

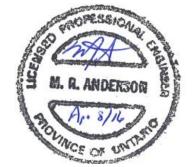
# PRELIMINARY GEOTECHNICAL INVESTIGATION TRAFALGAR ROAD IMPROVEMENTS FROM STEELES AVENUE TO HIGHWAY 7 HALTON REGION, ONTARIO

**Report Submitted** 

То

MMM Group Limited

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## 1.0 INTRODUCTION

This report presents the results of a preliminary geotechnical investigation carried out by Thurber Engineering Ltd. in support of the Class Environmental Assessment Study underway for proposed improvements to the Trafalgar Road transportation corridor between Steeles Avenue and Highway 7 in the Region of Halton, Ontario. The project corridor is approximately 12.8 km in length.

The purpose of this investigation was to obtain subsurface information along the roadway corridor and based on the findings, to provide preliminary geotechnical recommendations for roadway widening, pavement design, municipal service installation, culvert extensions, bridge widening and potential rail grade separations.

The geotechnical investigation was carried out in general accordance with Thurber's proposal letter No. 113-3787 dated November 4, 2013.

It is a condition of this report that Thurber's performance of its professional services will be subject to the attached Statement of Limitations and Conditions.

### 2.0 PROJECT AND SITE DESCRIPTION

Trafalgar Road is a major arterial road primarily comprising a two lane rural cross section with localized widening to four lanes at the intersections with Steeles Avenue and 5 Side Road. An urban curb and gutter section is present from 15 Side Road to north of 17 Side Road. The roadway generally passes through agricultural lands, and borders the west side of Georgetown at the north end of the study area between 15 Side Road and Highway 7. The ground surface is typically flat to undulating, with overall grades generally falling towards the south.

Structures/crossings within the corridor include the following:

- Two concrete culverts located approximately 400 and 1,000 m north of Steeles Avenue;
- The Black Creek bridge located approximately 500 m north of 15 Side Road;
- A level crossing of the Canadian National Railway (CNR) approximately 150 m north of 17 Side Road/Maple Avenue; and
- A level crossing of the Metrolinx transit rail located approximately 300 m south of Highway 7.



Photographs from the site are provided in Appendix D.

The anticipated corridor improvements include pavement widening to four lanes, potential grade separations at the railway crossings, intersection improvements, and alignment adjustments where necessary.

The study area is located within the South Slope physiographic region, a gently rolling till plain generally comprising silty clay to clayey silt till (Halton Till) underlain by reddish brown shale bedrock of the Queenston Formation. Surficial deposits of glaciolacustrine silts and clays, outwash sands and gravels (north of 15 Side Road), and recent alluvium are expected to overlie the Halton Till locally. The south end of the corridor extends into the Peel Plain region, where surficial deposits of glaciolacustrine clay become more prevalent.

The depth to bedrock is expected to be highly variable, with depths of about 5 to 25 m indicated on maps of drift thickness. A poorly defined bedrock valley is believed to exist below the approximate alignment of Black Creek, and bedrock depths greater than 30m have been reported. In addition, a bedrock exposure is indicated on the south side of Black Creek immediately east of Trafalgar Road.

### 3.0 INVESTIGATION PROCEDURES

### 3.1 Field Investigation

The field investigation was carried out during the period February 4 to 17, 2016 and comprised 21 boreholes drilled at approximate 500 m intervals along Trafalgar Road. Boreholes 15-01 to 15-05 were drilled to 2.1 m depth in the section south of 5 Side Road where existing borehole information was available from a previous investigation. At the bridge and railway crossing locations, Boreholes 15-15 and 15-17 were terminated in shale at 9.3 and 12.3 m depth, and Borehole 15-20 was drilled to 15.9 m depth. The remaining boreholes were terminated at depths of 4.7 to 5.2 m.

The borehole locations are shown on Drawings 19-1351-253-1 to 4, Appendix A. The borehole locations were established by Thurber relative to existing site features. The locations were subsequently tied in using a GPS unit with an accuracy of 0.5 m. The ground elevations at the boreholes were interpreted from a base plan provided by MMM Group Limited.

All borehole locations were cleared of utilities and road occupancy permits were obtained prior to commencement of drilling. The boreholes were repositioned as necessary in consideration of



the utility locations and surface features. Traffic control was provided during drilling on the roadway.

The boreholes were advanced using a truck-mounted CME-55 drill rig supplied and operated by DBW Drilling Limited. Solid stem augers were employed to advance all boreholes except the three deeper boreholes in which hollow stem augers were employed, and soil samples were obtained in conjunction with the Standard Penetration Test (SPT).

The field investigation was carried out under the full-time supervision of Thurber technical staff. All boreholes were logged in the field. Soil samples were identified, placed in labelled containers and transported back to Thurber's laboratory for further examination and testing.

Groundwater conditions in the open boreholes were observed during drilling. Standpipe piezometers were installed in selected boreholes to measure groundwater levels. All boreholes without standpipes were backfilled with auger cuttings or bentonite holeplug upon completion in general accordance with MOE Regulation 903.

Results of the field drilling, sampling and testing are presented on the Record of Borehole sheets in Appendix B.

### 3.2 Laboratory Testing

Geotechnical laboratory testing consisted of natural moisture content determinations, visual classification and description of all soil samples. Grain size distribution analyses were carried out on selected samples of the pavement granular materials and subgrade soils, and Atterberg Limits tests were completed on several samples exhibiting plasticity.

Results of the geotechnical laboratory testing are presented on the Record of Borehole sheets included in Appendix B and are presented on the figures included in Appendix C.

### 4.0 SUMMARY OF SUBSURFACE CONDITIONS

A generalized description of the subsurface conditions encountered in the boreholes drilled at the site is given below. The Record of Borehole sheets in Appendix B provide detailed descriptions of the soil conditions at specific locations drilled, and must be used in preference to these generalized descriptions. It should be recognized that soil conditions may vary between and beyond borehole locations.



The subsurface stratigraphy encountered in the boreholes generally comprises a surficial pavement structure and discontinuous fill layers, overlying till deposits comprising silty clay to sand and silt, and locally zones of sand to silt. Shale bedrock was contacted in three boreholes.

## 4.1 Pavement Structure

The pavement structure revealed in the boreholes drilled on Trafalgar Road comprised 150 to 175 mm of asphalt overlying 455 to 735 mm of granular material. The total pavement thickness varied from 610 to 900 mm.

The results of particle size distribution analyses conducted on samples of the granular material are presented on Figures C1 and C2 in Appendix C. The gradation of the samples generally meets the OPSS Granular B Type I gradation specification with the exception of the measured fines content (percentage passing the 75  $\mu$ m sieve) of 10 to 25%. The fines content may reflect the effects of compaction, auger sampling procedures, infiltration of fines with road runoff, or deterioration of the granular material over time.

Moisture contents in the granular material ranged from 2 to 5%.

# 4.2 Fill

Fill was encountered below the pavement structure in 13 of the 21 boreholes. In general, the fill layer was 0.6 to 1.5 m thick and consisted of silty sand, trace clay to clayey, trace to some gravel. Locally at the Black Creek bridge (Borehole 15-15) and Metrolinx crossing (Borehole 15-20), the fill thickness was 1.8 and 3.7 m, respectively. Clay fill was encountered at two locations (Boreholes 15-06 and 15-17), and gravelly sand fill was encountered south of Highway 7 (Borehole 15-21).

The lower boundary of the fill was encountered at depths of 1.4 to 4.4 m (Elev. 229.0 to 274.4 m).

Standard Penetration Test N-values obtained in the fill generally varied from 10 to 27 blows/0.3 m, indicating a compact or stiff to very stiff condition. Higher N-values of 60 blows/0.3 m to 50 blows/0.1 m were obtained in Boreholes 15-06, 15-09, 15-11 and 15-13 where a buried asphalt layer was encountered, believed to be a former road surface. Moisture contents ranged from 4 to 12%.

The results of grain size distribution analyses conducted on samples of the fill are presented on Figure C3 of Appendix C. The results are summarized as follows:



Gravel %	5 to 23
Sand %	40 to 53
Silt %	18 to 36
Clay %	9 to 19

# 4.3 Silty Clay

A layer of silty clay with trace to some sand was encountered below the pavement structure and fill in Boreholes 15-15, 15-18 and 15-21. The clay layer was 0.8 to 2.1 m thick, with a lower boundary at depths of 2.3 to 4.6 m (Elev. 237.9 to 273.7). The clay was firm to stiff, with N-values of 4 to 12 blows/0.3 m. Moisture contents of 9% to 24% were measured. The clay in Borehole 15-15 was dark brown and contained organics, and presumably comprised alluvial material adjacent to Black Creek.

### 4.4 Silty Sand Till to Silty Clay Till

A major glacial till deposit was encountered in all boreholes except Boreholes 15-15, 15-19 and 15-21. The composition of the till varied from silty clay, some sand, to silty sand, trace clay, and contained trace to some gravel. The majority of the boreholes were terminated in the till at depths of 2.1 to 5.2 m (Elev. 202.4 to 259.8 m). Where penetrated, the till deposit was 1.5 to 2.9 m thick, locally 9.8 m in Borehole 15-17, with a lower boundary at depths of 2.3 to 11.3 m (Elev. 251.4 and 270.2 m).

SPT N-values recorded in the till varied widely from 5 blows/0.3 m to 50 blows/0.125 m, indicating a loose/firm to very dense/hard condition. The N-values less than 15 blows/0.3 m were typically obtained immediately below the upper boundary of the till, indicating some surficial softening of this deposit. Moisture contents generally ranged from 6 to 20%, with one value of 28%.

The results of grain size distribution analyses conducted on samples of the till are presented on Figures C4 and C5 of Appendix C. The results are summarized as follows:

Gravel %	0 to 16
Sand %	23 to 58
Silt %	26 to 53
Clay %	11 to 24



Till soils frequently contain cobbles, boulders and shale slabs, and these should be anticipated when excavating during construction.

The results of Atterberg Limits testing carried out on three samples of the till exhibiting plasticity are presented on Figure C8 in Appendix C. The results indicate that the till has low plasticity with a group symbol of CL.

### 4.5 Sand to Silt

Cohesionless deposits varying from sand, trace silt, to silt, some sand, were encountered below the fill and pavement structure in Boreholes 15-15, 15-19 and 15-20, below the clay layer in Borehole 15-21, and below the till in Boreholes 15-07, 15-13 and 15-18. Boreholes 15-07, 15-13, 15-18, 15-19 and 15-21 were terminated in the sand/silt at depths of 4.7 to 5.2 m (Elev. 255.8 to 271.5). The sand and silt was underlain by shale at 7.6 m depth (Elev. 234.9) in Borehole 15-15, indicating a layer thickness of 3.1 m. In Borehole 15-20, an upper 1.7 m thick layer of silty sand was encountered below the fill, overlying a 1.5 m thick till layer, and an underlying sand deposit extending to the borehole termination depth of 15.9 m (Elev. 261.7).

The cohesionless deposits were typically compact to very dense with SPT N-values ranging from 20 blows/0.3 m to 50 blows/0.075 m. Isolated N-values of 4 to 8 blows/0.3 m were obtained in in Boreholes 15-13, 15-20 and 15-21, indicating loose zones. Moisture contents of 3% to 21% were recorded.

The results of grain size distribution analyses conducted on samples of the sand and silt are presented on Figures C6 and C7 of Appendix C. The results are summarized as follows:

	Silt/Sand	<u>Sand</u>
Gravel %	0	3 to 16
Sand %	19 to 45	68 to 90
Silt %	47 to 69	7 to 16
Clay %	8 to 12	7 to 16

### 4.6 Shale Bedrock

Shale bedrock was contacted below the till in Boreholes 15-08 and 15-17, and below the sand and silt in Borehole 15-15. The depth to bedrock and the bedrock surface elevation encountered in the boreholes are summarized in Table 4.1.



Borehole No.	Bedrock Surface Level		
Borenole No.	Depth (m)	Elevation (m)	
15-08	4.6	251.4	
15-15	7.6	234.9	
15-17	11.3	256.2	

Table 4.1 – Depth/Elevation of Bedrock Surface

Borehole 15-08 was terminated essentially at the bedrock surface. Boreholes 15-15 and 15-17 were advanced to total depths of 9.3 and 12.3 m by augering 1.7 and 1.1 m into the bedrock.

#### 4.7 Groundwater Levels

Water was observed in Borehole 15-10 upon completion of drilling. Standpipe piezometers were installed in Boreholes 15-06, 15-09, 15-12, 15-15, 15-17 and 15-20 upon completion. The depths and elevations of water levels measured in the boreholes upon completion and in the piezometers installed are summarized in Table 4.2.

Borehole No.	Measured Water Levels		Date	Comment	
Borenole No.	Depth (m)	Elevation (m)	Dale		
15-06	Dry	-	Feb 09, 2016	Upon completion	
15-00	Dry	-	Mar 15, 2016	In piezometer	
15-09	2.1	251.4	Feb 09, 2016	Upon completion	
15-09	1.6	251.9	Mar 15, 2016	In piezometer	
15-10	1.7	251.7	Feb 12, 2016	Upon completion	
15-12	Dry	-	Feb 11, 2016	Upon completion	
10-12	1.2	256.6	Mar 15, 2016	In piezometer	
15-15	2.4	240.1	Mar 15, 2016	In piezometer	
15-17	0.7	266.8	Mar 15, 2016	In piezometer	
15-20	8.9	268.7	Mar 15, 2016	In piezometer	

 Table 4.2 – Measured Groundwater Levels

The recorded levels are short-term readings and seasonal fluctuations are to be expected. The groundwater level may be at a higher elevation after the spring snowmelt or after periods of heavy rainfall.

### 5.0 EXISTING GEOTECHNICAL DATA

Existing geotechnical information was available from two previous investigations carried out within the project corridor:



- 1. Geotechnical Investigation, Trafalgar Road / Stewarttown Road Watermain, Halton Hills, Ontario. Thurber Report No. 17-550-137 dated July 6, 2001.
- Geotechnical Data Report, Zone 4 Feedermains, Trafalgar Road and Derry Road, Regional Municipality of Halton. Thurber Report No. 17-123-902 dated November 9, 2015.

The Record of Borehole sheets from the previous investigations are included in Appendix E. The locations of the previous boreholes are included on the Borehole Location Plan drawings in Appendix A. A brief summary of the borehole findings is presented below.

### 5.1 Trafalgar/Stewarttown Watermain

In June 2001, two boreholes designated 01-3 and 01-4 were drilled along Trafalgar Road between 15 Side Road and Stewarttown Road. The subsurface stratigraphy encountered in one borehole consisted of a pavement structure overlying firm to soft silty clay (possible fill) underlain by compact sandy silt. In the other borehole, the pavement structure was underlain by very stiff to hard clayey silt till overlying sand. Both boreholes were terminated at 5.0 m depth.

### 5.2 Zone 4 Feedermain

During the period January to August 2015, a series of 21 boreholes designated 14-073 to 14-103 were drilled to depths of 6.2 to 18.4 m along Trafalgar Road from between Steeles Avenue and 1.0 km north of 5 Side Road. The subsurface stratigraphy encountered in the boreholes was generally consistent with the current information, comprising a pavement structure or granular shoulder material overlying discontinuous fill layers, underlain by predominant till deposits with intermittent layers of silt, sand and clay. Shale was contacted below the till deposits at depths of 9.9 to 12.2 m in boreholes drilled between Steeles Avenue and 700 m north.

The pavement structure recorded in the boreholes consisted of 150 to 200 mm of asphalt over approximately 550 to 1900 mm of granular material. An approximate 700 to 2200 mm thick layer of granular material was encountered in the roadway shoulders.

Boreholes 14-076 and 14-099 were drilled adjacent to the culvert located approximately 400 m north of Steeles Avenue. The stratigraphy encountered in these boreholes consisted of a pavement/shoulder structure overlying firm to very stiff clay fill and loose to compact sand fill, underlain by hard silty sandy clay till contacted at depths of 4.1 and 4.3 m (Elev. 201.3 and 201.2). The till deposit graded to sand and silt (very dense) with depth, and then back to clay till



in Borehole 14-076. Shale bedrock was contacted at 9.9 m depth (Elev. 195.6) in Borehole 14-099. Water was measured at 2.8 m depth (Elev. 202.6) in a piezometer installed in Borehole 14-076.

Boreholes 14-080/80A and 14-103 were drilled adjacent to the culvert located approximately 1.0 km north of Steeles Avenue. The stratigraphy encountered in these boreholes consisted of shoulder granular material primarily overlying very stiff to hard clay till, underlain by compact to very dense sand and silt deposits contacted at depths of 7.4 and 7.8 m (Elev. 195.2 and 195.7). The boreholes were terminated in the sand at depths of 14.3 and 17.0 m (Elev. 188.6 and 186.0). Water was measured at depths of 0.7 to 1.0 m (Elev. 202.4 to 201.9) in piezometers installed in the boreholes.

## 6.0 EXISTING PAVEMENT CONDITIONS

A visual examination of the roadway surface was carried out in March 2016 to obtain a general overview of the existing pavement conditions. In general, the existing roadway pavement is in good condition with relatively few distresses. The following localized conditions were noted:

- The intersections at Steeles Avenue and 5 Side Road have been widened and reconstructed relatively recently.
- Slight to moderate longitudinal cracking is evident intermittently, and is particularly noted in an approximate 600 m long section north of Hornby Road.
- Two sections of pavement, approximately 200 m long and located about 200 m to the north and south of 10 Side Road, exhibit more severe distresses (cracking and distortion), and appear to have been omitted from resurfacing works at the 10 Side Road intersection and along Trafalgar Road to the north and south.
- Extensive routing and sealing of longitudinal and transverse cracks has been carried out between the CNR crossing and Highway 7.

Representative photographs of the existing pavement are provided in Appendix D.



## 7.0 GEOTECHNICAL EVALUATION AND PRELIMINARY RECOMMENDATIONS

This section provides preliminary geotechnical recommendations for widening and rehabilitation of the pavement structure within the project limits, extension of two culverts if required, bridge widening, potential railway grade separations, and underground municipal services.

The preliminary recommendations are based on the subsurface soil and groundwater conditions encountered during the investigation. The soil conditions may vary between and beyond the borehole locations. A detailed geotechnical investigation is required to further define the subsurface conditions and confirm the preliminary recommendations when details of the design are established.

### 7.1 Pavement Structure Design

It is anticipated that Trafalgar Road will be widened to four lanes from the current two lane configuration. Pavement structural design analysis and recommendations for a 20 year design life are discussed in the ensuing sections.

#### 7.1.1 Design Methodology

Traffic projections for Trafalgar Road were provided by MMM Group based on midblock 8-hour volume counts. The information is summarized in Table 7.1.

Section		Estimated 2031 24-hr	Growth Rate	2013 Truck %		
Section	Traffic	Traffic	(Compound)	Small	Medium	Heavy
South of 5 Side Road	13707	20348	2.5%	4.0	3.7	2.7
North of 5 Side Road	18458	27401	2.5%	2.1	2.1	2.2
North of 10 Side Road	16997	25231	2.5%	2.7	2.0	1.8
200m South of Maple Avenue	18086	26852	2.5%	2.3	1.5	2.3
North of Maple Avenue (north of CNR)	11277	16742	2.5%	-	-	-
Between 20 Side Road and Highway 7	9859	14638	2.5%	3.2	2.5	2.9

Typical truck factors were assigned to each vehicle class, as per the MTO publication *Adaptation and Verification of AASHTO Pavement Design Guide for Ontario Conditions*. The assumed truck factors are summarized in Table 7.2.



Vehicle Type	Average Truck Factor
Small Trucks	0.5
Medium Trucks	4.0
Heavy Trucks	2.0

Table 7.2 – Design Truck Factors

The traffic data was used to determine the pavement damage caused by the anticipated traffic volumes. Using the truck factors, the pavement damage caused by different truck classes are converted to a standard axle load known as an Equivalent Single Axle Loads (ESALs). The ESALs calculation was completed in accordance with the MTO *Procedures for Estimating Traffic Loads for Pavement Designs*. The 20-year design ESALs computed for each section of Trafalgar Road, based on construction in 2018 south of 10 Side Road and 2020 north of 10 Side Road, are as follows:

Section	20-Year ESALs
South of 5 Side Road	12,195,000
North of 5 Side Road	10,248,000
North of 10 Side Road	8,712,000
200m South of Maple Avenue	8,440,000
North of Maple Avenue (north of CNR)	8,601,000
Between 20 Side Road and Highway 7	9,031,000

Table 7.3 – Calculated Design ESALs

Flexible pavement designs were developed using the AASHTO procedure as outlined in the 1993 Guide for Design of Pavement Structures. The AASHTO procedure for the design of flexible pavements determines a required Structural Number (SN) that characterizes the structural capacity of the pavement layers, for a given set of inputs. This structural number is then distributed in terms of thickness among the various pavement layers (asphalt and granular base/subbase) according to the structural coefficients for each layer, as well as the materials drainage characteristics. The AASHTO design methodology was adapted and verified for pavement design in Ontario, as outlined in the 2001 Ministry of Transportation, Ontario (MTO) publication MI-183.

The following inputs were used in calculating the required structural number for Trafalgar Road:

- Design period = 20 years
- Initial serviceability, (P<sub>i</sub>) = 4.5



- Terminal serviceability (Pt) = 2.5
- Mean soil resilient modulus (M<sub>R</sub>) = 32 MPa (Stiff Clay Till Subgrade)
- Reliability level (R) = 90 percent
- Overall standard of deviation (S<sub>o</sub>) = 0.44

Based on the selected input values and the calculated ESALs, the required design SN (SN<sub>Des</sub>) values for Trafalgar Road were determined to range from 140 to 143 mm south of 10 Side Road and 136 to 138 mm north of this intersection. The new pavement structures to support the calculated SN<sub>Des</sub> are as follows:

	South of 10 Side Road	North of 10 Side Road
Hot Mix Asphalt	175 mm	160 mm
Granular A Base	150 mm	150 mm
Granular B, Type II Subbase	550 mm	550 mm

### 7.1.2 Recommended Pavement Design

Based on the borehole data, the anticipated traffic volumes, and assuming adequate subgrade drainage, the following preliminary pavement design is recommended for reconstruction of Trafalgar Road:

	South of 10 Side Road	North of 10 Side Road
HL1	50 mm	50 mm
HDBC (2 lifts)	125 mm	110 mm
Granular A Base	150 mm	150 mm
(19mm crusher run limestone)		
Granular B Type II Subbase	550 mm	550 mm
(50mm crusher run limestone)		

All Hot Mix Asphalt (HMA) material should meet the requirements of OPSS 310, as modified by the Region of Halton Specifications for Hot Mix Asphalt Paving, Materials, Sampling, and Testing. An asphalt cement binder grade of PG 64-28 is recommended for all asphalt mixes. All granular base material shall consist of OPSS Granular A or 19 mm crusher run limestone, while the granular subbase material shall consist of OPSS Granular B, Type II or 50 mm crusher run limestone.

If grades permit rehabilitation of the existing pavement structure for reuse in the final pavement, a hot mix overlay of 140 mm would be required over the existing pavement to carry the predicted 20-year ESALs (following a 40 mm milling of the existing surface). This overlay would



require a grade raise of 100 mm and would not fully prevent distresses in the existing pavement from reflecting through the overlay to the new pavement surface. Pulverizing (full depth in-place reclamation) of the existing hot mix, followed by regrading, compacting and placement of the hot mix thicknesses outlined above for new pavements could be considered in order to eliminate reflection cracking, provided a grade raise of 160 to 175 mm can be accommodated.

## 7.1.3 Pavement Subgrade Preparation

Pavement subgrade preparation should include removal of the existing pavement structure and all surficial vegetation, topsoil, organic or compressible material. Grading to the new top of subgrade should match or exceed the thickness of the existing pavement to maintain lateral drainage at the top of subgrade. The exposed subgrade should be compacted and proof-rolled with a heavy roller and examined to identify areas of unstable subgrade. Any soft/wet areas identified shall be subexcavated and replaced with approved material within 2% of Optimum Moisture Content (OMC), and compacted to at least 98% of Standard Proctor Maximum Dry Density (SPMDD).

Bulk fill used to raise the road grade should be constructed as engineered fill, consisting of approved inorganic material, placed in maximum 200 mm thick lifts, within 2% of optimum moisture content, and compacted to at least 98% of SPMDD. Standard side slopes of 2H:1V or flatter should be suitable for embankment construction. Exposed embankment surfaces should be provided with a vegetation cover or otherwise protected against erosion in accordance with OPSS 804.

The top of the compacted subgrade should be graded smooth with a minimum crossfall of 3% towards side ditches or subdrains. Continuity of drainage should be maintained at transitions from existing pavement to new pavement.

# 7.2 Culvert Extension – 400 m North of Steeles Avenue

The existing box culvert located approximately 400 m north of Steeles Avenue will require extension to accommodate the widened four lane cross-section.

The stratigraphy encountered in Boreholes 14-076 and 14-099 drilled adjacent to the culvert consisted of a pavement/shoulder structure overlying firm to very stiff clay fill and loose to compact sand fill, underlain by hard silty sandy clay till contacted at depths of 4.1 and 4.3 m (Elev. 201.3 and 201.2). The till deposit graded to sand and silt (very dense) with depth. Shale bedrock was contacted at 9.9 m depth (Elev. 195.6) in one borehole. Water was measured at 2.8 m depth (Elev. 202.6).



The base of the box culvert extensions should be placed at the same level as the existing culvert base. All existing fill, topsoil, organic/streambed deposits and soft/loose soils should be removed from the culvert subgrade prior to placement of the culvert bedding material.

Based on the borehole data, the highest recommended level for the underside of the granular bedding material is Elev. 201.2 m. A factored bearing resistance at ULS of 450 kPa and a bearing resistance at SLS of 300 kPa is recommended for preliminary assessment of a culvert base founded on undisturbed native silty sandy clay till at this level.

Backfill to the culvert and any headwalls should consist of free-draining, non-frost susceptible granular materials conforming to OPS Granular A or Granular B Type II requirements. Reference should be made to the backfill arrangements stipulated in OPSD 803.010, 3121.150 and 3190.100, as appropriate.

Erosion protection should be provided at the new culvert inlet and outlet areas. Vegetation cover, riprap or other protective measures should be established on the creek banks to protect against surficial erosion and seepage-induced material loss.

# 7.3 Culvert Extension and Addition – 1.0 km North of Steeles Avenue

The existing twin box culvert located approximately 1.0 km north of Steeles Avenue will require extension to accommodate the widened four lane cross-section. A third cell will also be added to accommodate future drainage conditions and avoid flooding under Regional storm events.

The stratigraphy encountered in Boreholes 14-080/080A and 14-103 drilled adjacent to the culvert consisted of a shoulder structure overlying very stiff to hard clayey silt and silty sandy clay till contacted at depths of 1.4 and 1.2 m (Elev. 201.5 and 201.8). Compact to very dense sand and silt deposits were contacted at depths of 7.4 and 7.8 m (Elev. 195.2 and 195.7). Water was measured at depths of 0.7 to 1.0 m (Elev. 202.4 to 201.9).

The base of the box culvert extensions and addition should be placed at the same level as the existing culvert base. All existing fill, topsoil, organic/streambed deposits and soft/loose soils should be removed from the culvert subgrade prior to placement of the culvert bedding material.

Based on the borehole data, the highest recommended level for the underside of the granular bedding material is Elev. 201.5 m. A factored bearing resistance at ULS of 300 kPa and a bearing resistance at SLS of 200 kPa is recommended for preliminary assessment of a culvert base founded on undisturbed native clayey silt and silty sandy clay till at this level.



Backfill to the culvert and any headwalls should consist of free-draining, non-frost susceptible granular materials conforming to OPS Granular A or Granular B Type II requirements. Reference should be made to the backfill arrangements stipulated in OPSD 803.010, 3121.150 and 3190.100, as appropriate.

Erosion protection should be provided at the new culvert inlet and outlet areas. Vegetation cover, riprap or other protective measures should be established on the creek banks to protect against surficial erosion and seepage-induced material loss.

### 7.4 Black Creek Bridge Replacement

The existing Black Creek bridge will require replacement to accommodate the widened four lane cross-section and a grade raise to avoid overtopping of Trafalgar Road under Regional storm events.

The stratigraphy encountered in Borehole 15-15 drilled at the bridge location consisted of a pavement structure overlying compact silty sand fill and a silty clay alluvial layer, underlain by very dense native sand and silt contacted at 4.6 m depth (Elev. 237.9). Shale bedrock was contacted below the sand and silt at 7.6 m depth (Elev. 234.9). Water was measured at a depth of 2.4 m below the road surface (Elev. 240.1).

The preliminary profile drawing provided by MMM Group indicates that the base of the creek channel is at about Elev. 238.8.

Based on the borehole data, supporting the replacement bridge on spread footings extended down to the very dense sand and silt encountered at 4.6 m depth, below the level of all fill and organic material, could be considered. It is noted however that excavation for footing construction would extend approximately 2.0 m below the measured groundwater level, and installation of a cofferdam and dewatering system would be required to enable construction of footings in the dry and prevent base instability in the cohesionless foundation subgrade. Installation of a driven sheet pile cofferdam may not be practical due to the very dense condition of the underlying sand and silt, and therefore spread footings are not the preferred foundation option based on the preliminary borehole information.

The use of steel H-piles driven to refusal in the very dense sand and silt or shale bedrock may be considered. For preliminary design purposes, a factored geotechnical resistance at ULS of 1,400 kN and a geotechnical reaction at SLS of 1,200 kN are recommended for HP310x110 piles driven to refusal in the sand/silt or shale. Considering the shallow depth to very dense



native soil, pre-augering may be required to advance the piles to an adequate depth to achieve lateral fixity.

Augered caissons socketed into the underlying bedrock are considered feasible provided a steel liner is sealed into the bedrock to cut off water inflow and support the caisson sidewalls in the alluvial deposits and cohesionless sand and silt below the water level. The axial resistance of the caisson will depend upon the diameter and length of the rock socket. For preliminary planning purposes, factored axial resistances at ULS of 2,500 and 4,000 kN may be assumed for 0.9 and 1.2 m diameter caissons socketed 2.5 m into the bedrock. The SLS reaction will not govern for design of caissons founded in bedrock.

It must be noted that the thickness of alluvial deposits and the depth to bedrock may vary significantly over short distances at the site. Supplementary drilling within the footprint of the proposed foundation units will be necessary to further assess the preferred foundation type and confirm geotechnical parameters for design.

Vegetation cover, riprap or other protective measures should be established on the creek banks to protect against surficial erosion and scour. Scour protection is particularly important if spread footings are employed.

### 7.5 CNR Grade Separation

The preliminary profile drawing provided by MMM Group indicates that the proposed grade separation at the CNR crossing will entail a road cut to carry Trafalgar Road under the CNR. The base of the road cut will be near Elev. 260.0 beneath the rail alignment.

The stratigraphy encountered in Borehole 15-17 drilled near the rail crossing location consisted of a pavement structure overlying silty clay fill to 1.5 m depth, underlain by stiff to very stiff silty clay till and very dense sand and silt till. Shale bedrock was contacted below the sand and silt till at 11.3 m depth (Elev. 256.2). Water was measured at a depth of 0.7 m below the road surface (Elev. 266.8).

Based on the borehole data, the road cut is expected to extend through the silty clay till and into the underlying sand and silt till. In general, the base and sidewalls of the road cut excavated in the till deposits are expected to be stable with permanent cut slopes designed at inclinations not exceeding 2H : 1V. Considering the relatively low permeability of the till, dewatering from within the excavation should be feasible and permanent drainage via the storm sewer system should be adequate.



The recommended foundation type for support of the grade separation structure comprises spread footings founded on the very dense sand and silt till encountered at 4.6 m depth. A factored geotechnical resistance at ULS of 600 kPa and a geotechnical reaction at SLS of 400 kPa are recommended for preliminary design of spread footings founded on the very dense till.

The use of steel H-piles driven to refusal in the very dense sand and silt till or shale bedrock may also be considered. Pre-augering and/or socketing the piles will be required to provide an adequate depth of pile embedment to provide lateral fixity. For preliminary design purposes, a factored geotechnical resistance at ULS of 1,400 kN and a geotechnical reaction at SLS of 1,200 kN are recommended for HP310x110 piles driven to refusal in the very dense till or shale.

Considering the high geotechnical resistance available in the very dense till at the anticipated founding level for spread footings, the use of augered caissons is not expected to be a cos-effective foundation alternative.

## 7.6 Metrolinx Grade Separation

The preliminary profile drawing provided by MMM Group indicates that the proposed grade separation at the Metrolinx rail crossing will entail a relatively shallow road cut under the railway, primarily involving excavation through the existing raised track embankment. The base of the road cut will near Elev. 272.0 beneath the rail alignment.

The stratigraphy encountered in Borehole 15-20 drilled near the rail crossing location consisted of a pavement structure overlying compact silty sand fill to 4.4 m depth, underlain by a 1.7 m thick layer of loose silty sand, a 1.5 m thick layer of very stiff silty sandy clay till, and compact to dense sand contacted at 7.6 m depth (Elev. 270.0). Water was measured at a depth of 8.9 m below the road surface (Elev. 268.7).

Based on the borehole data, the road cut is expected to extend through the silty sand embankment fill, silty sand layer and into the underlying silty clay till. In general, the base and sidewalls of the road cut excavated in these deposits are expected to be stable with permanent cut slopes designed at inclinations not exceeding 2H:1V. The groundwater level was measured to be below the proposed base of cut, and therefore groundwater is not expected to be an issue.

Consideration may be given to supporting the proposed grade separation structure on spread footings founded on the dense to compact sand encountered at 7.6 m depth. A factored geotechnical resistance at ULS of 400 kPa and a geotechnical reaction at SLS of 250 kPa are recommended for preliminary design of spread footings founded on the dense sand.



In view of the potentially large footing dimensions necessitated by the available bearing resistance, the use of driven steel H-piles may be preferred. For preliminary design purposes, a factored geotechnical resistance at ULS of 1,200 kN and a geotechnical reaction at SLS of 1,000 kN are recommended for HP310x110 piles driven into the very dense sand below a depth of at least 16.0 m (Elev. 261.6). Additional drilling to greater depth will be required to confirm the recommended pile tip elevation and the axial resistance of pile foundations.

Considering the thick deposit of cohesionless sand below the water table, the use of augered caissons is not recommended to support the proposed grade separation structure at this site due to the potential for sidewall and base instability, dewatering issues and the inability to examine the competency of the caisson base.

## 7.7 Retaining Wall South of Black Creek

We understand that the existing concrete retaining wall on the east side of Trafalgar Road opposite Stewarttown Road South will be replaced and relocated to the east of the existing alignment. The existing wall appears to be performing well.

Boreholes were drilled to the north (Borehole 15-15) and south (previous Borehole 01-3) of the retaining wall. The borehole drilled to the north at Black Creek encountered fill and probable alluvial soils over very dense native sand and silt a depth of 4.6 m. The borehole located to the south encountered fill overlying compact native sandy silt at 3.7 m depth.

Based on the available information, replacement of the existing retaining wall with a concrete cantilever wall, a soldier pile wall or a reinforced soil structure (RSS) is considered feasible from a geotechnical perspective. An RSS wall or spread footings for a cantilever wall should be founded on the compact to very dense native sand/silt below the level of all fill, alluvial/organic materials or loose/soft soils. Soldier piles if employed should be socketed into the very dense native sand and silt and/or the underlying shale bedrock.

A borehole investigation will be required adjacent to the wall during detailed design to establish the depth to competent native material and bedrock at the wall location, and to determine appropriate geotechnical resistance values for foundation design.

### 7.8 Embankment North of Black Creek

It is anticipated that grades on Trafalgar Road will be raised by up to 5 m between Black Creek and Stewarttown Road North. The information from Borehole 15-15 at the Black Creek bridge approach indicates that the existing embankment is underlain by a layer of firm to stiff dark



brown silty clay, presumably comprising alluvial materials deposited in the Black Creek floodplain. Visual examination of the lands adjacent to the embankment appear to be low and wet, and soft organic/alluvial materials are probable in these areas.

Where soft/organic soils are present under the existing embankment fill or embankment widening areas, remedial measures may be required to address the stability of embankment slopes and potential long-term settlement due to the increased embankment loading. Potential measures may include subexcavation of organic deposits, flattening of embankment side slopes, and/or preloading/surcharging of the embankment to minimize post-construction settlement. Further investigation is required during detailed design to determine the thickness and extent of soft, organic soils, and evaluate the need for remedial measures.

#### 7.9 Backfill and Lateral Earth Pressures

Backfill to the grade separation abutments, bridges and any retaining walls should consist of free-draining, non-frost susceptible granular materials conforming to OPS Granular A or Granular B Type II requirements.

The lateral earth pressures acting on the walls, assuming full drainage from behind the walls, may be computed using the following pressure distribution:

р	)	=	Κ (γΗ + q)
where p	)	=	lateral earth pressure acting at depth H, kPa
k	K	=	earth pressure coefficient
γ		=	unit weight of retained soil or backfill, kN/m <sup>3</sup>
F	ł	=	depth below top of wall where pressure is computed, m
q		=	surcharge pressure including traffic loads, kPa

Table 7.4 lists the unfactored parameters recommended for design, assuming an essentially level ground surface behind and in front of the walls:



	Retained Material					
Parameter	OPSS Granular A or Granular B Type II	OPSS Granular B Type I				
Unit Weight, kN/m <sup>3</sup>	22.8	21.2				
Friction Angle, degrees	35	32				
Active Pressure Coefficient, Ka	0.27	0.31				
At-Rest Pressure Coefficient, K0	0.43	0.47				
Passive Pressure Coefficient, $K_p$	3.7	3.3				

#### Table 7.4 – Earth Pressure Parameters

If lateral movement is not permissible and/or the wall is restrained from lateral yielding, the at-rest earth pressure coefficient,  $K_o$ , should be used. If the wall design allows lateral yielding (non-rigid structure), the active earth pressure coefficient,  $K_a$ , may be used.

The earth pressure coefficients in the table above do not include potential compaction effects that must be included in the design. Compaction effects should be considered as per the CHBDC.

Design of the structures must incorporate measures such as weepholes to permit drainage of the backfill and avoid potential build-up of hydrostatic pressures behind the walls.

### 7.10 Municipal Service Installation

Excavation for open cut installation of municipal services within urban sections of roadway will primarily extend through the existing roadway pavement structure and embankment fill, and into native silty clay till and localized sand deposits. Use of a hydraulic excavator should be suitable for trench excavation within these materials.

All temporary excavations must be carried out in accordance with the current Occupational Health and Safety Act (OHSA) of Ontario and local regulations. In general, the fill and native soils are classified as Type 3 soils above the groundwater level, and Type 4 soils if excavation extends below the water level without prior dewatering. Groundwater is not expected to pose construction issues during excavation of relatively shallow trenches.

Prior to placement of the pipe bedding, the base of the trench should be maintained in a dry condition, free of loose or disturbed material. The pipe must be placed on a uniformly competent



subgrade. Pipe bedding materials, compaction and cover should follow OPSD 802.030 to 803.034, and/or Halton Region specifications.

Trench backfill materials should be placed in loose lift thicknesses not exceeding 200 mm and compacted to at least 98% of its SPMMD. Where utility trenches are located beneath the roadway, OPSS Granular A or B material, or unshrinkable fill should be employed as backfill.

For trenches located outside of the roadway, the portion of the trench above the pipe cover can be backfilled with excavated soil provided it is unfrozen and free of organics, debris and other deleterious materials. The placement moisture content should be within about 2% of the optimum moisture content for efficient compaction, and the till must be adequately broken down and compacted in the trench.

#### 7.11 Detailed Geotechnical Investigation

The information presented in this report is provided for preliminary design and planning purposes only. Detailed geotechnical investigation will be required to confirm the subsurface conditions and recommendations. This work should include:

- additional boreholes within the existing roadway pavement and widening areas to confirm the subgrade conditions and preliminary pavement design recommendations;
- deflection testing (FWD) and Ground Penetrating Radar (GPR) testing of the existing roadway if sections of the existing pavement are to be rehabilitated;
- additional boreholes at the proposed bridge, grade separation structures, retaining walls and fill embankments to confirm geotechnical recommendations for foundation design, roadway cut excavations, temporary track and road protection requirements, and embankment design.
- additional boreholes along proposed underground utility alignments, if applicable, when further details regarding the alignment and depth of these services are established;
- further assessment of dewatering requirements and the need for a PTTW; and
- chemical testing to evaluate excess material disposal.



#### STATEMENT OF LIMITATIONS AND CONDITIONS

#### 1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

#### 2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

#### 3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

#### 4. USE OF THE REPORT

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#### 5. INTERPRETATION OF THE REPORT

- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.
- b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.
- c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.
- d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

#### 6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

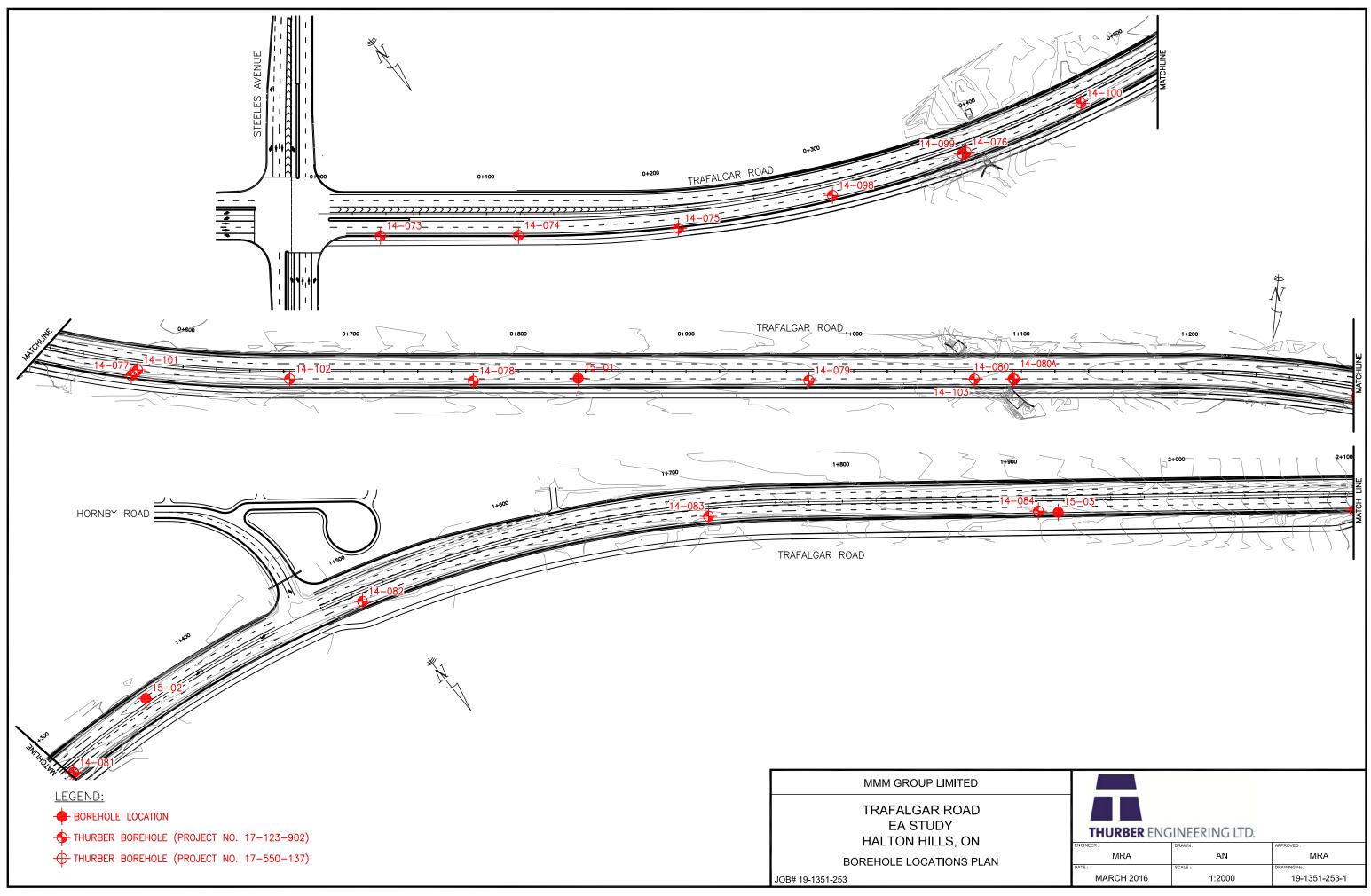
#### 7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpretations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

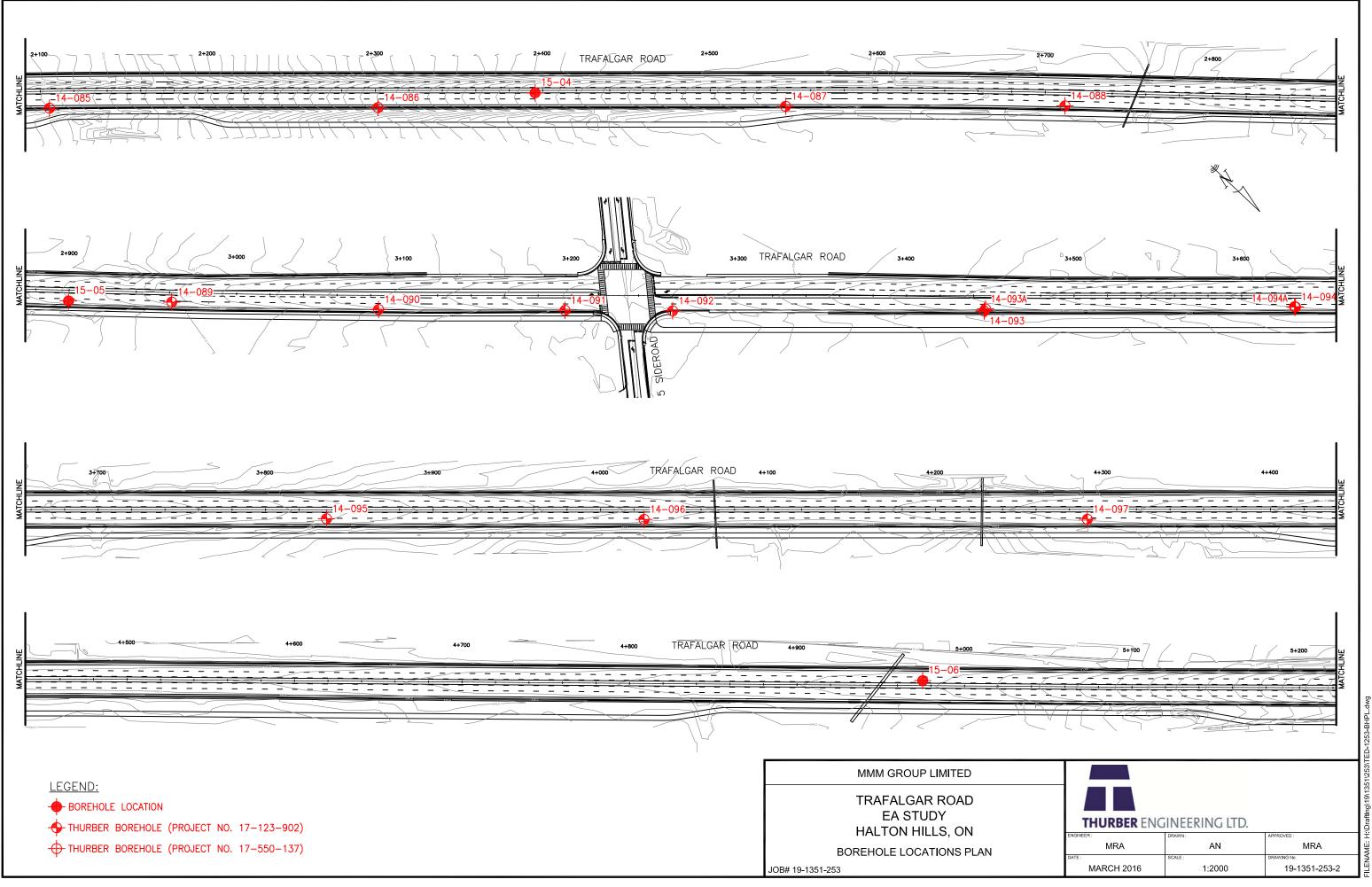


APPENDIX A

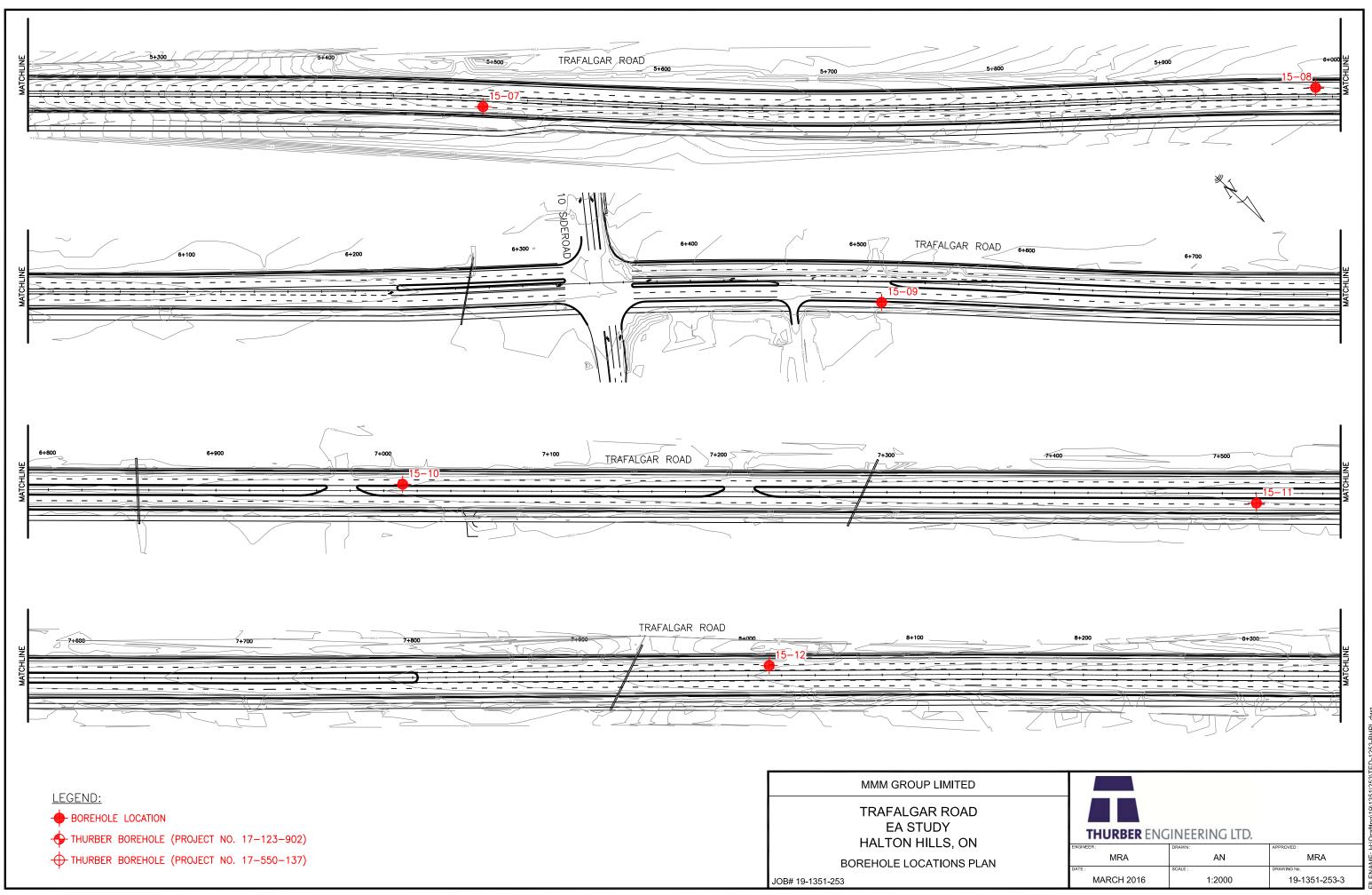
# BOREHOLE LOCATION PLANS



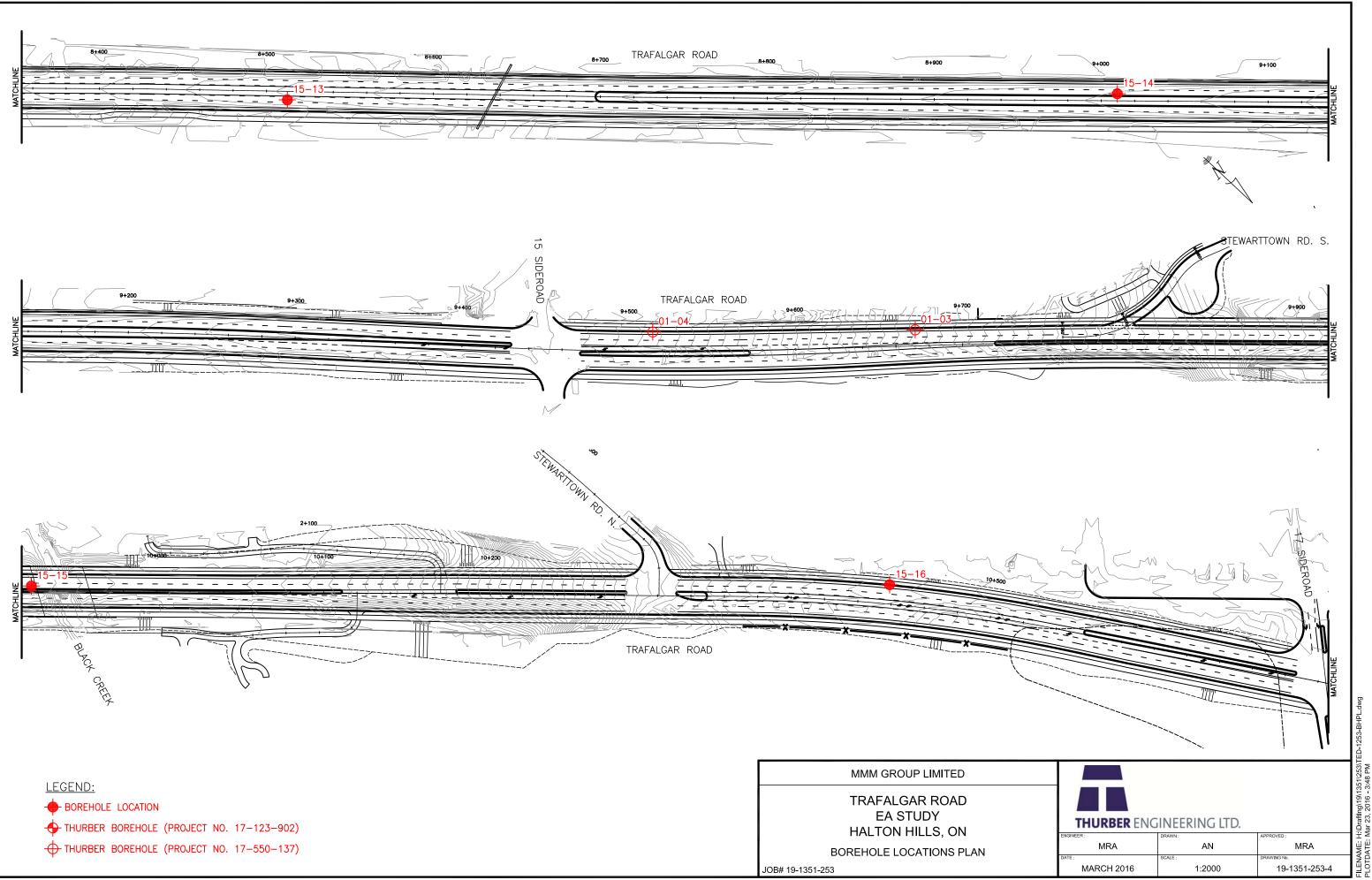
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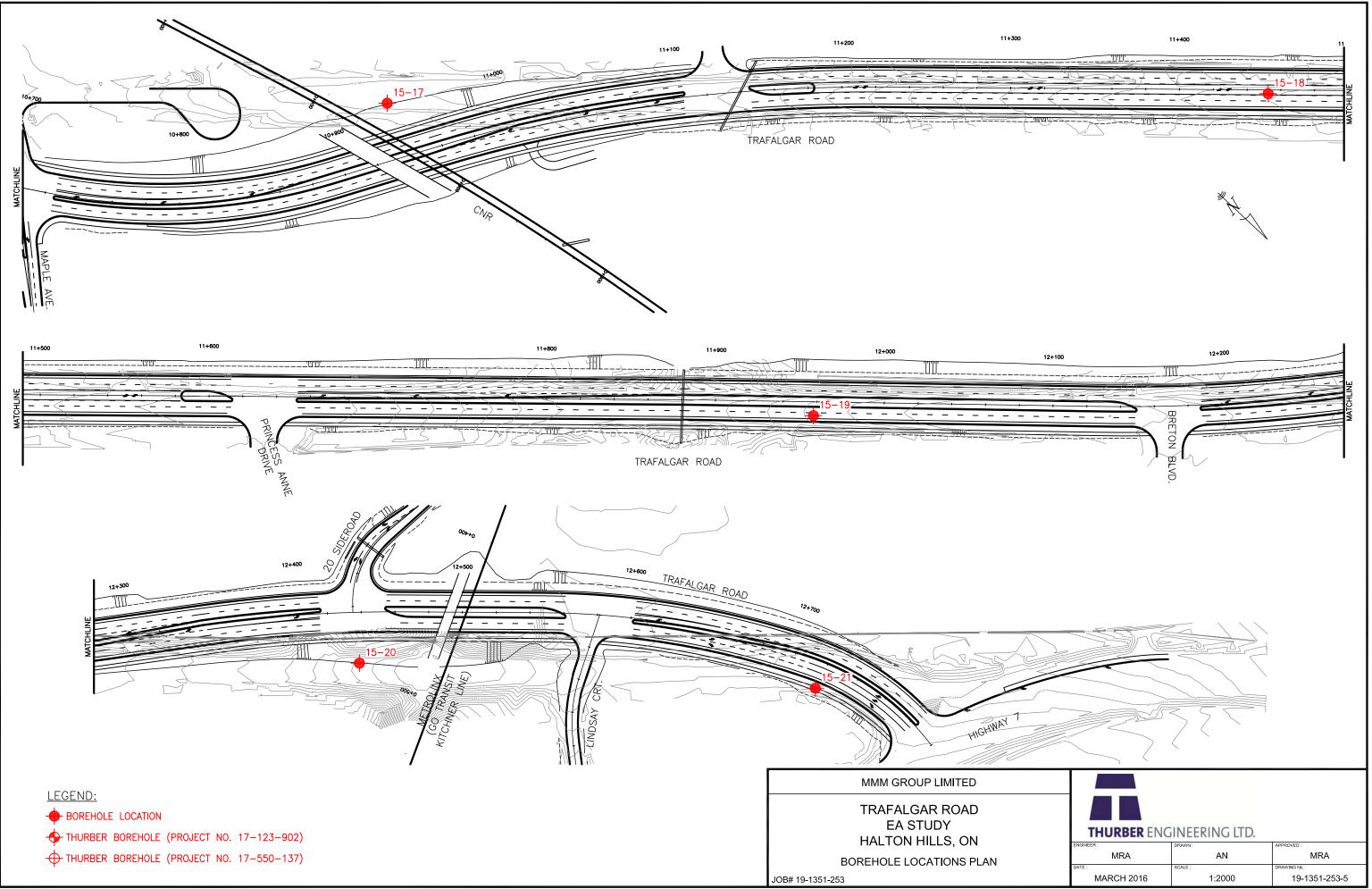
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# APPENDIX B

# **RECORD OF BOREHOLE SHEETS**

#### SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

#### 1. <u>TEXTURAL CLASSIFICATION OF SOILS</u>

2.

3.

4.

5.

Boulders	PARTICLE SIZE						
Cobbles	Greater than 200mm 75 to 200mm	same					
		same					
Gravel	4.75 to 75mm 0.075 to 4.75mm	5 to 75mm Not visible particles to 5mm					
Sand							
Silt	0.002 to 0.075mm	Non-plastic particles, not visible to					
Class	Less than 0.002mm	the naked eye Plastic particles, not visible to					
Clay	Less than 0.002mm	the naked eye					
COARSE GRAIN SOIL DE	ESCRIPTION (50% greater than 0.						
TERMINOLOGY		PROPORTION					
Trace or Occasional		Less than 10%					
Some		10 to 20%					
Adjective (e.g. silty or sand	y)	20 to 35%					
And (e.g. sand and gravel)		35 to 50%					
TERMS DESCRIBING CO	NSISTENCY (COHESIVE SOILS	ONLY)					
DESCRIPTIVE TERM	UNDRAINED SHEAI	R APPROXIMATE SPT <sup>(1)</sup> N'					
	STRENGTH (kPa)	VALUE					
Very Soft	12 or less	Less than 2					
Soft	12 to 25	2  to  4					
Firm	25 to 50	4 to 8					
Stiff	50 to 100	8 to 15					
Very Stiff	100 to 200	15 to 30					
Hard	Greater than 200	Greater than 30					
	4)	<ul><li>3) Laboratory Vane Testing</li><li>4) SPT value</li><li>5) Pocket Penetrometer</li></ul>					
	5)	i oeket i enetrometer					
TERMS DESCRIBING DE	NSITY (COHESIONLESS SOILS	SONLY)					
		SONLY)					
DESCRIPTIVE TERM	SPT "N" VALUE	SONLY)					
DESCRIPTIVE TERM Very Loose	SPT "N" VALUE Less than 4	SONLY)					
DESCRIPTIVE TERM Very Loose Loose	SPT "N" VALUE Less than 4 4 to 10	SONLY)					
DESCRIPTIVE TERM Very Loose Loose Compact	SPT "N" VALUE Less than 4 4 to 10 10 to 30	<u>SONLY)</u>					
DESCRIPTIVE TERM Very Loose Loose	SPT "N" VALUE Less than 4 4 to 10	<u>SONLY)</u>					
DESCRIPTIVE TERM Very Loose Loose Compact Dense	SPT "N" VALUE Less than 4 4 to 10 10 to 30 30 to 50 Greater than 50	<u>SONLY)</u>					
DESCRIPTIVE TERM Very Loose Loose Compact Dense Very Dense LEGEND FOR RECORDS	SPT "N" VALUE Less than 4 4 to 10 10 to 30 30 to 50 Greater than 50 OF BOREHOLES						
DESCRIPTIVE TERM Very Loose Loose Compact Dense Very Dense <u>LEGEND FOR RECORDS</u> SYMBOLS AND	SPT "N" VALUE Less than 4 4 to 10 10 to 30 30 to 50 Greater than 50 OF BOREHOLES SS Split Spoon Sample W	S Wash Sample AS Auger (Grab) Sample					
DESCRIPTIVE TERM Very Loose Loose Compact Dense Very Dense <u>LEGEND FOR RECORDS</u> SYMBOLS AND ABBREVIATIONS	SPT "N" VALUE Less than 4 4 to 10 10 to 30 30 to 50 Greater than 50 OF BOREHOLES SS Split Spoon Sample W TW Thin Wall Shelby Tube Sar	S Wash Sample AS Auger (Grab) Sample mple TP Thin Wall Piston Sample					
DESCRIPTIVE TERM Very Loose Loose Compact Dense Very Dense <u>LEGEND FOR RECORDS</u> SYMBOLS AND	SPT "N" VALUE Less than 4 4 to 10 10 to 30 30 to 50 Greater than 50 OF BOREHOLES SS Split Spoon Sample W	S Wash Sample AS Auger (Grab) Sample mple TP Thin Wall Piston Sample raulic Pressure PM Sampler Advanced by Manual Pre					
DESCRIPTIVE TERM Very Loose Loose Compact Dense Very Dense <u>LEGEND FOR RECORDS</u> SYMBOLS AND ABBREVIATIONS FOR SAMPLE TYPE	SPT "N" VALUE Less than 4 4 to 10 10 to 30 30 to 50 Greater than 50 OF BOREHOLES SS Split Spoon Sample W TW Thin Wall Shelby Tube Sar PH Sampler Advanced by Hydr	S Wash Sample AS Auger (Grab) Sample mple TP Thin Wall Piston Sample raulic Pressure PM Sampler Advanced by Manual Pre					
DESCRIPTIVE TERM Very Loose Loose Compact Dense Very Dense <u>LEGEND FOR RECORDS</u> SYMBOLS AND ABBREVIATIONS FOR	SPT "N" VALUE Less than 4 4 to 10 10 to 30 30 to 50 Greater than 50 OF BOREHOLES SS Split Spoon Sample W. TW Thin Wall Shelby Tube Sar PH Sampler Advanced by Hydr WH Sampler Advanced by Self	S Wash Sample AS Auger (Grab) Sample mple TP Thin Wall Piston Sample raulic Pressure PM Sampler Advanced by Manual Pre					
DESCRIPTIVE TERM Very Loose Loose Compact Dense Very Dense <u>LEGEND FOR RECORDS</u> SYMBOLS AND ABBREVIATIONS FOR SAMPLE TYPE	SPT "N" VALUE Less than 4 4 to 10 10 to 30 30 to 50 Greater than 50 OF BOREHOLES SS Split Spoon Sample W. TW Thin Wall Shelby Tube Sar PH Sampler Advanced by Hydr WH Sampler Advanced by Self Undisturbed Shear Strength	S Wash Sample AS Auger (Grab) Sample mple TP Thin Wall Piston Sample raulic Pressure PM Sampler Advanced by Manual Pre					

SPT 'N' Value Standard Penetration Test 'N' Value – refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.
 DCPT Dynamic Cone Penetration Test – Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone

penetration is the number of hammer blows required for each 0.3 m advance of the conical point into undisturbed ground.

# **EXPLANATION OF ROCK LOGGING TERMS**

ROCK WEATHERING CLASSIFICATION Fresh (FR)	No visible signs of weathering.
Fresh Jointed (FJ)	Weathering limited to the surface of major discontinuities.
Slightly Weathered (SW)	Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock material.
Moderately Weathered (MW)	Weathering extends throughout the rock mass, but the rock material is not friable.
Highly Weathered (HW)	Weathering extends throughout the rock mass and the rock is partly friable.
Completely Weathered (CW)	Rock is wholly decomposed and in a friable condition, but the rock texture and structure are preserved.

DISCONTINUITY SPAC	<u>UNG</u>
Bedding	<b>Bedding Plane Spacing</b>
Very thickly bedded	Greater than 2m
Thickly bedded	0.6 to 2m
Medium bedded	0.2 to 0.6m
Thinly bedded	60mm to 0.2m
Very thinly bedded	20 to 60mm
Laminated	6 to 20mm
Thinly Laminated	Less than 6mm

STRENGTH CLASSIFIC Rock Strength	Approximate Uniaxial C	ompressive Strength	Field Estimation of Hardness*				
	(MPa)	(psi)					
Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer				
Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break				
Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break				
Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.				
Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty				
Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.				
Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail				

TERMS	
Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length
Solid Core Recovery:(SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run
Rock Quality Designation:(RQD)	Total length of sound core recovered in pieces 0.1m in length or larger as a % of total core run length.
Uniaxial Compressive Strength (UCS)	Axial stress required to break the specimen
Fracture Index:(FI)	Frequency of natural fractures per 0.3m of core run.

#### UNIFIED SOILS CLASSIFICATION

$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	MAJO	OR DIVISIONS	GROUP SYMBOL	TYPICAL DESCRIPTION
$\begin{array}{c c c c c c c c c c c c c c c c c c c $			GW	Well-graded gravels or gravel-sand mixtures, little or
GRAVELLY         or no fines.           SOILS         GM         Silty gravels, gravel-sand-silt mixtures.           GRAINED         GC         Clayey gravels, gravel-sand-clay mixtures.           SOILS         SAND AND         SW         Well-graded sands or gravelly sands, little or no fines.           SANDY         SP         Poorly-graded sands or gravelly sands, little or no fines.           SOILS         SM         Silty sands, sand-silt mixtures.           SOILS         SC         Clayey gravels, gravel-sand-silt mixtures.           SOILS         SM         Silty sands, sand-silt mixtures.           SOILS         SM         Silty sands, sand-clay mixtures.           SULTS AND         Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity           FINE         CLAYS         CL         Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.           GRAINED         WL < 50%		GRAVEL		no fines.
COARSE GRAINED         SOILS         GM         Silly gravels, gravel-sand-silt mixtures.           GRAINED         GC         Clayey gravels, gravel-sand-clay mixtures.           SOILS         GC         Clayey gravels, gravel-sand-clay mixtures.           SAND AND         SW         Well-graded sands or gravelly sands, little or no fines.           SANDY         SP         Poorly-graded sands or gravelly sands, little or no fines.           SOILS         SM         Silty sands, sand-silt mixtures.           SOILS         SC         Clayey sands, sand-clay mixtures.           SN         Silty sands, sand-clay mixtures.         ML           Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity, gravelly sandy clays, silty clays, lean clays.         (WL < 30%).		AND	GP	Poorly-graded gravels or gravel-sand mixtures, little
GRAINED     GC     Clayey gravels, gravel-sand-clay mixtures.       SOILS     SAND AND     SW     Well-graded sands or gravelly sands, little or no fines.       SANDY     SP     Poorly-graded sands or gravelly sands, little or no fines.       SOILS     SM     Silty sands, sand-silt mixtures.       SOILS     SM     Silty sands, sand-clay mixtures.       SUILS     SM     Silty sands, sand-clay mixtures.       SILTS AND     ML     Inorganic silts and very fine sands, rock flour, silty o clayey fine sands or clayey silts with slight plasticity, gravelly clays, sandy clays, silty clays, lean clays.       FINE     CLAYS     CL     Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.       GRAINED     WL < 50%		GRAVELLY		or no fines.
SOILS SOILS SAND AND SAND AND SANDY SOILS SANDY SOILS	COARSE	SOILS	GM	Silty gravels, gravel-sand-silt mixtures.
SAND AND SANDY     fines.       SANDY     SP       Poorly-graded sands or gravelly sands, little or no fines.       SOILS     SM       SILTS AND     SILTS AND       SILTS AND     CL       Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.       GRAINED     WL < 50%	GRAINED		GC	Clayey gravels, gravel-sand-clay mixtures.
$\begin{array}{ c c c c c } SANDY \\ SOILS & SP & Poorly-graded sands or gravelly sands, little or no fines. \\ \hline SOILS & SM & Silty sands, sand-silt mixtures. \\ \hline SOIL & SC & Clayey sands, sand-clay mixtures. \\ \hline SC & Clayey sands, sand-clay mixtures. \\ \hline SC & Clayey fine sands or clayey silts with slight plasticity or clayey fine sands or clayey silts with slight plasticity (ulays, sandy clays, silty clays, lean clays. \\ \hline CL & Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. \\ \hline CLAYS & (W_L < 30\%). \\ \hline CI & Inorganic clays of medium plasticity, silty clays. \\ \hline CI & Inorganic silts and organic silty-clays of low plasticity (30\% < W_L < 50\%). \\ \hline OL & Organic silts and organic silty-clays of low plasticity. \\ \hline SILTS AND & SILTS AND \\ \hline CLAYS & CH & Inorganic clays of high plasticity, fat clays. \\ \hline W_L > 50\% & OH & Organic clays of high plasticity, fat clays. \\ \hline W_L > 50\% & OH & Organic clays of high plasticity, fat clays. \\ \hline HIGHLY & Pt & Peat and other highly organic soils. \\ \hline CLAY SHALE & SANDSTONE & \\ \hline SILTSTONE & \\ \hline SILTSTONE & \\ \hline CLAYSTONE & \hline \\ \hline CLAYSTONE & \hline \\ \hline \end{array}$	SOILS		SW	Well-graded sands or gravelly sands, little or no
SOILS     fines.       SOILS     SM       SILY sands, sand-silt mixtures.       SC     Clayey sands, sand-clay mixtures.       SC     Clayey sands, sand-clay mixtures.       SILTS AND     Inorganic silts and very fine sands, rock flour, silty o clayey fine sands or clayey silts with slight plasticity       GRAINED     CLAYS       WL < 50%		SAND AND		fines.
$ \begin{array}{ c c c c c } & SM & Silty sands, sand-silt mixtures. \\ \hline SC & Clayey sands, sand-clay mixtures. \\ \hline SC & Clayey fine sands or clayey silts with slight plasticity or clayey fine sands or clayey silts with slight plasticity (UL & CL & Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. \\ \hline CL & Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. \\ \hline CL & (W_L < 30\%). \\ \hline GRAINED & W_L < 50\% & CI & Inorganic clays of medium plasticity, silty clays. \\ \hline OR & Organic silts and organic silty-clays of low plasticity (30\% < W_L < 50\%). \\ \hline OL & Organic silts and organic silty-clays of low plasticity (30\% < W_L < 50\%). \\ \hline OL & Organic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts. \\ \hline SILTS AND \\ \hline CLAYS & CH & Inorganic clays of medium to high plasticity, organic silts. \\ \hline HIGHLY & Pt & Peat and other highly organic soils. \\ \hline HIGHLY & VL & $		SANDY	SP	Poorly-graded sands or gravelly sands, little or no
SC     Clayey sands, sand-clay mixtures.       ML     Inorganic silts and very fine sands, rock flour, silty o clayey fine sands or clayey silts with slight plasticity clays, sandy clays, silty clays, lean clays.       FINE     CLAYS       GRAINED     W <sub>L</sub> < 50%		SOILS		fines.
ML       Inorganic silts and very fine sands, rock flour, silty o         clayey fine sands or clayey silts with slight plasticity       CL         SILTS AND       CL         FINE       CLAYS         CLAYS       (W <sub>L</sub> < 30%).			SM	Silty sands, sand-silt mixtures.
$\begin{array}{c c c c c c c c c c c c c c c c c c c $			SC	Clayey sands, sand-clay mixtures.
$\begin{array}{ c c c } \hline CL & Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. \\ \hline CLAYS & (W_L < 30\%). \\ \hline CLAYS & (W_L < 50\%) & CI & Inorganic clays of medium plasticity, silty clays. \\ \hline (30\% < W_L < 50\%). & OL & Organic silts and organic silty-clays of low plasticity \\ \hline OL & Organic silts and organic silty-clays of low plasticity \\ \hline MH & Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts. \\ \hline CLAYS & CH & Inorganic clays of medium to high plasticity, organic silts. \\ \hline HIGHLY & Pt & Peat and other highly organic soils. \\ \hline CLAY SHALE & \\ \hline SANDSTONE & \\ \hline SILTSTONE & \\ \hline CLAYSTONE & \\ \hline \end{array}$			ML	Inorganic silts and very fine sands, rock flour, silty or
$\begin{array}{ c c c } & \begin{tabular}{ c c } & \begin$				clayey fine sands or clayey silts with slight plasticity.
FINE       CLAYS $(W_L < 30\%)$ .         GRAINED $W_L < 50\%$ CI       Inorganic clays of medium plasticity, silty clays. ( $30\% < W_L < 50\%$ ).         SOILS       OL       Organic silts and organic silty-clays of low plasticity         SULS       MH       Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.         SILTS AND CLAYS       CH       Inorganic clays of high plasticity, fat clays.         W <sub>L</sub> > 50%       OH       Organic clays of medium to high plasticity, organic silts.         HIGHLY ORGANIC SOILS       Pt       Peat and other highly organic soils.         CLAY SHALE       SANDSTONE       SILTSTONE         SILTSTONE       CLAYSTONE       CLAYSTONE			CL	Inorganic clays of low to medium plasticity, gravelly
GRAINED SOILS $W_L < 50\%$ CIInorganic clays of medium plasticity, silty clays. ( $30\% < W_L < 50\%$ ).SOILSOLOrganic silts and organic silty-clays of low plasticitySILTS AND CLAYSMHInorganic clays of high plasticity, fat clays.WL > 50%CHInorganic clays of high plasticity, fat clays.WL > 50%OHOrganic clays of medium to high plasticity, organic silts.HIGHLY ORGANIC SOILSPtPeat and other highly organic soils.CLAY SHALE SANDSTONESILTSTONE CLAYSTONESILTSTONE		SILTS AND		clays, sandy clays, silty clays, lean clays.
SOILS     (30% < W <sub>L</sub> < 50%).	FINE	CLAYS		$(W_L < 30\%).$
OLOrganic silts and organic silty-clays of low plasticityOLOrganic silts and organic silty-clays of low plasticityMHInorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.CLAYSCHInorganic clays of high plasticity, fat clays.WL > 50%OHOrganic clays of medium to high plasticity, organic silts.HIGHLYPtPeat and other highly organic soils.ORGANICSOILSCLAY SHALESANDSTONESILTSTONECLAYSTONECLAYSTONE	GRAINED	$W_L < 50\%$	CI	Inorganic clays of medium plasticity, silty clays.
MH     Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.       CLAYS     CH     Inorganic clays of high plasticity, fat clays.       WL > 50%     OH     Organic clays of medium to high plasticity, organic silts.       HIGHLY     Pt     Peat and other highly organic soils.       ORGANIC     Pt     Peat and other highly organic soils.       SOILS     CLAY SHALE     SANDSTONE       SILTSTONE     CLAYSTONE     CLAYSTONE	SOILS			$(30\% < W_L < 50\%).$
SILTS AND CLAYSSandy or silty soils, elastic silts.CLAYSCHInorganic clays of high plasticity, fat clays.WL > 50%OHOrganic clays of medium to high plasticity, organic silts.HIGHLYPtPeat and other highly organic soils.ORGANICInorganicInorganic clays of medium to high plasticity, organic silts.SOILSInorganic clays of medium to high plasticity, organic silts.CLAY SHALEInorganic clays of medium to high plasticity, organic silts.SILTSTONEInorganic clays of medium to high plasticity, organic silts.CLAYSTONEInorganic clays of medium to high plasticity, organic silts.			OL	Organic silts and organic silty-clays of low plasticity.
CLAYS     CH     Inorganic clays of high plasticity, fat clays.       WL > 50%     OH     Organic clays of medium to high plasticity, organic silts.       HIGHLY     Pt     Peat and other highly organic soils.       ORGANIC     ON     Other highly organic soils.       SOILS     Inorganic clays of medium to high plasticity, organic soils.       CLAY SHALE     SANDSTONE       SILTSTONE     CLAYSTONE			MH	Inorganic silts, micaceous or diatomaceous fine
WL > 50%     OH     Organic clays of medium to high plasticity, organic silts.       HIGHLY     Pt     Peat and other highly organic soils.       ORGANIC     Pt     Peat and other highly organic soils.       SOILS     CLAY SHALE     SANDSTONE       SILTSTONE     CLAYSTONE     CLAYSTONE		SILTS AND		sandy or silty soils, elastic silts.
HIGHLY Pt Peat and other highly organic soils. ORGANIC SOILS CLAY SHALE SANDSTONE SILTSTONE CLAYSTONE CLAYSTONE		CLAYS	СН	Inorganic clays of high plasticity, fat clays.
HIGHLY Pt Peat and other highly organic soils. ORGANIC SOILS CLAY SHALE SANDSTONE SILTSTONE CLAYSTONE CLAYSTONE		$W_L > 50\%$	ОН	Organic clays of medium to high plasticity, organic
ORGANIC SOILS CLAY SHALE SANDSTONE SILTSTONE CLAYSTONE				silts.
SOILS CLAY SHALE SANDSTONE SILTSTONE CLAYSTONE	HIGHLY		Pt	Peat and other highly organic soils.
CLAY SHALE       SANDSTONE       SILTSTONE       CLAYSTONE	ORGANIC			
SANDSTONE SILTSTONE CLAYSTONE	SOILS			
SILTSTONE CLAYSTONE	CLAY SHALE	3		
CLAYSTONE	SANDSTONE			-
	SILTSTONE			-
COAL	CLAYSTONE	,		-
	COAL			-

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		JEC	0	dy										Project	No. 19-1351-253
		ATIC RTE												SHEFT	1 OF 1
	COMPLETED : February 12, 2016				N 4 825 535.0 E 593 323.0								A Geodetic		
щ		DO	SOIL PROFILE			SA	MPI	ES	COMMENTS		SHEAR S nat V -		H: Cu, KPa Q - X Cpen ▲	.0	
DEPTH SCAL (metres)	DEPTH SCALE (metres) BORING METHOD		DESCRIPTION		ELEV. DEPTH (m)	NUMBER	түре	BLOWS/0.3m			40 80 U U WATER CONTEL WP	80 1 │ ONTENT ──────────────────────────────────	20 160 		PIEZOMETER OR STANDPIPE INSTALLATION
	-	ă T	GROUND SURFACE	STRATA PLOT	204.50			B			10 :	20 3	30 40		
-			ASPHALT: (175mm)		204:32										
			SAND, some silt, some gravel, brown, moist: (FILL)		0.18					0					
ŀ	srs		CLAY, silty, sandy, trace gravel, very stiff,		203.84 0.66										
-1	9 Auge	'n	brown, moist: (TILL)												
•	Solid Stem Augers														
ŀ	Solic														
[						1	ss	22			0				
-2					202.37										·
Ì			END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION.		2.13										
-			BOREHOLE BACKFILLED WITH CUTTINGS TO 0.2m, THEN ASPHALT COLD PATCH TO SURFACE.												
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THURBER2S 19-1351-253.GPJ 3/22/16	GROUNDWATER ELEVATIONS														
ER2S			$\overline{\nabla}$ water level upon co					Ζ 14	/ATER LEVEL IN WELL/PIEZ		ED		_	_	
HURBE			- WATER LEVEL UPON CC	JIVIPL	LE LIUN			- V	VATER LEVEL IN WELL/PIEZ			LOGGE CHECK			THURBER
≓ <b>└</b>															HURDER

				F	REC	0	RI	) (	OF BOREHOLE	15	-02				
		JEC	0	dy										Project I	No. 19-1351-253
		ATIC RTE												SHEET	1 OF 1
			TED : February 12, 2016				I	N 4	825 515.0 E 592 797.0						Geodetic
ш		Ð	SOIL PROFILE			SA	MPI	ES	COMMENTS		SHEAR nat V	STRENGT	H: Cu, KPa Q - X Cpen ▲	. 0	
DEPTH SCALE (metres)	()	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100		40	80 1 CONTENT	20 160	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	+		GROUND SURFACE	IS	205.00			8				20 .			
			ASPHALT: (150mm)		203:00 204:88 0.15										
-			SAND, gravelly, some silt, brown, moist: (FILL)		0.15	1	GS			0					
- - 1 -	Solid Stem Augers		CLAY, silty, sandy, trace gravel, very stiff, brown, moist: (TILL)		204.16 0.84		63								
-2					202.87	2	SS	22			0				
			END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO 0.2m, THEN ASPHALT COLD PATCH TO SURFACE.		2.13										
- 3 - -															
-4															
- 5															
- 6 -															
- - 7 -															
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.GPJ 3/22/16															
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9-135															
THURBER2S 19-1351-253.GPJ 3/22/16			GROUNDWATER ELE ☑ WATER LEVEL UPON CO				Ţ	Z w	VATER LEVEL IN WELL/PIEZ	OMET	ER	LOGGE CHECK			THURBER

				F	REC	0	RI	) (	OF BOREHOLE	15-0	)3					
		JEC	0	dy										Pr	roject N	No. 19-1351-253
		ATIC RTEI												0	HEET '	
			D : February 12, 2016 TED : February 12, 2016					N 4	825 820.0 E 592 333.0							Geodetic
			SOIL PROFILE			0		LES		s	HEAR S	TRENG	TH: Cu, KF			000000
DEPTH SCALE (metres)		METHOD	SOIL PROFILE	Ŀ	I	54		-	COMIMENTS	-	nat V - rem V -		TH: Cu, KF Q - X Cpen ▲		ADDITIONAL LAB. TESTING	PIEZOMETER
H SC etres		3 ME		STRATA PLOT	ELEV.	BER	ш	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT				120 160		TEST	OR STANDPIPE
EPT (, m		BORING	DESCRIPTION	RATA	DEPTH	NUMBER	TYPE	SWO	$\geq$		/p				ADD	INSTALLATION
		BO		STF	(m)	2		BL	20 40 60 80 100				30 40	)	L .	
			GROUND SURFACE ASPHALT: (175mm)		210.00 209:82					_						
ł			SAND, gravelly, some silt, brown, moist:	- 	209:82 0.18											
-			(FILL)			1	GS		Grain Size Analysis: Gr 28%/Sa 62%/ Si & Cl 10%	0						
-	ers				209.26											
- 1	1 Aug		CLAY, silty, sandy, trace gravel, very stiff, brown, moist: (TILL)		0.74											
. '	Ster															
	Solid Stem Augers															
-																
-						2	SS	21		0						
-2			END OF BOREHOLE AT 2.13m.		207.87											
			BOREHOLE OPEN AND DRY UPON COMPLETION.		2.13											
			BOREHOLE BACKFILLED WITH CUTTINGS TO 0.2m, THEN ASPHALT													
-			COLD PATCH TO SURFACE.													
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			GROUNDWATER ELE					_								
- 9			${\overline{ au}}$ water level upon CC	OMPL	ETION	I	_	Ľν	ATER LEVEL IN WELL/PIEZ	OMETE	R	LOGGE	ED : A	HF		
												CHECK	KED: N	/IRA		THURBER
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		JEC	6	dy										Pr	oject N	lo. 19-1351-253
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			TED : February 12, 2016				I	N 4	826 142.0 E 591 995.0					D		Geodetic
щ		QO	SOIL PROFILE			SA	MPI	LES	COMMENTS		SHEAR S nat V -		TH: Cu, KP: Q - X Cpen ▲	a	ıט	
DEPTH SCALE (metres)		BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	,	40 8   WATER C wp I	80 1   ONTENT 	20 160     , PERCEN	) IT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
_			GROUND SURFACE ASPHALT: (165mm)		230.50 230:34											
			SAND, gravelly, silty, brown, moist: (FILL)		230:34 0.16		GS			0						
- - 1 -	Solid Stem Augers	2	SAND, silty, some gravel, brown, moist: (FILL) Asphalt layer at 0.9m		229.71 0.79 228.98	-										
-2			CLAY, silty, sandy, trace gravel, hard, brown, moist: (TILL)		1.52	2	SS	47			o					
			END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO 0.2m, THEN ASPHALT COLD PATCH TO SURFACE.		2.13											
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			<b>GROUNDWATER ELE</b> $\Sigma$ water level upon CC					Ľν	ATER LEVEL IN WELL/PIEZ	OMET	ĒR	LOGGE		HF		THURBER
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PROJECT LOCATION	: Trafalgar Road EA Stu : Halton Hills, ON	dy												
												Ρ	roject N	lo. 19-1351-253
STARTED	: February 12, 2016											S	HEET <sup>,</sup>	I OF 1
COMPLETED					١	4	826 505.0 E 591 645.0							Geodetic
шG	SOIL PROFILE			SA	MPL	.ES	COMMENTS	S	HEAR S nat V -		H: Cu, Kl Q - X Cpen ▲	Pa	. 0	
DEPTH SCALE (metres) soring METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	түре	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	- 4 W	ATER C	30 1	20 16	0 NT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
ш		STRA	(m)	NN		BLO	20 40 60 80 100		rp <b>I</b> 2				LAI	
	JND SURFACE IALT: (150mm)		236.30 238:99											
	, gravelly, some silt, brown, moist:		0.15											
				1	GS			0						
- 1 Brown	. silty, sandy, trace gravel, stiff,		235.49 0.81											
-1 E browr	/, silty, sandy, trace gravel, stiff, n, moist: (TILL)													
olid S														
۵.														
				2	SS	12			0					
-2	OF BOREHOLE AT 2.13m.	×20	234.17 2.13											
BORE	HOLE OPEN AND DRY UPON PLETION.		2.10											
CUTT	HOLE BACKFILLED WITH INGS TO 0.2m, THEN ASPHALT PATCH TO SURFACE.													
3	PATCH TO SURFACE.													
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	GROUNDWATER ELE			L										
	WATER LEVEL UPON CO					- w	ATER LEVEL IN WELL/PIEZO		R	10005		A L 17		
						vv				LOGGE CHECK		AHF MRA		
														THURBER

				REC	0	RI	D	OF BOREHOLE	15-0	)6				
	ROJE	0	dy										Project	No. 19-1351-253
	OCAT ARTI												SHEET	1 OF 1
СС	OMPL	ETED : February 9, 2016					N 4	827 967.0 E 590 172.0						Geodetic
Щ	ДQ	SOIL PROFILE			SA	MP	LES	COMMENTS	SI	HEAR S nat V - rem V		TH: Cu, KPa Q - X Cpen ▲	a Jor	
DEPTH SCALE (metres)	BORING METHOD		PLOT	ELEV.	щ		0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	4	0	80 ·	120 160		PIEZOMETER OR
HT ( me	RING	DESCRIPTION	STRATA F	DEPTH	NUMBER	TYPE	BLOWS/0.3m		W/	ATER C		T, PERCEN	ADDIT A	STANDPIPE INSTALLATION
	ß		STR	(m)	2		BLO	20 40 60 80 100	1	0	20	30 40		
		GROUND SURFACE ASPHALT: (150mm)		247.00 248:89			-							 
Ì		SAND, gravelly, silty, brown, moist: (FILL)		0.15	-			Grain Size Analysis:						Cement
-					1	GS		Gr 28%/Sa 47%/ Si & Cl 25%	0					Filter Sand
ł.		SAND, silty, some gravel, very dense, brown, moist: (FILL)		246.24 0.76										
- 1		Asphalt layer at 0.9m			2	SS	72		0					
-				245.48	_									
		CLAY, silty, trace sand and gravel, some organics, stiff, dark brown, moist: (FILL)		1.52										Bentonite
-2	s				3	SS	10		(	D				
-	Auger			244.71										
-	Solid Stem Augers	CLAY, silty, some sand, trace gravel, firm, brown, moist: (TILL)		2.29	4	ss	5			0				
	Solid					33	5							Filter Sand
- 3		SAND, silty, some gravel, trace clay, loose, brown, moist: (TILL)	- ///  0	244.03 2.97										
		loose, brown, moist: (TILL)		4	5	ss	8	Grain Size Analysis: Gr 16%/Sa 58%/ Si & Cl 26%		0				
-			0											
-			0											Slotted Screen
-4			0	- - -										
-			0											Slotted Screen
		Becoming very dense			6	ss	50/		0					
- 5		END OF BOREHOLE AT 4.85m. Piezometer installation consists of 25mm		242.15 4.85			0.12	5						
-		diameter Schedule 40 PVC pipe with a 1.52m slotted screen.												
I														
ŀ		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m)	)											
-6		Feb09/2016 Dry - Mar15/2016 Dry -												· ·
-														
- 7														
-														
-8														
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-9														
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ĺ														
		GROUNDWATER ELE $\overline{\mathbb{Y}}$ water level upon co					Ζ.,,	VATER LEVEL IN WELL/PIEZ		-				
			JVIPL		1	-1	- V	VATER LEVEL IN WELL/PIEZ	UNETE	٦	LOGGE		HF RA	
- 9														THURBER

			F	REC	0	RI	) (	OF BOREHOLE	15-07		
	ROJEC	0	dy							Project N	No. 19-1351-253
	CATI	-									
		<b>3</b>				,		000 044 0 E E00 040 0		SHEET	
		ETED : February 9, 2016			_			828 341.0 E 589 813.0			Geodetic
Щ	METHOD	SOIL PROFILE			SA	MPL	ES	COMMENTS	SHEAR STRENGTH: Cu, KPa nat V - ● Q - ¥ rem V - ● Cpen ▲	Ę Ļ	
DEPTH SCALE (metres)	METI		STRATA PLOT		Ř		BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	40 80 120 160	ADDITIONAL LAB. TESTING	PIEZOMETER OR
PTH (met	Ŋ	DESCRIPTION	TAF	ELEV. DEPTH	NUMBER	TYPE	NS/0		WATER CONTENT, PERCENT	B. TE	STANDPIPE INSTALLATION
В	BORING I		STRA	(m)	z		BLO	20 40 60 80 100	wp	LA A	
		GROUND SURFACE	0,	260.80							
		ASPHALT: (150mm)		268:88							
[		SAND, gravelly, some silt, brown, moist: (FILL)		0.15		-					
				260.14	1	GS			0		
		CLAY, silty, sandy, trace gravel, very stiff, brown, moist: (TILL)		0.66							
- 1					2	ss	18	Grain Size Analysis: Gr 0%/ Sa 38%/ Si 39%/ Cl 23%			
					-						
<u> </u>					3	SS	27		0		
-2	ers										
	Solid Stem Augers	SAND, silty, very dense, light brown, moist	- 442	258.51 2.29							
-	Stem				4	ss	50		0		
-	olid										
- 3	5	SILT, trace to some sand, very dense,		257.83 2.97							
-		light brown, moist			5	ss	74/		0		
-							0.22	5			
-											
-4											
4											
-											
-		Becoming grey									
					6		90/ 0.22		0		
- 5		END OF BOREHOLE AT 5.00m.		255.80 5.00			0.22;				
-		BOREHOLE OPEN AND DRY UPON COMPLETION.									
		BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS	3								
		TO 0.2m, THEN ASPHALT COLD PATCH TO SURFACE.									
-6											
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		${\overline{ar{ abla}}}$ water level upon CC	OMPL	ETION	I	7	⊢ v	VATER LEVEL IN WELL/PIEZO	OMETER LOGGED : AHF	-	
									CHECKED : MR	4	THURBER

			F	REC	0	RI	) (	OF BOREHOLE	15-0	)8					
PF	ROJEC	0	dy										Ρ	roject N	No. 19-1351-253
	OCATI ARTE													HEET	
		D : February 9, 2016 ETED : February 9, 2016				I	N 4	828 683.0 E 589 453.0							Geodetic
	9	SOIL PROFILE			SA	MPI	ES	COMMENTS	S	HEAR S	TRENGT	TH: Cu, KF Q - ¥ Cpen ▲	Pa		
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER		BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	- Z	10 i	80 1 	20 16	0 NT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	ß		STF	(m)	2		BL	20 40 60 80 100	1			30 40	)		
		GROUND SURFACE ASPHALT: (150mm)		256.00 258:88											
t		SAND, gravelly, some silt, brown, moist: (FILL)		0.15											
					1	GS			0						
-		CAND silts some group trace day		255.16 0.84											
- 1		SAND, silty, some gravel, trace clay, compact, brown, moist: (FILL)		0.04	2	ss	13		0						
Ì		Asphalt layer at 0.8m													
[				254.32											
-		CLAY, silty, sandy, trace gravel, trace organics, firm, grey, moist: (TILL)		1.68	3	ss	8			0					
-2	rders														
ŀ	am Al														
[	Solid Stem Augers	Becoming very stiff to hard, brown			4	ss	27			<b>b</b>					
-	ŝ														
- 3															
Ē.					5	ss	35			0					
-															
-															
-4															
t															
		SHALE, highly weathered, reddish brown		251.43 25 <b>4.6</b> 3	6	SS	50/		0						
-		END OF BOREHOLE AT 4.67m. BOREHOLE OPEN AND DRY UPON		4.67			0.10								
- 5		COMPLETION. BOREHOLE BACKFILLED WITH													
[		BENTONITE HOLEPLUG AND CUTTINGS TO 0.2m, THEN ASPHALT COLD PATCH													
		TO SURFACE.													
ł															
-6															
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-8															
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, 5-															
2		GROUNDWATER ELE	VAT	IONS	,;		I	1	-1		1	1		<u> </u>	
		$\overline{{ar ar {}}}$ water level upon CC				1	Z w	ATER LEVEL IN WELL/PIEZO	OMETE	R	LOGGE	D · 4	٩HF		
HUK			_	-					_		CHECK		MRA		THURBER
- L															

				REC	0	R	) (	OF BOREHOLE	15-0	09		
		0	ly								Project I	No. 19-1351-253
ST	ARTE					I	N 4	829 061.0 E 589 090.0			SHEET DATUM	1 OF 1 Geodetic
ш	8	SOIL PROFILE			SA	MPI	ES	COMMENTS	S	SHEAR STRENGTH: Cu, K nat V - ♥ Q - ¥ rem V - ● Cpen 4	Pa	
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	w v	40 80 120 10 ↓ ↓ ↓ /ATER CONTENT, PERCE wp		PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE ASPHALT: (165mm)		253.50 253.34								[v*v][v
		SAND, gravelly, some silt, brown: (FILL)		253:34 0.16	1	GS		Grain Size Analysis: Gr 25%/Sa 55%/ Si & Cl 20%	0			Cement
- - 1 -		SAND, silty, some gravel, occasional asphalt particles, very dense to compact, brown, moist: (FILL)		252.60 0.90	2	ss	60		0			
-2	rrs	Becoming dark brown, trace organics		254.27	3	ss	11		0			
-	Solid Stem Augers	CLAY, silty, sandy, trace gravel, firm, grey, moist: (TILL)		251.37 2.13	4	ss	7			c		
- 3 - 3	й	Becoming very stiff, brown	8		5	SS	20			o		Filter Sand
- - -4				249.39								Slotted Screen
-		SAND, sility, some clay, trace gravel, very dense, brown, moist: (TILL)	0	4.11 248.70	6	SS	50/ 0.07		0			
- 5		END OF BOREHOLE AT 4.80m. Piezometer installation consists of 125mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		4.80								
- - - -		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Feb09/2016 2.06 251.44 Mar15/2016 1.63 251.87										
- 7 - 7												
-8												
- 9												
	• •	GROUNDWATER ELE	VAT	TIONS				,		· · · ·	•	
		$\overline{ Y}$ water level upon CO	MPL	ETION		1		VATER LEVEL IN WELL/PIEZO larch 15, 2016	OMETE		AHF MRA	THURBER

			F	REC	0	RI	) (	OF BOREHOLE	15-10			
	OJEC	8	ły								Project	No. 19-1351-253
	CATIO										SHEET	1 OF 1
		ETED : February 12, 2010				I	N 4	829 406.0 E 588 732.0				Geodetic
	Q	SOIL PROFILE			SA	MPI			SHEAR STRENG nat V - rem V -	TH: Cu, KPa	-	
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	40 80	120 160	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE	ω'	253.40	$\vdash$						_	
_		ASPHALT: (150mm)		259:99								
		SAND, gravelly, some silt, brown, moist: (FILL)		0.15								
-		SAND and SILT, always trace gravel		252.79 0.61	1	GS			0			
		SAND and SILT, clayey, trace gravel, compact, brown, moist: (FILL)		0.01								
• 1					2	ss	21	Grain Size Analysis: Gr 5%/ Sa 40%/ Si 36%/ Cl 19%	0			
				252.03								
		CLAY, silty, sandy, trace gravel, trace organics, firm, grey, moist: (TILL)		1.37								⊻
					3	ss	8		0			<u> </u>
-2					ľ							
	lers	Becoming very stiff to hard, brown										
	Solid Stem Augers											
	Sten				4	SS	18		0			
3	Solid					-						
0					5		72/		0			
						33	0.27	5				
4												
-4		SAND, silty, some clay, trace gravel,		249.29 4.11								
		dense, grey, moist: (TILL)										
			0									
					6	ss	32		0			
5				248.22								
		END OF BOREHOLE AT 5.18m. BOREHOLE OPEN AND WATER LEVEL		5.18								
		AT 1.67m UPON COMPLETION. BOREHOLE BACKFILLED WITH										
		BENTONITE HOLEPLUG AND CUTTINGS TO 0.2m, THEN ASPHALT COLD PATCH										
-6		SURFACE.										
· 7												
-8												
0												
_												
9												
		GROUNDWATER ELE	L VA	L FIONS	∟	1	<u> </u>	I				
		$\overline{\mathbb{Y}}$ water level upon CC				Ţ	L v	VATER LEVEL IN WELL/PIEZC				
L												THURBER

			F	REC	0	RI	) (	OF BOREHOLE	15-11		
	OJE	8	dy							Project N	No. 19-1351-253
	CAT ART	ION : Halton Hills, ON ED : February 11, 2016								SHEET ?	1 OF 1
		ETED : February 11, 2016				I	N 4	829 773.0 E 588 379.0			Geodetic
		SOIL PROFILE			SA	MPI		COMMENTS	SHEAR STRENGTH: Cu, KPa nat V - ● Q - ¥ rem V - ● Cpen ▲		
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER		BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE	ی ا	255.00	_	<u> </u>	8				
		ASPHALT: (150mm)		254:89							
		SAND, gravelly, some silt, brown, moist: (FILL)		0.15	-						
					1	GS			0		
		SAND, silty, clayey, brown, moist: (FILL)		254.24 0.76	2	SS	50/		0		
1		Asphalt layer					0.12				
		SAND and SILT, clayey, trace gravel, firm		253.48							
		to stiff, brown, moist: (TILL)		4	3	ss	6	Grain Size Analysis: Gr 10%/Sa 48%/Si 28%/ Cl 14%	0		
2			6								
	gers										
	Solid Stem Augers				4	00	11				
	d Ster		6		4	33					
3	Soli			1							
			И								
		Becoming hard	Ø		5	SS	32		0		
4											
T		SAND, silty, some clay, trace gravel,		250.89 4.11							
		compact, brown, moist: (TILL)		4							
			0								
-			0		6	ss	28		φ		
5				249.82							
		END OF BOREHOLE AT 5.18m. BOREHOLE OPEN AND DRY UPON COMPLETION.		5.18							
		BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS	3								
		TO 0.2m, THEN ASPHALT COLD PATCH TO SURFACE.									
5											
7											
3											
9											
						_	_				
		${\overline{ au}}$ water level upon CO	OMPL	LETION	I	7	Ľν	ATER LEVEL IN WELL/PIEZO	METER LOGGED : AH	=	
									CHECKED : MR	A	THURBER

			F	REC	0	RI	) (	OF BOREHOLE	15-12					
	ROJE DCAT	0	dy								P	roject N	No. 19-1351-2	253
S	TART	ED : February 11, 2016											1 OF 1	
	-	LETED : February 11, 2016 SOIL PROFILE			64	MPL		830 111.0 E 588 021.0 COMMENTS	SHEAR	STRENGTH: Cu			Geodetic	
DEPTH SCALE (metres)	BORING METHOD	SUIL PROFILE	Ь						nat \ rem \ 40	STRENGTH: Cu √ -	- ¥ n▲ 160	ADDITIONAL LAB. TESTING	PIEZOMET	ER
PTH S (metre	M SNI	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	ТҮРЕ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT				DDITIC B. TES	OR STANDPIF INSTALLAT	
B	BOR		STRA	(m)	NN		BLO	20 40 60 80 100	wp I— 10	20 30	40	LAI		
	$\left  \right $	GROUND SURFACE ASPHALT: (165mm)		257.80 257:84										<b>.</b>
ļ.		SAND, gravelly, some silt, brown, moist: (FILL)		0.16	1	GS		Grain Size Analysis: Gr 29%/Sa 55%/ Si & Cl 16%	0				Cement	
				257.03		63		GI 29% SA 55% SI & CI 10%					Filter Sand	
- 1		SAND, silty, clayey, trace gravel, compact, brown, moist: (FILL)		0.77	2	SS	27		0					
-				256.43	2	33	21						Ţ	
Į.		<b>CLAY</b> , silty, sandy, trace gravel, very stiff to hard, brown, moist: (TILL)		1.37									Bentonite	
					3	ss	26		<b>р</b>					
-2	ers													
ŀ	Solid Stem Augers				4	SS	46		0					
[	lid Stel				4	55	40						Filter Sand	
- 3	ŝ													
-					5	SS	46		0					
-														
-4													Slotted Screen	
-														
-														E
- 5					6	ss	28		φ					
ľ	$\vdash$	END OF BOREHOLE AT 5.18m.		252.62 5.18										
-		Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.												
-														
-6		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m)	)											•
-		Feb11/2016         Dry         -           Mar15/2016         1.20         256.60												
- 7														
-														
ľ														
-8														
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- 9														
3/2														
253.GI														
THURBER2S 19-1351-253.GPJ 3/22/16														
2S 19	• •	GROUNDWATER ELE					-				I			
JRBER		abla water level upon CC	OMPL	ETION		Ţ		ATER LEVEL IN WELL/PIEZC	DMETER	LOGGED :	AHF			
Ĩ							IV	arch 15, 2016		CHECKED :	MRA		THU	RBER

				F	REC	0	RI	) (	OF BOREHOLE	15-'	13					
	ROJ DCA		Ū	ły										F	Project N	lo. 19-1351-253
ST	ΓAR	TE						N 4	830 473.0 E 587 676.0						SHEET 1 DATUM	1 OF 1 Geodetic
щ	6	3	SOIL PROFILE			SA	MP	ES	COMMENTS	S	HEAR ST nat V - rem V -		FH: Cu, K Q - 2	(Pa	ں . ں	
DEPTH SCALE (metres)			DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	түре	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	W N	40 8 ⊥ ATER CC /p I	0 1 DNTENT	20 1    , PERCE	60   ENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
_			GROUND SURFACE	0)	261.80											
		-	ASPHALT: (150mm) SAND, gravelly, some silt, brown, moist: (FILL)		269:89 0.15	1	GS			0						
- 1			SAND, silty, some clay, trace gravel, brown, moist: (FILL) Asphalt layer at 0.8m		261.17 0.63		SS	<u>50/</u> 0.100		0						
			SAND and SILT, clayey, trace gravel, very stiff, brown, moist: (TILL)		260.43 1.37											
-2			stiff, brown, moist: (TILL)			3	SS	18			0					
	Solid Stem Augers					4	SS	14				1				
- 3	Solid Ste		SILT, some sand, some clay, loose to compact, brown, moist		258.98 2.82							ſ				
						5	SS	8	Grain Size Analysis: Gr 0%/ Sa 19%/ Si 69%/ Cl 12%			D				
-4																
-																
- - 5 -			END OF BOREHOLE AT 5.18m.		256.62 5.18		SS	26		0						
			END OF BOREHOLE AT 5.18m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO 0.2m. THEN ASPHALT COLD PATCH													
-6			TO 0.2m, THEN ASPHALT COLD PATCH TO SURFACE.													
-																
- 7																
-8																
- 9																
-																
┢──			GROUNDWATER ELE	L VA1	i Fions	L	1	<u> </u>	<u> </u>	<u> </u>					1	
- 9 - - -			$\overline{\mathcal{Y}}$ water level upon CC				Ţ	Z w	ATER LEVEL IN WELL/PIEZ	OMETE		LOGGE CHECK		AHF MRA		THURBER

			F	REC	0	RI	) (	OF BOREHOLE	15-	14					
		0	dy										F	Project N	No. 19-1351-253
	CATI ARTE												S	HEET '	1 OF 1
СС	OMPLI	ETED : February 17, 2016					N 4	830 821.0 E 587 321.0	_					DATUM	Geodetic
Щ	ДОН	SOIL PROFILE			SA	MPI	LES	COMMENTS	s	HEAR S nat V -		TH: Cu, K Q - Cpen	(Pa	Ę Ļ	
DEPTH SCALE (metres)	METHOD		STRATA PLOT	ELEV.	щ		0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT		40 8 	BO 1	120 1	60 I	ADDITIONAL LAB. TESTING	PIEZOMETER OR
EPTH (me	BORING I	DESCRIPTION	RATA	DEPTH	NUMBER	TYPE	BLOWS/0.3m			VATER C		T, PERCE		ADDIT AB. T	STANDPIPE INSTALLATION
	BO		STR	(m)	2		BLO	20 40 60 80 100					10	<u> </u>	
		GROUND SURFACE ASPHALT: (150mm)		265.00 264:89		-									
-		SAND, gravelly, some silt, brown, moist: (FILL)		0.15	_										
		CAND silty some play compact raddich		264.39 0.61		GS			0						
ŀ		SAND, silty, some clay, compact, reddish brown, moist: (FILL)		0.01											
- 1					1	ss	19		0						
[				263.48	_										
ŀ		SAND and SILT, clayey, trace gravel, stiff to very stiff, brown, moist: (TILL)	Ŵ	1.52											
-2					2	SS	12			0					
[2	S														
	Solid Stem Augers							Grain Size Analysis:							
	Stem	25mm sand seam at 2.6m	10		3	SS	25	Gr 7%/ Sa 41%/ Si 35%/ Cl 17%			+-1				
- 3	Solid														
·							07								
			Ø		4	55	27			0					
			4												
-4															
-															
[															
-		Becoming wet	10		5	ss	29				5				
- 5				259.82											
		END OF BOREHOLE AT 5.18m. BOREHOLE OPEN AND DRY UPON COMPLETION.		5.18											
		BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS													
-6		TO 0.2m, THEN ASPHALT COLD PATCH TO SURFACE.													
ŀ															
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- 9	_					_	_			_	_	_	_		
		$\overline{{\mathbb Y}}$ water level upon CC	MPL	ETION	I	7	L v	VATER LEVEL IN WELL/PIEZ	OMETE	R	LOGGE		RMT		
											CHECK	KED :	MRA		THURBER

			F	REC	0	R	) (	OF BOREHOLE	15	-15							
		0	dy											I	Project I	No. 19-1351-2	53
	ARTE													5	SHEET	1 OF 2	
cc	MPL	ETED : February 4, 2016						831 473.0 E 586 679.0				ENOT			DATUM	Geodetic	
ALE	DOH.	SOIL PROFILE			SA	MPL		COMMENTS	_	SHEA nat rem	V - •	ENGI	H: Cu, I Q - Cpen	KPa K	NG	PIEZOMETE	- D
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT		40 │ WATE wp	80 R CON 20	12 ITENT, ⊖ <sup>W</sup> 3(	PERC		I ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATIC	E
-		GROUND SURFACE ASPHALT: (150mm)		242.50 249:99													 चार
		SAND, gravelly, some silt, brown: (FILL)		242:35												Cement	
-		SAND, silty, some clay, compact, brown, moist: (FILL)		241.89 0.61	1	GS			0							Filter Sand	
- 1					2	SS	26	Grain Size Analysis: Gr 11%/Sa 51%/Si 26%/ Cl 12%		0							
-																	
-2					3	SS	20			0							
		CLAY, silty, some sand, with organics, firm		240.05 2.45	1											Ţ	
-		CLAY, silty, some sand, with organics, firm to stiff, dark brown, moist			4	SS	5										
- 3																Bentonite	
					5	SS	12				0						
-																	
-4	ε																
	I Auger			237.93													
-	Hollow Stem Augers	SAND and SILT, trace clay, trace gravel, very dense, brown, moist		4.57	6	SS	50/ 0.07	;	0								
- 5	Hollo																
-																	
-				•													
-6					7	ss	50/	Grain Size Analysis: Gr 0%/ Sa 45%/ Si 47%/ Cl 8%		0							
					<u> </u>		0.07			Ũ						Filter Sand	
-																Filter Sand	
-7																	
				234.88													
-		SHALE, highly weathered, reddish brown		7.62	8	SS	<u>25/</u> 0.10(	)	0								
-8				- - - -													
																Slotted Screen	
-																	
-9				233.23	9	SS	50/		0								E
-		END OF BOREHOLE AT 9.27m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a		9.27			0.12	5									
-		1.52m slotted screen.															
		GROUNDWATER ELE				I	I							1	1		
		$\overline{\mathbb{Y}}$ water level upon CO	OMPL	ETION	I	7		/ATER LEVEL IN WELL/PIEZ arch 15, 2016	OMET	ER				AHF			
							IV				C	HECKE	ט : י	MRA		THUR	BER

THURBER2S 19-1351-253.GPJ 3/22/16

			REC	0	RD	) (	OF BOREHOLE	15-15		
	ROJE	e e	dy						Project I	No. 19-1351-253
	OCATI <sup>,</sup> TARTE								SHEET	2 OF 2
С	OMPL	ETED : February 4, 2016			N	4 8	831 473.0 E 586 679.0		DATUM	Geodetic
Ë	ДОН	SOIL PROFILE	<u></u>	SA	MPLE	-	COMMENTS	SHEAR STRENGTH: Cu, KPa nat V - ● Q - ¥ rem V - ● Cpen ▲	2 S F	
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	ELEV.	NUMBER	ТҮРЕ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	40 80 120 160 WATER CONTENT, PERCENT Wp → W I 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Mar15/2016 2.45 240.05								
- 11										
- - -12 -										
- 13 -										
- - -14 -										
- 15										
- -16										
- - 17										
-18										
THURBER2S 19-1351-253.GPJ 3/22/16										
9-1351										
HURBER2S 16		GROUNDWATER ELE $\overline{\mathcal{Y}}$ water level upon co			Ţ		ATER LEVEL IN WELL/PIEZC arch 15, 2016	DMETER LOGGED : AHF CHECKED : MR/		THURBER

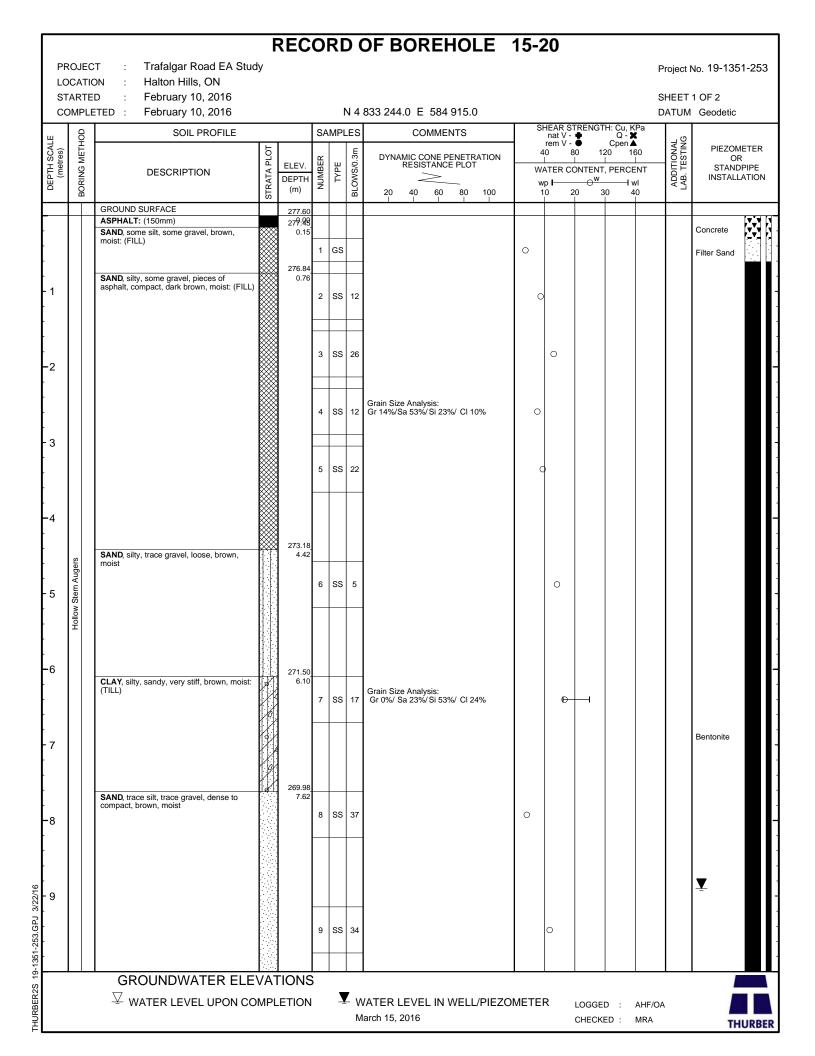
PROLECT       Transform Road EA Study       Project No. 19-1351-283         STARTD       February 4.2016       Start TO F         DOMINETTO       February 4.2016       N 4 831 83.0.0 E 586 314.0       DATUM Geodeside         Total Book mission       Start Total Book mission       DESCRIPTION       Start Total Book mission       DESCRIPTION         Total Book mission       Start Total Book mission       Start Total Book mission       DESCRIPTION       Start Total Book mission       Start Total Book mission         Total Book mission       Start total Book mission <th></th> <th></th> <th></th> <th>R</th> <th>REC</th> <th>0</th> <th>RI</th> <th>) (</th> <th>OF BOREHOLE</th> <th>15-16</th> <th></th> <th></th>				R	REC	0	RI	) (	OF BOREHOLE	15-16		
STATE     Image: Petruary 4, 2016     SHEET OF 1       COMPLETE     February 4, 2016     N 4331 835.0 E 596 314.0     DETUNE Conduction       Image: Petruary 4, 2016     SAMPLES     COMMENTS     Image: Petruary 4, 2016       Image: Petruary 4, 2016     SAMPLES     COMMENTS     Image: Petruary 4, 2016       Image: Petruary 4, 2016     SAMPLES     COMMENTS     Image: Petruary 4, 2016       Image: Petruary 4, 2016     SAMPLES     COMMENTS     Image: Petruary 4, 2016       Image: Petruary 4, 2016     Sample Signature     Image: Petruary 4, 2016     Petruary 4, 2016       Image: Petruary 4, 2016     Sample Signature     Image: Petruary 4, 2016     Petruary 4, 2016       Image: Petruary 4, 2016     Sample Signature     Image: Petruary 4, 2016     Petruary 4, 2016       Image: Petruary 4, 2016     Sample Signature     Image: Petruary 4, 2016     Petruary 4, 2016       Image: Petruary 4, 2016     Sample Signature     Image: Petruary 4, 2016     Petruary 4, 2016       Image: Petruary 4, 2016     Sample Signature     Image: Petruary 4, 2016     Petruary 4, 2016       Image: Petruary 4, 2016     Sample Signature     Image: Petruary 4, 2016     Petruary 4, 2016       Image: Petruary 4, 2016     Sample Signature     Image: Petruary 4, 2016     Petruary 4, 2016       Image: Petruary 4, 2016     Sample Signature     Image: Petr			-	dy							Project	No. 19-1351-253
LOUNDETED:         February 4, 2016         N 4 831 83.0         E 380 34.0         DATUM Geodetic           and the second sec											SHEET	1 OF 1
Ogging En         DESCRIPTION         Operation Fill         Easy and participant         Operation Fill         Operation	С	OMPL					I	N 4	831 835.0 E 586 314.0			A Geodetic
Ogging En         DESCRIPTION         Operation Fill         Easy and participant         Operation Fill         Operation	Щ	Ð	SOIL PROFILE			SA	MPL	ES	COMMENTS	SHEAR STRENGTH: Cu nat V -  Q	,KPa •¥ ↓ ⊈	
CROUND SURVACE         Crown         Crow         Crown         Crown	EPTH SCAI (metres)	RING METH	DESCRIPTION	RATA PLOT	DEPTH	JUMBER	ТҮРЕ	OWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	40 80 120	CENT CENT ADDITIONA AB. TESTIN	PIEZOMETER OR STANDPIPE INSTALLATION
-4         ASPHALT: (1710mm)         2000         2000         Control (1000)         Cont		8		STR		2		BLG	20 40 60 80 100	10 20 30	40	
1     SMC0 gavely, sorte all, toron, molt:     0.16     0.16     0.16     0.07       1     CLAY shy, astro, molt:     1     0.16     0.16     0.07       1     1     1     1     1     0.16     0.07       1     1     1     1     1     0.16     0.07       1     1     1     1     1     0.16     0.17       1     1     1     1     1     0.16     0.17       1     1     1     1     1     0.17     0.17       1     1     1     1     1     0.17     0.17       1     1     1     1     1     0.17     0.17       1     1     1     1     1     0.17     0.17       1     1     1     1     1     0.17     0.17       1     1     1     1     1     0.17     0.17       1     1     1     1     1     1     1       1     1     1     1     1     1     1       1     1     1     1     1     1     1       1     1     1     1     1     1     1       1<			ASPHALT: (175mm)		260.60 260:42							
1     Image: brown, mode: (TiL)     Image: brown, mode: brown	ļ.		SAND, gravelly, some silt, brown, moist: (FILL)						Grain Size Analysis:			
1     Index brown, mole: (TILL)       2     SS       1     Index brown, mole: (TILL)       2     SS       1     Index brown, mole: (TILL)       1     Index brown, Index (TILL)       1 <td></td> <td></td> <td>CLAY silty sandy trace gravel stiff to</td> <td></td> <td></td> <td></td> <td>65</td> <td></td> <td>GI 20%/Sa 55%/ SI &amp; CI 19%</td> <td></td> <td></td> <td></td>			CLAY silty sandy trace gravel stiff to				65		GI 20%/Sa 55%/ SI & CI 19%			
-2     -2     -2     -3     -3     -5     -4     -4     -4     -5     -5     -6     -7     -6     -7     -6     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     <			hard, brown, moist: (TILL)									
-2     -3     -3     -4     -5     -5     -7       -3     -4     -4     -5     -5     -7       -4     -4     -5     -5     -7       -5     -6     -7     -7     -7       -7     -7     -7     -7     -7       -7     -7     -7     -7     -7       -8     -7     -7     -7	['					2	SS	14		Ф		
-2     -3     -4     -4     -5     -5     -7       -4     -4     -5     -5     -6     -7       -6     -7     -7     -7     -7       -7     -7     -7     -7     -7       -8     -1     -1     -1	ŀ											
-2     -3     -4     -4     -5     -5     -7       -4     -4     -5     -5     -6     -7       -6     -7     -7     -7     -7       -7     -7     -7     -7     -7       -8     -1     -1     -1	İ.							20				
-4     -5     -6     -7     -6     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7	-2					3	55	30				-
-4     -5     -5     -6     -5       -5     -6     -6     -5       -6     -7     -7     -7       -7     -7     -7       -8     -8		gers										
-4     -5     -5     -6     -5       -5     -6     -6     -5       -6     -7     -7     -7       -7     -7     -7       -8     -8	Ĺ	em Au				4	ss	50		0		
-4     -5     -5     -6     -5       -5     -6     -6     -5       -6     -7     -7     -7       -7     -7     -7       -8     -8	-	olid Ste										
-4     6     SS     54       -5	- 3	Ň										
5     6     SS     54       5     6     SS     54       5     80REHOLE AT 5.18m. BOREHOLE DEN AND DRY UPON COMPLETION. BOREHOLE PLACKFILLED WITH BOREHOLE	-					5	ss	70		0		
-5     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i<	-											
-5     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i     i<	-4											
1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1 </td <td>-</td> <td></td>	-											
-5     25.42       -6     5.18       -7     -7       -8     -8	-											
-5	ļ.											
-6 END OF BOREHOLE AT 5.18m, BOREHOLE BACKFILLED WITH BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO 0.2m, THEN ASPHALT COLD PATCH TO SURFACE.	- 5				255 42	6	SS	54				
COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO 0.2m, THEN ASPHALT COLD PATCH TO SURFACE. -6 -7 -7 -8 -8 -8 -8 -8 -8 -8 -8 -8 -8	ŀ		END OF BOREHOLE AT 5.18m. BOREHOLE OPEN AND DRY UPON	(1/1/)								
TO 0.2m, THEN ASPHALT COLD PATCH TO SURFACE.	-		COMPLETION. BOREHOLE BACKFILLED WITH									
	-		TO 0.2m, THEN ASPHALT COLD PATCH									
	-6											-
	-											
	7											
	·											
	ŀ											
9 GROUNDWATER ELEVATIONS ₩ATER LEVEL UPON COMPLETION WATER LEVEL IN WELL/PIEZOMETER LOGGED : AHF CHECKED : MRA	-8											-
9 GROUNDWATER ELEVATIONS ↓ WATER LEVEL IN WELL/PIEZOMETER ↓ LOGGED : AHF CHECKED : MRA	Ì											
-9       GROUNDWATER ELEVATIONS         ✓       WATER LEVEL UPON COMPLETION         ✓       WATER LEVEL IN WELL/PIEZOMETER         LOGGED :: AHF         CHECKED :: MRA	-											
GROUNDWATER ELEVATIONS												
GROUNDWATER ELEVATIONS	-9											
	-											
GROUNDWATER ELEVATIONS	ľ											
GROUNDWATER ELEVATIONS          Vater level upon completion       Vater level in well/piezometer       logged : AHF       Image: Checked : MRA         Checked : MRA       THURBER	<u> </u>					Ĺ						L
— WATER LEVEL UPON COMPLETION           — WATER LEVEL IN WELL/PIEZOMETER         LOGGED         :         AHF         CHECKED         :         MRA         THURBER								7				
CHECKED : MRA THURBER			→ WATER LEVEL UPON CC	MPLE	ETION		1	⊾ V	ATER LEVEL IN WELL/PIEZ			
										CHECKED :	WINA	THURBER

					-			OF BOREHOLE	10							
		0	dy										F	Project I	No. 19-1351-25	3
ST	ARTE					1	N 4	832 179.0 E 585 981.0						SHEET DATUM	1 OF 2 Geodetic	
щ	QO	SOIL PROFILE			SA	MPL	ES	COMMENTS	S	HEAR S nat V - rem V -		GTH: Cu, Q -	x	ں <sub>ا</sub>		
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	W	10 8 │ ATER C ′p I	30	IT. PERC	160	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
-		GROUND SURFACE ASPHALT: (150mm)		267.50 269:99											[v*v	T
		SAND, gravelly, some silt, compact, brown, dry: (FILL)		267:35 0.15 266.81	1	SS	24		0						Concrete	
- 1		<b>CLAY</b> , silty, trace sand, very stiff, brown: (FILL)		0.69	2	SS	22		0						<u> </u>	
		CLAY, silty, sandy, trace gravel, stiff to very stiff, brown: (TILL)		265.98 1.52	3	SS	8	Grain Size Analysis: Gr 0%/ Sa 28%/ Si 51%/ Cl 21%		0						
-2					,											ŀ
- 3					4	SS	27			<b>⊢</b>						
					5	SS	29			o						
-4																ŀ
- - - 5	Hollow Stem Augers	SAND and SILT, some clay, trace to some gravel, very dense, brown to grey, damp: (TILL)	0	262.93 4.57	6	SS	90	Grain Size Analysis: Gr 10%/Sa 40%/ Si 39%/ Cl 11%		0					Bentonite	
	Hollo	Becoming wet	0													
			0 		7	SS	92		0							
- 7			0 0													
- - -8			0 		8	SS	114		0							
			0. 0													
		Becoming reddish brown, damp, with shale fragments	0		9	SS	139	Grain Size Analysis: Gr 0%/ Sa 37%/Si 50%/ Cl 13%	0							
		GROUNDWATER ELE	VA	L TIONS	L;				L							
		$\overline{\nabla}$ water level upon co				<b>_</b>		/ATER LEVEL IN WELL/PIEZO arch 15, 2016	METE	R	LOGG CHEC		GA MRA		THURB	ER

					REC	0	R	) (	OF BOREHOLE	15-′	17						
	ROJI CA <sup>.</sup>		0	ły										F	roject I	No. 19-135	1-253
S	TAR	TEI	D : February 5, 2016													2 OF 2	
	-	_	TED : February 5, 2016 SOIL PROFILE			SA		LES	832 179.0 E 585 981.0 COMMENTS	s	HEAR S		FH: Cu, I			Geodetic	
DEPTH SCALE (metres)	BORING METHOD		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT		10 8 │ ATER C ′p I	80 1	20 1 , PERC	60	ADDITIONAL LAB. TESTING	PIEZON OF STAND INSTALL	R PIPE
- 11 - 12 - 12 - 13 - 12 - 12 - 13 - 12 - 12 - 13 - 12 - 12 - 13 - 12 - 13 - 12 - 13 - 12 - 13 - 13 - 14 - 15 - 16 - 17 - 17 - 17 - 17 - 17 - 17 - 17 - 17			SHALE, highly weathered, reddish brown BOREHOLE OPEN AND DRY UPON COMPLETION. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Mar15/2016 0.70 266.80		256.22 11.28 255.16 12.34		SS	121		0						Filter Sand Slotted Screen	
ER2S			$\overline{\nabla}$ water level upon co				ļ	L 1/1	/ATER LEVEL IN WELL/PIEZC	METE	R	LOGGE	. u	GA			
THURB				L					arch 15, 2016			CHECK		GA MRA		TH	URBER

			F	REC	0	RI	) (	OF BOREHOLE	15-1	18					
	ROJE	0	dy										F	Project N	lo. 19-1351-253
	)CATI TARTE												5	SHEET '	1 OF 1
СС	OMPL	ETED : February 17, 2016				I	N 4	832 543.0 E 585 607.0						DATUM	Geodetic
μ	DOH	SOIL PROFILE	1.		SA	MPI		COMMENTS	s	HEAR S - nat V - rem V		TH: Cu, Q - Cpen	KPa X ▲	NG₽	
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	4	10 8	30 1     	20	160	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE
DE P.	BORIN	DESCRIPTION	STRAT.	DEPTH (m)	NUN	≿	BLOW	20 40 60 80 100	v	/p ——	— 0 <sup>w</sup>			ADC LAB.	INSTALLATION
_		GROUND SURFACE	0,	274.30											
ŀ		ASPHALT: (150mm) SAND, gravelly, some silt, brown: (FILL)		274:99 0.15											
İ.				273.69	1	GS			0						
-		CLAY, silty, some sand, trace gravel, firm, brown, moist		0.61	-										
- 1					1	SS	6		С						
ŀ															
ŀ					2	SS	4				0				
-2	gers					00	-								-
	Solid Stem Augers	SILT, sandy, clayey, trace gravel, compact to dense, brown, moist: (TILL)		272.01											
-	olid St	to dense, brown, moist: (TILL)			3	ss	22	Grain Size Analysis: Gr 8%/ Sa 33%/Si 42%/ Cl 17%		0					
- 3	Ň														
ŀ															
È			0		4	SS	32			0					
-4		SAND, some silt, very dense, brown, moist	Л	270.19 4.11											-
[															
ŀ				269.58 4.72	5	SS	50/ 0.15	- -							
- 5		END OF BOREHOLE AT 4.72m. BOREHOLE OPEN AND DRY UPON COMPLETION.		4.72					0						
-		BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO 0.2m, THEN ASPHALT COLD PATCH													
[		TO SURFACE.													
-6															-
ŀ															
ļ															
- 7															
ļ.															
-8															-
ļ.															
ŀ															
- 9															-
ŀ															
		GROUNDWATER ELE			Ľ										
- 9		$\overline{\Sigma}$ water level upon CC				<u> </u>	Lν	VATER LEVEL IN WELL/PIEZ	OMETE	R	LOGGE	· n	RMT		
			L			-	v		,,,, <b>C</b>   C	•••	CHECK		MRA		THURBER
<u> </u>															

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		0	dy							Project I	No. 19-1351-253
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		ETED : February 17, 2016				I	N 4	832 907.0 E 585 256.0			Geodetic
щ	QO	SOIL PROFILE			SA	AMPI	ES	COMMENTS	SHEAR STRENGTH: Cu, KPa nat V - ● Q - ★ rem V - ● Cpen ▲	ں <sub>ا</sub>	
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	rem V - ●         Cpen ▲           40         80         120         160           ↓         ↓         ↓         ↓           WATER CONTENT, PERCENT         wp ►         ₩           10         20         30         40           ↓         ↓         ↓         ↓	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
_		GROUND SURFACE ASPHALT: (150mm)		273.60 279:49							
		SAND, gravelly, some silt, brown: (FILL) SAND, some gravel, some silt, very dense		273.45 0.15 272.89 0.71	1	GS		Grain Size Analysis: Gr 28%/Sa 59%/ Si & Cl 13%	0		
- 1		to compact, brown, moist			1	SS	60		0		
-2					2	SS	48	Grain Size Analysis: Gr 16%/Sa 68%/ Si & Cl 16%	0		
-	Solid Stem Augers				3	SS	20		0		
- 3	So				4	SS	24		0		
-4 -4											
- - 5				268.42		SS	21		o		
		END OF BOREHOLE AT 5.18m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO 0.2m, THEN ASPHALT COLD PATCH TO SURFACE.	3	5.18							
- 7											
- 8 -											
<u>~</u>					Ĺ						
		GROUNDWATER ELE $\overline{\mathcal{Y}}$ water level upon CC				1	Z v	/ATER LEVEL IN WELL/PIEZC	DMETER LOGGED : RM CHECKED : MR		THURBER



				REC	0	R	) (	OF BOREHOLE	15-20		
		Ũ	dy							Project I	No. 19-1351-253
	DCAT TART	ED : February 10, 2016								SHEET	2 OF 2
	-	LETED : February 10, 2016			1			833 244.0 E 584 915.0	SHEAR STRENGTH: Cu. KPa		Geodetic
CALE (s)	THOD	SOIL PROFILE	L.			.MPL		COMMENTS	SHEAR STRENGTH: Cu, KPa nat V • ● Q - X rem V • ● Cpen ▲ 40 80 120 160	NAL	PIEZOMETER
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
DEI	BORI		STRA	DEPTH (m)	N		BLOV	20 40 60 80 100	wp	LAE	INGTALLATION
- - - - - 11					10	SS	23	Grain Size Analysis: Gr 3%/ Sa 90%/ Si & Cl 7%	0		
-12											-
- - - 13 -	Hollow Stem Augers	Beocming loose to compact, wet			11	SS	6		0		Filter Sand
14					12	SS	26		0		Slotted Screen
- 15		Becoming dense END OF BOREHOLE AT 15.85m.		261.75		SS	40		φ		
-16		Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.									-
- 17		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Mar15/2016 8.90 268.70									
-18 - -											-
- 19											
	<u> </u>	GROUNDWATER ELE				_		/ATER LEVEL IN WELL/PIEZO arch 15, 2016	DMETER LOGGED : AH CHECKED : MR	IF/OA RA	THURBER

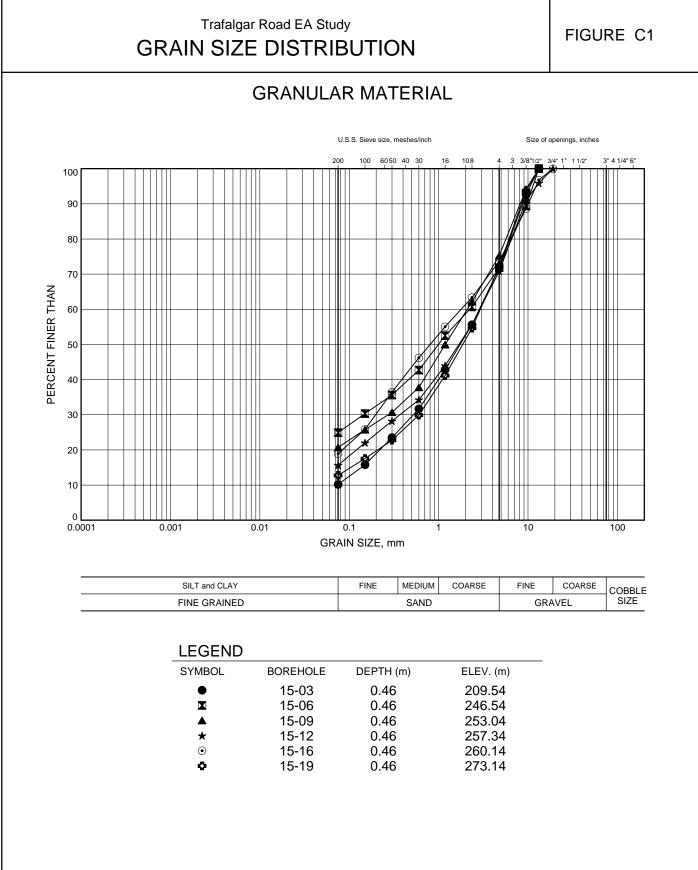
THURBER2S 19-1351-253.GPJ 3/22/16

				F	REC	0	RI	) (	OF BOREHOLE	15-2	21					
	ROJ		0	ly										I	Project N	No. 19-1351-253
	DCA FAR		,												SHEET	
			TED : February 17, 2016				I	N 4	833 445.0 E 584 734.0							Geodetic
		_	SOIL PROFILE			SA	MPI			S	HEAR S	TRENG	TH: Cu, Q - Cpen			
DEPTH SCALE (metres)	METHOD			Ь				-		_	rem V -	<b>.</b> 30 .	Cpen 120	<b>1</b> 60	I ADDITIONAL LAB. TESTING	PIEZOMETER
TH Si metre	U U		DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	W					TES	OR STANDPIPE
DEP	BORING			TRAT	DEPTH (m)	NUN	È	POW	20 40 60 80 100		/p			wl 40	ADI	INSTALLATION
		נ ו	GROUND SURFACE	ν'	276.70									40		
			ASPHALT: (150mm)		278:88								1			
[			SAND, gravelly, some silt, brown: (FILL)		0.15		00		Grain Size Analysis:							
-					276.04	1	GS		Gr 27%/Sa 60%/ Si & Cl 13%	0						
ŀ			SAND, gravelly, some silt, trace clay, dense to compact, brown to dark brown,		0.66											
- 1			moist: (FILL)			2	ss	38	Grain Size Analysis: Gr 23%/Sa 50%/ Si 18%/ Cl 9%	0						
-																
-						3	ss	14			0					
-2																-
	Solid Stem Augers		CLAY, silty, trace sand, firm, brown, moist		274.41 2.29											
-	am Al		,,,,,,			4	ss	5								
	id Ste															
- 3	Sol		SAND, trace silt, loose, brown, moist		273.65 3.05											
ŀ			SAND, trace silt, loose, blown, moist		3.05	5	ss	4			0					
-																
-4																
ŀ																
ŀ																
[			Beocming dense													
- 5						6	SS	32		0						
ŀ		_	END OF BOREHOLE AT 5.18m. BOREHOLE OPEN AND DRY UPON		271.52 5.18											
ŀ			COMPLETION.													
			BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO 0.2m, THEN ASPHALT COLD PATCH													
-6			TO SURFACE.													
-																
ŀ																
ŀ																
-7																
Ľ																
ŀ																
ŀ																
-8																-
-																
•																
- 9																
-																
ŀ																
ŀ																
			GROUNDWATER ELE	VAT	LIONS	<u> </u>	1	I	I		1	1	1			
- 9 - - -			$\overline{\mathcal{Y}}$ water level upon co				Ţ	L v	VATER LEVEL IN WELL/PIEZO	METF	R	LOGGI	- D	RMT		
1				6				·			-	CHECH		MRA		
																THURBER

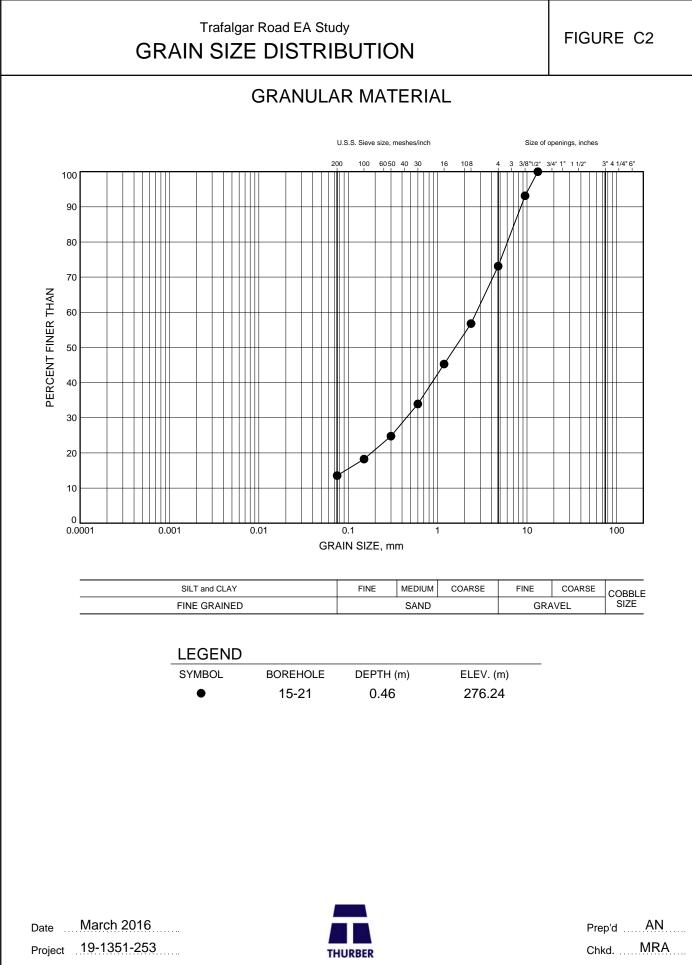


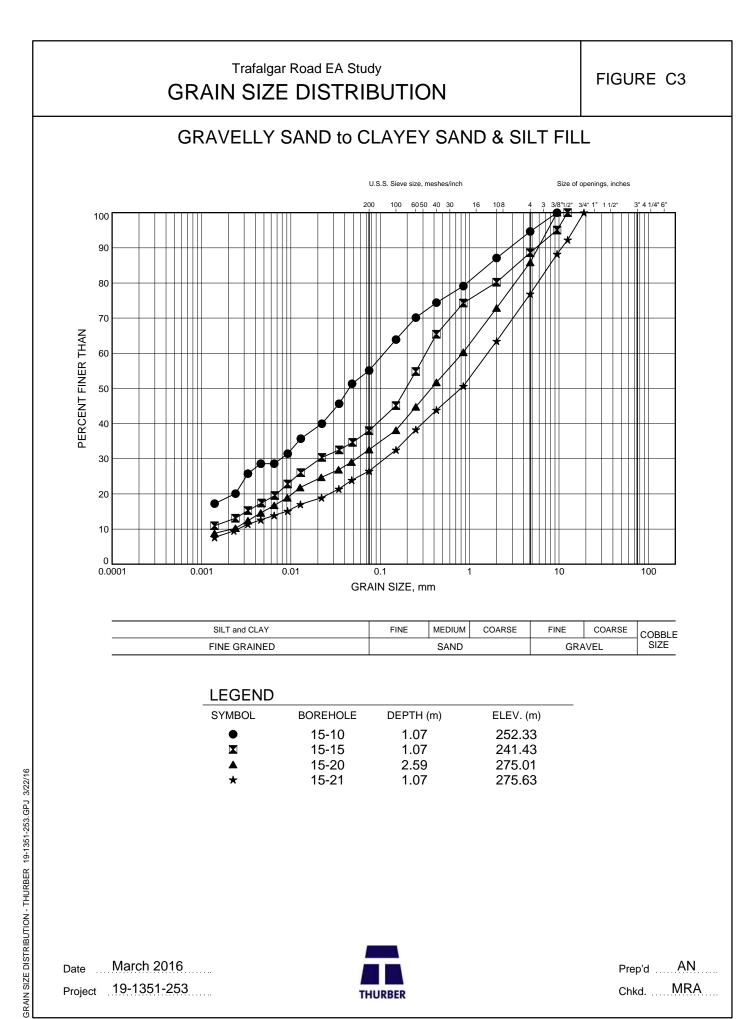
## APPENDIX C

## **GEOTECHNICAL LABORATORY TEST RESULTS**

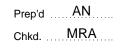


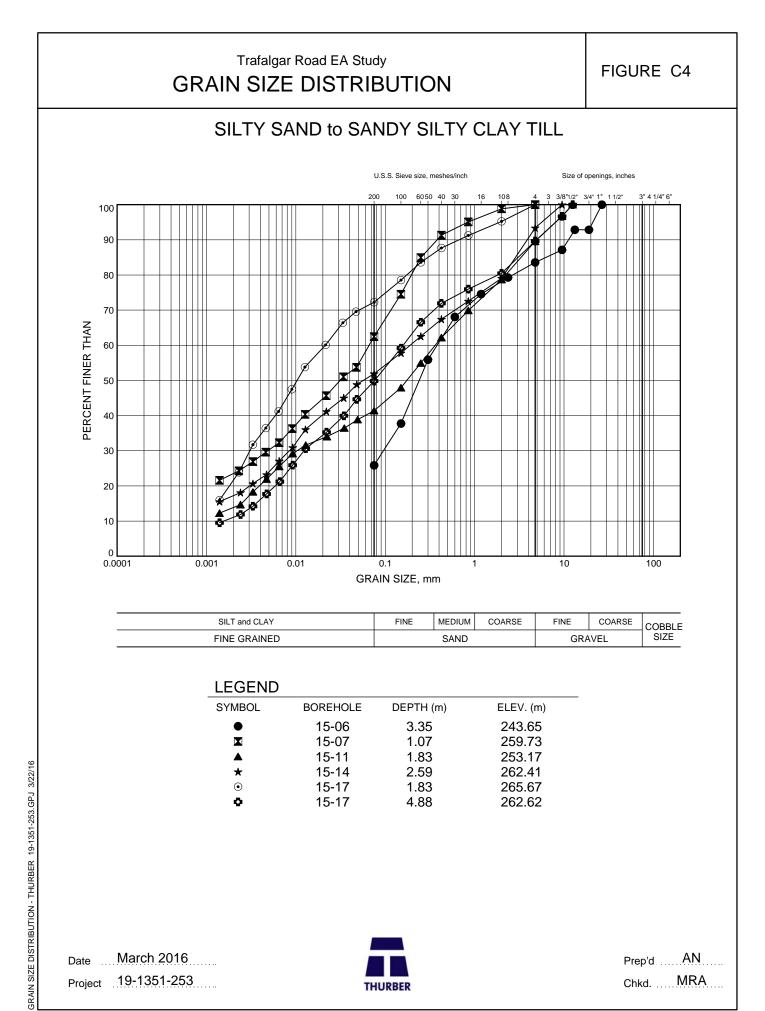




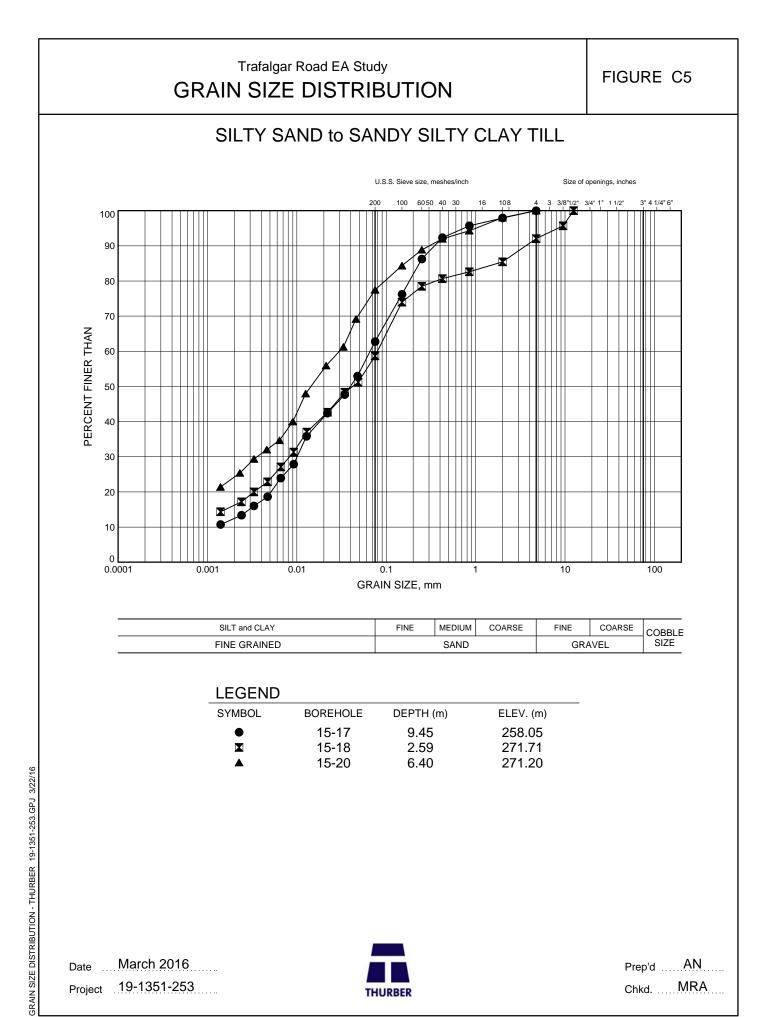




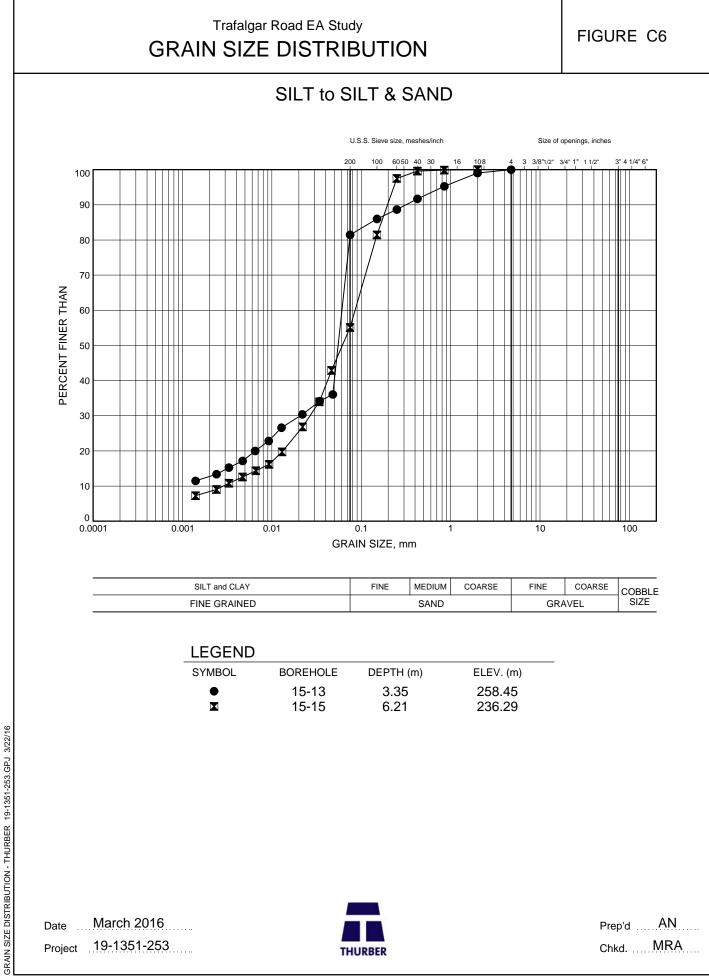






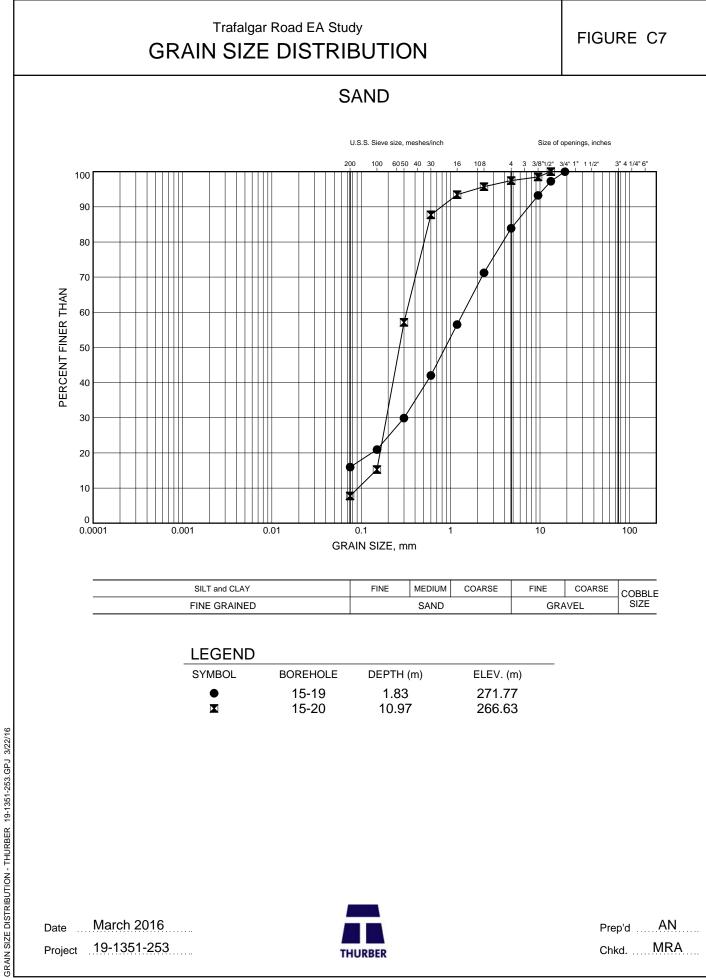






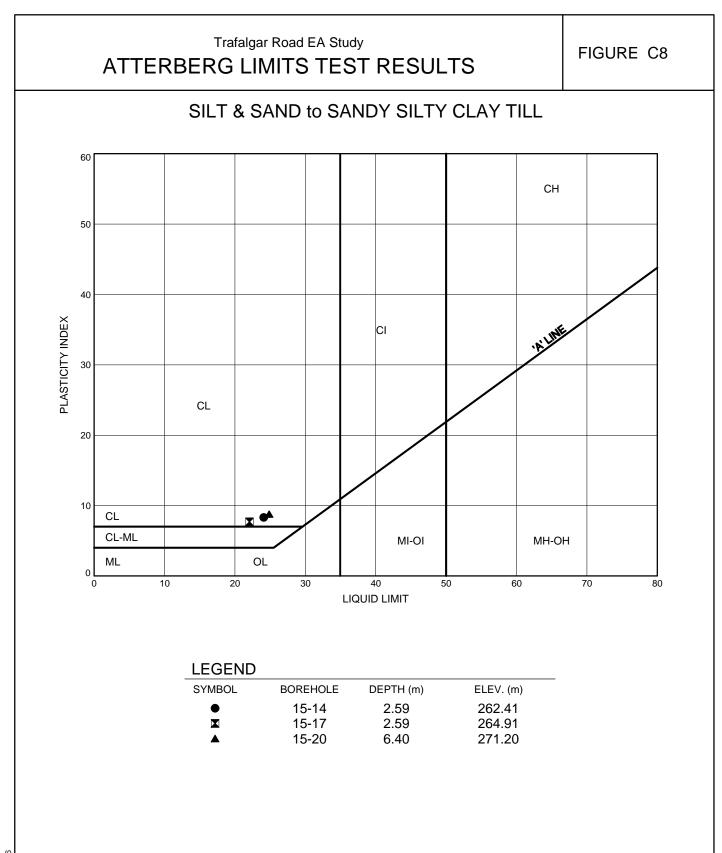
Date March 2016 Project 19-1351-253





Date March 2016 Project 19-1351-253





 Date
 March 2016

 Project
 19-1351-253





APPENDIX D

SITE PHOTOGRAPHS





Photograph 1 – Inlet of Culvert at 400 m North of Steeles Avenue



Photograph 2 – Outlet of Culvert at 400 m North of Steeles Avenue





Photograph 3 – Inlet of Culvert at 1.0 km North of Steeles Avenue



Photograph 4 – Outlet of Culvert at 1.0 km North of Steeles Avenue





Photograph 5 – Pavement Condition South of Hornby Road



Photograph 6 – Pavement Condition North of Hornby Road





Photograph 7 – Deteriorated Pavement Condition South of 10 Side Road



Photograph 8 – Deteriorated Pavement Condition North of 10 Side Road





Photograph 9 – Pavement Condition South of 15 Side Road



Photograph 10 – Pavement Condition at Black Creek





Photograph 11 – Upstream Side of Black Creek Bridge



Photograph 12 – Downstream Side of Black Creek Bridge





Photograph 13 – Pavement Condition North of CNR Crossing



Photograph 14 – Trafalgar Road Embankment at Metrolinx Crossing, looking east from Side Road 20, railway at left



APPENDIX E

## **RECORD OF BOREHOLE SHEETS**

FROM PREVIOUS INVESTIGATIONS

			R	ECC	DR	RD	0	F BOREHOLE	14-07	3				
PF	ROJEC	T : Zone 4 Feedermains										Pi	oject N	lo. 17-123-902
	CATIO													
		<b>,</b>				,							HEET 1	
	-	TED : February 19, 2015						825 334.0 E 594 071.9						Geodetic
ΓE	BORING METHOD	SOIL PROFILE		-	SA	.MPL	-	COMMENTS	°	nat V - + rem V - •	NGTH: Cu, K Q - X Cpen		NGA	
DEPTH SCALE (metres)	MET		STRATA PLOT	ELEV.	Ë	ш	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	ı'	40 80	120 10	60 I	ADDITIONAL LAB. TESTING	PIEZOMETER OR
HE HE	RING	DESCRIPTION	ATA	DEPTH	NUMBER	TYPE	/S/\		vv	ATER CONT	TENT, PERCE		AB. T	STANDPIPE INSTALLATION
ä	BOF		STR.	(m)	Ī		BLC	20 40 60 80 100		10 20	30 4	10	< 7	
		GROUND SURFACE		207.80										
ł		ASPHALT: (150mm) SAND, gravelly, compact, brown, moist:	$\mathbb{X}$	20 <b>0.66</b> . 0.15	1	GS								
F		(FILL)	$ \mathbb{X} $		-				ľ					
-1			$\bigotimes$	206.73	1	ss	18		0					
i.		CLAY, silty, sandy, trace gravel, trace rootlets, stiff, black to brown, moist: (FILL)	$\mathbb{X}$	1.07							o			
-			$\bigotimes$											
-2			$\otimes$		2	SS	11			0				-
i.		trace brick fragments, very stiff	$\otimes$											
ł			$\otimes$		3	SS	27			Ф				
- 3			$\bigotimes$											
F			$\mathbb{X}$		4	ss	45		0					
ļ.			$\bigotimes$											
-4		SAND and SILT, trace clay, trace gravel,	$\left  \right\rangle$	203.69 4.11										-
-		very dense, brown, moist: (TILL)	4											
-			0		5	SS	50/ 0.075		0					
- 5														
ł					6	SS	50/ 0.125		0					
ŀ			0					Ossia Oisa Arabaia						
-6 1		becoming grey			7	SS	50/ 0.125	Grain Size Analysis: Gr 4%/ Sa 45%/ Si 45%/ Cl 6%	0					-
ţ.						'	0.125							
-7	ers		0		8	ss	50/							-
- '	IAug					'	0.100							
ļ.	Hollow Stem Augers	some cobbles	0		-9-	88	50/		0					
-8	N						0.025	no recovery						_
ľ	Ξ													
ł			0		10		150/ 0.075			1				
- 9														
ł					-11	SS	<del>50/</del> 0.050							
ł			0											
-10			0		12	SS	50/ 0.100		(					-
ļ.				197.39 10.41										
ł.		SILT, trace clay, trace gravel, very dense, grey, moist		10.41	13	ss				0				
- 11						'	0.050							-
-					14	SS	50/	Grain Size Analysis: Gr 0%/ Sa 7%/ Si 85%/ Cl 8%		0				
ļ.						SS	0.125							
-12														-
ł					15	SS	<u>50/</u> 0.150			0				
ŀ														
- 13														
ł		CLAY, silty, sandy, trace gravel, trace		194.39 13.41										
<u>م</u>		siltstone and shale fragments, hard, grey, moist: (TILL)			16	SS	50/ 0.125		0					
14 14			X			'	0.120							-
L L														
02.G														
THURBER2S 3902.GPJ 11/9/15		GROUNDWATER ELE	VA	LIONS	3									
3ER2		abla water level upon CO	MPL	ETION		Ţ	L w	ATER LEVEL IN WELL/PIE	ZOMETE	R LO	GGED :	ME		
HURE												MTB		THURBER
FL														HIORDER

			R	ECO	DF	RD	0	F BOREHOLE 1	4-073				
PROJE LOCAT START	TIO TED	N : Milton/Halton Hills, ON : February 18, 2015										SHEET 2	
		TED : February 19, 2015						825 334.0 E 594 071.9	SHEAF	R STRENGTH		DATUM	Geodetic
DEPTH SCALE (metres) BORING METHOD		SOIL PROFILE	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	.MPL JALE	BLOWS/0.3m	COMMENTS DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	40 U WATER	R STRENGTH: V - 80 120 R CONTENT, P 0 20 30	160	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
-16 -17 -17 -18 -19 -20 -21 -22 -21 -22 -22 -23 -24 -25 -26 -27 -28 -28		END OF BOREHOLE AT 18.42m. BOREHOLE BACKFILLED WITH GROUT TO 1.83m, BENTONITE HOLEPLUG TO 0.61m, CONCRETE TO 0.15m, THEN ASPHALT TO SURFACE.		189.38 18.42	_18	SS	507 0.100 0.125 507 0.125						
		GROUNDWATER ELE	LLI VA1	L FIONS	⊥ S								
- 29		$\overline{\mathcal{Y}}$ water level upon co				<u> </u>	L w	ATER LEVEL IN WELL/PIEZO	OMETER	LOGGED CHECKED	: ME : MTB		THURBER

		TED : February 19, 2015 SOIL PROFILE			SA	MPL		COMMENTS	5	HEAR S	TRENG	TH: Cu, K			Geodetic
UEP IH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	N v	40   /ATER C wp		120 1 I T, PERCI	160 L ENT	ADDITIONAL LAB. TESTING	PIEZOMETE OR STANDPIP INSTALLATI
		GROUND SURFACE ASPHALT: (200mm)		206.88 20 <b>9.99</b>					-						
1		SAND, trace gravel, very dense, brown, frozen: (FILL)	$\bigotimes$	0.20 205.66	1	GS <del>SS</del>	<del>50/</del> ).050		0 0						
2		CLAY, silty, sandy, trace gravel, very stiff to hard, brown: (FILL)		1.22	2	SS	24				o				
3					3	SS SS	62 54			0					
4		SAND and SILT, trace gravel, trace clay, very dense, brown, moist: (TILL)	× •	203.22 3.66		SS		Grain Size Analysis: Gr 7%/ Sa 43%/ Si 42%/ Cl 8%		0					Ţ
5			0 0 0			ss	).125		(						
6			0 0		-8	ss			(						
7	Stem Auger	CLAY, silty, sandy, trace gravel, hard,	0	199.26 <u>.</u> 7.62	-		0.075		(						
8	Solid	grey, damp: (TILL)		7.02		SS	J.075		0						
9							).100	Grain Size Analysis: Gr 3%/ Sa 31%/ Si 48%/ Cl 18%		0					
10 11					_13_ _14_	SS ( <del>SS</del>		Gr 3%/ Sa 31%/ Si 48%/ Cl 18%		0					
12															
13					-15	SS	<del>50/</del> ).075			¢					
14					16	SS	<u>50/</u> ).125			0					

				R	ECO	DR	<b>RD</b>	0	F BOREHOLE 14	4-07	4					
l I	_OC	JEC ATIC	N : Milton/Halton Hills, ON													lo. 17-123-902
		RTEI 1PLE	D : February 19, 2015 TED : February 19, 2015				I	N 4	825 384.9 E 594 007.2	_				D	HEET 2 ATUM	2 OF 2 Geodetic
Ц		ДОН	SOIL PROFILE	1.		SA	MPL	ES	COMMENTS	SI	HEAR S <sup>-</sup> nat V - rem V -		H: Cu, KF Q - X Cpen ▲	°a	μų	
DEPTH SCALE		BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 1 1 1 1 1	4 W/ w	0 8   ATER C0 p	30 1: L ONTENT	20 16    , PERCEI	i0 NT 1	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
- - - - - - - - - - - - - - - - - - -	;		SAND, fine grained, trace silt, trace gravel, very dense, brown, wet		190.57 16.31			50/ 0.075			0					
- 17	,  -		END OF BOREHOLE AT 16.86m. BOREHOLE OPEN TO 10.97m AND WATER LEVEL AT 3.66m UPON COMPLETION.		190.02 16.86	18	SS	0.100			0					
- - - 18 -	3		BOREHOLE BACKFILLED WITH CEMENT GROUT TO 1.22m, BENTONITE HOLEPLUG TO 0.30m, CEMENT TO 0.08m, THEN ASPHALT TO SURFACE.													
- - 19 -	)															
-20	)															
- 21																
-22	2															
- 23	3															
-24																
- 25																
-26	5															
- 27	,															
-28 -28	3															
THURBER2S 3902.GPJ 11/9/15	)															
THURBER2S 3			GROUNDWATER ELE				7	L w	ATER LEVEL IN WELL/PIEZC	METE	R	LOGGE CHECKI		ES MTB		THURBER

	ARTE	D : February 19, 2015 TED : February 20, 2015					N 4	825 440.9 E 593 929.8					SHEET DATUM	1 OF 2 Geodetic	
LΠ	дон	SOIL PROFILE	1.		SA	MPL	ES	COMMENTS	S	HEAR S nat V - rem V -		H: Cu, KPa Q - X Cpen ▲	AG VG		
UET IN SUALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	W	10 8 ↓ ATER CI	30 12 J ONTENT, O <sup>W</sup>	20 160 PERCENT	ADDITIONAL LAB. TESTING	PIEZOMI OR STANDI INSTALL	PIPE
		GROUND SURFACE ASPHALT: (150mm)		206.42 20 <b>6.20</b>										Concrete	
1		SAND, silty, some gravel, trace asphalt fragments, very dense, brown, dry: (FILL)		0.15	1	GS SS	-	Grain Size Analysis: Gr 11%/Sa 56%/ Si & Cl 33%	0 0					Filter Sand	V
2		some silt, some clay		204.36		SS	<u>50/</u> 0.100	<u>г</u> об	0					Bentonite	
3		CLAY, silty, sandy, trace to some gravel, very stiff to hard, brown, moist: (FILL)		2.06	3	SS	19			0				<u> </u>	
4					4		27	Grain Size Analysis:	C						
5		SAND and SILT, trace clay, trace gravel, trace cobbles, very dense, brown, moist: (TILL)		201.92 4.50		SS	32 96/ 0.27	Gr 2%/ Sa 32%/ Si 44%/ Cl 22% Grain Size Analysis: Gr 6%/ Sa 42%/ Si 43%/ Cl 9%	0					Grout	
-			0		7	SS			c						
6	SIS		0		8		50/ 0.100	μ -	0						
_	low Stem Augers	occasional oxide staining	0		9 10	SS SS	50/ 0.12	grain Size Analysis:	0						
	IIOH		0		11	SS	0.27 50/ 0.150	7 7 70	с	,					
9			0				0.07			0				Bentonite	
10		CLAY, silty, sandy, trace gravel, hard, reddish brown, moist: (TILL)	0	195.75 10.67		SS		т.	0	0				Filter Sand	
11		TOGIST DOWN, HIDISE (TILE)													
12		SHALE, highly weathered, trace siltstone, weak, red: (Queenston Formation)		194.23 12.19	-15	ss	50/ 0.07		0					Slotted Screen	
-		END OF BOREHOLE AT 13.79m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 3.02m slotted screen.		192.63 13.79	-16	ss	50/ 0.07			0					
14		Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a		FIONS	6			NATER LEVEL IN WELL/PIEZC		R	LOGGEE	D : ME			

			RE	CO	R	) (	F BOREHOLE 14	1-075		
	OJEC CATIC								Project N	lo. 17-123-902
ST	ARTE	D : February 19, 2015							SHEET 2	
		TED : February 20, 2015					825 440.9 E 593 929.8	SHEAR STRENGTH: Cu, KPa		Geodetic
SCALE res)	ИЕТНОГ	SOIL PROFILE	LOT	+		PLES	COMMENTS DYNAMIC CONE PENETRATION RESISTANCE PLOT	SHEAR STRENGTH: Cu, KPa nat V - ♥ Q - ¥ rem V - ♥ Cpen ▲ 40 80 120 160	IONAL STING	PIEZOMETER OR
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT U) JED	V. TH	NUMBER	BLOWS/0.3m	RESISTANCE PLOT	WATER CONTENT, PERCENT wp	ADDITIONAL LAB. TESTING	STANDPIPE INSTALLATION
-		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Mar. 10/15 3.10 203.32								
-16		Apr. 28/15 2.32 204.10								
- - 17										
-18										
- 19										
-20										
- - 21										
-22										
- 23										
-24										
- 25										
-26										
- 27										
-28										
- 29										
						_		- · · · · ·		
		$\overline{\mathbf{V}}$ water level upon col	MPLETI	ON			VATER LEVEL IN WELL/PIEZC .pril 28, 2015	METER LOGGED : ME CHECKED : MT		THURBER

CC	MPL	ETED : January 27, 2015				1	N 4	825 511.9 E 593 767.3				0	DATUM	Geodetic
	DOH-	SOIL PROFILE			SA	MPL	1	COMMENTS	s	HEAR S nat V - rem V -	TRENGTH:	Cu, KPa Q - X Cpen ▲	NG	PIEZOMETEI
(metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	W.	L ATER C( p I	30 120 1 1 ONTENT, P 0 20 30 1 1		ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATIO
		GROUND SURFACE ASPHALT: (50mm)		205.44 20 <b>6.69</b>										Concrete
		SAND, silty, some gravel, compact, brown, damp: (FILL)		0.00	1	GS			0					Concrete
1		CLAY, silty, some sand, trace gravel, very stiff, dark brown to brown: (FILL)	$\bigotimes$	204.32 1.12	1	SS	29			0				
2		SAND, gravelly, some silt, compact,	$\bigotimes$	203.15 2.29	2	SS	19	Grain Size Analysis:			0			
3		brown, damp: (FILL)			3	SS	26	Gr 30%/Sa 53%/ Si & Cl 17%	0					Ţ
4				004.00	4	SS	13		0					Bentonite
4	s	CLAY, silty, sandy, trace gravel, occasional cobbles, hard, brown: (TILL) occasional sandy silt lenses		201.33 4.11	5				0					
5	Solid Stem Augers						0.075							
6 7	Solid	SAND and SILT, trace clay, trace gravel, very dense, grey, moist: (TILL)	000	199.34_ 6.10	6	SS	50/ 0.100	Grain Size Analysis: Gr 4%/ Sa 43%/ Si 45%/ Cl 8%	0					
8			0 0 0		7	SS	50/ 0.125			Þ				
9			0		8	SS	<u>50/</u> 0.100			þ				Filter Sand
10		CLAY, silty, sandy, trace gravel, hard, reddish brown: (TILL)		195.53 9.91										Slotted Screen
11		END OF BOREHOLE AT 10.74m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.	X/Q//	194.70 10.74	9	SS	50/ 0.075		C					<u> </u>
12		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Mar. 10/15 3.50 201.94 Apr. 28/15 2.84 202.60												
13														
14														

			R	ECC	DR	D	0	F BOREHOLE 1	4-077		
	ROJE									Project I	No. 17-123-902
ST	ARTE					N	148	325 550.4 E 593 589.1		SHEET DATUM	1 OF 1 Geodetic
ш	8	SOIL PROFILE			SA	MPLE	s	COMMENTS	SHEAR STRENGTH: Cu, KPa nat V - ● Q - X rem V - ● Cpen ▲	. 0	
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION		ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	rem V - ● Cpen ▲ 40 80 120 160 I I I I WATER CONTENT, PERCENT wp I ──────── I wl 10 20 30 40 I I I I	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
-		GROUND SURFACE SAND, silty, some gravel, compact, brown, damp: (FILL)		205.89 0.00	1	GS		Grain Size Analysis: Gr 17%/Sa 54%/ Si & Cl 29%	0		
- - 1 -		CLAY, silty, sandy, trace gravel, hard, brown: (TILL)(CL)		204.62 1.27	1	SS	23		0		
- -2		brown: (TILL)(CL) occasional sandy silt lenses			2	SS	48	Grain Size Analysis: Gr 5%/ Sa 32%/ Si 43%/ Cl 20%			
- - - 3		occasional black sand seams			3		.250		0		
- - - -4	Solid Stem Augers				4	SS 9	50/ <del>.125</del>		0		⊻.
- 5	Solid				5	SS (	50/ .100		0		
-6		becoming grey			6	SS	51/		o		
- - - 7 -							.150				
- - -8 -		END OF BOREHOLE AT 7.75m. WATER LEVEL AT 3.35m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS		198.14 7.75	_7_	SS .	<u>50/</u> .125		0		
- - 9 -		TO SURFACE.									
- 											
- 11											
-12											
- 13 -											
-14											
					Ĺ						L
		GROUNDWATER ELE				Ţ	w	ATER LEVEL IN WELL/PIEZC	DMETER LOGGED : ES CHECKED : MTI	3	THURBER

			R	ECO	)F	RD	0	F BOREHOLE 1	4-078		
	ROJEC									Project I	No. 17-123-902
	CATI									SHEET	1 OF 1
		ETED : January 28, 2015				I	N 4	825 540.6 E 593 385.3			Geodetic
щ	ДŎ	SOIL PROFILE			SA	MPL	ES	COMMENTS	SHEAR STRENGTH: Cu, KPa nat V - ♥ Q - X rem V - ♥ Cpen ▲	чÖ	
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	ТҮРЕ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	40 80 120 160	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	×	GROUND SURFACE	STI	(m)	_		В				
-		SAND, silty, some gravel, dense, brown, damp: (FILL)	$\boxtimes$	205.47 0.00	1	GS			0	_	
- 1					1	ss			•		
				203.59							
-2		CLAY, sitty, sandy, trace gravel, hard, brown: (TILL)		1.88		SS			ο		-
- 3	Solid Stem Augers				3	SS			Φ		
	Solid Ster				4	SS	64		0		
-4											- 1
		becoming grey, occasional sandy silt lenses			5	SS	90/ 0.27	Grain Size Analysis: Gr 0%/ Sa 32%/ Si 49%/ Cl 19%	0		<u></u>
- 5 - -							0.273	2			
6		becoming brown		199.09	6	SS	50/		q		-
- 7 - 1		END OF BOREHOLE AT 6.38m. WATER LEVEL AT 4.42m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.		6.38			0.12				
-8											-
- 9 -											
10											-
- 11											
-12 -											-
- 13											
- - - - - - - - - - - - - - - - - - -											-
19-17 7											
	<u>   </u>	GROUNDWATER ELE					L v	I /ATER LEVEL IN WELL/PIEZO			
		January 28, 2015							CHECKED : MTI	3	THURBER

			R	RECO	DF	RD	0	F BOREHOLE 1	4-07	9					
	ROJE												Ρ	roject N	No. 17-123-902
	)CAT TART												s	HEET <sup>,</sup>	1 OF 1
		LETED : January 28, 2015				I	N 4	825 527.5 E 593 185.7							Geodetic
	8	SOIL PROFILE			SA	MPL	ES	COMMENTS	S	HEAR S nat V -		H: Cu, Ki Q - X Cpen A	Pa	(1)	
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	түре	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	4 W	0 a L ATER C	30 1	20 16	50 NT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
В	BOR		STR/	(m)	z		BLO	20 40 60 80 100		p ┣─── 0 :	20 :			LA A	
_		GROUND SURFACE		203.86					1						
-		SAND, silty, trace gravel, very dense, brown: (FILL)		0.00	1	GS			0						
			$\otimes$		1	SS	50/		0						
- 1				000 40			0.10								
		CLAY, silty, some sand to sandy, trace gravel, occasional sandy silt seams, hard, brown: (TILL)	- K	202.49 1.37											
-2		brown: (TILL)			2	SS	37			0					
2															
	rgers				3	SS	73			0					
3	em A							Grain Size Analysis: Gr 0%/ Sa 16%/ Si 65%/ Cl 19%			0				$\overline{\Delta}$
	Solid Stem Augers	becoming grey			4	SS	58			0	7				
4	Ň														
-4															
					5	SS	59/		0						
- 5		occasional cobbles			-		0.150								
_															
-6		END OF BOREHOLE AT 6.20m.		197.66 6.20	6	SS	50/ 0.10		0						
		WATER LEVEL AT 3.12m UPON COMPLETION.		0.20			0.100								
· 7		BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS													
		TO SURFACE.													
-8															
9															
-10															
· 11															
12															
40															
• 13															
-14															
	1	GROUNDWATER ELE	EVA	TIONS	5	1		I	-	I	1	1			
-14 		$\overline{{ar ar {}}}$ water level upon CO				7	<u>v</u>	VATER LEVEL IN WELL/PIEZO	OMETE	R	LOGGE	D:	ES		
		January 28, 2015									CHECK		MTB		THURBER

			R	RECO	DF	RD	0	F BOREHOLE 14	4-08	0						
	ROJE	ION : Milton/Halton Hills, ON											Pro	oject N	No. 17-123-	902
	art Ompl	ED : January 28, 2015 LETED : January 28, 2015				1	N 4	825 518.7 E 593 064.2							1 OF 1 Geodetic	
	_	-			SA	MPL	ES	COMMENTS	s	HEAR S nat V -		H: Cu, KP Q - X Cpen ▲	а	0		
DEPTH SCALE (metres)	BORING METHOD		STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	w v	10   ATER C	B0 1 L ONTENT	20 16	0 IT	ADDITIONAL LAB. TESTING	PIEZOME OR STANDF INSTALLA	PIPE
		GROUND SURFACE SAND, silty, trace to some gravel, very		202.91 0.00											Concrete	লেনে ব
- 1 - 1 2		dense, brown, damp: (FILL)		201.54 1.37		GS SS SS SS	72/ 0.150 30	Grain Size Analysis: Gr 3%/ Sa 34%/ Si 47%/ Cl 16%	0	0						
- 3							20									
ł	Solid Stem Augers				4	SS	51			0					Bentonite	
- 5 -	Solid				5	SS	73	Grain Size Analysis: Gr 5%/ Sa 38%/ Si 43%/ Cl 14%	c	)						
6		occasional cobble			6	SS	98/ 0.250		с						Filter Sand	
- 7 - 7 		SILT, sandy, trace clay, dense, brown, moist		195.16 7.75	7	ss	46				0				Slotted Screen	
- 9		END OF BOREHOLE AT 8.23m. Well installation consists of 50mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS:	<u>l+ 1. </u> t.	194.68 8.23												<u></u>
- - -10		DATE         DEPTH(m)         ELEV.(m)           Mar. 17/15         1.20         201.71           (Frozen)														
- 11 																
- -12																
- 13																
- 14 																
		GROUNDWATER ELE	VA	TIONS	5		1			1	1	<u> </u>	I			
		$\overline{ au}$ water level upon CC	OMPL	ETION	1	<u>_</u>		/ATER LEVEL IN WELL/PIEZC oril 29, 2015	METE	R	LOGGE CHECK		ES MTB		тн	URBER

: Zone 4 Feedermains : Milton/Halton Hills, ON : August 19, 2015 ED : August 19, 2015 SOIL PROFILE DESCRIPTION BROUND SURFACE to sampling	STRATA PLOT	ELEV. DEPTH (m) 202.91 0.00	~	MPLI	ES	825 518.9 E 593 063.4 COMMENTS	S	HEAR S nat V - rem V -		TH: Cu, KF Q - ¥ Cpen ▲	S	HEET 1 ATUM	OF 2 Geodetic
ED : August 19, 2015 SOIL PROFILE DESCRIPTION	STRATA PLOT	DEPTH (m) 202.91		MPLI	ES		s	HEAR S nat V - rem V -	TRENG	TH: Cu, KF	D		
DESCRIPTION SROUND SURFACE	STRATA PLOT	DEPTH (m) 202.91				COMMENTS	s	HEAR S - nat V - rem V		TH: Cu, KF	Pa	٦Ū	
GROUND SURFACE	STRATA PLOT	DEPTH (m) 202.91	NUMBER	TYPE	.3m					(Chen 🔺			
				•	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	W.	10   ATER C 10	BO L ONTEN O <sup>W</sup>	120 16 1 1 T. PERCEN	10 NT 1	ADDITIONAL LAB. TESTING	PIEZOMETEI OR STANDPIPE INSTALLATIC
CLAY, silty, sandy, trace gravel, hard, rown: (TILL) // ILT, sandy, trace clay, very dense, rown, moist	1			SS	53		0	с					
SAND, trace to some silt, trace gravel, ery dense to dense, brown, moist		194.22 8.69											
ecoming fine grained sand, reddish brown t 9.45m			2	SS	52	Gran Size Analysis: Gr 4%/ Sa 85%/ Si & Cl 11%		0					
ecoming dense			3	SS	46				þ				
ecoming silty, trace clay			4	SS	32	Grain Size Analysis: Gr 0%/ Sa 71%/ Si 25%/ Cl 4%		с					
AND, some gravel, trace silt, very dense, rey, moist		189.65 <u></u> 13.26											
		188 58	5	SS	62			0					
ND OF BOREHOLE AT 14.33m. SOREHOLE BACKFILLED WITH CEMENT SENTONITE GROUT TO 1.00m,		14.33											
	rown: (TILL)         ILT, sandy, trace clay, very dense, rown, moist         AND, trace to some silt, trace gravel, ery dense to dense, brown, moist         ecoming fine grained sand, reddish brown 19.45m         ecoming dense         ecoming silty, trace clay         AND, some gravel, trace silt, very dense, rey, moist         ND OF BOREHOLE AT 14.33m.         OREHOLE BACKFILLED WITH CEMENT ENTONITE GROUT TO 1.00m,         GROUNDWATER ELE	rown: (TILL)         ILT, sandy, trace clay, very dense, rown, moist         AND, trace to some silt, trace gravel, ery dense to dense, brown, moist         ecoming fine grained sand, reddish brown 19.45m         ecoming dense         ecoming silty, trace clay         AND, some gravel, trace silt, very dense, rey, moist         ND OF BOREHOLE AT 14.33m.         OREHOLE BACKFILLED WITH CEMENT ENTONITE GROUT TO 1.00m,         GROUNDWATER ELEVAT	LAY, silty, sandy, trace gravel, hard, rown: (TILL)       199.60         rown: (TILL), sandy, trace clay, very dense, rown, moist       194.22         AND, trace to some silt, trace gravel, ery dense to dense, brown, moist       194.22         ecoming fine grained sand, reddish brown       19.45m         ecoming dense       189.65         ecoming silty, trace clay       189.65         AND, some gravel, trace silt, very dense, rey, moist       189.65         BAND, some gravel, trace silt, very dense, rey, moist       188.58         ND OF BOREHOLE AT 14.33m.       188.58         OREHOLE BACKFILLED WITH CEMENT       184.33         GROUNDWATER ELEVATIONS       184.33	LAY, silty, sandy, trace gravel, hard, rown: (TILL) ILT, sandy, trace clay, very dense, rown, moist 2 AND, trace to some silt, trace gravel, ery dense to dense, brown, moist ecoming fine grained sand, reddish brown 9.45m ecoming dense accoming silty, trace clay 4 AND, some gravel, trace silt, very dense, rey, moist 3 AND, some gravel, trace silt, very dense, rey, moist 5 ND OF BOREHOLE AT 14.33m. OREHOLE BACKFILLED WITH CEMENT	LAY, silty, sandy, trace gravel, hard, rown: (TILL) ILT, sandy, trace clay, very dense, rown, moist AND, trace to some silt, trace gravel, ery dense to dense, brown, moist ecoming fine grained sand, reddish brown 19.45m ecoming dense ecoming silty, trace clay ecoming silty, trace clay AND, some gravel, trace silt, very dense, rey, moist AND, SOME gravel, trace silt, very dense, rey, moist CROUNDWATER ELEVATIONS	LAY, silty, sandy, trace gravel, hard, rown: (TILL)       19.462       1       SS       53         rown: or ULL, sandy, trace clay, very dense, rown, moist       194.22       8.69       1       SS       53         AND, trace to some silt, trace gravel, ery dense to dense, brown, moist       194.22       8.69       2       SS       52         ecoming fine grained sand, reddish brown       9.45m       3       SS       46         ecoming dense       3       SS       46         and the gravel, trace clay       4       SS       32         ecoming silty, trace clay       4       SS       32         AND, some gravel, trace silt, very dense, rey, moist       5       SS       62         ND OF BOREHOLE AT 14.33m.       14.33       14.33       14.33         OREHOLE BACKFILLED WITH CEMENT ENDITE GROUT TO 1.00m,       14.33       14.33       14.33	LAY, silty, sandy, trace gravel, hard, town: (TILL)       199.62       1       SS       53         AND, trace to some silt, trace gravel, and, reddish brown is demonstered to dense, brown, moist       194.22       8.69       1       SS       52         acoming fine grained sand, reddish brown is 4.55m       2       SS       52       Grain Size Analysis: Gr 4%/ Sa 85%/ Si & Cl 11%         ecoming dense       3       SS       46       4       SS       32         ecoming silty, trace clay       4       SS       32       Grain Size Analysis: Gr 4%/ Sa 85%/ Si & Cl 11%         ecoming dense       3       SS       46       5       SS       62         AND, some gravel, trace silt, very dense, rey, moist       189.65       13.26       6       Grain Size Analysis: Gr 0%/ Sa 71%/ Si 25%/ Cl 4%         ND OF BOREHOLE AT 14.33m.       14.33       1       1       1       1         ORCUNDWATER ELEVATIONS       GROUNDWATER Stational state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state state st	LAY, sitty, sandy, trace gravel, hard, rown: (TILL)       1       SS       53         II, sandy, trace clay, very dense, rown, moist       1       SS       53         AND, trace to some silt, trace gravel, ary dense, brown, moist       194.22       8.69       I       I         ecoming fine grained sand, reddish brown 19.45m       2       SS       52       Grain Size Analysis:       Grain Size Analysis:         ecoming dense       3       SS       46       I       I       I         ecoming silty, trace clay       4       SS       32       Grain Size Analysis:       Grain Size Analysis:         ecoming dense       189.65       I       I       I       I       I         AND, some gravel, trace silt, very dense, rey, moist       189.65       I       I       I         198.58       I       I       I       I       I       I         AND, some gravel, trace silt, very dense, rey, moist       I       I       I       I       I       I         198.65       I       I       I       I       I       I       I       I         AND, some gravel, trace silt, very dense, rey, moist       I       I       I       I       I       I       I       I       <	LAY, silty, sandy, trace gravel, hard, rown, moist       193.62       1       SS       53         ILT, sandy, trace clay, very dense, rown, moist       194.22       8.69       1       6         AND, trace to some silt, trace gravel, ary dense, brown, moist       2       SS       52       Grain Size Analysis: Gr 4%/ Sa 85%/ Si & Cl 11%       0         ecoming fine grained sand, reddish brown       3       SS       46       4       SS       32         ecoming dense       3       SS       46       4       SS       32       Grain Size Analysis: Gr 4%/ Sa 85%/ Si & Cl 11%       0         ecoming silty, trace clay       4       SS       32       5       SS       62         AND, some gravel, trace silt, very dense, rey, moist       189.65       1       1       6       0         ND OF BOREHOLE AT 14.33m. OREHOLE BACKFILLED WITH CEMENT       188.58       14.33       1       0       0         GROUNDWATER ELEVATIONS       GROUNDWATER SCHONE       1       0       0       0	LAY, sity, sandy, trace gravel, hard, wery dense, town, moist       1       SS       53         AND, trace to some sit, trace gravel, and the second state to dense, brown, moist       194.22       Image: Site analysis: Grain Size Analysis: Gra	LAY, sity, sandy, trace gravel, hard, own, (TIL)       194.62       1       SS       53         ILT, sandy, trace clay, very dense, own, moist       194.22       194.22       8.69       0       0         IND, trace to some silt, trace gravel, and, reddish brown       194.22       SS       52       Grain Size Analysis:       0       0         ecoming fine grained sand, reddish brown       2       SS       52       Grain Size Analysis:       0       0         ecoming dense       3       SS       46       4       SS       32       Grain Size Analysis:       0       0         ecoming silty, trace clay       4       SS       32       Grain Size Analysis:       0       0         ecoming silty, trace clay       4       SS       32       Grain Size Analysis:       0       0         ecoming silty, trace clay       4       SS       32       Grain Size Analysis:       0       0         ND oF BOREHOLE AT 14.33m.       188.56       188.58       14.33       0       0       0       0         ND OF BOREHOLE AT 14.33m.       188.58       14.33       0       0       0       0       0         Rey, most       188.06       14.33       0       0       0 <td>LAY, sity, sandy, trace gravel, hard, own, rittle       22       1       SS       53         III.T. sandy, trace clay, very dense, own, noist       194,22       194,22       6       0         AND, trace to some silt, trace gravel, ary dense, brown, moist       194,22       8.69       1       1         ecoming fine grained sand, reddish brown       2       SS       52       Grain Size Analysis: Gr 4%/ Sa 85%/ Si &amp; Cl 11%       0         ecoming dense       3       SS       46       1       1       1         ecoming silty, trace clay       4       SS       32       Grain Size Analysis: Gr 4%/ Sa 85%/ Si &amp; Cl 11%       0         ecoming dense       1       1       1       1       1       1         acoming silty, trace clay       1       1       1       1       1         ND of BOREHOLE AT 14.33m.       1       1       1       1       0       0         ND OF BOREHOLE AT 14.33m.       14.33       1       1       0       0       0       0         RCROUNDWATER ELEVATIONS       GROUNDWATER LEVATIONS       14.33       1       1       1       0       0</td> <td>LAY, silly, sandy, trace gravel, hard, with the gravel, hard, with trace gravel, hard, with trade gravel, hard, with trace gravel, hard, wit</td>	LAY, sity, sandy, trace gravel, hard, own, rittle       22       1       SS       53         III.T. sandy, trace clay, very dense, own, noist       194,22       194,22       6       0         AND, trace to some silt, trace gravel, ary dense, brown, moist       194,22       8.69       1       1         ecoming fine grained sand, reddish brown       2       SS       52       Grain Size Analysis: Gr 4%/ Sa 85%/ Si & Cl 11%       0         ecoming dense       3       SS       46       1       1       1         ecoming silty, trace clay       4       SS       32       Grain Size Analysis: Gr 4%/ Sa 85%/ Si & Cl 11%       0         ecoming dense       1       1       1       1       1       1         acoming silty, trace clay       1       1       1       1       1         ND of BOREHOLE AT 14.33m.       1       1       1       1       0       0         ND OF BOREHOLE AT 14.33m.       14.33       1       1       0       0       0       0         RCROUNDWATER ELEVATIONS       GROUNDWATER LEVATIONS       14.33       1       1       1       0       0	LAY, silly, sandy, trace gravel, hard, with the gravel, hard, with trace gravel, hard, with trade gravel, hard, with trace gravel, hard, wit

			R	ECO	R	D	OF	BOREHOLE 14	-080	Α					
	ROJEC OCATIO												Ρ	roject N	lo. 17-123-902
S	TARTE					r	N 4	825 518.9 E 593 063.4						HEET 2 ATUM	2 OF 2 Geodetic
	-	SOIL PROFILE			SA	MPL		COMMENTS	Sł	IEAR ST	RENGT	H: Cu, KF Q - X Cpen ▲			
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 1 1 1 1 1	4 WA	0 8 ATER CO	0 12 L DNTENT	20 16 L L , PERCEN	10 NT 1	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
-		BENTONITE HOLEPLUG TO 0.20m, THEN GRANULAR TO SURFACE.													
- 															
- 17 -															
: - 19 -															
-20															
: - 21 -															
-22															
: - 23 -															
: -24															
: - 25 -															
: -26															
- 27															
-28															
THURBER2S 3902.GPJ 11/9/15															
330.	1 1	GROUNDWATER ELE	VAT	L FIONS	ــــــ ک		<u> </u>		1						
THURBER2		$\overline{ au}$ water level upon co	MPL	ETION	l		L w	ATER LEVEL IN WELL/PIEZO	DMETEI		LOGGEI		DJP MTB		THURBER

			R	RECO	OF	RD	0	F BOREHOLE 1	4-081		
	ROJEC									Project N	No. 17-123-902
	CATIC ARTE									SHEET 1	1 OF 1
СС	OMPLE	ETED : February 5, 2015				I	N 4	825 516.0 E 592 858.8		DATUM	Geodetic
Ш	Đ	SOIL PROFILE	1.		SA	MPL	ES	COMMENTS	SHEAR STRENGTH: Cu, KPa nat V - ● Q - X rem V - ● Cpen ▲	귀일	
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	40 80 120 160 40 80 120 160 40 120 120 40 120 120 40 120	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	ß		STF	(m)	L		BLO	20 40 60 80 100	10 20 30 40		
-		GROUND SURFACE SAND, some silt, trace gravel, very dense, brown, damp: (FILL)	$\boxtimes$	204.02 0.00						_	
					1	GS			0		
- - 1					1	SS	<u>50/</u> 0.100		0		
-			$\otimes$								
-2		CLAY, silty, sandy, trace gravel, very stiff to hard, brown: (TILL)(CL)		202.27 1.75		ss	18		0		
-2								Grain Size Analysis:			
		occasional rootlets to 2.4m			3	SS	43	Grain Size Analysis: Gr 0%/ Sa 32%/ Si 47%/ Cl 21%			
- 3											
	jers				4	SS	50		0		
-4	Solid Stem Augers										
-	lid Ste										
- - 5	S				5	ss	46		•		
					_						
-6						00	05				
-					6	SS	85		0		
- 7											
-8		occasional siltstone			7	ss	57		o		
-		END OF BOREHOLE AT 8.23m. BOREHOLE DRY UPON COMPLETION.	2612	195.79 8.23							
		BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS									
- 9		TO SURFACE.									
-10											
-											
- - 11											
-											
-12											
-											
- 13											
-											
-14											
		GROUNDWATER ELE				_	_		· _ · ·		
-14		$\overline{ au}$ water level upon CC	MPL	ETION	I	7	Ľν	ATER LEVEL IN WELL/PIEZO			
									CHECKED : MTE		THURBER

			R	ECC	DF	RD	0	F BOREHOLE 1	4-08	32		
	OJE										Project I	No. 17-123-902
	CAT ART										SHEET	1 OF 1
		ETED : February 5, 2015				1	N 4	825 565.1 E 592 664.6				Geodetic
ш	ДŎ	SOIL PROFILE			SA	MPL	ES	COMMENTS	S	HEAR STRENGTH: Cu, KPa nat V - ♥ Q - X rem V - ♥ Cpen ▲	- P	
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION		ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	N.	40         80         120         160           1         1         1         1           VATER CONTENT, PERCENT         wp         wp         with with with with with with with with	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
_		GROUND SURFACE		205.57								
-		SAND, some silt, trace gravel, brown, damp: (FILL)		0.00	1	GS			0			
- 1 -		CLAY, silty, sandy, trace gravel, very stiff to hard, dark brown to brown: (TILL)		204.61 0.96	1	ss	22			p		
-2		occasional topsoil and rootlets to 1.5m			2	ss	57			0		
- 3					3	ss	35			0		
- 1	vugers				4	ss	42			0		
-4 -4	Solid Stem Augers											
- - 5	Ň	becoming grey			5	ss	35	Grain Size Analysis: Gr 0%/ Sa 26%/ Si 46%/ Cl 28%		ο		
- - 6												∑
- - -					6	ss	34			0		
-7												
-8		END OF BOREHOLE AT 7.90m. WATER LEVEL AT 5.79m UPON COMPLETION.		197.67 7.90	7		50/ 0.125		0			
- - 9		BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.										
- 10												
- 11												
-12												
- - 13												
-14												
-					Ĺ							
- 		GROUNDWATER ELE WATER LEVEL UPON CO February 5, 2015				<u> </u>	<u>v</u>	ATER LEVEL IN WELL/PIEZO	OMETE	ER LOGGED : ES CHECKED : MT		

			R	ECO	OF	RD	0	F BOREHOLE 1	4-08	3					
	ROJEC												Р	roject N	lo. 17-123-902
	CATIO ARTE												S	HEET 1	I OF 1
CC	OMPLE	ETED : January 30, 2015				I	N 4	825 674.7 E 592 482.5						ATUM	Geodetic
Щ	БЬ	SOIL PROFILE	1.		SA	MPL	1	COMMENTS	s	HEAR S nat V - rem V -		FH: Cu, KF Q - X Cpen ▲	Pa	귀입	
DEPTH SCALE (metres)	BORING METHOD		STRATA PLOT	ELEV.	Ë	μ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	4	8 OI	30 1	120 16	60 I	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE
ЦЦ Ш Ш Ш	DRING	DESCRIPTION	RATA	DEPTH	NUMBER	ТҮРЕ	OWS,	$\geq$	w	р 🗕 —		, PERCE	/I	ADDI _AB. T	INSTALLATION
		GROUND SURFACE	STI	(m)	L		В	20 40 60 80 100	1		20 ;	30 4	0	_	
-		SAND, some gravel, some silt, very dense to compact, brown: (FILL)	$\boxtimes$	207.61 0.00		GS			0						
						<u> </u>			0						
- 1			$\otimes$		1	SS	<u>50/</u> 0.12		0						
			$\otimes$												
				205 52	2	ss	22			0					
-2		CLAY, silty, sandy, trace gravel, hard, brown: (TILL)(CL)	Ŕ	205.53 2.08											
-					3	ss	50			0					
- 3															
	vugers				4	SS	85			ρ					
-4	Solid Stem Augers														
-	Solid S														
					5	ss	51	Grain Size Analysis: Gr 6%/ Sa 29%/ Si 44%/ Cl 21%		0 —					
- 5															
-															
-6															
-					6	SS	50/ 0.12		0						
-															
- 7															
		END OF BOREHOLE AT 7.72m.		199.89 7.72		ss	50/ 0.100		0						
-8		BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH					0.100								
-		BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.													
- 9															
-															
-															
-10															
- 11															
-															
-12															
- 12															
-															
- 13															
-14															
-															
-															
		GROUNDWATER ELE	VAT	FIONS	5	1	1			1	1	1		· 1	
-14		$\overline{{\mathbb Y}}$ water level upon CC	MPL	ETION	I	7	Z v	ATER LEVEL IN WELL/PIEZO	OMETE	R	LOGGE	D :	ES		
											CHECK	ED :	MTB		THURBER

			R	ECO	DF	RD	0	F BOREHOLE 1	4-08	4					
	ROJEC												Р	roject N	lo. 17-123-902
	CATIO												s	HEET '	1 OF 1
СС	OMPLE	TED : January 30, 2015				1	N 4	825 811.2 E 592 340.9						ATUM	Geodetic
Ш	дон	SOIL PROFILE	_		SA	MPL	ES	COMMENTS	s	HEAR S nat V -		H: Cu, K Q - X Cpen A	Pa	L IG	
DEPTH SCALE (metres)	BORING METHOD		STRATA PLOT	ELEV.	н	ш	0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	4	10 	80 1	20 1 	60 I	ADDITIONAL LAB. TESTING	PIEZOMETER OR
HTT (m€	RING	DESCRIPTION	RATA	DEPTH	NUMBER	TYPE	BLOWS/0.3m			ATER C		, PERCE		ADDI AB. T	STANDPIPE INSTALLATION
Δ	BO		STR	(m)	Z		BLO	20 40 60 80 100			20 :	30 4	10	<u> </u>	
		GROUND SURFACE SAND, silty, gravelly, very dense, brown:	$\boxtimes$	209.74 0.00				Grain Size Analysis:							
ł		(FILL)	$\otimes$		1	GS		Gr 23%/Sa 52%/ Si & Cl 25%	0						
- 1			$\bigotimes$		1	ss	50/ 0.07!		0						
			$\otimes$				[								
		CLAY, silty, sandy, trace gravel, very stiff		208.09 1.65			07	Grain Size Analysis: Gr 6%/ Sa 32%/ Si 53%/ Cl 9%							
-2		to hard, brown: (TILL)			2	SS	27	Gr 6%/ Sa 32%/ Si 53%/ Ci 9%		0					
					3	ss	50			0					
2					5					Γ					
- 3	SIS	possible cobble			4	SS	<del>50/</del> 0.05(			ρ					
	Solid Stem Augers														
-4	Ster	becoming reddish brown													
	Solid														
- 5					5	SS	0.10		0						
- 5															$\overline{\nabla}$
															$\overline{\Delta}$
-6		in-lashbla			6	SS	50/								
		occasional cobbles					0.10			Í					
- 7															
-				202.02		SS			0						
-8		END OF BOREHOLE AT 7.72m. WATER LEVEL AT 5.49m UPON COMPLETION.		7.72			0.10								
		BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS													
		TO SURFACE.													
- 9															
-10															
-															
- 11															
-															
- 12															
- 13															
-14															
		GROUNDWATER ELE	VA	LIONS	5	1	I	1		1	1	1	1		
-14		$\overline{{ar ar {}}}$ water level upon CC	MPL	ETION	I	<u> </u>	L v	ATER LEVEL IN WELL/PIEZO	OMETE	R	LOGGE	D :	ES		
		January 30, 2015									CHECK		MTB		THURBER

			RECO	)R	D	0	F BOREHOLE 14	4-08	5					
LC	ROJE DCAT TART	FION : Milton/Halton Hills, ON										Project N	№. 17-123-: 1 OF 1	902
CC	r –	LETED : January 30, 2015					325 944.0 E 592 207.0					DATUM	Geodetic	
DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE	STRATA PLOT (W) (W)	~	JPLE 3d AL	BLOWS/0.3m	COMMENTS DYNAMIC CONE PENETRATION RESISTANCE PLOT	w	40 8 L ATER CC	0 120 	160	ADDITIONAL LAB. TESTING	PIEZOME OR STANDP INSTALLA	PIPE
ß	BOF		(m)	ž		BLO	20 40 60 80 100		/p   10 2	0 30	40	٩J		
		GROUND SURFACE SAND, silty, some gravel, very dense, brown, damp: (FILL)	215.81 0.00	1	GS			0					Concrete	
- 1 - 1 -			214.24	1	<u>SS</u> : 0.	<u>50/</u> ).125		0						
-2		CLAY, silty, some sand, trace gravel, occasional cobble, hard, brown: (FILL)	1.57	2	SS	40			0				-	
- 3	Sla	CLAY, silty, sandy, some gravel, occasional cobbles, hard, reddish brown: (TILL)	213.52 2.29			50/ ).125 50/ ).125			0				Pentonite	
- - -4 -	Solid Stem Augers													
- 5		some rock fragments below 5.0m		5	SS	81	Grain Size Analysis: Gr 17%/Sa 36%/Si 33%/Cl 14%		0					
- 6 -				6	<u>SS (</u>	<u>50/</u> ).125			0				Filter Sand	
- 7 - 1		END OF BOREHOLE AT 7.75m.	208.06 7.75	7	SS :	<u>50/</u> 0.125			0				Slotted Screen	
-8 - - -		WATER LEVEL AT 2.74m UPON COMPLETION. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.												-
-9		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Mar. 10/15 2.60 213.21 Apr. 28/15 2.28 213.53												
-10 -		Apr. 20/10 2.20 210.00												-
- 11 -														
-12														-
- - 13 -														
- - - - -														-
		GROUNDWATER ELE		;				<u> </u>		[		1		
		$\overline{ au}$ water level upon CC	OMPLETION		<b>▼</b>		ATER LEVEL IN WELL/PIEZC ril 28, 2015	DMETE		LOGGED : CHECKED :			тни	JRBER

							U	F BOREHOLE 14	4-00	0					
	ROJEC CATIO												Ρ	roject N	lo. 17-123-902
ST	ARTE					Ν	14	826 082.1 E 592 067.6						HEET 1 ATUM	I OF 1 Geodetic
щ	8	SOIL PROFILE			SA	MPL	ES	COMMENTS	S	HEAR S nat V -		TH: Cu, K Q - X Cpen	Pa	. ت	
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	- 4 W. W.	l0 a L ATERC pI——	30 1 L ONTENT	120 1	60   ENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
_		GROUND SURFACE SAND, silty, some gravel, very dense,	XX	226.04 0.00											
-		brown: (FILL)	$\bigotimes$		1	GS			0						
- 1		CLAY, silty, some sand, trace gravel, hard, brown: (FILL)	$\bigotimes$	224.92 1.12	1	SS	78		0	0					
-2		CLAY, silty, sandy, trace gravel, hard, brown, damp: (TILL)		224.47 1.57	2		67/ ).150	Grain Size Analysis: Gr 7%/ Sa 36%/ Si 43%/ Cl 14%	0						
				223.31	3	SS	<u>50/</u> ).125		0						
- 3 - 3 -	Augers	SAND and SILT, some gravel, trace clay, very dense, brown, moist: (TILL)	0 0	2.73	4	SS (	50/ 0.100		0						
- 4 -	Solid Stem Augers		o Z												
- 5			0		_5_	SS (	50/ 0.100			0					
- -6		possible cobble	0		-6-	<del>-88</del> (	<del>50/</del> ).025		0						
- 7			0 0 4												
- -8		END OF BOREHOLE AT 7.67m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.		218.37 <u></u> 7.67	=7-	<del>SS</del> (	<del>50/</del> 0.050		0						
- 9															
: 															
: - 11 -															
: 12															
- - 13															
- - - - - - - - - - - - - 14															
C19.2															
	<u>     </u>	GROUNDWATER ELE				<u> </u>				I	1	1	1	<u> </u>	
		abla water level upon co	MPL	ETION		Ţ	-	ATER LEVEL IN WELL/PIEZC	DMETE	R	LOGGE CHECK		ES MTB		THURBER

			R	ECO	OF	RD	0	F BOREHOLE 14	4-087	7				
LC ST	ROJEC CATIO ARTE	DN : Milton/Halton Hills, ON D : February 3, 2015									:	SHEET		902
C		ETED : February 3, 2015						826 253.2 E 591 894.6	SHE	FAR STRENGTH			Geodetic	
DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	MPL 3d/L	BLOWS/0.3m S	COMMENTS DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	40		160 I PERCENT	ADDITIONAL LAB. TESTING	PIEZOME OR STANDF INSTALLA	PIPE
		GROUND SURFACE SAND, silty, some gravel, very dense, damp: (FILL)	$\boxtimes$	234.27 0.00									Concrete	
- - - 1 - -		Ganp. (FiLL)			1	GS SS SS			0	0			Cuttings	
-2		SAND and SILT, trace alou, trace group		232.06 2.21		55	31							
- - - 3 -	igers	SAND and SILT, trace clay, trace gravel, hard, brown: (TILL) occasional sand pockets, becoming very dense	0 0 0	2.21	3	SS SS	49 50/ 0.125	Grain Size Analysis: Gr 4%/ Sa 48%/ Si 40%/ Cl 8%	0				Bentonite	
- 4 - -	Solid Stem Augers		0 0 2		5	SS	<u>50/</u> 0.125		o	)				
- 5 - - -			0 0 4										Ţ. Filter Sand	
-6 - - - - 7			0		_6_	SS	.50/ 0.100		C				Slotted Screen	
- - - 8 -		END OF BOREHOLE AT 7.75m. BOREHOLE DRY UPON COMPLETION. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.	<u>а</u>	226.52 7.75	7	SS	<u>50/</u> 0.125		0					. H.
- - 9 -		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m)												
- - - 10		Mar. 10/15 6.10 228.17 Apr. 28/15 5.13 229.14												
- 11														
-12														
- - 13 -														
-14														
		GROUNDWATER ELE				1			<u> </u>		I			
		abla water level upon CO	MPL	ETION	1	<u> </u>		ATER LEVEL IN WELL/PIEZC oril 28, 2015	DMETER	CHECKEE			тн	URBER

			R	ECO	DF	RD	0	F BOREHOLE 14	4-08	8					
	OJEC CATIC												Ρ	roject N	lo. 17-123-902
ST	ARTE					1	N 4	826 370.6 E 591 776.2						HEET 1 ATUM	I OF 1 Geodetic
	Ð	SOIL PROFILE			SA	MPL	ES	COMMENTS	S	HEAR S		H: Cu, K Q - X Cpen A	Pa		
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	w v	40 8 ⊥ ATER CI	30 1 L ONTENT	20 16   , PERCE   v	60   NT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE SAND, silty, some gravel, very dense,		234.38 0.00											
· 1		brown: (FILL)			1	GS SS	<b>50/</b> 0.075		0 0						
-2		CLAY, silty, sandy, trace gravel, very stiff, brown: (CL)(TILL)		233.16 1.22	2	ss	18	Grain Size Analysis: Gr 0%/ Sa 30%/ Si 47%/ Cl 23%		ю		4			
		SAND and SILT, trace clay, trace gravel, compact to very dense, brown, moist: (TILL)		232.17 2.21	3	SS	36			Φ					
3	Solid Stem Augers		0 0 4		4	SS	70			Φ					
-4	Solid Ste		0 0 2		5	SS	<u>50/</u> 0.125		0						
5			0												
-6		SAND, silty, trace gravel, very dense, brown, damp		228.28 6.10	6	SS	<u>50/</u> 0.125		0						
7				226.66			EOI		0						
-8		END OF BOREHOLE AT 7.72m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.		7.72			0.100								
9															
-10															
11															
-12															
13															
-14															
-14		GROUNDWATER ELE ♀ WATER LEVEL UPON CO					<u> </u>	ATER LEVEL IN WELL/PIEZC	I METE	IR	LOGGE		ES MTB		THURBE

			R	ECO	DF	RD	0	F BOREHOLE 1	4-089		
LC		ON : Milton/Halton Hills, ON								-	No. 17-123-902
	arte Ompli	ED : February 5, 2015 ETED : February 5, 2015				I	N 4	826 549.0 E 591 601.8		SHEET DATUM	Geodetic
щ	Б	SOIL PROFILE			SA	MPL	ES	COMMENTS	SHEAR STRENGTH: Cu, KPa nat V - ● Q - X rem V - ● Cpen ▲	- 9	
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	40         80         120         160           40         80         120         160           40         80         120         160           40         90         10         10           40         20         30         40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
_		GROUND SURFACE ASPHALT: (65mm)		237.69 23 <b>8.68</b>							 \▼*₩[\*
- - -		SAND, some gravel, very dense, brown, damp: (FILL)		0:06	1	GS			0		Concrete
- 1		CLAY, silty, sandy, trace gravel, hard, brown: (TILL)		236.65 1.04	1	ss	70		0		
-2					2	ss	46		0		Bentonite
		SAND and SILT, some clay, some gravel, very dense, brown, damp: (TILL)	0	235.40 2.29	3	ss	93		0		
- 3	gers		0		4	SS	50/ 0.12	Grain Size Analysis: Gr 11%/Sa 34%/ Si 43%/ Cl 12%	0		
- -4	Solid Stem Augers		0								Filter Sand
	Soli		o Z		5	ss	<u>50/</u> 0.100		0		
- 5			0								Slotted Screen
-6			0		_6	ss	50/ 0.100		0		Screen
- 7			0								
		occasional fine sand layer END OF BOREHOLE AT 7.75m.	l d	229.94 7.75	7	SS	<u>50/</u> 0.125		0		
-8 - -		BOREHOLE DRY UPON COMPLETION. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.									
- -9		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m)									
-10		Mar. 10/15 (Dry) Apr. 28/15 6.23 231.46 Sep. 05/15 (Dry)									
-		(Dy)									
- 11 -											
-12											
- 13											
-											
-14											
Ŀ					Ĺ						
-14		GROUNDWATER ELE				7					
							A	pril 28, 2015	CHECKED : MT	В	THURBER

	ARTE	D : March 27, 2015 TED : March 27, 2015				1	N 4	826 639.2 E 591 517.4					DAT		OF 1 Geodetic
ALF	DOH.	SOIL PROFILE			SA	.MPL		COMMENTS	S	HEAR ST nat V - rem V -	RENGTH	l: Cu, KPa Q - X Cpen ▲	AL	NG	DIEZOMETE
UEF IN SUALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	v	40 8 I ATER CC	0 12 I I	0 160 PERCENT		LAB. TESTING	PIEZOMETE OR STANDPIPI INSTALLATIO
		GROUND SURFACE ASPHALT: (150mm)		239.64 23 <b>9.49</b>											
		SAND, gravelly, trace silt, grey, moist: (FILL)		0.15	1	GS			0						
1		compact	$\bigotimes$	238.58 1.07	1	ss	16		0						
		SILT, clayey, trace sand, trace gravel, trace organic material, very stiff to stiff, brown, most: (FILL)		1.07					0						
2				237.43	2	SS	15			0					
		<b>SILT</b> , clayey, sandy, trace gravel, firm to very stiff, brown, moist: (TILL)		2.21	3	ss	8			0					
3								Grain Size Analysis:							
	vugers		0		4	SS	30	Gr 0%/ Sa 32%/ Si 54%/ Cl 14%		φμι					
4	Solid Stem Augers	CLAY, silty, some sand, hard, grey, moist:		235.53 4.11											
	Solid	(TILL)		7.11				Grain Size Analysis:							
5					5	SS	50	Grain Size Analysis: Gr 0%/ Sa 18%/ Si 41%/ Cl 41%				-			
6															
					6	SS	56			0					
7															
				231.87	7	SS	50/			0					
8		SILT, sandy, trace gravel, very dense, brown, moist: (TILL) END OF BOREHOLE AT 7.90m.		23 <b>†.74</b> 7.90			0.125		0						
		BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG MIXED WITH CUTTINGS TO 0.91m, SAND TO 0.15m,													
9		THEN ASPHALT TO SURFACE.													
10															
11															
12															
13															
14															

CC	MPLE	TED : April 6, 2015						826 718.1 E 591 438.8				DATUM	Geodetic
ALE	гнор	SOIL PROFILE	⊢ ⊢		SA	MPL	-	COMMENTS		nat V -	RENGTH: Cu, KPa Q - X Cpen A	ING ING	PIEZOMETE
UEP IN SCALI (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	W.	0 80 ATER COI p	NTENT, PERCENT	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATIO
	_	GROUND SURFACE ASPHALT: (150mm)		241.40 24 <b>0.24</b>									Concrete
		SAND, gravelly, trace to some silt, brown, moist: (FILL)	$\bigotimes$	0.15	1	GS			0				Filter Sand
1		compact	$\bigotimes$		1	ss	21		0				Ţ.
		CLAY, silty, some sand, trace gravel, stiff to hard, brown, moist: (TILL)		240.10 1.30									-
2					2	ss	12			0			
3					3	SS	20			0			**** ****
Ĵ					4	ss	25			0			
					_			Grain Size Analysis:					
4					5	SS	36	Gr 0%/ Sa 17%/ Si 37%/ Cl 46%		a			
					6	ss	87/			0			
5		SAND, silty to gravelly, with cobbles and boulders, very dense, brown, moist: (TILL)	0	236.27 5.13			0.22						
	Stem Augers	boulders, very dense, brown, moist. (TILL)	4		7	ss	72		0				Cement/ Bentonite Grout
6	Stem				8	SS			0				Giout
	Hollow	with zones of sand to sandy silt					0.250		0				
7			0		9	ss	98/ 0.275	Grain Size Analysis: Gr 0%/ Sa 82%/ Si & Cl 18%	0				
			0 2		10	00	50/		0				····
8			0		10		0.12						
			o		11	SS	50/ 0.075		0				
9			0										
			o		12	SS	50/ 0.125		0				
10			0		13	SS	50/		0				Filter Sand
		SAND, gravelly, some silt, very dense,		231.03 10.36	1		0.07	very slow augering from 10.3m to 12.2m (1.5 hours to advance 1.9m)					
11		brown, moist	• • • • • • • • • • • • • • • • • • •			SS	100/ 0.10(		0				
		SILT, sandy, some gravel, trace clay, trace cobble fragments, trace siltstone fragments, very dense, reddish brown, moist: (TILL)		230.12 11.28									
12		very dense, reddish brown, moist: (TILL)											Slotted Screen
	_				15	SS	100/ 0.12		0				
12	Tricone		4										
13	+	END OF BOREHOLE AT 13.28m.	0	228.11 13.28	16	88	<del>100/</del> 0.02	no sample recovery, sampler bouncing					
		Well installation consists of 50mm diameter Schedule 40 PVC pipe with a 3.04m slotted screen.											
14		WATER LEVEL READINGS:											
		DATE DEPTH(m) ELEV.(m) Sep. 15/15 1.20 240.20											

СС		D : March 30, 2015 TED : April 1, 2015						826 763.6 E 591 393.5				DATUM	Geodetic
	THOD	SOIL PROFILE			SA	MPL	1	COMMENTS		HEAR STRENG nat V - •	Q - X Cpen ▲	NG NG	PIEZOMETE
(metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	W.	40 80       /ATER CONTEN vp	120 160 T, PERCENT / wl 30 40	ADDITIONAL LAB. TESTING	OR STANDPIP INSTALLATI
		GROUND SURFACE ASPHALT: (150mm)		242.12 240.90									
		SAND, gravelly, trace silt, trace asphalt, brown, moist: (FILL)		0.15	1	GS			0				
1		trace clayey silt pockets, compact		240.67	1	SS	25		0				
2		CLAY, silty, trace sand, stiff, reddish brown, moist: (POSSIBLE FILL)	X	1.45 239.91	2	SS	11			0			
		<b>SILT</b> , some sand, trace clay, compact, dense, brown, moist		2.21	3	ss	21						
3		SILT, some clay, trace sand, dense, brown, moist		239.17 2.95	4	SS	32	Grain Size Analysis: Gr 0%/ Sa 9%/ Si 73%/ Cl 18%					
4		SAND, silty to gravelly, with numerous cobbles and boulders, very dense, brown: (TILL)	0	238.39 3.73		SS	50/ 0.050		0				
5	Coring		0		6	ss	50/ 0.100		0 0				
6	Tricone/NQ		0		7	SS		cored through cobbles and boulders from 5.5m to 7.5m	0				
7	Hollow Stem Augers/Tricone/NQ		0		-8	SS	0.100						
8	Hollow		0		9	SS	<u>100/</u> 0.150		0				
0			0	233.28		SS	50/ <del>0.15</del> 0		0				
9		SILT, clayey, trace sand, with some shale fragments, hard, red, moist: (TILL)	Ø	8.84		SS	100/ 0.100			0			
10		SAND, silty to gravelly, with numerous cobbles and boulders, very dense, brown: (TILL)	0	231.76 10.36		SS	100/ 0.100			0			
11		(TILL)	0		13	SS	50/ 0.100		0				
12			0	229.88 12.24	14	ss	100/						
13		END OF BOREHOLE AT 12.24m. BOREHOLE BACKFILLED WITH CEMENT/GROUT MIXED WITH BENTONITE HOLEPLUG TO 0.91m, SANE TO 0.15m, THEN ASPHALT TO SURFACE.		12.24			0.050						
14													
		GROUNDWATER ELE											

			R	RECO	DF	RD	0	F BOREHOLE 1	4-09	3					
LC	ROJE( )CATI TARTE	ON : Milton/Halton Hills, ON												Project N	lo. 17-123-902
СС	OMPL	ETED : March 27, 2015				I	N 4	826 894.8 E 591 261.7					C		Geodetic
Щ	ДОН	SOIL PROFILE			SA	MPL	ES	COMMENTS	s	HEAR S nat V - rem V -	TRENG	TH: Cu, K Q - X Cpen 4	Pa	lo r	
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	w v	40 		120 1	60   ENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE ASPHALT: (150mm)		244.93 24 <b>9.08</b>											
-		SAND, gravelly, granular, brown, moist: (FILL)	$\mathbb{X}$	0.15	1	GS			0						
- 1		compact SILT, clayey, trace gravel, trace sand, topsoil staining, very stiff to stiff, brown to	X	243.71 1.22		ss	16		0		0				
-2	ers	black, moist			2	ss	10				0				
- - -	Solid Stem Augers			242.11	3	ss	14			0					
- 3 - -	Solid	SAND, silty, some gravel to gravelly, trace clay, occasional rock fragments, hard, brown, moist: (TILL)	0	2.82	4	SS	60	Grain Size Analysis: Gr 30%/Sa 43%/ Si & Cl 27% very slow augering from 3.0m to 5.2m	c	,					
-4 -4			0		2	GS									
- - - 5		SAND, gravelly, trace to some silt, occasional cobbles, very dense, brown,	***	240.36 4.57	5				0						
- 5 - -		moist END OF BOREHOLE AT 5.26m UPON AUGER REFUSAL. BOREHOLE BACKFILLED WITH		239.67 5.26		ISS	100/ 0.075		0						
- -6		BENTONITE HOLEPLUG MIXED WITH CUTTINGS TO 0.91m, SAND TO 0.15m, THEN ASPHALT TO SURFACE.													
- 7															
- - -															
-8															
- 9															
- - -10															
- 11															
- - 12															
-															
- 13															
-14															
-14		GROUNDWATER ELE				1	Z w	/ATER LEVEL IN WELL/PIEZ	OMETE	R	LOGGE		ME MTB		
											0.1201				THURBER

			R	ECO	R	D	O	BOREHOLE 14	-093	Α					
	ROJE												Ρ	roject N	lo. 17-123-902
	)CATI FARTI												S	HEET 1	OF 1
C	OMPL	ETED : August 18, 2015				1	N 4	826 894.5 E 591 260.2						ATUM	Geodetic
Ц	ДОН	SOIL PROFILE	1.		SA	MPL		COMMENTS	SHE	EAR STE nat V -	RENGT	H: Cu, KF Q - X Cpen ▲	Pa	7G VG	
DEPTH SCALE (metres)	BORING METHOD		STRATA PLOT	ELEV.	BER	щ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	40	80	1:	20 16   PERCE	50 I	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE
DEPT (m	ORING	DESCRIPTION	<b>FRATA</b>	DEPTH (m)	NUMBER	ТҮРЕ	NOT	20 40 60 80 100	wp 10	I			vl	ADD LAB.	INSTALLATION
		GROUND SURFACE	S	244.93			8					4			
F		No sampling		0.00											
-															
- 1															
ł															
-2															
-															
- 3	Augers														
ł	Stem /														
-4	Hollow Stem Augers														
				240.36											
Ť,		SAND, gravelly, trace to some silt, trace clay, occasional cobbles, very dense brown,	* * * * * * *	4.57		SS	50/ 0.100	very slow augering from 4.5m to 6.4m, augers grinding	0						
- 5		moist			2	66	50/		0						
-		some gravel		*		33	50/ 0.025								
-6 1				238.53		SS	100/ 0.100		0						
•		<b>GRAVEL</b> , some sand to sandy, trace silt, trace clay, occasional cobbles and boulders,	* *	6.40			0.100								
7	ne	very dense, brown, moist	<ul><li>◇</li><li>◇</li></ul>	1	4	SS	118/ 0.200	Grain Size Analysis: Gr 75%/Sa 19%/ Si & Cl 6%	0						
ł	Tricone		。 。 。	237.23	5	ss			0						
-8		END OF BOREHOLE AT 7.70m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 0.91m, SAND		7.70			0.075								
Ē		TO 0.30m, THEN CONCRETE TO SURFACE.													
- 9															
ŗ															
i i															
-10															
- 11															
-															
-12															
ł															
- 13															
-															
⊊ 14															
11/9															
THURBER2S 3902.GPJ 11/9/15															
5S 39(	#	GROUNDWATER ELE					<u>ı                                    </u>	1	<b>.</b>			1	1		
RBER		$\overline{\mathbb{V}}$ water level upon CC	OMPL		I	7	Ľγ	ATER LEVEL IN WELL/PIEZO	OMETER	L	.OGGEI	D :	ME		
INH										C	HECK	ED :	MTB		THURBER

			F	RECO	DF	RD	0	F BOREHOLE 14	4-09	4					
	ROJE												F	Project N	No. 17-123-902
	arte	ED : March 26, 2015 ETED : March 26, 2015					N 4	827 024.2 E 591 128.2					C	SHEET <sup>^</sup> DATUM	1 OF 1 Geodetic
щ	Ð	SOIL PROFILE		_	SA	MPL	ES	COMMENTS	s	HEAR S nat V - rem V -		H: Cu, K Q - Cpen	(Pa	<u>ں</u> ۔	
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	w	10 8 ↓ ATER C <sup> </sup>	30 1	20 1 , PERCE	160  ENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE SAND, gravelly, with clayey silt pockets,		246.49 0.00											
ŀ		brown, moist: (FILL)	$\otimes$	245.80	1	GS			0						
-1		SILT, clayey, trace sand, trace gravel, stiff, brown, moist	Ĭ	0.69		ss	12		0						
					2	ss	10			0					
-2	1 Augers	SILT, clayey, sandy, trace gravel, very stiff, to hard, reddish brown, moist: (TILL)		244.28	-										
- 3	Solid Stem Augers		0		3	SS	29	Carrie Circo Anglesia							
	S		0		4	SS	37	Grain Size Analysis: Gr 2%/ Sa 40%/ Si 42%/ Cl 16%	c						
-4			9												
- - 5		SAND and GRAVEL, trace to some silt, occasional cobbles, very dense, brown, moist	× *		5	SS	<u>50/</u> 0.12	very slow augering	0						
•		END OF BOREHOLE AT 5.23m UPON AUGER REFUSAL. BOREHOLE BACKFILLED WITH		241.26 5.23		SS	100/ 0.05(								
-6		BENTONITE HOLEPLUG WITH CUTTINGS TO SURFACE.													
- 7															
- -															
-8															
- - 9															
-10															
- - 11															
-12															
- 13															
-14															
· · · · · · · · · · · · · · · · · · ·															
2		GROUNDWATER ELE													
		abla water level upon CC	MPI	LETION	I	1	L v	VATER LEVEL IN WELL/PIEZC	DMETE	R	LOGGE CHECK		ME MTB		THURBER

				RE	ECO	R	D	O	BOREHOLE 14	-094A		
		JEC ATIC									Project N	No. 17-123-902
s	ΤA	RTEI					ı	N 4	827 023.7 E 591 128.5		SHEET <sup>·</sup> DATUM	1 OF 1 Geodetic
щ	Τ	ДŎ	SOIL PROFILE			SA	MPL	.ES	COMMENTS	SHEAR STRENGTH: Cu, KPa nat V - ♥ Q - X rem V - ♥ Cpen ▲	ں _	
DEPTH SCALE (metres)	()	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 1 1 1 1	rem V - €         Cpen 40           40         80         120         160           WATER CONTENT, PERCENT         wp         ●         With 10         20         30         40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
-	+	-	GROUND SURFACE No sampling		246.49 0.00							
- - - 1 -												
-2												
- 3 - 3	lidere	0.000										
-4	Hollow Stem Augers				241.92							
- 5			SAND and GRAVEL, trace to some clay, trace silt, occasional cobbles, very dense, brown, moist	* * * * * *	4.57	2	SS		Grain Size Analysis: Gr 41%/Sa 44%/ Si & Cl 15%	0		
-6			some gravel	\$ \$ \$ \$ \$ \$		3	SS		;	0		
- 7 - 7 -				* * * * * *	238.77	5	ss	0.050		0 0		
-8			END OF BOREHOLE AT 7.72m. BOREHOLE BACKFILLED WITH CUTTINGS MIXED WITH HOLEPLUG TO 0.91m, THEN SAND AND CUTTINGS TO SURFACE.		7.72			0.100				
- 9												
-10												
- 11												
-12 - - - - 13												
-												
.GPJ 11/												
3902			GROUNDWATER ELE	LL VA1	L	L		<u> </u>				
THURBER2S 3902.GPJ 11/9/15			abla water level upon CC				1	Z v	/ATER LEVEL IN WELL/PIEZO	DMETER LOGGED : ME CHECKED : MTI	3	THURBER

			R	RECO	JF	RD	0	F BOREHOLE 14	1-09	)5		
	ROJEC CATIO										Project N	<sub>Io.</sub> 17-123-902
ST	ARTE					I	N 4	827 167.3 E 590 982.6			SHEET 1 DATUM	I OF 1 Geodetic
щ	IOD	SOIL PROFILE			SA	MPL	ES	COMMENTS	S	HEAR STRENGTH: Cu, KPa nat V - ● Q - X rem V - ● Cpen ▲	ں _	
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	W	rem V - ● Cpen ▲ 40 80 120 160 I I I I /ATER CONTENT, PERCENT vp I ─ ─ ─ ─ ─ W wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
_		GROUND SURFACE ASPHALT: (150mm)		245.89 24 <b>6.04</b>								
		SAND, some gravel, trace asphalt, brown, moist: (FILL)	$\boxtimes$	0.15	1	GS			0			
<del>.</del> 1		SILT, clayey, trace gravel, trace asphalt, very stiff, brown to black, moist: (FILL)	$\bigotimes$	245.20 0.69		ss	29			ο		
-		some asphalt fragments										
-2			$\bigotimes$	243.68		SS	28			0		
	Augers	CLAY, silty, sandy, trace gravel, stiff, brown, moist: (TILL)		2.21	3	ss	9	Grain Size Analysis: Gr 0%/ Sa 29%/ Si 47%/ Cl 24%		011		
- 3	Solid Stem Augers				4	ss	8			0		
-4 -4	S											
		becoming reddish brown, hard		241.01		ss	35			0		
- 5		SILT, sandy, trace clay, trace gravel, very dense, reddish brown, moist: (TILL)	0	4.88				very slow augering from 5.3m to the bottom of the borehole		Φ		
-6		limestone fragments END OF BOREHOLE AT 6.17m.	d	239.72 6.17	-6	ss	100/ 0.075		0			
- 7		BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG MIXED WITH CUTTINGS TO 0.15m, THEN ASPHALT PATCH TO SURFACE.										
-8												
- 9												
-10												
- 11												
-12												
- 13												
-14												
-												
	<u> </u>	GROUNDWATER ELE				_	_		•			
		abla water level upon CO	MPL	ETION		7	– v	ATER LEVEL IN WELL/PIEZC	METE	R LOGGED : ME CHECKED : MI		THURBER

LOC STA	OJEC CATIC ARTE MPLE	ON : Milton/Halton Hills, ON											F	Project N	lo. 17-123-902
STA COM	ARTE	D : March 26, 2015 TED : March 26, 2015													
DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE				1	N 4	827 301.3 E 590 848.4					[	SHEET ? DATUM	OF 1 Geodetic
DEPTH SCA (metres)	BORING METH				SA	MPL	ES	COMMENTS	S	HEAR S nat V -		H: Cu, ł Q - Cpen	KPa X	цП	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	түре	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	w v	10 ; ⊥ ATER C /p I	30 1 L ONTENT	20   , PERC	160   ENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
-		GROUND SURFACE ASPHALT: (150mm)		243.87 24 <b>9.00</b>											
1		SAND, some gravel, brown, moist: (FILL)	$\bigotimes$	0.15 243.18	1	GS			0						
-1		SILT, clayey, trace gravel, trace asphalt, very stiff to stiff, grey to black, moist: (FILL)		0.69	1	ss	19				5				
-2				241.66	2	ss	12		0						
- - -		CLAY, silty, sandy, trace gravel, very stiff, brown, moist: (TILL)		2.21		ss	19			0					
- 3	ugers				4	SS	17	Grain Size Analysis: Gr 7%/ Sa 35%/ Si 37%/ Cl 21%		0 <b>—</b>					
-4	Solid Stem Augers														
-5	й И	becoming hard, reddish brown			5	SS	47		0	þ					
-6		occasional rock fragments			6	SS	48	very slow augering from 6.0m to the bottom of the borehole	0						
- 7															
-8		END OF BOREHOLE AT 7.75m. BOREHOLE BACKFILLED WITH		236.12 7.75	7	SS	75/ 0.125		0						
		BENTONITE HOLEPLUG MIXED WITH CUTTINGS TO 0.15m, THEN ASPHALT PATCH TO SURFACE.													
- 9 -															
- -10															
- 11															
-12															
- 13															
-14															
		GROUNDWATER ELE		L FIONS	⊥ S										
- 14		∑ WATER LEVEL UPON CO				<u> </u>	Z w	ATER LEVEL IN WELL/PIEZC	DMETE	R	LOGGE CHECK		ME MTB		THURBER

No.5         Display         DESCRIPTION         EV El El El El El El El El El El El El El				R	ECO	OF	RD	0	F BOREHOLE 1	4-097		
Understand         Sold PROFILE         SMAPLES         COMMENTS         SMAPLES         COMMENTS           Understand         DESCRIPTION         State         EVEN UP COMENTS         State         State<	LC ST	CAT ART	ION : Milton/Halton Hills, ON ED : March 26, 2015								SHEET	1 OF 1
Single Line         DESCRIPTION         Solution		<u> </u>								SHEAR STRENGTH: Cu, KPa		Geodetic
1         Astrikut: Itom         285         1         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0	DEPTH SCALE (metres)	BORING METHOE	DESCRIPTION	STRATA PLOT	DEPTH			-	DYNAMIC CONE PENETRATION RESISTANCE PLOT	40 80 120 160	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
1         Image: Strategy and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products and products												Concrete
1       Image method (in [11, 1])	-		SAND, gravelly, granular, brown, moist: (FILL)	$\bigotimes$	0.15 242.86	1	GS			0		
-2       -3       -2       -3       -2       -3       -2       -3       -2       -3       -3       -2       -3       -3       -2       -3       -3       -3       -2       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3       -3 <td< td=""><td>- 1</td><td></td><td>fragments, dense to loose, blackish brown, moist: (FILL)</td><td></td><td>0.00</td><td></td><td>ss</td><td>33</td><td></td><td>0</td><td></td><td></td></td<>	- 1		fragments, dense to loose, blackish brown, moist: (FILL)		0.00		ss	33		0		
13     13     14     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     15     16     15     16     15     16     16     16     16     16     16     16     16     16     16     16     16     16     16     16     16     16     16     16     16     16     16     16     16     16     16     16     16     16     16     16     16     16     16     16     <	-2		some clayey silt pockets		041.94		ss	8		0		
3     4     4     85     36       4     4     85     36       5     6     5     85     50       6     4     5     85     50       7     6     4     5     55     50       8     7     8     0     0     0       9     9     0     0     0     0       10     1     1     0     0     0       11     1     1     1     1     1	-		<b>SILT</b> , clayey, some sand, trace gravel, hard, brown, moist: (TILL)			$\vdash$	ss	28		0		
-6     -6     -7     -6     -7     -6     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     -7     <	- 3	s		0		4	ss	36		Φ		
-5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     -5     <	- -4	em Auger										
5       Image rook fragments       Image rook fragmen	-	Solid St	SAND, silty, some gravel to gravelly, trace clay, very dense, brown, moist: (TILL)	0			SS	50/	Grain Size Analysis: Gr 26%/ Sa 49%/ Si & Cl 25%	0		
-6       race rock fragments       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0	- 5			0				0.100	very slow augering from 4.5m to 6.0m			
-7     -7     -7     -7     -5     97     -225.55     7     -5     977     -0.222       -8     -1     -225.55     7     -5     977     -0.222     -0.222       -9     -1.2     -1.2     -1.2     -1.2     -1.2     -1.2     -1.2       -11     -12     -1.3     -1.4     -1.4     -1.4     -1.4     -1.4	- - -6			0		0		50/				Filter Sand
7     Screen       8     END OF BOREHOLE AT 8.00m. Plezometer installation consists of 25mm diameter Scheude 40 PVC pipe with a 1.52m slotted screen.     235.55     7     SS 1977 0.228       9     WATER LEVEL READINGS: DATE     DEPTH(m)     ELEV.(m)       Sep. 15/15     2.76     240.79       -10     -11       11     -12       13     -13	-		trace rock fragments	o		0	33	0.12				
111     239.35     0.228       9     Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.     8.00       9     WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Sep. 15/15     2.76       240.79     1	- 7			0								
diameter Schedule 40 PVC pipe with a 1.52m slotted screen. 9 WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Sep. 15/15 2.76 240.79 -10 -11 -12 -13	-8			0			ss	97/ 0.22		0		
-11       -12         -13       -13	-		diameter Schedule 40 PVC pipe with a									
	-9		DATE DEPTH(m) ELEV.(m)									
	10											
	- - - 11											
	- - -											
	-12											
GROUNDWATER ELEVATIONS	- 13											
GROUNDWATER ELEVATIONS	-											
GROUNDWATER ELEVATIONS	-14											
GROUNDWATER ELEVATIONS	-											
✓ WATER LEVEL UPON COMPLETION ✓ WATER LEVEL IN WELL/PIEZOMETER LOGGED : ME		•						_		• • • • •		
September 15, 2015 CHECKED : MTB THU			abla water level upon CC	OMPL	ETION	1	_		/ATER LEVEL IN WELL/PIEZO eptember 15, 2015			THURBE

ST	CATIC ARTE MPLE	D : August 4, 2015				I	N 4	825 482.5 E 593 845.7						1 OF 2 Geodetic
ц		SOIL PROFILE			SA	MPL		COMMENTS	5	HEAR STRENGT nat V - ● rem V - ●	H: Cu, KPa Q - 🗙			200000
DEP IH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	v,	40 80 12 VATER CONTENT, wp I 0 <sup>W</sup>	20 160	T	ADDITIONAL LAB. TESTING	PIEZOMETI OR STANDPIP INSTALLATI
		GROUND SURFACE ASPHALT: (150mm)		205.72 20 <b>6.60</b>										
		SAND, some silt, some gravel, brown, moist: (FILL)	$\boxtimes$	20 <b>6.6</b> 0 0.15	1	GS			0					
		very dense	$\otimes$											
1					1	SS	67		0					
		becoming loose	$\otimes$			00			0					
2		SILT, clayey, trace gravel, trace rootlets, firm, dark brown, moist	Й	203.74 1.98	2	SS	8		-			550		
		nim, dark brown, moist	H		3	ss	7			0				
3														
		trace sand			4	ss	6	Grain Size Analysis: Gr 0%/ Sa 31%/ Si 43%/ Cl 26%		0				
4														
4				201.30										
	S	SAND, silty to SAND and SILT, trace to some clay, trace to some gravel, very dense, brown, moist: (TILL)	0	4.42	<u> </u>	0.0	-	Grain Size Analysis:						
5	I Augers	dense, brown, moist: (TILL)	0		5	SS	52	Gr 13%/Sa 53%/Si 24%/Cl 10%	0					
	/ Stem		o											
6	Hollow		4											
			0		6	ss	89/ 0.275			φ				
7			0											
1			ø											
			o		7	SS	50/							
8							0.075							
			Ø		8	SS	50/ 0.100		0					
9			۹ د											
			Ø		9	ss	100/	Grain Size Analysis: Gr 2%/ Sa 37%/ Si 55%/ Cl 6%		9				
10			0		10		50/		0					
10		haseming raddich hypur			10		0.100							
	_	becoming reddish brown		194.90	11	SS	80/		0	þ			FI	
11		SHALE, moderately weathered to fresh, thinly bedded, medium strong, reddish brown with strong, grey limestone interbeds:		10.82			0.100	TCR=78% SCR=67% RQD=51%	Ĭ				7 2	
		(Queenston Formation) limestone seams at 11.13 to 11.25, 11.53 to 11.58, and 11.91 to 11.94m			1	RUN	1	UCS =34MPa (Shale) UCS =87MPa (Limestone)					2	
12		clay seam at 11.13 to 11.33m vertical fracture at 11.89 to 11.94m					<u> </u>							
		limestone seams at 12.09 to 12.12, 12.23 to 12.24, 12.40 to 12.42, 12.57 to 12.65, 12.67 to 12.75, 12.95 to 12.98, 13.11 to 13.13,						TCB-100% CCB-100% DCD-000%					3 3	
13	Coring	and 13.39 to 13.41m clay seam at 12.80 to 12.93m			2	RUN	1	TCR=100% SCR=100% RQD=82% UCS =44MPa (Shale) UCS =76MPa (Limestone)					3	
	NQ Cor	subhorizontal fracture at 13.01 to 13.03m subvertical fracture at 13.23 to 13.28m											1 2	
	-	strong											2	
14		subvertical fracture at 13.97 to 14.02m			3	RUN	4	TCR=95% SCR=95% RQD=48% UCS =39MPa (Shale)					1 2	
		clay seams at 14.65 to 14.71, and 14.83 to											7	
		GROUNDWATER ELE			L		1						4	
		$\overline{Y}$ water level upon co	•731				,	ATER LEVEL IN WELL/PIEZO						

			R	ECC	DF	RD	0	F BOREHOLE 1	4-098	\$					
	ROJEC												P	Project N	lo. 17-123-902
S	TARTE	D : August 4, 2015												HEET 2	
С		TED : August 4, 2015						825 482.5 E 593 845.7	SHE	AR ST	RENGT	H·Cu k			Geodetic
cALE s)	BORING METHOD	SOIL PROFILE	ы			MPL		COMMENTS	re 40	at V - m V - 8	• 0 1	H: Cu, K Q - 2 Cpen 2 20 1	× 4 ▲ 160	NAL TING	PIEZOMETER
DEPTH SCALE (metres)	ING M	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	ТҮРЕ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT		ER CC		L PERCI	ENT	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
DE	BOR		STR₽	(m)	Z		BLO	20 40 60 80 100	wp 10	2	0 :	30	wl 40	ΓA Ι	
		END OF BOREHOLE AT 15.04m. BOREHOLE BACKFILLED WITH CEMENT		15.04	_									2	
ŀ		GROUT TO 0.61m, SAND TO 0.15m, THEN ASPHALT TO SURFACE.													
-16															-
- 17															
ŀ															
-18															
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- 19															
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11/9															
THURBER2S 3902.GPJ 11/9/15															
R2S 3(							- • •								
IURBE		$\overline{ au}$ water level upon CO	MPL	ETION	I	1	÷ N	ATER LEVEL IN WELL/PIEZ	OMETER		logge Check		ME/AHF MTB	=	THURBER
Ė <b>∟</b>															HORDER

		TED : August 10, 2015						825 511.2 E 593 769.7		HEARS	TRENGT	H: Culiki			Geodetic
SCALE tres)	ТНОР	SOIL PROFILE	۲		-	MPL	-	COMMENTS		rem V -	•	H: Cu, KI Q - X Cpen A 20 16	<b>L</b>	ING	PIEZOMETE
UEP IN SUR (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	W.	ATER C	L ONTENT O <sup>W</sup> O	, PERCE	NT	ADDITIONAL LAB. TESTING	OR STANDPIP INSTALLATI
		GROUND SURFACE SAND, some gravel, trace to some silt,		205.46 0.00											
		brown, moist: (FILL)		0.00	1	GS			0						
1		CLAY, silty, trace gravel, trace peat, firm, dark brown, moist: (FILL)		204.39 1.07	1	SS	8		0	0					
2		brown			2	ss	6				5				
		with peat			3	ss	3				0				
3		SAND, some gravel, trace to some silt, loose, brown, moist: (FILL)	$\bigotimes$	202.18 3.28	4	ss	9		0		þ				
4			$\bigotimes$	201.19											
_	Stem Augers	CLAY, silty, sandy, trace gravel, occasional cobbles, very hard, brown, moist: (TILL)		4.27	5	ss	69/ 0.27	Grain Size Analysis: Gr 10%/Sa 38%/ Si 37%/ Cl 15%	0						
5	Hollow Stem ,														
6	PH	SAND and SILT, trace clay, trace gravel, very dense, grey, moist: (TILL)	0	199.67 5.79	6	55	56								
7			0		7	ss				•					
			0		8		74	Grain Size Analysis: Gr 4%/ Sa 36%/ Si 51%/ Cl 9%							
8			0												
9		some gravel	o o		9		78		0						
			0	195.55			0.15		0						
10	_	SHALE, highly weathered, thinly bedded, medium strong, reddish brown with medium strong to very strong, grey limestone interbeds: (Queenston Formation) becoming slightly weathered to fresh		9.91			100/ 0.10	TCR=42% SCR=25% RQD=0% UCS =101MPa (Limestone)	0					FI >30	
11		limestone interbeds (50mm) at 10.7m, (25mm) at 11.6m, (60mm) at 11.9m, and (50mm) at 12.1m			2	RUN	J	TCR=95% SCR=77% RQD=67% UCS =30MPa (Shale) UCS =47MPa (Limestone)						10 4 6	
12	NQ Coring	limestone interbeds (50mm) at 12.2m and 12.6m, and (25mm) at 12.9m												6 3 4	
13					3	RUN	1	TCR=100% SCR=93% RQD=85% UCS =33MPa (Shale)						4 3 0	
14		END OF BOREHOLE AT 13.72m. BOREHOLE BACKFILLED WITH CEMENT/BENTONITE GROUT TO 0.61m, THEN CUTTINGS MIXED WITH SAND TO SURFACE.	<u></u>	191.74 13.72										0	

CC	MPLE	TED : August 6, 2015						825 531.4 E 593 695.5				-	1 Geodetic
) ALE	тнор	SOIL PROFILE	F		SA	.MPL	-	COMMENTS	- ·	SHEAR STRENG nat V - rem V -	Cpen 🔺	ING ING	PIEZOMETE
UEP IN SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT		40 80 VATER CONTEN wp I 0 <sup>V</sup> 10 20	120 160 IT, PERCENT V IV 30 40	ADDITIONAL LAB. TESTING	STANDPIP INSTALLATI
		GROUND SURFACE SAND, some gravel, trace to some silt, brown, moist: (FILL)	$\boxtimes$	205.17 0.00	1	GS			0				
1		trace asphalt fragments, compact			1	ss	13		0				
2		SAND and SILT, trace clay, loose, brown, moist: (FILL)	$\bigotimes$	203.72 1.45 203.04	2	ss	6			0			
		CLAY, silty, sandy, trace gravel, hard, reddish brown, moist: (TILL)		2.13	3	ss	31		C				
3		occasional cobbles			4	SS	37	Grain Size Analysis: Gr 3%/ Sa 34%/ Si 44%/ Cl 19%					
4													
5	Stem Augers				5	ss	40						
6	Hollow St	trace linearlang for success 1											
_		trace limestone fragments, stiff, brown SAND and SILT, trace clay, trace to some		198.39 6.78	6	ss	13	Grain Size Analysis: Gr 11%/Sa 38%/ Si 36%/ Cl 15% very slow augering from 6.7m to 10.0m		⊫ 			
7		gravel, occasional cobbles and boulders, compact to very dense, brown, moist: (TILL)	0		7	SS	21			S			
8			<u> </u>		8		55	Grain Size Analvsis:	0				
9			0		9		52	Grain Size Analysis: Gr 12%/Sa 35%/Si 43%/Cl 10%					
10		SILT, clayey, trace gravel, trace shale fragments, hard, red, moist: (TILL)		195.34 19 <b>9</b> :锋ቅ 10.06		SS SS	67 100/ 0.100		0	0			
11	_	SHALE, highly weathered, thinly bedded, weak, reddish brown with medium strong, grey limestone interbeds: (Queenston Formation) becoming slightly weathered to fresh			12 1	SS RUN	0.100 100/ 0.07!					FI >25 >28	
	p	becoming slightly weathered to fresh limestone interbeds (40mm) at 10.8m, (75mm) at 11.0m, and (50mm) at 11.6m			2	RUN	J	TCR=87% SCR=55% RQD=33% UCS =17MPa (Shale)				>16 >30 9	
12 13	NQ Coring	limestone interbeds (40mm) at 12.4m, (60mm) at 12.6m,(40mm) at 13.1m, and 13.4m, and (60mm) at 13.6m			3	RUN	J	TCR=100% SCR=87% RQD=80% UCS =20MPa (Shale) UCS =56MPa (Limestone)				9 7 >12 9 9 9	
14		END OF BOREHOLE AT 13.72m. BOREHOLE BACKFILLED WITH CEMENT/BENTONITE GROUT TO 0.61m, THEN SAND TO SURFACE.		191.45 13.72								2	

es)		TED : August 11, 2015				I	N 4	825 546.8 E 593 585.6				DA	TUM	OF 1 Geodetic
es)	loD	SOIL PROFILE			SA	MPL	ES	COMMENTS		SHEAR STREN nat V - 🕈 rem V - ●	GTH: Cu, KP Q - X Cpen ▲	a	_ 0	
UET IN SUALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	түре	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT	v	40 80 ↓ ↓ VATER CONTEL wp ↓ ← ← 10 20	120 160	0 IT	ADDITIONAL LAB. TESTING	PIEZOMETE OR STANDPIP INSTALLATI
		GROUND SURFACE SAND, some gravel, trace to some silt,		205.89 0.00					-					
		brown, moist: (FILL)	$\bigotimes$		1	GS			0					
1		compact	$\bigotimes$	204.82	1	SS	10		0					
		<b>CLAY</b> , silty, sandy, trace gravel, very stiff, brown, moist: (TILL)		1.07		ss	18			0				
					2	ss	23			0				
2														
		becoming hard			3	ss	48			ο				
3		reddish brown			4	ss	81/							
					-		0.250							
4														
5	gers	occasional cobbles			5	SS	50/ 0.12		C					
	em Au													
	Hollow Stem Augers													
6	머	grey			6	ss	84/							
		SAND and SILT, trace gravel, trace to		199.11 6.78			0.27							
7		some clay, very dense, grey, moist: (TILL)	0 4	0.70	7	ss	82	Grain Size Analysis: Gr 10%/Sa 40%/ Si 38%/  Cl 12%	0					
			0		8	99	50/		0					
8			o ,				0.12							
		occasional cobbles	0		9		68							
9			o			33	00							
		CLAY, silty, sandy, trace gravel, trace shale fragments, hard, red, moist: (TILL)		196.59 9.30	10		50/ 0.12	;	0					
10					11		105	Grain Size Analysis:						
						33	125/ 0.15(	Grain Size Analysis: Gr 2%/ Sa 20%/ Si 62%/ Cl 16%						
		SHALE, highly weathered, thinly bedded, medium strong, reddish brown with strong,		195.22 10.67	12	SS	157/		0				FI	
11		grey limestone interbeds: (Queenston Formation)			1	RUN	p.22	TCR=0% SCR=0% RQD=0%					>16	
		becoming fresh						TCR=100% SCR=83% ROD=75%					2 4	
12	p	limestone interbeds (75mm) at 12.1m,			2	RUN	4	TCR=100% SCR=83% RQD=75% UCS =45MPa (Shale)					8	
	2 Coring	12.3m, and 12.6m											8 2	
13	ğ	siltstone interbed at 12.7m limestone interbeds (40mm) at 12.7m and 13.1m, (75mm) at 13.9m, and (50mm) at					1						>13	
		14.1m			3	RUN	1	TCR=87% SCR=80% RQD=75% UCS =52MPa (Shale)					>22 2	
14				191.72			1						0	
ľ		END OF BOREHOLE AT 14.17m. BOREHOLE BACKFILLED WITH CEMENT GROUT TO 0.61m, THEN CUTTINGS MIXED WITH BENTONITE HOLEPLUG TO		14.17									0	
		GROUNDWATER ELE	VA1	TIONS	∟}}	I	1		<u> </u>			[		

No.         SOL PROFILE         SAMPLES         COMMENTS         Comments <t< th=""><th></th><th>ARTE</th><th>0</th><th></th><th></th><th>_</th><th></th><th>N 4</th><th>825 546.4 E 593 494.7</th><th></th><th>E</th><th></th><th>Geodetic</th><th></th></t<>		ARTE	0			_		N 4	825 546.4 E 593 494.7		E		Geodetic	
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2         Image: consistent outbule, hand         Image: consis for tons for tons for tons for	'		<b>SILT</b> , clayey, some sand, trace gravel, very stiff, brown, moist: (TILL)				SS	22		0				
3         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -				6		2	ss	29		0				
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4         100 ct; (TLL)         5         85         113         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0	3		SAND and SILT, trace clay, trace gravel,			1	SS	50/						
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7       Image: Control Size Analysis: Gr 5% Sa 38% Si 42% Cl 15%       0       Image: Control Size Analysis: Gr 5% Sa 38% Si 42% Cl 15%       0       Image: Control Size Analysis: Gr 5% Sa 38% Si 42% Cl 15%       0       Image: Control Size Analysis: Gr 5% Sa 38% Si 42% Cl 14%       0       0       Image: Control Size Analysis: Gr 5% Sa 38% Si 42% Cl 14%       0       0       Image: Control Size Analysis: Gr 4% Sa 31% Si 46% Cl 14%       0       0       Image: Control Size Analysis: Gr 4% Sa 43% Si 39% Cl 14%       0       0       Image: Control Size Analysis: Gr 4% Sa 43% Si 39% Cl 14%       0       0       Image: Control Size Analysis: Gr 4% Sa 43% Si 39% Cl 14%       0       0       Image: Control Size Analysis: Gr 4% Sa 43% Si 39% Cl 14%       0       0       Image: Control Size Analysis: Gr 4% Sa 43% Si 39% Cl 14%       0       0       Image: Control Size Analysis: Gr 4% Sa 43% Si 39% Cl 14%       0       0       Image: Control Size Analysis: Gr 4% Sa 43% Si 39% Cl 14%       0       0       Image: Control Size Analysis: Gr 4% Sa 43% Si 39% Cl 14%       0       0       Image: Control Size Analysis: Gr 4% Sa 43% Si 39% Cl 14%       0       0       Image: Control Size Analysis: Gr 4% Sa 43% Si 37% Cl 7%       0       Image: Control Size Analysis: Gr 4% Sa 43% Si 37% Cl 7%       0       Image: Control Size Analysis: Gr 4% Sa 43% Si 37% Cl 7%       0       Image: Control Size Analysis: Gr 4% Sa 43% Si 37% Cl 7%       0       Image: Control Size Analysis: Gr 4% Sa 43% Si 37% Cl 7%       0       Image: Control Size		ollow S	CLAY, silty, sandy, trace gravel, hard, brown, moist: (TILL)			]								
7     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1     1 <td>6</td> <td>Ĭ</td> <td></td> <td></td> <td></td> <td>F</td> <td>0.5</td> <td></td> <td>Grain Size Analysis:</td> <td></td> <td></td> <td></td> <td></td> <td></td>	6	Ĭ				F	0.5		Grain Size Analysis:					
8         7         SS         49         Gr 9%/ Sa 31%/ Si 46%/ Cl 14%         O         O           9         8         8         8         8         8         8         5         61         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         <						6	SS	44	Gr 5%/ Sa 38%/ Si 42%/ Cl 15%					
88         Image: Signal and SILT, trace clay, some gravel, some gravel, some gravel, redish brown, most; (TILL)         9         \$S         33         Grain Size Analysis: Gr 4%/ Sa 43%/ Si 33%/ Cl 14%         0         Filter Sand           10         Image: Size Analysis: Gr 4%/ Sa 43%/ Si 33%/ Cl 14%         0         0         Size Analysis: Gr 4%/ Sa 43%/ Si 33%/ Cl 14%         0           11         SHALE, highly weathered, thinly bedded, weak, redish brown with strong, grey minestone interbeds at 11.05, 11.18, 11.35, 11.71, 11.89, 12.27, and 12.47m         11         Size Analysis: Gr 13%, Sa 41%/ Si 37%/ Cl 7%         0           12         Image: Size Analysis interbeds at 12.50, 13.59, 13.66, and 13.57m         Image: Size Analysis interbeds at 12.50, 13.59, 13.66, and 13.57m         Image: Size Analysis interbeds at 12.50, 13.59, 13.66, and 13.57m         Image: Size Analysis interbeds at 12.50, 13.59, 13.66, and 13.57m         Image: Size Analysis interbeds at 12.50, 13.59, 13.66, and 13.57m         Image: Size Analysis interbeds at 12.50, 13.59, 13.66, and 13.57m         Image: Size Analysis interbeds at 12.50, 13.59, 13.66, and 13.57m         Image: Size Analysis interbeds at 12.50, 13.59, 13.66, and 13.57m         Image: Size Analysis interbeds at 12.50, 13.59, 13.66, and 13.57m         Image: Size Analysis interbeds at 12.50, 13.59, 13.66, and 13.57m         Image: Size Analysis interbeds at 12.50, 13.59, 13.66, and 13.57m         Image: Size Analysis interbeds at 12.50, 13.59, 13.66, and 13.57m         Image: Size Analysis interbeds at 12.50, 13.59, 13.66, and 13.57m         Image: Size Analysis interbeds at 12.50, 13.59, 13.66,	7					7	ss	49	Grain Size Analysis: Gr 9%/ Sa 31%/ Si 46%/ Cl 14%					
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9         10         SAND and SILT, trace clay, some gravel, very dense, reddish brown, moist (TILL)         9         SS 33         Grain Size Analysis: Gr 4%/ Sa 43%/ Si 39%/ Cl 14%         0         Filter Sand           11         -         SAND and SILT, trace clay, some gravel, very dense, reddish brown, moist (TILL)         10         SS 92         0         0         0         Sioted Screen           11         -         SHALE, highly weathered, thinly bedded, weak, reddish brown with strong grey inmestore interbeds at 11.05, 11.18, 11.35, 11.87, 11.87, 11.89, 12.27, and 12.47m         10.82         11         SS 53         Grain Size Analysis: Grain Si	8					8	ss	61		0				
9       SAND and SILT, trace clay, some gravel, very dense, reddish brown, moist: (TILL)       9       SS 33       Gr 4%/ Sa 43%/ Si 39%/ Cl 14%       G       G         10       SAND and SILT, trace clay, some gravel, very dense, reddish brown, moist: (TILL)       9.83       11       SS 53       Grain Size Analysis: Gr 15%/ Sa 41%/ Si 37%/ Cl 7%       G       G       Site Analysis: Gr 15%/ Sa 41%/ Si 37%/ Cl 7%       G         11       SHALE, highly weathered, think bedded, weak, reddish brown with strong, grey limestone interbeds: (Queenston Formation) interstore interbeds: (Queenston Formation) interstore interbeds: 11.05, 11.61, 13.5, 13.66, and 13.97m       TCR=30% SCR=20% RQD=0%       G       FI         12       Imestone interbeds at 12.50, 13.59, 13.66, and 13.97m       Imestone interbeds at 12.50, 13.59, 13.66, and 13.97m       TCR=100% SCR=100% RQD=100%       G       Screen       Screen         14       END OF BOREHOLE AT 14.02m       191.38       14.02       TCR=100% SCR=100% RQD=100%       0       0       0         14       END OF BOREHOLE AT 14.02m       191.38       14.02       191.38       0       0       0       0       0         14       END OF BOREHOLE AT 14.02m       191.38       14.02       191.38       0       0       0       0       0						F	F	+	Grain Size Analysis:				Bentonite	
10       SAND and SILT, trace clay, some gravel, very dense, reddish brown, moist: (TILL)       10       SS       92         11       SAND and SILT, trace clay, some gravel, very dense, reddish brown, moist: (TILL)       11       SS 53       Grain Size Analysis:: Gr 15%/Sa 41%/Si 37%/ Cl 7%       O         11       SHALE, highly weathered, thinly bedded, weak, reddish brown with strong, grey limestone interbeds at (0.6, 11.18, 11.35, 11.28, 11.28, 11.28, 11.28, 11.28, 11.28, 11.28, 11.38, 11.28, 11.28, 11.38, 11.28, 11.28, 11.39, 11.28, 11.28, 11.39, 11.28, 11.28, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39, 11.39,	۹					9	SS	33	Gr 4%/ Sa 43%/ Si 39%/ Cl 14%				Filter Sand	
10       SAND and SILT. trace clay, some gravel, very dense, reddish brown, moist: (TILL)       9.83       11       SS       53       Grain Size Analysis: Gr 15%/Sa 41%/Si 37%/Cl 7%       0       FI       Slotted       Screen         11       SHALE. highly weathered, thinly bedded, weak, reddish brown with strong, grey limestone interbeds: (Queenston Formation) limestone interbeds: (Queenston Formation) limestone interbeds at 11.05, 11.16, 11.35, 11.71, 11.89, 12.27, and 12.47m       11       SS       SS       SCR=63%       RQD=0%       C       5         13       Imestone interbeds at 12.50, 13.59, 13.66, and 13.97m       191.38       14.2       RUN       TCR=100% SCR=100% RQD=100%       5       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       540       55       56       56       56       56       56       56	J I					10	ss	92						
10       very dense, reddish brown, moist: (TILL)       11       SS       53         11       SHALE, highly weathered, thinly bedded, weak, reddish brown with strong, grey limestone interbeds: (Queenston Formation) limestone interbeds at 11.05, 11.18, 11.35, 11.71, 11.89, 12.27, and 12.47m       11       SS       53         12       0       1       SWALE, highly weathered, thinly bedded, weak, reddish brown with strong, grey limestone interbeds: (Queenston Formation) limestone interbeds at 11.05, 11.18, 11.35, 11.71, 11.89, 12.27, and 12.47m       1       INO.100       TCR=30% SCR=63% RQD=0%       0         12       0       1       Imestone interbeds at 12.50, 13.59, 13.66, and 13.97m       1       TCR=97% SCR=63% RQD=58%       0       5         13       Imestone interbeds at 12.50, 13.59, 13.66, and 13.97m       191.38       1       1       TCR=100% SCR=100% RQD=100%       0       0         14       END OF BOREHOLE AT 14.02m. Plezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a       191.38       14.02       191.38       1       1       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0			CAND and SILT trace along a series in			F	E							
11     SHALE, highly weathered, thinly bedded, weak, reddish brown with strong, grey limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) limestone interbeds: (ucenston Formation) lim	10		very dense, reddish brown, moist: (TILL)	0	9.83		ss	53	Grain Size Analysis: Gr 15%/Sa 41%/Si 37%/ Cl 7%	•				
12       11.71, 11.89, 12.27, and 12.47m       2       RUN       TCR=97% SCR=63% RQD=58%       6       5         13       11       11       11       11       11       11       11       12       13       12       13       13       13       13       13       13       13       11       13       11       13       11       13       11       13       13       14       191.38       191.38       14.02       191.38       14.02       191.38       14.02       14       11       11       14       191.38       14.02       14.02       191.38       14.02       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       15       15       15       15       15       16       15       16       16       16       16       16       16       16       16       16       16       16       1		_	SHALE, highly weathered, thinly bedded.			12	ss	100,				FI		
12       11.71, 11.89, 12.27, and 12.47m       2       RUN       TCR=97% SCR=63% RQD=58%       6       5         13       11       11       11       11       11       11       11       12       13       12       13       13       13       13       13       13       13       11       13       11       13       11       13       11       13       13       14       191.38       191.38       14.02       191.38       14.02       191.38       14.02       14       11       11       14       191.38       14.02       14.02       191.38       14.02       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       14.02       15       15       15       15       15       15       16       15       16       16       16       16       16       16       16       16       16       16       16       1	11		weak, reddish brown with strong, grey limestone interbeds: (Queenston Formation) limestone interbeds at 11.05, 11.18, 11.35			1	RUN	ν <b>0</b> .10	ICR=30% SCR=20% RQD=0%					20
12       0       >40       >40       >24       Cuttings         13       13       13       3       RUN       TCR=100% SCR=100% RQD=100%       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       <			11.71, 11.89, 12.27, and 12.47m				<b>.</b>		TCR=97% SCR=63% POD=58%					
13       Immestorie interbeds at 12.50, 13.59, 13.66, and 13.97m       Immestorie interbeds at 12.50, 13.59, 13.66, and 15.57m       Immestorie interbeds at 12.50, 13.59, 13.66, and 13.97m       Immestorie interbeds at 12.50, 13.59, 13.66, and 15.57m       Immestorie interbeds at 12.50, 13.59, 13.66, and 15.57m       Immestorie interbeds at 12.50, 13.59, 13.66, and 15.57m       Immestorie interbeds at 12.57m       Immestorie interbeds at 12.57	12	ĝ				2	RUN	V	UCS =9MPa (Shale)					
13       Immestore interbeds at 12.50, 13.59, 13.66, and 13.97m       Immestore interbeds at 12.50, 13.59, 13.66, and 13.97m       Immestore interbeds at 12.50, 13.59, 13.66, and 13.97m         14       Immestore interbeds at 12.50, 13.59, 13.66, and 13.97m       Immestore interbeds at 12.50, 13.59, 13.66, and 13.97m       Immestore interbeds at 12.50, 13.59, 13.66, and 13.97m         14       Immestore interbeds at 12.50, 13.59, 13.66, and 13.97m       Immestore interbeds at 12.50, 13.59, 13.66, and 13.97m       Immestore interbeds at 12.50, 13.59, 13.66, and 15.57m         14       Immestore interbeds at 12.50, 13.59, 13.66, and 15.57m       Immestore interbeds at 12.50, 13.59, 13.66, and 15.57m       Immestore interbeds at 12.50, 13.59, 13.66, and 15.57m         14       Immestore installation consists of 19mm       Immestore interbeds at 14.02       Immestore interbeds at 14.02       Immestore interbeds at 12.50, 13.59, 13.66, and 14.02         Immestore installation consists of 19mm       Immestore interbeds at 14.02       Immestore interbeds at 14.02       Immestore interbeds at 14.02         Immestore interbeds at 50.57m       Immestore interbeds at 12.50, 13.59, 13.66, and 14.02       Immestore interbed at 14.02       Immestore interbed at 14.02         Immestore interbed at 14.02       Immestore interbed at 14.02       Immestore interbed at 14.02       Immestore interbed at 14.02       Immestore interbed at 14.02         Immestore interbed at 14.02       Immestore interbed at 14.02       Immestore interbed at 14.02		Q Cori											Cuttinas	
14 END OF BOREHOLE AT 14.02m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a	12	ž										0		
14 END OF BOREHOLE AT 14.02m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a	10					3	RUN	J	TCR=100% SCR=100% RQD=100% UCS =11MPa (Shale)					
END OF BOREHOLE AT 14.02m.     14.02       Piezometer installation consists of 19mm     14.02       diameter Schedule 40 PVC pipe with a     14.02					404.00									
	14		Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a									0		KCIC

			R	ECC	DF	RD	0	F BOREHOLE 1	4-102		
LC	ROJEC CATIC	ON : Milton/Halton Hills, ON								Project N	No. 17-123-902
	COMPLETED : August 13, 2015					1		Geodetic			
ЧГE	дон	SOIL PROFILE	т. т		SA	MPL		COMMENTS	SHEAR STRENGTH: Cu, KPa nat V - ♥ Q - ¥ rem V - ♥ Cpen ▲	۸G	
DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	түре	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	40 80 120 160 WATER CONTENT, PERCENT wp	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Sep. 15/15 0.73 204.67									
16											-
- 17											
- - - 18 -											-
- 19											
-20											-
: - 21											
-22 -22											-
- - 23 -											
-24											-
- - 25 -											
-26											-
- 27											
-28											-
- 29											
-					Ļ						
- 29		GROUNDWATER ELE <sup> </sup> <sup> </sup>				<u> </u>		ATER LEVEL IN WELL/PIEZC	DMETER LOGGED : ME CHECKED : MTI		THURBER

СС	MPLE	D : August 13, 2015 TED : August 16, 2015					N 4	825 520.4 E 593 087.2					1 Geodetic
	дон <u>,</u>	SOIL PROFILE			SA	MPL		COMMENTS	S	HEAR STR nat V - 🖶 rem V - 单	ENGTH: Cu, KPa Q - X Cpen ▲	AL NG	PIEZOMET
(metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	v	40 80     /ATER CON	120 160 I TENT, PERCEN O W I W 30 40	LION	PIEZOME I OR STANDPIF INSTALLAT
		GROUND SURFACE SAND, trace to some silt, trace gravel, brown, moist: (FILL)	$\bigotimes$	203.04 0.00	1	GS			0				
1		some gravel, compact	$\bigotimes$										<b>⊥</b>
		SILT, clayey, trace gravel, very stiff, brown, moist trace roots		201.82 1.22	1	SS	28		0	0			
2				200.83 2.21	2	SS	15			0			
3		CLAY, silty, sandy, trace gravel, hard, brown, moist: (TILL)			3	ss	34			0			
5					4	ss	38			0			
4													
5					5	ss	48		0				
-													
6		occasional sand seams and cobbles			6	ss	54	Grain Size Analysis: Gr 6%/ Sa 30%/ Si 47%/ Cl 17%					Cement/
7		SILT, sandy, with clay seams, trace gravel, occasional cobbles, very dense, brown,	0	196.26 6.78				GI U 701 GA 3U701 GI 41701 GI 1170					Bentonite Grout
		moist: (TILL) SILT, sandy, trace clay, trace gravel, compact, brown, moist	4	195.65 7.39	7	SS	64	Orain Dire Anchata		0			
8	Augers			9	8	ss	16	Grain Size Analysis: Gr 0%/ Sa 22%/ Si 73%/ Cl 5%		C			
9	Hollow Stem Auge	becoming wet			9	ss	27			0			
	PH	SAND, some silt, trace gravel, dense to very dense, brown, saturated		9.07	10	ss	40			0			
10													
11					11	ss	71	Grain Size Analysis: Gr 0%/ Sa 90%/ Si & Cl 10%		Q			
12													
13						SS	37			0			Bentonite
		SILT, some sand, trace clay, loose, brown, wet		189.63 13.41									Filter Sand
14					13	ss	7	Grain Size Analysis: Gr 0%/ Sa 14%/ Si 82%/ Cl 4%			0		
		SAND, gravelly, trace silt, very dense, GROUNDWATER ELE		188.26 14.78									

				R	ECC	DF	RD	0	F BOREHOLE 1	4-1	03						
		OJEC CATIC													P	Project N	No. 17-123-902
	STA	ARTE	D : August 13, 2015													HEET	
			TED : August 16, 2015 SOIL PROFILE			64	.MPL		825 520.4 E 593 087.2 COMMENTS		SHEAF	RSTRE	NGTH:	Cu, K		1	Geodetic
CALE	(metres)	BORING METHOD		OT				-		_	nat rem 40	R STRE V - ● V - ● 80	( 120	Q - 2 Cpen 4 1	60	ADDITIONAL LAB. TESTING	PIEZOMETER
PTH S	(metre	RING M	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC CONE PENETRATION RESISTANCE PLOT		WATEF wp I	R CONT	ENT, F	PERCE		DDITIO	OR STANDPIPE INSTALLATION
B		BOF		STR/	(m)	ž	Ĺ	BLC	20 40 60 80 100		10	20	30		40	< ₹	
-	-	-	grey, wet	* * *					Grain Size Analysis:	-			+				Slotted
			GRAVEL, sandy, some silt, trace clay, very dense, reddish grey, moist	•••	187.50 15.54	14	SS	72	Gr 28%/Sa 69%/ Si & Cl 3%								Screen
-1	6		SAND, some silt, trace gravel, with clay	۰ ۰	186.89 16.15												
ł			seams, very dense, brown, wet														
- 1	7		END OF BOREHOLE AT 17.02m. Piezometer installation consists of 19mm		186.02 17.02	15	SS	83/ 0.250									
			diameter Schedule 40 PVC pipe with a 3.05m slotted screen.														
-1	8																-
ł			WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Sep. 15/15 0.65 202.39														
- 1	9																
-2	0																-
-																	
- 2	1																
ł																	
-2	2																-
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11/6/1	9																
THURBER2S 3902.GPJ 11/9/15																	
12S 39(			GROUNDWATER ELE					-		<u> </u>		I			1		
URBER			abla water level upon CO	MPL	ETION		7		ATER LEVEL IN WELL/PIEZO eptember 15, 2015	OME	TER		GGED ECKED		ME MTB		
Ē								5				UT		· .	WITD.		THURBER