



**FINAL REPORT**

**FOUNDATION INVESTIGATION REPORT**

**Additional Foundation Engineering Retainer Services for Detail Design for  
New Eastbound and Westbound Truck Climbing lanes on Highway 17  
from Pays Plat River Easterly for 7.2 km, Thunder Bay Area, Ontario**

**Agreement No. 6017-E-0066  
Assignment No. 5  
GWP No. 6120-15-00  
MTO GEOCREs No. 42D-58  
(Latitude: 48° 52' 43"; Longitude: 87° 32' 19")**

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**exp Services Inc.**  
August 29, 2019

# Ontario Ministry of Transportation

## Northwestern Region Geotechnical Section

### Foundation Investigation Report

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# Table of Contents

<b>1</b>	<b>FOUNDATION INVESTIGATION REPORT .....</b>	<b>1</b>
1.1	Introduction .....	1
1.2	Site Descriptions and Geological Setting .....	2
1.2.1	Site Descriptions .....	2
1.2.1.1	General .....	2
1.2.1.2	Section A .....	2
1.2.1.3	Section B .....	2
1.2.1.4	Section C .....	2
1.2.1.5	Section D .....	2
1.2.1.6	Section E .....	3
1.2.2	Geological Setting.....	3
1.3	Investigation Procedures .....	3
1.3.1	Site Investigation and Field Testing.....	3
1.3.2	Available Documents .....	6
1.3.3	Laboratory Testing.....	7
1.4	Subsurface Conditions .....	7
1.4.1	Section A (Station 17+000 to Station 17+050).....	7
1.4.1.1	Rootmat/Peat.....	7
1.4.1.2	Gravel with Blast Rock (Fill) .....	8
1.4.1.3	Silty Sand with Gravel (Fill) .....	8
1.4.1.4	Sand (Fill) .....	9
1.4.1.5	Peaty Sand .....	10
1.4.2	Section B (Station 18+600 to Station 18+675).....	10
1.4.2.1	Rockfill .....	11
1.4.3	Section C (Station 19+325 to Station 19+600).....	11
1.4.3.1	Rootmat/Peat.....	11
1.4.3.2	Silty Sand with Gravel/Sand with Silt/Silty Gravel with Sand (Fill) .....	11
1.4.3.3	Gravel with Silt and Sand (Fill) .....	12
1.4.3.4	Peaty Silt .....	13
1.4.3.5	Bedrock .....	14
<b>1.4.4</b>	<b>Section D (Station 20+275 to Station 20+325) .....</b>	<b>14</b>
1.4.4.1	Rootmat/Peat.....	14
1.4.4.2	Silty Sand with Gravel (Fill) .....	14
1.4.4.3	Sandy Peat .....	15
1.4.4.4	Sandy Clayey Silt .....	16
<b>1.4.5</b>	<b>Section E (Station 17+550 to Station 17+825).....</b>	<b>17</b>
1.4.5.1	Rootmat/Peat.....	17
1.4.5.2	Silt.....	17
1.4.5.3	Silty Gravel with Sand .....	18
1.4.5.4	Silty Sand .....	18
1.4.5.5	Bedrock .....	19
1.5	Groundwater Conditions .....	19

2 CLOSURE ..... 22  
*LIMITATIONS AND USE OF REPORT* ..... 23

## Appendices

Site Photographs ..... A  
Drawings ..... B  
Borehole Logs ..... C  
Laboratory Data ..... D

# 1 FOUNDATION INVESTIGATION REPORT

## 1.1 Introduction

This report presents the results of an additional geotechnical investigation completed by **exp** Services Inc. (**exp**) for new eastbound and westbound truck climbing lanes on Hwy 17 from Pays Plat River easterly for 7.2 km (from Station 17+000 to Station 20+325 of the proposed new alignment) including rock surplus management from 17+550 to Station 17+825 of the existing Hwy 17, Rossport, Thunder Bay Area, Ontario. The work was undertaken under Agreement No. 6017-E0066, Assignment No. 5. The terms of reference (TOR) were as presented in Ministry of Transportation Ontario (MTO) email dated May 08, 2019. The investigation program includes the following:

- a) Investigation for a high fill embankment and widening of Hwy 17:
  - From Station 17+000 to 17+050 Lt, 4 to 13 m high (Section A)
  - From Station 18+600 to Station 18+675 Lt, 7 to 13 m high (Section B)
  - From Station 19+325 to Station 19+600 Rt, 4 to 13 m high (Section C)
  - From Station 20+275 to Station 20+325 Lt, up to 5 m high (Section D)
- b) Rock surplus management area:
  - From Station 17+550 to Station 17+825 Lt. (Section E)

The purpose of these investigations was to determine the subsurface conditions by means of a limited number of boreholes (a) along the toe of the embankment of Hwy 17 to permit detailed design and recommendations for the construction of new proposed high fill embankments/roadway widening; and (b) at the proposed rock surplus management area. The site specific geotechnical investigation consisted of a field investigation including visual inspections, drilling of boreholes with hand auger, soil sampling, and laboratory testing.

This foundation investigation report has been prepared specifically and solely for the project described herein. It contains the factual results of the investigation and the laboratory testing completed for this project.

## 1.2 Site Descriptions and Geological Setting

### 1.2.1 Site Descriptions

#### 1.2.1.1 General

The general site conditions were assessed during the site reconnaissance on June 6, 2019. Photographs of the sites are presented in Appendix A. At the subject sites, Hwy 17 travels in a predominantly north-south direction along the north edge of Lake Superior. It is a two lane highway with a speed limit of 90 km/h and paved shoulders.

#### 1.2.1.2 Section A

Section A from Station 17+000 to 17+050 is the area located east of existing Hwy 17. It is investigated for widening the westbound lane (WBL). In this area the highway embankment is approximately 4 m to 13 m high. In some portions the side slope is very steep. The area is heavily vegetated by bushes and trees (Photos 1 to 4). The northern and middle portions of this section are located on the old Hwy 17 rock cut (i.e. blast zone) (Photos 1 and 2), while the southern portion of the embankment base is swampy lowland with a small creek in the middle (Photos 3 and 4). The bedrock outcrop was noticed at the toe level close to Station 17+025 (Photo 2).

#### 1.2.1.3 Section B

Section B from Station 18+600 to 18+675 is the area located east of existing Hwy 17, which is investigated for widening the WBL. In this area the highway embankment is approximately 7 m to 13 m high, with rocky steep slopes (Photo 5). The base of the embankment where the boreholes were located is also covered by rockfill. East of the embankment base the terrain raises into the steep natural rocky slope (Photos 5 and 6). The area is vegetated by bushes and trees (Photos 7 and 8). A small creek was observed in the middle portion of this section as shown on Photo 8. This area also has overhead powerlines, Hydro and Fiber Optics Telephone System (Photo 5).

#### 1.2.1.4 Section C

Section C from Station 19+325 to 19+600 is the area located west of existing Hwy 17, since it was investigated for widening the eastbound lane (EBL). In this area the highway embankment is approximately 4 m to 13 m high, with rocky steep slopes. This area is rugged difficult terrain, heavily vegetated by bushes and dense trees, and barely accessible. Erosion was noticed at the toe level close to Station 19+450 (Photo 10). The bedrock outcrops were noticed at the toe level along the whole section as shown on Photos 10, 11 and 12.

#### 1.2.1.5 Section D

Section D from Station 20+275 to 20+325 is the area located east of existing Hwy 17 which is investigated for widening the WBL. The maximum height of the existing embankment is estimated to be about 5 m, with rocky steep slopes in some portions (Photo 14). In the middle of the section the base of the embankment is swampy and barely accessible (Photo 15). The area is also heavily

vegetated by bushes and trees. The bedrock outcrop was noticed at the toe level close to Station 20+325 (Photo 16).

#### 1.2.1.6 Section E

Section E from Station 17+550 to 17+825 is the approximately 250 m by 150 m area located east of existing Hwy 17 proposed for rock surplus disposal. The proposed area is the rugged hard rocky terrain with rock outcrops and shallow bedrock mostly overlain by thin layer of soil. The area is heavily vegetated by bushes and trees. The photographs of this area are shown in Appendix A (Photos 17 to 25).

### 1.2.2 Geological Setting

According to the MNR Northern Ontario Engineering Geology Terrain Data Base Map, Ontario Geological Survey Map 2518, dated 1987, the underlying native soil at the site is predominantly glaciofluvial deposits, including shallow water, and sand glaciolacustrine delta deposits. The glaciolacustrine delta of Pays Plat Bay has been known to consist varved clay.

According to Ontario Geological Survey, Bedrock Geology of Ontario Map No. 2518, issued 1991, the bedrock at the site is described as from the Archean Era. The rock is intrusive rock, mainly massive to foliated granodiorite and granite.

## 1.3 Investigation Procedures

### 1.3.1 Site Investigation and Field Testing

The field investigation fieldwork was carried out on June 6, 2019 and June 7, 2019 during which time thirty-four (34) boreholes were drilled in Sections A to E with hand augers. The locations of BHs are shown on the Borehole Location Plans, Drawings 1 to 6 in Appendix B.

The field program of this project was as follows:

#### Section A:

- Drilling of three (3) boreholes (19-MAH-1 to 19-MAH-3A/B) along the proposed embankment toes, off-road drilling

#### Section B:

- Drilling of three (3) boreholes (19-MAH-4 to 19-MAH-6) along the proposed embankment toes, off-road drilling

#### Section C:

- Drilling of seven (7) boreholes (19-MAH-7 to 19-MAH-13) along the proposed embankment toes, off-road drilling

Section D:

- Drilling of three (3) boreholes (19-MAH-14 to 19-MAH-16) along the proposed embankment toes, off-road drilling

Section E:

- Drilling of fifteen (15) boreholes (19-RS-1 to 19-RS-15A) strategically located along the proposed area, off-road drilling

All boreholes were strategically located along the proposed widening to provide subsurface information for the design of new high fill embankment and rock surplus management area. The number and location of boreholes were finally determined by MTO and **exp** based on observations during the site reconnaissance on June 6, 2019. These locations were staked in the field by **exp** personnel. The borehole locations (referenced to the MTM NAD83/ Zone 14 coordinate system), ground elevations (referenced to the geodetic datum) and the depths in all sections are summarized in the following Table 1.1.

All of the boreholes in Section A to E (19-MAH-1 to 19-MAH-16 and 19-RS-1 to 19-RS-15A) were advanced to depths of about 0 m to 4.5 m below the ground surface with a hand auger operated by **exp** personnel, since the sites were not accessible with drill rigs or excavators.

The groundwater level was measured upon completion of their drilling and the levels were recorded on borehole log sheets in Appendix C.

The fieldwork was supervised by an **exp** geotechnical representative who directed drilling and sampling operations, logged borehole data in accordance with MTO and/or ASTM Standards for Soils Classification, and retrieved soil samples for subsequent laboratory testing and identification.

All recovered soil samples were placed in labelled moisture-proof bags and returned to **exp**'s Thunder Bay laboratory for additional visual, textual, olfactory examination and selective testing.

Table 1.1. Locations, elevations and depths of BHs

Section	BH #	Location	MTM NAD83 Northing	MTM NAD83 Easting	Ground Elevation (m)	Borehole Depth (m)
A	19-MAH-1	Existing embankment toe	5414599.0	265820.0	262.0	0.3
	19-MAH-2	Existing embankment toe	5414570.9	265829.1	260.9	0.3
	19-MAH-3	Existing embankment toe	5414561.7	265855.9	255.9	2.3
	19-MAH-3A	Existing embankment toe	5414561.7	265855.9	255.9	2.1

	19-MAH-3B	Existing embankment toe	5414561.7	265855.9	255.9	2.1
B	19-MAH-4	Existing embankment toe	5413255.9	266674.3	314.8	0.0*
	19-MAH-5	Existing embankment toe	5413222.0	266668.6	319.8	0.0*
	19-MAH-6	Existing embankment toe	5413190.3	266650.6	324.5	0.0*
C	19-MAH-7	Existing embankment toe	5412558.8	266398.8	300.4	0.0**
	19-MAH-8	Existing embankment toe	5412523.5	266388.3	292.4	0.5
	19-MAH-9	Existing embankment toe	5412473.6	266373.8	282.9	0.7
	19-MAH-10	Existing embankment toe	5412436.1	266378.3	279.0	0.4
	19-MAH-11	Existing embankment toe	5412390.4	266377.7	279.8	1.0
	19-MAH-12	Existing embankment toe	5412352.8	266380.1	282.8	0.3
	19-MAH-13	Existing embankment toe	5412308.1	266385.6	285.2	0.3
D	19-MAH-14	Existing embankment toe	5411670.9	266602.7	240.2	0.6
	19-MAH-15	Existing embankment toe	5411646.9	266615.0	238.8	2.3
	19-MAH-16	Existing embankment toe	5411617.6	266632.7	238.9	0.5
E	19-RS-1	Rock surplus stockpile area	5414229.81	266306.53	311.24	0.2
	19-RS-2	Rock surplus stockpile area	5414166.55	266326.47	310.18	0.4
	19-RS-3	Rock surplus stockpile area	5414108.33	266368.01	309.90	2.0
	19-RS-4	Rock surplus stockpile area	5414051.76	266398.32	310.16	0.2
	19-RS-5	Rock surplus stockpile area	5413986.74	266428.61	309.64	4.5
	19-RS-6	Rock surplus stockpile area	5414189.36	266233.56	313.82	0.7
	19-RS-7	Rock surplus stockpile area	5414114.43	266261.51	313.83	0.0**

	19-RS-8	Rock surplus stockpile area	5414077.56	266299.24	310.99	0.0**
	19-RS-9	Rock surplus stockpile area	5414012.00	266330.46	317.00	0.0**
	19-RS-10	Rock surplus stockpile area	5413956.04	266362.10	314.61	0.6
	19-RS-11	Rock surplus stockpile area	5414164.71	266171.75	309.83	0.4
	19-RS-12	Rock surplus stockpile area	5414106.65	266205.06	308.34	0.1
	19-RS-13	Rock surplus stockpile area	5414049.25	266227.58	307.05	1.2
	19-RS-14	Rock surplus stockpile area	5413975.49	266263.05	313.06	0.0**
	19-RS-15	Rock surplus stockpile area	5413923.87	266298.51	311.24	0.0**
	19-RS-15A	Rock surplus stockpile area	5413923.87	266298.51	311.24	0.5

\* - top of rockfill

\*\* - top of outcrop

### 1.3.2 Available Documents

The available report of the previous investigation in the MTO GEOCREs library is:

*Geocres No. 42D-45: "Preliminary Foundation Investigation and Design Report, Proposed Embankment Station 15+800 to 16+275 Township of Lahontan Highway 17" prepared by TBT Engineering Ltd., December 19, 2016*

In addition, MTO provided the following documents:

*Drainage and Hydrology Report, GWP 612-15-00 "Highway 17 Eastbound and Westbound Truck Climbing Lane, Curve Realignment and Hazard Rock Improvements Pays Plat First Nation Easterly" prepared by Associated Engineering, July 28, 2017*

*Preliminary Design Report, GWP 6120-15-00 "Highway 17 Pays Plat River Easterly, Truck Climbing Lanes, Curve Realignment, Hazard Rock and Resurfacing Pays Plat First Nation Easterly" prepared by TBT Engineering Ltd., October 9, 2018*

Previous Investigation by **exp**:

*Foundation Investigation and Design Report, GWP No. 6120-15-00 "Widening of Highway 17 East from Pays Plat River Easterly 7.2 km, Thunder Bay Area, Ontario" prepared by EXP Services Inc., June 13, 2019*

### 1.3.3 Laboratory Testing

All samples returned to the laboratory were subjected to visual examination and classification. The laboratory testing program included the determination of natural moisture content on all samples, and particle size distribution and Atterberg Limit tests for approximately 25% of the collected soil samples from all five sections. All of the laboratory tests were carried out according to MTO and/or ASTM Standards as appropriate.

The laboratory test results are provided on the attached borehole log sheets in Appendix C. The results of the grain size analyses tests and Atterberg Limit tests are presented graphically in Appendix D.

## 1.4 Subsurface Conditions

The detailed subsurface conditions encountered in the boreholes advanced during this investigations are presented on the borehole log sheets in Appendix C. Laboratory test results of grain size analyses and Atterberg limit tests are provided in Appendix D. The "Explanation of Terms Used in Report" preceding the borehole logs in Appendix C forms an integral part of and should be read in conjunction with this report.

Borehole location plans and stratigraphic sections at the sites are provided in Appendix B. It should be noted that the stratigraphic boundaries indicated on the borehole logs and stratigraphic sections are inferred from non-continuous sampling and observations of drilling progress. These boundaries typically represent transitions from one soil type to another and should not be regarded as exact planes of geological change. Further, subsurface conditions may vary between and beyond the borehole locations.

A detailed description of the stratigraphy encountered in Sections A through E is discussed in subsequent sections.

### 1.4.1 Section A (Station 17+000 to Station 17+050)

In general, the subsurface conditions along the proposed east side widening zone of Hwy 17 between Station 17+000 and 17+050 consist of surficial rootmat/peat underlain by gravel with rock blast/silty sand with gravel/ poorly graded sand fill followed by peaty sand. The auger refusal was encountered at the depths of 0.3 m to 2.3 m. Observed outcrops in vicinities of drilled boreholes suggest that refusal was at bedrock. A detailed description of the subsurface conditions within Section A is discussed further in subsequent sections based on the geotechnical investigation conducted by **exp**.

#### 1.4.1.1 Rootmat/Peat

Rootmat/peat was encountered at the surface of all boreholes in Section A, 19-MAH-1 to 19-MAH-3B. The thickness of rootmat/peat is about 0.1 m.

The composition of the layer consists of rootmats and decaying organic matter. The material is brown to black in color and moist to wet.

Laboratory testing performed on selected samples consisted of moisture content tests. The test results indicate that natural moisture content of this material ranges from 21% to 412.6%.

The results of the moisture content tests performed are provided on the record of borehole sheets in Appendix C.

#### 1.4.1.2 Gravel with Blast Rock (Fill)

A gravel with blast rock fill layer was encountered below the rootmat/peat in borehole 19-MAH-1, and was terminated within this layer due to auger refusal. The approximate elevations of the surface and base of the fill and the thickness of fill as encountered in boreholes are summarized in Table 1.2 below:

Table 1.2. Summary of gravel with blast rock fill layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)
	Top	Bottom		
19-MAH-1	261.9	261.7	0.1	0.2

The composition of this layer consists of blast rock and gravel. The material is brown in color and damp.

Laboratory testing performed on one sample consisted of moisture content tests. The test results indicate that natural moisture content of this material is about 3%.

The results of the moisture content tests performed are provided on the record of borehole sheets in Appendix C.

#### 1.4.1.3 Silty Sand with Gravel (Fill)

A silty sand with gravel fill layer was encountered below the rootmat/peat in borehole 19-MAH-2, and was terminated within this layer due to auger refusal. The approximate elevations of the surface and base of the fill and the thickness of fill as encountered in boreholes are summarized in Table 1.3 below:

Table 1.3. Summary of silty sand with gravel fill layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)
	Top	Bottom		
19-MAH-2	260.8	260.6	0.1	0.2

The composition of this layer consists of silt and sand with gravel, some blast rock. The material is brown in color and moist to wet. From site investigation, during drilling and sampling, relative density for this part of the layer matrix was assessed to be compact compactness condition.

Laboratory testing performed on selected samples consisted of moisture content and grain size distribution tests. The test results are as follow:

Moisture Content:

- 10%

Grain Size Distribution:

- 41% gravel
- 47% sand
- 13% silt and clay

The results of the moisture content and grain size distribution tests are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution test is also provided on Figure 1 in Appendix D.

#### 1.4.1.4 Sand (Fill)

A poorly graded sand fill layer was encountered below the rootmat/peat in boreholes 19-MAH-3, 19-MAH-3A and 19-MAH-3B. The approximate elevations of the surface and base of the fill and the thickness of fill as encountered in boreholes are summarized in Table 1.4 below:

Table 1.4. Summary of sand fill layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)
	Top	Bottom		
19-MAH-3	255.8	255.3	0.1	0.5
19-MAH-3A	255.8	255.6	0.1	0.2
19-MAH-3B	255.8	255.4	0.1	0.4

The composition of this layer consists of sand. The material is brown in color and wet. From site investigation, during drilling and sampling, relative density for this part of the layer matrix was assessed to be very loose compactness condition.

Laboratory testing performed on selected samples consisted of moisture content and grain size distribution tests. The test results are as follow:

Moisture Content:

- 22% to 36%

Grain Size Distribution:

- 1% to 2% gravel

- 96% to 97% sand
- 2% to 3% silt and clay

The results of the moisture content and grain size distribution tests are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution test is also provided on Figure 2 in Appendix D.

#### 1.4.1.5 Peaty Sand

A native peaty sand layer was encountered below the poorly graded sand fill layer in boreholes 19-MAH-3, 19-MAH-3A and 19-MAH-3B, and was terminated within this layer due to auger refusal. The approximate elevations of the surface and base of the deposit and the thickness of deposit as encountered in boreholes are summarized in Table 1.5 below:

Table 1.5. Summary of peaty sand layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)
	Top	Bottom		
19-MAH-3	255.3	253.6	0.6	1.7
19-MAH-3A	255.6	253.8	0.3	1.8
19-MAH-3B	255.4	253.8	0.5	1.6

The composition of this layer consists of peat and sand. The material is dark brown in color and wet. From site investigation, during drilling and sampling, relative density for this part of the layer matrix was assessed to be very loose compactness condition.

Laboratory testing performed on one sample consisted of moisture content tests. The test results indicate that natural moisture content of this material ranges from 50% to 62%.

The results of the moisture content tests performed are provided on the record of borehole sheets in Appendix C.

### 1.4.2 Section B (Station 18+600 to Station 18+675)

In general, the subsurface conditions along the proposed east side widening of Hwy 17 (i.e. the toe of the existing embankment) between Station 18+600 and 18+675 consist of surficial rockfill. The presence of rockfill on the ground level prevented the drilling by the hand auger. However, the observed outcrops suggest the shallow bedrock. A detailed description of the subsurface conditions encountered along the proposed widening of the Hwy 17 within Section B is discussed further in subsequent sections. It should be noted that the following sections are based on the geotechnical investigation conducted by **exp**.

#### 1.4.2.1 Rockfill

Rockfill was encountered at the surface of the toe of the existing embankment of boreholes 19-MAH-4, 19-MAH-5, and 19-MAH-6. Due to this surficial rockfill, the hand auger drilling was impossible. In addition, due to overhead powerlines, Hydro and Fiber Optics Telephone System (FOTS) no drilling rig or excavator access is possible. Photographs in Appendix A show the details of the site and borehole locations and this information is also provided on the record of borehole sheets in Appendix C.

#### 1.4.3 Section C (Station 19+325 to Station 19+600)

In general, the subsurface conditions along the proposed west side widening of Hwy 17 (i.e. the toe of the existing embankment) between Station 19+325 and Station 19+600 consist of rootmat/peat underlain by granular fill followed by peaty silt. Auger refusals were encountered at the depths of 0.3 m to 1.0 m. Outcrop was noticed at the ground surface beside the toe of the existing embankment at Station 19+325. A detailed description of the subsurface conditions encountered along the proposed widening of the Hwy 17 within Section C is discussed further in subsequent sections. It should be noted that the following sections are based on the geotechnical investigation conducted by **exp**.

##### 1.4.3.1 Rootmat/Peat

Rootmat/peat was encountered at the surface of boreholes 19-MAH-8 to 19-MAH-13. The thickness of rootmat/peat ranges from 0.1 m to 0.4 m. In addition, peat was found inbetween well graded sand with silt fill and peaty silt for a thickness of 0.2 m in borehole 19-MAH-9. Boreholes 19-MAH-10 and 19-MAH-12 was terminated within this layer due to auger refusal.

The composition of the layer consists of rootmats, trace sand and some gravel. The material is brown/dark brown to black in color, wet and soft.

Laboratory testing performed on selected samples consisted of moisture content tests. The test results indicate that natural moisture content of this material ranges from 122.3% to 281.1%.

The results of the moisture content tests performed are provided on the record of borehole sheets in Appendix C.

##### 1.4.3.2 Silty Sand with Gravel/Sand with Silt/Silty Gravel with Sand (Fill)

Silty sand with gravel fill layer was encountered below the rootmat in borehole 19-MAH-8; a well graded and poorly graded sand with silt fill was encountered below the rootmat in borehole 19-MAH-9 and 19-MAH-11, respectively; silty gravel with sand fill was encountered below the rootmat in borehole 19-MAH-13. Boreholes 19-MAH-11 and 19-MAH-13 was terminated within this fill layer due to auger refusal. The approximate elevations of the surface and base of the fill and the thickness of fill as encountered in boreholes are summarized in Table 1.6 below:

Table 1.6. Summary of silty sand with gravel/sand with silt/silty gravel with sand fill layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)
	Top	Bottom		
19-MAH-8	292.3	292.0	0.1	0.3
19-MAH-9	282.8	282.6	0.1	0.2
19-MAH-11	279.7	278.8	0.1	0.9
19-MAH-13	285.2	285.0	0.1	0.2

The composition of this layer consists of sand, silt, gravel, some organics and occasional cobbles. The material is brown/rusty brown to dark brown in color and moist to wet. From site investigation, during drilling and sampling, relative density for this part of the layer matrix was assessed to be loose to compact compactness condition.

Laboratory testing performed on selected samples consisted of moisture content and grain size distribution tests. The test results are as follow:

Moisture Content:

- 29% to 43%

Grain Size Distribution:

- 2% to 45% gravel
- 38% to 88% sand
- 5% to 19% silt and clay

The results of the moisture content and grain size distribution tests are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution test is also provided on Figure 3 in Appendix D.

#### 1.4.3.3 Gravel with Silt and Sand (Fill)

A poorly graded gravel with silt and sand fill layer was encountered below the silty sand with gravel fill in borehole 19-MAH-8, and was terminated within this layer due to auger refusal. The approximate elevations of the surface and base of the fill and the thickness of fill as encountered in boreholes are summarized in Table 1.7 below:

Table 1.7. Summary of gravel with silt and sand fill layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)
	Top	Bottom		
19-MAH-8	292.1	292.0	0.4	0.1

The composition of this layer consists of gravel, sand, silt, roots and some organics. The material is dark brown in color and moist to wet. From site investigation, during drilling and sampling, relative density for this part of the layer matrix was assessed to be compact compactness condition.

Laboratory testing performed on selected samples consisted of moisture content and grain size distribution tests. The test results are as follow:

Moisture Content:

- 19%

Grain Size Distribution:

- 55% gravel
- 34% sand
- 11% silt and clay

The results of the moisture content and grain size distribution tests are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution test is also provided on Figure 4 in Appendix D.

#### 1.4.3.4 Peaty Silt

A native peaty silt layer was encountered below the peat layer in borehole 19-MAH-9, and was terminated within this layer due to auger refusal. The approximate elevations of the surface and base of the deposit and the thickness of deposit as encountered in boreholes are summarized in Table 1.8 below:

Table 1.8. Summary of peaty silt layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)
	Top	Bottom		
19-MAH-9	282.4	282.2	0.5	0.2

The composition of this layer consists of peat, silt, some sand, some gravel and some cobbles. The material is dark brown in color. From site investigation, during drilling and sampling, relative density for this part of the layer matrix was assessed to be compact compactness condition.

Laboratory testing performed on selected samples consisted of moisture content tests. The test results indicate that natural moisture content of this material is about 76%.

The results of the moisture content tests performed are provided on the record of borehole sheets in Appendix C.

#### 1.4.3.5 Bedrock

Solid outcrop overlain by eroded bits and pieces of rock was encountered at the ground surface beside the toe of the existing embankment at location of borehole 19-MAH-7. Photographs in Appendix A show the details of the site and this information is also provided on the record of borehole sheets in Appendix C.

### 1.4.4 Section D (Station 20+275 to Station 20+325)

The subsurface conditions along the proposed east side widening of Hwy 17 from Station 20+275 to 20+325 (i.e. the toes of the existing embankment) consist of rootmat/peat underlain by silty sand with gravel fill, sandy peat followed by sandy clayey silt. Auger refusals were encountered at the depths of 0.5 m to 2.3 m. Outcrops were observed in the vicinity of drilling locations. A detailed description of the subsurface conditions encountered along the proposed widening of the Hwy 17 within Section D is discussed further in subsequent sections. It should be noted that the following sections are based on the geotechnical investigation conducted by **exp**.

#### 1.4.4.1 Rootmat/Peat

Rootmat/peat was encountered at the surface of all boreholes 19-MAH-14 to 19-MAH-16. The thickness of rootmat/peat ranges from 0.1 m to 0.7 m. Borehole 19-MAH-16 was terminated within this layer due to auger refusal.

The composition of this layer consists of roots and rootlets and trace to some sand. The material is dark brown to black in color, wet and soft.

Laboratory testing performed on selected samples consisted of moisture content tests. The test results indicate that natural moisture content of this material ranges from 122.5% to 248.1%. The results of the moisture content tests are provided on the record of borehole sheets in Appendix C.

#### 1.4.4.2 Silty Sand with Gravel (Fill)

A silty sand with gravel fill layer was encountered below the rootmat/peat in borehole 19-MAH-14, and was terminated within this layer due to auger refusal. The approximate elevations of the surface and base of the fill and the thickness of fill as encountered in boreholes are summarized in Table 1.9 below:

Table 1.9. Summary of silty sand with gravel fill layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)
	Top	Bottom		
19-MAH-14	240.1	239.7	0.1	0.5

The composition of this layer consists of silt, sand and gravel. The material is light brown to brown in color and wet. From site investigation, during drilling and sampling, relative density for this part of the layer matrix was assessed to be loose to compact compactness condition.

Laboratory testing performed on one sample consisted of moisture content and grain size distribution tests. The test results are as follow:

Moisture Content:

- 36%

Grain Size Distribution:

- 21% gravel
- 60% sand
- 19% silt and clay

The results of the moisture content and grain size distribution tests are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution test are also provided on Figure 5 in Appendix D.

#### 1.4.4.3 Sandy Peat

A native sandy peat deposit was encountered below the rootmat/peat layer in borehole 19-MAH-15. The approximate elevations of the surface and base of the deposit and the thickness of the deposit as encountered in boreholes are summarized in Table 1.10 below:

Table 1.10. Summary of sandy peat deposit

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)
	Top	Bottom		
19-MAH-15	238.2	237.4	0.7	0.7

The composition of this layer consists of peat and sand. The material is dark brown in color and wet. From site investigation, during drilling and sampling, relative density for this part of the layer matrix was assessed to be soft in consistency.

Laboratory testing performed on selected samples consisted of moisture content tests. The test results indicate that natural moisture content of this material is about 40%. The results of the moisture content tests are provided on the record of borehole sheets in Appendix C.

#### 1.4.4.4 Sandy Clayey Silt

A native sandy clayey silt deposit was encountered below the sandy peat deposit in 19-MAH-15, and was terminated within this layer due to auger refusal. The approximate elevations of the surface and base of the deposit and the thickness of the deposit as encountered in boreholes are summarized in Table 1.11 below:

Table 1.11. Summary of sandy clayey silt deposit

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)
	Top	Bottom		
19-MAH-15	237.4	236.6	1.4	0.9

The composition of this layer consists of sand, silt and clay. The material is light grey in color and wet. From site investigation, during drilling and sampling, relative density for this part of the layer matrix suggests firm in consistency.

Laboratory testing performed on selected samples consisted of moisture content, grain size distribution and Atterberg Limits tests. The test results are as follows:

Moisture Content:

- 21%

Grain Size Distribution:

- 2% gravel;
- 27% sand;
- 55% silt; and
- 16% clay;

Atterberg Limits:

- Liquid Limit: 20%;
- Plastic Limit: 12%; and
- Plasticity Index: 8%

The results of the moisture content, grain size distribution and Atterberg Limits tests are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution and Atterberg Limit tests are also provided on Figures 6 and 9, respectively in Appendix D.

### 1.4.5 Section E (Station 17+550 to Station 17+825)

The subsurface conditions within the footprint (250 m by 150 m) of the proposed rock surplus management area located east of Hwy 17 between Station 17+550 and 17+825 consist of a surficial layer of rootmat/peat underlain by silt, silty gravel with sand followed by silty sand. Auger refusals were encountered at the depths of 0.2 m to 1.2 m in all boreholes except in boreholes located at the south-east boundary of the proposed area. In that area a 2 m thick layer of soft peat was encountered above the underlying refusal in borehole 19-RS-04. In borehole 19-RS-05 a layer of soft compressible peat was encountered to the explored depth of 4.5 m which was the limitation of the hand auger. Outcrops were observed throughout the proposed area. A detailed description of the subsurface conditions encountered for rock surplus management of the Hwy 17 within Section E is discussed further in subsequent sections. It should be noted that the following sections are based on the geotechnical investigation conducted by **exp**.

#### 1.4.5.1 Rootmat/Peat

Rootmat/peat was encountered at the surface of boreholes 19-RS-1 to 19-RS-6, 19-RS-10 to 19-RS-13 and 19-RS-15A. The thickness of rootmat/peat ranges from 0.1 m to 4.5 m. Boreholes 19-RS-1 to 19-RS-5, 19-RS-12, 19-RS-13 and 19-RS-15A was terminated within this layer due to auger refusal.

The composition of this layer consists of roots and rootlets. The material is brown/dark brown to black in color, wet and soft. Peat in borehole 19-RS-13 was fibrous with very strong sulphur odors and charcoal bits were found in upper 0.4 m; peat in borehole 19-RS-6 was also fibrous, but in borehole 19-RS-5, it was spongy and green in colour for upper 0.2 m.

Laboratory testing performed on selected samples consisted of moisture content tests. The test results indicate that natural moisture content of this material ranges from 79% to 389%. The results of the moisture content tests are provided on the record of borehole sheets in Appendix C.

#### 1.4.5.2 Silt

Silt was encountered below the rootmat/peat in borehole 19-RS-10. The approximate elevations of the surface and base of deposit and the thickness of deposit as encountered in boreholes are summarized in Table 1.12 below:

Table 1.12. Summary of silt layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)
	Top	Bottom		
19-RS-10	314.6	314.5	0.1	0.1

The composition of this layer consists of silt, some sand and trace gravel. The material is grey in color and moist to wet. From site investigation, during drilling and sampling, relative density for this part of the layer matrix was assessed to be compact compactness condition.

Laboratory testing performed on one sample of moisture content test. The test result indicate that natural moisture content of this material is about 30%. The results of the moisture content test is provided on the record of borehole sheets in Appendix C.

#### 1.4.5.3 Silty Gravel with Sand

A native silty gravel with sand deposit was encountered below the rootmat layer in borehole 19-RS-11, and was terminated within this layer due to auger refusal. The approximate elevations of the surface and base of the deposit and the thickness of the deposit as encountered in boreholes are summarized in Table 1.13 below:

Table 1.13. Summary of silty gravel with sand deposit

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)
	Top	Bottom		
19-RS-11	309.7	309.5	0.2	0.2

The composition of this layer consists of silt, gravel, sand and some cobbles. The material is brown to grey in color and wet. From site investigation, during drilling and sampling, relative density for this part of the layer matrix was assessed to be compact compactness condition.

Laboratory testing performed on selected samples consisted of moisture content and grain size distribution tests. The test results are as follows:

Moisture Content:

- 20%

Grain Size Distribution:

- 44% gravel
- 32% sand
- 24% silt and clay

The results of the moisture content and grain size distribution tests are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution tests are also provided on Figure 7 in Appendix D.

#### 1.4.5.4 Silty Sand

A native silty sand deposit was encountered below the peat deposit in 19-RS-6 and below silt deposit in 19-RS-10, and both the boreholes were terminated within this layer due to auger refusal. The approximate elevations of the surface and base of the deposit and the thickness of the deposit as encountered in boreholes are summarized in Table 1.14 below:

Table 1.14. Summary of silty sand deposit

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)
	Top	Bottom		
19-RS-6	313.6	313.2	0.3	0.4
19-RS-10	314.5	314.0	0.1	0.5

The composition of this layer consists of sand, silt and occasional cobbles and boulders. The material is light brown/rusty brown to brown in color and moist to wet. From site investigation, during drilling and sampling, relative density for this part of the layer matrix was assessed to be compact compactness condition.

Laboratory testing performed on selected samples consisted of moisture content, grain size distribution and Atterberg Limits tests. The test results are as follows:

Moisture Content:

- 27% to 45%

Grain Size Distribution:

- 4% to 9% gravel
- 58% to 68% sand
- 24% to 36% silt and clay

The results of the moisture content and grain size distribution tests are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution tests are also provided on Figure 8 in Appendix D.

#### 1.4.5.5 Bedrock

Outcrops were encountered at the ground surface at the locations of boreholes 19-RS-7 to 19-RS-9, 19-RS-14 and 19-RS-15. Photographs in Appendix A show the details of the site and this information is also provided on the record of borehole sheets in Appendix C.

## 1.5 Groundwater Conditions

Information regarding groundwater levels at the sites was obtained by measuring water levels in the open holes of all boreholes after completion of drilling. The groundwater levels measured in the boreholes are shown on Table 1.15 and on the borehole logs. Water levels measured in open boreholes might not be stabilized due to the relatively short period of observation.

Table 1.15. Groundwater data

Site	Borehole	Date Completed and Measured	Ground Surface Elevation (m)	Groundwater Elevation (m)	Groundwater Depth (m)
Section A	19-MAH-1	6/6/2019	262.0	Dry in open hole	
	19-MAH-2	6/6/2019	260.9	Dry in open hole	
	19-MAH-3	6/6/2019	255.9	255.8	0.1
	19-MAH-3A	6/6/2019	255.9	255.8	0.1
	19-MAH-3B	6/6/2019	255.9	255.8	0.1
Section B	19-MAH-4	6/6/2019	314.8	Not Measured <sup>1</sup>	
	19-MAH-5	6/6/2019	319.8	Not Measured <sup>1</sup>	
	19-MAH-6	6/6/2019	324.5	Not Measured <sup>1</sup>	
Section C	19-MAH-7	6/6/2019	300.4	Not Measured <sup>1</sup>	
	19-MAH-8	6/6/2019	292.4	Dry in open hole	
	19-MAH-9	6/6/2019	282.9	Dry in open hole	
	19-MAH-10	6/6/2019	279.0	Dry in open hole	
	19-MAH-11	6/6/2019	279.8	279.5	0.3
	19-MAH-12	6/6/2019	282.8	Dry in open hole	
	19-MAH-13	6/6/2019	285.2	Dry in open hole	
Section D	19-MAH-14	6/7/2019	240.2	239.95	0.25
	19-MAH-15	6/7/2019	238.8	238.8	0.0
	19-MAH-16	6/7/2019	238.9	239.05	-0.15
Section E	19-RS-1	6/7/2019	311.24	Dry in open hole	
	19-RS-2	6/7/2019	310.18	Dry in open hole	
	19-RS-3	6/7/2019	309.90	309.5	0.4
	19-RS-4	6/7/2019	310.16	Dry in open hole	
	19-RS-5	6/7/2019	309.64	309.64	0.0
	19-RS-6	6/7/2019	313.82	313.37	0.45
	19-RS-7	6/7/2019	313.83	Not Measured <sup>1</sup>	
	19-RS-8	6/7/2019	310.99	Not Measured <sup>1</sup>	
	19-RS-9	6/7/2019	317.00	Not Measured <sup>1</sup>	
	19-RS-10	6/7/2019	314.61	Dry in open hole	
	19-RS-11	6/7/2019	309.83	Dry in open hole	
	19-RS-12	6/7/2019	308.34	Dry in open hole	
	19-RS-13	6/7/2019	307.05	306.9	0.15
	19-RS-14	6/7/2019	313.06	Not Measured <sup>1</sup>	
	19-RS-15	6/7/2019	311.36	Not Measured <sup>1</sup>	
19-RS-15A	6/7/2019	311.36	311.36	0.0	

Notes:

<sup>1</sup>Since rockfill/bedrock was found on ground surface, groundwater levels at these holes could not be measured at the time of drilling operations.

Seasonal variations in the water tables should be expected, with higher levels occurring during wetter periods of the year and lower levels during drier periods.

## 2 CLOSURE

A subsurface investigation is a limited sampling of a site; the subsurface conditions have been established only at the test hole locations. Should conditions at the site be encountered which differ from those reported at the test locations, we require that we be notified immediately in order to assess this additional information and our recommendations, as appropriate. It may then be necessary to perform additional investigation and analysis.

Contractors bidding on or undertaking any proposed work at this site should, relative to the subsurface conditions, decide on their own investigations, if deemed necessary, as well as their own interpretations of the factual results provided herein, so they may draw their own conclusions as to how the subsurface conditions may affect them.

This Foundation Investigation and Design Report has been prepared by Ms. Sugitha Anandakumar, M.Eng., EIT and Dr. Silvana Micic, P.Eng. It was reviewed by Mr. TaeChul Kim, M.E.Sc., P.Eng. and by Mr. Stan E. Gonsalves, M.Eng., P.Eng., Designated MTO Foundation Contact. The field investigation was supervised by Mr. Elwin Farkas.

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## **LIMITATIONS AND USE OF REPORT**

### **BASIS OF REPORT**

*This report ("Report") is based on site conditions known or inferred by the geotechnical investigation undertaken as of the date of the Report. Should changes occur which potentially impact the geotechnical condition of the site, or if construction is implemented more than one year following the date of the Report, the recommendations of exp may require re-evaluation.*

*The Report is provided solely for the guidance of design engineers and on the assumption that the design will be in accordance with applicable codes and standards. Any changes in the design features which potentially impact the geotechnical analyses or issues concerning the geotechnical aspects of applicable codes and standards will necessitate a review of the design by exp. Additional field work and reporting may also be required.*

*Where applicable, recommended field services are the minimum necessary to ascertain that construction is being carried out in general conformity with building code guidelines, generally accepted practices and exp's recommendations. Any reduction in the level of services recommended will result in exp providing qualified opinions regarding the adequacy of the work. exp can assist design professionals or contractors retained by the Client to review applicable plans, drawings, and specifications as they relate to the Report or to conduct field reviews during construction.*

*Contractors contemplating work on the site are responsible for conducting an independent investigation and interpretation of the borehole results contained in the Report. The number of boreholes necessary to determine the localized underground conditions as they impact construction costs, techniques, sequencing, equipment and scheduling may be greater than those carried out for the purpose of the Report.*

*Classification and identification of soils, rocks, geological units, contaminant materials, building envelopment assessments, and engineering estimates are based on investigations performed in accordance with the standard of care set out below and require the exercise of judgment. As a result, even comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations or building envelope descriptions involve an inherent risk that some conditions will not be detected. All documents or records summarizing investigations are based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated. Some conditions are subject to change over time. The Report presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, these should be disclosed to exp to allow for additional or special investigations to be undertaken not otherwise within the scope of investigation conducted for the purpose of the Report.*

### **RELIANCE ON INFORMATION PROVIDED**

*The evaluation and conclusions contained in the Report are based on conditions in evidence at the time of site inspections and information provided to exp by the Client and others. The Report has been prepared for the specific site, development, building, design or building assessment objectives and purpose as communicated by the Client. exp has relied in good faith upon such representations, information and instructions and accepts no responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of any misstatements, omissions, misrepresentation or fraudulent acts of persons providing information. Unless specifically stated otherwise, the applicability and reliability of the findings, recommendations, suggestions or opinions expressed in the Report are*

*only valid to the extent that there has been no material alteration to or variation from any of the information provided to exp.*

#### **STANDARD OF CARE**

*The Report has been prepared in a manner consistent with the degree of care and skill exercised by engineering consultants currently practicing under similar circumstances and locale. No other warranty, expressed or implied, is made. Unless specifically stated otherwise, the Report does not contain environmental consulting advice.*

#### **COMPLETE REPORT**

*All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment form part of the Report. This material includes, but is not limited to, the terms of reference given to exp by its client ("Client"), communications between exp and the Client, other reports, proposals or documents prepared by exp for the Client in connection with the site described in the Report. In order to properly understand the suggestions, recommendations and opinions expressed in the Report, reference must be made to the Report in its entirety. exp is not responsible for use by any party of portions of the Report.*

#### **USE OF REPORT**

*The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. No other party may use or rely upon the Report in whole or in part without the written consent of exp. Any use of the Report, or any portion of the Report, by a third party are the sole responsibility of such third party. exp is not responsible for damages suffered by any third party resulting from unauthorised use of the Report.*

#### **REPORT FORMAT**

*Where exp has submitted both electronic file and a hard copy of the Report, or any document forming part of the Report, only the signed and sealed hard copy shall be the original documents for record and working purposes. In the event of a dispute or discrepancy, the hard copy shall govern. Electronic files transmitted by exp have utilize specific software and hardware systems. exp makes no representation about the compatibility of these files with the Client's current or future software and hardware systems. Regardless of format, the documents described herein are exp's instruments of professional service and shall not be altered without the written consent of exp.*

## **Appendix A – Site Photographs**

**SECTION A – From 17+000 to 17+050**



Photo 1. Section A- Old Hwy 17 close to Station 17+000, looking west



Photo 2. Section A- Bedrock close to 19-MAH-2, west bottom of Hwy 17 existing embankment close to Station 17+025, looking west



Photo 3. Section A- Toe of Hwy 17 existing embankment, creek close to Station 17+050, looking east



Photo 4. Section A- Toe of Hwy 17 existing embankment close to Station 17+000, looking west

**SECTION B – From 18+600 to 18+675**



Photo 5. Section B - Toe of Hwy 17 existing embankment, rocky steep slopes close to Station 18+675, looking north



Photo 6. Section B – Overhead powerlines at toe of Hwy 17 existing embankment close to Station 18+650, looking south



Photo 7. Section B –Hwy 17 existing embankment close to Station 18+600 (i.e. rocky base), looking east



Photo 8. Section B – Small creek close to Station 18+650, looking east

**SECTION C – From 19+325 to 19+600**



Photo 9. Section C - Toe of Hwy 17 existing embankment, rocky steep slopes close to Station 19+400, looking east



Photo 10. Section C - Hwy 17, erosion near 19-MAH-9, facing south



Photo 11. Section C - Toe of Hwy 17 existing embankment, possible bedrock near Station 19+325

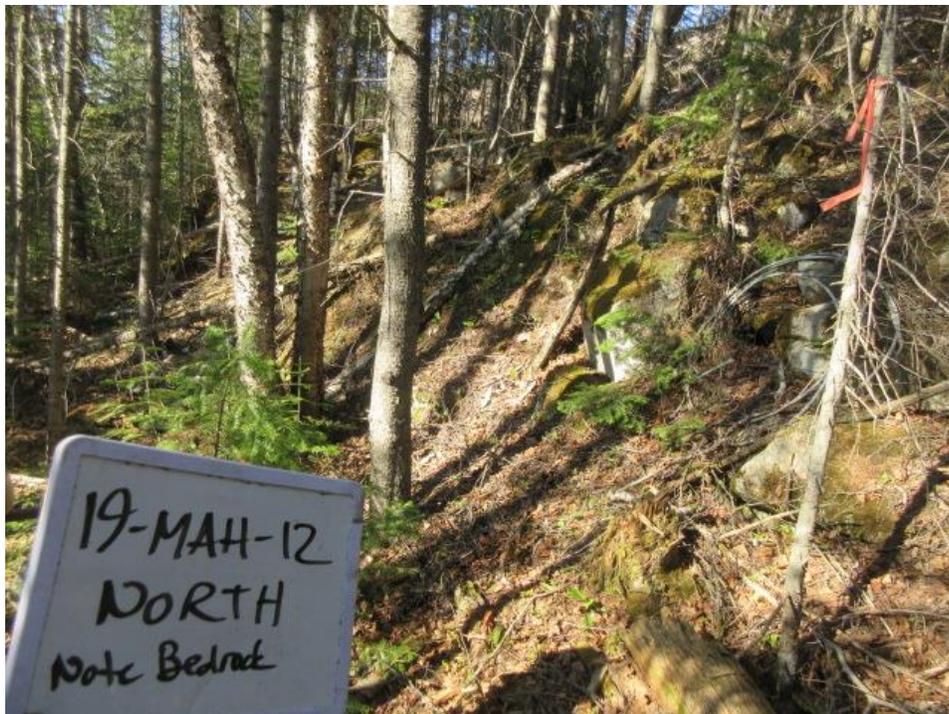


Photo 12. Section C - Toe of Hwy 17 existing embankment, possible bedrock near Station 19+550

**SECTION D – From 20+275 to 20+335**



Photo 13. Section D - Hwy 17, facing south-east



Photo 14. Section D – West of Hwy 17, rocky steep slope



Photo 15. Section D - Toe of Hwy 17 existing embankment, facing south



Photo 16. Section D – Bedrock outcrop close to 19-MAH-16, near Station 20+335, looking west

**SECTION E – From 17+550 to 20+825**



Photo 17. Section E – North-east corner of the proposed rock surplus management area, facing south



Photo 18. Section E – East boundary of the proposed rock surplus management area, bedrock ridge



Photo 19. Section E – South boundary of the proposed surplus management area, looking west



Photo 20. Section E – South-west corner of the proposed rock surplus management area, bedrock outcrop



Photo 21. Section E – South boundary of the proposed rock surplus management area, bedrock knob



Photo 22. Section E – East boundary of the proposed rock surplus management area, outcrop



Photo 23. Section E – South-east corner of the proposed rock surplus management area, bedrock near 19-RS-5



Photo 24. Section E – South boundary of the proposed rock surplus management area, bedrock near 19-RS-10

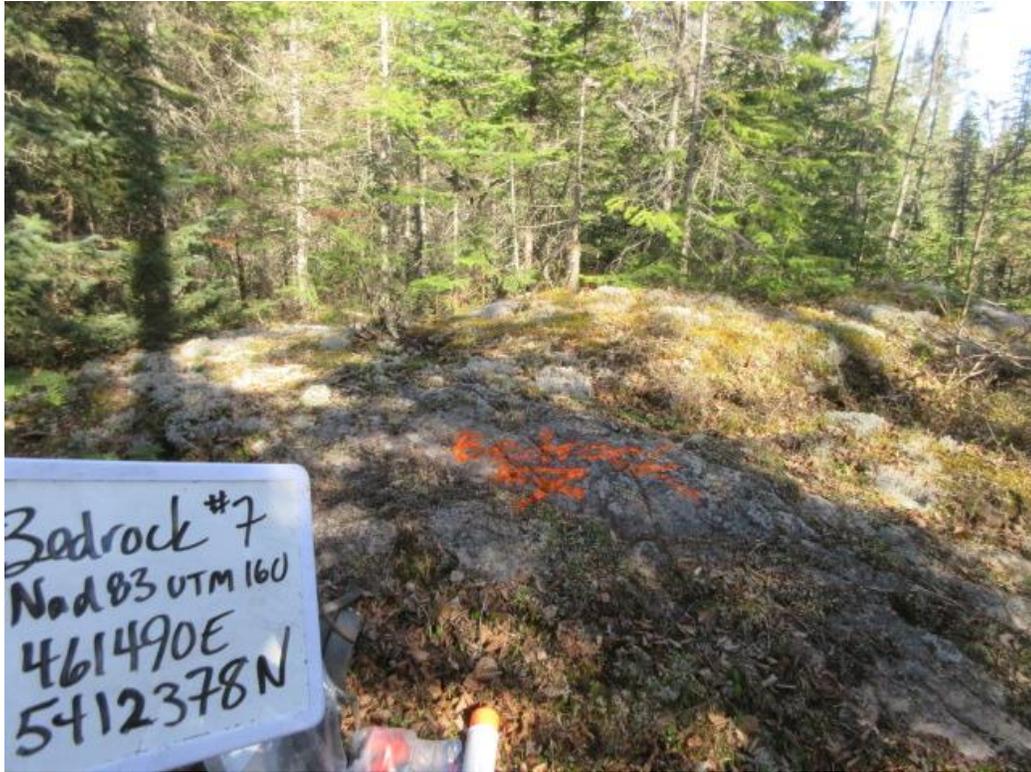
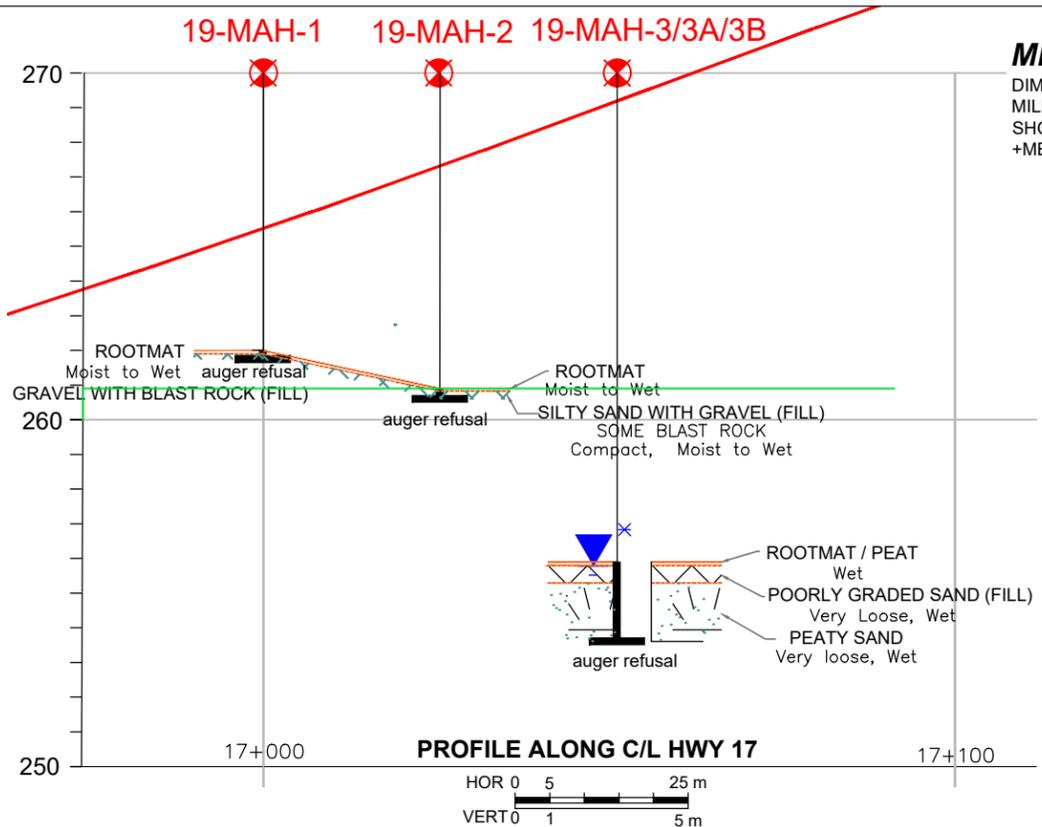
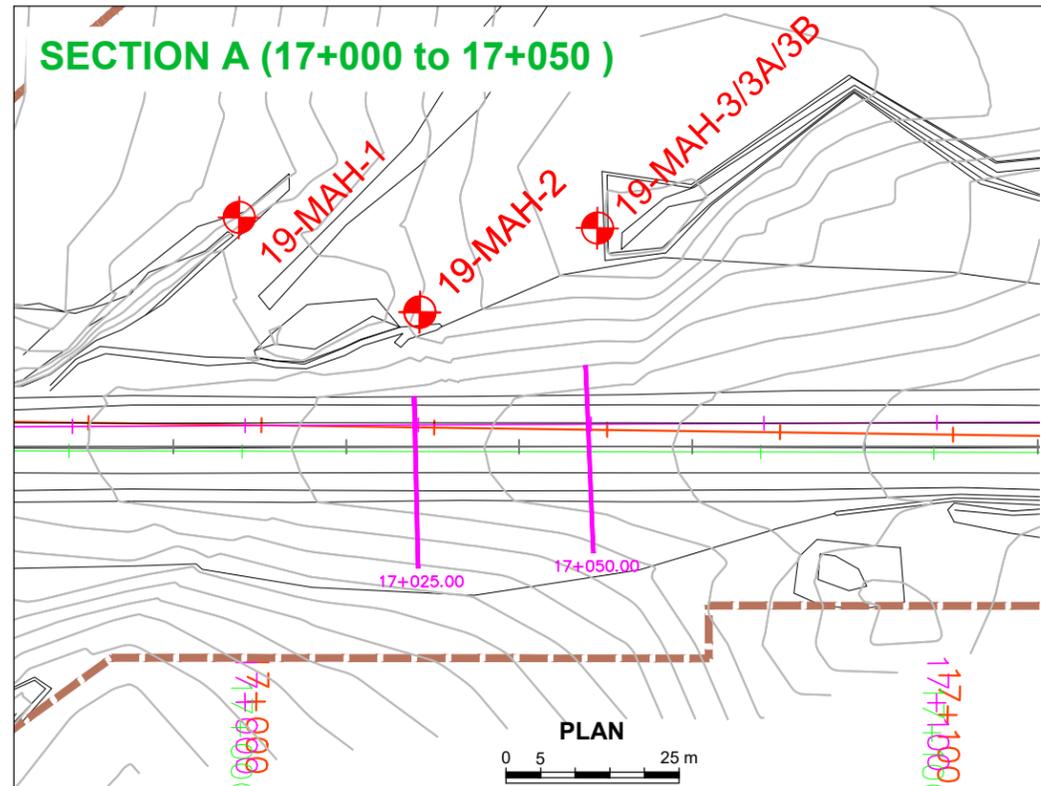


Photo 25. Section E – In the center of the proposed rock surplus management area, bedrock near 19-RS-7

## Appendix B – Drawings

**SECTION A (17+000 to 17+050)**



**METRIC**  
DIMENSIONS ARE IN METERS AND/OR MILLIMETERS UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETERS +METERS

Agreement No. 6017-E-0066  
Assignment No. 5  
WO # 2018-11011

Additional Foundation Engineering Retainer Services for Hwy 17 Widening from Pays Plat River Easterly for 7.2 km. Thunder Bay Area, ON

SHEET 1

**BOREHOLE LOCATION PLAN AND SOIL STRATA SECTION A**

exp **EXP Services Inc.**

KEY PLAN



LEGEND

- Borehole Location
- Standard Penetration Test (Blows/0.3 m)
- Groundwater level measured in open hole

SOIL STRATA SYMBOLS

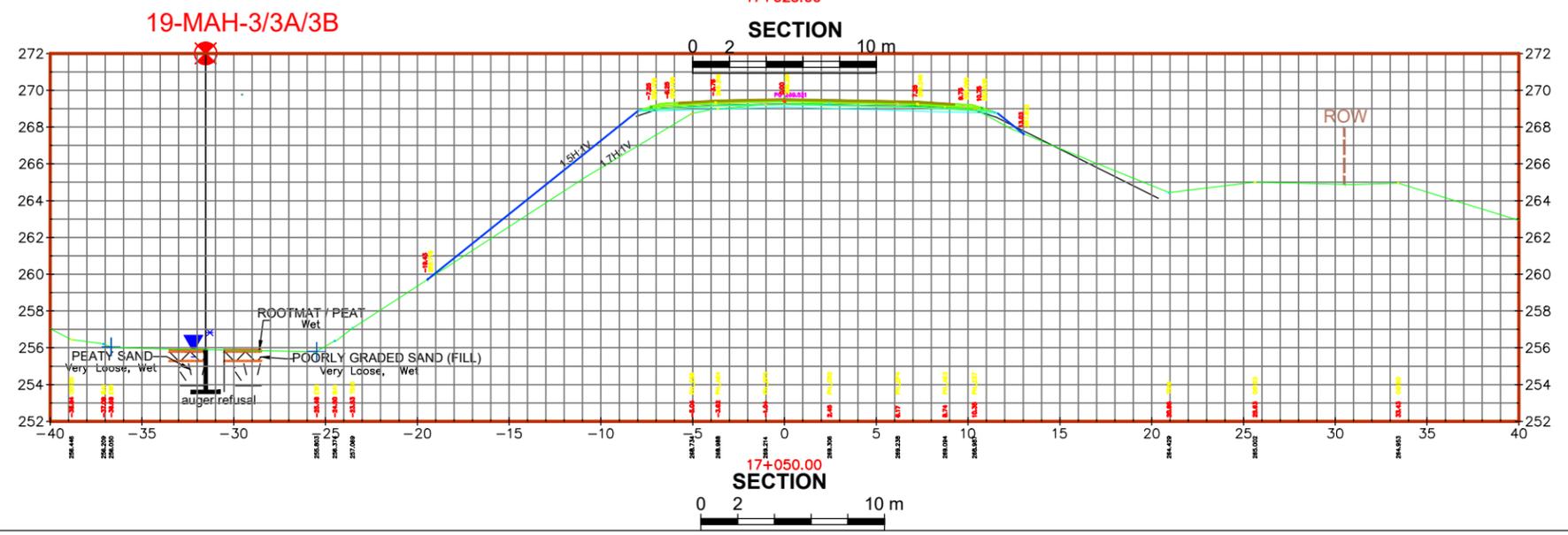
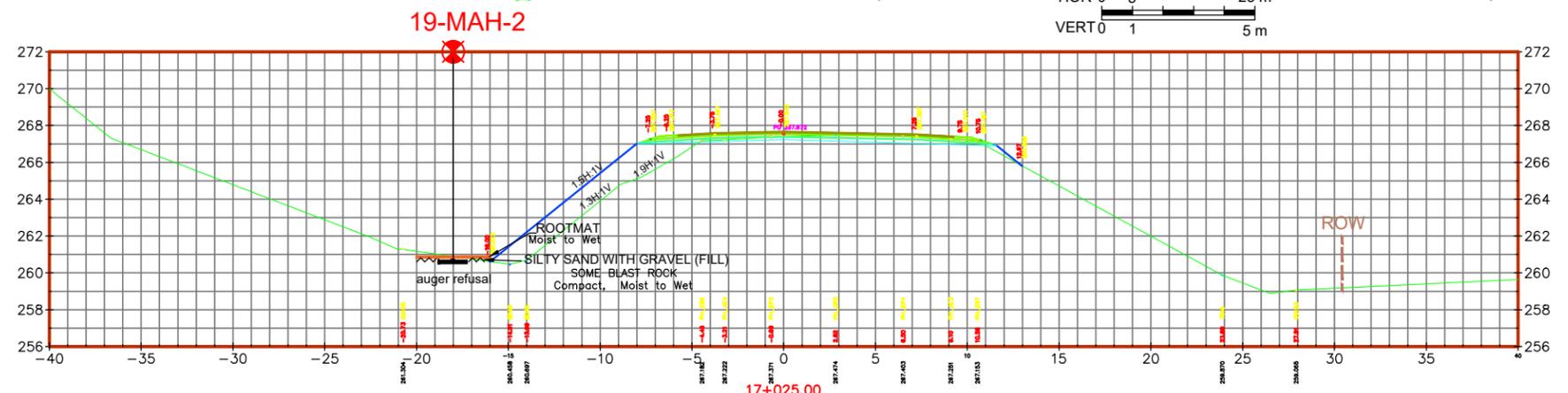
- ROOTMAT/PEAT
- FILL
- PEATY SAND

BH No.	ELEV.	MTM CO-ORDINATES (ZONE ON-14)	
		NORTHING	EASTING
19-MAH-1	262.0	5414599.0	265820.0
19-MAH-2	260.9	5414570.9	265829.1
19-MAH-3/3A	255.9	5414561.7	265855.9

NOTES

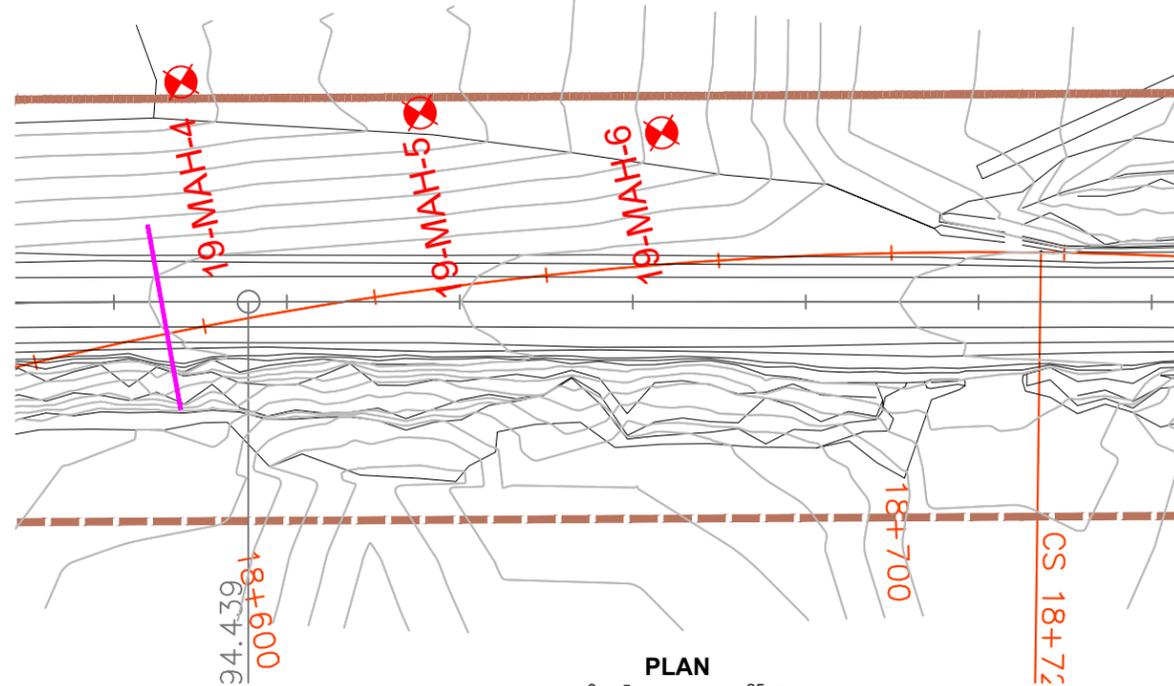
This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents

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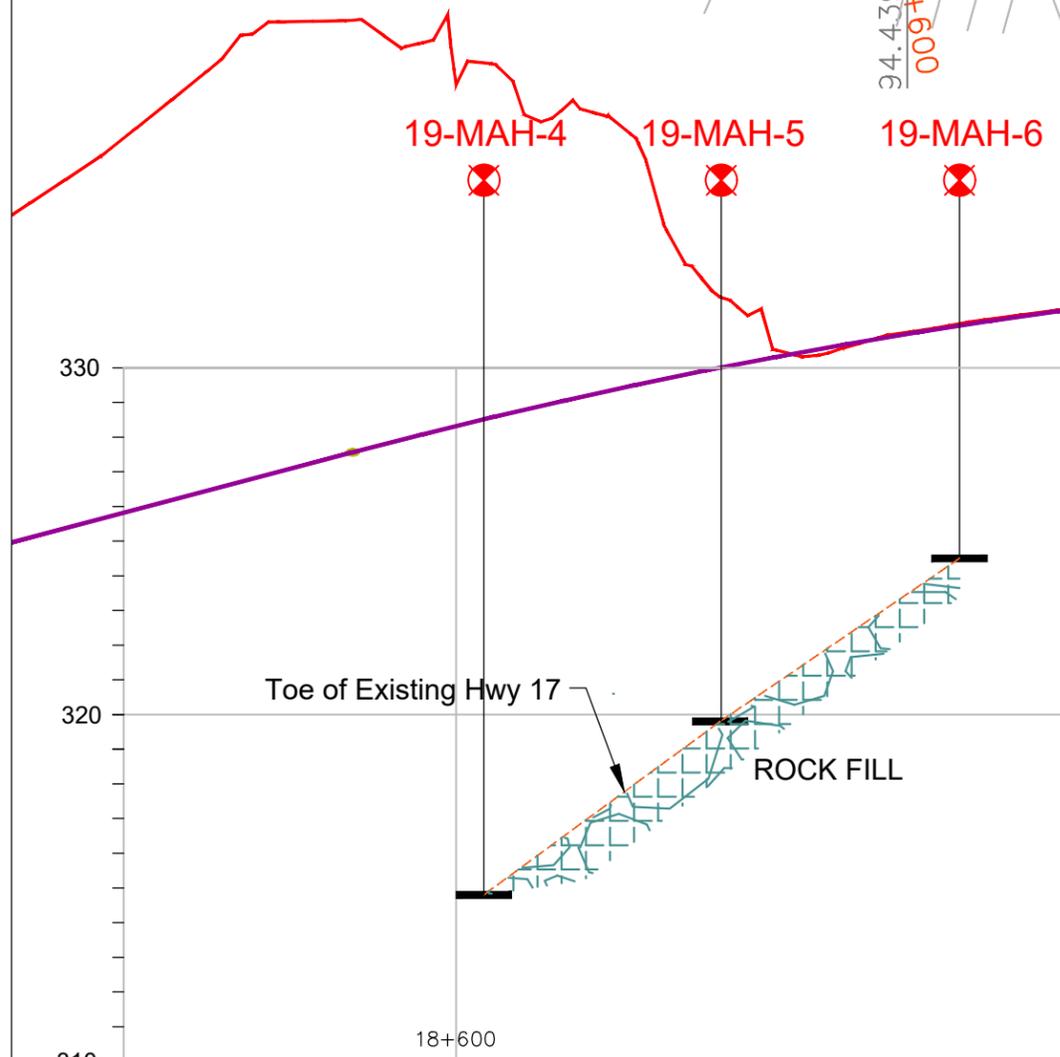


DATE	BY	DESCRIPTION
	SM	SUBMISSION FOR MTO REVIEW
		GEOCRIS NO. 42D-58
		PROJECT NO. ADM-00248798-E0
SUBM'D SH	CHECKED SM	DATE Aug. 29, 19
DRAWN SH	CHECKED SM	APPROVED SG DWG. 1

# SECTION B (18+600 to 18+675)

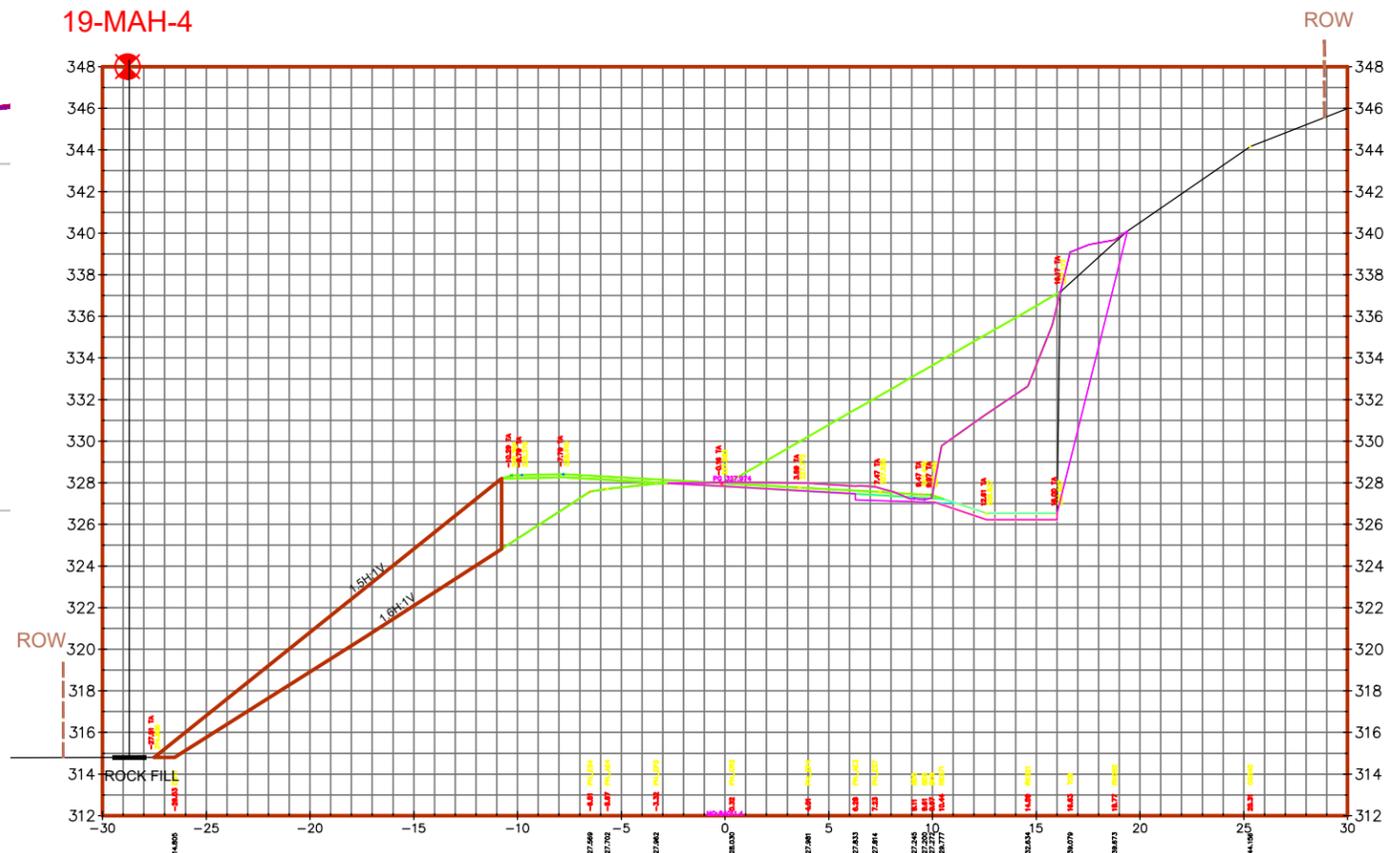


PLAN  
0 5 25 m



PROFILE ALONG C/L HWY 17

HOR 0 5 25 m  
VERT 0 1 5 m



SECTION

0 2 10 m

## METRIC

DIMENSIONS ARE IN METERS AND/OR MILLIMETERS UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETERS +METERS



Agreement No. 6017-E-0066	SHEET 1
Assignment No. 5	
WO #2018-11011	

### BOREHOLE LOCATION PLAN AND SOIL STRATA SECTION B

exp. EXP Services Inc.

#### KEY PLAN



LEGEND

- Borehole Location
- Standard Penetration Test (Blows/0.3 m)
- Groundwater level measured in open hole

#### SOIL STRATA SYMBOLS

	ROCK FILL
--	-----------

BH No.	ELEV.	MTM CO-ORDINATES (ZONE ON-14)	
		NORTHING	EASTING
19-MAH-4	314.8	5413255.9	266674.3
19-MAH-5	319.8	5413222.0	266668.6
19-MAH-6	324.5	5413190.3	266650.6

NOTES

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	SM	SUBMISSION FOR MTO REVIEW
		GEOCRÉS NO. 42D-58
		PROJECT NO. ADM-00248798-EO
SUBM'D SH	CHECKED SM	DATE Aug. 29, 19
DRAWN SH	CHECKED SM	APPROVED SG DWG. 2

**SECTION C (19+325 to 19+600)**

**METRIC**  
DIMENSIONS ARE IN METERS AND/OR MILLIMETERS UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETERS +METERS

Agreement No. 6017-E-0066  
Assignment No. 5  
WO #2018-11011

Additional Foundation Engineering Retainer Services for Hwy 17 Widening from Pays Plat River Easterly for 7.2 km. Thunder Bay Area, ON

SHEET 1

**BOREHOLE LOCATION PLAN AND SOIL STRATA SECTION C**

exp **EXP Services Inc.**

KEY PLAN



**LEGEND**

- Borehole Location
- Standard Penetration Test (Blows/0.3 m)
- Groundwater level measured in open hole

**SOIL STRATA SYMBOLS**

- Rootmat Peat
- Peaty SAND
- FILL

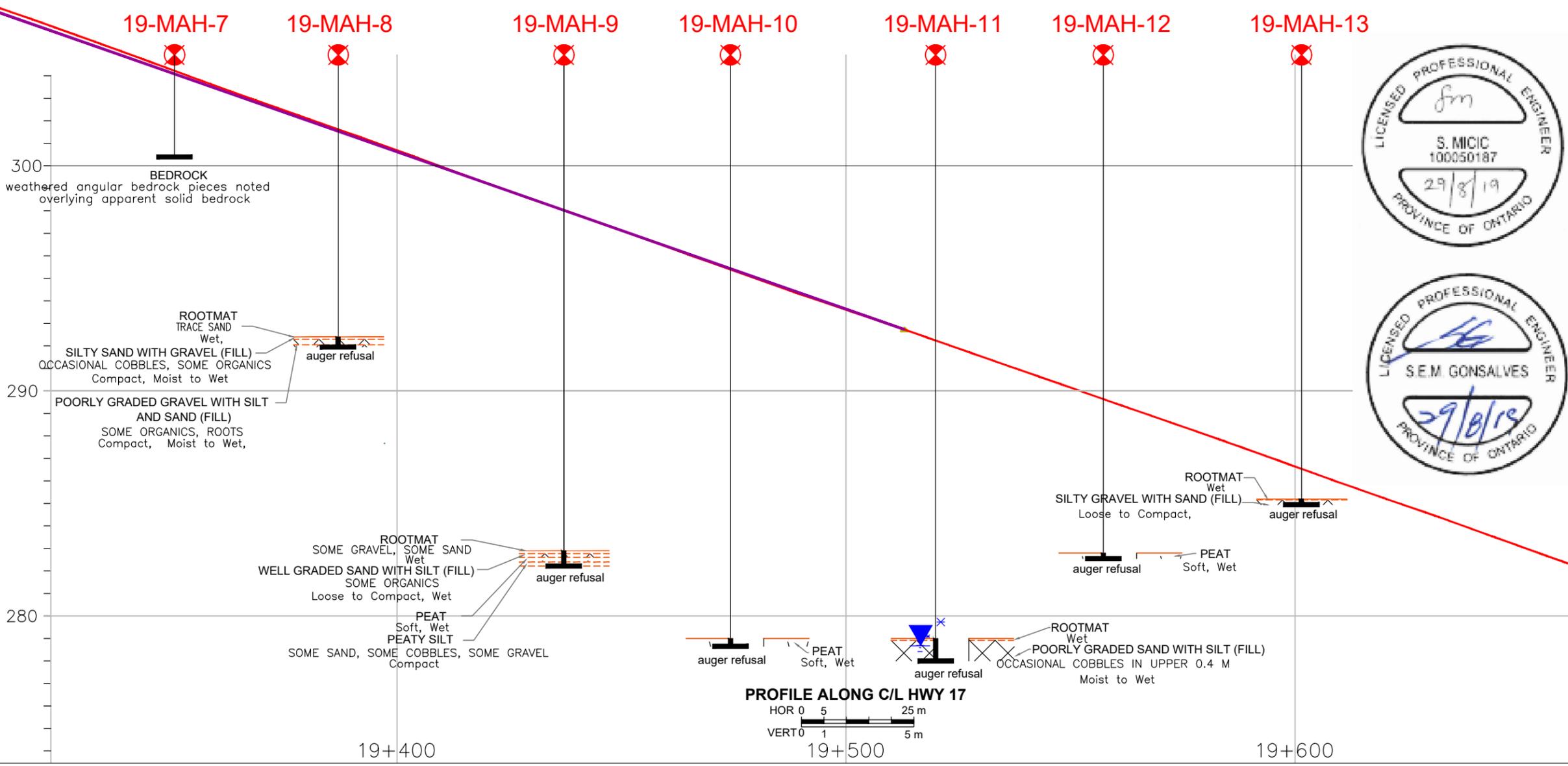
BH No.	ELEV.	MTM CO-ORDINATES (ZONE ON-14)	
		NORTHING	EASTING
19-MAH-7	300.4	5412558.8	266398.8
19-MAH-8	292.4	5412523.5	266388.3
19-MAH-9	282.9	5412473.6	266373.8
19-MAH-10	279.0	5412436.1	266378.3
19-MAH-11	279.8	5412390.4	266377.7
19-MAH-12	282.8	5412352.8	266380.1
19-MAH-13	285.2	5412308.1	266385.6

**NOTES**

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			GEOCREs NO. 42D-58
			PROJECT NO. ADM-00248798-E0
SUBM'D SH	CHECKED SM	DATE	Aug. 29, 19
DRAWN SH	CHECKED SM	APPROVED SG	DWG. 3



# SECTION C (19+325 to 19+600)

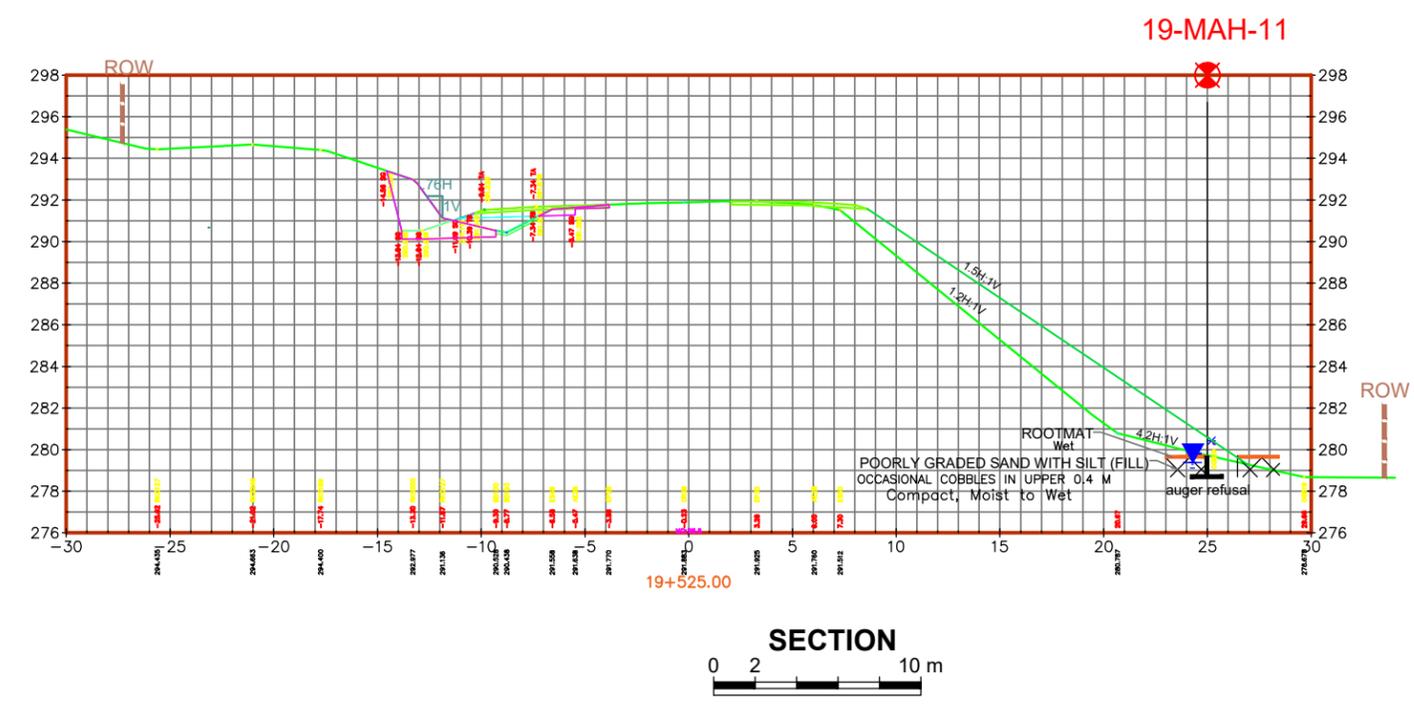
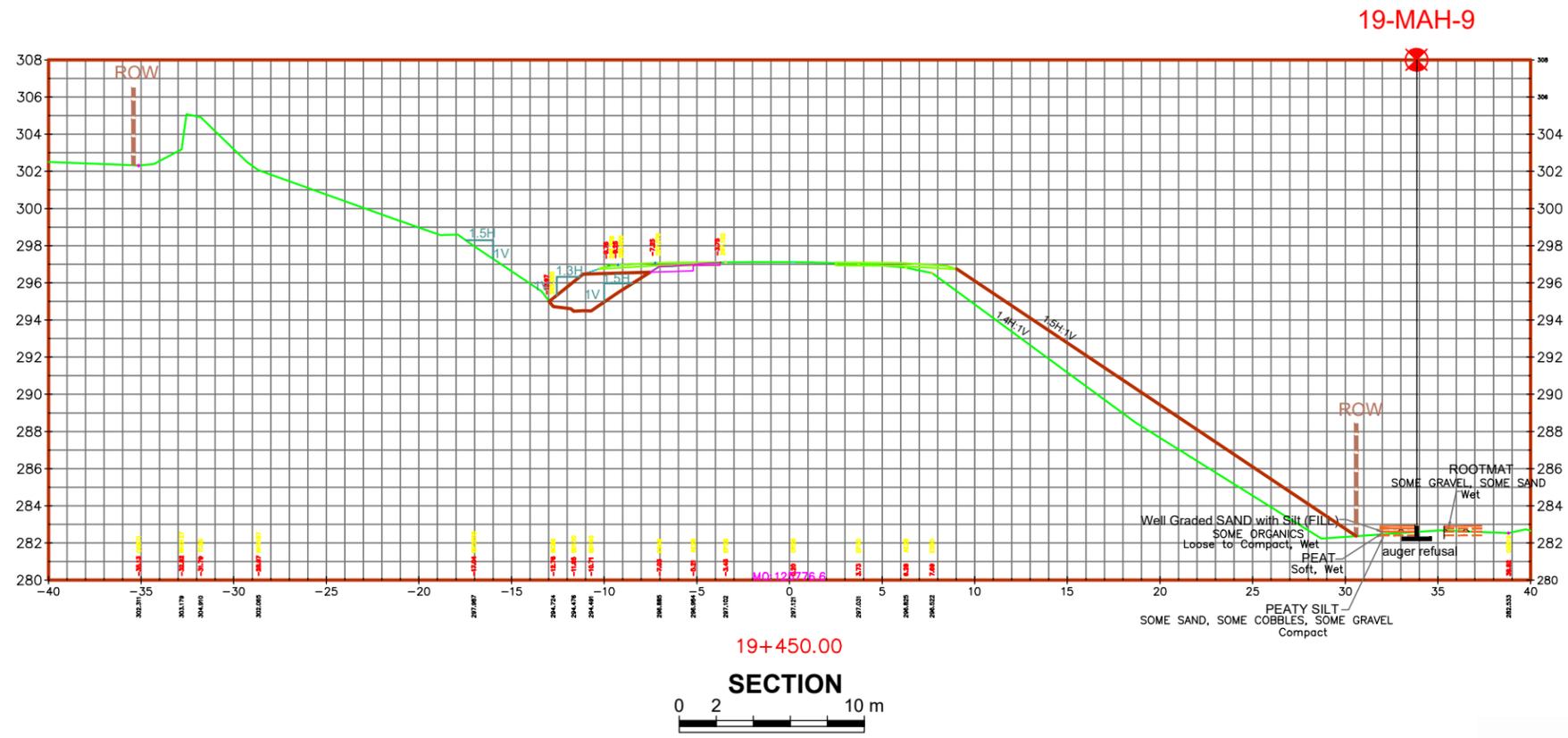
**METRIC**  
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 Assignment No. 5  
 WO #2018-11011

Additional Foundation Engineering Retainer Services for Hwy 17 Widening from Pays Plat River Easterly for 7.2 km. Thunder Bay Area, ON

SHEET 1

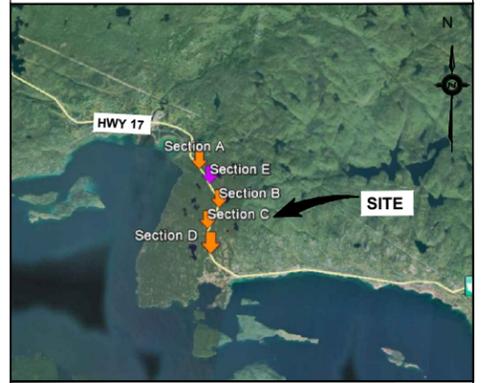
EAST WEST



## BOREHOLE LOCATION PLAN AND SOIL STRATA SECTION C

EXP Services Inc.

### KEY PLAN



### LEGEND

- Borehole Location
- Standard Penetration Test (Blows/0.3 m)
- Groundwater level measured in open hole

### SOIL STRATA SYMBOLS

- Rootmat/Peat
- FILL
- Peaty SAND

BH No.	ELEV.	MTM CO-ORDINATES (ZONE ON-14)	
		NORTHING	EASTING
19-MAH-7	300.4	5412558.8	266398.8
19-MAH-8	292.4	5412523.5	266388.3
19-MAH-9	282.9	5412473.6	266373.8
19-MAH-10	279.0	5412436.1	266378.3
19-MAH-11	279.8	5412390.4	266377.7
19-MAH-12	282.8	5412352.8	266380.1
19-MAH-13	285.2	5412308.1	266385.6

### NOTES

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DATE	SM	DESCRIPTION
	SM	SUBMISSION FOR MTO REVIEW
	SM	GEORES. NO. 42D-58
	SM	PROJECT NO. ADM-00248798-E0
SUBM'D SH	CHECKED SM	DATE Aug. 29, 19
DRAWN SH	CHECKED SM	APPROVED SG DWG. 4

# SECTION D (20+275 to 20+335)

**METRIC**  
 DIMENSIONS ARE IN METERS AND/OR MILLIMETERS UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETERS +METERS

Agreement No. 6017-E-0066  
 Assignment No. 5  
 WO #2018-11011

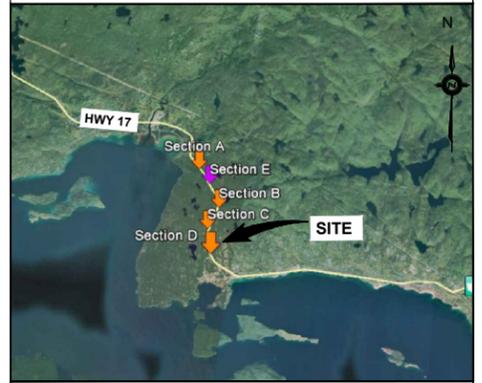
Additional Foundation Engineering Retainer Services for Hwy 17 Widening from Pays Plat River Easterly for 7.2 km. Thunder Bay Area, ON

SHEET 1

## BOREHOLE LOCATION PLAN AND SOIL STRATA SECTION D

EXP Services Inc.

### KEY PLAN



### LEGEND

- Borehole Location
- Standard Penetration Test (Blows/0.3 m)
- Groundwater level measured in open hole

### SOIL STRATA SYMBOLS

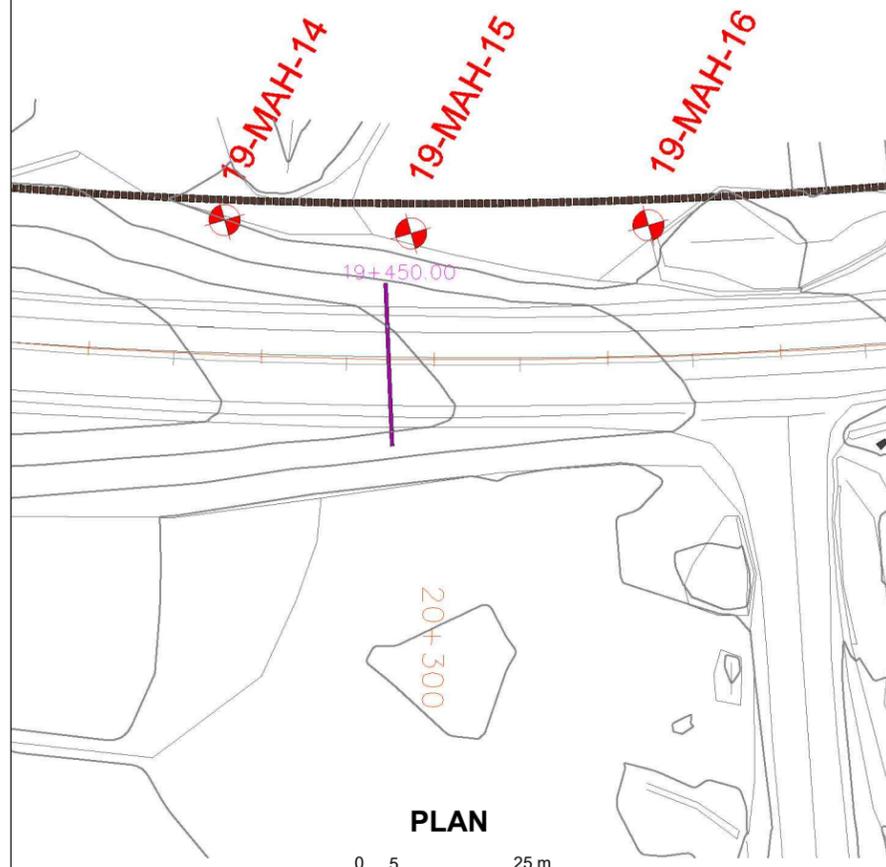
- Rootmat/Peat
- FILL
- Peaty SAND

BH No.	ELEV.	MTM CO-ORDINATES (ZONE ON-14)	
		NORTHING	EASTING
19-MAH-7	300.4	5412558.8	266398.8
19-MAH-8	292.4	5412523.5	266388.3
19-MAH-9	282.9	5412473.6	266373.8
19-MAH-10	279.0	5412436.1	266378.3
19-MAH-11	279.8	5412390.4	266377.7
19-MAH-12	282.8	5412352.8	266380.1
19-MAH-13	285.2	5412308.1	266385.6

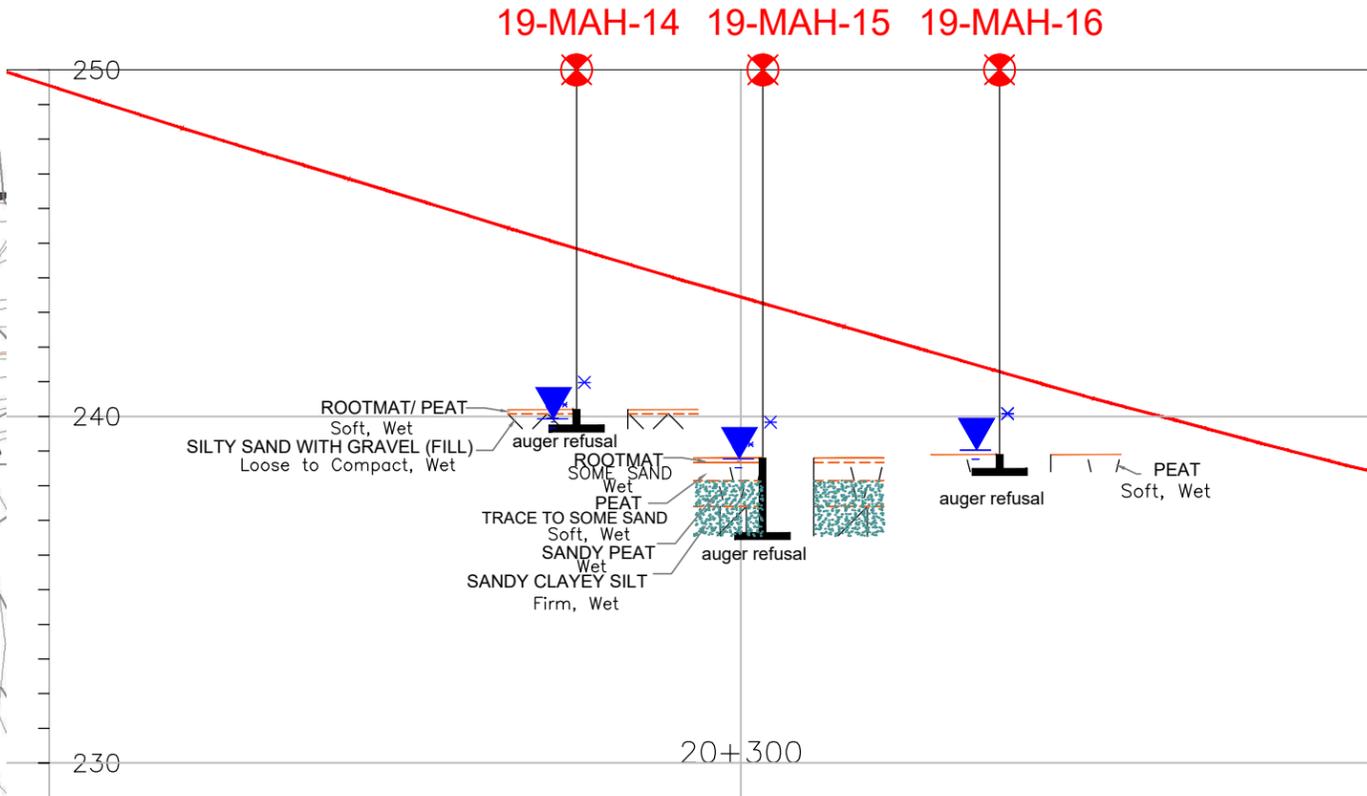
### NOTES

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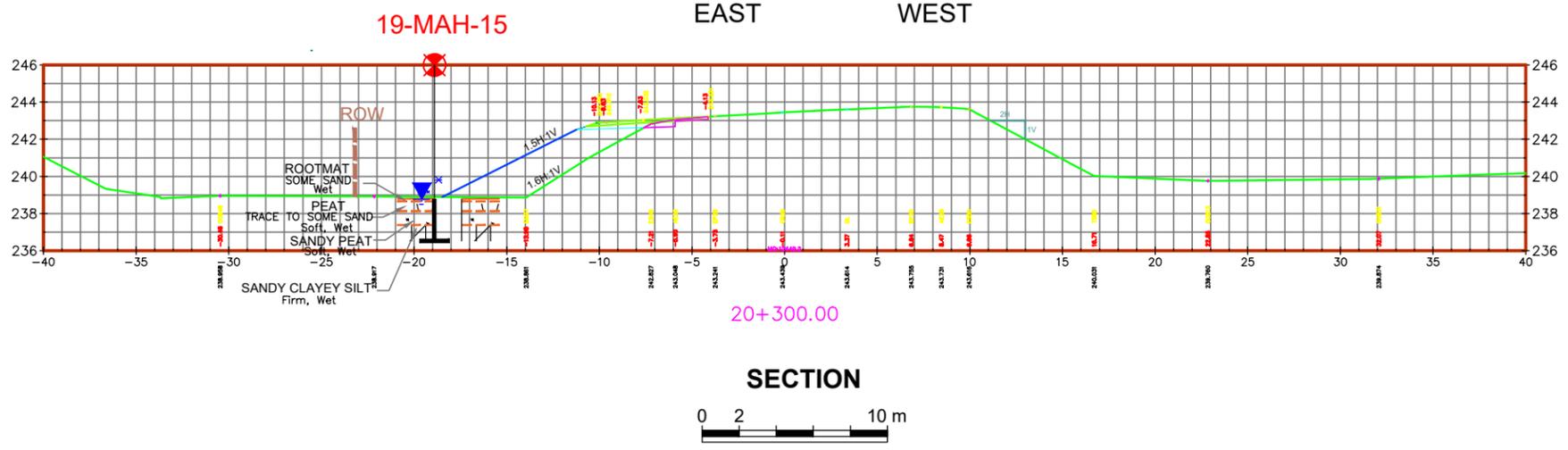
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**PLAN**  
 0 5 25 m



**PROFILE ALONG C/L HWY 17**  
 HOR 0 5 25 m  
 VERT 0 1 5 m



**SECTION**  
 0 2 10 m



DATE	BY	DESCRIPTION
	SM	SUBMISSION FOR MTO REVIEW
		GEOCRETS NO. 42D-58
		PROJECT NO. ADM-00248798-E0
SUBM'D SH	CHECKED SM	DATE Aug. 29, 19
DRAWN SH	CHECKED SM	APPROVED SG DWG. 5

# SECTION E (17+550 to 17+825)

## METRIC

DIMENSIONS ARE IN METERS AND/OR MILLIMETERS UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETERS +METERS

Agreement No. 6017-E-0066  
Assignment No. 5  
WO #2018-11011

Additional Foundation Engineering Retainer Services for Hwy 17 Widening from Pays Plat River Easterly for 7.2 km. Thunder Bay Area, ON

SHEET 1

### BOREHOLE LOCATION PLAN AND SOIL STRATA SECTION E

EXP Services Inc.

#### KEY PLAN

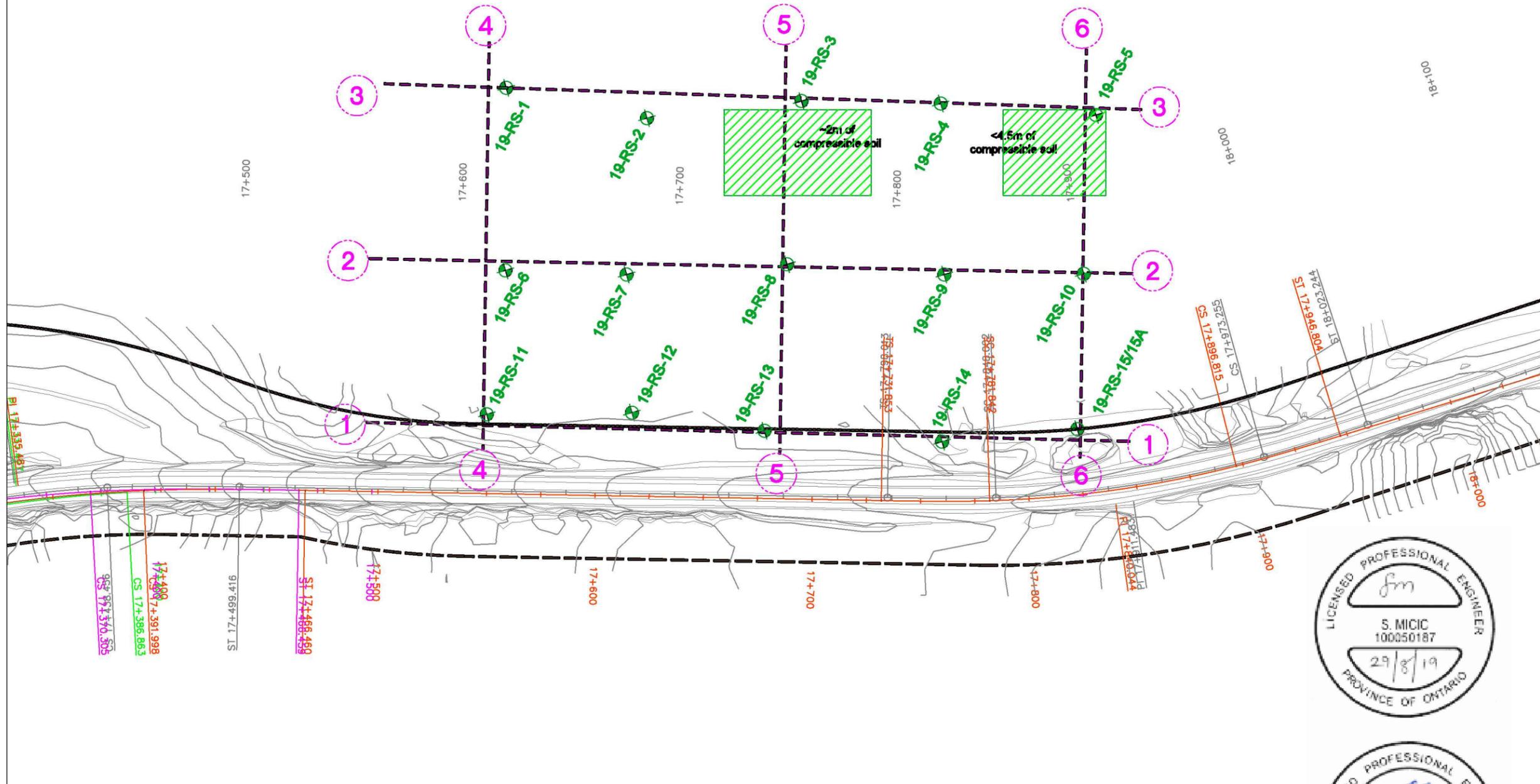


#### LEGEND

- Borehole Location
- N
- Standard Penetration Test (Blows/0.3 m)
- Groundwater level measured in open hole
- Area of special treatment

#### SOIL STRATA SYMBOLS

- Rootmat/ Peat
- Peaty SAND
- FILL



PLAN



BH No.	ELEV.	MTM CO-ORDINATES (ZONE ON-14)	
		NORTHING	EASTING
19-RS-01	311.2	5414229.8	266306.5
19-RS-02	310.2	5414166.6	266326.5
19-RS-03	309.9	5414108.3	266368.1
19-RS-04	310.2	5414051.8	266398.3
19-RS-05	309.6	5413986.7	266428.6
19-RS-06	313.8	5414189.4	266233.6
19-RS-07	313.8	5414139.7	266259.1
19-RS-08	310.0	5414077.6	266299.2
19-RS-09	317.0	5414012.0	266330.5
19-RS-10	314.6	5413956.0	266362.1
19-RS-11	309.8	5414164.7	266171.8
19-RS-12	308.3	5414106.7	266205.1
19-RS-13	307.1	5414049.3	266227.6
19-RS-14	313.1	5413975.5	266263.1
19-RS-15	311.4	5413923.9	266298.5
19-RS-15A	311.4	5413923.9	266298.5

#### NOTES

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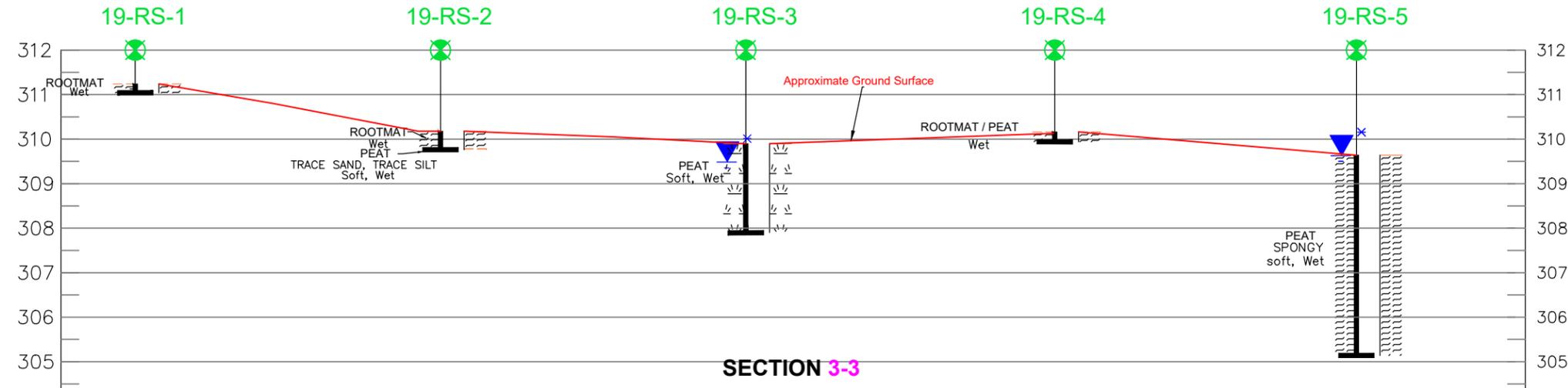
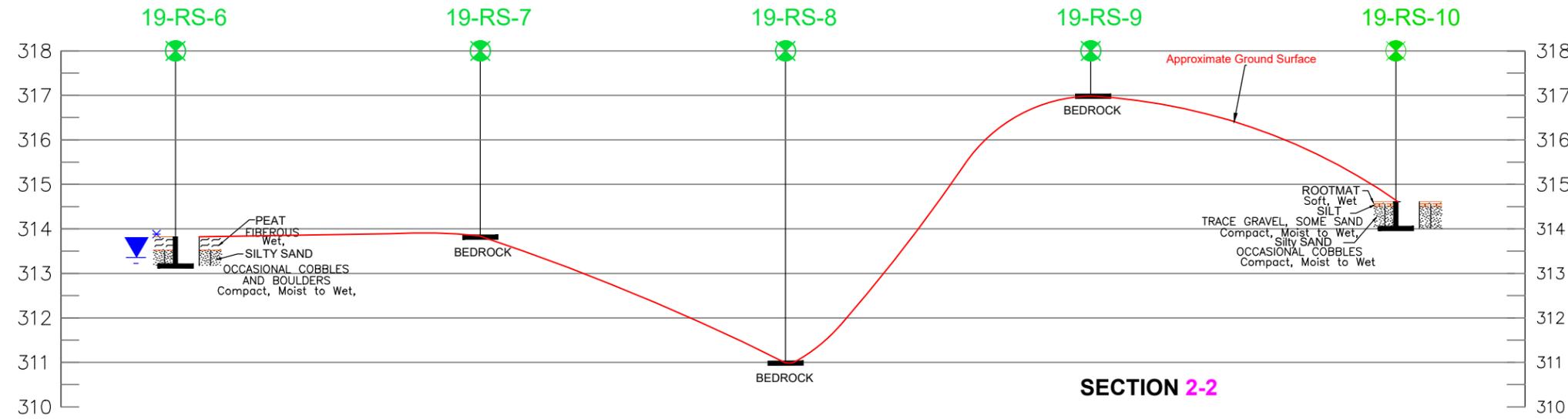
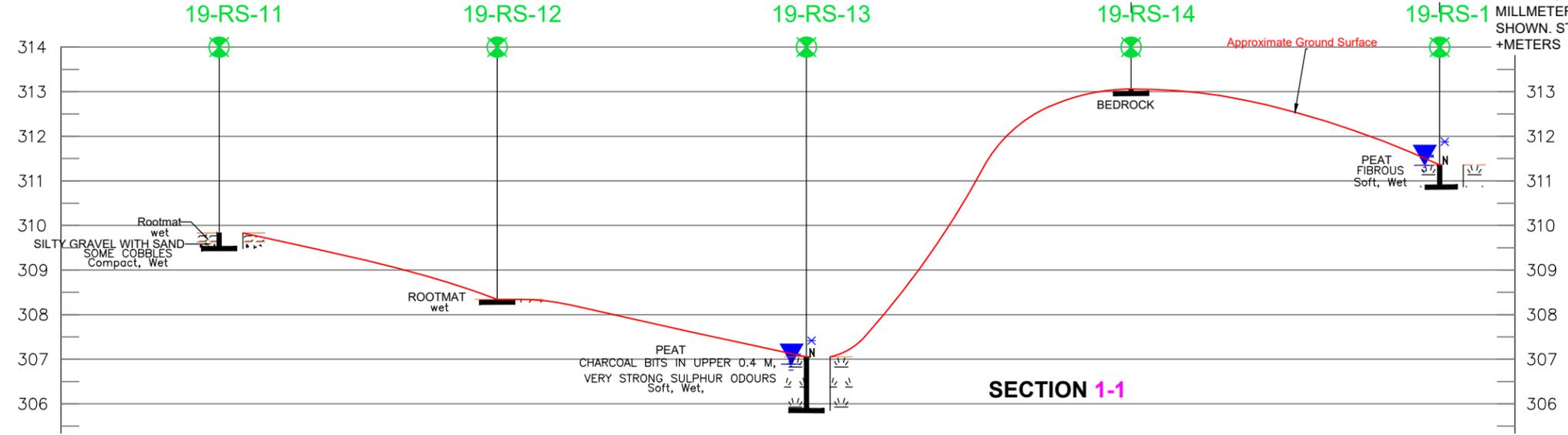
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		PROJECT NO. ADM-00248798-E0
SUBM'D SH	CHECKED SM	DATE Aug. 29, 19
DRAWN SH	CHECKED SM	APPROVED SG DWG. 6

# SECTION E (17+550 to 17+825)

## METRIC

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Agreement No. 6017-E-0066  
Assignment No. 5  
WO #2018-11011

Additional Foundation Engineering Retainer Services for Hwy 17 Widening from Pays Plat River Easterly for 7.2 km. Thunder Bay Area, ON

BOREHOLE LOCATION PLAN AND SOIL STRATA SECTION E



- LEGEND**
- Borehole Location
  - Standard Penetration Test (Blows/0.3 m)
  - Groundwater level measured in open hole

- SOIL STRATA SYMBOLS**
- Rootmat/Peat
  - FILL
  - Peaty SAND

BH No.	ELEV.	MTM CO-ORDINATES (ZONE ON-14)	
		NORTHING	EASTING
19-RS-01	311.2	5414229.8	266306.5
19-RS-02	310.2	5414166.6	266326.5
19-RS-03	309.9	5414108.3	266368.1
19-RS-04	310.2	5414051.8	266398.3
19-RS-05	309.6	5413986.7	266428.6
19-RS-06	313.8	5414189.4	266233.6
19-RS-07	313.8	5414139.7	266259.1
19-RS-08	310.0	5414077.6	266299.2
19-RS-09	317.0	5414012.0	266330.5
19-RS-10	314.6	5413956.0	266362.1
19-RS-11	309.8	5414164.7	266171.8
19-RS-12	308.3	5414106.7	266205.1
19-RS-13	307.1	5414049.3	266227.6
19-RS-14	313.1	5413975.5	266263.1
19-RS-15	311.4	5413923.9	266298.5
19-RS-15A	311.4	5413923.9	266298.5

**NOTES**

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SUBM'DSH	CHECKED SM	DATE	Aug. 29, 19
DRAWN SH	CHECKED SM	APPROVED SG	DWG. 7



# SECTION E (17+550 to 17+825)

## METRIC

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Agreement No. 6017-E-0066  
Assignment No. 5  
WO #2018-11011

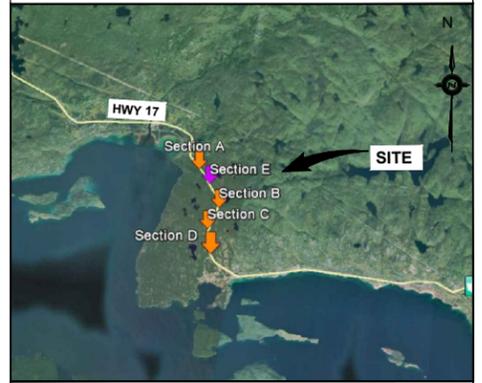
Additional Foundation Engineering Retainer Services for Hwy 17 Widening from Pays Plat River Easterly for 7.2 km. Thunder Bay Area, ON

SHEET 1

### BOREHOLE LOCATION PLAN AND SOIL STRATA SECTION E

EXP Services Inc.

#### KEY PLAN



#### LEGEND

- Borehole Location
- N
- Standard Penetration Test (Blows/0.3 m)
- Groundwater level measured in open hole

#### SOIL STRATA SYMBOLS

- Rootmat/Peat
- FILL
- Peaty SAND

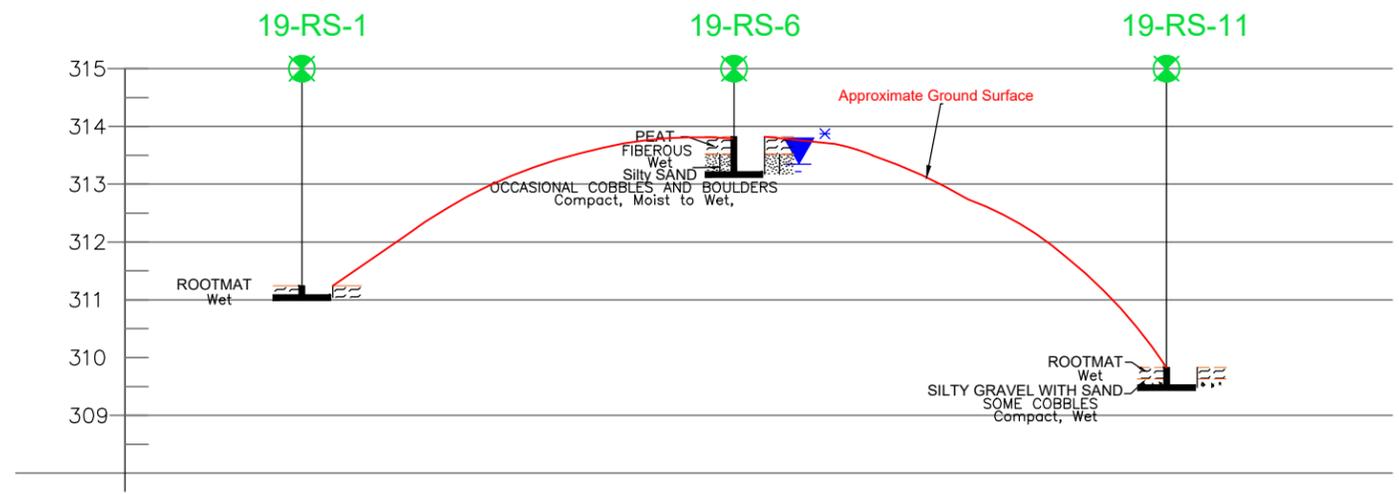
BH No.	ELEV.	MTM CO-ORDINATES (ZONE ON-14)	
		NORTHING	EASTING
19-RS-01	311.2	5414229.8	266306.5
19-RS-02	310.2	5414166.6	266326.5
19-RS-03	309.9	5414108.3	266368.1
19-RS-04	310.2	5414051.8	266398.3
19-RS-05	309.6	5413986.7	266428.6
19-RS-06	313.8	5414189.4	266233.6
19-RS-07	313.8	5414139.7	266259.1
19-RS-08	310.0	5414077.6	266299.2
19-RS-09	317.0	5414012.0	266330.5
19-RS-10	314.6	5413956.0	266362.1
19-RS-11	309.8	5414164.7	266171.8
19-RS-12	308.3	5414106.7	266205.1
19-RS-13	307.1	5414049.3	266227.6
19-RS-14	313.1	5413975.5	266263.1
19-RS-15	311.4	5413923.9	266298.5
19-RS-15A	311.4	5413923.9	266298.5

#### NOTES

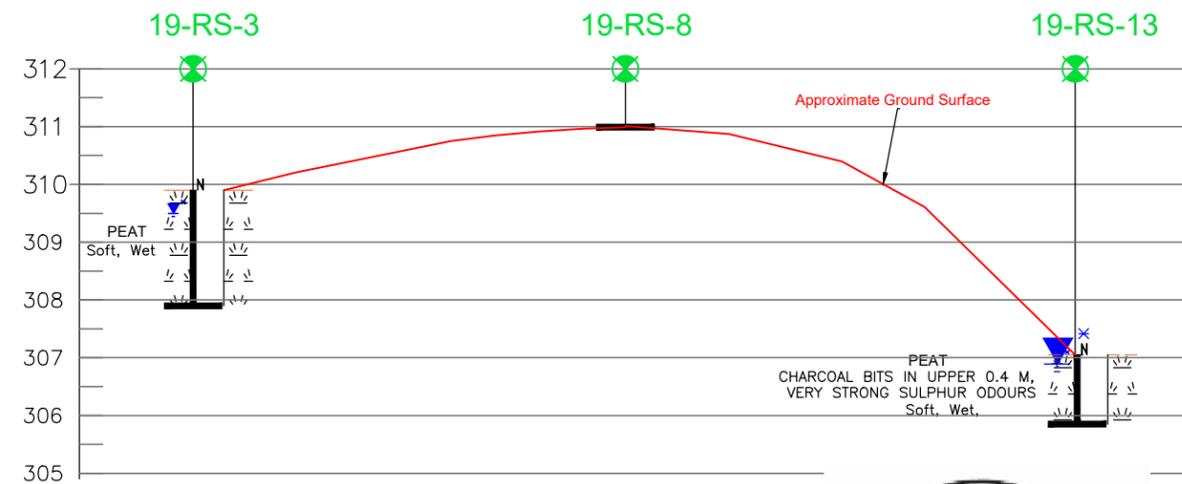
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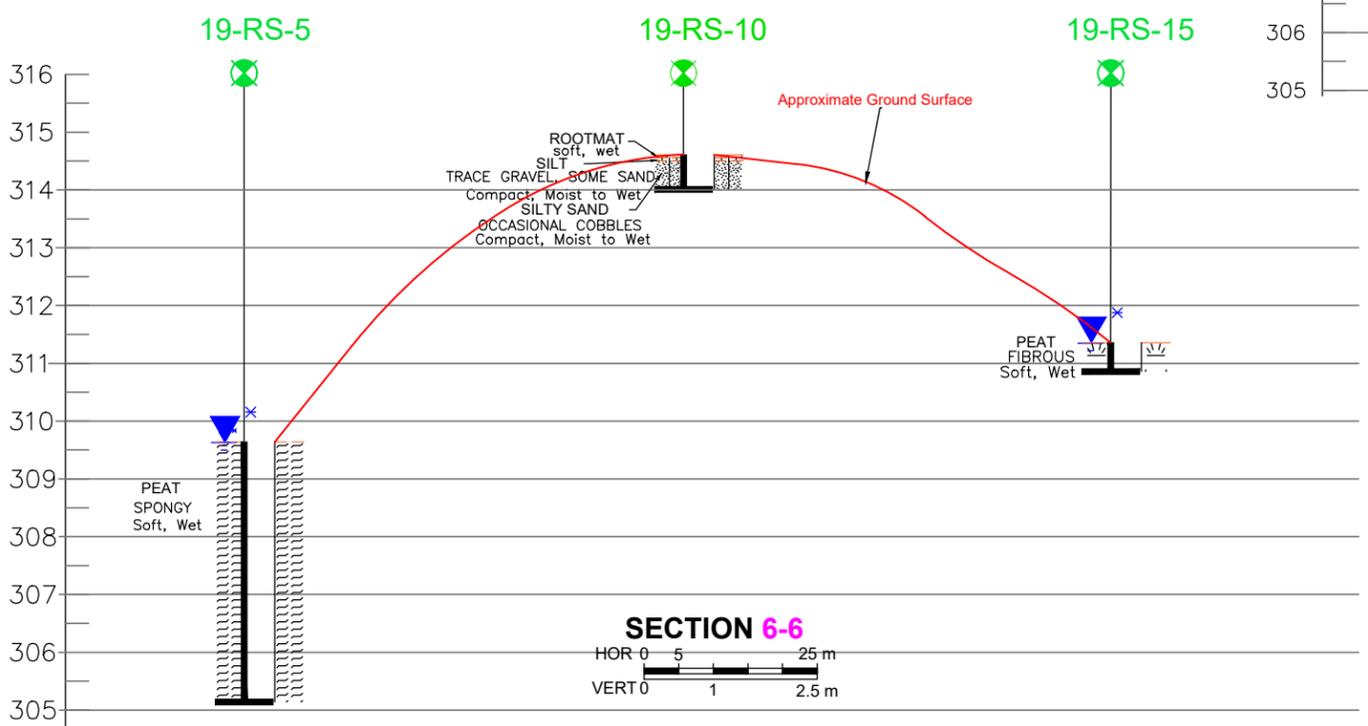
DATE	SM	DESCRIPTION
	BY	DESCRIPTION
		GEOCRETS NO. -
		PROJECT NO. ADM-00248798-E0
SUBM'D SH	CHECKED SM	DATE Aug. 29, 19
DRAWN SH	CHECKED SM	APPROVED SG DWG. 8



**SECTION 4-4**  
HOR 0 5 25 m  
VERT 0 1 2.5 m



**SECTION 5-5**  
HOR 0 5 25 m  
VERT 0 1 2.5 m



**SECTION 6-6**  
HOR 0 5 25 m  
VERT 0 1 2.5 m



## **Appendix C – Borehole Logs**

# Explanation of Terms Used on Borehole Records

## SOIL DESCRIPTION

Terminology describing common soil genesis:

*Topsoil:* mixture of soil and humus capable of supporting good vegetative growth.

*Peat:* fibrous fragments of visible and invisible decayed organic matter.

*Fill:* where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc.; none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.

*Till:* the term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Terminology describing soil structure:

*Desiccated:* having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.

*Stratified:* alternating layers of varying material or color with the layers greater than 6 mm thick.

*Laminated:* alternating layers of varying material or color with the layers less than 6 mm thick.

*Fissured:* material breaks along plane of fracture.

*Varved:* composed of regular alternating layers of silt and clay.

*Slickensided:* fracture planes appear polished or glossy, sometimes striated.

*Blocky:* cohesive soil that can be broken down into small angular lumps which resist further breakdown.

*Lensed:* inclusion of small pockets of different soil, such as small lenses of sand scattered through a mass of clay; not thickness.

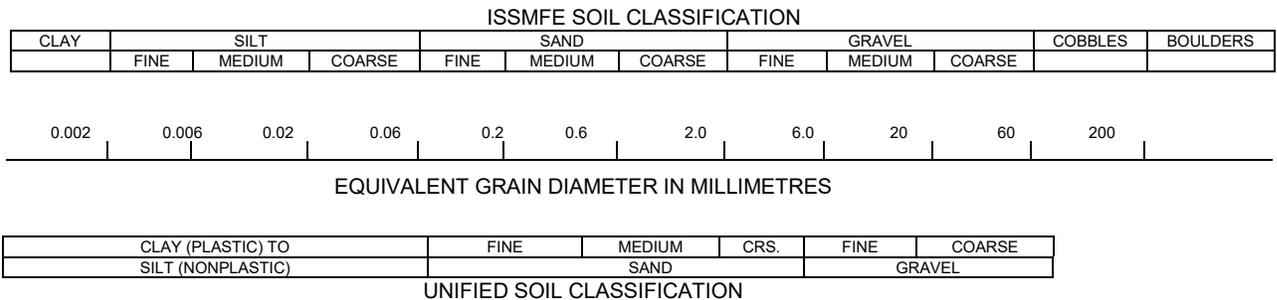
*Seam:* a thin, confined layer of soil having different particle size, texture, or color from materials above and below.

*Homogeneous:* same color and appearance throughout.

*Well Graded:* having wide range in grain sized and substantial amounts of all predominantly on grain size.

*Uniformly Graded:* predominantly on grain size.

All soil sample descriptions included in this report follow generally the ASTM D2487-11 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) with some modification to reflect current MTO practices. The system divides soils into three major categories: (1) coarse grained, (2) fine-grained, and (3) highly organic. The soil is then subdivided based on either gradation or plasticity characteristics. The system provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification. The classification excludes particles larger than 76 mm. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually in accordance with ASTM D2488-09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems. Others may use different classification systems; one such system is the ISSMFE Soil Classification.



Terminology describing materials outside the USCS, (e.g. particles larger than 76 mm, visible organic matter, construction debris) is based upon the proportion of these materials present and as described below in accordance with Canadian Foundation Engineering Manual (CFEM):

Table a: Percent or Proportion of Soil

	Criteria
Trace	1% - 10%
Some	10% - 20%
Little	20% - 35%
Some	>35% and main fraction

The standard terminology to describe cohesionless soils includes the compactness as determined by the Standard Penetration Test 'N' value:

Table b: Apparent Density of Cohesionless Soil

	'N' Value (blows/0.3 m)
Very Loose	N<5
Loose	5≤N<10
Compact	10≤N<30
Dense	30≤N<50
Very Dense	50≤N

The standard terminology to describe cohesive soils includes consistency, which is based on undrained shear strength as measured by insitu vane tests, penetrometer tests, unconfined compression tests or similar field and laboratory analysis, Standard Penetration Test 'N' values can also be used to provide an approximate indication of the consistency and shear strength of fine grained, cohesive soils:

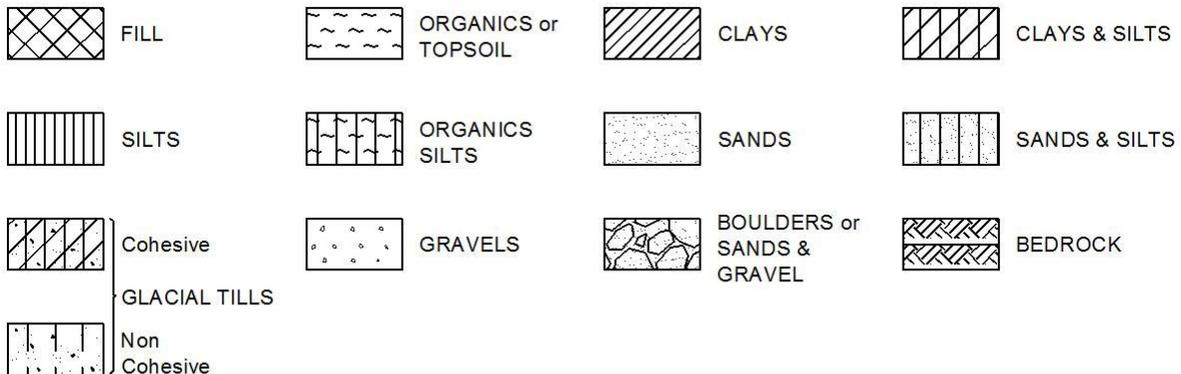
Table c: Consistency of Cohesive Soil

Consistency	Vane Shear Measurement (kPa)	'N' Value
Very Soft	<12.5	<2
Soft	12.5-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

Note: 'N' Value - The Standard Penetration Test records the number of blows of a 140 pound (64kg) hammer falling 30 inches (760mm), required to drive a 2 inch (50.8mm) O.D. split spoon sampler 1 foot (305mm). For split spoon samples where full penetration is not achieved, the number of blows is reported over the sampler penetration in meters (e.g. 50/0.15).

### STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols:



### WATER LEVEL MEASUREMENT



Open Borehole or Test Pit



Monitoring Well, Piezometer or Standpipe

## ABBREVIATIONS AND SYMBOLS

### FIELD SAMPLING

SS	Split spoon sample (obtained from the Standard Penetration Test)
WS	Wash sample
BS	Bulk sample
TW	Thin wall sample or Shelby tube
PS	Piston sample
AS	Auger sample
VT	Vane test
GS	Grab sample
HQ, NQ, etc.	Rock core samples obtained with the use of standard size diamond drilling bits

### STRESS AND STRAIN

$u_w$	kPa	Pore water pressure
$r_u$	1	Pore pressure ratio
$\sigma$	kPa	Total normal stress
$\sigma'$	kPa	Effective normal stress
$\tau$	kPa	Shear stress
$\sigma_1, \sigma_2, \sigma_3$	kPa	Principal stresses
$\varepsilon$	%	Linear strain
$\varepsilon_1, \varepsilon_2, \varepsilon_3$	%	Principal strains
E	kPa	Modulus of linear deformation
G	kPa	Modulus of shear deformation
$\mu$	1	Coefficient of friction

### MECHANICAL PROPERTIES OF SOIL

$m_v$	kPa <sup>-1</sup>	Coefficient of volume change
$c_c$	1	Compression index
$c_s$	1	Swelling index
$c_r$	1	Recompression index
$c_v$	m <sup>2</sup> /s	Coefficient of consolidation
H	m	Drainage path
T <sub>v</sub>	1	Time factor
U	%	Degree of consolidation
$\sigma'_{v0}$	kPa	Effective overburden pressure
$\sigma'_p$	kPa	Preconsolidation pressure
$\tau_f$	kPa	Shear strength
$c'$	kPa	Effective cohesion intercept
$\phi'$	—°	Effective angle of internal friction
$c_u$	kPa	Apparent cohesion intercept
$\phi_u$	—°	Apparent angle of internal friction
$\tau_R$	kPa	Residual shear strength
$\tau_r$	kPa	Remoulded shear strength
$S_t$	1	Sensitivity = $c_u/\tau_r$

### PHYSICAL PROPERTIES OF SOIL

$P_s$	kg/m <sup>3</sup>	Density of solid particles
$\gamma_s$	kN/m <sup>3</sup>	Unit weight of solid particles
$\rho_w$	kg/m <sup>3</sup>	Density of water
$\gamma_w$	kN/m <sup>3</sup>	Unit weight of water
$\rho$	kg/m <sup>3</sup>	Density of soil
$\gamma$	kN/m <sup>3</sup>	Unit weight of soil
$\rho_d$	kg/m <sup>3</sup>	Density of dry soil
$\gamma_d$	kN/m <sup>3</sup>	Unit weight of dry soil
$\rho_{sat}$	kg/m <sup>3</sup>	Density of saturated soil
$\gamma_{sat}$	kN/m <sup>3</sup>	Unit weight of saturated soil
$\rho'$	kg/m <sup>3</sup>	Density of submerged soil
$\gamma'$	kN/m <sup>3</sup>	Unit weight of submerged soil
$e$	1, %	Void ratio
$n$	1, %	Porosity
$w$	1, %	Water content
$S_r$	%	Degree of saturation
$W_L$	%	Liquid limit
$W_P$	%	Plastic limit
$W_s$	%	Shrinkage limit
$I_p$	%	Plasticity index = $(W_L - W_P)$
$I_L$	%	Liquidity index = $(W - W_P)/I_p$
$I_C$	%	Consistency index = $(W_L - W)/I_p$
$e_{max}$	1, %	Void ratio in loosest state
$e_{min}$	1, %	Void ratio in densest state
$I_D$	1	Density index = $(e_{max} - e)/(e_{max} - e_{min})$
D	mm	Grain diameter
$D_n$	mm	N percent - diameter
$C_u$	1	Uniformity coefficient
h	m	Hydraulic head or potential
q	m <sup>3</sup> /s	Rate of discharge
v	m/s	Discharge velocity
i	1	Hydraulic gradient
k	m/s	Hydraulic conductivity
j	kN/m <sup>3</sup>	Seepage force

Brampton, Ontario

**RECORD OF BOREHOLE No BH-S1**

1 OF 1

**METRIC**

W.P. GWP No. 6078-18-00 LOCATION Shabaqua Patrol Yard - Proposed Salt/Sand Shed MTM ON-15 312563E 5384446N ORIGINATED BY EF  
 DIST 61 HWY 11/17 BOREHOLE TYPE CME 55 Rubber Track / HSA / NQ COMPILED BY NK  
 DATUM Geodetic DATE 2019.05.22 - 2019.05.23 LATITUDE 48.59851 LONGITUDE -89.89474 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20						40	60	80	100	20
389.5	Asphalt																	
389.0	<b>ASPHALT</b> - about 100 mm																	
389.0	<b>Poorly Graded SAND AND GRAVEL (FILL)</b> - trace silt, brown, moist, compact		S1	SS	15													39 54 (8)
388.7	<b>CLAY</b> - trace sand, some silt, reddish brown, wet, very stiff		S2	SS	3													
388.7	- becoming silty		S3	SS	3													0 4 23 74
				VANE														Field Vane = 131 kPa, Sensitivity = 2
			S4	SH														
			S5	SS	2													
				VANE														Field Vane = 112 kPa, Sensitivity = 2
			S6	SS	2													
				VANE														Field Vane = 106 kPa, Sensitivity = 3
			S7	SS	1													
				VANE														Field Vane = 92 kPa
383.9	<b>SAND AND GRAVEL</b> - some silt, light brown, moist to wet, very dense - sand and gravel encountered during augering at about 5.6 m depth - refusal to auger and SPT at about 6.1 m depth, NQ core initiated - some cobbles to cobbley at about 6.1 m depth		S8	CORE														
383.9			S9	SS	60													40 43 (17)
383.9			S10	CORE														
379.6	<b>End of Borehole</b>																	
	Notes: Groundwater level measured at 0.3 m below ground surface.																	

ONTARIO MTO F-19115-AG - ADM-00248798-F0 - MTO 6 - SHABAQUA BUILDING - FINAL GPJ ONTARIO MTO.GDT 8/20/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-MAH-01**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 265820E 5414599N ORIGINATED BY EF  
 DIST                      HWY 17 BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.06 - 2019.06.06 LATITUDE 48.8685 LONGITUDE -87.5314 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80						100	20
262.0	Rootmat																	
0.0 261.9	Rootmat - brown, moist to wet	~	S1	AUGER														
0.1 261.8	Gravel with Blast Rock (FILL) - brown, damp	⊗	S2	AUGER														
0.3	End of Borehole - refusal																	
	- no groundwater encountered																	

ONTARIO.MTO.F-18130-BG-ADM-00248798-E0-MTO.5-HWY.17.PAYS.PLAT.TO.ROSSPORT.GPJ.ONTARIO.MTO.GDT.8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-MAH-02**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 265838E 5414580N ORIGINATED BY EF  
 DIST                      HWY 17 BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.06 - 2019.06.06 LATITUDE 48.8683 LONGITUDE -87.5311 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80						100	20
260.9	Rootmat																	
260.8	Rootmat - brown, moist to wet	~	S1	AUGER														
0.1	Silty SAND with Gravel (FILL) - compact, brown, moist to wet, some blast rock	⊗	S2	AUGER														41 47 (13)
260.6	End of Borehole - refusal																	
0.3	- no groundwater encountered																	

ONTARIO.MTO.F-18130-BG-ADM-00248798-E0-MTO.5-HWY.17.PAYS.PLAT.TO.ROSSPORT.GPJ.ONTARIO.MTO.GDT.8/27/19

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

Brampton, Ontario

**RECORD OF BOREHOLE No 19-MAH-03**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 265855E 5414562N ORIGINATED BY EF  
 DIST HWY 17 BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.06 - 2019.06.06 LATITUDE 48.8682 LONGITUDE -87.5309 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80						100	20	40
255.9	Rootmat / Peat		S1	AUGER															
0.0 255.8 0.1	Rootmat / Peat - dark brown to black, wet Poorly Graded SAND (FILL) - very loose, brown, wet		S2	AUGER															
255.3	Peaty SAND - very loose, dark brown, wet		S3	AUGER															
0.6			S4	AUGER															
253.6	End of Borehole - refusal																		

ONTARIO.MTO.F-18130-BG - ADM-00248798-E0 - MTO 5 - HWY 17 PAYS PLAT TO ROSSPORT.GPJ ONTARIO.MTO.GDT 8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE



Brampton, Ontario

**RECORD OF BOREHOLE No 19-MAH-03B** 1 OF 1 **METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rosspport MTM ON-14 265855E 5414562N ORIGINATED BY EF  
 DIST                      HWY 17 BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.06 - 2019.06.06 LATITUDE 48.8682 LONGITUDE -87.5309 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80						100	20	40
255.9	Rootmat / Peat		S1	AUGER															
0.0 255.8	Rootmat / Peat - dark brown to black, wet																		
0.1	Poorly Graded SAND (FILL) - very loose, brown, wet		S2	AUGER															
255.4	Peaty SAND - very loose, dark brown, wet		S3	AUGER															
0.5			S4	AUGER															
253.8	End of Borehole - refusal																		
2.1																			

ONTARIO.MTO.F-18130-BG - ADM-00248798-E0 - MTO 5 - HWY 17 PAYS PLAT TO ROSSPORT.GPJ ONTARIO.MTO.GDT 8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-MAH-04**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 266668E 5413257N ORIGINATED BY EF  
 DIST                      HWY 17 BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.06 - 2019.06.06 LATITUDE 48.8565 LONGITUDE -87.5197 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT <b>γ</b> kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
314.8 0.0	Fill <b>Rockfill</b> - no augering conducted																

ONTARIO.MTO\_F-18130-BG - ADM-00248798-E0 - MTO 5 - HWY 17 PAYS PLAT TO ROSSPORT.GPJ ONTARIO.MTO.GDT 8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-MAH-05**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 266666E 5413223N ORIGINATED BY EF  
 DIST                      HWY 17 BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.06 - 2019.06.06 LATITUDE 48.8562 LONGITUDE -87.5197 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100						20
319.8 0.0	Fill <b>Rockfill</b> - no augering conducted																	

ONTARIO.MTO\_F-18130-BG - ADM-00248798-E0 - MTO 5 - HWY 17 PAYS PLAT TO ROSSPORT.GPJ ONTARIO.MTO.GDT 8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-MAH-06**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 266651E 5413190N ORIGINATED BY EF  
 DIST                      HWY 17 BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.06 - 2019.06.06 LATITUDE 48.8705 LONGITUDE -87.5201 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT <b>γ</b> kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
324.5 0.0	Fill <b>Rockfill</b> - no augering conducted																

ONTARIO.MTO\_F-18130-BG - ADM-00248798-E0 - MTO 5 - HWY 17 PAYS PLAT TO ROSSPORT.GPJ ONTARIO.MTO.GDT 8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-MAH-07**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 266389E 5412568N ORIGINATED BY EF  
 DIST                      HWY 17 BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.06 - 2019.06.06 LATITUDE 48.8649 LONGITUDE -87.5236 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT <b>γ</b> kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
300.4 0.0	Bedrock <b>BEDROCK</b> - weathered angular bedrock pieces noted overlying apparent solid bedrock																

ONTARIO.MTO\_F-18130-BG - ADM-00248798-E0 - MTO 5 - HWY 17 PAYS PLAT TO ROSSPORT.GPJ ONTARIO.MTO.GDT 8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-MAH-08**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rosspart MTM ON-14 266387E 5412524N ORIGINATED BY EF  
 DIST                      HWY 17 BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.06 - 2019.06.06 LATITUDE 48.8499 LONGITUDE -87.5234 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80						100	20
292.4	Rootmat																	
0.0 292.3	Rootmat - brown, wet, trace sand	~	S1	AUGER														
0.1	Silty SAND with Gravel (FILL) - compact, dark brown, moist to wet, occasional cobbles, some organics	⊗	S2	AUGER												17	65	(19)
292.1 0.4 292.0	Poorly Graded GRAVEL with Silt and Sand (FILL) - compact, dark brown, moist to wet, some organics, roots	⊗	S3	AUGER		292										55	34	(11)
0.5	End of Borehole - refusal																	
	- no groundwater encountered																	

ONTARIO.MTO.F-18130-BG-ADM-00248798-E0-MTO.5-HWY.17.PAYS.PLAT.TO.ROSSPORT.GPJ.ONTARIO.MTO.GDT.8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-MAH-09**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 266385E 5412477N ORIGINATED BY EF  
 DIST                      HWY 17 BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.06 - 2019.06.06 LATITUDE 48.8495 LONGITUDE -87.5235 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80						100	20
282.9	Rootmat																	
0.0	<b>Rootmat</b> - brown, wet, some gravel, some sand		S1	AUGER														
282.8																		
0.1	<b>Well Graded SAND with Silt (FILL)</b> - loose to compact, wet, brown, some organics		S2	AUGER														2 86 (11)
282.6																		
0.3	<b>PEAT</b> - soft, dark brown to black, wet		S3	AUGER														
282.4																		
0.5	<b>Peaty SILT</b> - compact, dark brown, some gravel, some sand, some cobbles		S4	AUGER														
282.2																		
0.7	<b>End of Borehole</b> - refusal																	
	- no groundwater encountered																	

ONTARIO.MTO.F-18130-BG-ADM-00248798-E0-MTO.5-HWY.17.PAYS.PLAT.TO.ROSSPORT.GPJ.ONTARIO.MTO.GDT.8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-MAH-10**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 266381E 5412436N ORIGINATED BY EF  
 DIST                      HWY 17 BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.06 - 2019.06.06 LATITUDE 48.8491 LONGITUDE -87.5235 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80						100	20
279.0 0.0	Peat PEAT - soft, dark brown, wet																	
278.7 0.4	End of Borehole - refusal  - no groundwater encountered																	

ONTARIO.MTO.F-18130-BG-ADM-00248798-E0-MTO.5-HWY.17.PAYS.PLAT.TO.ROSSPORT.GPJ.ONTARIO.MTO.GDT.8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-MAH-11**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 266371E 5412369N ORIGINATED BY EF  
 DIST                      HWY 17 BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.06 - 2019.06.06 LATITUDE 48.8485 LONGITUDE -87.5236 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80						100	20
279.8	Rootmat	~	S1	AUGER														
279.9	<b>Rootmat</b> - dark brown to black, wet																	
0.1	<b>Poorly Graded SAND with Silt (FILL)</b> - compact, rusty brown, moist to wet, occasional cobbles in upper 0.4 m	⊗	S2	AUGER	∇											5	88	(8)
			S3	AUGER												9	86	(5)
278.8	<b>End of Borehole - refusal</b>																	
1.0																		

ONTARIO.MTO.F-18130-BG-ADM-00248798-E0-MTO.5-HWY.17.PAYS.PLAT.TO.ROSSPORT.GPJ.ONTARIO.MTO.GDT.8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-MAH-12** 1 OF 1 **METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 266367E 5412335N ORIGINATED BY EF  
 DIST                      HWY 17 BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.06 - 2019.06.06 LATITUDE 48.8482 LONGITUDE -87.5237 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80						100	20
282.8 0.0	Peat PEAT - soft, dark brown, wet		S1	AUGER														
282.6 0.3	End of Borehole - refusal  - no groundwater encountered																	

ONTARIO.MTO\_F-18130-BG - ADM-00248798-E0 - MTO 5 - HWY 17 PAYS PLAT TO ROSSPORT.GPJ ONTARIO.MTO.GDT 8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-MAH-13**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 266361E 5412301N ORIGINATED BY EF  
 DIST                      HWY 17 BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.06 - 2019.06.06 LATITUDE 48.8479 LONGITUDE -87.5238 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80					
285.2	Rootmat															
286.0	<b>Rootmat</b> - dark brown, wet	X	S1	AUGER												
0.1	<b>Silty GRAVEL with Sand (FILL)</b> - loose to compact, dark brown, wet, some organics	X	S2	AUGER												45 38 (18)
285.0	<b>End of Borehole</b> - refusal															
0.3	- no groundwater encountered															

ONTARIO.MTO.F-18130-BG-ADM-00248798-E0-MTO.5-HWY.17.PAYS.PLAT.TO.ROSSPORT.GPJ.ONTARIO.MTO.GDT.8/27/19

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-MAH-14** 1 OF 1 **METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rosspport MTM ON-14 266603E 5411671N ORIGINATED BY EF  
 DIST                      HWY 17 BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.07 - 2019.06.07 LATITUDE 48.8422 LONGITUDE -87.5204 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80						100	20	40
240.2	Rootmat / Peat	[Symbol]	S1	AUGER	[Symbol]	240													
0.0 240.1	Rootmat / Peat - soft, black, wet																		
0.1	Silty SAND with Gravel (FILL) - loose to compact, light brown to brown, wet	[Symbol]	S2	AUGER													21	60	(19)
239.7																			
0.6	End of Borehole - refusal																		

ONTARIO.MTO.F-18130-BG-ADM-00248798-E0-MTO.5-HWY.17.PAYS.PLAT.TO.ROSSPORT.GPJ.ONTARIO.MTO.GDT.8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-MAH-15**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 266615E 5411647N ORIGINATED BY EF  
 DIST                      HWY 17 BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.07 - 2019.06.07 LATITUDE 48.8422 LONGITUDE -87.5204 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80						100	20
238.8	Rootmat																	
0.0	<b>Rootmat</b> - dark brown to black, wet, some sand		S1	AUGER														
238.7																		
0.1	<b>PEAT</b> - soft, dark brown, wet, trace to some sand		S2	AUGER														
			S3	AUGER														
238.2																		
0.7	<b>Sandy PEAT</b> - soft, dark brown, wet		S4	AUGER														
237.4																		
1.4	<b>Sandy Clayey SILT</b> - firm, light grey, wet		S5	AUGER														
236.6																		
2.3	<b>End of Borehole</b> - refusal																	

ONTARIO.MTO.F-18130-BG-ADM-00248798-E0-MTO.5-HWY.17.PAYS.PLAT.TO.ROSSPORT.GPJ.ONTARIO.MTO.GDT.8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-MAH-16**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 266633E 5411618N ORIGINATED BY EF  
 DIST                      HWY 17 BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.07 - 2019.06.07 LATITUDE 48.8417 LONGITUDE -87.52 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80	100	W <sub>p</sub>	W		
238.9 0.0	Peat PEAT - soft, dark brown to black, wet		S1	AUGER										248.1		
238.4 0.5	End of Borehole - refusal  - groundwater / surface water encountered about 0.15 m above ground surface															

ONTARIO.MTO.F-18130-BG-ADM-00248798-E0-MTO.5-HWY.17.PAYS.PLAT.TO.ROSSPORT.GPJ.ONTARIO.MTO.GDT.8/27/19

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-RS-01**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 266299E 5414234N ORIGINATED BY EF  
 DIST \_\_\_\_\_ HWY \_\_\_\_\_ BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.07 - 2019.06.07 LATITUDE 48.8652 LONGITUDE -87.5247 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80						100	20
311.2	Rootmat																	
0.0	<b>Rootmat</b> - brown, wet	~ ~	S1	AUGER														
311.0	<b>End of Borehole</b> - refusal																	
0.2	- no groundwater encountered																	

ONTARIO.MTO\_F-18130-BG - ADM-00248798-E0 - MTO 5 - HWY 17 PAYS PLAT TO ROSSPORT.GPJ ONTARIO.MTO.GDT 8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-RS-02**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 266333E 5414174N ORIGINATED BY EF  
 DIST \_\_\_\_\_ HWY \_\_\_\_\_ BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.07 - 2019.06.07 LATITUDE 48.8646 LONGITUDE -87.5244 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80						100	20	40
310.2 0.0	Rootmat <b>Rootmat</b> - brown, wet		S1	AUGER		310													
309.8 308.8 0.4	PEAT - soft, dark brown to black, wet, trace sand, trace silt <b>End of Borehole</b> - refusal  - no groundwater encountered		S2	AUGER															

ONTARIO.MTO.F-18130-BG - ADM-00248798-E0 - MTO 5 - HWY 17 PAYS PLAT TO ROSSPORT.GPJ ONTARIO.MTO.GDT 8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-RS-03**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rosspart MTM ON-14 266364E 5414114N ORIGINATED BY EF  
 DIST                      HWY                      BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.07 - 2019.06.07 LATITUDE 48.8641 LONGITUDE -87.5239 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80					
309.9 0.0	Peat <b>PEAT</b> - soft, dark brown, wet		S1	AUGER										951.8 C		
			S2	AUGER										1087.1 C		
			S3	AUGER										314.1 C		
307.9 2.0	<b>End of Borehole</b> - refusal															

ONTARIO.MTO.F-18130-BG-ADM-00248798-E0-MTO.5-HWY.17.PAYS.PLAT.TO.ROSSPORT.GPJ.ONTARIO.MTO.GDT.8/27/19

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-RS-04**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 266397E 5414053N ORIGINATED BY EF  
 DIST \_\_\_\_\_ HWY \_\_\_\_\_ BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.07 - 2019.06.07 LATITUDE 48.8636 LONGITUDE -87.5234 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80						100	20
310.2	Rootmat / Peat																	
0.0	<b>Rootmat / Peat</b> - dark brown to black, wet	~ ~ ~	S1	AUGER		310												
309.9																		
0.2	<b>End of Borehole</b> - refusal  - no groundwater encountered																	

ONTARIO.MTO\_F-18130-BG - ADM-00248798-E0 - MTO 5 - HWY 17 PAYS PLAT TO ROSSPORT.GPJ ONTARIO.MTO.GDT 8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-RS-05**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rosspport MTM ON-14 266430E 5413993N ORIGINATED BY EF  
 DIST \_\_\_\_\_ HWY \_\_\_\_\_ BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.07 - 2019.06.07 LATITUDE 48.863 LONGITUDE -87.523 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80						100	20	40
309.6	Peat		S1	AUGER										1541.3					
0.0	Peat - soft, green, wet, spongy  - becoming dark brown at about 0.2 m depth																		
309																			
308																			
307			S2	AUGER										892.6					
306																			
305.1																			
4.5	End of Borehole - maximum auger extension																		

ONTARIO.MTO.F-18130-BG - ADM-00248798-E0 - MTO 5 - HWY 17 PAYS PLAT TO ROSSPORT.GPJ ONTARIO.MTO.GDT 8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-RS-06**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 266233E 5414199N ORIGINATED BY EF  
 DIST \_\_\_\_\_ HWY \_\_\_\_\_ BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.07 - 2019.06.07 LATITUDE 48.8648 LONGITUDE -87.5257 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80						100	20	40
313.8 0.0	Peat Peat - brown, wet, fibrous		S1	AUGER															
313.5 0.3	Silty SAND - compact, rusty brown, moist to wet, occasional cobbles and boulders		S2	AUGER															6 58 (36)
313.2 0.7	End of Borehole - refusal		S3	AUGER															9 68 (24)

ONTARIO.MTO.F-18130-BG-ADM-00248798-E0-MTO.5-HWY.17.PAYS.PLAT.TO.ROSSPORT.GPJ.ONTARIO.MTO.GDT.8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-RS-07**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 266265E 5414138N ORIGINATED BY EF  
 DIST                      HWY                      BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.07 - 2019.06.07 LATITUDE 48.8642 LONGITUDE -87.5253 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT <b>γ</b> kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
313.8 0.0	Bedrock <b>BEDROCK</b> - outcrop																

ONTARIO.MTO\_F-18130-BG - ADM-00248798-E0 - MTO 5 - HWY 17 PAYS PLAT TO ROSSPORT.GPJ ONTARIO.MTO.GDT 8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-RS-08**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 266298E 5414078N ORIGINATED BY EF  
 DIST                      HWY                      BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.07 - 2019.06.07 LATITUDE 48.8638 LONGITUDE -87.5248 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT <b>γ</b> kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
311.0	Bedrock																
0.0	<b>BEDROCK</b> - outcrop																

ONTARIO.MTO\_F-18130-BG - ADM-00248798-E0 - MTO 5 - HWY 17 PAYS PLAT TO ROSSPORT.GPJ ONTARIO.MTO.GDT 8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-RS-09**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 266331E 5414018N ORIGINATED BY EF  
 DIST \_\_\_\_\_ HWY \_\_\_\_\_ BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.07 - 2019.06.07 LATITUDE 48.8633 LONGITUDE -87.5244 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100						20
317.0	Bedrock																	
0.0	<b>BEDROCK</b> - outcrop																	

ONTARIO.MTO.F-18130-BG-ADM-00248798-E0-MTO.5-HWY.17.PAYS.PLAT.TO.CROSSPORT.GPJ.ONTARIO.MTO.GDT.8/27/19

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-RS-10**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rosspart MTM ON-14 266362E 5413956N ORIGINATED BY EF  
 DIST                      HWY                      BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.07 - 2019.06.07 LATITUDE 48.8628 LONGITUDE -87.5239 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80					
314.6	Rootmat															
314.6	<b>Rootmat</b> - soft, brown, wet		S1	AUGER												
314.5	<b>SILT</b> - compact, grey, moist to wet, trace gravel, some sand		S2	AUGER												
0.1	<b>Silty SAND</b> - compact, light brown to brown, moist to wet, occasional cobbles		S3	AUGER											4	64 (33)
314.0	<b>End of Borehole - refusal</b>															
0.6	- no groundwater encountered															

ONTARIO.MTO\_F-18130-BG - ADM-00248798-E0 - MTO 5 - HWY 17 PAYS PLAT TO ROSSPORT.GPJ ONTARIO.MTO.GDT 8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-RS-11**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rosspart MTM ON-14 266168E 5414163N ORIGINATED BY EF  
 DIST                      HWY                      BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.07 - 2019.06.07 LATITUDE 48.8646 LONGITUDE -87.5265 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80						100	20
309.8	Rootmat																	
0.0	Rootmat - brown, wet		S1	AUGER														
309.6																		
0.2	Silty GRAVEL with Sand - compact, brown to grey, wet, some cobbles		S2	AUGER														44 32 (24)
309.5																		
0.4	End of Borehole - refusal																	
	- bedrock outcrop observed about 4 m northwest of test hole																	
	- no groundwater encountered																	

ONTARIO.MTO\_F-18130-BG - ADM-00248798-E0 - MTO 5 - HWY 17 PAYS PLAT TO ROSSPORT.GPJ ONTARIO.MTO.GDT 8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-RS-12**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 266196E 5414108N ORIGINATED BY EF  
 DIST                      HWY                      BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.07 - 2019.06.07 LATITUDE 48.8641 LONGITUDE -87.5261 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80					
308.3	Rootmat	∩	S1	AUGER												
308.0	Rootmat - brown, wet															
0.1	End of Borehole - refusal															
	- bedrock outcrop observed about 2.5 m north of test hole															
	- no groundwater encountered															

ONTARIO.MTO.F-18130-BG - ADM-00248798-E0 - MTO 5 - HWY 17 PAYS PLAT TO ROSSPORT.GPJ ONTARIO.MTO.GDT 8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-RS-13**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 266227E 5414046N ORIGINATED BY EF  
 DIST                      HWY                      BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.07 - 2019.06.07 LATITUDE 48.8636 LONGITUDE -87.5258 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80	100	W <sub>p</sub>	W			W <sub>L</sub>	20	40	60
307.1	Peat																			
0.0	PEAT - soft, dark brown to black, wet, charcoal bits in upper 0.4 m, very strong sulphur odours	S1	AUGER			307														
			S2	AUGER																
305.9	End of Borehole - refusal																			
1.2																				

ONTARIO.MTO.F-18130-BG-ADM-00248798-E0-MTO.5-HWY.17.PAYS.PLAT.TO.ROSSPORT.GPJ.ONTARIO.MTO.GDT.8/27/19

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-RS-14**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 266262E 5413981N ORIGINATED BY EF  
 DIST                      HWY                      BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.07 - 2019.06.07 LATITUDE 48.8629 LONGITUDE -87.5253 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>			20	40	60	GR	SA
313.1	Bedrock																					
0.0	<b>BEDROCK</b> - outcrop																					

ONTARIO.MTO\_F-18130-BG - ADM-00248798-E0 - MTO 5 - HWY 17 PAYS PLAT TO ROSSPORT.GPJ ONTARIO.MTO.GDT 8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-RS-15**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rossport MTM ON-14 266294E 5413920N ORIGINATED BY EF  
 DIST                      HWY                      BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.07 - 2019.06.07 LATITUDE 48.8625 LONGITUDE -87.5248 CHECKED BY AM/DG

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT <b>γ</b> kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
311.4 0.0	Bedrock <b>BEDROCK</b> - outcrop																

ONTARIO.MTO\_F-18130-BG - ADM-00248798-E0 - MTO 5 - HWY 17 PAYS PLAT TO ROSSPORT.GPJ ONTARIO.MTO.GDT 8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

Brampton, Ontario

**RECORD OF BOREHOLE No 19-RS-15A**

1 OF 1

**METRIC**

W.P. GWP No. 6120-15-00 LOCATION Hwy 17 Between Pays Plat FN and Rosspport MTM ON-14 266298E 5413922N ORIGINATED BY EF  
 DIST \_\_\_\_\_ HWY \_\_\_\_\_ BOREHOLE TYPE Manual Hand Auger COMPILED BY KK  
 DATUM Geodetic DATE 2019.06.07 - 2019.06.07 LATITUDE 48.8625 LONGITUDE -87.5248 CHECKED BY AM/DG

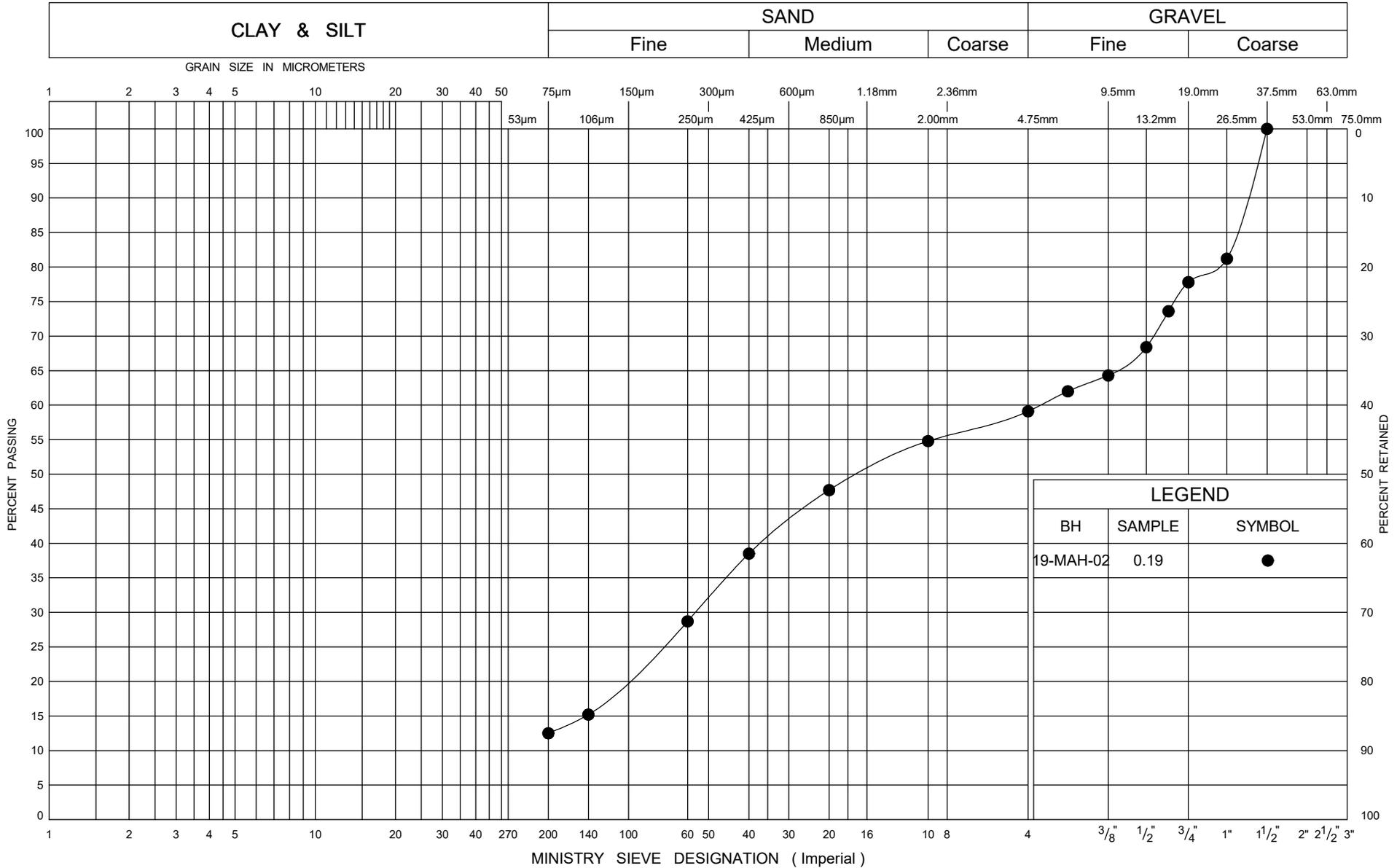
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT <b>γ</b> kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80					
311.4 0.0	Peat Moss Peat - soft, dark brown, wet, fibrous															
310.9 0.5	End of Borehole - refusal					311										

ONTARIO.MTO.F-18130-BG-ADM-00248798-E0-MTO.5-HWY.17.PAYS.PLAT.TO.ROSSPORT.GPJ.ONTARIO.MTO.GDT.8/27/19

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

## **Appendix D – Laboratory Data**

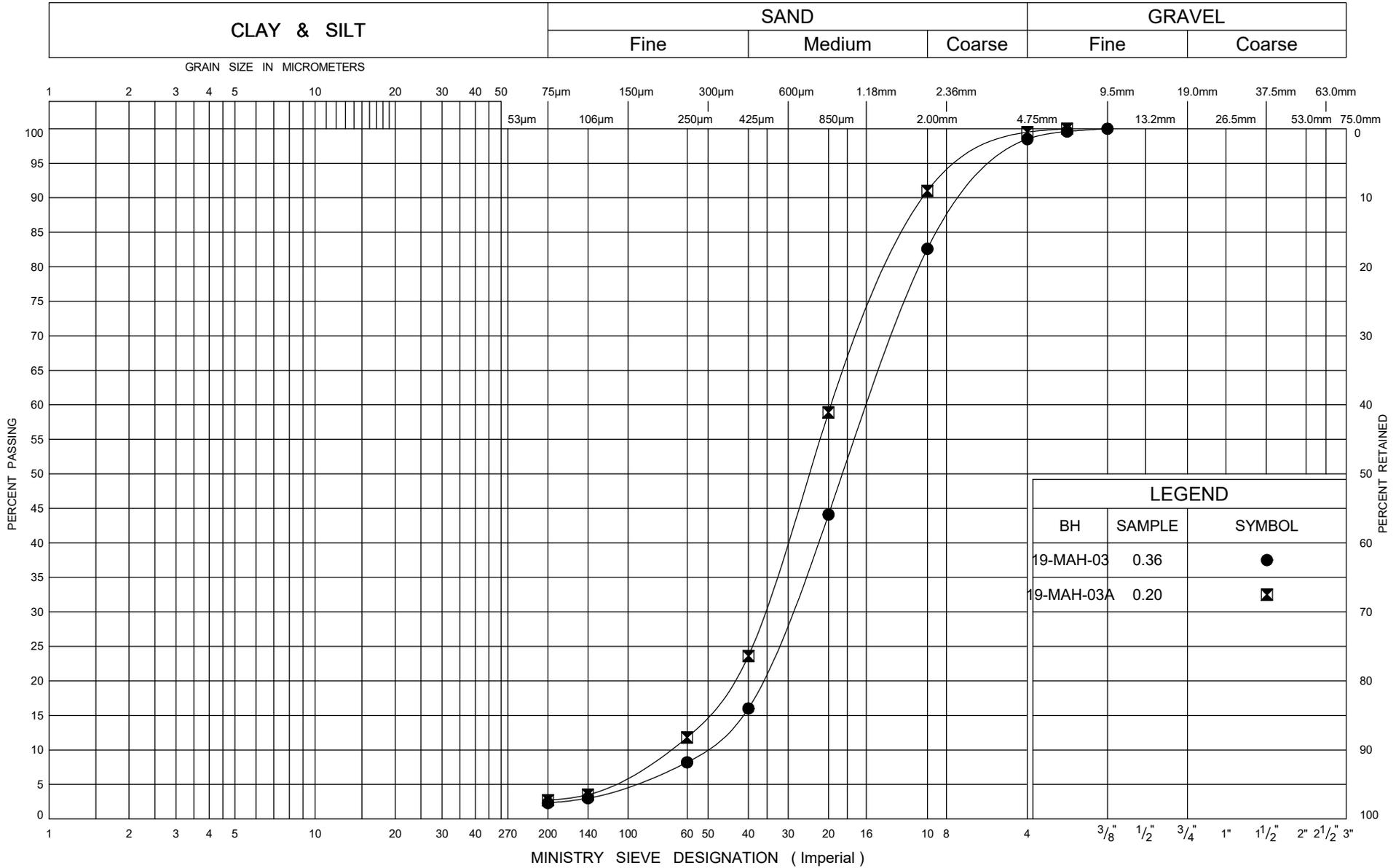
## UNIFIED SOIL CLASSIFICATION SYSTEM



**GRAIN SIZE DISTRIBUTION**  
Silty Sand with Gravel (Fill)

FIG No 1  
W P GWP No. 6120-15-00  
6017-E-0066, Assignment 5

## UNIFIED SOIL CLASSIFICATION SYSTEM



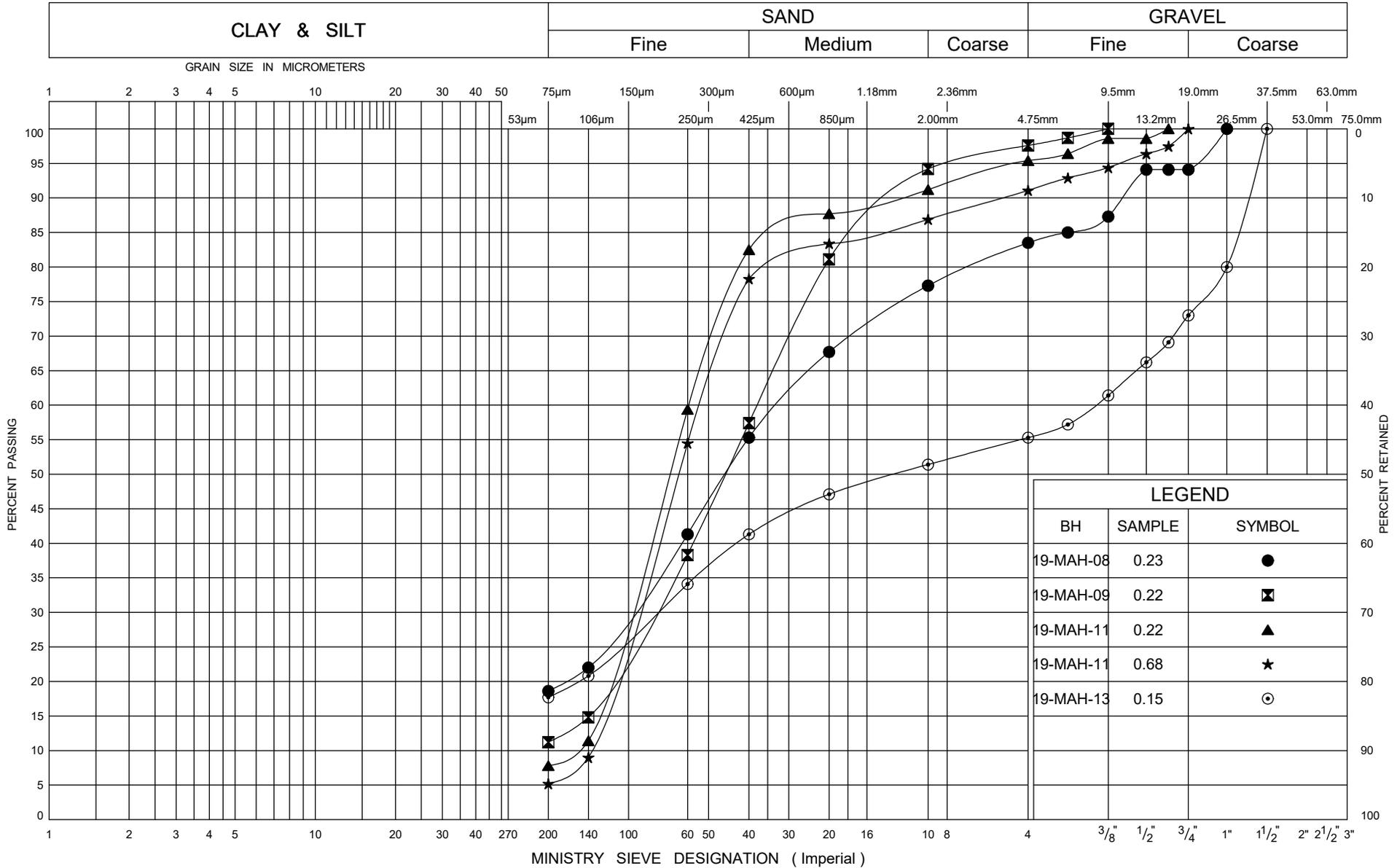
LEGEND		
BH	SAMPLE	SYMBOL
19-MAH-03	0.36	●
19-MAH-03A	0.20	☒



**GRAIN SIZE DISTRIBUTION**  
Sand (Fill)

FIG No 2  
W PGWP No. 6120-15-00  
6017-E-0066, Assignment 5

## UNIFIED SOIL CLASSIFICATION SYSTEM

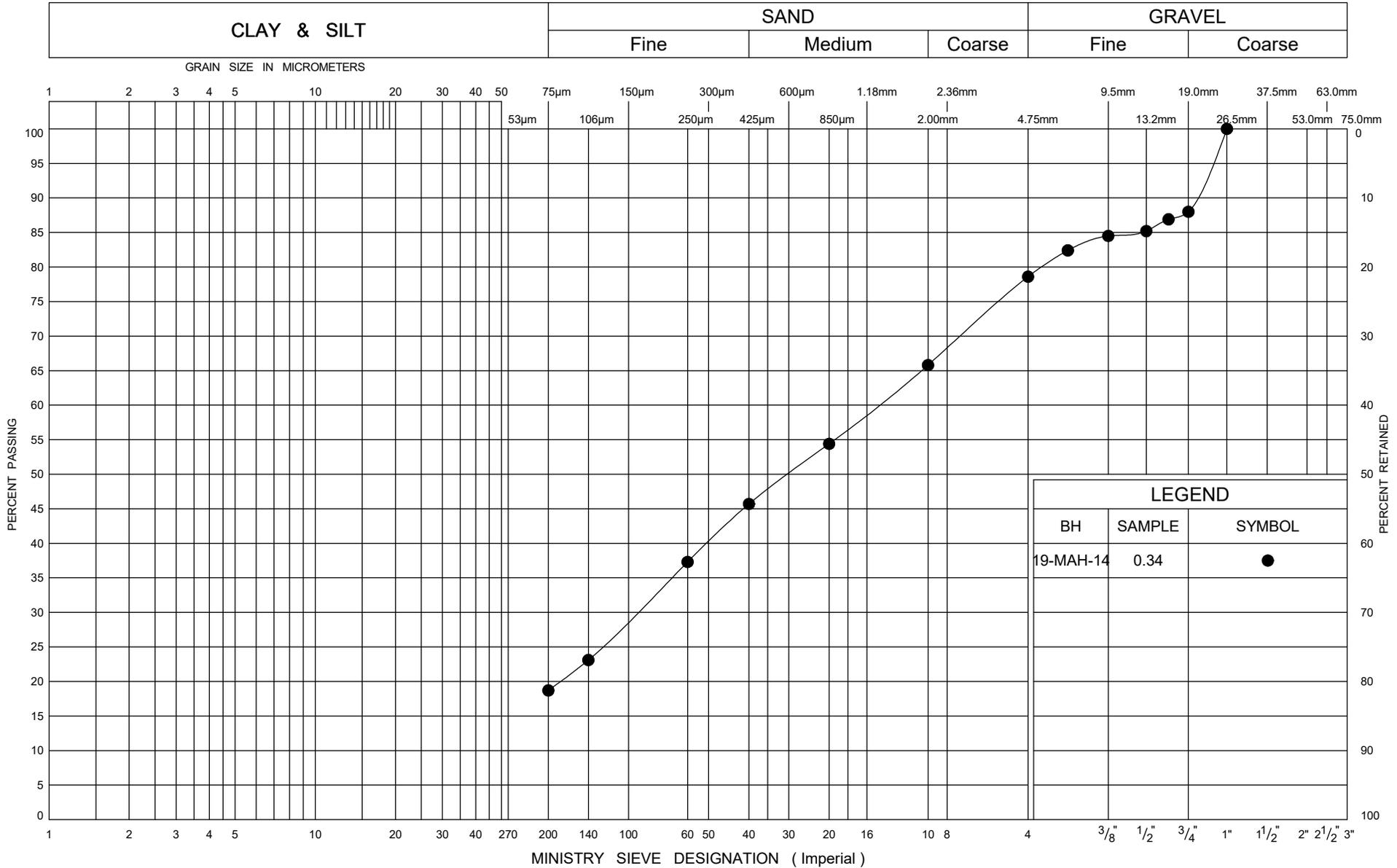


**GRAIN SIZE DISTRIBUTION**  
 Silty Sand with Gravel/Sand with Silt/Silty Gravel with Sand (Fill)

FIG No 3  
 W P GWP No. 6120-15-00  
 6017-E-0066, Assignment 5



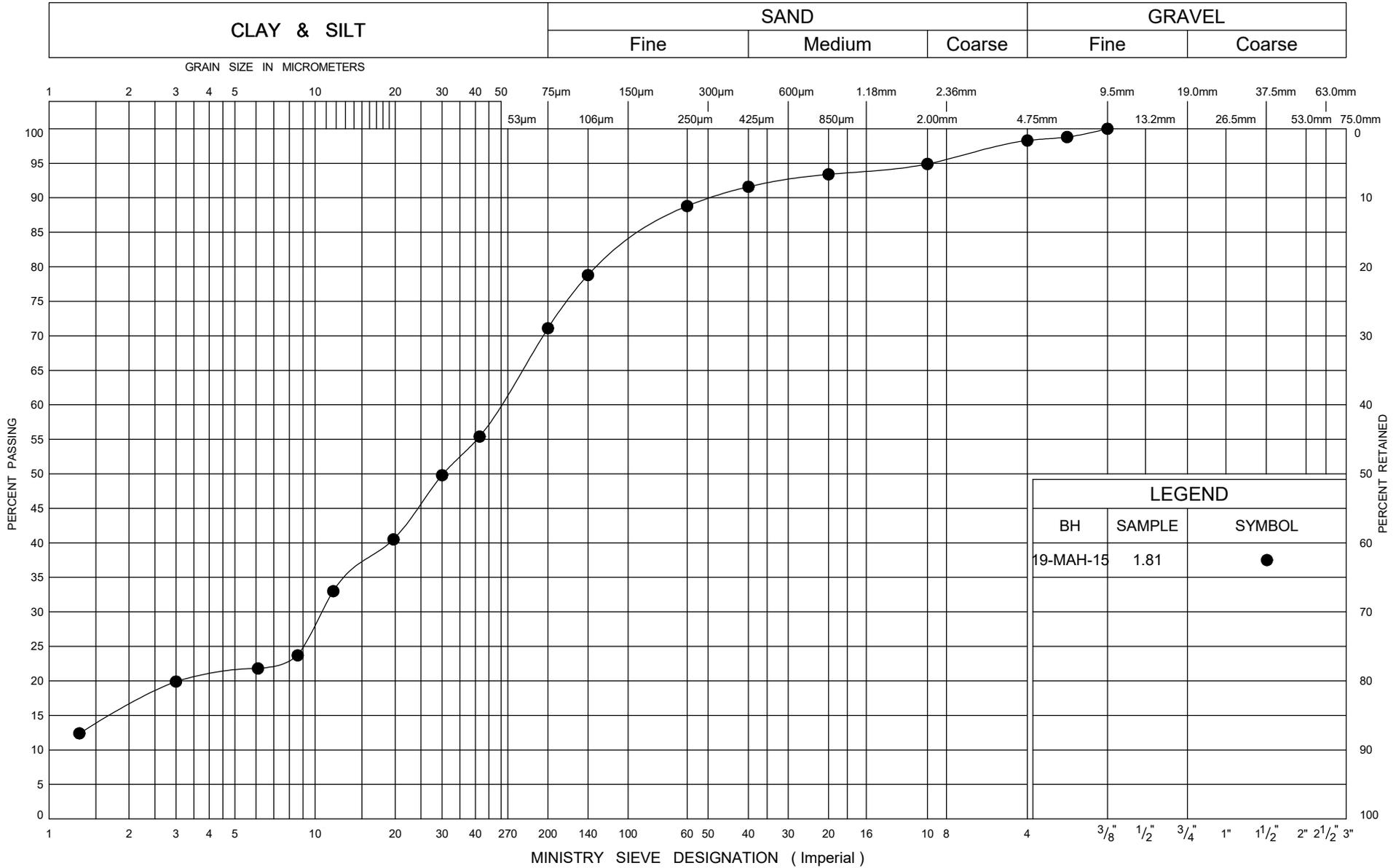
## UNIFIED SOIL CLASSIFICATION SYSTEM



**GRAIN SIZE DISTRIBUTION**  
Silty Sand with Gravel (Fill)

FIG No 5  
W PGWP No. 6120-15-00  
6017-E-0066, Assignment 5

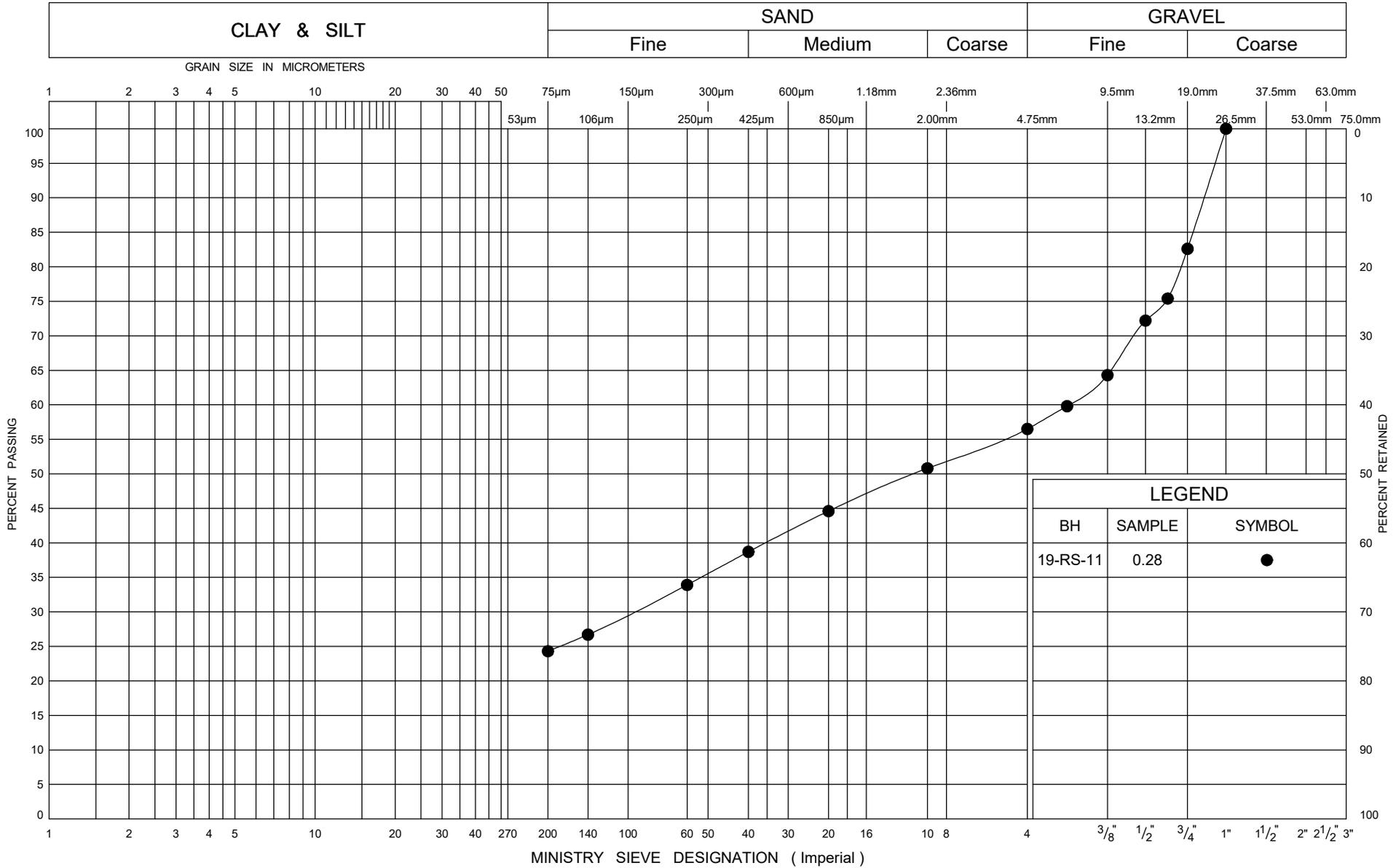
### UNIFIED SOIL CLASSIFICATION SYSTEM



**GRAIN SIZE DISTRIBUTION**  
Sandy Clayey Silt

FIG No 6  
W PGWP No. 6120-15-00  
6017-E-0066, Assignment 5

## UNIFIED SOIL CLASSIFICATION SYSTEM



### GRAIN SIZE DISTRIBUTION

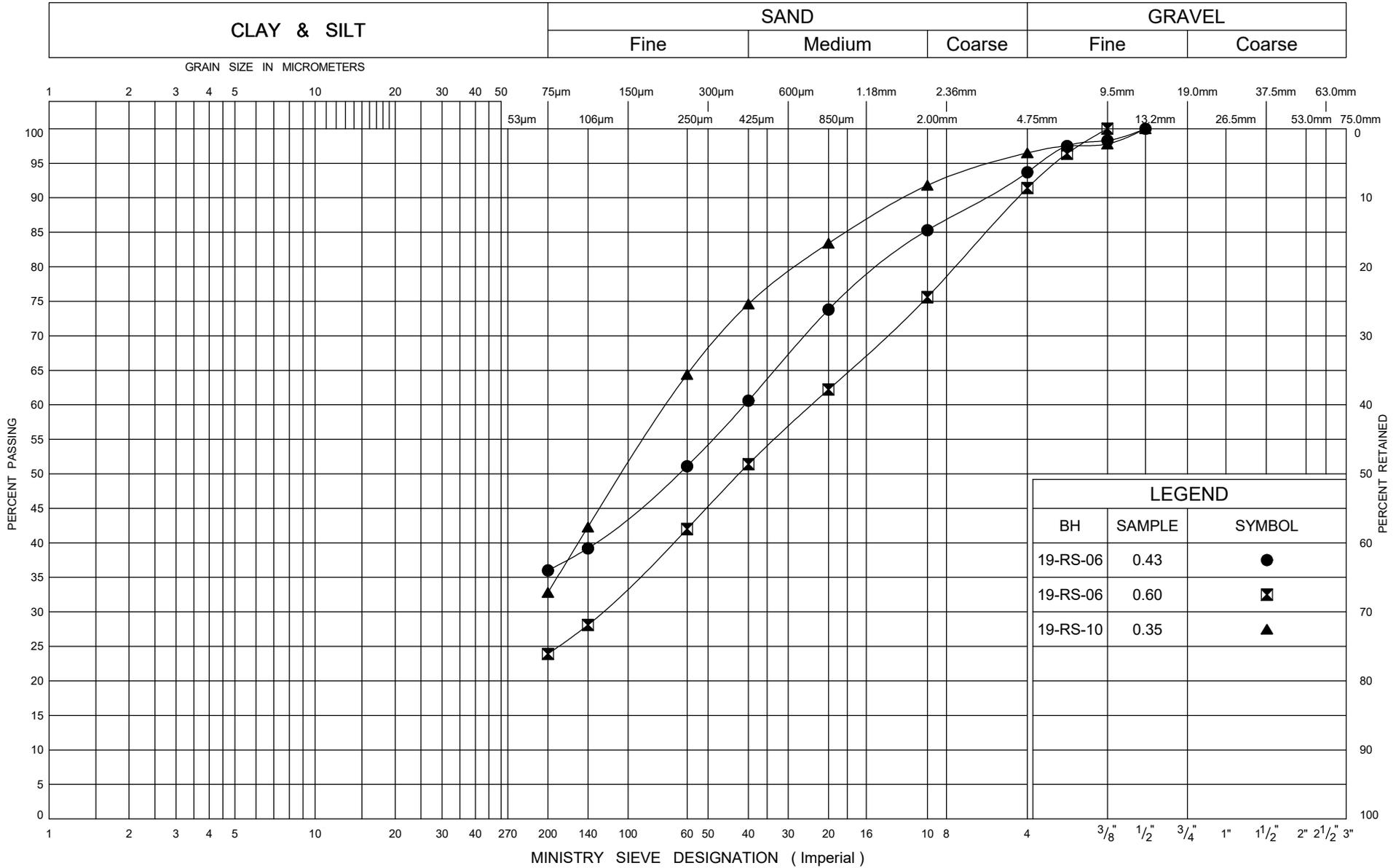
Silty Gravel with Sand

FIG No 7

W P GWP No. 6120-15-00

6017-E-0066, Assignment 5

## UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND		
BH	SAMPLE	SYMBOL
19-RS-06	0.43	●
19-RS-06	0.60	☒
19-RS-10	0.35	▲



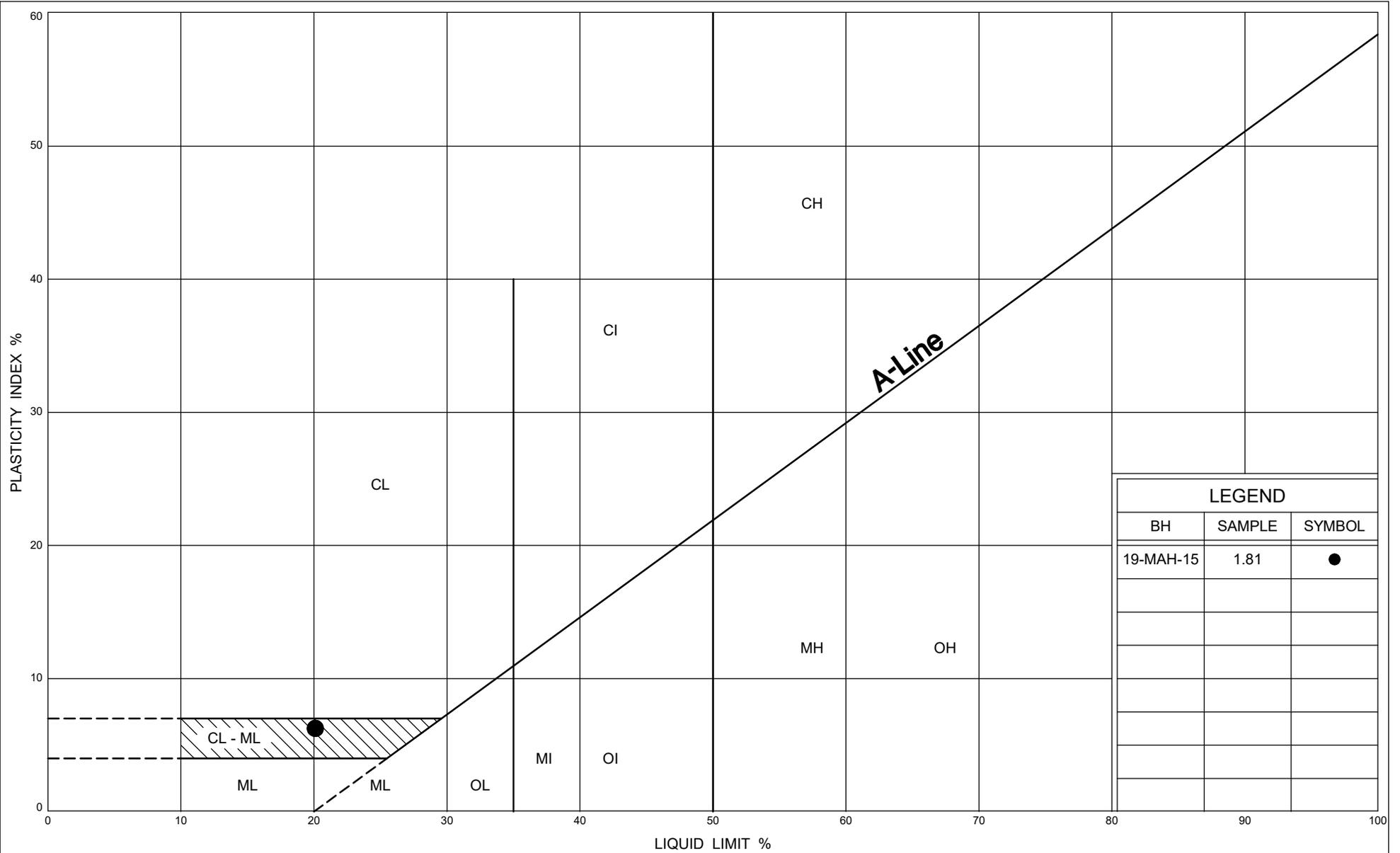
### GRAIN SIZE DISTRIBUTION

Silty Sand

FIG No 8

W PGWP No. 6120-15-00

6017-E-0066, Assignment 5



**PLASTICITY CHART**  
Sandy Clayey Silt

FIG No 9  
W P GWP No. 6120-15-00  
6017-E-0066, Assignment 5