



March 9, 2018

FOUNDATION INVESTIGATION REPORT

HIGHWAY 400 / 6th LINE UNDERPASS (SITE NO. 30-211/1&2) AND HIGH FILL EMBANKMENTS TOWN OF INNISFIL, SIMCOE COUNTY MINISTRY OF TRANSPORTATION, ONTARIO G.W.P. 2289-13-00

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REPORT



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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by Morrison Hershfield Limited (MH) on behalf of the Ministry of Transportation, Ontario (MTO) to provide foundation engineering services for the proposed reconstruction of Highway 400/6th Line underpass. The new Highway 400/6th Line underpass will be located north of the existing 6th Line overpass structure, in the Town of Innisfil, Simcoe County, Ontario.

The purpose of this investigation is to establish the subsurface soil and groundwater conditions at the proposed structure including the associated approach embankments, by borehole drilling and geotechnical/analytical laboratory testing on selected soil samples.

The Terms of Reference and the scope of work for the foundation investigation are outlined in MTO's Request for Proposal, dated November 30, 2016, which forms part of the Consultant Agreement for Assignment No. 2016-E-0057. The work has been carried out in accordance with Golder's Supplementary Specialty Plan for foundation engineering services for this project, dated May 19, 2017.

2.0 SITE DESCRIPTION

The proposed Highway 400/6th Line underpass is located about 7 km north of the Highway 400/Highway 89 underpass in the Town of Innisfil, Ontario. Highway 400 is oriented in a north-south direction, and 6th Line is oriented in an east-west direction. Highway 400 consists of three northbound and three southbound lanes, while 6th Line consists of one lane in each direction.

It is understood that the Town of Innisfil plans to realign 6th Line to the north of the existing local road alignment, and that a new underpass will be constructed approximately 40 m to 45 m north of the existing 6th Line overpass to accommodate the realignment.

Agricultural fields are located east and west of the proposed underpass site. At the location of the proposed structure site, the Highway 400 grade is at about Elevation 296.6 m and the highway embankment is about 1.5 m high relative to the immediately surrounding natural ground surface. The ground surface elevation within the agricultural fields varies from about Elevation 290 m to 295 m.

3.0 INVESTIGATION PROCEDURES

The field work for the foundation investigation was carried out between October 11 and October 27, 2017 and between January 3 and 19, 2018, during which time a total of 21 boreholes, designated as Boreholes 6UP-01 to 6UP-08, HF-01 to HF-10, and CE-01 to CE-03, were advanced near the location of the structure foundation footprints, approach and high fill embankments, and culvert, as summarized below.



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Foundation Element	Relevant Boreholes
High Fill Embankment West of Underpass	HF-01 to HF-04, and CE-01 to CE-03
West Approach Embankment	6UP-01
West Abutment	6UP-02 and 6UP-03
Center Pier	6UP-04 and 6UP-05
East Abutment	6UP-06 and 6UP-07
East Approach Embankment	6UP-08
High Fill Embankment East of Underpass	HF-05 to HF-10

The locations of the boreholes are shown on Drawings 1, 3 and 4, and the borehole records are provided in Appendix A. Lists of abbreviations and symbols are also provided in Appendix A to assist in the interpretation of the borehole records.

The field work was carried out using D-90 truck-mounted and D-50 track-mounted drill rigs supplied and operated by Walker Drilling Ltd. of Utopia, Ontario. The boreholes were advanced through the overburden using 203 mm outer diameter hollow stem augers. Soil samples were obtained at 0.75 m, 1.5 m and 3 m intervals of depth, using a 50 mm outer diameter split-spoon sampler driven by an automatic hammer in accordance with the Standard Penetration Test (SPT) procedures outlined in ASTM D1586-08¹.

The groundwater conditions and water levels in the open boreholes were observed during and immediately following drilling operations. A standpipe piezometer was installed in Boreholes 6UP-03, 6UP-06, HF-06, HF-09 and CE-03 to permit monitoring of the groundwater level at the borehole locations. The standpipe piezometers consist of a 50 mm diameter PVC pipe with a slotted screen sealed at a selected depth within the borehole. Details of the piezometer installation and water level readings are presented on the borehole records in Appendix A. All boreholes were backfilled with bentonite upon completion in accordance with Ontario Regulation 903: Wells (as amended).

The field work was observed by a member of Golder's engineering and technical staff, who located the boreholes, arranged for the clearance of underground services including both public and where applicable private locates, observed the drilling, sampling and in situ testing operations, logged the boreholes, and examined the soil samples. The samples were identified in the field, placed in appropriate containers, labelled and transported to Golder's Mississauga geotechnical laboratory where the samples underwent further visual examination and geotechnical laboratory testing. All of the geotechnical laboratory tests were carried out in accordance with MTO and/or ASTM Standards, as appropriate. Classification testing (water content, Atterberg limits and grain size distribution) was carried out on selected soil samples. The results of the geotechnical laboratory testing are included in Appendix B.

Four selected soil samples were submitted, under chain-of-custody procedures, to Maxxam Analytics of Mississauga, Ontario (a Standards Council of Canada (SCC) accredited laboratory) for corrosivity testing. The soil samples were analyzed for a suite of parameters, including conductivity, resistivity, soluble chloride

¹ ASTM D1586-08a – Standard Test Method for Standard Penetration Tests and Split Barrel Sampling of the soil.



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concentration, soluble sulphate concentration and pH. The results of the analytical tests are presented in Appendix B.

The borehole locations and ground surface elevations were measured using a GPS unit (Trimble XH 3.5G), having an accuracy of 0.1 m in the vertical and horizontal directions. The locations provided on the borehole records and shown on Drawings 1 to 4 are positioned relative to MTM NAD 83 (Zone 10) coordinates system, and the ground surface elevations are referenced to Geodetic datum. The borehole locations and ground surface elevations and drilled depths are summarized below.

Borehole No.	Location (MTM NAD 83, Zone 10)		Ground Surface Elevation (m)	Borehole Depth (m)
	Northing (m) (Latitude, °)	Easting (m) (Longitude, °)		
6UP-01	4,902,370.2 (44.261202)	290,897.2 (-79.674120)	293.6	11.3
6UP-02	4,902,380.2 (44.261292)	290,904.6 (-79.674030)	293.6	29.4
6UP-03	4,902,366.1 (44.261165)	290,907.9 (-79.673990)	293.7	29.6
6UP-04	4,902,392.3 (44.261402)	290,945.4 (-79.673518)	296.6	27.7
6UP-05	4,902,380.4 (44.261294)	290,948.1 (-79.673484)	296.6	29.1
6UP-06	4,902,402.4 (44.261493)	290,985.5 (-79.673017)	295.1	23.1
6UP-07	4,902,391.6 (44.261396)	290,988.0 (-79.672985)	295.2	23.3
6UP-08	4,902,398.0 (44.261454)	290,997.8 (-79.672863)	295.2	11.3
HF-01	4,902,295.4 (44.260529)	290,693.0 (-79.676674)	292.7	5.2
HF-02	4,902,323.1 (44.260772)	290,758.3 (-79.675865)	291.8	11.3
HF-03	4,902,332.8 (44.260929)	290,786.1 (-79.675278)	292.0	11.3
HF-04	4,902,353.0 (44.261072)	290,842.7 (-79.674684)	292.8	11.3
HF-05	4,902,417.5 (44.261630)	291,056.3 (-79.672130)	294.6	9.8
HF-06	4,902,429.4 (44.261739)	291,104.7 (-79.671524)	294.0	9.8
HF-07	4,902,438.9 (44.261825)	291,153.6 (-79.670912)	293.0	8.2
HF-08	4,902,446.0 (44.261890)	291,203.0 (-79.670293)	291.5	6.7
HF-09	4,902,451.6 (44.261941)	291,253.0 (-79.669667)	290.3	6.7



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Borehole No.	Location (MTM NAD 83, Zone 10)		Ground Surface Elevation (m)	Borehole Depth (m)
	Northing (m) (Latitude, °)	Easting (m) (Longitude, °)		
HF-10	4,902,471.4 (44.262120)	291,300.2 (-79.669077)	290.1	5.2
CE-01	4,902,340.6 (44.260932)	290,710.9 (-79.676453)	291.3	11.3
CE-02	4,902,291.7 (44.260490)	290,740.0 (-79.676090)	290.0	11.3
CE-03*	4,902,292.1 (44.260504)	290,740.9 (-79.676079)	290.0	5.2

* Purpose of borehole was to install a monitoring well and to confirm the low SPT 'N' value in Borehole CE-02 at a depth of 4.5 m below ground surface.

4.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

4.1 Regional Geology

This project area is located within the Peterborough Drumlin Field physiographic region, as delineated in *The Physiography of Southern Ontario* (Chapman and Putman, 1894)². The surficial soils in the Peterborough Drumlin Field frequently consist of gravelly sand till or sand and gravel deposits, although clayey silt to silt/sand till deposits are also common in the vicinity of the Highway 400 corridor. Drumlins (glacially-shaped hills comprised of till) are more frequent in the southern portion of the section of the Peterborough Drumlin Field that is traversed by Highway 400. Deposits of silt, clay or peat may be found in the low-lying areas between drumlins. The Peterborough Drumlin Field is underlain at depth by bedrock of the Lindsay and Verulam Formations, which consists mainly of fossiliferous limestone.

4.2 Subsurface Conditions

The detailed subsurface soil and groundwater conditions as encountered in the boreholes advanced during the investigation, together with the results of the laboratory tests carried out on selected soil samples, are presented on the borehole records provided in Appendix A. The results of the in-situ field tests (i.e. SPT "N" values) as presented on the borehole records and in sub-sections of Section 4.2 are uncorrected. The geotechnical laboratory testing plots are contained in Appendix B.

The stratigraphic boundaries shown on the borehole records and on the stratigraphic profile and cross sections on Drawings 1 to 4 are inferred from non-continuous sampling, observations of drilling progress and the results of Standard Penetration Tests. These boundaries, therefore, represent transitions between soil types rather than exact planes of geological change. Furthermore, subsurface conditions will vary between and beyond the borehole locations. It should be noted that the interpreted stratigraphy shown on Drawings 1 to 4 is a simplification of the subsurface conditions.

² Chapman, L.J. and Putman, D.F., 1894, *The Physiography of Southern Ontario*, Ontario Geological Society, Special Volume 2, Third Edition. Accompanied by Map p. 2715, Scale 1:600,000.)



In general, the subsurface conditions consist of a layer of topsoil or pavement structure underlain by fill that varies in composition from sand and gravel to clayey silt with sand to silty clay. At some borehole locations the topsoil is underlain by a surficial deposit of clayey silt with sand or silty sand. At all boreholes, the fill and surficial deposits are underlain by a glacial till deposit, which varies in composition from clayey silt with sand, to silt and sand, to silty gravelly sand. Layers or lenses of clayey silt, to silt, to silty sand to sand were observed throughout the till deposit. The till deposit is underlain by a lower deposit that varies in composition from clayey silt to silt. A more detailed description of the subsurface conditions encountered in the boreholes is provided in the following sections.

4.2.1 Asphalt Pavement

Boreholes 6UP-04 and 6UP-05 were advanced through the west shoulder of the Highway 400 southbound lanes, near the location of the proposed pier. The encountered asphalt is approximately 215 mm to 240 mm thick.

4.2.2 Topsoil

Topsoil was encountered at ground surface in Boreholes 6UP-01, 6UP-02, 6UP-03, 6UP-06, 6UP-07, 6UP-08, HF-01 to HF-10 and CE-01 to CE-03. The topsoil was between approximately 150 mm and 690 mm in thickness. The topsoil was classified based on visual and textural observations; organic content testing was not carried out.

4.2.3 Fill

Non-cohesive fill was encountered underlying the asphalt at Boreholes 6UP-04 and 6UP-05, and underlying the topsoil in Boreholes 6UP-08 and CE-01. This fill is variable in composition and generally consists of silt and sand, to sand, to sand and gravel. The surface of the non-cohesive fill was encountered at Elevation 296.4 m in Boreholes 6UP-04 and 6UP-05, at Elevation 295.1 m in Borehole 6UP-08 and at Elevation 290.6 in Borehole CE-01. In the boreholes advanced on Highway 400, the non-cohesive fill extends to depths of 0.5 m and 4.1 m (Elevation 296.1 m and 292.5 m). In Borehole 6UP-08, advanced near the toe of the existing embankment east of Highway 400, the sand and gravel fill extends to a depth of 1.4 m (Elevation 293.7 m) below the present ground surface, while in Borehole CE-01, the silty sand fill extends to a depth of 2.2 m (Elevation 289.1 m).

Cohesive fill was encountered underlying the non-cohesive fill in Borehole 6UP-04, and underlying the topsoil in Boreholes 6UP-06, 6UP-07, HF-05 and HF-07 to HF-10. The fill consists of sandy clayey silt, and clayey silt to silty clay. The surface of the cohesive fill was encountered between Elevations 296.1 m and 289.9 m, and the fill extends to depths between 0.7 m and 3.7 m (Elevation 294.4 m and 287.9 m) below the ground surface.

The SPT “N” values within the non-cohesive fill range from 9 blows to 46 blows per 0.3 m of penetration, indicating a loose to dense compactness condition. The SPT “N” values measured within the cohesive fill range from 4 blows to 20 blows per 0.3 m of penetration, indicating a firm to very stiff consistency.

The results of grain size distribution tests completed on four samples of the non-cohesive fill are presented on Figure B1 in Appendix B. The silt and sand fill contains trace to some clay and gravel, and the sand and gravel contains some fines. Atterberg limits tests were carried out on the fines portion of two samples of the granular fill, and measured liquid limits of about 13 and 15 percent, plastic limits of about 9 and 11 per cent, and plasticity indices of about 2 and 4 per cent. The results of the Atterberg limits tests are shown on a plasticity chart on Figure B2 in Appendix B, and indicate that the fines portion of the fill can be classified as a silt of slight plasticity.

The results of grain size distribution tests completed on two samples of the cohesive fill are presented on Figure B3 in Appendix B. Atterberg limits testing was carried out on the fines portion of four samples of this cohesive fill and measured liquid limits ranging from about 19 to 45 per cent, plastic limits ranging from about 11 to 19 per cent,



and plasticity indices ranging from about 8 to 27 per cent. The results of the Atterberg limits tests are shown on a plasticity chart on Figure B4 in Appendix B, and indicate that the fines portion of this fill can be classified as a clayey silt of low to medium plasticity. The water content measured in the fill material ranges from about 4 per cent to 27 per cent.

4.2.4 Surficial Sandy Silt to Silty Sand and Clayey Silt with Sand

Thin surficial layers of sandy silt to silty sand, and clayey silt with sand were encountered below the topsoil in Boreholes 6UP-01, 6UP-02, 6UP-03, HF-04 and CE-02. The upper surface of these layers was encountered between Elevation 293.3 m and 289.3 m, and where encountered they total approximately 1.0 m to 1.8 m in thickness, with their base between Elevation 292.2 m and 287.8 m at the borehole locations.

SPT “N” values ranging from 3 to 5 blows per 0.3 m of penetration were measured in all of the sandy silt to silty sand layers, indicating a loose relative density. SPT “N” values of 4 to 14 blows per 0.3 m of penetration were measured in the sandy clayey silt layers, indicating a firm to stiff consistency.

The results of grain size distribution tests completed on four samples of the surficial cohesive deposit are shown on Figure B5 in Appendix B. The clayey silt with sand to clayey silt contains trace to some gravel.

Atterberg limits tests were carried out on the fines portion of four samples of the surficial cohesive deposit, and measured liquid limits ranging from about 18 to 33 per cent, plastic limits ranging from about 10 to 15 per cent, and plasticity indices ranging from about 7 to 19 per cent. The results of the Atterberg limits tests are shown on a plasticity chart on Figure B6 in Appendix B, and indicate that the fines portion of the deposit can be classified as a clayey silt of low plasticity.

4.2.5 Clayey Silt with Sand Till to Silt and Sand to Silty Gravelly Sand Till

An extensive glacial till deposit was encountered underlying the asphalt, topsoil, fill and/or surficial soil layers in all boreholes advanced at the site. The till is variable in composition, grading between low plasticity clayey silt, clayey silt with sand or sandy clayey silt, and silt and sand or silty gravelly sand. The surface of the till deposit was encountered at depths ranging between about 0.3 m and 4.1 m (Elevation 294.4 m and 287.9 m). Where fully penetrated in the boreholes, the till deposit extends to depths of about 20.9 m to 27.7 m (between Elevations 274.2 m and 268.9 m).

The SPT “N” values recorded within the till deposit are variable, ranging from 5 blows per 0.3 m of penetration to 160 blows per 0.29 m of penetration. This suggests a firm to hard consistency within the cohesive till deposit, and loose to very dense compactness condition within the granular till deposit. In general, the lower SPT “N” values (and the firm to stiff or loose portions of the deposit) are found within the upper 1 m to 2 m of the till deposit.

The results of grain size distribution tests completed on 43 samples of the till deposit are shown on Figures B7A to B7G in Appendix B. Auger refusal, likely on cobbles or a boulder, was encountered within the till deposit at a depth of 3 m below ground surface in Borehole 6UP-03 and the borehole was abandoned and re-advanced at a location 1 m to the east. Although obstructions were not encountered and grinding of the augers during drilling was not evident at other boreholes, the till deposits in southern Ontario typically contain such materials and they should be expected within the glacial till deposits.

Atterberg limits tests were carried out on the fines portion of 51 samples of the till deposit, including three samples that were found to be non-plastic. The Atterberg limits tests completed on cohesive samples of this deposit



measured liquid limits ranging from about 11 to 23 per cent, plastic limits ranging from about 8 to 12 per cent, and plasticity indices ranging from about 4 to 12 per cent. For the samples of the cohesive till, the results of the Atterberg limits tests are shown on the plasticity charts on Figures B8A to B8E in Appendix B, and indicate that the fines portion of the deposit can be classified as a clayey silt of low plasticity. For the samples of the “non-cohesive” portions of the till, the results of the Atterberg limits tests are shown on the plasticity charts on Figures B9A and B9B in Appendix B, illustrating that the plasticity index of the tested samples is less than 4 per cent, and indicating that the fines in this portion of the deposit can be classified as a silt of slight plasticity. The natural water content measured on samples of this till deposit range from about 6 to 16 per cent.

4.2.6 Clayey Silt and Sandy Silt to Sand Interlayers Within the Till

Interlayers of clayey silt, sandy silt, silty sand and sand were encountered within the till deposit in many of the boreholes. The interlayers vary in thickness from about 0.2 m to 2.3 m, and these layers occur at variable depths throughout the till deposit. A much thicker interlayer or localized deposit/lens of clayey silt to sand was encountered in Boreholes 6UP-03, CE-01 and CE-02; at these locations, the layer is at least 4.1 m to 7.6 m in thickness. It is noted that additional interlayers of granular soil are likely present throughout the till, but may have not been encountered considering the 1.5 m sampling interval at depth in the boreholes.

The SPT “N” values recorded within the non-cohesive interlayers ranges from 11 blows per 0.3 m of penetration to 173 blows per 0.22 m of penetration, indicating a compact to very dense compactness condition. In Borehole CE-02 the SPT ‘N’ value recorded within the sand interlayer at a depth of 3.8 m was “weight of hammer”; Borehole CE-03 was advanced adjacent to CE-02 using techniques to counterbalance the water pressures, and the SPT ‘N’ value recorded at the same depth was 43 blows per 0.3 m, confirming that the low value measured in Borehole CE-02 is the result of sample disturbance due to groundwater inflow to the borehole. An SPT ‘N’ value of 57 blows per 0.3 m of penetration was recorded in the clayey silt interlayer in Borehole 6UP-03, suggesting a hard consistency.

The results of grain size distribution testing completed on three samples of the clayey silt to silt interlayers are shown on Figure B10. The results of grain size distribution testing completed on nine samples of the silty sand to sand interlayers are shown on Figures B11A and B11B. Atterberg limits testing was carried out on two samples of the fines from a granular interlayer, and confirmed these materials were non-plastic. The natural water content measured on selected samples of the non-cohesive interlayers range from about 8 to 21 per cent. The natural water content measured on the recovered sample of the clayey silt interlayer is about 11 per cent.

4.2.7 Lower Clayey Silt to Silt

A lower deposit of clayey silt to silt was encountered underlying the till deposit in Boreholes 6UP-03 to 6UP-07. This lower deposit varies in composition from clayey silt, to sandy silt, to a silt of slight plasticity. The surface of the deposit was encountered at depths of 22.3 m to 27.7 m (between about Elevations 272.8 m and 266.7 m). All of these boreholes were terminated within this deposit at depths of about 23.1 m to 29.6 m (between Elevation 272.0 m and 264.1 m).

SPT “N” values of 108 blow per 0.3 m of penetration and 100 blows per 0.08 m of penetration were measured within the clayey silt portion of this lower deposit, suggesting a hard consistency. The SPT “N” values measured within the silt to sandy silt portions of this lower deposit range from 176 blows per 0.3 m of penetration to 100 blows per 0.13 m of penetration, suggesting a very dense compactness condition.



Grain size distribution testing carried out on three samples of this lower deposit are shown on Figure B12 in Appendix B. Atterberg limits tests were carried out on the fine portions of five samples of this deposit and measured liquid limits ranging from about 19 to 22 per cent, plastic limits ranging from about 11 to 19 per cent, and plasticity indices ranging from about 2 to 11 per cent. The results of the Atterberg limits tests are shown on the plasticity chart on Figure B13, and indicate that the fines portions of this lower deposit can be classified as a clayey silt of low plasticity to a silt of slight plasticity. The natural water content measured on samples of the lower clayey silt to silt ranges from about 16 to 23 per cent.

4.2.8 Groundwater Conditions

The groundwater levels in the open boreholes were measured upon completion of drilling operations. The details of these measurements are shown on the borehole records contained in Appendix A; however, it is noted that these measurements are not considered to represent the stabilized groundwater level at the site.

While advancing and sampling Borehole 6UP-02 near the west abutment, about 3 m of sand “blew back” inside the hollow stem augers after advancing them to depths of about 14 m and 15.2 m (Elevations 279.6 m and 278.4 m). Subsequently, Borehole 6UP-03 was drilled with the addition of quick-gel to counter-balance the sub-artesian groundwater pressures in the sand layer; although no “blow-back” of sand was observed, difficulties occurred in retrieving the rods and split-spoon sampler, and this is considered to be due to the water pressures in the sand layer. Similarly in Borehole CE-02, sample disturbance occurred due to groundwater inflow to the borehole, when the augers were at a depth of 3.8 m below ground surface.

Standpipe piezometers were installed in Boreholes CE-03, 6UP-03, 6UP-06, and HF-09 (from west to east across the site) to permit monitoring of groundwater levels. Details of the piezometer installations and measured groundwater levels are shown on the borehole records in Appendix A. The measured groundwater levels are summarized below:

Borehole No.	Ground Surface Elevation (m)	Depth to Water Level (m)	Groundwater Elevation (m)	Date (dd/mm/yyyy)	Comments
CE-03	290.0	1.2	288.8	16/01/2018	Upon completion of drilling
		1.3	288.7	09/02/2018	Measured in standpipe piezometer
		1.1	288.9	05/03/2018	
6UP-03	293.7	7.3	286.4	10/01/2018	Upon completion of drilling
		2.2	291.5	09/02/2018	Measured in standpipe piezometer
		1.8	291.9	05/03/2018	
6UP-06	295.1	7.4	287.7	20/10/2017	Upon completion of drilling
		3.5	291.6	03/11/2017	Measured in standpipe piezometer
		3.0	292.1	14/11/2017	
		2.6	292.5	04/12/2017	
		3.0	292.1	10/01/2018	
		2.7	292.4	09/02/2018	
		2.3	292.8	05/03/2018	



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HF-09	290.3	0.9	289.4	27/10/2017	Upon completion of drilling
		0.5 above ground surface	290.8	03/11/2017	Measured in standpipe piezometer
		0.5 above ground surface	290.8	14/11/2017	
		0.5 above ground surface	290.8	04/12/2017	

It should be noted that the groundwater level in the area is subject to seasonal fluctuations and precipitation events, and should be expected to be higher during wet periods of the year.

4.2.9 Analytical Testing Results

Analytical testing was carried out on selected soil samples recovered from Boreholes 6UP-03, 6UP-05, 6UP-06 and CE-02 (advanced at the proposed west abutment, pier, east abutment, and culvert respectively). The soil samples were submitted to Maxxam Analytics of Mississauga, Ontario for corrosivity testing. Detailed analytical laboratory test results are provided on the Certificate of Analysis presented in Appendix B, and summarized below.

Borehole No.	Sample ID	Depth (m)	Parameters				
			Resistivity (ohm-cm)	Electrical Conductivity (µmho-cm)	Soluble Sulphate (So ₄) Content (µg-g)	Chlorides (CL) Content (µg-g)	pH (pH)
6UP-03	SS5	3.0 – 3.7	1,900	531	25	250	7.97
6UP-05	SS7 ¹	4.6 – 5.2	910	1,100	<20 ²	610	7.99
6UP-06	SS4A	2.3 – 2.7	4,700	215	<20	57	7.88
CE-02	SS4	2.3 – 2.7	6,500	153	<20	22	7.79

Note:

1. "SS" refers to a split-spoon sampler used to carry out the soil sampling in the boreholes.
2. The sulphate concentration are below the reportable detection limit of 20 µg/g.



5.0 CLOSURE

This Foundation Investigation Report was prepared by Ms. Sandra McGaghran, M.Eng., P.Eng., a geotechnical engineer and Associate with Golder. Ms. Lisa Coyne, P.Eng., a Principal and Designated MTO Contact for Golder, conducted an independent quality control review of the report.

GOLDER ASSOCIATES LTD.



Sandra McGaghran, M.Eng., P.Eng.
Geotechnical Engineer, Associate



Lisa Coyne, P.Eng.
Principal, Designated MTO Foundations Contact

SMM/LCC/sm

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<https://golderassociates.sharepoint.com/sites/13019g/6-deliverables/fnds/underpass/final/1670268-fidr-2018mar13-hwy-400-6th-line.docx>



REFERENCES

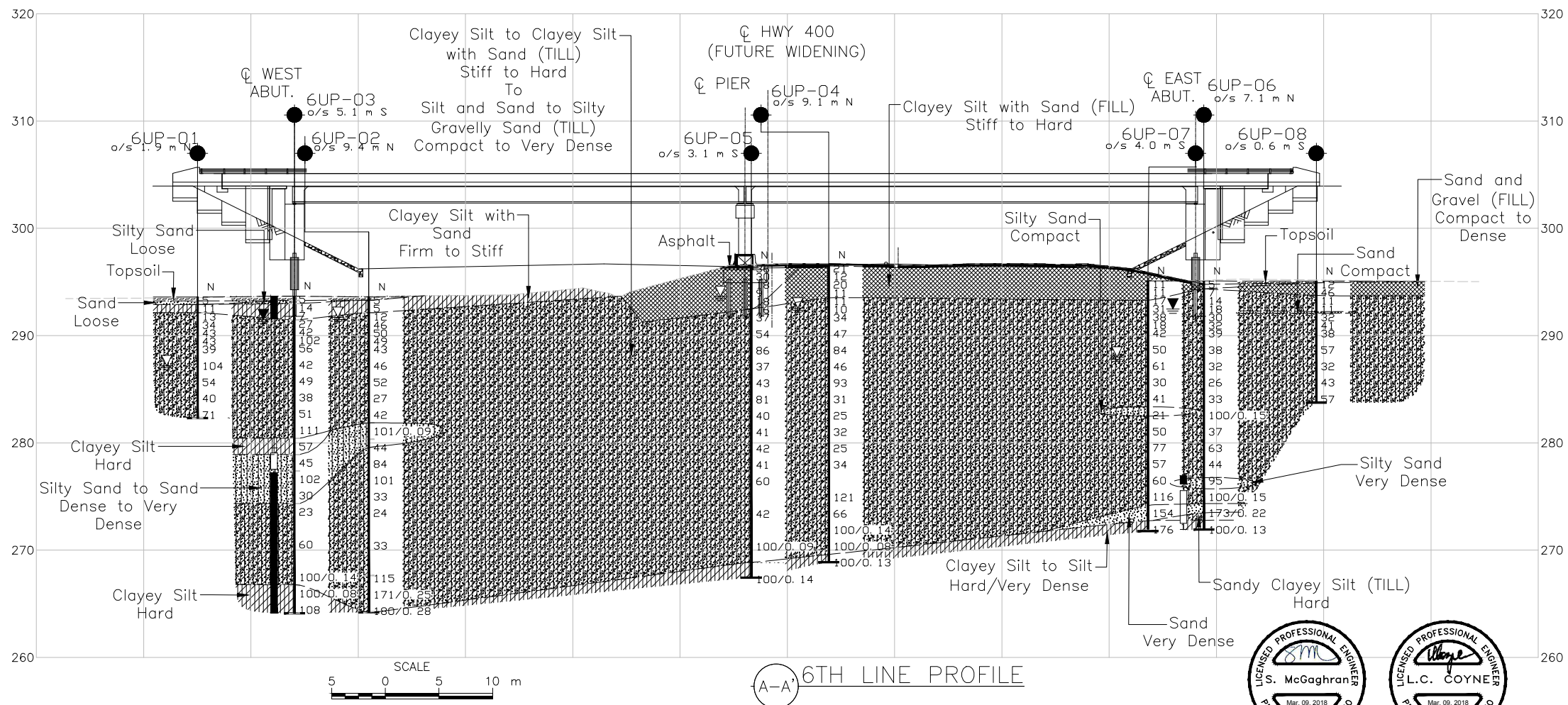
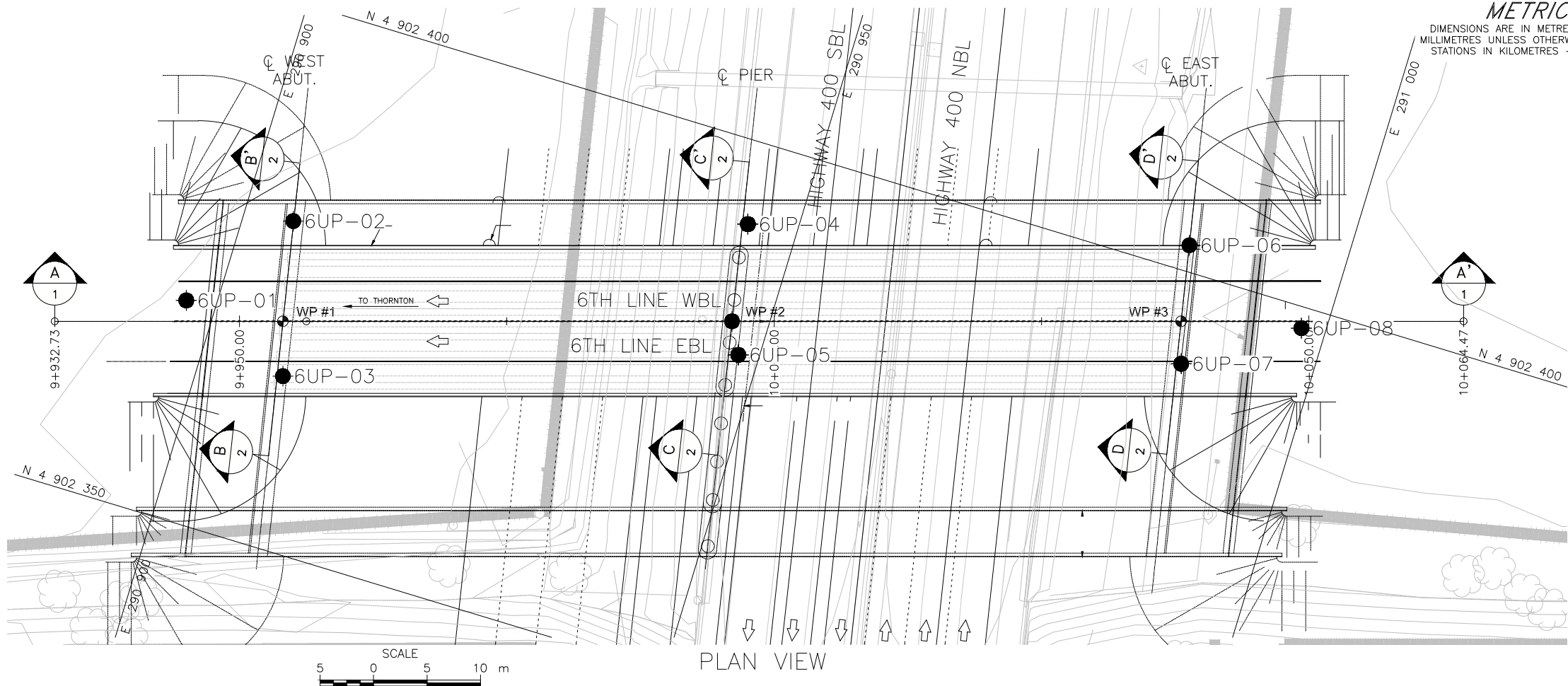
Chapman, L.J. and Putnam, D.F. 1984. The Physiography of Southern Ontario, Ontario Geological Survey, Special Volume 2, Third Edition. Accompanied by Map P.2715, Scale 1:600,000.

ASTM International:

ASTM D1586 Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils

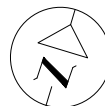
Ontario Water Resources Act:

Ontario Regulation 903 Wells (as amended)



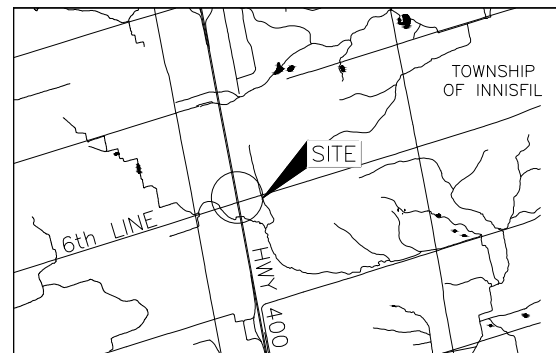
METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No. 2018-2003
GWP No. 2289-13-00



HIGHWAY 400 / 6TH LINE UNDERPASS
BOREHOLE LOCATIONS AND
SOIL STRATA

SHEET



KEY PLAN
SCALE
1 0 1 2 km

LEGEND

- Borehole - Current Investigation
- ⊥ Seal
- ⊥ Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- ≡ WL in piezometer, measured on March 5, 2018
- ≡ WL upon completion of drilling

BOREHOLE CO-ORDINATES

No.	ELEVATION	NORTHING	EASTING
6UP-01	293.6	4902370.2	290897.2
6UP-02	293.6	4902380.2	290904.6
6UP-03	293.7	4902366.1	290907.9
6UP-04	296.6	4902392.3	290945.4
6UP-05	296.6	4902380.4	290948.1
6UP-06	295.1	4902402.4	290985.5
6UP-07	295.2	4902391.6	290988.0
6UP-08	295.2	4902398.0	290997.8

NOTES

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

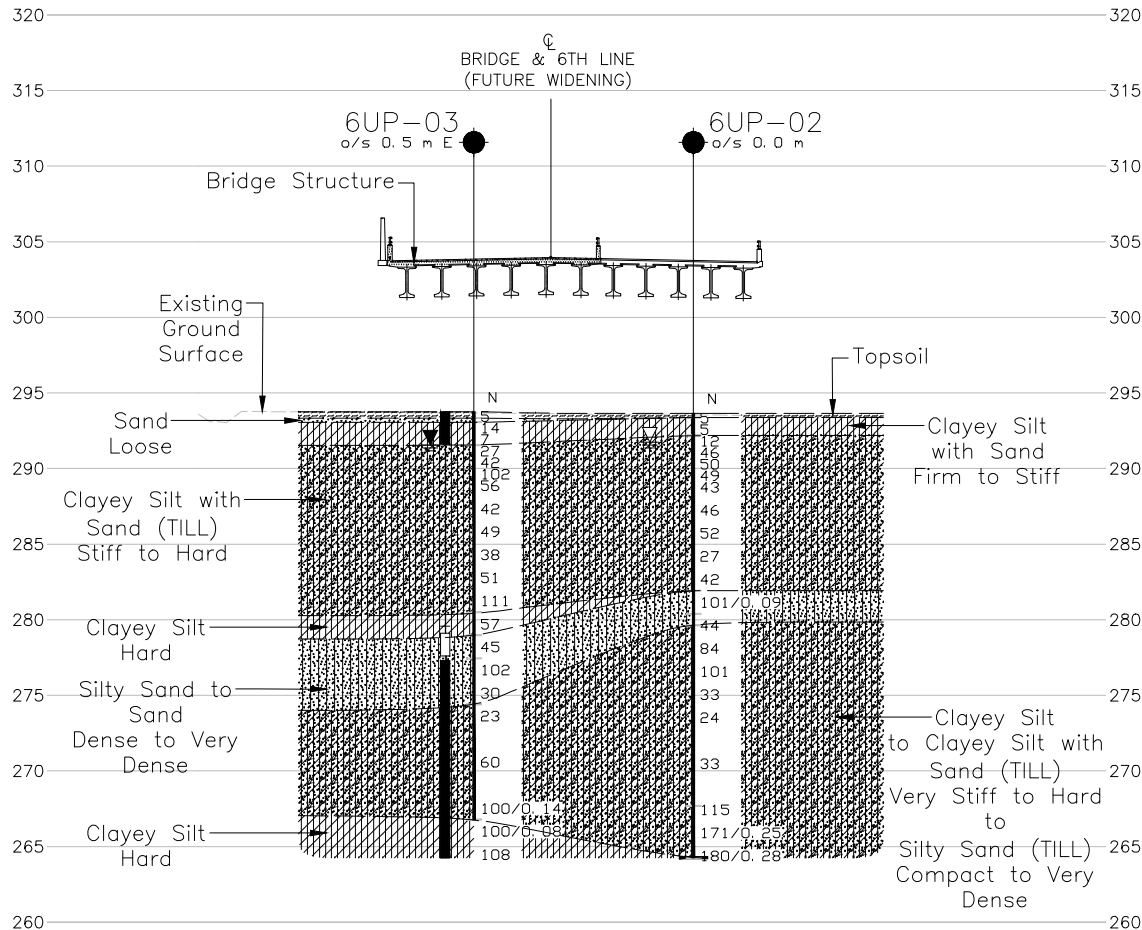
The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

REFERENCE

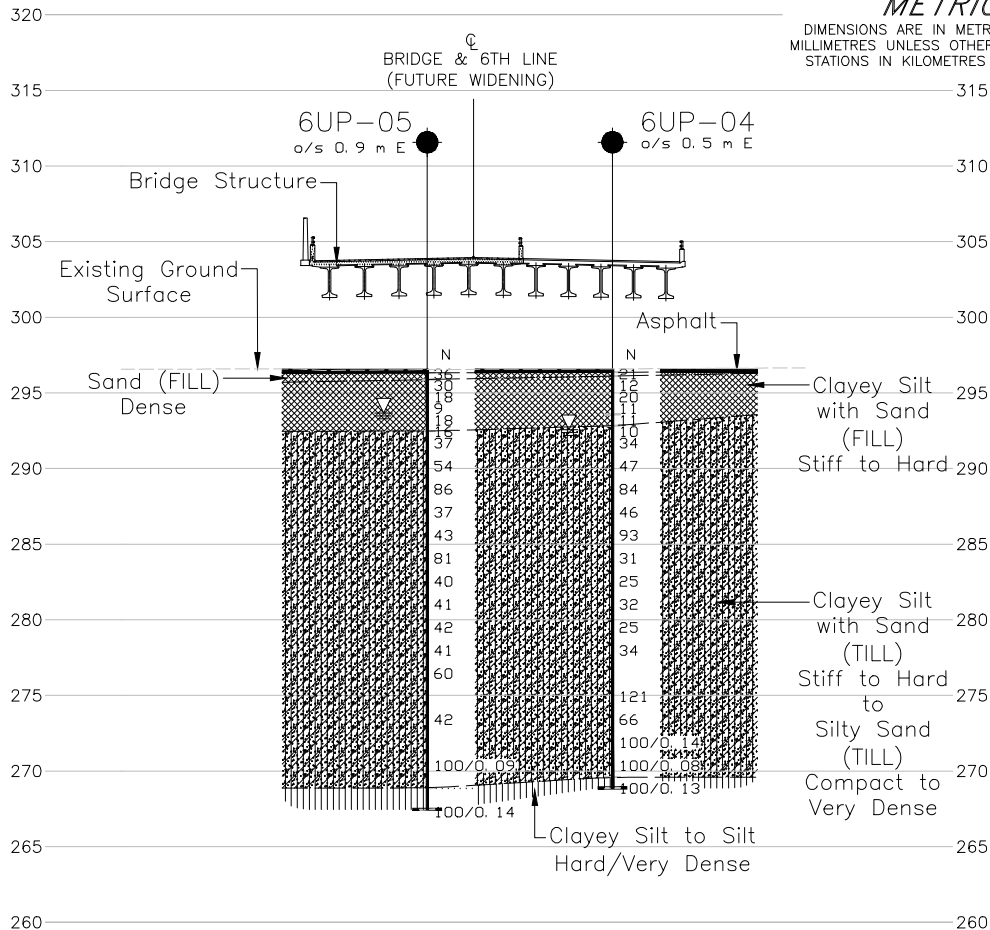
Base plans and interim design plan provided in digital format by MorrisonHersfield, drawing file nos. 1170234-MNC - Interim.dwg and x1170234base, dated 2017, received August 28, 2017.
Bridge General Arrangement provided in digital format by MorrisonHersfield, drawing file no. 1170234-01.dwg, Received on January 09, 2018.

NO.	DATE	BY	REVISION
Geocres No. 31D-695			
HWY. 400		PROJECT NO. 1670268	DIST. CENTRAL
SUBM'D. DF	CHKD. KN	DATE: 3/9/2018	SITE:30-211/1&2
DRAWN: SMD	CHKD. SMM	APPD. LCC	DWG. 1

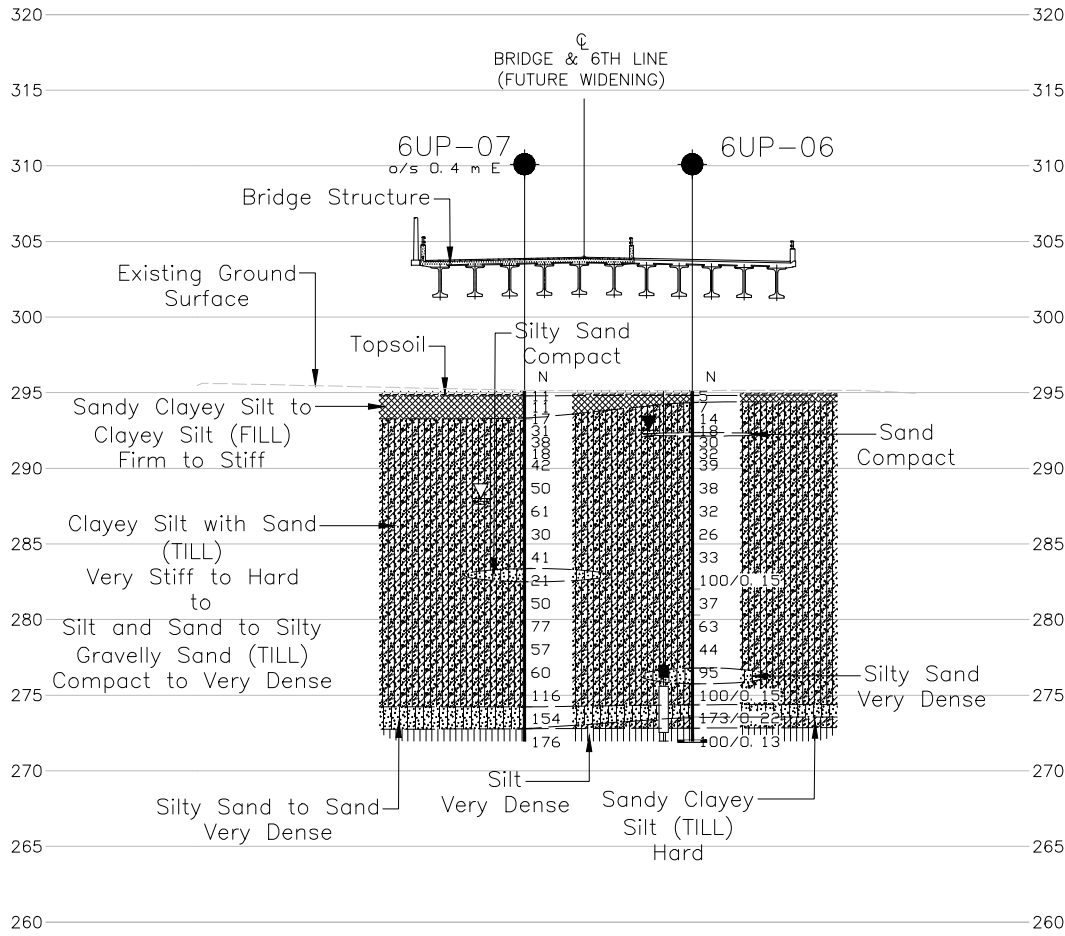




B-B WEST ABUTMENT CROSS-SECTION
01



C-C CENTRE PIER CROSS-SECTION
01



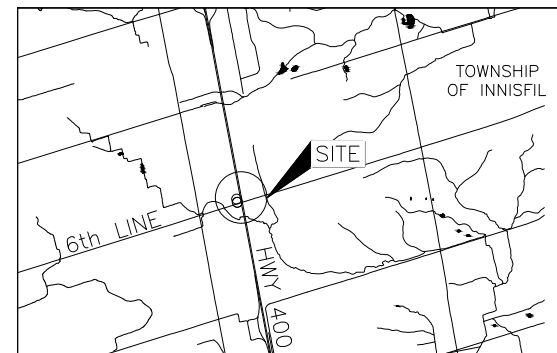
D-D EAST ABUTMENT CROSS-SECTION
01

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.

CONT No. 2018-2003
GWP No. 2289-13-00

HIGHWAY 400 / 6TH LINE UNDERPASS
SOIL STRATA

SHEET



KEY PLAN
SCALE
1 0 1 2 km

LEGEND

- Borehole - Current Investigation
- ⊥ Seal
- ⊥ Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- ≡ WL in piezometer, measured on March 5, 2018
- ≡ WL upon completion of drilling

BOREHOLE CO-ORDINATES

No.	ELEVATION	NORTHING	EASTING
6UP-02	293.6	4902380.2	290904.6
6UP-03	293.7	4902366.1	290907.9
6UP-04	296.6	4902392.3	290945.4
6UP-05	296.6	4902380.4	290948.1
6UP-06	295.1	4902402.4	290985.5
6UP-07	295.2	4902391.6	290988.0

NOTES

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The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

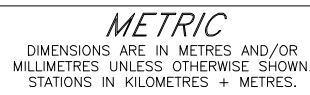
REFERENCE

Base plans and interim design plan provided in digital format by MorrisonHersfield, drawing file nos. 1170234-MNC - Interim.dwg and x1170234base, dated 2017, received August 28, 2017.

Bridge General Arrangement provided in digital format by MorrisonHersfield, drawing file no. 1170234-01.dwg, Received on January 09, 2018.









NO.	DATE	BY	REVISION
Geocres No. 31D-695			
HWY. 400	PROJECT NO. 1670268		DIST. CENTRAL
SUBM'D. DF	CHKD. KN	DATE: 3/9/2018	SITE: 30-211/1&2
DRAWN: SMD	CHKD. SMM	APPD. LCC	DWG. 2



**Golder
Associates**



	Borehole – Current Investigation
	Seal
	Piezometer
	Standard Penetration Test Value
N	Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
16	
	WL in piezometer, measured on December 4, 2017
	WL upon completion of drilling

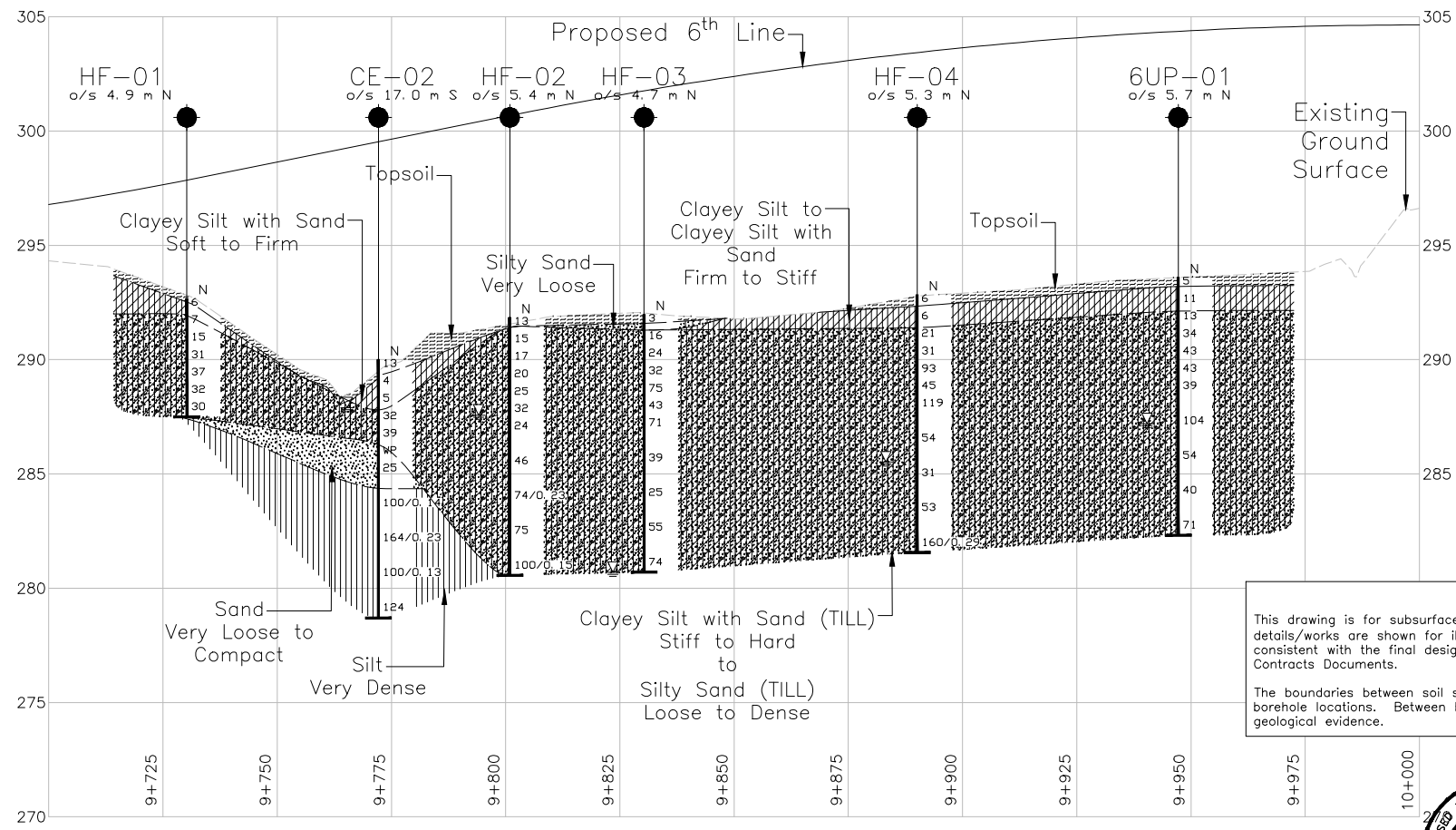
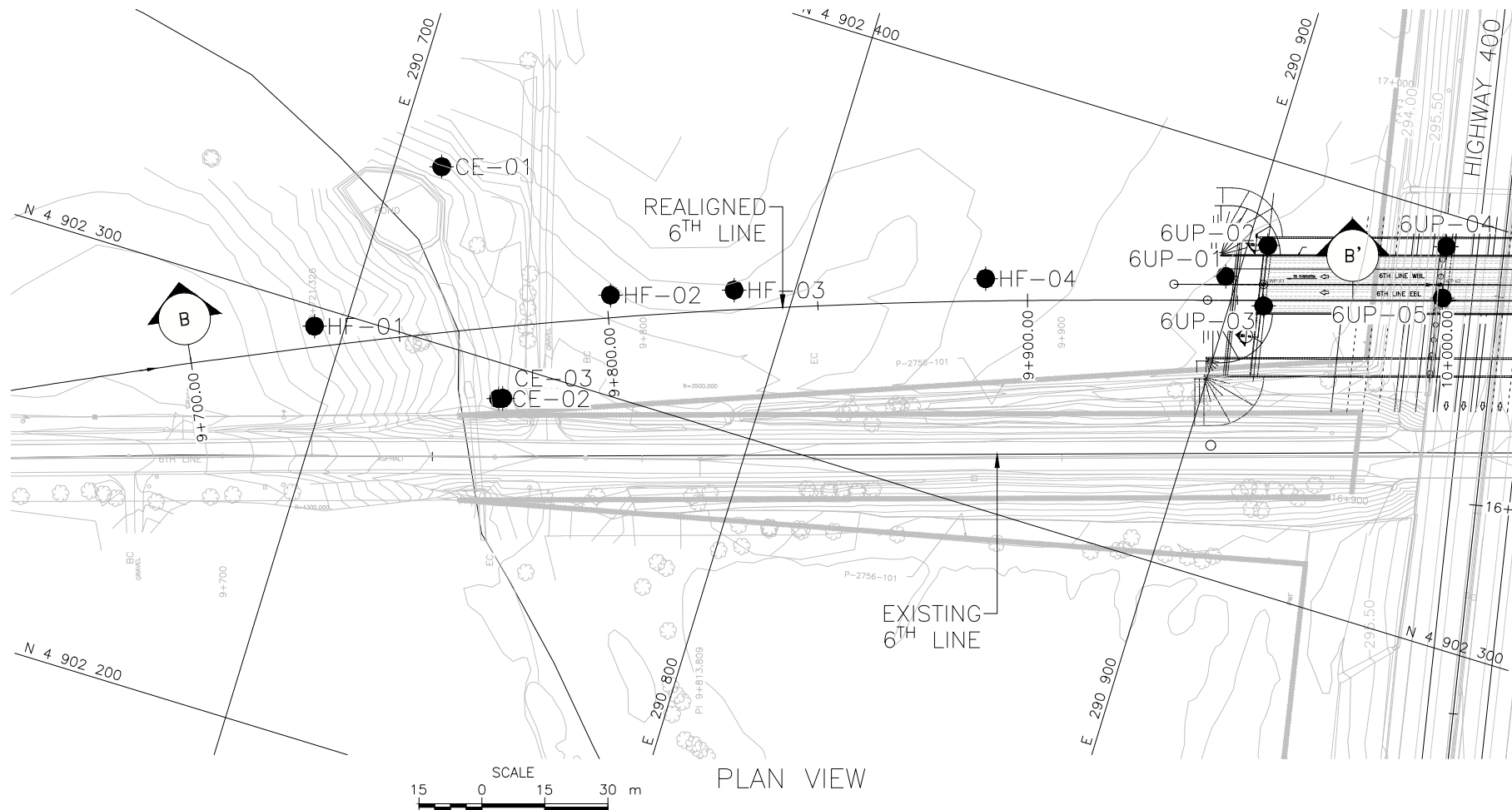
NOTES

The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

Base plans and ultimate design plan provided in digital format by MorrisonHersfield, drawing file ACAD-1170234-Alignment - Ultimate-Model.dwg, dated 2017, received September 18, 2017 and x1170234base, dated 2017, received August 28, 2017.
Bridge General Arrangement provided in digital format by Morrison Hersfield, drawing file no. 1170234-01.dwg, Received on January 09, 2018.

NO.		DATE		BY		REVISION	
Geocres No. 31D-695							
HWY. 400				PROJECT NO. 1670268		DIST. CENTRAL	
SUBM'D. DF		CHKD. KN		DATE: 3/9/2018		SITE: 30-211/1 &	
DRAWN: SMD		CHKD. SMM		APPD. LCC		DWG. 3	





NOTES

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.



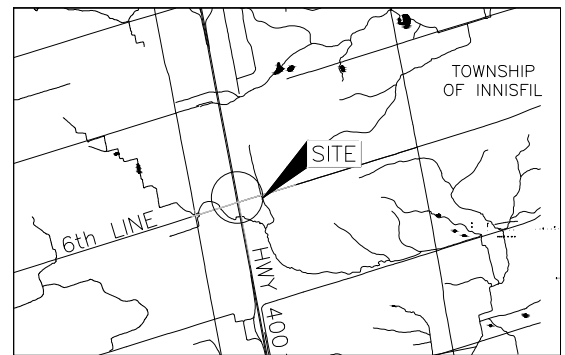
METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No. 2018-2003
GWP No. 2289-13-00



SHEET

HIGHWAY 400 / 6TH LINE UNDERPASS
HIGH FILL EMBANKMENT
BOREHOLE LOCATIONS AND SOIL STRATA



LEGEND

- Borehole - Current Investigation
- ⬮ Seal
- ⬮ Piezometer
- N Standard Penetration Test Value
- WH* Sample Disturbed
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- 100% Rock Quality Designation (RQD)
- ≡ WL in piezometer, measured on March 5, 2018
- ≡ WL upon completion of drilling

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
6UP-01	293.5	4902370.2	290897.2
6UP-02	293.5	4902380.2	290904.6
6UP-03	293.7	4902366.1	290907.9
6UP-04	296.6	4902392.3	290945.4
6UP-05	296.6	4902380.4	290948.1
CE-01	291.3	4902340.6	290710.9
CE-02	290.0	4902291.7	290740.0
CE-03	290.0	4902292.1	290740.9
HF-01	292.7	4902295.4	290693.0
HF-02	291.8	4902323.1	290758.3
HF-03	292.0	4902332.8	290786.1

REFERENCE

Base plans and ultimate design plan provided in digital format by MorrisonHersfield, drawing file ACAD-1170234-Alignment - Ultimate-Model.dwg, dated 2017, received September 18, 2017 and x1170234base, dated 2017, received August 28, 2017. Bridge General Arrangement provided in digital format by MorrisonHersfield, drawing file no. 1170234-01.dwg, Received on January 09, 2018.

NO.	DATE	BY	REVISION
Geocres No. 31D-695			
HWY. 400	PROJECT NO. 1670268		DIST. CENTRAL
SUBM'D. DF	CHKD. KN	DATE: 3/9/2018	SITE: 30-211/1&2
DRAWN: SMD	CHKD. SMM	APPD. LCC	DWG. 4



APPENDIX A

Borehole Records

PROJECT		1670268		RECORD OF BOREHOLE No 6UP-01		SHEET 1 OF 1		METRIC						
G.W.P.		2289-13-00		LOCATION		N 4902370.2; E 290897.2 MTM NAD 83 ZONE 10 (LAT. 44.261202; LONG. -79.674120)		ORIGINATED BY JLS						
DIST		Central HWY 400		BOREHOLE TYPE		Power Auger - 203 mm O.D. Hollow Stem Augers		COMPILED BY KN						
DATUM		Geodetic		DATE		January 10, 2018		CHECKED BY SMM						
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
293.6	GROUND SURFACE													
0.0	TOPSOIL (360 mm)													
293.2			1	SS	5									
0.4	CLAYEY SILT, some sand, trace gravel Stiff Brown-grey Moist		2	SS	11									1 18 43 38
292.2			3	SS	13									11 40 37 12
1.5	CLAYEY SILT with SAND, trace to some gravel, contains cobble fragments (TILL) Stiff to hard Grey to brown-grey Moist		4	SS	34									
			5	SS	43									
			6	SS	43									6 57 23 14
			7	SS	39									
			8	SS	104									
			9	SS	54									
			10	SS	40									
			11	SS	71									
282.3	END OF BOREHOLE													
11.3	NOTE: 1. Water level recorded in open borehole at a depth of about 6.4 m (Elev. 287.2 m) below ground surface upon completion of drilling.													

PROJECT		RECORD OF BOREHOLE		No 6UP-02		SHEET 1 OF 3		METRIC						
G.W.P. 2289-13-00		LOCATION		N 4902380.2; E 290904.6 MTM NAD 83 ZONE 10 (LAT. 44.261292; LONG. -79.674030)		ORIGINATED BY		DMF						
DIST Central HWY 400		BOREHOLE TYPE		Power Auger - 203 mm O.D. Hollow Stem Augers		COMPILED BY		KN						
DATUM Geodetic		DATE		January 3, 4, and 8, 2018		CHECKED BY		SMM						
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
293.6	GROUND SURFACE													
0.0	TOPSOIL (280 mm)													
0.3	CLAYEY SILT with SAND, trace gravel Firm Brown to grey Moist		1	SS	5		293							4 42 41 13
292.2	CLAYEY SILT with SAND, trace to some gravel, contains cobble fragments (TILL) Stiff to hard Brown Moist		2	SS	5		292							
1.5			3	SS	12		291							6 56 25 13
			4	SS	46		290							
			5	SS	50		289							
			6	SS	49		288							
			7	SS	43		287							
			8	SS	46		286							
			9	SS	52		285							
			10	SS	27		284							2 58 25 15
			11	SS	42		283							
281.9	Silty SAND Very dense Grey Wet		12	SS	101/0.09		282							
280.3	SAND, trace to some silt, trace clay Dense Grey Moist		13A	SS	44		281							
279.6			13B	SS	44		280							0 86 12 2
14.0							279							

Continued Next Page

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

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PROJECT <u>1670268</u>		RECORD OF BOREHOLE No 6UP-02				SHEET 2 OF 3		METRIC	
G.W.P. <u>2289-13-00</u>		LOCATION <u>N 4902380.2; E 290904.6 MTM NAD 83 ZONE 10 (LAT. 44.261292; LONG. -79.674030)</u>				ORIGINATED BY <u>DMF</u>			
DIST <u>Central</u> HWY <u>400</u>		BOREHOLE TYPE <u>Power Auger - 203 mm O.D. Hollow Stem Augers</u>				COMPILED BY <u>KN</u>			
DATUM <u>Geodetic</u>		DATE <u>January 3, 4, and 8, 2018</u>				CHECKED BY <u>SMM</u>			

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					W _p	W			W _L	
								20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED										
	--- CONTINUED FROM PREVIOUS PAGE ---																	
	CLAYEY SILT with SAND, trace gravel, contains cobble fragments (TILL) Very stiff to hard Grey Moist To Silty SAND, trace to some clay, trace gravel, contains cobble fragments (TILL) Compact to very dense Grey Moist		14	SS	84													
278																		
277																		
276																		
275																		
274																		
273																		
272																		
	CLAYEY SILT, some sand (TILL) Hard Grey Moist		15	SS	101													
276																		
275																		
274																		
273																		
272																		
271																		
270																		
	CLAYEY SILT, some sand (TILL) Hard Grey Moist		16	SS	33													
275																		
274																		
273																		
272																		
271																		
270																		
269																		
	CLAYEY SILT, some sand (TILL) Hard Grey Moist		17	SS	24													
274																		
273																		
272																		
271																		
270																		
269																		
268																		
	CLAYEY SILT, some sand (TILL) Hard Grey Moist		18	SS	33													
270																		
269																		
268																		
267																		
266																		
265																		
264																		
	CLAYEY SILT, some sand (TILL) Hard Grey Moist		19	SS	115													
267																		
266																		
265																		
264																		
263																		
262																		
261																		
	CLAYEY SILT, some sand (TILL) Hard Grey Moist		20	SS	71/0.25													
266																		
265																		
264																		
263																		
262																		
261																		
260																		
	CLAYEY SILT, some sand (TILL) Hard Grey Moist		21	SS	80/0.25													
265																		
264																		
263																		
262																		
261																		
260																		
259																		

Continued Next Page

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

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PROJECT <u>1670268</u>		RECORD OF BOREHOLE No 6UP-02				SHEET 3 OF 3		METRIC										
G.W.P. <u>2289-13-00</u>		LOCATION <u>N 4902380.2; E 290904.6 MTM NAD 83 ZONE 10 (LAT. 44.261292; LONG. -79.674030)</u>				ORIGINATED BY <u>DMF</u>												
DIST <u>Central</u> HWY <u>400</u>		BOREHOLE TYPE <u>Power Auger - 203 mm O.D. Hollow Stem Augers</u>				COMPILED BY <u>KN</u>												
DATUM <u>Geodetic</u>		DATE <u>January 3, 4, and 8, 2018</u>				CHECKED BY <u>SMM</u>												
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					W _p	W			W _L	
	--- CONTINUED FROM PREVIOUS PAGE ---						<div style="display: flex; justify-content: space-between;"> 20 40 60 80 100 20 40 60 80 100 </div> <div style="display: flex; justify-content: space-between;"> ○ UNCONFINED ○ FIELD VANE </div> <div style="display: flex; justify-content: space-between;"> ● QUICK TRIAXIAL × REMOULDED </div>					<div style="display: flex; justify-content: space-between;"> 10 20 30 </div>						
	END OF BOREHOLE NOTES: 1. After advancing the borehole to depths of about 14 m and 15.2 m (Elevations 279.6 m and 278.4 m) about 3 m of sand "blew back" inside the hollow stem augers. Water was added to counterbalance the water pressure. 2. Water level measured in open borehole at a depth of about 1.9 m (Elev. 291.7 m) below ground surface upon completion of drilling.																	

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PROJECT <u>1670268</u>		RECORD OF BOREHOLE No 6UP-03		SHEET 1 OF 3		METRIC	
G.W.P. <u>2289-13-00</u>		LOCATION <u>N 4902366.1; E 290907.9 MTM NAD 83 ZONE 10 (LAT. 44.261165; LONG. -79.673990)</u>		ORIGINATED BY <u>DMF</u>			
DIST <u>Central</u> HWY <u>400</u>		BOREHOLE TYPE <u>Power Auger - 203 mm O.D. Hollow Stem Augers</u>		COMPILED BY <u>KN</u>			
DATUM <u>Geodetic</u>		DATE <u>January 8, 9, and 10, 2018</u>		CHECKED BY <u>SMM</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _p W W _L	WATER CONTENT (%)			
293.7	GROUND SURFACE													
0.0	TOPSOIL (405 mm)													
293.3			1	SS	5									
293.0	Silty SAND, trace gravel, trace clay Loose Brown Moist		2	SS	14									
0.7	CLAYEY SILT with SAND, trace gravel, trace rootlets Firm to stiff Brownish-grey Moist		3	SS	7									
291.5														
2.2	CLAYEY SILT with SAND, some gravel, cobble fragments (TILL) Very stiff to hard Brown Moist - Auger refusal encountered at 3.0 m depth on possible cobble or boulder; borehole advanced 1 m east		4	SS	27									
			5	SS	42									
			6	SS	102									
			7	SS	56									
			8	SS	42									
			9	SS	49									
			10	SS	38									
			11	SS	51									
			12	SS	111									
280.4	CLAYEY SILT, trace to some sand Hard Grey Moist		13	SS	57									
13.3														
278.9														
14.8														

Continued Next Page

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

GTA-MTO 001 S:\CLIENTS\MTOWHY_400_AND_6TH_LINE_INNISFIL02_DATAGINT\1670268.GPJ GAL-GTA.GDT 3/13/18

PROJECT 1670268		RECORD OF BOREHOLE No 6UP-03		SHEET 2 OF 3		METRIC						
G.W.P. 2289-13-00		LOCATION N 4902366.1; E 290907.9 MTM NAD 83 ZONE 10 (LAT. 44.261165; LONG. -79.673990)		ORIGINATED BY DMF								
DIST Central HWY 400		BOREHOLE TYPE Power Auger - 203 mm O.D. Hollow Stem Augers		COMPILED BY KN								
DATUM Geodetic		DATE January 8, 9, and 10, 2018		CHECKED BY SMM								
SOIL PROFILE		SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER			TYPE	"N" VALUES					
	--- CONTINUED FROM PREVIOUS PAGE ---											
277.4	SAND, trace gravel, trace to some silt, trace clay Dense Grey Wet		14	SS	45							1 88 6 5
16.3	Silty SAND, trace gravel, plastic fine inclusions Dense to very dense Grey Moist		15	SS	102							
			16	SS	30							
274.4	CLAYEY SILT with SAND, trace to some gravel (TILL) Very stiff to hard Grey Moist		17	SS	23							9 42 21 28
19.4			18	SS	60							
			19	SS	100/0.1							1 26 48 25
266.7	CLAYEY SILT, trace to some sand Hard Grey Moist		20	SS	100/0.0							
27.0			21	SS	108							0 8 54 38
264.1												
29.6												

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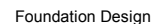
+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

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PROJECT <u>1670268</u>		RECORD OF BOREHOLE No 6UP-03				SHEET 3 OF 3		METRIC																			
G.W.P. <u>2289-13-00</u>		LOCATION <u>N 4902366.1; E 290907.9 MTM NAD 83 ZONE 10 (LAT. 44.261165; LONG. -79.673990)</u>				ORIGINATED BY <u>DMF</u>																					
DIST <u>Central</u> HWY <u>400</u>		BOREHOLE TYPE <u>Power Auger - 203 mm O.D. Hollow Stem Augers</u>				COMPILED BY <u>KN</u>																					
DATUM <u>Geodetic</u>		DATE <u>January 8, 9, and 10, 2018</u>				CHECKED BY <u>SMM</u>																					
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL											
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					W _p	W			W _L										
	--- CONTINUED FROM PREVIOUS PAGE ---						<div style="display: flex; justify-content: space-between;"> 20 40 60 80 100 20 40 60 80 100 </div> <div style="display: flex; justify-content: space-between;"> ○ UNCONFINED + FIELD VANE </div> <div style="display: flex; justify-content: space-between;"> ● QUICK TRIAXIAL × REMOULDED </div>					WATER CONTENT (%)															
	END OF BOREHOLE NOTES: 1. Water level recorded at a depth of 7.3 m (Elev. 286.4 m) below ground surface upon completion of drilling. 2. Water level measurements in standpipe piezometer: <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Date</th> <th style="text-align: left;">Depth (m)</th> <th style="text-align: left;">Elev. (m)</th> </tr> </thead> <tbody> <tr> <td>10/01/18</td> <td>2.2</td> <td>291.5</td> </tr> <tr> <td>09/02/18</td> <td>2.2</td> <td>291.5</td> </tr> <tr> <td>05/03/18</td> <td>1.8</td> <td>291.9</td> </tr> </tbody> </table>	Date	Depth (m)	Elev. (m)	10/01/18	2.2	291.5	09/02/18	2.2	291.5	05/03/18	1.8	291.9														
Date	Depth (m)	Elev. (m)																									
10/01/18	2.2	291.5																									
09/02/18	2.2	291.5																									
05/03/18	1.8	291.9																									

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+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE



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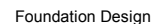
+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

PROJECT <u>1670268</u>		RECORD OF BOREHOLE No 6UP-04				SHEET 3 OF 3		METRIC																
G.W.P. <u>2289-13-00</u>		LOCATION <u>N 4902392.3; E 290945.4 MTM NAD 83 ZONE 10 (LAT. 44.261402; LONG. -79.673520)</u>				ORIGINATED BY <u>DMF</u>																		
DIST <u>Central</u> HWY <u>400</u>		BOREHOLE TYPE <u>Power Auger - 203 mm O.D. Hollow Stem Augers</u>				COMPILED BY <u>JL</u>																		
DATUM <u>Geodetic</u>		DATE <u>October 11, 16 and 17, 2017</u>				CHECKED BY <u>SMM</u>																		
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL								
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					W _p	W			W _L							
	--- CONTINUED FROM PREVIOUS PAGE ---						<div style="display: flex; justify-content: space-between;"> 20 40 60 80 100 20 40 60 80 100 </div> <div style="display: flex; justify-content: space-between;"> ○ UNCONFINED + FIELD VANE </div> <div style="display: flex; justify-content: space-between;"> ● QUICK TRIAXIAL × REMOULDED </div>																	
	END OF BOREHOLE Notes: 1. Water level measured in open borehole at a depth of 4.0 m (Elev. 292.6 m) on October 17, 2017 before start of drilling when borehole was at a depth of 24.7 m. * The water level measurement is not considered to be representative of the groundwater level due to the introduction of drilling mud/water during boring operations.																							

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+³, ×³: Numbers refer to Sensitivity ○³% STRAIN AT FAILURE



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+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

PROJECT <u>1670268</u>		RECORD OF BOREHOLE No 6UP-05				SHEET 3 OF 3		METRIC	
G.W.P. <u>2289-13-00</u>		LOCATION <u>N 4902380.4; E 290948.1 MTM NAD 83 ZONE 10 (LAT. 44.261294; LONG. -79.673480)</u>				ORIGINATED BY <u>DMF</u>			
DIST <u>Central</u> HWY <u>400</u>		BOREHOLE TYPE <u>Power Auger - 203 mm O.D. Hollow Stem Augers</u>				COMPILED BY <u>JL</u>			
DATUM <u>Geodetic</u>		DATE <u>October 12 and 16, 2017</u>				CHECKED BY <u>SMM</u>			

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					W _p	W		
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					WATER CONTENT (%)					
						20	40	60	80	100						
	--- CONTINUED FROM PREVIOUS PAGE --- END OF BOREHOLE NOTE: 1. Water level measured in open borehole at depth of 2.9 m (Elev. 293.7 m) on October 16, 2017 before start of decommissioning. * The water level measurement is not considered to be representative of the groundwater level due to introduction of water/drilling mud during boring operations.															

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PROJECT 1670268		RECORD OF BOREHOLE No 6UP-06		SHEET 1 OF 2		METRIC											
G.W.P. 2289-13-00		LOCATION N 4902402.4; E 290985.5 MTM NAD 83 ZONE 10 (LAT. 44.261493; LONG. -79.673020)		ORIGINATED BY DMF													
DIST Central HWY 400		BOREHOLE TYPE Power Auger - 203 mm O.D. Hollow Stem Augers		COMPILED BY JL													
DATUM Geodetic		DATE October 19 to 20, 2017		CHECKED BY SMM													
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100	20 40 60 80 100	W _p	W	W _L	γ	GR	SA	SI	CL
295.1	GROUND SURFACE																
294.8	TOPSOIL (280 mm)		1A	SS	5		295										
0.3	Clayey silt, some sand, contains rootlets (FILL/REWORKED)		1B	SS	7												
294.4	Firm Brown Moist		2	SS	7		294							2	29	34	35
0.7	Sandy CLAYEY SILT, trace gravel, oxidation staining (TILL)		3	SS	14												
	Firm to very stiff Brown Moist		4A	SS	18		293										
292.4	SAND, trace to some gravel, trace silt		4B	SS	18												
3.0	Compact Brown Moist		5	SS	30		292										
	CLAYEY SILT with SAND, trace to some gravel (TILL)		6	SS	32		291										
	Very stiff to hard Brown, becoming grey at 7.2 m Moist		7	SS	39		290										
	to		8	SS	38		289							4	59	25	12
	SILT and SAND, trace to some clay, trace gravel (TILL)		9	SS	32		288										
	Compact to very dense Brown becoming grey at 7.2 m Moist		10	SS	26		287										
			11	SS	33		286										
			12	SS	100/0.15		285										
282.0	Sandy CLAYEY SILT, trace to some gravel (TILL)		13	SS	37		282										
13.1	Hard Grey Moist						281							9	25	40	26
280.3																	
14.8																	

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+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

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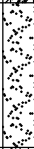

PROJECT 1670268		RECORD OF BOREHOLE No 6UP-06				SHEET 2 OF 2		METRIC																																
G.W.P. 2289-13-00		LOCATION N 4902402.4; E 290985.5 MTM NAD 83 ZONE 10 (LAT. 44.261493; LONG. -79.673020)				ORIGINATED BY DMF																																		
DIST Central HWY 400		BOREHOLE TYPE Power Auger - 203 mm O.D. Hollow Stem Augers				COMPILED BY JL																																		
DATUM Geodetic		DATE October 19 to 20, 2017				CHECKED BY SMM																																		
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS		ELEVATION SCALE		DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT		REMARKS & GRAIN SIZE DISTRIBUTION (%)																						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES					SHEAR STRENGTH kPa			W _p W W _L			γ	GR SA SI CL																							
	--- CONTINUED FROM PREVIOUS PAGE ---									○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED			WATER CONTENT (%)			kN/m ³																								
280	CLAYEY SILT, trace to some gravel (TILL) Hard Brown, becoming grey at 7.2 m Moist		14	SS	63																																			
279																																								
278			15	SS	44																																			
277																																								
276.8	Silty SAND, trace to some clay, trace gravel Very dense Grey Wet		16	SS	95														1 65 28 6																					
275.7																																								
275	Sandy CLAYEY SILT, trace to some gravel (TILL) Hard Grey Moist		17	SS	100/0.15																																			
274.4																																								
274	SAND, trace fines Very dense Brown Wet		18A	SS	73/0.2														0 97 (3)																					
273.6			18B																																					
273	Sandy CLAYEY SILT, trace to some gravel (TILL) Hard Grey Moist																																							
272.8																																								
272	SILT, trace sand, clay Very dense Grey Wet		19	SS	100/0.15																																			
272.0																																								
23.1	END OF BOREHOLE																																							
NOTES: 1. Water level in open borehole at a depth of 7.4 m (Elev. 287.7 m) upon completion of drilling on October 20, 2017. 2. Water level measurements in standpipe piezometer: <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Date</th> <th>Depth (m)</th> <th>Elev. (m)</th> </tr> </thead> <tbody> <tr> <td>03/11/17</td> <td>3.5</td> <td>291.6</td> </tr> <tr> <td>14/11/17</td> <td>3.0</td> <td>292.1</td> </tr> <tr> <td>04/12/17</td> <td>2.6</td> <td>292.5</td> </tr> <tr> <td>10/01/18</td> <td>3.0</td> <td>292.1</td> </tr> <tr> <td>09/02/18</td> <td>2.7</td> <td>292.4</td> </tr> <tr> <td>05/03/18</td> <td>2.3</td> <td>292.8</td> </tr> </tbody> </table>																				Date	Depth (m)	Elev. (m)	03/11/17	3.5	291.6	14/11/17	3.0	292.1	04/12/17	2.6	292.5	10/01/18	3.0	292.1	09/02/18	2.7	292.4	05/03/18	2.3	292.8
Date	Depth (m)	Elev. (m)																																						
03/11/17	3.5	291.6																																						
14/11/17	3.0	292.1																																						
04/12/17	2.6	292.5																																						
10/01/18	3.0	292.1																																						
09/02/18	2.7	292.4																																						
05/03/18	2.3	292.8																																						

PROJECT 1670268		RECORD OF BOREHOLE No 6UP-07				SHEET 1 OF 2		METRIC									
G.W.P. 2289-13-00		LOCATION N 4902391.6; E 290988.0 MTM NAD 83 ZONE 10 (LAT. 44.261396; LONG. -79.672990)				ORIGINATED BY DH											
DIST Central HWY 400		BOREHOLE TYPE Power Auger - 203 mm O.D. Hollow Stem Augers				COMPILED BY JL											
DATUM Geodetic		DATE October 23 to 24, 2017				CHECKED BY SMM											
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)
295.2	GROUND SURFACE							20	40	60	80	100					
294.9	TOPSOIL (300 mm)		1A	SS	11		295										
0.3	Sandy clayey silt, trace gravel (FILL/REWORKED) Stiff Brown Moist to wet		1B	SS	11												
			2	SS	11		294										
293.4			3	SS	17												
1.8	CLAYEY SILT with SAND, some gravel, contains sand pockets (TILL) Very stiff to hard Brown, becoming grey at 7.2 m Moist, becoming wet at 7.2 m to Silty Gravelly SAND, trace to some clay (TILL) Compact to very dense Brown becoming grey at 7.2 m Moist becoming wet at 7.2 m		4	SS	31		293										
			5	SS	38		292										
			6	SS	18		291										
			7	SS	42												
							290										
			8	SS	50		289										
							288										
			9	SS	61		287										
							286										
			10	SS	30		285										
							284										
283.5							283										
11.7	Silty SAND, trace to some clay, trace gravel Compact Grey Moist to wet		12A	SS	21												
282.6			12B	SS	21		282										
12.6	CLAYEY SILT with SAND, trace to some gravel, contains sand pockets, sand layers encountered between depths of about 15.5 m to 15.6 m (TILL) Very stiff to hard Grey Moist to wet						281										
			13	SS	50												

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+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

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PROJECT		2289-13-00		LOCATION		N 4902391.6; E 290988.0 MTM NAD 83 ZONE 10 (LAT. 44.261396; LONG. -79.672990)		ORIGINATED BY		DH													
DIST		Central HWY 400		BOREHOLE TYPE		Power Auger - 203 mm O.D. Hollow Stem Augers		COMPILED BY		JL													
DATUM		Geodetic		DATE		October 23 to 24, 2017		CHECKED BY		SMM													
SOIL PROFILE				SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	20			40	60	80	100	20						40	60	80	100	10
--- CONTINUED FROM PREVIOUS PAGE ---																							
	CLAYEY SILT with SAND, trace to some gravel, contains sand pockets, sand layers encountered between depths of about 15.5 m to 15.6 m (TILL) Very stiff to hard Grey Moist to wet		14	SS	77																		
274.3 20.9	Silty SAND, trace to some gravel, trace clay Very dense Grey Moist to wet		15	SS	57																		
272.9 22.3	SILT, trace sand, trace clay Very desne Grey Wet		16	SS	60																		
271.9 23.3	END OF BOREHOLE NOTE: 1. Water level measured in open borehole at a depth of 7.1 m (Elev. 288.1 m) on October 24, 2017 before start of drilling when the borehole was at a depth of 7.1 m		17	SS	116																		
			18	SS	154																		
			19	SS	176																		

PROJECT 1670268		RECORD OF BOREHOLE No 6UP-08				SHEET 1 OF 1		METRIC									
G.W.P. 2289-13-00		LOCATION N 4902398.0; E 290997.8 MTM NAD 83 ZONE 10 (LAT. 44.261454; LONG. -79.672860)				ORIGINATED BY DH											
DIST Central HWY 400		BOREHOLE TYPE Power Auger - 203 mm O.D. Hollow Stem Augers				COMPILED BY JL											
DATUM Geodetic		DATE October 24, 2017				CHECKED BY SMM											
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
295.2	GROUND SURFACE																
0.0	TOPSOIL (150 mm)																
0.1	Sand and gravel, some fines (FILL) Compact to dense Brown Moist		1A 1B	SS	12												
293.8			2	SS	46												32 53 (15)
1.4	CLAYEY SILT with SAND, trace to some gravel, contains sand pockets (TILL) Stiff to hard Brown Moist to wet		3	SS	11												8 40 39 13
292.4			4A 4B	SS	11												
3.0	SAND, trace to some gravel, some fines Compact Brown Moist		5	SS	32												5 59 26 10
	CLAYEY SILT with SAND, trace to some gravel, contains sand pockets (TILL) Hard Brown Moist to wet		6	SS	41												
	to		7	SS	38												
	Silty SAND, trace to some clay, trace gravel (TILL) Dense to very dense Brown Moist to wet		8	SS	57												
			9	SS	32												
			10	SS	43												7 55 27 11
			11	SS	57												
283.9	END OF BOREHOLE																
11.3	NOTE: 1. Water level not measured upon completion of drilling.																

GTA-MTO 001 S:\CLIENTS\MTOWHY_400_AND_6TH_LINE_INNISFIL02_DATAGINT\1670268.GPJ GAL-GTA.GDT 3/12/18

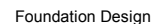
PROJECT 1670268		RECORD OF BOREHOLE No CE-01				SHEET 1 OF 1		METRIC								
G.W.P. 2289-13-00		LOCATION N 4902340.6; E 290710.9 MTM NAD 83 ZONE 10 (LAT. 44.260932; LONG. -79.676453)				ORIGINATED BY LJS										
DIST Central HWY 400		BOREHOLE TYPE Power Auger - 203 mm O.D. Hollow Stem Augers				COMPILED BY KN										
DATUM Geodetic		DATE January 16, 2018				CHECKED BY SMM										
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
291.3	GROUND SURFACE															
0.0	TOPSOIL (690 mm)		1	DO	6											
290.6																
0.7	Silty sand, trace gravel, some clay (FILL / REWORKED TILL) Loose to compact Brown, mottled Moist		2	DO	9											4 59 24 13
			3	DO	12											
289.1																
2.2	CLAYEY SILT with SAND, trace gravel, containing cobble fragments (TILL) Hard Brown to grey Moist		4	DO	30											2 55 23 20
			5	DO	80											
			6	DO	47											
286.3			7	DO	58											
5.0	SAND, trace gravel, trace non-plastic fines Compact Grey Wet															
285.7																
5.6	Silty SAND, trace gravel (TILL) Very dense Grey Moist		8	DO	126											
284.1																
7.2	SAND, trace gravel, trace non-plastic fines (TILL) Very dense Grey Wet		9	DO	74											
			10	DO	65											
281.1																
10.2	SILT, some clay Very dense Grey Moist															
			11	DO	65											0 0 87 13
280.0																
11.3	END OF BOREHOLE															
	NOTES: 1. Borehole advanced with water inside the hollow stem augers in order to counterbalance the water pressures. 2. Water level recorded in open borehole at a depth of about 3.0 m (Elev. 288.3 m) below ground surface upon completion of drilling.															

PROJECT 1670268		RECORD OF BOREHOLE No CE-02				SHEET 1 OF 2		METRIC								
G.W.P. 2289-13-00		LOCATION N 4902291.7; E 290740.0 MTM NAD 83 ZONE 10 (LAT. 44.260490; LONG. -79.676090)				ORIGINATED BY DMF										
DIST Central HWY 400		BOREHOLE TYPE Power Auger - 203 mm O.D. Hollow Stem Augers				COMPILED BY KN										
DATUM Geodetic		DATE January 15, 2018				CHECKED BY SMM										
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
290.0	GROUND SURFACE															
0.0	TOPSOIL (690 mm)		1	DO	13											
289.3																
0.7	CLAYEY SILT with SAND, trace gravel Soft to firm Brown Moist to wet		2	DO	4											
			3	DO	5											
287.8																
2.2	CLAYEY SILT with SAND, some gravel, trace cobble fragments (TILL) Hard Brown to grey Moist to wet		4	DO	32											
			5	DO	39											
286.3																
3.7	SAND, some silt, trace to some clay, trace gravel Very loose to compact Brown to grey Wet		6	DO	WH*											
			7	DO	25											
284.4																
5.6	SILT, trace sand, trace to some clay Very dense Grey Moist to wet		8	DO	100/0.14											
			9	DO	164/0.23											
			10	DO	100/0.13											
			11	DO	124											
278.7																
11.3	END OF BOREHOLE															
NOTES:																
1. Sample 6 is likely disturbed, see borehole record for CE-03 which was advanced with water inside the hollow stem augers in order to counterbalance the water pressures.																
2. Water level recorded in open borehole at a depth of 2.1 m (Elev. 287.9 m) below ground surface upon completion of drilling.																

Continued Next Page

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

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+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

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PROJECT 1670268		RECORD OF BOREHOLE No CE-03				SHEET 1 OF 1		METRIC																		
G.W.P. 2289-13-00		LOCATION N 4902292.1; E 290740.9 MTM NAD ZONE 10 (LAT. 44.260504; LONG. -79.676079)				ORIGINATED BY DMF																				
DIST Central HWY 400		BOREHOLE TYPE Power Auger - 203 mm O.D. Hollow Stem Augers				COMPILED BY KN																				
DATUM Geodetic		DATE January 16, 2018				CHECKED BY SMM																				
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)										
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa									WATER CONTENT (%)									
290.0	GROUND SURFACE						20	40	60	80	100															
0.0	Refer to stratigraphy in Borehole CE-02																									
287.0																										
3.0	CLAYEY SILT with SAND, trace gravel, containing cobble fragments (TILL)		1	DO	34																					
286.3	Dense Grey Moist																									
3.7	SAND, trace to some silt, trace gravel, trace clay		2	DO	43																					
	Dense to compact Grey Wet																									
284.8			3	DO	29																					
5.2	END OF BOREHOLE																									
NOTES: 1. Borehole advanced with water inside the hollow stem augers in order to counterbalance the water pressures. 2. Water level recorded in open borehole at a depth of about 1.2 m (Elev. 288.8 m) below ground surface upon completion of drilling. 3. Water level measurements in standpipe piezometer: <table border="1" style="width:100%; margin-top: 10px;"> <thead> <tr> <th>Date</th> <th>Depth (m)</th> <th>Elev. (m)</th> </tr> </thead> <tbody> <tr> <td>09/02/18</td> <td>1.3</td> <td>288.7</td> </tr> <tr> <td>05/03/18</td> <td>1.1</td> <td>288.9</td> </tr> </tbody> </table>		Date	Depth (m)	Elev. (m)	09/02/18	1.3	288.7	05/03/18	1.1	288.9																
Date	Depth (m)	Elev. (m)																								
09/02/18	1.3	288.7																								
05/03/18	1.1	288.9																								

PROJECT <u>1670268</u>		RECORD OF BOREHOLE No HF-01				SHEET 1 OF 1		METRIC	
G.W.P. <u>2289-13-00</u>		LOCATION <u>N 4902295.4; E 290693.0 MTM NAD 83 ZONE 10 (LAT. 44.260529; LONG. -79.676674)</u>				ORIGINATED BY <u>DMF</u>			
DIST <u>Central</u> HWY <u>400</u>		BOREHOLE TYPE <u>Power Auger - 203 mm O.D. Hollow Stem Augers</u>				COMPILED BY <u>JL</u>			
DATUM <u>Geodetic</u>		DATE <u>January 19, 2018</u>				CHECKED BY <u>SMM</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					WATER CONTENT (%)						
						20	40	60	80	100	10	20	30				
292.7 0.0	GROUND SURFACE TOPSOIL (610 mm)		1	SS	6												
292.1 0.6	CLAYEY SILT with SAND, trace to some gravel, contains cobble fragments (TILL); Firm to hard Grey-brown Moist		2	SS	7												
	to		3	SS	15												
	Silty SAND, trace to some clay, trace to some gravel, contains cobble fragments (TILL) Loose to dense Grey-brown Moist		4	SS	31												
			5	SS	37												
			6	SS	32												
			7	SS	30												
287.5 5.2	END OF BOREHOLE NOTE: 1. Borehole dry upon completion of drilling.																

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PROJECT 1670268		RECORD OF BOREHOLE No HF-02				SHEET 1 OF 1		METRIC								
G.W.P. 2289-13-00		LOCATION N 4902323.1; E 290758.3 MTM NAD 83 ZONE 10 (LAT. 44.260772; LONG. -79.675865)				ORIGINATED BY DMF										
DIST Central HWY 400		BOREHOLE TYPE Power Auger - 203 mm O.D. Hollow Stem Augers				COMPILED BY KN										
DATUM Geodetic		DATE January 11, 2018				CHECKED BY SMM										
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
291.8	GROUND SURFACE															
0.0	TOPSOIL (380 mm)		1	SS	13											
291.4																
0.4	CLAYEY SILT with SAND, trace to some gravel, cobble fragments (TILL) Stiff to hard Grey-brown with oxidation stains Moist		2	SS	15											
	To		3	SS	17											
	Silty SAND, trace to some clay, cobble fragments (TILL) Compact to very dense Grey-brown with oxidation stains Moist		4	SS	20											
			5	SS	25											
			6	SS	32											
			7	SS	24											
			8	SS	46											
			9	SS	74/0.23											
			10	SS	75											
			11	SS	100/0.15											
280.5	END OF BOREHOLE															
11.3	NOTE: 1. Water level recorded in open borehole at a depth of about 4.3 m (Elev. 287.5 m) below ground surface upon completion of drilling.															

+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

PROJECT 1670268		RECORD OF BOREHOLE No HF-04		SHEET 1 OF 1		METRIC																
G.W.P. 2289-13-00		LOCATION N 4902353.0; E 290842.7 MTM NAD 83 ZONE 10 (LAT. 44.261072; LONG. -79.674684)		ORIGINATED BY DMF																		
DIST Central HWY 400		BOREHOLE TYPE Power Auger - 203 mm O.D. Hollow Stem Augers		COMPILED BY KN																		
DATUM Geodetic		DATE January 11, 2018		CHECKED BY SMM																		
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)							
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa					WATER CONTENT (%)			γ			GR SA SI CL			
292.8 0.0	GROUND SURFACE TOPSOIL (510 mm)		1	SS	6		292	20	40	60	80	100	10	20	30	3	43	37	17			
292.3 0.5	CLAYEY SILT with SAND, trace gravel Firm Brown Moist		2	SS	6		291															
291.4 1.5	CLAYEY SILT with SAND, trace to some gravel, cobble fragments (TILL) Very stiff to hard Brown, becoming grey at 6.1 m Moist		3	SS	21		290															
			4	SS	31		289															
			5	SS	93		288															
			6	SS	45		287															
			7	SS	119		286															
			8	SS	54		285															
			9	SS	31		284															
			10	SS	53		283															
			11	SS	60/0.29		282															
281.5 11.3	END OF BOREHOLE																					
NOTE:																						
1. Water level recorded in open borehole at a depth of about 7.3 m (Elev. 285.5 m) below ground surface upon completion of drilling.																						



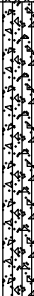
PROJECT 1670268		RECORD OF BOREHOLE No HF-05				SHEET 1 OF 1		METRIC								
G.W.P. 2289-13-00		LOCATION N 4902417.5; E 291056.3 MTM NAD 83 ZONE 10 (LAT. 44.261630; LONG. -79.672130)				ORIGINATED BY DH										
DIST Central HWY 400		BOREHOLE TYPE Power Auger - 203 mm O.D. Hollow Stem Augers				COMPILED BY JL										
DATUM Geodetic		DATE October 24, 2017				CHECKED BY SMM										
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
294.6	GROUND SURFACE															
0.0	TOPSOIL (230 mm)															
0.2	Clayey silt, some sand to sandy (FILL) Firm to stiff Brown Moist - Rootlets from a depth of about 0.2 m to 0.6 m		1A 1B	SS	7		294									
			2	SS	14											
293.2							293									
1.5	CLAYEY SILT with SAND, trace to some gravel, contains sand pockets (TILL) Hard Brown, becoming grey at 7.6 m Moist		3	SS	53											
			4	SS	65		292									
			5	SS	94											
			6	SS	46		291									
			7	SS	113/0.28		290									
							289									
			8	SS	71		288									
							287									
			9	SS	38		286									
							285									
284.9	END OF BOREHOLE		10	SS	43											
9.8	NOTES: 1. Water level measured in open borehole at a depth of 9.4 m (Elev. 285.2 m) below ground surface upon completion of drilling.															

PROJECT 1670268		RECORD OF BOREHOLE No HF-06		SHEET 1 OF 1		METRIC																												
G.W.P. 2289-13-00		LOCATION N 4902429.4; E 291104.7 MTM NAD 83 ZONE 10 (LAT. 44.261739; LONG. -79.671524)		ORIGINATED BY DH																														
DIST Central HWY 400		BOREHOLE TYPE Power Auger - 203 mm O.D. Hollow Stem Augers		COMPILED BY JL																														
DATUM Geodetic		DATE October 25, 2017		CHECKED BY SMM																														
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)																			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					W _p W W _L WATER CONTENT (%)			γ kN/m ³			GR SA SI CL															
294.0	GROUND SURFACE							20 40 60 80 100																										
0.0	TOPSOIL (300 mm)																																	
0.3	CLAYEY SILT with SAND, trace to some gravel, contains sand pockets (TILL) Very stiff to hard Brown Moist, becoming wet at 9.1 m		1	SS	15		293																											
			2	SS	22																													
			3A	SS	28		292																											
			3B																															
			4	SS	53		291																											
			5	SS	51		290																											
			6	SS	62																													
			7	SS	98		289																											
			8	SS	63		288																											
							287																											
			9	SS	44		286																											
			10A	SS	71		285																											
			10B																															
284.3	END OF BOREHOLE																																	
9.8	NOTES: 1. Water level measured in open borehole at a depth of about 9.1 m (Elev. 284.9 m) below ground surface upon completion of drilling on October 25, 2017. 2. Standpipe piezometer damaged on site after installation, and unable to be monitored.																																	

PROJECT 1670268		RECORD OF BOREHOLE No HF-07				SHEET 1 OF 1		METRIC								
G.W.P. 2289-13-00		LOCATION N 4902438.9; E 291153.6 MTM NAD 83 ZONE 10 (LAT. 44.261825; LONG. -79.670912)				ORIGINATED BY DH										
DIST Central HWY 400		BOREHOLE TYPE Power Auger - 203 mm O.D. Hollow Stem Augers				COMPILED BY JL										
DATUM Geodetic		DATE October 25, 2017				CHECKED BY SMM										
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
293.0	GROUND SURFACE															
0.0	TOPSOIL (250 mm)															
0.3	Sandy clayey silt, trace gravel, containing rootlets (FILL) Stiff to very stiff Light brown Moist		1A 1B	SS	9											
291.6			2	SS	18											
1.5	SILT and SAND, trace to some gravel, trace to some clay (TILL) Compact to very dense Brown, becoming grey at 6.1 m Moist		3	SS	16											6 46 37 11
	to		4	SS	15											
	CLAYEY SILT with SAND, trace to some gravel, contains sand pockets (TILL) Very stiff to hard Brown, becoming grey at 6.1 m Moist		5	SS	91											
			6	SS	57											8 56 23 13
			7	SS	72											
			8	SS	25											
			9	SS	25											
284.8	END OF BOREHOLE															
8.2	NOTES: 1. Water level measured in open borehole at a depth of 8.1 m (Elev. 284.9 m) below ground surface upon completion of drilling.															

PROJECT 1670268		RECORD OF BOREHOLE No HF-08		SHEET 1 OF 1		METRIC																
G.W.P. 2289-13-00		LOCATION N 4902446.0; E 291203.0 MTM NAD 83 ZONE 10 (LAT. 44.261890; LONG. -79.670293)		ORIGINATED BY DH																		
DIST Central HWY 400		BOREHOLE TYPE Power Auger - 203 mm O.D. Hollow Stem Augers		COMPILED BY JL																		
DATUM Geodetic		DATE October 25, 2017		CHECKED BY SMM																		
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC NATURAL LIQUID			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)							
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa					WATER CONTENT (%)			γ			GR SA SI CL			
291.5	GROUND SURFACE							20 40 60 80 100					10 20 30									
0.0	TOPSOIL (250 mm)							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					Wp W WL									
290.9	Sandy clayey silt to clayey silt and sand (FILL) Firm Light brown Moist		1A 1B	SS	5		291															
0.6	SILT and SAND, trace to some clay, trace to some gravel (TILL) Loose to dense Brown, becoming grey at 3.0 m Moist		2	SS	5		290															
	to		3	SS	9		289															
	CLAYEY SILT with SAND, trace to some gravel, contains sand pockets (TILL) Firm to hard Brown, becoming grey at 3.0 m Moist - Oxidation staining at depths between 2.3 m and 2.9 m		4	SS	17		288															
			5	SS	38		287															
			6	SS	47		286															
			7	SS	33		285															
284.8	END OF BOREHOLE		8	SS	43		285															
6.7	NOTES: 1. Water level measured in open borehole at a depth of 6.4 m (Elev. 285.1 m) below ground surface upon completion of drilling.																					

PROJECT 1670268		RECORD OF BOREHOLE No HF-09		SHEET 1 OF 1		METRIC																							
G.W.P. 2289-13-00		LOCATION N 4902451.6; E 291253.0 MTM NAD 83 ZONE 10 (LAT. 44.261941; LONG. -79.669667)		ORIGINATED BY DH																									
DIST Central HWY 400		BOREHOLE TYPE Power Auger - 203 mm O.D. Hollow Stem Augers		COMPILED BY JL																									
DATUM Geodetic		DATE October 27, 2017		CHECKED BY SMM																									
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)														
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED			WATER CONTENT (%) W _p W W _L			γ	GR SA SI CL														
290.3	GROUND SURFACE							20 40 60 80 100																					
0.0	TOPSOIL (250 mm)							20 40 60 80 100																					
0.3	Clayey silt, some sand, oxidation staining (FILL) Firm Brown		1A 1B	SS	6		290																						
289.4	Moist		2	SS	7		289																						
0.9	Silty clay, trace sand (FILL) Firm to stiff Brown to grey		3A 3B	SS	10		288.5										0 4 36 60												
1.8	SILT and SAND, some clay, trace to some gravel (TILL) Compact to dense Grey Moist to wet		4	SS	15		288										5 45 38 12												
			5	SS	15		287																						
			6	SS	26		286																						
			7	SS	30		285																						
284.8	Silty SAND, some gravel, trace clay Dense Grey Wet		8	SS	48		284										16 54 27 3												
5.5																													
283.6	END OF BOREHOLE																												
6.7	NOTES: 1. Water level measured in open borehole at a depth of 0.9 m (Elev. 289.4 m) below ground surface upon completion of drilling. 2. Water level measurements in standpipe piezometer: <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Date</th> <th>Depth*(m)</th> <th>Elev. (m)</th> </tr> </thead> <tbody> <tr> <td>03/11/17</td> <td>-0.5</td> <td>290.8</td> </tr> <tr> <td>14/11/17</td> <td>-0.5</td> <td>290.8</td> </tr> <tr> <td>04/12/17</td> <td>-0.5</td> <td>290.8</td> </tr> </tbody> </table> * Water level measured above ground surface within stick up.																	Date	Depth*(m)	Elev. (m)	03/11/17	-0.5	290.8	14/11/17	-0.5	290.8	04/12/17	-0.5	290.8
Date	Depth*(m)	Elev. (m)																											
03/11/17	-0.5	290.8																											
14/11/17	-0.5	290.8																											
04/12/17	-0.5	290.8																											

PROJECT 1670268		RECORD OF BOREHOLE No HF-10				SHEET 1 OF 1		METRIC							
G.W.P. 2289-13-00		LOCATION N 4902471.4; E 291300.2 MTM NAD 83 ZONE 10 (LAT. 44.262120; LONG. -79.669077)				ORIGINATED BY DH									
DIST Central HWY 400		BOREHOLE TYPE Power Auger - 203 mm O.D. Hollow Stem Augers				COMPILED BY JL									
DATUM Geodetic		DATE October 27, 2017				CHECKED BY SMM									
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
290.1	GROUND SURFACE														
0.0	TOPSOIL (230 mm)														
0.2	Silty clay, oxidation staining (FILL) Firm to very stiff Brown Moist to wet		1A	SS	4		290								
			2A												
			2B	SS	13		289								
			3	SS	18		288								
287.9	SILT and SAND, trace to some gravel, trace to some clay (TILL) Loose to dense Grey Moist to wet - Contains CLAYEY SAND layers at 2.3 m, 2.9 m, 3.8 m and 4.2 m		4	SS	6		287								
2.2			5A												
			5B	SS	19		286								
			6	SS	21/0.25										
			7	SS	41	285									
284.9	END OF BOREHOLE														
5.2	NOTES: 1. Water level measured in open borehole at a depth of 0.8 m (Elev. 289.3 m) below ground surface upon completion of drilling. 2. Borehole caved to a depth of 0.8 m (Elev. 289.3 m) below ground surface upon completion of drilling.														

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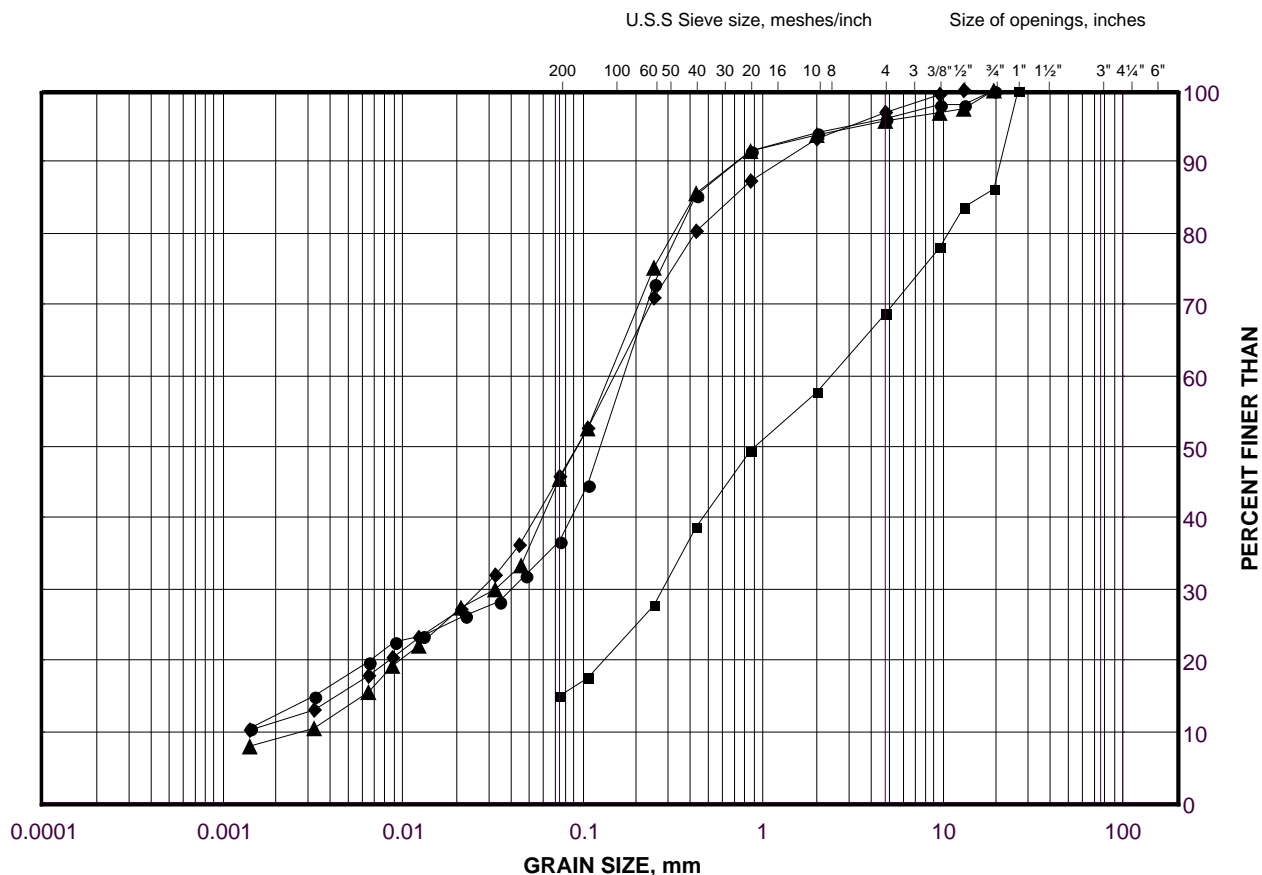
APPENDIX B

Geotechnical Laboratory Test Results and Chemical Test Results

GRAIN SIZE DISTRIBUTION

Silt and Sand to Sand and Gravel (Fill/Reworked)

FIGURE B1



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

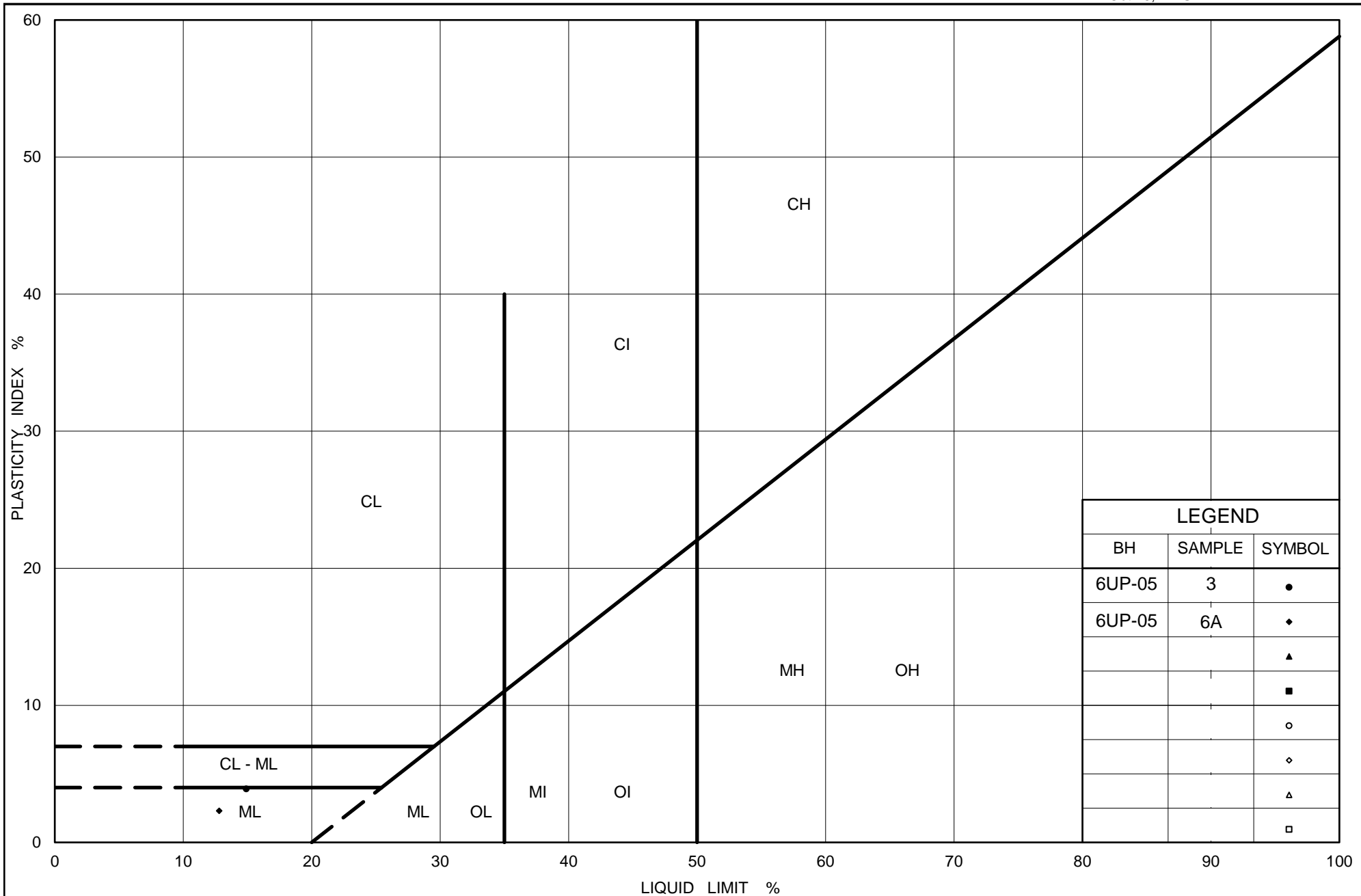
SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	CE-01	2	290.2
■	6UP-08	2	294.2
◆	6UP-05	3	294.8
▲	6UP-05	6A	292.6

Project Number: 1670268

Checked By: SMM

Golder Associates

Date: 08-Mar-18



Ministry of Transportation

Ontario

PLASTICITY CHART Silt and Sand (Fill/Reworked)

Figure No. B2

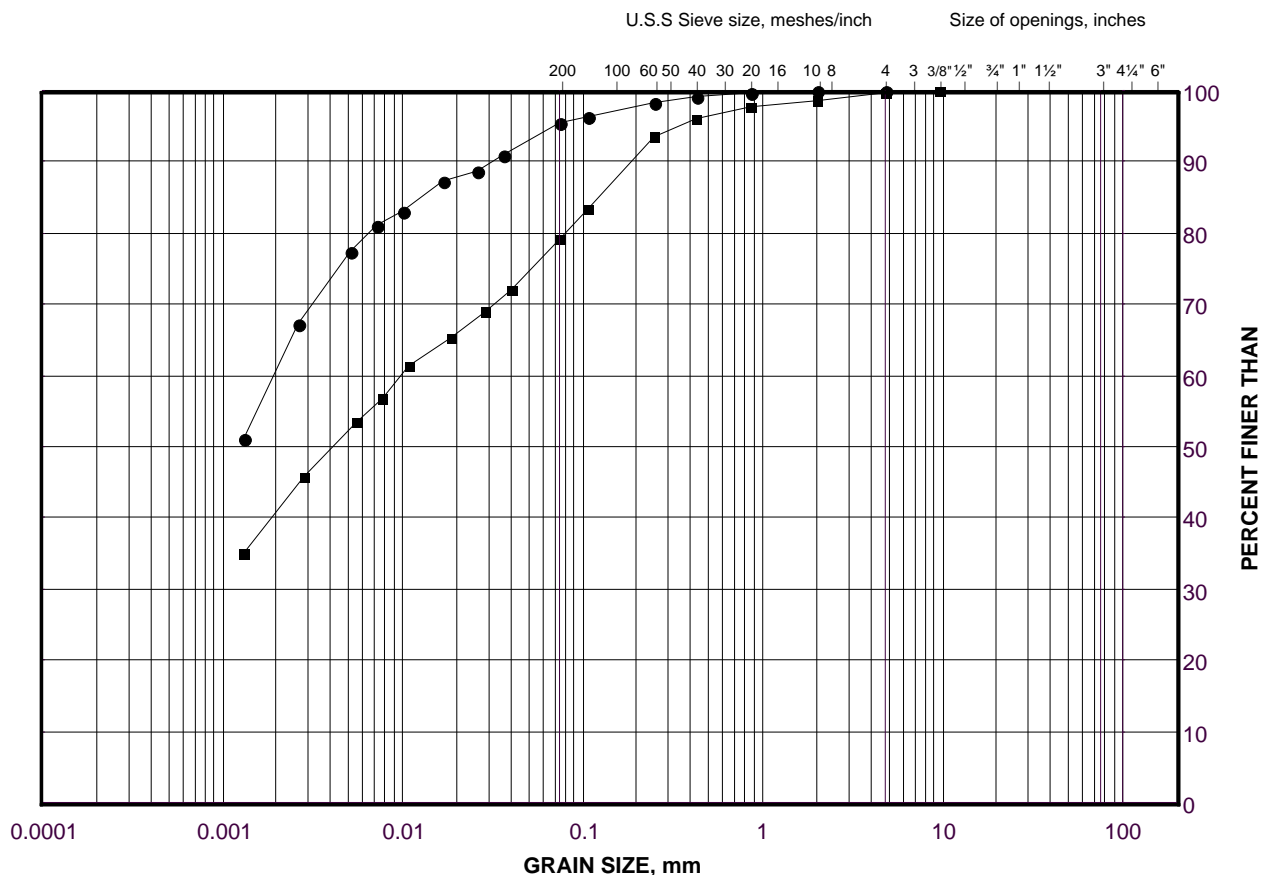
Project No. 1670268

Checked By: SMM

GRAIN SIZE DISTRIBUTION

Sandy Clayey Silt to Silty Clay (Fill)

FIGURE B3



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

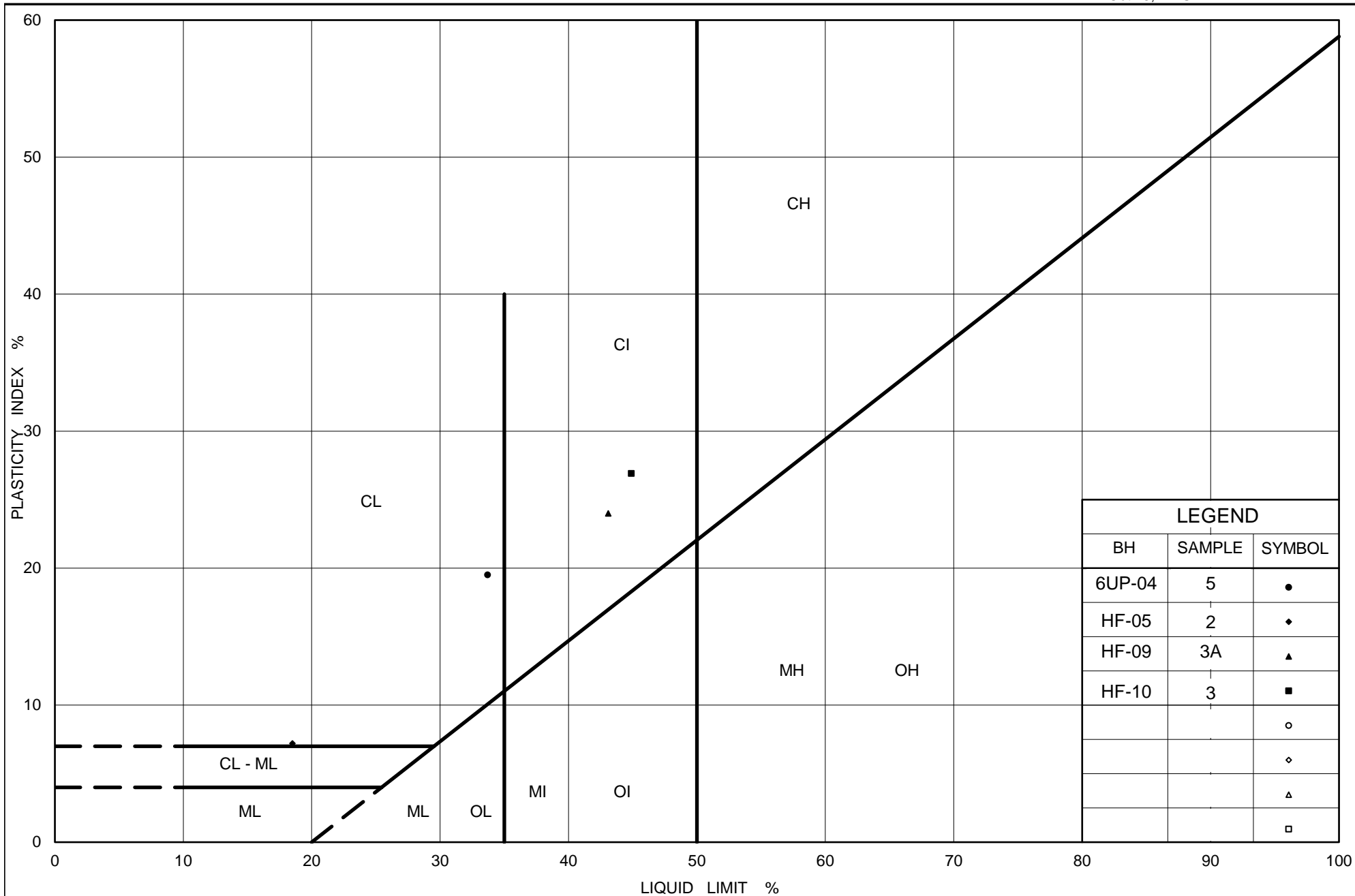
SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	HF-09	3A	288.6
■	6UP-04	5	293.2

Project Number: 1670268

Checked By: SMM

Golder Associates

Date: 08-Mar-18



Ministry of Transportation

Ontario

PLASTICITY CHART

Sandy Clayey Silt to Silty Clay (Fill)

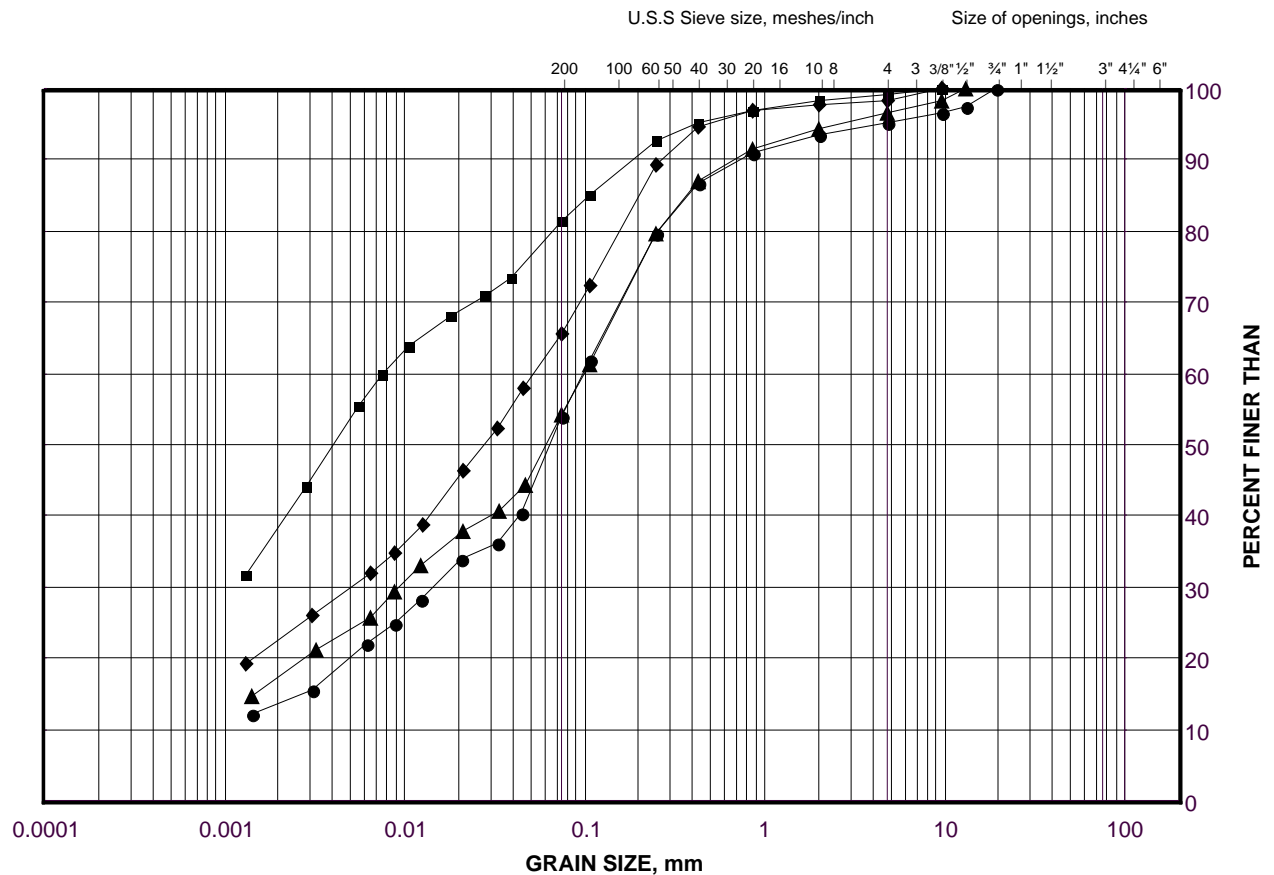
Figure No. B4

Project No. 1670268

Checked By: SMM

Clayey Silt with Sand to Clayey Silt

FIGURE B5



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

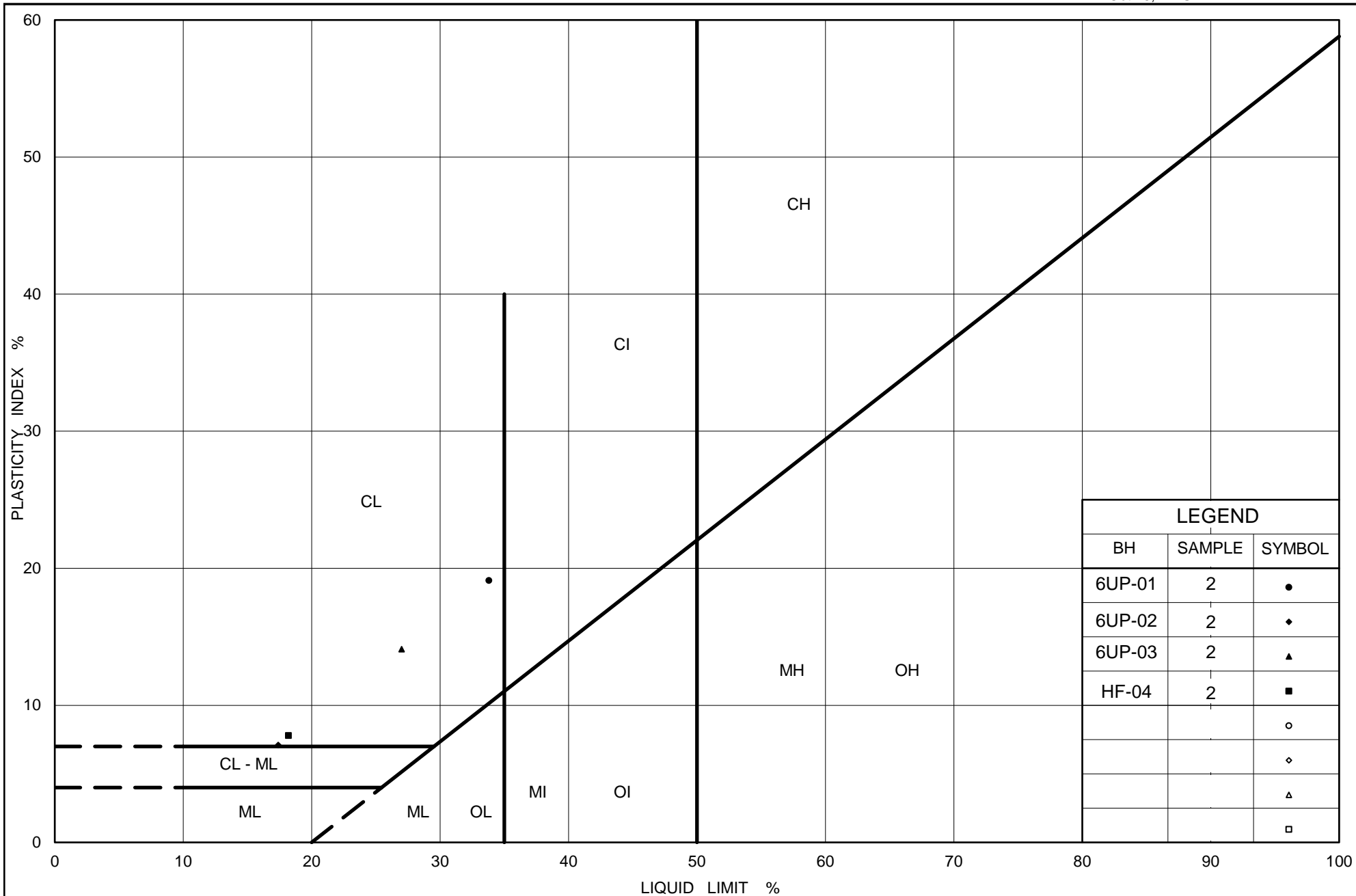
SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	6UP-02	2	292.6
■	6UP-01	2	292.5
◆	CE-02	2	288.9
▲	HF-04	2	291.8

Project Number: 1670268

Checked By: SMM

Golder Associates

Date: 08-Mar-18



Ministry of Transportation

Ontario

PLASTICITY CHART

Sandy Clayey Silt to Clayey Silt

Figure No. B6

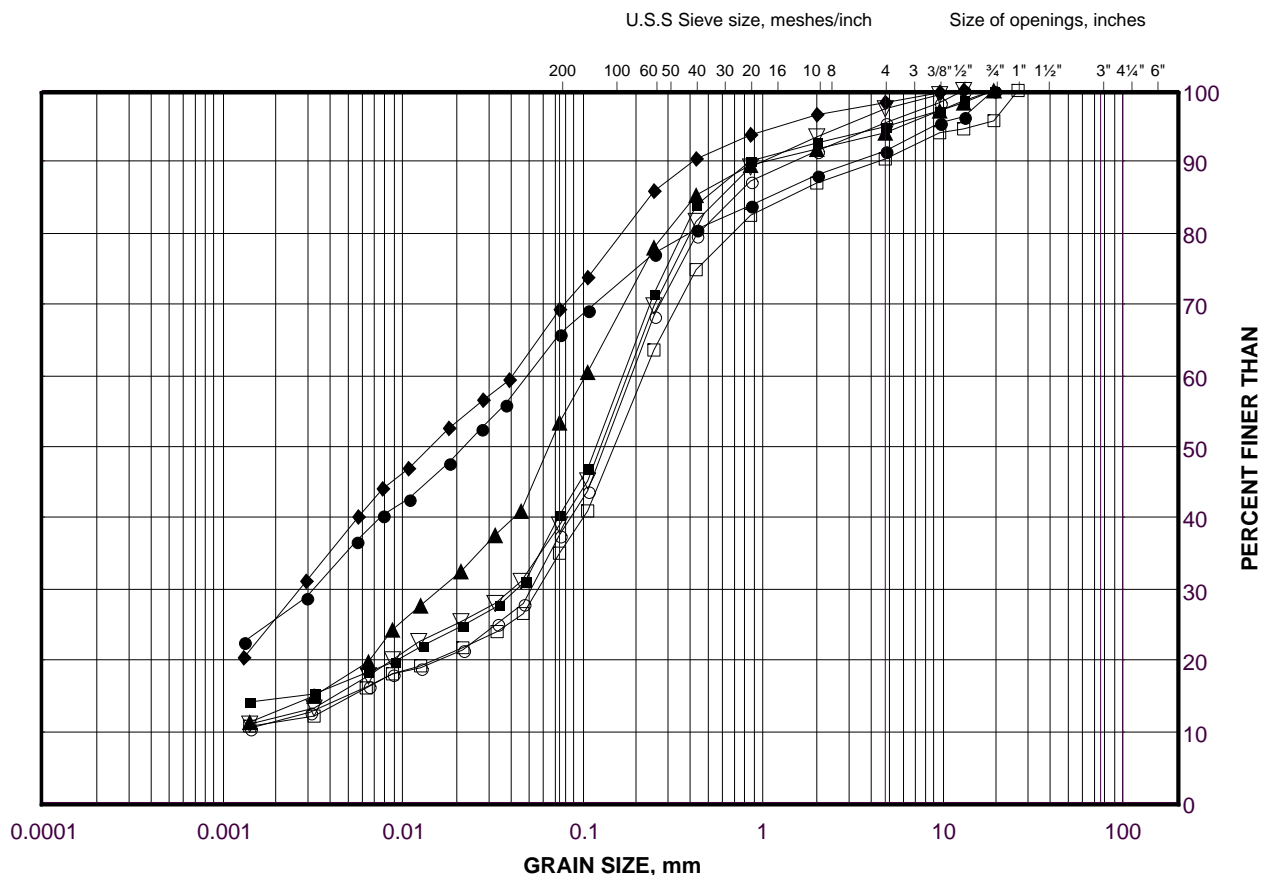
Project No. 1670268

Checked By: SMM

GRAIN SIZE DISTRIBUTION

Sandy Clayey Silt to Clayey Silt with Sand (Till)

FIGURE B7A



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	6UP-06	13	281.1
■	6UP-04	13	282.6
◆	6UP-06	2	294.0
▲	6UP-04	6	292.5
▽	6UP-05	8	290.2
○	6UP-06	8	288.7
□	6UP-05	9	288.7

Project Number: 1670268

Checked By: SMM

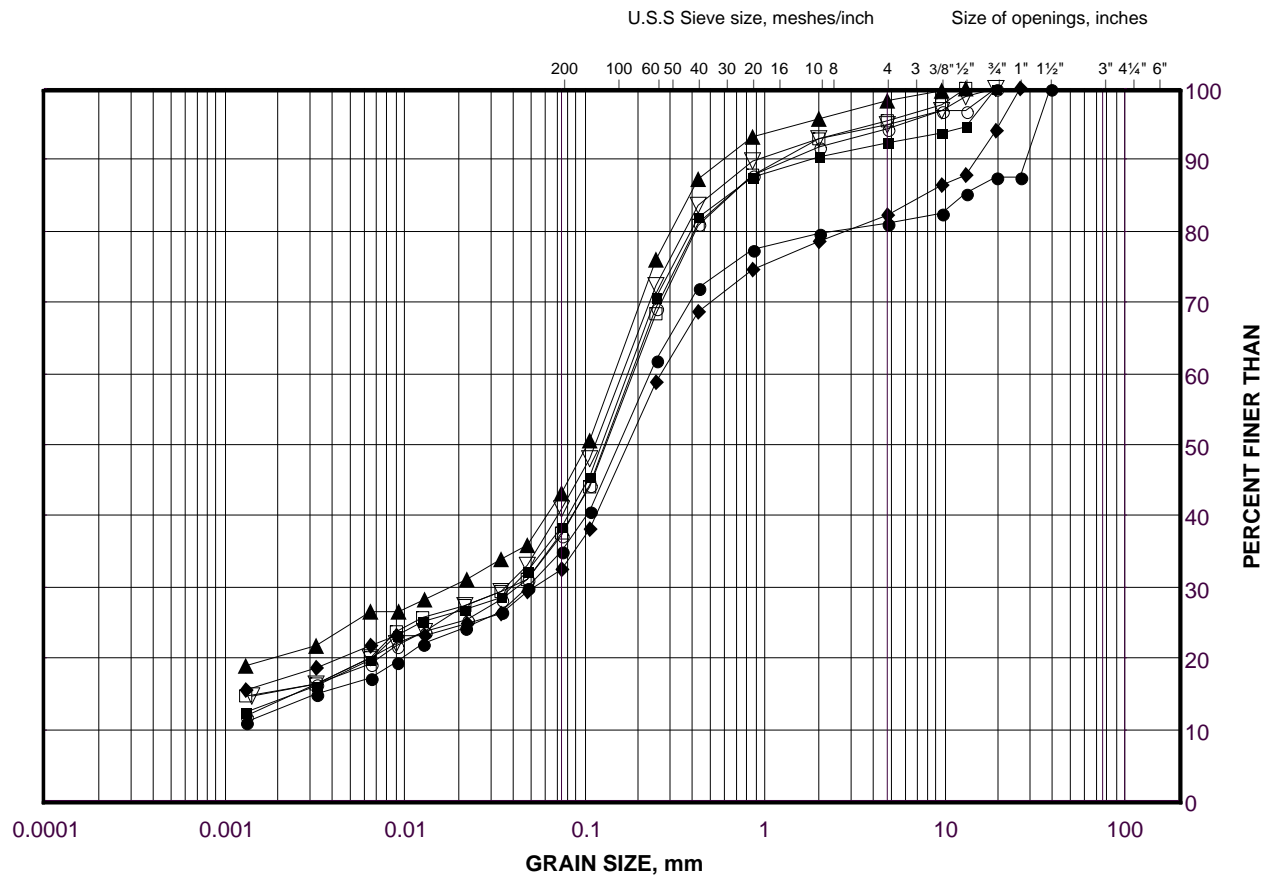
Golder Associates

Date: 23-Jan-18

GRAIN SIZE DISTRIBUTION

Clayey Silt with Sand (Till)

FIGURE B7B



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	HF-03	2	290.9
■	HF-02	3	290.0
◆	CE-02	4	287.4
▲	CE-01	4	288.7
▽	HF-03	5	288.6
○	HF-01	5	289.3
□	HF-02	7	287.0

Project Number: 1670268

Checked By: SMM

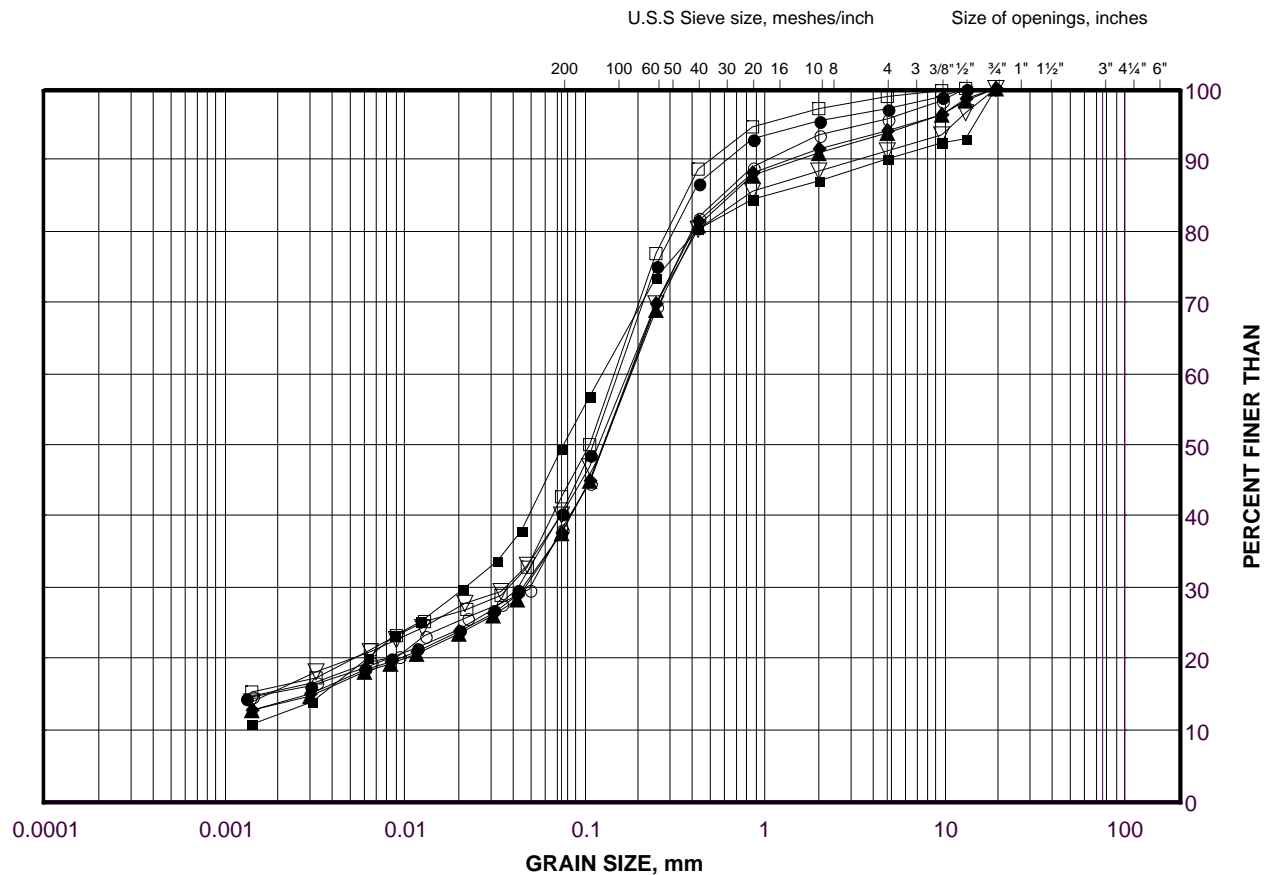
Golder Associates

Date: 08-Mar-18

GRAIN SIZE DISTRIBUTION

Clayey Silt with Sand (Till)

FIGURE B7C



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	6UP-02	10	284.1
■	6UP-01	3	291.8
◆	6UP-02	4	291.0
▲	6UP-01	6	289.5
▽	HF-04	7	288.0
○	HF-04	9	284.9
□	HF-03	9	284.1

Project Number: 1670268

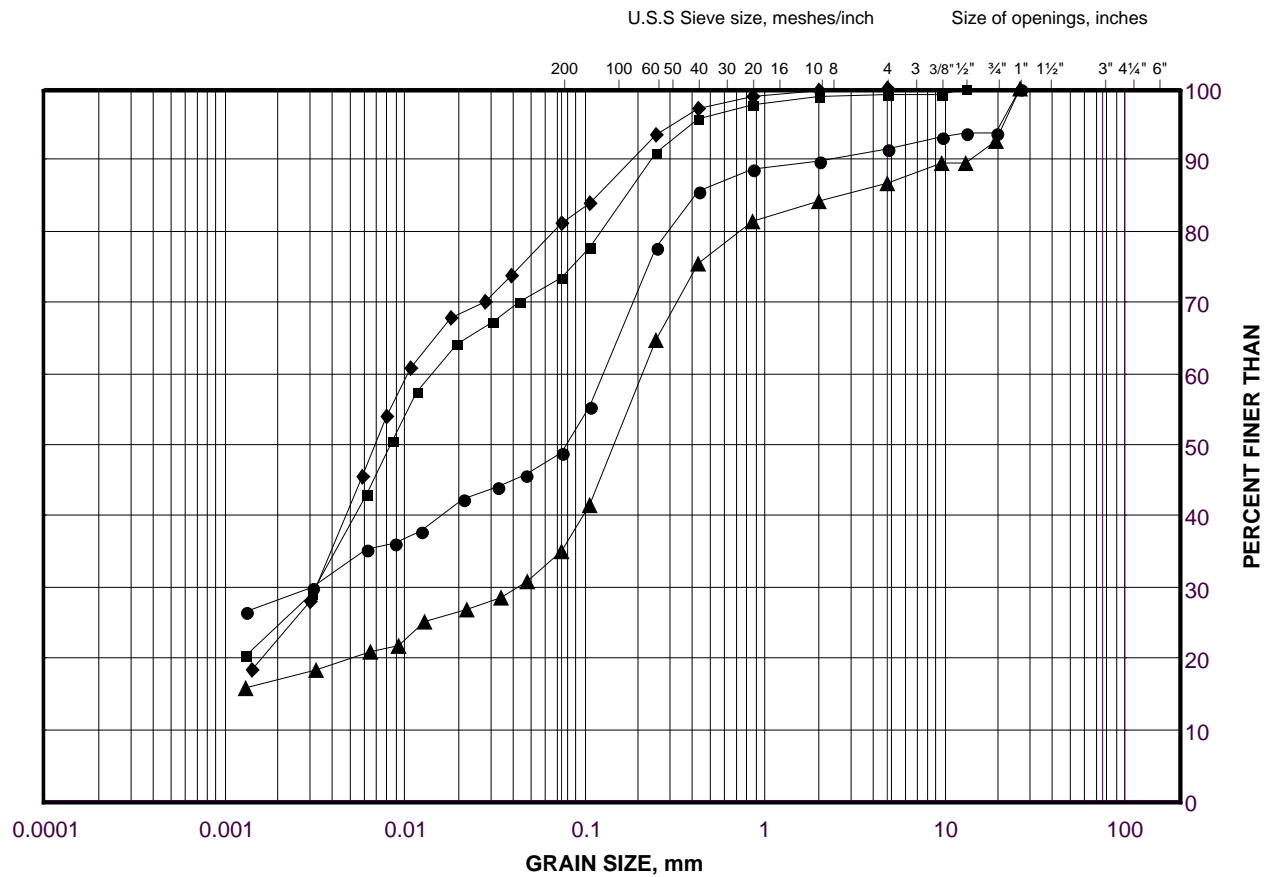
Checked By: SMM

Golder Associates

Date: 08-Mar-18

Clayey Silt with Sand (Till)

FIGURE B7D



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	6UP-03	17	273.6
■	6UP-03	19	267.7
◆	6UP-02	20	265.9
▲	6UP-03	7	288.8

Project Number: 1670268

Checked By: SMM

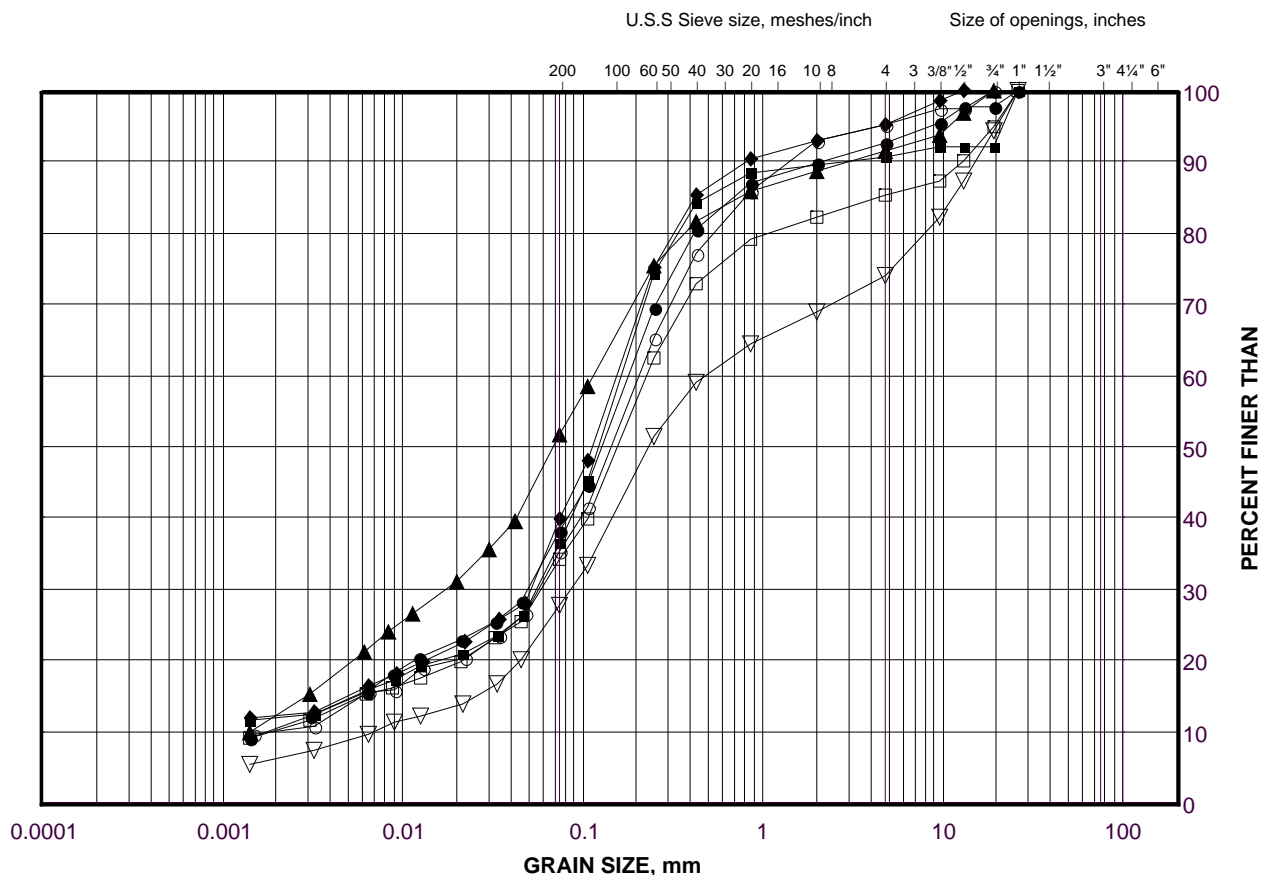
Golder Associates

Date: 08-Mar-18

GRAIN SIZE DISTRIBUTION

Sandy Clayey Silt to Silty Gravelly Sand (Till)

FIGURE B7E



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	6UP-08	10	285.7
■	6UP-07	15	278.0
◆	6UP-04	17	275.0
▲	6UP-08	3	293.3
▽	6UP-07	4	292.5
○	6UP-08	5	291.7
□	6UP-07	9	287.2

Project Number: 1670268

Checked By: SMM

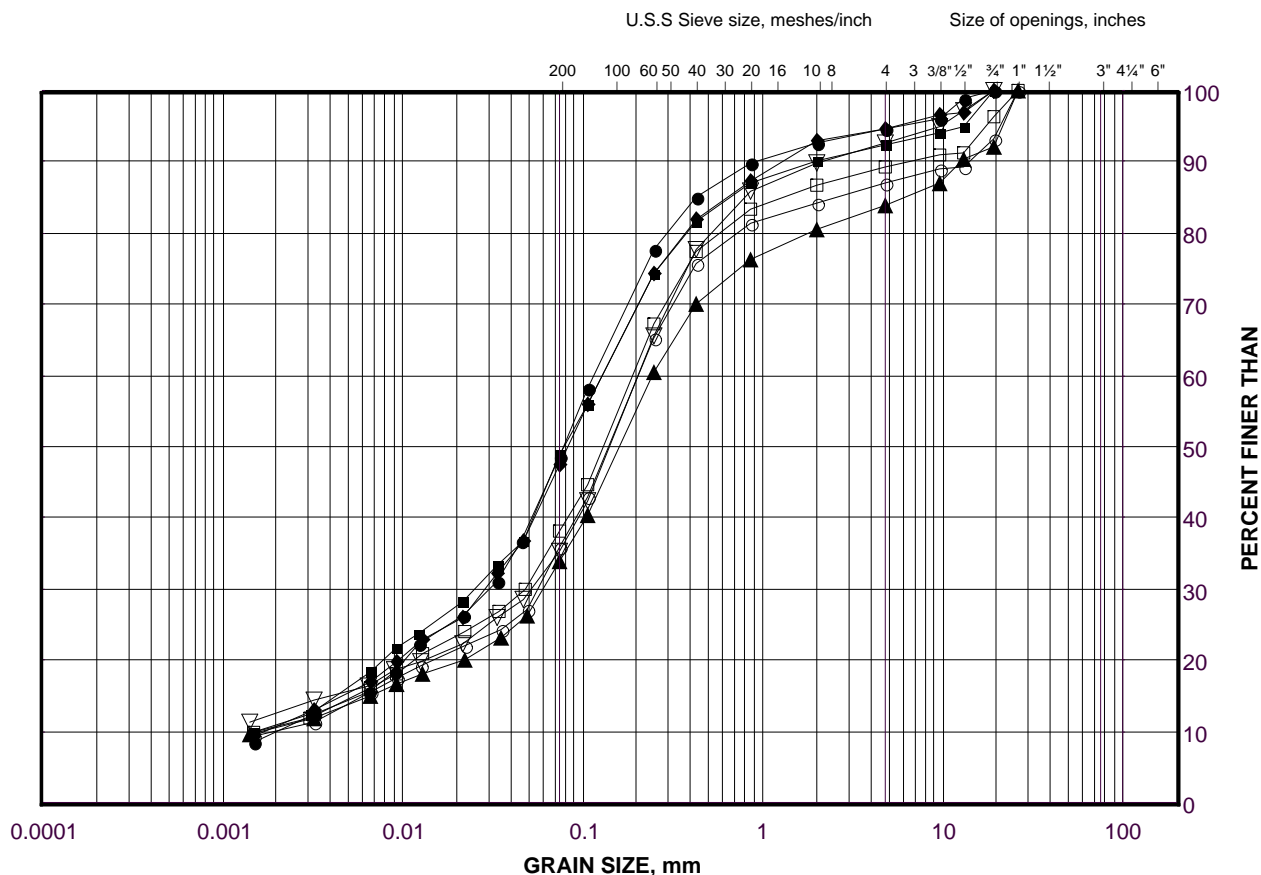
Golder Associates

Date: 23-Jan-18

GRAIN SIZE DISTRIBUTION

Clayey Silt with Sand to Silt and Sand (Till)

FIGURE B7F



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	HF-08	2	290.4
■	HF-06	2	292.9
◆	HF-07	3	291.2
▲	HF-08	5	288.1
▽	HF-07	6	288.8
○	HF-06	7	289.1
□	HF-05	7	289.8

Project Number: 1670268

Checked By: SMM

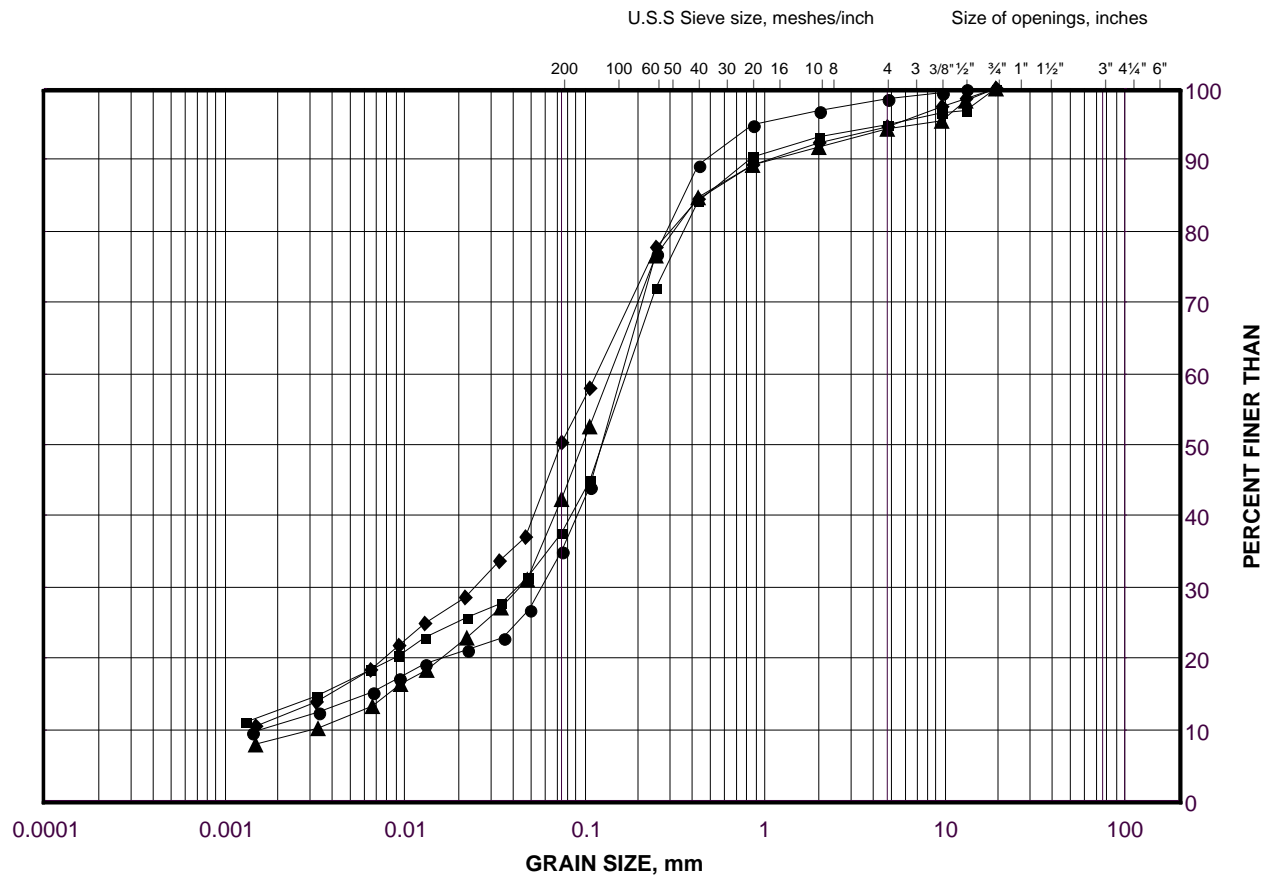
Golder Associates

Date: 23-Jan-18

GRAIN SIZE DISTRIBUTION

Silt and Sand to Silty Sand (Till)

FIGURE B7G



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

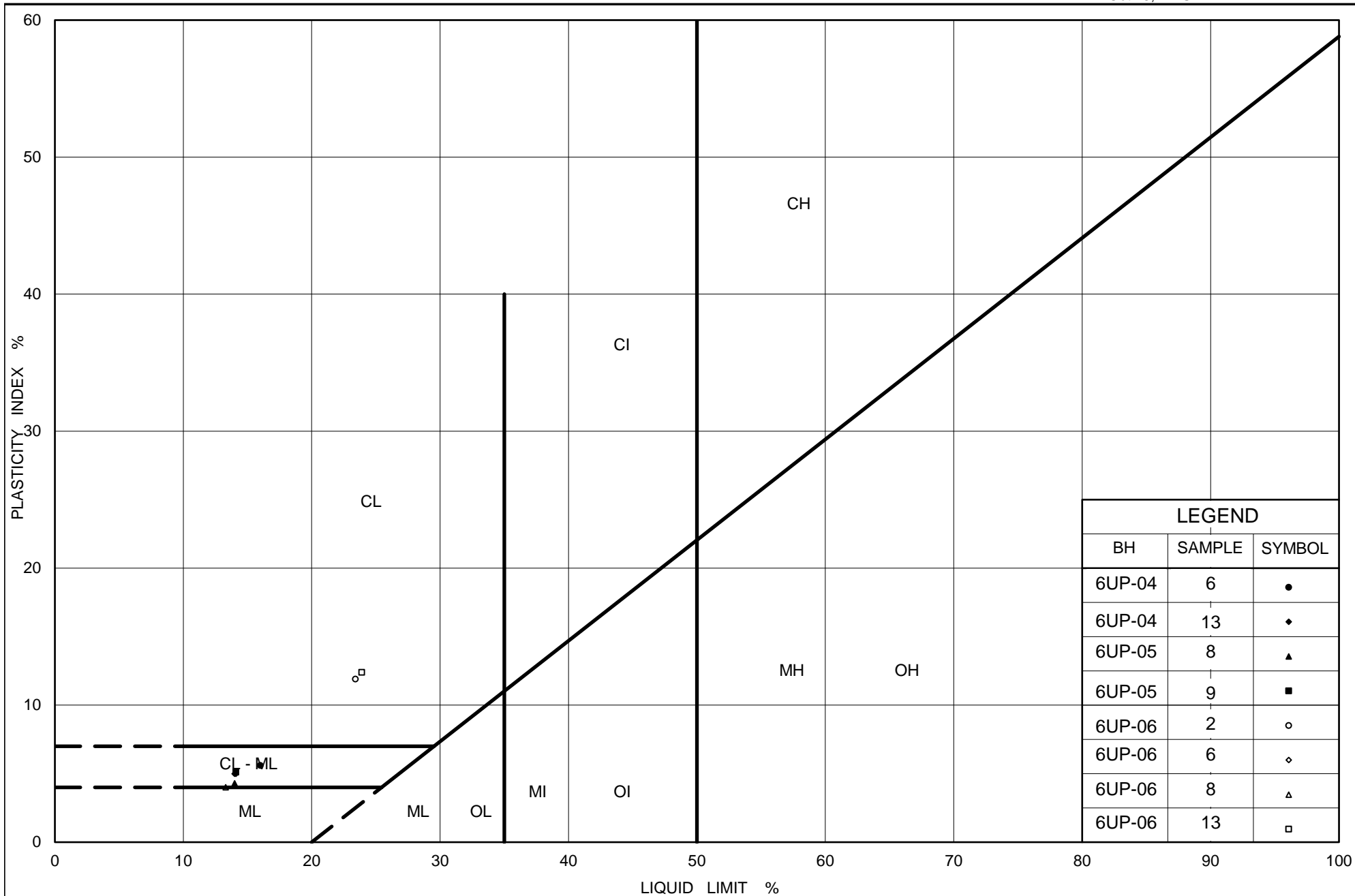
SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	HF-02	10	282.4
■	HF-01	2	291.6
◆	HF-09	4	287.7
▲	HF-10	6	286.0

Project Number: 1670268

Checked By: SMM

Golder Associates

Date: 08-Mar-18



Ministry of Transportation

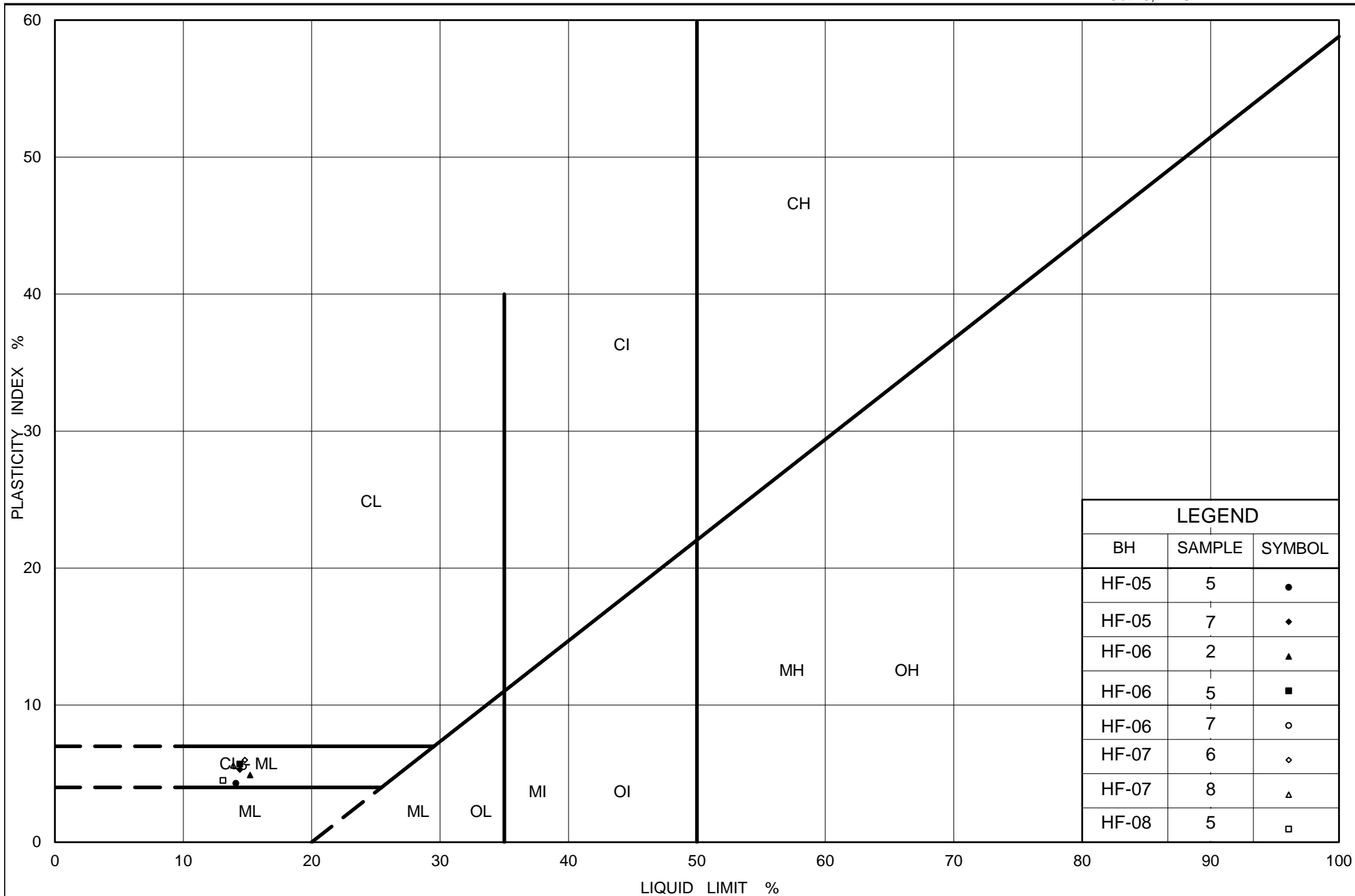
Ontario

PLASTICITY CHART Sandy Clayey Silt to Clayey Silt with Sand (Till)

Figure No. B8A

Project No. 1670268

Checked By: SMM



Ministry of Transportation

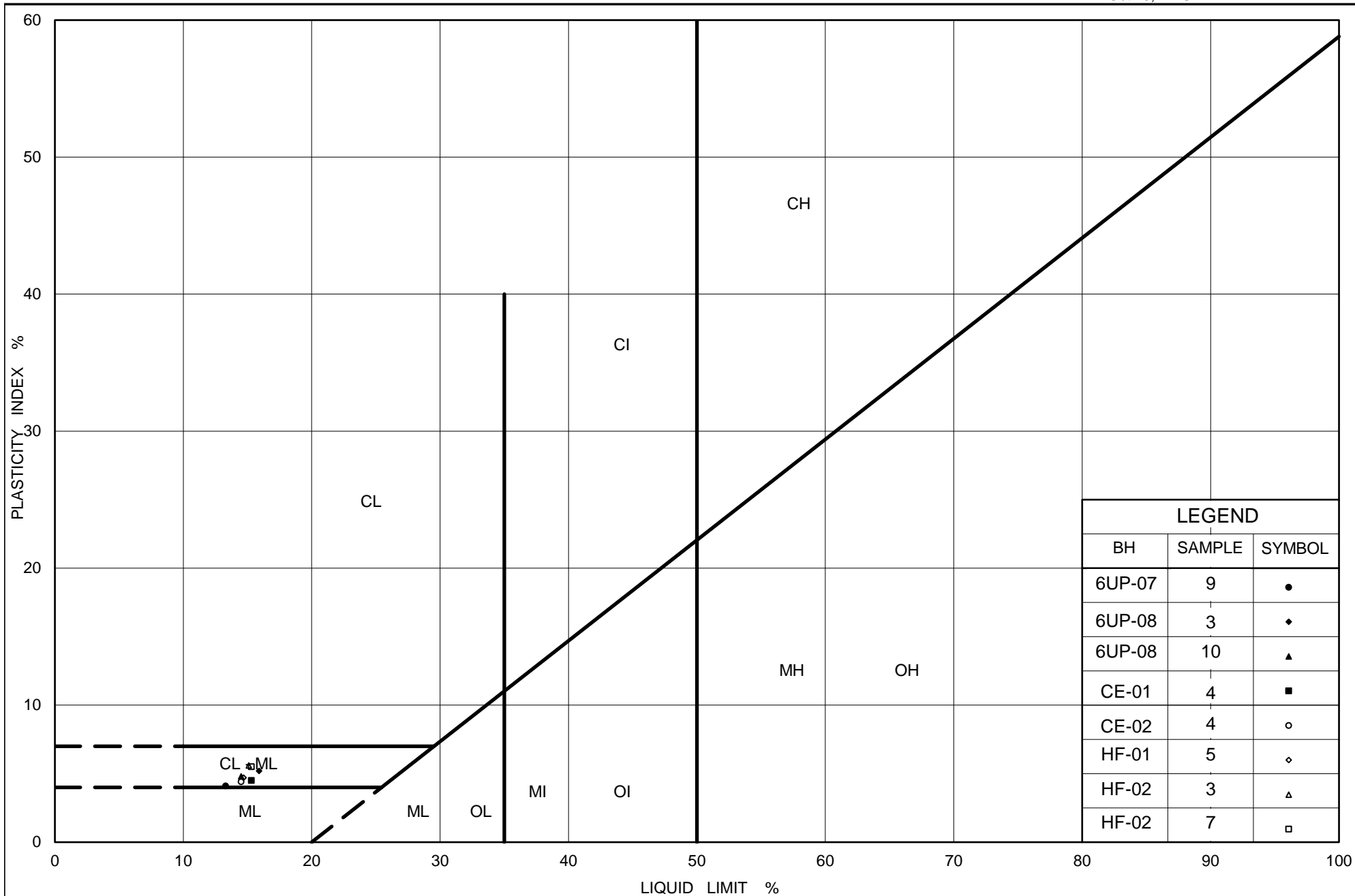
Ontario

PLASTICITY CHART Sandy Clayey Silt to Clayey Silt with Sand (Till)

Figure No. B8B

Project No. 1670268

Checked By: SMM



Ministry of Transportation

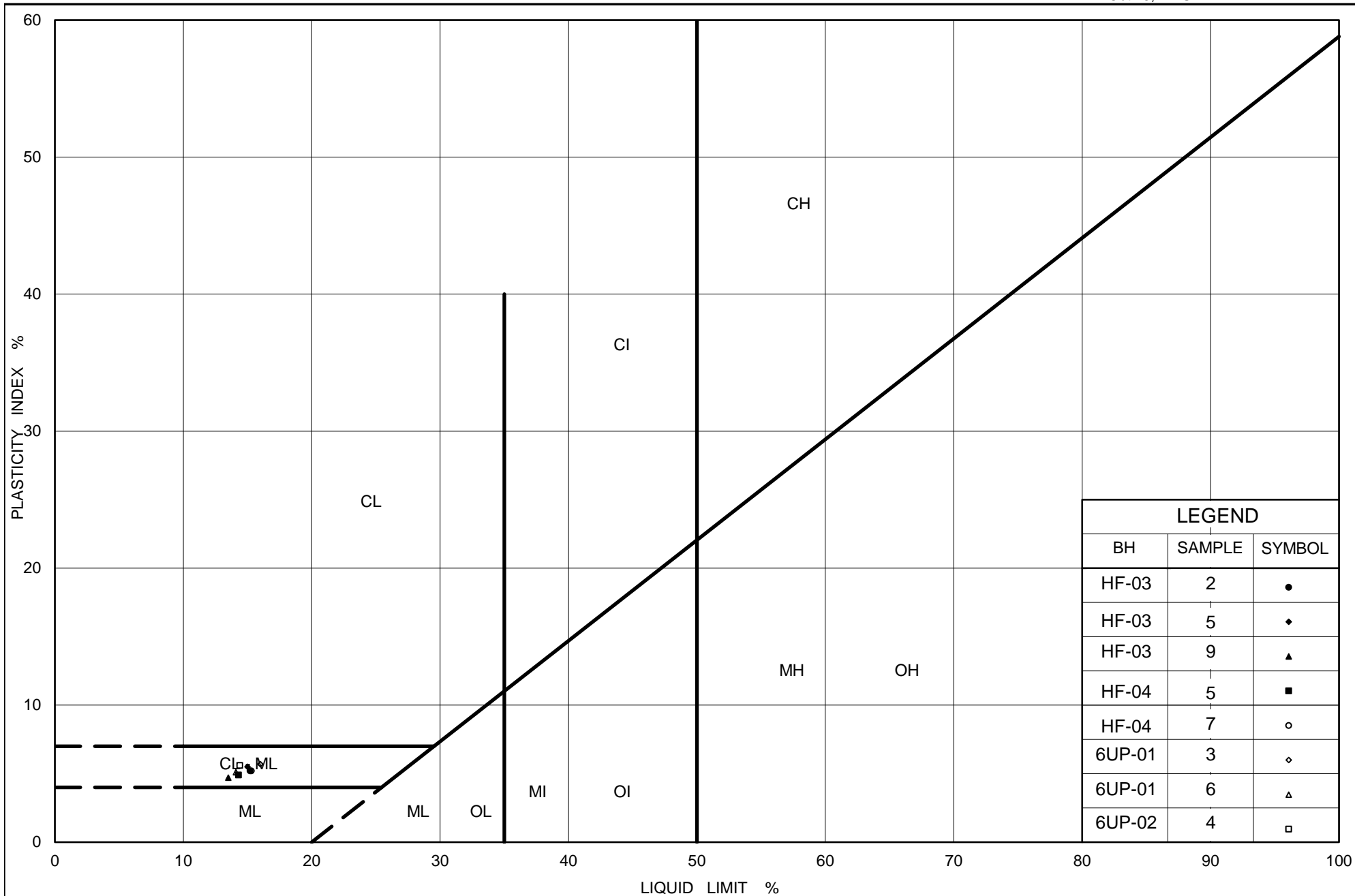
Ontario

PLASTICITY CHART Sandy Clayey Silt to Clayey Silt with Sand (Till)

Figure No. B8C

Project No. 1670268

Checked By: SMM



Ministry of Transportation

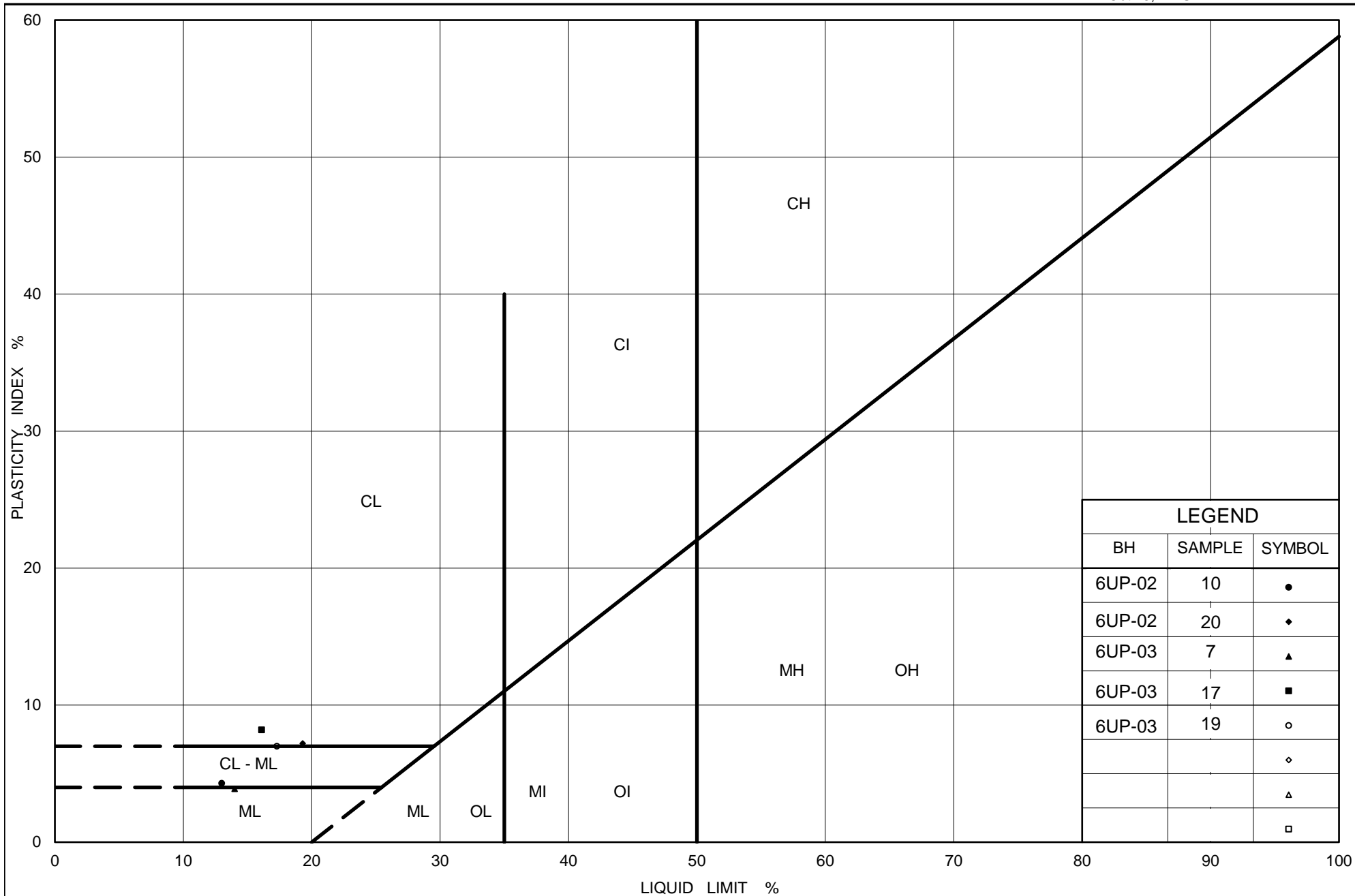
Ontario

PLASTICITY CHART Clayey Silt with Sand (Till)

Figure No. B8D

Project No. 1670268

Checked By: SMM



Ministry of Transportation

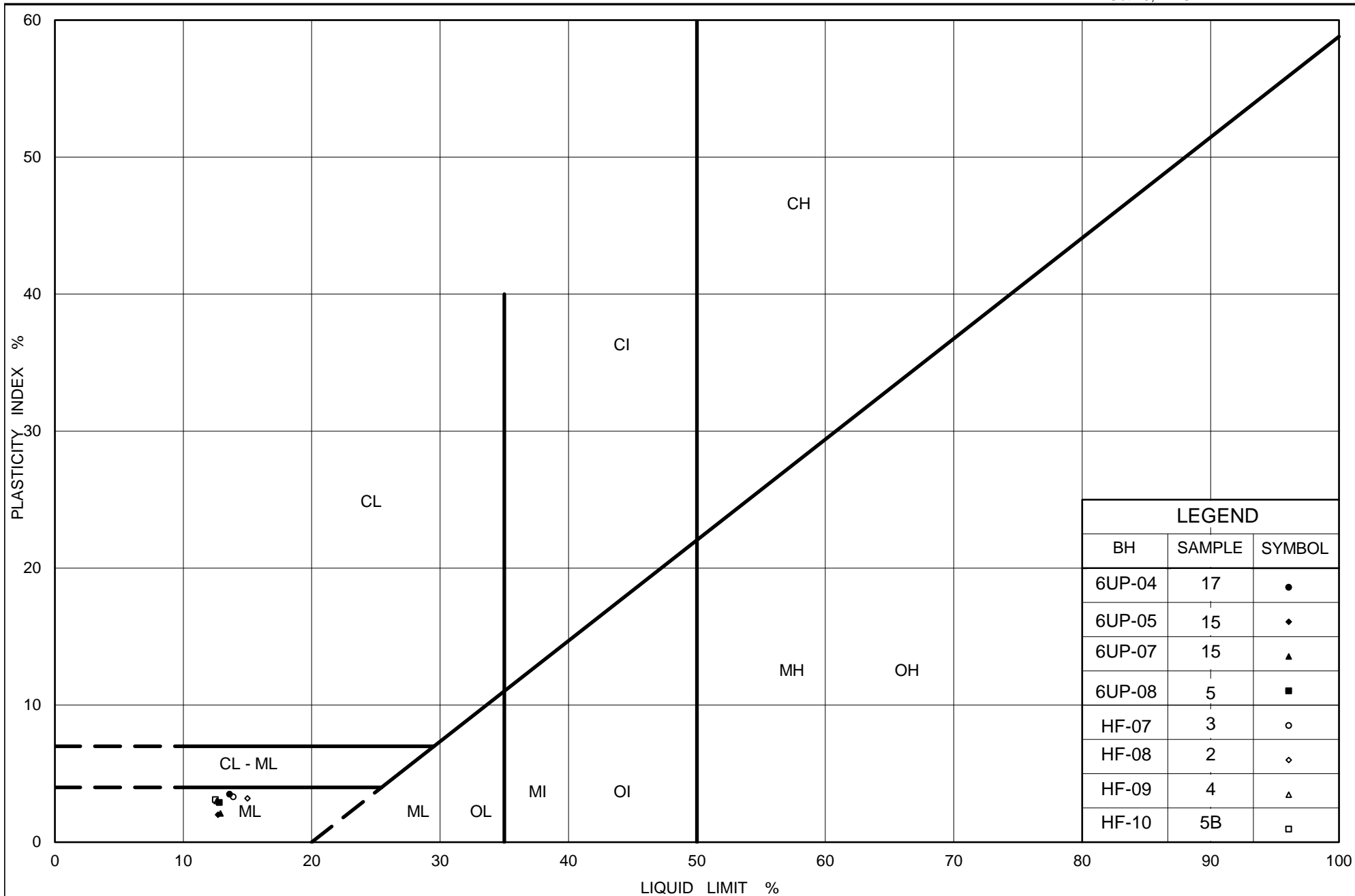
Ontario

PLASTICITY CHART Clayey Silt with Sand (Till)

Figure No. B8E

Project No. 1670268

Checked By: SMM



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Ontario

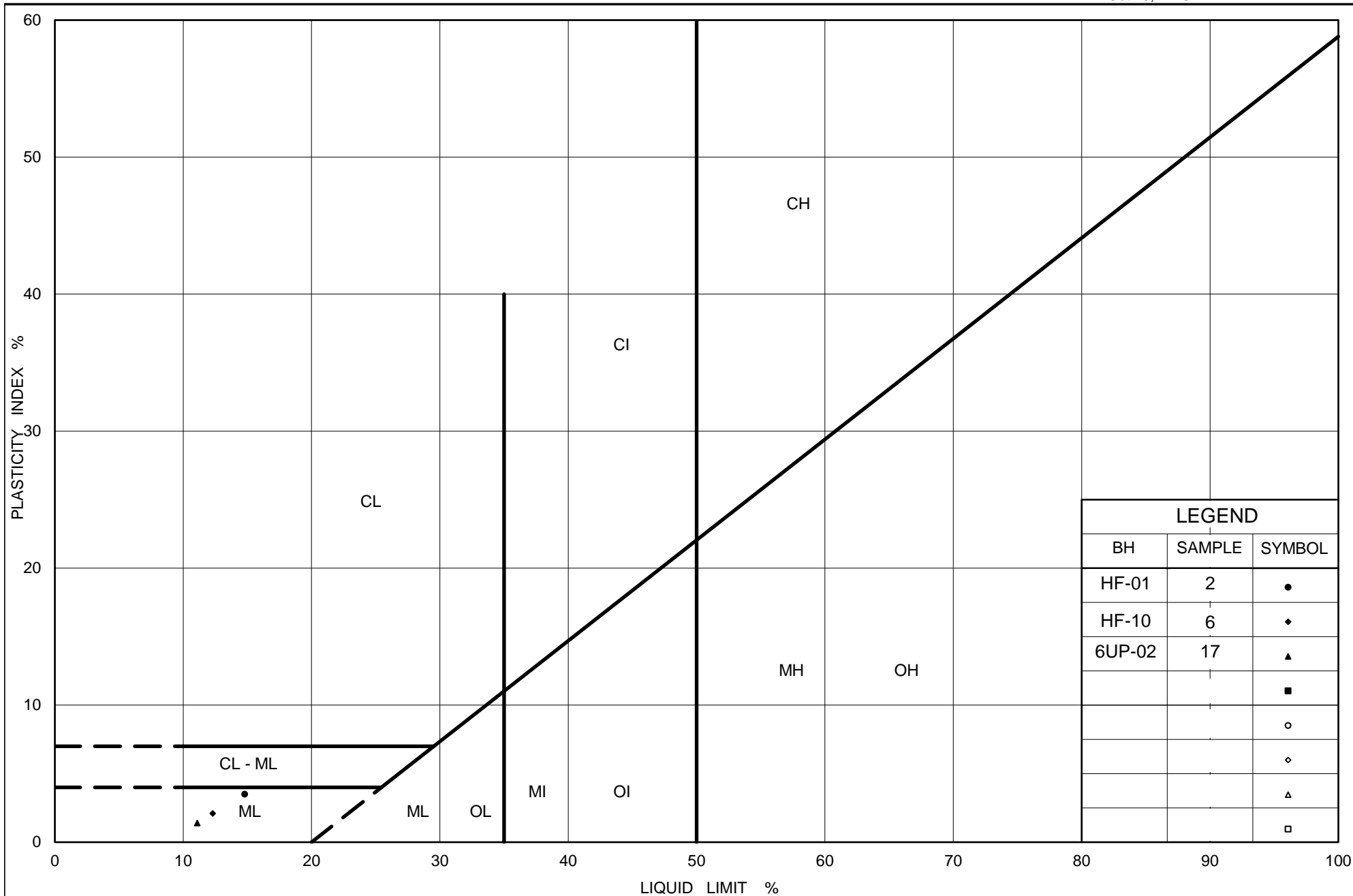
PLASTICITY CHART

Silt and Sand to Silty Sand (Till)

Figure No. B9A

Project No. 1670268

Checked By: SMM



Ministry of Transportation

Ontario

PLASTICITY CHART Silt and Sand to Silty Sand (Till)

Figure No. B9B

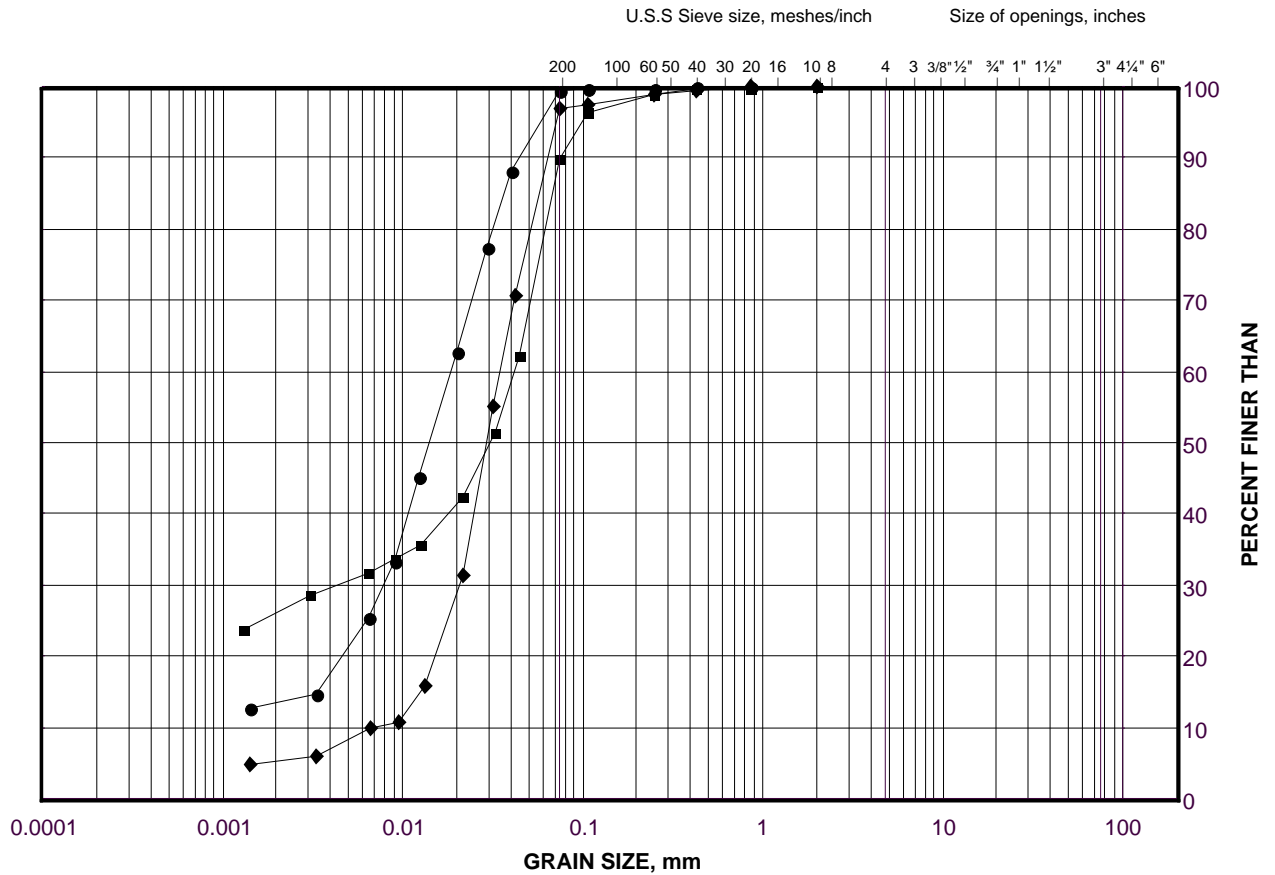
Project No. 1670268

Checked By: SMM

GRAIN SIZE DISTRIBUTION

Clayey Silt to Silt (Upper Interlayer)

FIGURE B10



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	CE-01	11	280.3
■	6UP-03	13	279.7
◆	CE-02	9	282.2

Project Number: 1670268

Checked By: SMM

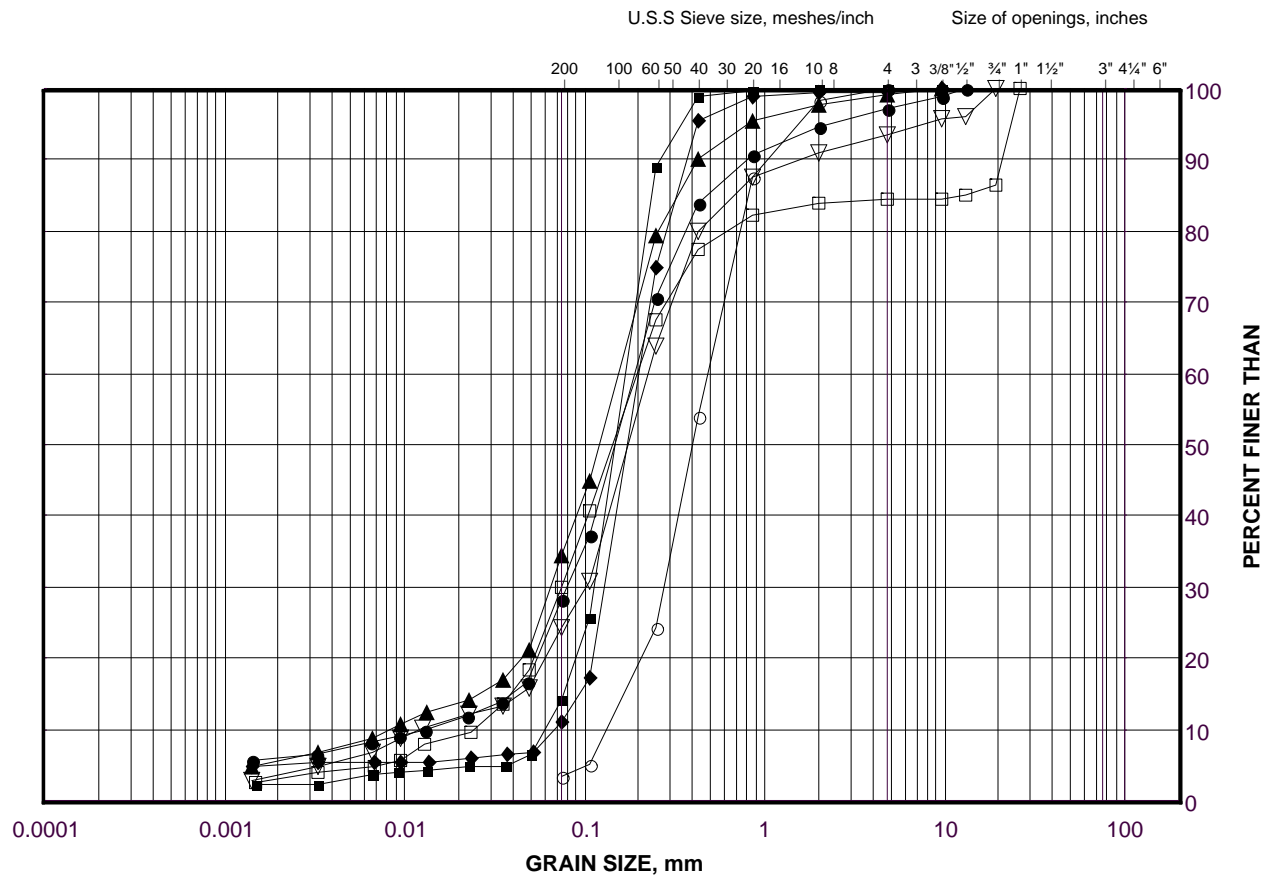
Golder Associates

Date: 08-Mar-18

GRAIN SIZE DISTRIBUTION

Silty Sand to Sand

FIGURE B11A



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	6UP-07	12A	282.8
■	6UP-02	13	279.6
◆	6UP-03	14	278.2
▲	6UP-06	16	276.5
▽	6UP-07	18	273.5
○	6UP-06	18A	273.7
□	HF-09	8	283.9

Project Number: 1670268

Checked By: SMM

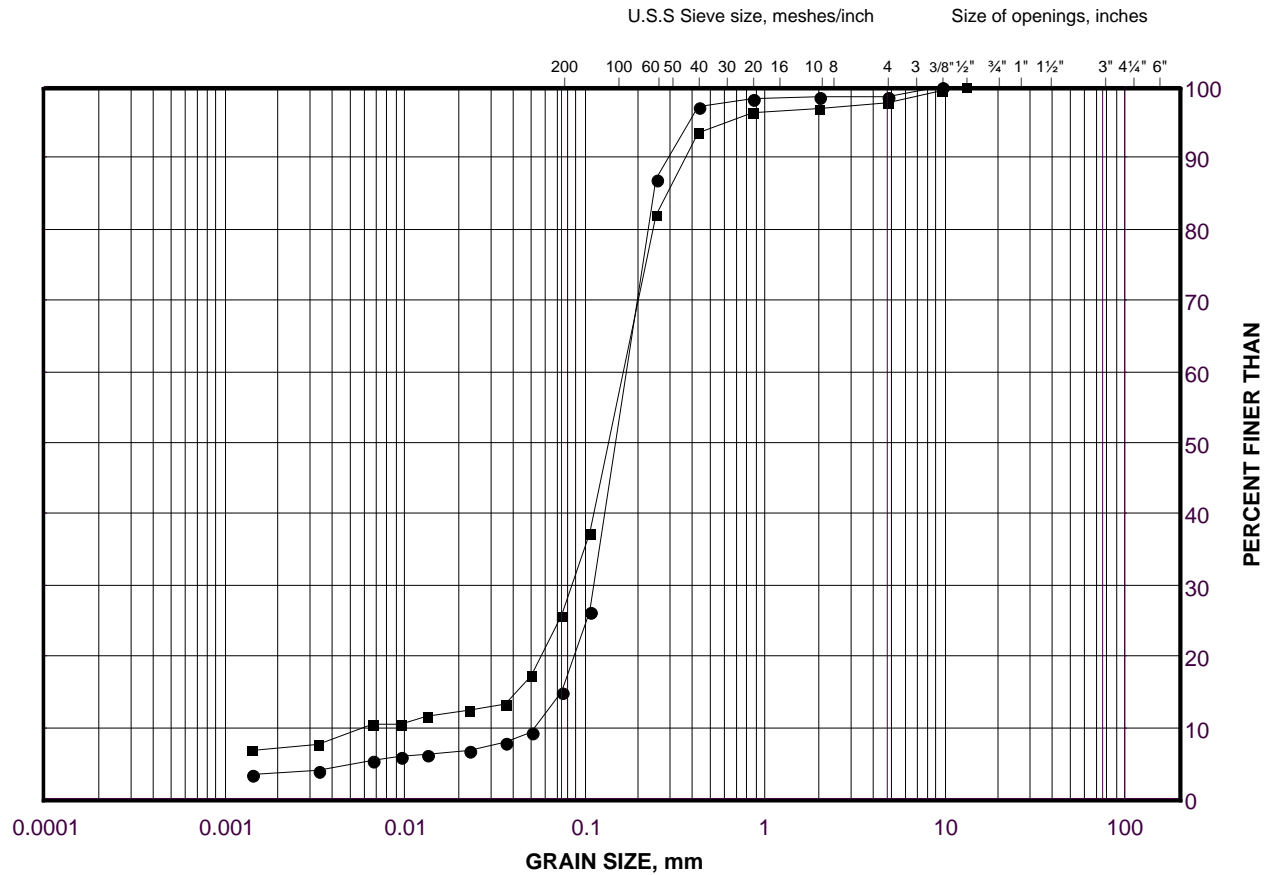
Golder Associates

Date: 08-Mar-18

GRAIN SIZE DISTRIBUTION

Silty Sand to Sand

FIGURE B11B



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	CE-03	2	285.9
■	CE-02	7	285.1

Project Number: 1670268

Checked By: SMM

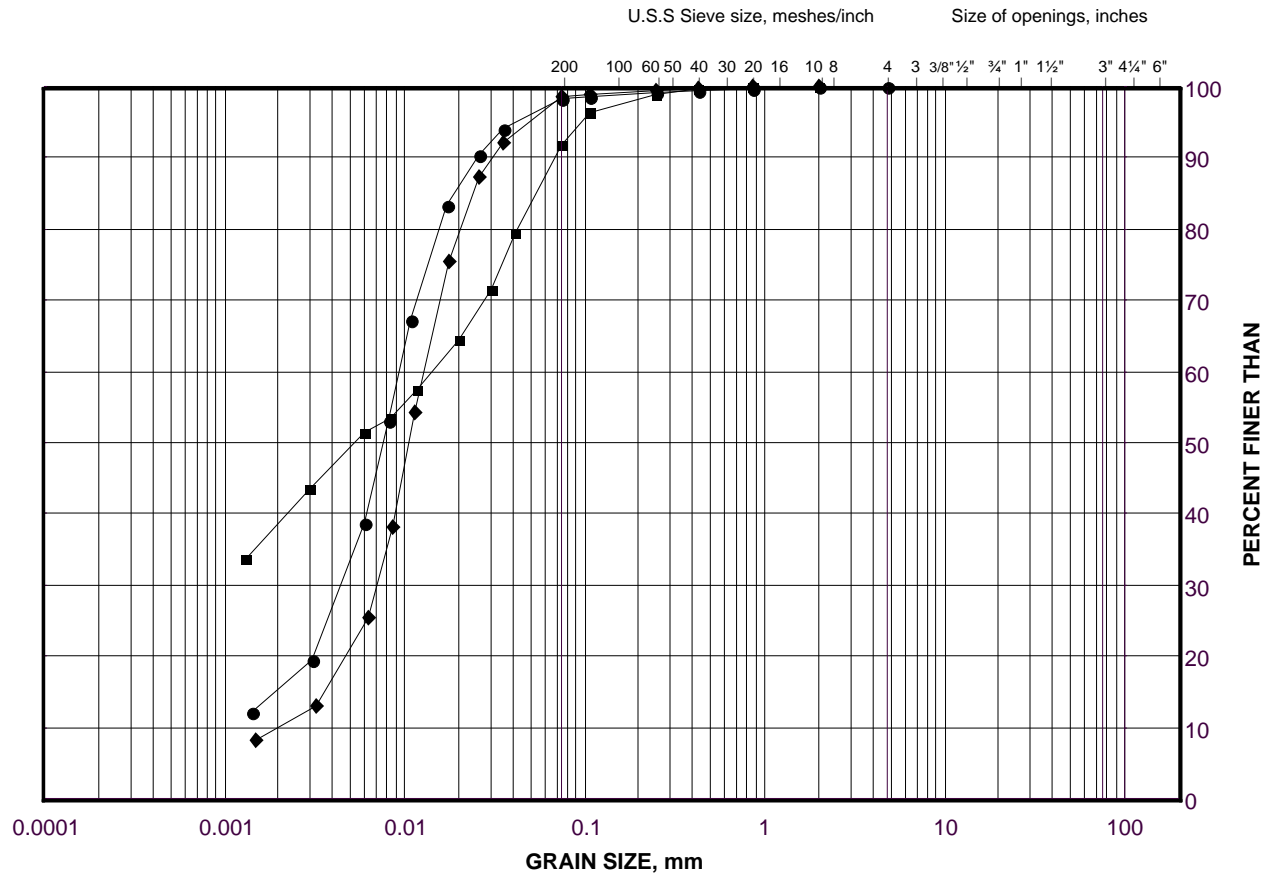
Golder Associates

Date: 08-Mar-18

GRAIN SIZE DISTRIBUTION

Clayey Silt to Silt

FIGURE B12



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

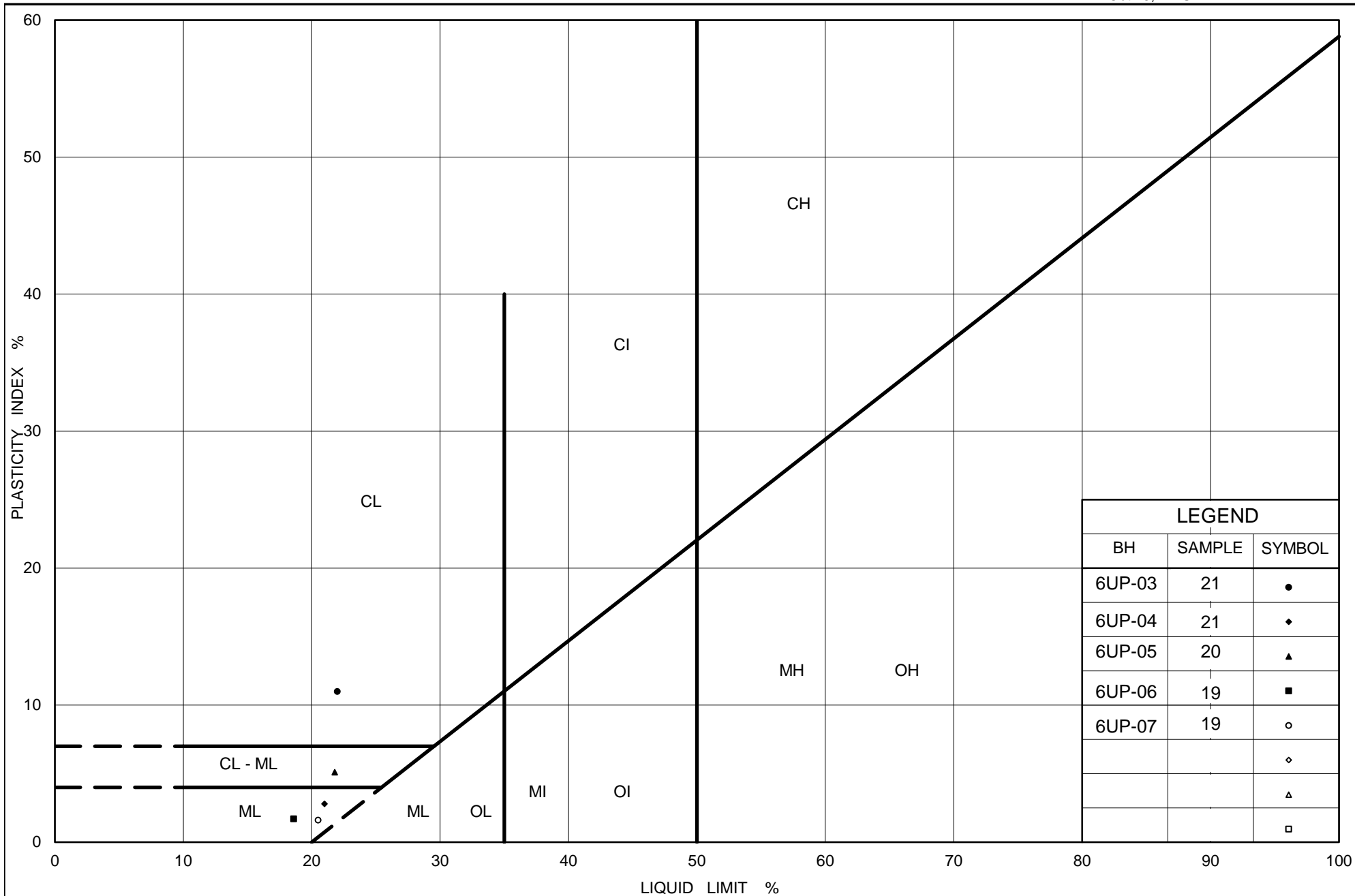
SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	6UP-05	20	267.6
■	6UP-03	21	264.4
◆	6UP-04	21	269.0

Project Number: 1670268

Checked By: SMM

Golder Associates

Date: 08-Mar-18



Ministry of Transportation

Ontario

PLASTICITY CHART Clayey Silt to Silt

Figure No. B13

Project No. 1670268

Checked By: SMM

Your Project #: 1670268
Site Location: HWY 400/6TH LINE
Your C.O.C. #: 60263

Attention:David Marmor

Golder Associates Ltd
Mississauga - Standing Offer
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2017/11/14
Report #: R4856769
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7P2674

Received: 2017/11/09, 15:45

Sample Matrix: Soil
Samples Received: 2

Analyses	Date		Date Analyzed	Laboratory Method	Reference
	Quantity	Extracted			
Chloride (20:1 extract)	2	N/A	2017/11/14	CAM SOP-00463	EPA 325.2 m
Conductivity	2	N/A	2017/11/14	CAM SOP-00414	OMOE E3530 v1 m
pH CaCl2 EXTRACT	2	2017/11/14	2017/11/14	CAM SOP-00413	EPA 9045 D m
Resistivity of Soil	2	2017/11/09	2017/11/14	CAM SOP-00414	SM 22 2510 m
Sulphate (20:1 Extract)	2	N/A	2017/11/14	CAM SOP-00464	EPA 375.4 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Your Project #: 1670268
Site Location: HWY 400/6TH LINE
Your C.O.C. #: 60263

Attention:David Marmor

Golder Associates Ltd
Mississauga - Standing Offer
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2017/11/14
Report #: R4856769
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7P2674
Received: 2017/11/09, 15:45

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ema Gitej, Senior Project Manager

Email: EGitej@maxxam.ca

Phone# (905)817-5829

=====

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Maxxam Job #: B7P2674
Report Date: 2017/11/14

Golder Associates Ltd
Client Project #: 1670268
Site Location: HWY 400/6TH LINE
Sampler Initials: JL

RESULTS OF ANALYSES OF SOIL

Maxxam ID		FNH590	FNH590	FNH591	FNH591		
Sampling Date		2017/10/12	2017/10/12	2017/10/19	2017/10/19		
COC Number		60263	60263	60263	60263		
	UNITS	6UP-05-SA7	6UP-05-SA7 Lab-Dup	6UP-06-SA4A	6UP-06-SA4A Lab-Dup	RDL	QC Batch
Calculated Parameters							
Resistivity	ohm-cm	910		4700			5261646
Inorganics							
Soluble (20:1) Chloride (Cl)	ug/g	610		57	57	20	5262943
Conductivity	umho/cm	1100	1130	215		2	5264045
Available (CaCl2) pH	pH	7.99		7.88			5262832
Soluble (20:1) Sulphate (SO4)	ug/g	<20		<20		20	5262956
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							
Lab-Dup = Laboratory Initiated Duplicate							

Maxxam Job #: B7P2674
Report Date: 2017/11/14

Golder Associates Ltd
Client Project #: 1670268
Site Location: HWY 400/6TH LINE
Sampler Initials: JL

TEST SUMMARY

Maxxam ID: FNH590
Sample ID: 6UP-05-SA7
Matrix: Soil

Collected: 2017/10/12
Shipped:
Received: 2017/11/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5262943	N/A	2017/11/14	Deonarine Ramnarine
Conductivity	AT	5264045	N/A	2017/11/14	Tahir Anwar
pH CaCl2 EXTRACT	AT	5262832	2017/11/14	2017/11/14	Tahir Anwar
Resistivity of Soil		5261646	2017/11/14	2017/11/14	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5262956	N/A	2017/11/14	Alina Dobreanu

Maxxam ID: FNH590 Dup
Sample ID: 6UP-05-SA7
Matrix: Soil

Collected: 2017/10/12
Shipped:
Received: 2017/11/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Conductivity	AT	5264045	N/A	2017/11/14	Tahir Anwar

Maxxam ID: FNH591
Sample ID: 6UP-06-SA4A
Matrix: Soil

Collected: 2017/10/19
Shipped:
Received: 2017/11/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5262943	N/A	2017/11/14	Deonarine Ramnarine
Conductivity	AT	5264045	N/A	2017/11/14	Tahir Anwar
pH CaCl2 EXTRACT	AT	5262832	2017/11/14	2017/11/14	Tahir Anwar
Resistivity of Soil		5261646	2017/11/14	2017/11/14	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5262956	N/A	2017/11/14	Alina Dobreanu

Maxxam ID: FNH591 Dup
Sample ID: 6UP-06-SA4A
Matrix: Soil

Collected: 2017/10/19
Shipped:
Received: 2017/11/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5262943	N/A	2017/11/14	Deonarine Ramnarine

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	2.7°C
-----------	-------

Results relate only to the items tested.

QUALITY ASSURANCE REPORT

Golder Associates Ltd
Client Project #: 1670268
Site Location: HWY 400/6TH LINE
Sampler Initials: JL

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5262832	Available (CaCl ₂) pH	2017/11/14			99	97 - 103			0.32	N/A
5262943	Soluble (20:1) Chloride (Cl)	2017/11/14	NC	70 - 130	106	70 - 130	<20	ug/g	0.12	35
5262956	Soluble (20:1) Sulphate (SO ₄)	2017/11/14	NC	70 - 130	106	70 - 130	<20	ug/g	1.2	35
5264045	Conductivity	2017/11/14			100	90 - 110	<2	umho/cm	2.6	10

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Cristina Carriere

Cristina Carriere, Scientific Service Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Invoice Information		Report Information (if differs from invoice)		Project Information (where applicable)		Turnaround Time (TAT) Required						
Company Name: <u>Golder Associates Ltd.</u>		Company Name:		Quotation #:		<input checked="" type="checkbox"/> Regular TAT (5-7 days) Most analyses						
Contact Name: <u>David Marmor</u>		Contact Name:		P.O. #/ A/E#:		PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS						
Address: <u>100-6925 Century Ave.</u>		Address:		Project #: <u>1670268</u>		Rush TAT (Surcharges will be applied)						
<u>Mississauga, ON L5N 7K2</u>				Site Location: <u>Hwy 400 / 6th Line</u>		<input type="checkbox"/> 1 Day <input type="checkbox"/> 2 Days <input type="checkbox"/> 3-4 Days						
Phone: <u>905-567-4444</u> Fax: <u>905-567-6561</u>		Phone: Fax:		Site #:		Date Required:						
Email: <u>David.Marmor@golder.com</u>		Email:		Sampled By:		Rush Confirmation #:						
MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY												
Regulation 153		Other Regulations		Analysis Requested		LABORATORY USE ONLY						
<input type="checkbox"/> Table 1 <input type="checkbox"/> Res/Park <input type="checkbox"/> Med/ Fine <input type="checkbox"/> Table 2 <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Coarse <input type="checkbox"/> Table 3 <input type="checkbox"/> Agri/ Other <input type="checkbox"/> Table <input type="checkbox"/> FOR RSC (PLEASE CIRCLE) Y <input checked="" type="checkbox"/> N		<input type="checkbox"/> CCME <input type="checkbox"/> Sanitary Sewer Bylaw <input type="checkbox"/> MISA <input type="checkbox"/> Storm Sewer Bylaw <input type="checkbox"/> PWQO Region <input type="checkbox"/> Other (Specify) <input type="checkbox"/> REG 558 (MIN. 3 DAY TAT REQUIRED)		REFER TO BACK OF COC REG 153 METALS & INORGANICS REG 153 ICPMS METALS REG 153 METALS (Hg, Cr VI, CPMS Metals, HNS - B) Corrosivity Package CpH, sulfate, chloride, resistivity, etc.		CUSTODY SEAL Y <input checked="" type="checkbox"/> N Present Intact COOLING MEDIA PRESENT: Y <input checked="" type="checkbox"/> N COMMENTS						
Include Criteria on Certificate of Analysis: Y <input checked="" type="checkbox"/> N												
SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM												
SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED (CIRCLE) Metals / Hg / CrVI	BTX/ PHC F1	PHC F2 - F4	VOCs	REG 153 METALS & INORGANICS	REG 153 ICPMS METALS	REG 153 METALS (Hg, Cr VI, CPMS Metals, HNS - B)	HOLD- DO NOT ANALYZE
1 <u>GUP-05-SA7</u>	<u>2017/10/12</u>	<u>am</u>	<u>Soil</u>	<u>1</u>	<u>N</u>						<u>X</u>	
2 <u>GUP-06-SA4A</u>	<u>2017/10/19</u>	<u>am</u>	<u>Soil</u>	<u>1</u>	<u>N</u>						<u>X</u>	
3												
4												
5												
6												
7												
8												
9												
10												
RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	MAXXAM JOB #						
<u>Jeremy Labow</u>	<u>2017/11/09</u>	<u>15:42</u>	<u>Tara-T. Thompson</u>	<u>2017/11/09</u>	<u>15:46</u>							

09-Nov-17 15:45
Ema Gitej
B7P2674
TSP ENV-627

Your Project #: 1670268
Site Location: 400 / 6TH LINE
Your C.O.C. #: 76783

Attention: Sandra McGaghran

Golder Associates Ltd
Mississauga - Standing Offer
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2018/02/06
Report #: R4971214
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B822296

Received: 2018/01/30, 18:58

Sample Matrix: Soil
Samples Received: 2

Analyses	Date		Date Analyzed	Laboratory Method	Reference
	Quantity	Extracted			
Chloride (20:1 extract)	2	N/A	2018/02/02	CAM SOP-00463	EPA 325.2 m
Conductivity	2	N/A	2018/02/06	CAM SOP-00414	OMOE E3530 v1 m
pH CaCl2 EXTRACT	2	2018/02/02	2018/02/02	CAM SOP-00413	EPA 9045 D m
Resistivity of Soil	2	2018/01/30	2018/02/06	CAM SOP-00414	SM 22 2510 m
Sulphate (20:1 Extract)	2	N/A	2018/02/02	CAM SOP-00464	EPA 375.4 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Your Project #: 1670268
Site Location: 400 / 6TH LINE
Your C.O.C. #: 76783

Attention: Sandra McGaghran

Golder Associates Ltd
Mississauga - Standing Offer
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2018/02/06
Report #: R4971214
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B822296
Received: 2018/01/30, 18:58

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ema Gitej, Senior Project Manager

Email: EGitej@maxxam.ca

Phone# (905)817-5829

=====

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RESULTS OF ANALYSES OF SOIL

Maxxam ID		FZU734			FZU734			FZU735		
Sampling Date		2018/01/15			2018/01/15			2018/01/08		
COC Number		76783			76783			76783		
	UNITS	CE02_4	RDL	QC Batch	CE02_4 Lab-Dup	RDL	QC Batch	6UP-03_5	RDL	QC Batch
Calculated Parameters										
Resistivity	ohm-cm	6500		5375407				1900		5375407
Inorganics										
Soluble (20:1) Chloride (Cl)	ug/g	22	20	5381327				250	20	5381327
Conductivity	umho/cm	153	2	5386260	153	2	5386260	531	2	5386260
Available (CaCl2) pH	pH	7.79		5381502				7.97		5381502
Soluble (20:1) Sulphate (SO4)	ug/g	<20	20	5381328				25	20	5381328
RDL = Reportable Detection Limit										
QC Batch = Quality Control Batch										
Lab-Dup = Laboratory Initiated Duplicate										

TEST SUMMARY

Maxxam ID: FZU734
Sample ID: CE02_4
Matrix: Soil

Collected: 2018/01/15
Shipped:
Received: 2018/01/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5381327	N/A	2018/02/02	Deonarine Ramnarine
Conductivity	AT	5386260	N/A	2018/02/06	Neil Dassanayake
pH CaCl2 EXTRACT	AT	5381502	2018/02/02	2018/02/02	Tahir Anwar
Resistivity of Soil		5375407	2018/02/06	2018/02/06	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5381328	N/A	2018/02/02	Deonarine Ramnarine

Maxxam ID: FZU734 Dup
Sample ID: CE02_4
Matrix: Soil

Collected: 2018/01/15
Shipped:
Received: 2018/01/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Conductivity	AT	5386260	N/A	2018/02/06	Neil Dassanayake

Maxxam ID: FZU735
Sample ID: 6UP-03_5
Matrix: Soil

Collected: 2018/01/08
Shipped:
Received: 2018/01/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5381327	N/A	2018/02/02	Deonarine Ramnarine
Conductivity	AT	5386260	N/A	2018/02/06	Neil Dassanayake
pH CaCl2 EXTRACT	AT	5381502	2018/02/02	2018/02/02	Tahir Anwar
Resistivity of Soil		5375407	2018/02/06	2018/02/06	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5381328	N/A	2018/02/02	Deonarine Ramnarine

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	5.7°C
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Results relate only to the items tested.

QUALITY ASSURANCE REPORT

Golder Associates Ltd
Client Project #: 1670268
Site Location: 400 / 6TH LINE
Sampler Initials: DMF

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5381327	Soluble (20:1) Chloride (Cl)	2018/02/02	112	70 - 130	102	70 - 130	<20	ug/g	NC	35
5381328	Soluble (20:1) Sulphate (SO4)	2018/02/02	108	70 - 130	106	70 - 130	<20	ug/g	NC	35
5381502	Available (CaCl2) pH	2018/02/02			99	97 - 103			0.65	N/A
5386260	Conductivity	2018/02/06			100	90 - 110	<2	umho/cm	0.13	10

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference $\leq 2 \times \text{RDL}$).

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Cristina Carriere

Cristina Carriere, Scientific Service Specialist

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CHAIN OF CUSTODY RECORD 76783 Page 1 of 1

Invoice Information		Report Information (if differs from invoice)						Project Information (where applicable)								Turnaround Time (TAT) Required	
Company Name: <u>Golder Associates</u>		Company Name:						Quotation #:								<input checked="" type="checkbox"/> Regular TAT (5-7 days) Most analyses	
Contact Name: <u>Sandra McBaghran</u>		Contact Name:						P.O. # / AFE#:								PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS	
Address: <u>6925 Century Ave #100</u>		Address:						Project #: <u>1670268</u>								Rush TAT (Surcharges will be applied)	
<u>MISSISSAUGA, ON</u>								Site Location: <u>400 16th Line</u>								<input type="checkbox"/> 1 Day <input type="checkbox"/> 2 Days <input type="checkbox"/> 3-4 Days	
Phone: <u>905-567-4447</u>		Phone:						Site #:								Date Required:	
Fax: _____		Fax:						Sampled By: <u>DMF</u>									
Email: <u>Sandra-mcBaghran@golder.com</u>		Email:															
MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY														Rush Confirmation #:			
Regulation 153		Other Regulations						Analysis Requested								LABORATORY USE ONLY	
<input type="checkbox"/> Table 1 <input type="checkbox"/> Res/Park <input type="checkbox"/> Med/ Fine		<input type="checkbox"/> CCME <input type="checkbox"/> Sanitary Sewer Bylaw						REFER TO BACK OF COC								CUSTODY SEAL Y / N	
<input type="checkbox"/> Table 2 <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Coarse		<input type="checkbox"/> MISA <input type="checkbox"/> Storm Sewer Bylaw														COOLER TEMPERATURES	
<input type="checkbox"/> Table 3 <input type="checkbox"/> Agri/ Other		<input type="checkbox"/> PWQO Region _____						REG 153 METALS & INORGANICS REG 153 ICPMS METALS REG 153 METALS (Hg, Cr VI, ICPMS Metals, HWS - B) <u>Corrosivity</u>								Present Intact	
<input type="checkbox"/> Table _____		<input type="checkbox"/> Other (Specify) _____														N N 7/6/4	
FOR RSC (PLEASE CIRCLE) Y / N		<input type="checkbox"/> REG 558 (MIN. 3 DAY TAT REQUIRED)						HOLD - DO NOT ANALYZE								COOLING MEDIA PRESENT: Y / <u>N</u>	
Include Criteria on Certificate of Analysis: Y / N		SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM														COMMENTS	
SAMPLE IDENTIFICATION		DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED (CIRCLE) Metals / Hg / CrVI	BTEX / PHC F1	PHCs P2 - F4	VOCs	REG 153 METALS & INORGANICS	REG 153 ICPMS METALS	REG 153 METALS (Hg, Cr VI, ICPMS Metals, HWS - B)					
1	CE Ø2 - 4	2018/01/15	AM	SOIL	1								X				
2	bUP-Ø3 - 5	2018/01/08	AM	SOIL	1								X				
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
RELINQUISHED BY: (Signature/Print)		DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)		DATE: (YYYY/MM/DD)	TIME: (HH:MM)	MAXXAM JOB #									
<u>Kahle Klen</u>		<u>2018/01/30</u>	<u>6:55</u>	<u>Rashid/Rashid t. Purewal</u>		<u>2018/01/30</u>	<u>18:58</u>										

As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

For more information, visit golder.com

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