 55438
Phone: 952-995-2000

Client:

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

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
<Blank>, <Blank>

Sample Information

Metafield ID: 307726

Completed Date: 05/12/2020

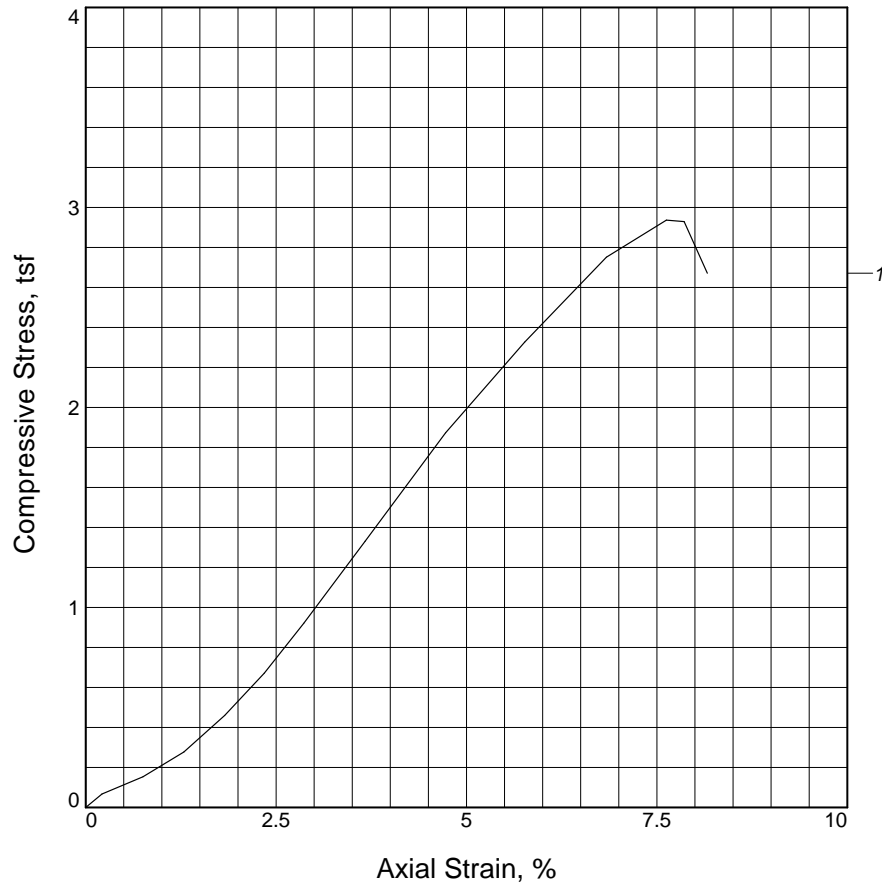
Prepared By: Streier, Jim

Laboratory Results Summary

Boring	Sample	Depth (ft)	MC (%)	Wash Loss (%)	LL	PL	PI	Organic Content %	Dry Density (pcf)	Resistivity (ohm-cm)	Q _u (tsf)	Specific Gravity
27-C-1	TW	12.0			32	15	17					
27-C-1	TW	25.0			40	15	25					
31-C	TW	5.0			68	21	47					
31-C	TW	15.0			49	18	31					
31-C	TW	25.0					NP					
31-C	TW	50.0			20	16	4					

General

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.9367			
Undrained shear strength, tsf	1.4684			
Failure strain, %	7.6			
Strain rate, %/min.	1.00			
Water content, %	14.4			
Wet density, pcf	140.2			
Dry density, pcf	122.6			
Saturation, %	98.8			
Void ratio	0.4005			
Specimen diameter, in.	2.849			
Specimen height, in.	5.587			
Height/diameter ratio	1.96			

Description: FAT CLAY, reddish brown (CH)

LL = **PL =** **PI =** **Assumed GS= 2.75** **Type:** Thinwall

Project No.: B2001991

Date Sampled:

Remarks:
ASTM D 2166

Client:

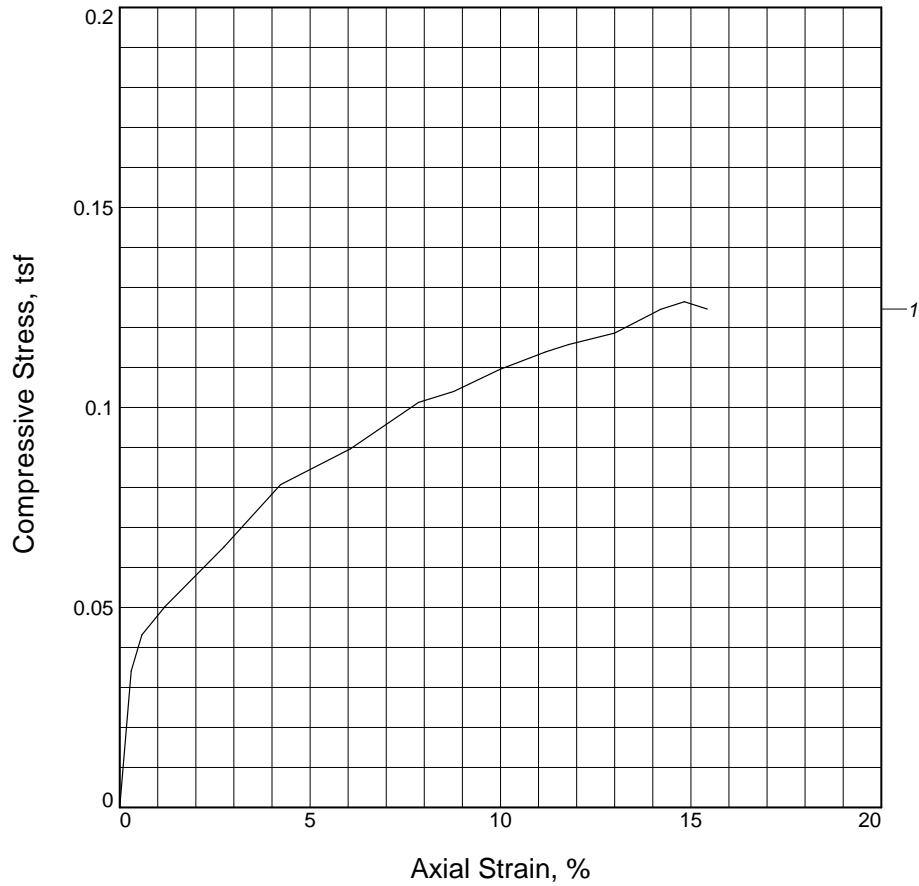
Project: Enbridge Line 5 Re-route
Enbridge Line 5

Source of Sample: 29-C-1 **Depth:** 79.5'

BRAUNSM
INTERTEC

Figure _____

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.1264			
Undrained shear strength, tsf	0.0632			
Failure strain, %	14.8			
Strain rate, %/min.	1.00			
Water content, %	34.4			
Wet density, pcf	118.2			
Dry density, pcf	87.9			
Saturation, %	99.4			
Void ratio	0.9535			
Specimen diameter, in.	2.720			
Specimen height, in.	4.970			
Height/diameter ratio	1.83			

Description: SILTY CLAY with SAND, reddish brown (CL-ML)

LL =	PL =	PI =	Assumed GS= 2.75	Type: Thinwall
------	------	------	------------------	----------------

Project No.: B2001991

Date Sampled:

Remarks:
ASTM D 2166

Client:

Project: Enbridge Line 5 Re-route
Enbridge Line 5

Source of Sample: 29-C-1 **Depth:** 69.5'

Figure _____

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