

**FOUNDATION INVESTIGATION AND DESIGN REPORT
HIGH MAST LIGHTING POLES
HIGHWAY 400 WIDENING
TESTON ROAD TO NORTH OF KING ROAD
VAUGHAN, ONTARIO
G.W.P. 2539-04-00**

GEOCRES No. 30M13-193

Submitted

To

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PART 1 FACTUAL INFORMATION

1.0 INTRODUCTION

This report presents the factual data from a foundation investigation carried out by Thurber Engineering Ltd. (Thurber) for the detailed design of High Mast Lighting (HML) poles at locations between the service station to the north of Teston Road to north of King Road along Highway 400 in the Regional Municipality of York, Ontario. Thurber has been retained by SNC-Lavalin Inc. (SLI) to carry out this investigation under the Ministry of Transportation Ontario (MTO) Agreement No. 2005-E-0037.

The purpose of this investigation was to determine the subsurface conditions in areas where HML poles are proposed and, based on this data, to provide borehole location drawings, records of boreholes, laboratory test results and a written description of the subsurface conditions.

It is understood that as of June 24, 2011, 70 high mast lighting (HML) pole locations have been proposed for the Highway 400 widening project from Major Mackenzie Drive to north of King Road. Twenty-three of the HML pole locations have previously been investigated and the results reported in Thurber's report entitled "Foundation Investigation and Design Report, High Mast Lighting Poles, Highway 400, Major Mackenzie Drive to North of Teston Road, Toronto, Ontario", G.W.P. 2539-04-00 Report to SNC-Lavalin, File No. 19-92-68, April 1, 2010. The remaining HML pole locations are addressed in this report. The locations of these HML poles were established based on information dated June 24, 2011 provided by MTO and are listed in Table 1 at the end of the text.



In addition to the boreholes drilled specifically for the HML poles, reference has been made to information on subsurface conditions contained in another foundation report to be issued for the overhead and cantilevered sign support design.

2.0 SITE DESCRIPTION

The HML poles are to be located along the alignment of the proposed Highway 400 widening, from the service station just north of Teston Road to north of King Road. This is part of a project of broader scope involving the widening of Highway 400 from Major MacKenzie Drive to King Road.

The project area is located within the physiographic region known as the South Slope of the Oak Ridges Moraine, which is comprised predominantly of the Halton drift (till). The Halton till is an interbedded complex of clayey silt to silt till and sand. This till comprises a slightly hummocky till plain, into which the surface watercourses have eroded 10 to 15 m deep gullies. Relatively recent fluvial sediments have been deposited in the gullies. The Halton drift overlies bedrock at depths in the order of 100 m in the vicinity of the project area.

Drainage in the vicinity of the project area is largely controlled by the Humber River and its tributaries. Localized drainage is facilitated by the creeks flowing within the gullies.

The land use adjacent to this section of Highway 400 is largely rural and agricultural, although there is increasing residential and commercial development in recent years.

3.0 INVESTIGATION PROCEDURES

3.1 Field Investigation

A borehole investigation program for the HML poles was carried out between April 18 and May 5, 2011. This investigation consisted of a total of 14 boreholes, 13 of which were advanced at selected locations within the Highway 400 right-of-way in the vicinities where new HML poles are to be constructed, and 1 of which was advanced at the approximate location of one of the



proposed overhead sign supports. Ten of the boreholes (HML11-01 to HML11-09 and BH11-20) were located along the centre median of the highway and four of the boreholes (HMLK-1 to HMLK-4) were located at the Highway 400-King Road Interchange. These boreholes were terminated at between 9.4 m and 9.8 m depths.

Previously drilled, relevant boreholes located within the subject section of Highway 400 are also referenced in this report and are included in Appendix C. The approximate locations of all relevant boreholes are shown on the Borehole Locations Plans immediately following the text and tables.

In each borehole, soil samples were obtained at selected intervals with a 50 mm outside diameter split spoon sampler driven in conjunction with the Standard Penetration Test (SPT). Groundwater conditions in the open boreholes were observed upon completion of the drilling operations. Standpipe piezometers were installed in boreholes located off of the highway to facilitate longer term monitoring of the groundwater levels. The borehole completion details are summarized in Table 3.1 below.

Table 3.1 – Borehole Completion Details

Borehole Number	Piezometer Tip Depth / Elevation (m)	Completion Details
HML11-01	None Installed	Bentonite holeplug to 6.7 m, cuttings to 0.2 m, concrete to 0.1 m, then asphalt to surface.
HML11-02	None Installed	Bentonite holeplug to 7.3 m, cuttings to 0.2 m, concrete to 0.1 m, then asphalt to surface.
HML11-03	None Installed	Bentonite holeplug to 7.6 m, cuttings to 0.3 m, concrete to 0.1 m, then asphalt to surface.
HML11-04	None Installed	Bentonite holeplug to 0.4 m, concrete to 0.2 m, then asphalt to surface.
HML11-05	None Installed	Bentonite holeplug to 0.5 m, concrete to 0.1 m, then asphalt to surface.
HML11-06	None Installed	Bentonite holeplug to 1.2 m, concrete to 0.1 m, then asphalt to surface.
HML11-07	None Installed	Bentonite holeplug to 1.3 m, concrete to 0.1 m, then asphalt to surface.
HML11-08	None Installed	Bentonite holeplug to 1.2 m, concrete to 0.1 m, then asphalt to surface.



HML11-09	None Installed	Bentonite holeplug and cuttings to 0.4 m, concrete to 0.1 m, then asphalt to surface.
HMLK-1	9.1 / 278.4	Filter sand from 9.1 m to 7.3 m, bentonite holeplug from 7.3 m to 0.9 m, then cuttings to surface.
HMLK-2	9.2 / 283.8	Filter sand from 9.2 m to 7.2 m, bentonite holeplug from 7.2 m to 0.6 m, then cuttings to surface.
HMLK-3	9.1 / 289.4	Filter sand from 9.1 m to 6.4 m, bentonite holeplug to surface.
HMLK-4	9.6 / 283.1	Filter sand from 9.6 m to 7.3 m, bentonite holeplug to surface.
BH11-20	None Installed	Bentonite holeplug to 1.0 m, concrete to 0.1 m, then asphalt to surface.

The drilling investigation was supervised on a full-time basis by a member of Thurber's technical staff who located the boreholes in the field, cleared borehole locations of underground utilities, directed the drilling, sampling and in-situ testing operations, and logged the boreholes. The soil samples were identified in the field, placed in appropriately labeled containers and transported back to Thurber's laboratory for further examination and testing.

3.2 Laboratory Testing

Geotechnical laboratory testing consisted of natural moisture content determination and visual identification of all soil samples in accordance with the current MTO standards. Grain size distribution analysis and Atterberg Limits tests were conducted on selected samples. Laboratory test results are summarized on the Record of Borehole sheets included in Appendix A and are presented on the figures in Appendix B.

4.0 SUBSURFACE STRATIGRAPHY

4.1 General

This section presents a generalized summary of the subsurface conditions encountered in Boreholes HML11-01 to HML11-09, HMLK-1 to HMLK-4, and BH11-20. The detailed subsurface soil and groundwater conditions encountered in these boreholes are presented in the Records of Borehole sheets included in Appendix A. Selected boreholes from Reference 1 are included in Appendix C. The actual borehole data closest to any one HML pole location governs



any interpretation of the site conditions at that specific pole location. It should be recognized that the subsurface conditions may vary between and beyond the borehole locations.

In general, the subsurface conditions encountered in the boreholes located on the highway consist of pavement structure overlying either embankment fill or native clayey silt to silty clay till. Deposits of sandy silt were encountered within the clayey silt to silty clay till in some boreholes. In the boreholes drilled off of the highway, a thin layer of topsoil or sand fill was encountered at surface overlying clayey silt fill, which was underlain by clayey silt to silty clay till in most boreholes. A sand deposit was encountered in two of the four boreholes located at the Highway 400-King Road Interchange and sandy silt till was also encountered in the other 2 boreholes at this location.

4.2 Topsoil

Topsoil was encountered surficially in Boreholes HMLK-3 and HMLK-4 which were advanced at the Highway 400-King Road Interchange. The topsoil was 100 mm thick in both boreholes.

4.3 Sand Fill

A thin layer of sand fill was encountered surficially at the location of Borehole HMLK-1. The sand fill is brown and contains some gravel. The thickness of the sand fill at this location is 200 mm.

4.4 Pavement Structure

Pavement structure consisting of asphalt overlying granular fill was encountered in all of the boreholes located along the centre median of Highway 400 (Boreholes HML11-01 to HML11-09, and BH11-20). The thickness of the asphalt ranges between 150 mm and 300 mm. The granular fill typically consists of brown sand containing trace to some gravel and trace silt and clay. The thickness of the granular fill ranges from 0.6 m to 1.8 m. The base of the granular fill varies from Elevation 259.0 m to 308.6 m.



SPT N-values recorded in the granular fill ranged from 9 blows to 59 blows for 0.3 m penetration, indicating a loose to very dense condition. Typically SPT N-values ranged from 10 to 27 blows for 0.3 m penetration, indicating a compact condition.

The measured moisture contents of samples of the granular fill ranged from 4% to 18%.

Selected samples of the granular fill underwent grain size analysis testing, the results of which are summarized below. These results are also presented on the Record of Borehole sheets included in Appendix A. Figure B1, Appendix B illustrates the grain size distribution curves of these selected samples of the sand fill.

Soil Particles	Percentage (%)
Gravel	1 to 18
Sand	67 to 96
Silt and Clay	3 to 26

4.5 Embankment Fill

Below the pavement structure, embankment fill was encountered in Boreholes HML11-01, 02, 04, 05, 07, 09 and Borehole 11-20. The embankment fill is typically brown and consists of clayey silt with sand and trace gravel. The thickness of the embankment fill ranged from 0.3 m to 3.0 m. The base of the embankment fill varies from Elevation 257.9 m to 307.2 m.

SPT N-values recorded in the clayey silt embankment fill typically ranged from 10 blows to 17 blows for 0.3 m penetration, indicating a stiff to very stiff consistency. A higher SPT N-value of 42 blows was recorded in Borehole HML11-01 and a lower SPT N-value of 6 blows was recorded in HML11-09.

The measured moisture contents of samples of the clayey silt embankment fill generally ranged from 10% to 25%.



Selected samples of the clayey silt embankment fill underwent grain size analysis and Atterberg Limits testing, where appropriate. The results of these tests are presented on the Record of Borehole sheets included in Appendix A and are summarized below. Figure B2 of Appendix B shows the grain size distribution curves for these samples of the clayey silt fill. Figure B10 illustrates the results of the Atterberg Limits tests for these samples.

Soil Particles	Percentage %
Gravel	0 to 1
Sand	24 to 29
Silt	47 to 51
Clay	20 to 25

Index Property	Percentage %
Liquid Limit	25 to 32
Plastic Limit	13 to 15
Plasticity Index	12 to 17

The results of the Atterberg Limits tests indicate that the clayey silt embankment fill is of low plasticity with a group symbol of CL.

4.6 Clayey Silt Fill

At the King Road Interchange, clayey silt fill was encountered below the sand fill in Borehole HMLK-1, at surface in Borehole HMLK-2, and below the topsoil in Boreholes HMLK-3 and 4. The clayey silt fill at these locations is similar to the embankment fill material and is also brown and contains sand and trace to some gravel. The thickness of the clayey silt fill at these locations ranged from 1.5 m to 2.1 m. The base of the clayey silt fill at the King Road Interchange varies from Elevation 285.8 m to 296.7 m.

SPT N-values recorded in the clayey silt fill typically ranged from 10 blows to 29 blows for 0.3 m penetration, indicating a stiff to very stiff consistency. Higher SPT N-values of 52 blows and 67 blows for 0.3 m penetration were also recorded in this fill, indicating a very hard consistency at some locations and depths.



The measured moisture contents of samples of the clayey silt fill at the King Road Interchange generally ranged from 12% to 22%.

Selected samples of the clayey silt fill underwent grain size analysis and Atterberg Limits testing, where appropriate. The results of these tests are presented on the Record of Borehole sheets included in Appendix A and are summarized below. Figure B2 of Appendix B shows the grain size distribution curves for these samples of the clayey silt fill. Figure B10 illustrates the results of the Atterberg Limits tests for these samples.

Soil Particles	Percentage (%)
Gravel	2 to 10
Sand	24
Silt	49 to 56
Clay	17 to 19

Index Property	Percentage %
Liquid Limit	28
Plastic Limit	15
Plasticity Index	13

The results of the Atterberg Limits tests indicate that the clayey silt fill is of low plasticity with a group symbol of CL.

4.7 Clayey Silt to Silty Clay Till

A deposit of native clayey silt to silty clay till was encountered either directly below the pavement structure or below the pavement structure and embankment fill in Boreholes HML11-01 to HML11-09 and BH11-20. In Boreholes HMLK-2 to HMLK-4 the clayey silt to silty clay till was encountered below the clayey silt fill and in Borehole HMLK-1 the clayey silt to silty clay was encountered below a sand deposit.



The clayey silt to silty clay till contains some sand to sandy and trace gravel and is typically brown changing to grey with increased depth. In all boreholes, except Borehole HMLK-2, this deposit was not fully penetrated. In some boreholes (HML11-08, HML11-09, BH11-20, HMLK-3, and HMLK-4) a non-cohesive sandy silt interbed was encountered within this cohesive deposit. The thickness and the elevation of the bottom of the clayey silt to silty clay deposit for each borehole is summarized in Table 4.1.

Table 4.1 – Clayey Silt to Silty Clay Till Thickness and Base Elevations

Borehole	Thickness (m)	Base Elevation (m)	Interbed Encountered
HML11-01	at least 7.3	250.6	-
HML11-02	at least 6.6	254.9	-
HML11-03	at least 8.6	263.7	-
HML11-04	at least 8.3	272.4	-
HML11-05	at least 5.7	257.0	-
HML11-06	at least 7.8	266.2	-
HML11-07	at least 8.3	275.8	-
HML11-08	at least 8.8	294.0	3.1 m Sandy SILT
HML11-09	at least 7.5	296.7	1.6 m Sandy SILT
HMLK-1	at least 0.2	278.0	-
HMLK-2	7.3	283.5	-
HMLK-3	at least 7.9	288.8	4.9 m Sandy SILT TILL
HMLK-4	at least 7.4	283.1	3.5 m Sandy SILT TILL
BH11-20	at least 7.6	299.6	1.5 m Sandy SILT

SPT N-values recorded in the clayey silt to silty clay till ranged from 8 blows for 0.3 m penetration to 100 blows for less than 0.3 m penetration, indicating a stiff to very hard consistency. Typically, SPT N-values were greater than 25 blows for 0.3 m penetration.



Measured moisture contents of the clayey silt to silty clay till samples generally ranged between 10% and 28%. Moisture content values less than 10% were measured in 3 samples of the clayey silt to silty clay till.

Some of the clayey silt to silty clay till samples were selected for laboratory grain size analysis and Atterberg Limits testing, the results of which are summarized below. These results are also presented on the Record of Borehole sheets included in Appendix A. Figures B3 to B6 of Appendix B illustrate the grain size distribution curves for these samples and Figures B11 to B13 illustrate the results of the Atterberg Limits tests.

Soil Particles	Percentage (%)
Gravel	0 to 1
Sand	2 to 30
Silt	46 to 73
Clay	13 to 38

Index Property	Percentage %
Liquid Limit	21 to 40
Plastic Limit	12 to 26
Plasticity Index	8 to 21

The above results show that the clayey silt to silty clay till ranges from low to medium plasticity with a group symbol of CL to CI.

4.5 Sandy Silt Till

A layer of sandy silt till was encountered within the clayey silt to silty clay till deposit in Boreholes HMLK-3 and HMLK-4. The sandy silt till is brown to grey in colour and contains trace to some clay and trace gravel. The thickness of the sandy silt till ranges from 3.5 m to 4.9 m. The base of the sandy silt till layer was found to vary between Elevation 283.9 m and 289.0 m.



SPT N-values recorded in the sandy silt till layer ranged from 18 blows to 38 blows for 0.3 m penetration, indicating a compact to dense condition.

The measured moisture contents of samples of the sandy silt till generally ranged from 14% to 18%.

Selected samples of the sandy silt till underwent laboratory grain size analysis testing, the results of which are summarized below. These results are also presented on the Record of Borehole sheets included in Appendix A. Figure B8 of Appendix B presents the grain size distribution curves for these samples.

Soil Particles	Percentage (%)
Gravel	0 to 1
Sand	16 to 30
Silt	66 to 72
Clay	3 to 11

4.6 Sandy Silt

A layer of sandy silt was encountered within the clayey silt to silty clay till deposit in Boreholes HML11-08, HML11-09, and BH11-20. The sandy silt is brown to grey in colour and contains trace clay. The thickness of the sandy silt ranges from 1.5 m to 3.1 m. The base of the sandy silt layer was found to vary between Elevation 297.5 m and 300.8 m.

SPT N-values recorded in the sandy silt layer ranged from 18 blows to 37 blows for 0.3 m penetration, indicating a compact to dense condition.

The measured moisture contents of samples of the sandy silt till generally ranged from 14% to 18%.

Some samples of the sandy silt were selected for laboratory grain size analysis testing, the results of which are summarized below. These results are also presented on the Record of Borehole



sheets included in Appendix A. Figure B7 of Appendix B presents the grain size distribution curves for these samples.

Soil Particles	Percentage (%)
Gravel	0
Sand	21 to 28
Silt	66 to 76
Clay	3 to 9

4.7 Sand

Sand was encountered below the clayey silt fill in Borehole HMLK-1 and below the silty clay till encountered in Borehole HMLK-2. In Borehole HMLK-1 the sand was 7.5 m thick and was underlain by clayey silt till. In Borehole HMLK-2 the sand was encountered near the base of the borehole and therefore the borehole penetrated only 0.2 m of this deposit. The sand is brown and fine grained and contains trace gravel and trace silt and clay. The base of the sand layer was found to vary between Elevation 278.2 m and 283.4 m.

SPT N-values recorded in the sand ranged from 28 blows to 69 blows for 0.3 m penetration, indicating a compact to very dense condition. In general, the SPT N-value in the sand increases with depth.

The measured moisture contents of samples of the sand generally ranged from 2% to 5%.

Selected samples of the sand underwent laboratory grain size analysis testing, the results of which are summarized below. These results are also presented on the Record of Borehole sheets included in Appendix A. Figure B9 of Appendix B presents the grain size distribution curves for these samples.

Soil Particles	Percentage (%)
Gravel	0 to 1
Sand	90 to 92
Silt and Clay	7 to 10



4.7 Groundwater Conditions

Groundwater conditions were observed during and upon completion of drilling. Some boreholes were dry upon completion. Standpipe piezometers were installed in the boreholes located off of the highway at the King Road Interchange. The water levels measured in the open boreholes upon completion of drilling and in the piezometers are presented in Table 4.2.

Table 4.2 Water Level Measurements

Borehole	Date	Depth (m)	Elevation (m)	Comments
HML11-01	April 20, 2011	8.5	251.7	Open Borehole
HML11-02	April 21, 2011	1.8	262.8	Open Borehole
HML11-03	April 21, 2011	Dry		Open Borehole
HML11-04	April 29, 2011	Dry		Open Borehole
HML11-05	April 29, 2011	Dry		Open Borehole
HML11-09	April 29, 2011	1.4	305.0	Open Borehole
HMLK-1	April 19, 2011	Dry		Open Borehole Piezometer
	June 27, 2011	9.1	278.4	
HMLK-2	April 19, 2011	5.0	288.0	Open Borehole Piezometer
	June 27, 2011	6.5	286.5	
HMLK-3	June 27, 2011	2.7	295.8	Piezometer
HMLK-4	April 18, 2011	1.4	291.3	Open Borehole Piezometer
	June 27, 2011	0.6	292.1	

Previous borehole results and observations as discussed above indicate that the groundwater level varies from 2 m to 9 m depth at the borehole locations. It should be noted that these are very short term observations and groundwater levels are subject to seasonal fluctuations and severe climatic events.

5.0 MISCELLANEOUS

Thurber staked and/or marked the borehole locations in the field and obtained utility clearances prior to drilling. The as-drilled borehole locations (northing, easting, elevation) were surveyed by Thurber using a Trimble Pathfinder ProXRT differential GPS.



DBW Drilling Ltd. of Ajax, Ontario supplied the drill rig and conducted the drilling, sampling and in-situ testing operations. Kodiak Drilling of Oakville, Ontario supplied a limited-access rig for drilling, sampling, and in-situ testing of Borehole HMLK-3. Traffic control during the field work was provided by Barricade Traffic Services Inc. where required.

The drilling and sampling operations in the field were supervised on a full time basis by a member of Thurber's technical field staff. Laboratory testing was carried out by Thurber in its MTO-approved Oakville laboratory.

Mr. Mark Farrant, P.Eng provided overall direction of the field operations and Ms. Lindsey Blaine, E.I.T prepared this report. Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations projects, reviewed the report.



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PART 2 ENGINEERING DISCUSSION AND RECOMMENDATIONS

6.0 HML SUPPORT DESIGN RECOMMENDATIONS

6.1 General

This section of the report presents foundation recommendations for the design of the proposed HML pole supports foundation.

Information on the currently proposed locations of the HML poles was provided to Thurber by SLI. Based on the proposed design layout, a total of 13 boreholes (HML11-01 to HML11-09 and HMLK-1 to HMLK-4) were drilled at selected locations near these pole locations. It was envisaged that these boreholes, in addition to previous boreholes, would provide adequate subsurface information for detailed foundation design of the new HML poles.

Records of all available boreholes that are considered relevant to the foundation design of the HML pole supports are presented in Appendices A and C. Table 1 immediately following the text of this report provides a listing of boreholes relevant to the design of each HML pole.

The design drawings indicate that the HML poles are to be 25, 30 or 35 m in height and have caisson diameters of 1.22 and 1.37 m.

6.2 Foundation Design Parameters

For design of the HML pole foundation, reference should be made to the following documents.



- Ministry of Transportation, Ontario (2003) “Guidelines for the Design of High Mast Pole Foundations”, Third Edition, BRO-006, Engineering Standards Branch, Bridge Office (Reference 1).
- Canadian Highway Bridge Design Code and Commentary (2006). CAN/CSA-S6-00 and S6.1-00 (Reference 2).

It is understood that a typical HML pole is supported on a single conventional augered caisson (drilled shaft). Table 1 following the text of this report presents the recommended geotechnical parameters for design of the HML pole caisson foundations. The subsurface conditions in Boreholes HML11-01 to HML11-09, BH11-20, and HMLK-1 to HMLK-4 and selected boreholes from the investigation for the overhead and cantilevered sign supports have been used to cover all proposed HML pole locations.

In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of a caisson within the upper 1.2 m below final grade should be neglected in the foundation design. It is recommended that all topsoil and organics be neglected in determining lateral resistance.

Where downward sloping fill or native soil exists in front of a caisson, reduction of lateral passive resistance should be taken into account during design. For foundation design at the caissons, it can be assumed that full lateral resistance can only be mobilized where the width of the soil in front of or behind the caisson is equal to or greater than approximately 4 times the diameter of the caissons. For sloping ground in front of a caisson, the magnitude of the mobilized passive resistance can be estimated by interpolating between zero passive resistance at the level where the slope face intersects the pile, and full passive resistance at the level where the slope face is equal to or greater than 4 times the diameter of the caisson.

Where an unconfined compressive strength, q_u , ($q_u = 2 \times C_u$, undrained shear strength) is provided for a cohesive soil (silty clay to silty clay till), the ultimate lateral passive resistance should be calculated in conjunction with the total soil unit weight. When designing for portions of the



caissons below the groundwater level in cohesionless sands and silts, the submerged soil unit weight, γ' , should be used. The required depth of the drilled shaft will be governed by lateral loads, including wind loads, acting on the pole. The length of the caisson should also be sufficient to counteract frost jacking (upward) forces.

An equivalent caisson width equal to 2 times the caisson diameter may be assumed for lateral resistance calculations. Appropriate load and resistance factors should be applied for caisson design.

6.3 Caisson Installation

Caisson installation should generally be carried out in accordance with SP 903S01.

The contract documents should contain an NSSP alerting the contract bidders of the specific aspects relating to caisson construction for HML pole foundation supports at this site. Suggested wordings for this NSSP are provided in Appendix D.

Caisson installation equipment must be able to dislodge, handle and remove cobbles, boulders, rock fragments, to penetrate obstructions within the fill and to drill through hard or very dense layers, where encountered.

Groundwater levels may be considered to vary from 2 m to 9 m depth below existing ground surface. Soil sloughing and water seepage may occur in unsupported holes especially in sands and silts below the groundwater level. Temporary liners should be available to support the caisson sidewalls and to provide seepage cut-off where required. Any accumulated water may have to be pumped out from the hole prior to placing concrete. Should it be considered impractical to remove the accumulated water from inside the hole, it is recommended that the concrete be placed by the tremie method. Each caisson foundation should be excavated, inspected, approved and concreted in sequence without delay.



6.4 Construction Concerns

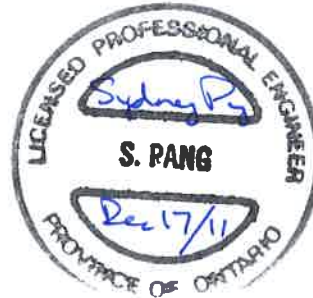
Concerns during caisson construction mainly involve the handling and removal of cobbles or boulders, or other obstructions in the fill and till, drilling through hard/very dense soils, soil sloughing and water seepage from caisson sidewalls, and basal instability. Recommendations on how to address these issues have been outlined in the previous section.

6.5 Construction Inspection and Testing

Caisson construction should be monitored by qualified geotechnical personnel (as per SP 903S01) to verify the soil conditions and to confirm that those conditions are consistent with the design assumptions in this report.



Sydney Pang, P.Eng.
Associate, Senior Project Engineer



P.K. Chatterji, P.Eng.
Review Principal, Designated MTO Contact



**TABLE 1 FOUNDATION DESIGN PARAMETERS
HIGH MAST LIGHTING (HML) POLES
HIGHWAY 400 WIDENING
NORTH OF TESTON ROAD TO NORTH OF KING ROAD**

Pole Number and Location (Station)	Reference Borehole and Location	Reference Simplified Subsurface Stratigraphy For Design	Depth Below Existing Ground Surface (m)	Foundation Design Parameters						
				q _u (kPa)	ϕ' (deg.)	n _h (MN/m ³)	K _p	γ (kN/m ³)	γ' (kN/m ³)	Groundwater Depth (m)
P22 / P23 (21+480 / 21+630)	HM-2 / 11-09 (21+465 o/s 30W / 21+445)	Clayey Silt Till Sand Sandy Silt Till	1.2 – 5.5	200	-	-	-	21	-	3 (below existing grade)
			5.5 – 7.5	-	35	7.0	3.7	21	11	
			7.5 – 11.0	-	32	3.5	3.3	21	11	
P24 (21+780)	11-10 (21+775)	Sand (Fill) Silty Clay (Fill) Silty Clay (Fill) Clayey Silt Till	0.3 – 1.3	-	30	3.0	3.0	20	-	6 (below existing grade)
			1.3 – 4.0	80	-	-	-	20	-	
			4.0 – 10.0	150	-	-	-	20	-	
			10.0 – 11.3	240	-	-	-	21	-	
P25 (21+930) P26 (22+070)	11-11 (21+843)	Sand (Fill) Silty Clay (Fill) Clayey Silt Till	0.3 – 1.6	-	30	3.0	3.0	20	-	6 (below existing grade)
			1.6 – 8.0	160	-	-	-	20	-	
			8.0 – 11.3	180	-	-	-	20	-	
P27 (22+220) P28 (22+370)	11-12 (22+275)	Sand (Fill) Silty Clay Till Silty Clay Till	0.3 – 1.3	-	30	3.0	3.0	20	-	4 (below existing grade)
			1.3 – 5.0	120	-	-	-	20	-	
			5.0 – 11.3	200	-	-	-	21	-	
P29 (22+520) P30 (22+670)	11-13 (22+533)	Sand (Fill) Silty Clay Till Silty Clay Till	0.3 – 1.3	-	30	3.0	3.0	20	-	4 (below existing grade)
			1.3 – 4.0	180	-	-	-	21	-	
			4.0 – 11.3	200	-	-	-	21	-	
P31 (22+820) P32 (22+970)	HML11-01 (22+848)	Sand (Fill) Clayey Silt (Fill) Clayey Silt Till	0.2 – 1.2	-	30	3.0	3.0	20	-	3 (below existing grade)
			1.2 – 2.3	160	-	-	-	20	-	
			2.3 – 9.6	240	-	-	-	21	-	

Notes: 1. This table must be read in conjunction with the text of this report.

2. In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of the caisson within the upper 1.2 m below final grade should be neglected in the foundation design.

High Mast Lighting (HML) Poles
Highway 400 Widening, North of Teston Road to North of King Road

Pole Number and Location (Station)	Reference Borehole and Location	Reference Simplified Subsurface Stratigraphy For Design	Depth Below Existing Ground Surface (m)	Foundation Design Parameters						
				q _u (kPa)	ϕ' (deg.)	n _h (MN/m ³)	K _p	γ (kN/m ³)	γ' (kN/m ³)	Groundwater Depth (m)
P33 (23+110) P34 (23+250) P35 (23+380)	HML11-02 (23+275)	Sand (Fill) Clayey Silt (Fill) Silty Clay Till	0.2 – 1.2	-	30	3.0	3.0	20	-	2 (below existing grade)
			1.2 – 3.2	150	-	-	20	-		
			3.2 – 9.8	200	-	-	21	-		
P36 (23+510) P37 (23+650)	11-14 (23+620)	Sand/Clayey Silt (Fill) Silty Clay Till Silty Clay Till	0.3 – 2.5	-	30	3.0	3.0	20	-	6 (below existing grade)
			2.5 – 6.0	150	-	-	20	-		
			6.0 – 11.3	200	-	-	21	-		
P38 (23+790) P39 (23+930)	HML11-03 (23+900)	Sand (Fill) Clayey Silt Till Silty Clay Till	0.2 – 1.2	-	30	3.0	3.0	20	-	4 (below existing grade)
			1.2 – 5.5	240	-	-	21	-		
			5.5 – 9.8	240	-	-	21	-		
P40 (24+070)	11-15 (24+135)	Sand (Fill) Clayey Silt (Fill) Silty Clay Till	0.3 – 1.3	-	30	3.0	3.0	20	-	3 (below existing grade)
			1.3 – 4.0	50	-	-	19	-		
			4.0 – 11.3	200	-	-	21	-		
P41 (24+210) P42 (24+353)	11-16 (24+210)	Sand (Fill) Silty Clay (Fill) Clayey Silt Till Silty Clay Till	0.3 – 1.2	-	30	3.0	3.0	20	-	3 (below existing grade)
			1.2 – 4.5	100	-	-	20	-		
			4.5 – 9.0	190	-	-	21	-		
P43 (24+496) P44 (10+084)	11-17 (10+128)	Sand (Fill) Clayey Silt (Fill) Silty Clay Till	9.0 – 11.3	160	-	-	-	20	-	4 (below existing grade)
			0.3 – 1.3	-	30	3.0	3.0	20	-	
			1.3 – 4.5	100	-	-	20	-		
P45 (10+232) P46 (10+381)	HML11-04 (10+325)	Sand/Clayey Silt (Fill) Silty Clay Till	4.5 – 11.3	180	-	-	-	21	-	3 (below existing grade)
			0.3 – 1.5	-	30	3.0	3.0	20	-	
			1.5 – 9.8	150	-	-	21	-		

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2. In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of the caisson within the upper 1.2 m below final grade should be neglected in the foundation design.

High Mast Lighting (HML) Poles
Highway 400 Widening, North of Teston Road to North of King Road

Pole Number and Location (Station)	Reference Borehole and Location	Reference Simplified Subsurface Stratigraphy For Design	Depth Below Existing Ground Surface (m)	Foundation Design Parameters						
				q _u (kPa)	ϕ' (deg.)	n _h (MN/m ³)	K _p	γ (kN/m ³)	γ' (kN/m ³)	Groundwater Depth (m)
P47 (10+530) P48 (10+677) P49 (10+826)	11-18 (10+645)	Sand (Fill) Silty Clay Till Silty Clay Till	0.3 – 1.3 1.3 – 9.0 9.0 – 11.0	- 160 200	30 - -	3.0 - -	3.0 - -	20 20 21	- - -	4 (below existing grade)
P50 (10+975)	HML11-05 (11+024)	Sand (Fill) Clayey Silt (Fill) Clayey Silt Till	0.3 – 1.1 1.1 – 4.1 4.1 – 9.8	- 100 160	30 - -	3.0 - -	3.0 - -	20 20 21	- - -	8 (below existing grade)
P51 (11+124) P52 (11+144) (11+264)	11-19 (11+144)	Sand (Fill) Clayey Silt (Fill) Clayey Silt (Fill) Sand	0.2 – 1.2 1.2 – 8.0 8.0 – 10.0 10.0 – 11.3	- 150 170 -	30 - - 35	3.0 - - 7.0	3.0 - - 3.7	20 20 20 20	- - - 10	8 (below existing grade)
P53 (11+404) P54 (11+534)	HML11-06 (11+449)	Sand (Fill) Clayey Silt Till	0.2 – 2.0 2.0 – 9.8	- 200	30 -	3.0 -	3.0 -	20 21	- -	5 (below existing grade)
P55 (11+669) P56 (11+818, 44m W of CL)	HML11-07 (11+764)	Sand/Clayey Silt (Fill) Silty Clay Till Silty Clay Till	0.2 – 1.5 1.5 – 4.1 4.1 – 9.8	- 100 180	30 - -	3.0 - -	3.0 - -	20 20 21	- - -	5 (below existing grade)
P57 (11+814, 52 m E of CL) P58 (11+954) P59 (11+950, 102m E of CL)	HMLK-1	Sand/Clayey Silt (Fill) Sand Sand	0.0 – 1.7 1.7 – 3.7 3.7 – 9.4	- - -	30 34 38	3.0 8.0 12.0	3.0 3.5 4.3	20 20 21	- - 11	9 (below existing grade)

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High Mast Lighting (HML) Poles
Highway 400 Widening, North of Teston Road to North of King Road

Pole Number and Location (Station)	Reference Borehole and Location	Reference Simplified Subsurface Stratigraphy For Design	Depth Below Existing Ground Surface (m)	Foundation Design Parameters						
				q _u (kPa)	ϕ' (deg.)	n _h (MN/m ³)	K _p	γ (kN/m ³)	γ' (kN/m ³)	Groundwater Depth (m)
P60 (12+106, 124 m W of CL) P62 (12+199, 91 m W of CL)	HMLK-2	Clayey Silt (Fill) Silty Clay Till Silty Clay Till	0.0 – 2.1	150	-	-	-	20	-	6 (below existing grade)
			2.1 – 5.0	180	-	-	-	20	-	
			5.0 – 9.6	240	-	-	-	21	-	
P61 (12+128) P64 (12+280, 65 m E of CL)	HMLK-3	Clayey Silt (Fill) Silty Clay Till Sandy Silt Till	0.1 – 1.8	110	-	-	-	20	-	3 (below existing grade)
			1.8 – 4.6	150	-	-	-	20	-	
			4.6 – 9.7	-	32	3.5	3.2	20	10	
P63 (12+277) P65 (12+417)	HML11-08 (12+363)	Sand (Fill) Silty Clay Till Sandy Silt Silty Clay Till	0.2 – 0.8	-	30	3.0	3.0	20	-	3 (below existing grade)
			0.8 – 3.0	160	-	-	-	20	-	
			3.0 – 6.1	-	30	3.0	3.0	20	10	
			6.1 – 9.6	200	-	-	-	21	-	

Notes: 1.

2.

This table must be read in conjunction with the text of this report.

In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of the caisson within the upper 1.2 m below final grade should be neglected in the foundation design.

High Mast Lighting (HML) Poles
Highway 400 Widening, North of Teston Road to North of King Road

Sign Number and Location (Station)	Reference Borehole and Location	Reference Simplified Subsurface Stratigraphy For Design	Depth Below Existing Ground Surface (m)	Foundation Design Parameters						
				q _u (kPa)	ϕ' (deg.)	n _h (MN/m ³)	K _p	γ (kN/m ³)	γ' (kN/m ³)	Groundwater Depth (m)
P66 (12+547)	BH11-20 (12+708)	Sand/Clayey Silt (Fill) Silty Clay Till Sandy Silt	0.2 – 2.2	-	30	3.0	20	-	8 (below existing grade)	
P67 (12+677)			2.2 – 7.6	180	-	-	20	-		
P68 (12+807)			7.6 – 9.8	-	34	6.0	3.5	20		10
P69 (12+942)										
P70 (13+077)	BH11-21 (13+052)	Sand/Clayey Silt (Fill) Silty Clay Till Sand	0.2 – 2.3	-	30	3.0	20	-	6 (below existing grade)	
			2.3 – 7.5	150	-	-	20	-		
			7.5 – 11.0	-	34	6.0	3.5	20		10

LEGEND

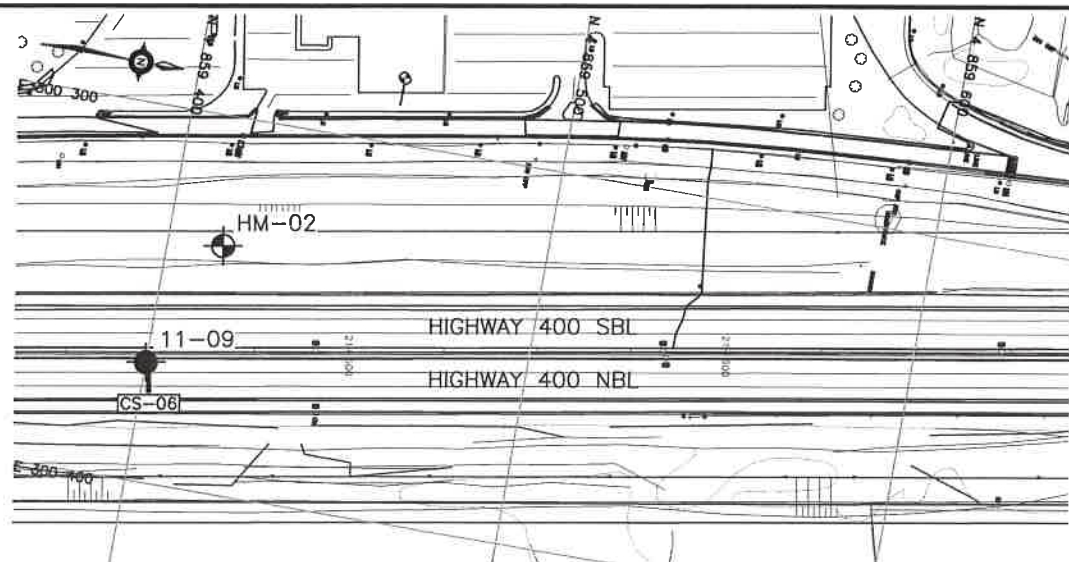
- q_u = Unconfined Compressive Strength ($= 2 \times C_u$, undrained shear strength) (kPa)
- ϕ' = Angle of Internal Friction (degrees)
- n_h = Coefficient of Horizontal Subgrade Reaction (MN/m³ or $\times 10^3$ kN/m³)
- K_p = Coefficient of Passive Earth Pressure
- γ = Soil Unit Weight (kN/m³)
- γ' = Submerged Soil Unit Weight (kN/m³) – to be used only for cohesionless soils below the groundwater table

Notes: 1.

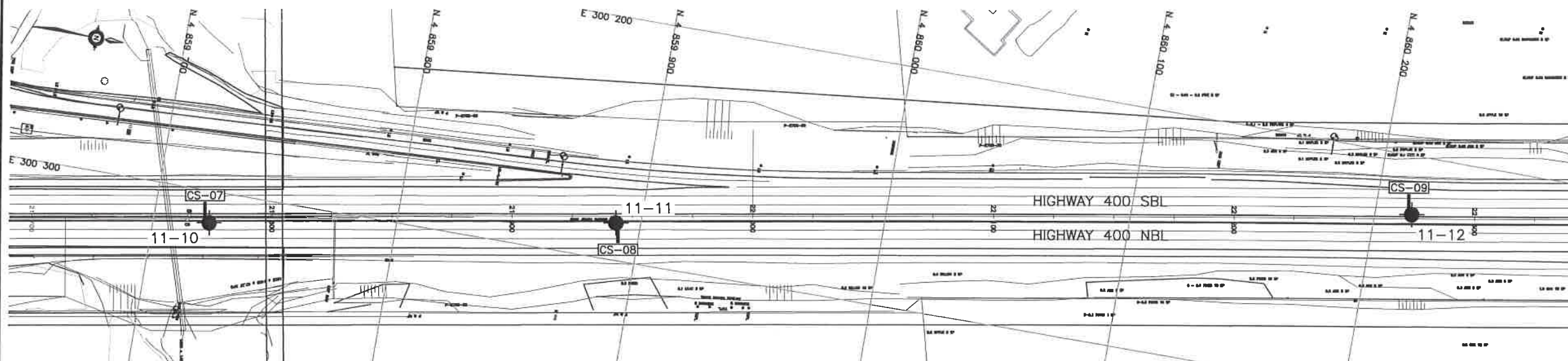
2.

This table must be read in conjunction with the text of this report.

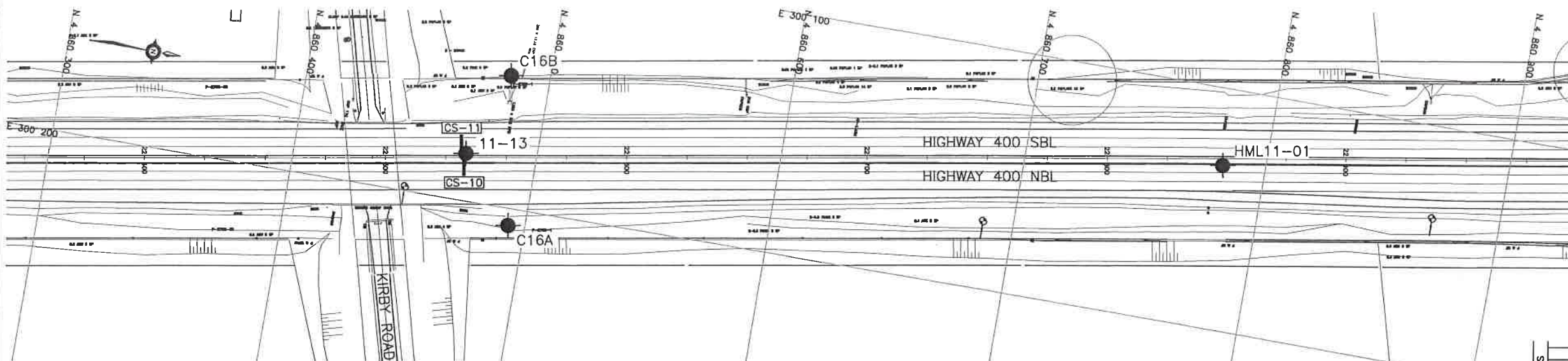
In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of the caisson within the upper 1.2 m below final grade should be neglected in the foundation design.



PLAN
SCALE 1:2000



PLAN
SCALE 1:2000



PLAN
SCALE 1:2000



METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

HIGHWAY 400
CONT No
GWP No 2539-04-00

HWY 400 WIDENING
HIGH MAST LIGHTING POLES
TESTON RD TO NORTH OF KING RD
BOREHOLE LOCATIONS PLAN



SHEET



KEYPLAN

LEGEND

- ◆ Borehole
- ◆ Borehole and Cone
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- W Water Level
- ↑ Head Artesian Water
- Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

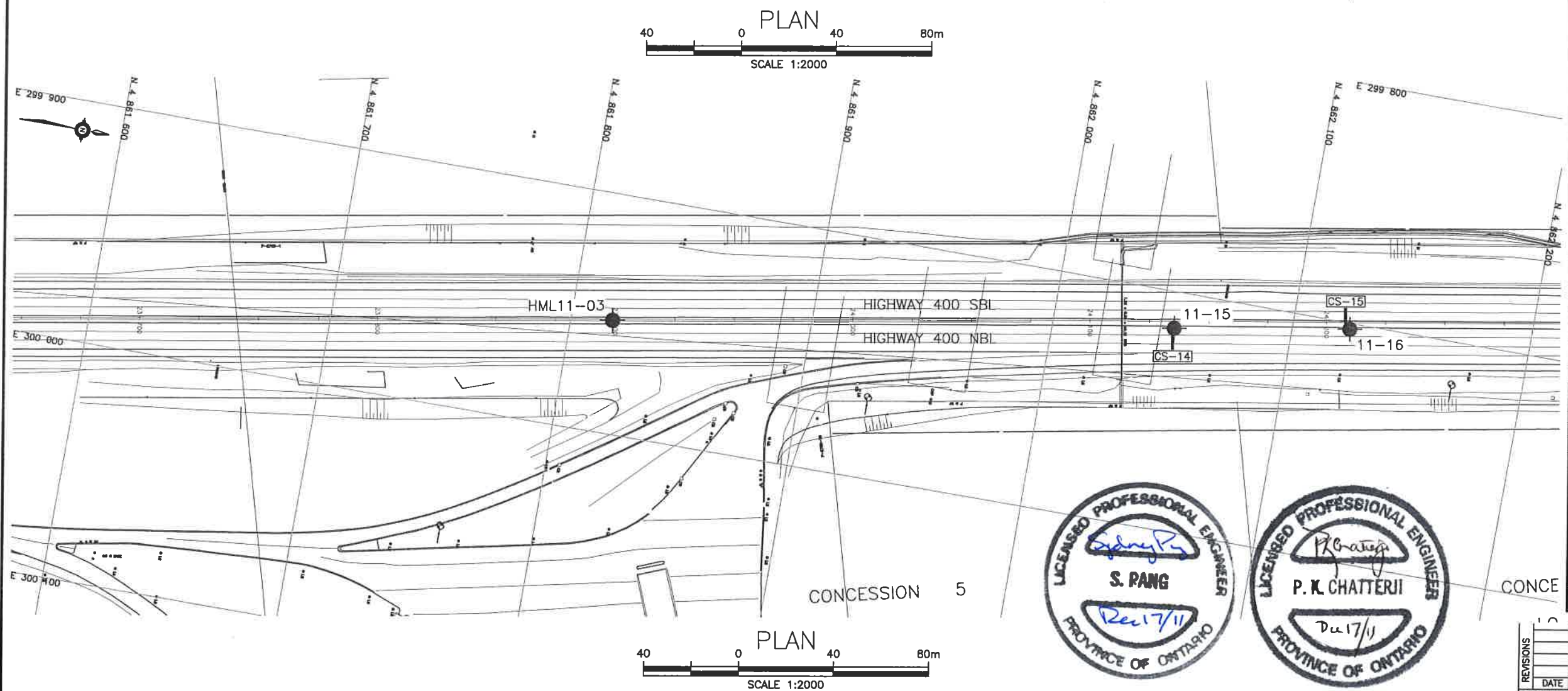
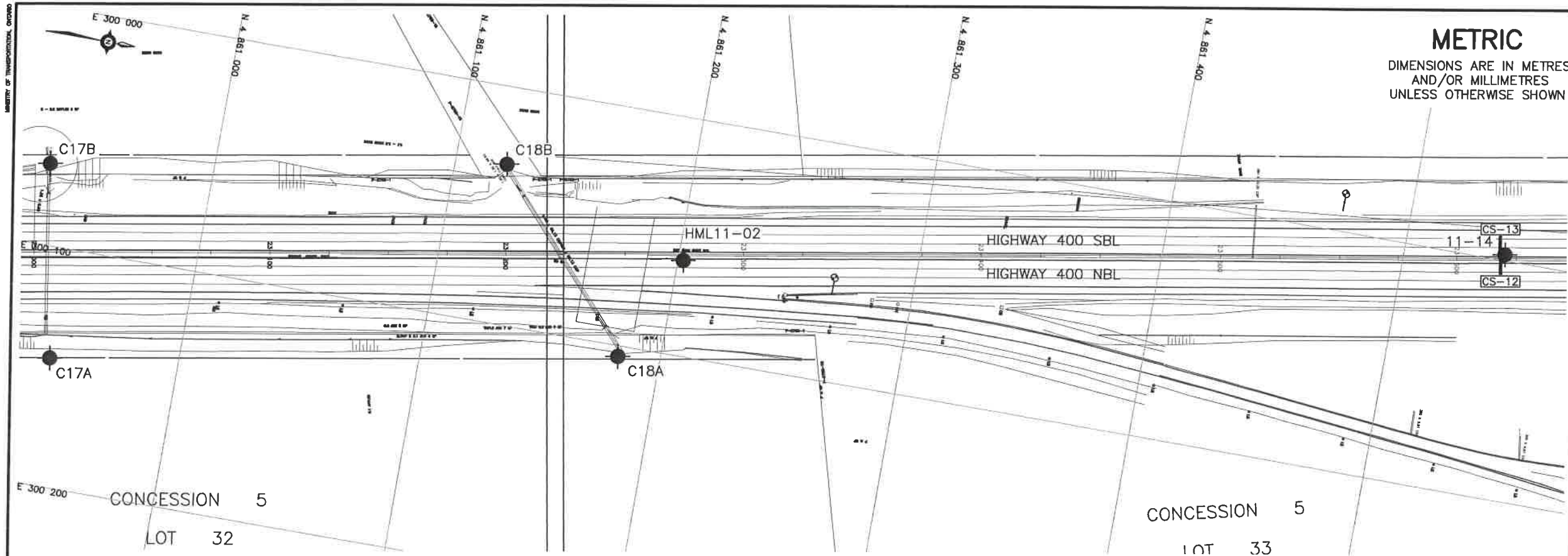
NO	ELEVATION	NORTHING	EASTING
11-09	249.4	4 859 400.1	300 368.3
11-10	251.0	4 859 723.2	300 313.0
11-11	252.0	4 859 889.9	300 284.5
11-12	255.2	4 860 215.2	300 224.2
11-13	257.6	4 860 470.9	300 180.5
C16A	—	4 860 493.2	300 207.0
C16B	—	4 860 483.9	300 145.6
HM-02	250.0	4 859 414.8	300 334.5
HML11-01	260.2	4 860 782.2	300 131.8

NOTES

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

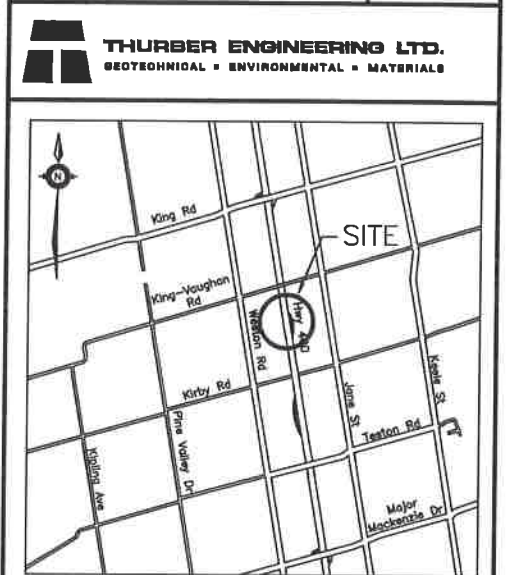
GEOCRES NO. 30M13-193

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METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

HIGHWAY 400 CONT No GWP No 2539-04-00		
HWY 400 WIDENING HIGH MAST LIGHTING POLES TESTON RD TO NORTH OF KING RD BOREHOLE LOCATIONS PLAN		
		SHEET



KEYPLAN

LEGEND

- Borehole
- Borehole and Cone
- Blows /0.3m (Std Pen Test, 475J/blow)
- Blows /0.3m (60° Cone, 475J/blow)
- Pressure, Hydraulic
- Water Level
- Head Artesian Water
- Piezometer
- Rock Quality Designation (RQD)
- Auger Refusal

NO	ELEVATION	NORTHING	EASTING
11-14	271.6	4 861 542.3	299 997.5
11-15	274.2	4 862 050.9	299 915.2
11-16	274.5	4 862 124.3	299 902.5
C17A	-	4 860 945.9	300 146.3
C17B	-	4 860 931.1	300 065.6
C18A	-	4 861 182.3	300 104.4
C18B	-	4 861 122.0	300 032.7
HML11-02	264.6	4 861 202.3	300 060.0
HML11-03	273.5	4 861 817.2	299 952.6

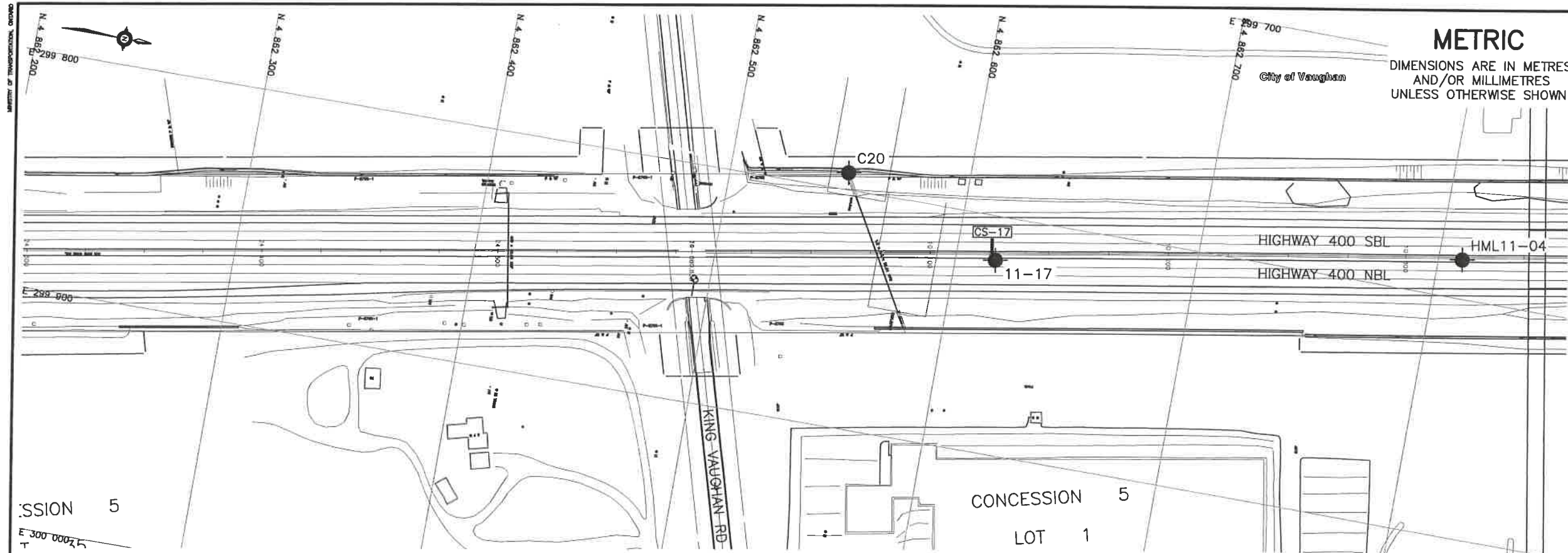
-NOTES-

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCRES NO. 30M13-193



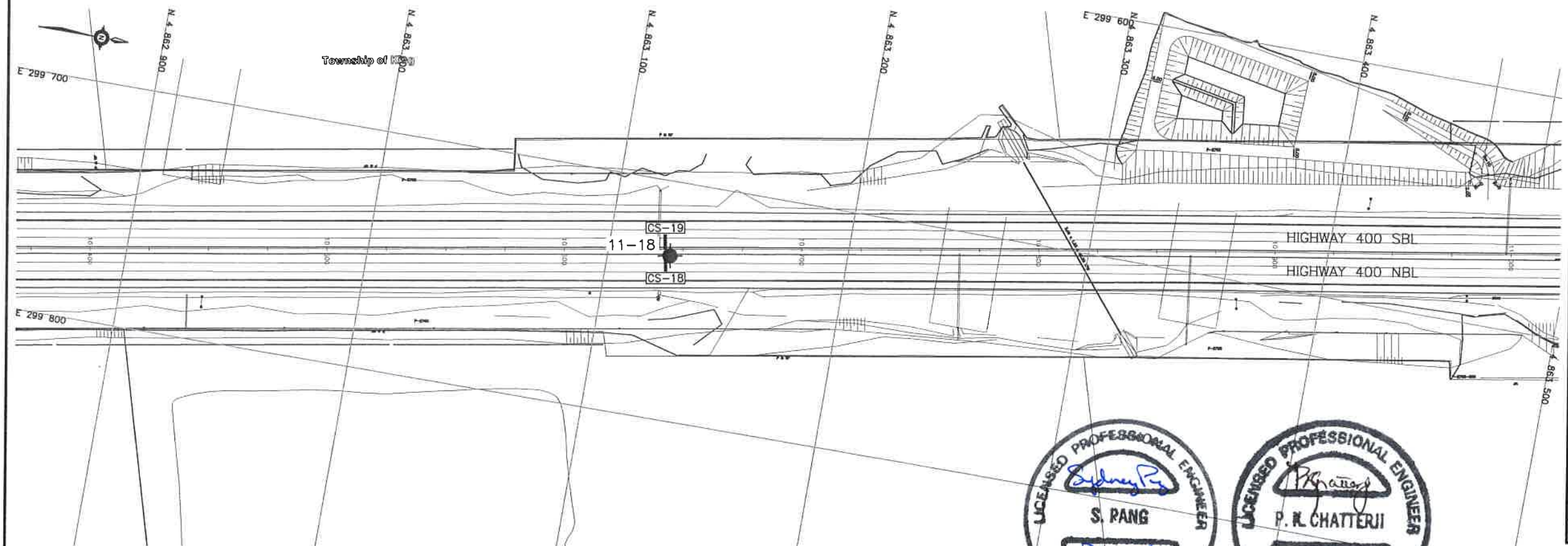
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CONCESSION 5
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CONCESSION 5
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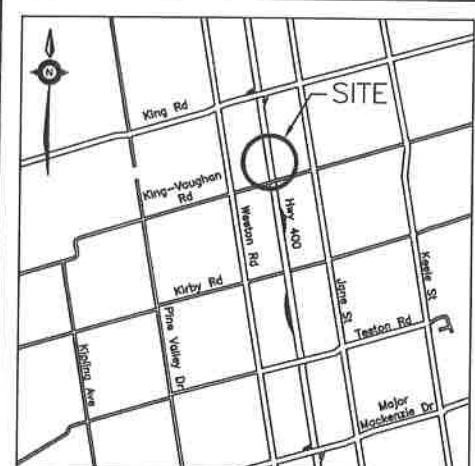


METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

HIGHWAY 400
CONT No
GWP No 2539-04-00

HWY 400 WIDENING
HIGH MAST LIGHTING POLES
TESTON RD TO NORTH OF KING RD
BOREHOLE LOCATIONS PLAN



KEYPLAN

LEGEND

- Borehole
- Borehole and Cone
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- Water Level
- Head Artesian Water
- Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
11-17	280.4	4 862 616.7	299 818.6
11-18	277.1	4 863 126.1	299 731.1
C20	-	4 862 549.3	299 792.8
HML11-04	282.1	4 862 810.0	299 783.6

NOTES

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GEOCRES NO. 30M13-193

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METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

HIGHWAY 400
CONT No
GWP No 2539-04-00



HWY 400 WIDENING
HIGH MAST LIGHTING POLES
TESTON RD TO NORTH OF KING RD
BOREHOLE LOCATIONS PLAN

SHEET



KEYPLAN LEGEND

- Borehole
- Borehole and Cone
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- Water Level
- Head Artesian Water
- Piezometer
- 90% Rock Quality Designation (RQD)
- Auger Refusal

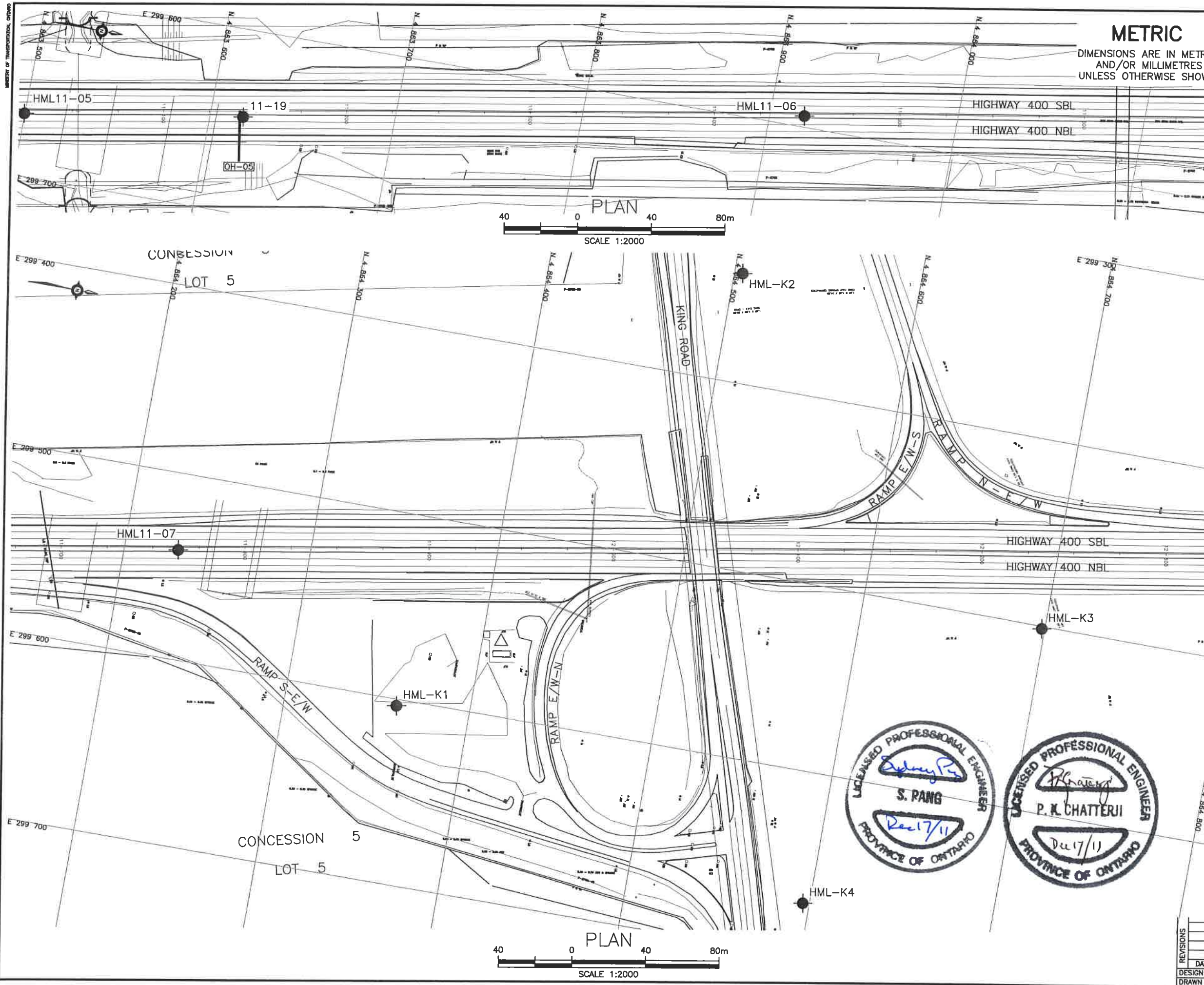
NO	ELEVATION	NORTHING	EASTING
11-19	267.6	4 863 618.0	299 647.5
HML11-05	266.8	4 863 499.7	299 666.0
HML11-06	276.0	4 863 918.5	299 593.9
HML11-07	285.6	4 864 229.1	299 541.1
HML-K1	287.5	4 864 360.6	299 603.5
HML-K2	293.0	4 864 504.4	299 341.2
HML-K3	298.5	4 864 698.4	299 501.2
HML-K4	292.7	4 864 596.4	299 670.7

-NOTES-



- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCRES NO. 30M13-193

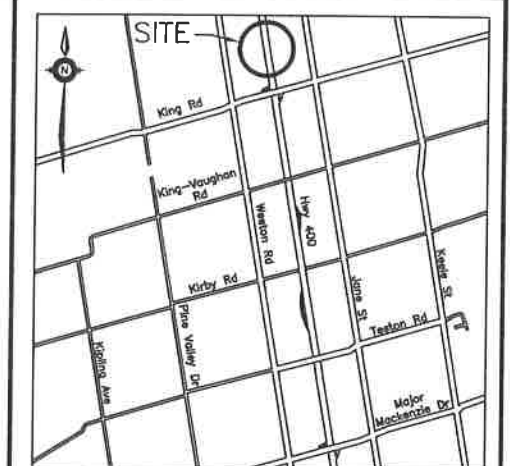
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







METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

HIGHWAY 400 CONT No GWP No 2539-04-00		 SHEET
HWY 400 WIDENING HIGH MAST LIGHTING POLES TESTON RD TO NORTH OF KING RD BOREHOLE LOCATIONS PLAN		
		

 THURBER ENGINEERING LTD. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS



KEYPLAN
LEGEND

-  Borehole
-  Borehole and Cone
-  N Blows /0.3m (Std Pen Test, 475J/blow)
-  CONE Blows /0.3m (60' Cone, 475J/blow)
-  PH Pressure, Hydraulic
-  Water Level
-  Head Artesian Water
-  Piezometer
-  90% Rock Quality Designation (RQD)
-  A/R Auger Refusal

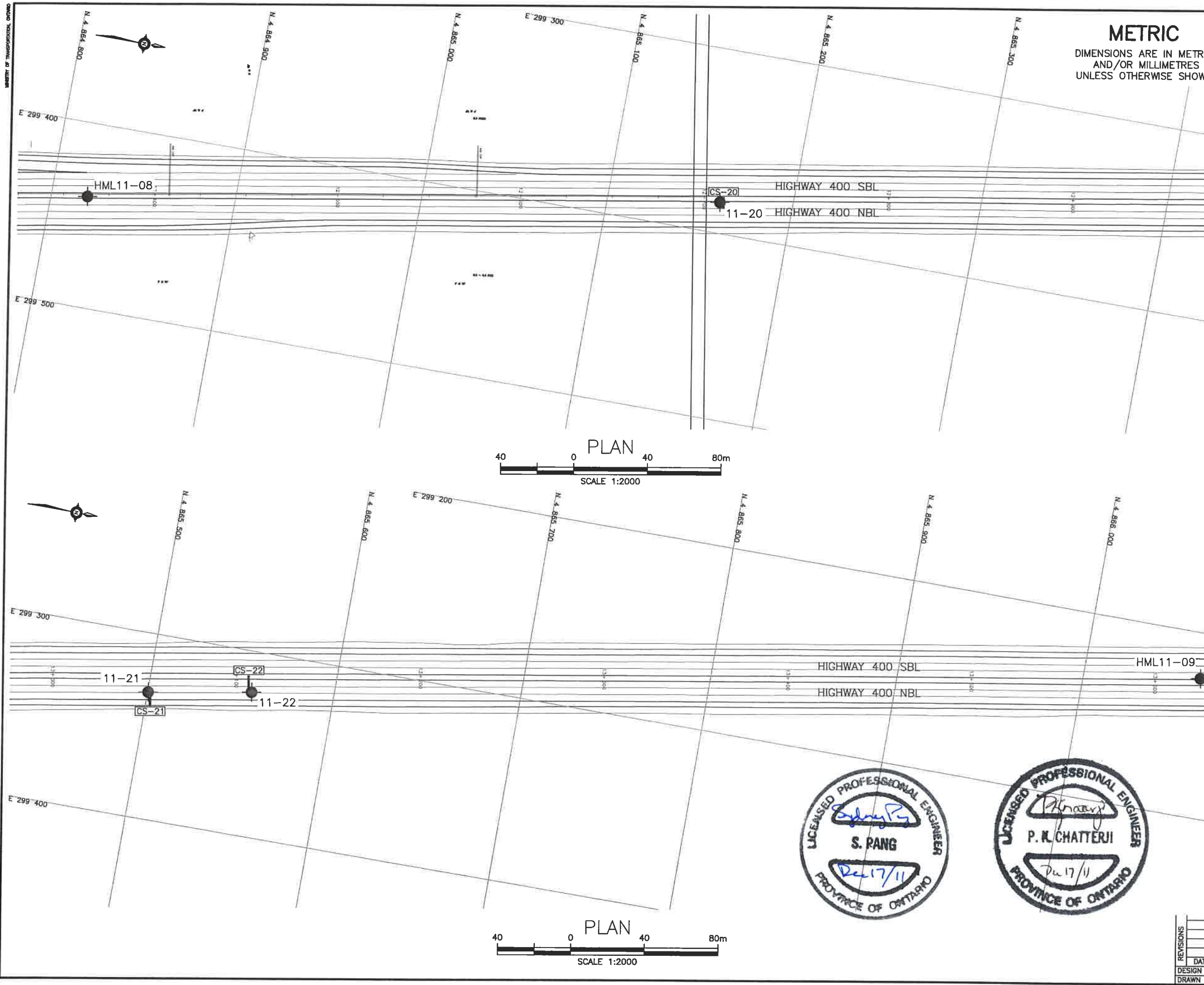
NO	ELEVATION	NORTHING	EASTING
11-20	309.4	4 865 160.6	299 383.2
11-21	306.1	4 865 500.3	299 331.6
11-22	305.6	4 865 555.8	299 322.0
HML11-08	303.6	4 864 820.0	299 439.9
HML11-09	306.4	4 866 062.9	299 224.6

-NOTES-

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GEOCRES NO. 30M13-193

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Appendix A

Record of Boreholes (Present Investigation)

19-92-68



RECORD OF BOREHOLE No HML11-01

1 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 860 782.21 E 300 131.82 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.04.20 - 2011.04.20 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	
260.2												
0.0	ASPHALT: (175mm)											
0.2	SAND, some gravel Compact Brown Moist (FILL)		1	GS			260		o			
259.0			1	SS	25				o			
1.2	Clayey SILT, with sand, trace gravel Very Stiff to Hard Brown (FILL)		2	SS	42		259		o			
257.9												
2.3	Clayey SILT, with sand, trace gravel Hard Brown (TILL)		3	SS	57		258		o			
	Becomes grey		4	SS	77		257		o			
			5	SS	57		256		o			
			6	SS	67		254		o			
							253					
			7	SS	71		252		o			
							251		o			
250.6			8	SS	75							
9.6	END OF BOREHOLE AT 9.6m. BOREHOLE OPEN AND WATER											

Continued Next Page

+³, X³: Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HML11-01

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 860 782.21 E 300 131.82 ORIGINATED BY ES
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.04.20 - 2011.04.20 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
	Continued From Previous Page													
	LEVEL AT 8.5m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 6.7m, CUTTINGS TO 0.20m, CONCRETE TO 0.10m THEN ASPHALT TO SURFACE.													

ONTMT4S 9288.GPJ 8/15/11

+³.X³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HML11-02

1 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 861 202.26 E 300 060.01 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.04.21 - 2011.04.21 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE						
264.6							20 40 60 80 100							
0.0	ASPHALT: (160mm)													
0.2	SAND, trace gravel, trace silt Dense Brown Damp (FILL)		1	GS						○				1 96 3 (SI+CL)
263.4			1	SS	39					○				
1.2	Clayey SILT, with sand, trace gravel Very Stiff to Stiff Grey (FILL)		2	SS	16					○				0 29 46 24
			3	SS	14						○			
261.4														
3.2	Silty CLAY, trace sand, trace gravel Very Stiff Grey (TILL)		4	SS	26					○				
260.5														
4.1	Brown		5	SS	72					○				
259.1														
5.6			6	SS	51						⊢			0 2 60 38
			7	SS	30					○				
			8	SS	25					○				
254.9														
9.8	END OF BOREHOLE AT 9.8m.													

Continued Next Page

+ 3, × 3: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HML11-02

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 861 202.26 E 300 060.01 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.04.21 - 2011.04.21 CHECKED BY MEF

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
	Continued From Previous Page												
	BOREHOLE OPEN AND WATER LEVEL AT 1.8m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 7.3m, CUTTINGS TO 0.2m, CONCRETE TO 0.10m THEN ASPHALT TO SURFACE.												

RECORD OF BOREHOLE No HML11-03

1 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 861 817.24 E 299 952 62 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.04.21 - 2011.04.21 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
273.5								20	40	60	80	100		
0.0	ASPHALT: (200mm)													
0.2	SAND, fine grained, some silt, trace gravel Compact Brown Moist (FILL)		1	GS			273							
272.3			1	SS	22									6 82 12 (SI+CL)
1.2	Clayey SILT, some sand, trace gravel Hard Brown (TILL)		2	SS	42		272							
			3	SS	55		271							1 19 60 20
			4	SS	46		270							
							269							
	Becomes grey		5	SS	41		268							
268.0							267							0 13 54 33
5.5	Silty CLAY, some sand Hard Grey (TILL)		6	SS	50		266							
			7	SS	51		265							
			8	SS	38		264							
263.7														
9.8	END OF BOREHOLE AT 9.8m.													

Continued Next Page

+³ x³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HML11-03

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 861 817 24 E 299 952 62 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.04.21 - 2011.04.21 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
	Continued From Previous Page							20 40 60 80 100	20 40 60					
	BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 7.6m, CUTTINGS TO 0.3m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.													

RECORD OF BOREHOLE No HML11-04

1 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 862 809.96 E 299 783.58 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.04.29 - 2011.04.29 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
282.1							20	40	60	80	100		
0.0	ASPHALT: (275mm)												
281.9													
0.3	SAND, some silt, trace gravel Compact to Loose Brown Moist (FILL)		1	SS	27								
280.9			2	SS	9								8 81 11
1.2	Clayey SILT, trace gravel Stiff Brown Moist (FILL)		3	SS	14								(SI+CL)
280.7													
1.5	Silty CLAY, with sand, trace gravel Stiff to Very Stiff Brown Moist (TILL)		4	SS	10								
	Becomes grey		5	SS	11								
			6	SS	11								1 26 50 24
			7	SS	21								
			8	SS	21								1 28 47 25
			9	SS	24								
272.4													
9.8	END OF BOREHOLE AT 9.8m.												

ONTMT4S 9288 GPJ 8/15/11

Continued Next Page

+³ . X³ : Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HML11-04

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 862 809.96 E 299 783.58 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.04.29 - 2011.04.29 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL LIQUID MOISTURE CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W P	W	W L		
	Continued From Previous Page							20 40 60 80 100						
	BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 0.4m, CONCRETE TO 0.2m THEN ASPHALT TO SURFACE.							20 40 60 80 100						

RECORD OF BOREHOLE No HML11-05

1 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 863 499.72 E 299 666.03 ORIGINATED BY SLL
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.04.29 - 2011.04.29 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)				GR	SA	SI	CL
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE	W _P	W	W _L					
266.8							20	40	60	80	100								
0.0	ASPHALT: (260mm)																		
266.5																			
0.3	Silty SAND, some gravel Dense Brown Moist (FILL)		1	SS	34								○						
265.7			2	SS	14								○						
1.1	Clayey SILT, with sand, trace gravel Stiff to Very Stiff Brown Moist (FILL)												○						
			3	SS	14								○						
			4	SS	17								○						
			5	SS	10								○						
262.7																			
4.1	Clayey SILT, some sand, trace gravel Very Stiff to Stiff Brown Moist (TILL)																		
			6	SS	16								○						
			7	SS	15								○						
			8	SS	22								○						
			9	SS	55								○						
257.0																			
9.8	END OF BOREHOLE AT 9.8m.																		

Continued Next Page

+ ³, X ³: Numbers refer to
Sensitivity 20
15-0.5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HML11-05

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 863 499.72 E 299 666.03 ORIGINATED BY SLL
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.04.29 - 2011.04.29 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
	Continued From Previous Page																
	BOREHOLE OPEN AND DRY UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 0.5m, CONCRETE TO 0.1m THEN ASPHALT TO SURFACE.																

RECORD OF BOREHOLE No HML11-06

1 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 863 918.52 E 299 593.91 ORIGINATED BY MAT
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.05.04 - 2011.05.04 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											
								20 40 60 80 100							PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							w _p w w _L				
							WATER CONTENT (%)					20 40 60							
276.0							276												
0.0	ASPHALT: (150mm)																		
0.2	SAND, some gravel, trace silt and clay Very Dense to Compact Brown Damp to Moist (FILL)		1	SS	59														
			2	SS	19		275										18 72 10 (SI+CL)		
			3	SS	10														
274.0	Clayey SILT, with sand, trace gravel Very Stiff to Hard Brown Moist (TILL)		4	SS	41		274												
2.0			5	SS	28		273												
							272												
	Becomes grey		6	SS	42		271										1 22 60 17		
							270												
			7	SS	32														
							269												
			8	SS	32		268												
							267												
			9	SS	26														
266.2																			
9.8	END OF BOREHOLE AT 9.8m.																		

ONTMT4S 9266 GPJ 8/15/11

Continued Next Page

+³, X³: Numbers refer to
Sensitivity 20
15-0.5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HML11-06

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 863 918.52 E 299 593.91 ORIGINATED BY MAT
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.05.04 - 2011.05.04 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
	Continued From Previous Page BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 1.2m, CONCRETE MIX TO 0.1m, THEN ASPHALT TO SURFACE.													

METRIC

[illegible]

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No HML11-07

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 864 229.12 E 299 541.14 ORIGINATED BY MAT
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.05.04 - 2011.05.04 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
	Continued From Previous Page													
	BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 1.3m, CONCRETE MIX TO 0.1m, THEN ASPHALT TO SURFACE.													

RECORD OF BOREHOLE No HML11-08

1 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 864 820.03 E 299 439.93 ORIGINATED BY MAT
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.05.03 - 2011.05.03 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	
303.6	ASPHALT: (150mm)											
0.0												
0.2	SAND, some gravel Compact Brown Damp (FILL)		1	SS	27		303					
302.8												
0.8	Silty CLAY, some sand, trace gravel Stiff to Very Stiff Grey Moist (TILL)		2	SS	19		302					
			3	SS	12							1 12 51 36
			4	SS	25		301					
300.5												
3.0	Sandy SILT, trace clay Compact to Dense Brown Moist to Wet		5	SS	18		300					
			6	SS	32		299					0 21 76 3
							298					
297.5												
6.1	Silty CLAY, trace sand, trace gravel Hard Grey Moist (TILL)		7	SS	41		297					
			8	SS	32		296					
							295					
			9	SS	100/ 0.275							
294.0												
9.6	END OF BOREHOLE AT 9.6m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 1.2m											

Continued Next Page

+³, X³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HML11-08

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 864 820.03 E 299 439 93 ORIGINATED BY MAT
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.05.03 - 2011.05.03 CHECKED BY MEF

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
							20	40	60	80	100	W _p	W	W _L		
	Continued From Previous Page CONCRETE MIX TO 0.1m, THEN ASPHALT TO SURFACE.															

RECORD OF BOREHOLE No HML11-09

1 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 866 062.86 E 299 224.63 ORIGINATED BY SLL
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.04.29 - 2011.04.29 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
306.4								20 40 60 80 100		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	
0.0	ASPHALT: (300mm)									w _P	w	w _L	
0.2	SAND, trace gravel, trace silt Compact Brown Moist to Wet (FILL)		1	SS	25		306						
305.3			2	SS	11								
1.2	Clayey SILT, with sand, some roots and rootlets, topsoil stained Firm Dark Brown Moist (FILL)		3	SS	6		305						
304.2													0 27 48 25
2.3	Silty CLAY, with sand, trace gravel Stiff Brown Moist to Wet (TILL)		4	SS	14		304						
302.5			5	SS	8		303						
4.0	Sandy SILT, trace gravel, trace clay Dense Brown to Grey Moist		6	SS	32		302						0 21 70 9
300.8							301						
5.6	Silty CLAY, with sand Stiff to Hard Grey Moist (TILL)		7	SS	14		300						
			8	SS	45		299						0 22 48 30
			9	SS	52		298						
296.7							297						
9.8	END OF BOREHOLE AT 9.8m.												

Continued Next Page

+³ . X³ : Numbers refer to
Sensitivity 20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HML11-09

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 866 062.86 E 299 224.63 ORIGINATED BY SLL
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.04.29 - 2011.04.29 CHECKED BY MEF



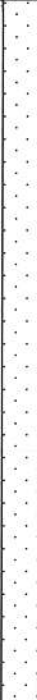
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
	Continued From Previous Page													
	BOREHOLE OPEN TO 1.4m AND WATER LEVEL AT 1.4m UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINS AND BENTONITE HOLEPLUG TO 0.4m, CONCRETE MIX TO 0.1m, THEN ASPHALT TO SURFACE.													

RECORD OF BOREHOLE No HMLK-1

1 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 864 360.61 E 299 603.50 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.04.19 - 2011.04.19 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		WATER CONTENT (%)						
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	20 40 60 80 100	w _p w w _L						
287.5								20 40 60 80 100		20 40 60				GR SA SI CL		
0.0	SAND, some gravel Brown Damp (FILL) Clayey SILT, with sand, trace gravel Very Stiff Dark Brown to Brown (FILL)		1	SS	17											
0.2																
			2	SS	67									2 24 56 19		
285.8																
1.7	SAND, fine grained, trace silt and clay, trace gravel Compact to Very Dense Brown Damp		3	SS	33									1 93 7 (SI+CL)		
					4	SS	28									
					5	SS	29									
			6	SS	52											
			7	SS	54									0 90 10 (SI+CL)		
			8	SS	69											

Continued Next Page

+³ . X³ : Numbers refer to
Sensitivity 15 5 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HMLK-1

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 864 360.61 E 299 603.50 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.04.19 - 2011.04.19 CHECKED BY MEF

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
							20	40	60	80	100	W _p	W	W _L		
	Continued From Previous Page															
	END OF BOREHOLE AT 9.4m. 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) Jun. 26, 11 9.1 278.4															

RECORD OF BOREHOLE No HMLK-2

1 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 864 504.40 E 299 341.16 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.04.19 - 2011.04.19 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	
293.0							293	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	WATER CONTENT (%) 20 40 60			GR SA SI CL
0.0	Clayey SILT, with sand, some gravel Stiff to Hard Brown (FILL)		1	SS	13		293		○			
			2	SS	52		292		○			10 24 49 17
			3	SS	29		291		○			
290.8							291					
2.1	Silty CLAY, some sand, trace gravel Very Stiff to Hard Brown Damp (TILL)		4	SS	24		290		○	1		0 12 52 37
			5	SS	32		289		○			
							289					
			6	SS	29		288		○			
							288					
							287		○			
	Becomes grey		7	SS	72		286					
							286					
			8	SS	60		285		○	1		1 16 52 31
							285					
							284		○			
283.5			9	SS	58							
283.4	SAND, fine grained Very Dense Brown											
9.6												

Continued Next Page

+ ³ × ³ : Numbers refer to
Sensitivity 20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HMLK-2

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 864 504.40 E 299 341.16 ORIGINATED BY ES
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.04.19 - 2011.04.19 CHECKED BY MEF

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
	Continued From Previous Page															
	<p>Moist</p> <p>END OF BOREHOLE AT 9.6m. BOREHOLE OPEN AND WATER LEVEL AT 5.0m UPON COMPLETION OF DRILLING. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.</p> <p>WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Jun. 26, 11 6.5 286.5</p>															

RECORD OF BOREHOLE No HMLK-3

1 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 864 698.41 E 299 501.25 ORIGINATED BY LRB
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.05.05 - 2011.05.05 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
298.5								20 40 60 80 100		20 40 60				
0.0	TOPSOIL, with sand: (100mm)		1	SS	11		298							
0.1	Clayey SILT, some sand, trace gravel, some rootlets Stiff Brown to Dark Grey (FILL)		2	SS	10									
296.7			3	SS	14		297							
1.8	Silty CLAY, some sand, trace gravel Very Stiff Brown (TILL)		4	SS	25		296							0 17 53 30
			5	SS	15		295							
293.9			6	SS	23		294							1 16 72 11
4.6	Sandy SILT, trace clay, trace gravel Compact Brown Moist to Wet (TILL) Becomes grey		7	SS	18		292							
			8	SS	25		291							
			9	SS	70		289							0 16 60 24
289.0														
9.5	Silty CLAY, some sand, trace gravel													
288.8	Hard													
9.7	Grey													

ONTMT4S 9288.GPJ 8/15/11

Continued Next Page

+³, ×³: Numbers refer to Sensitivity
 20
 15
 10
 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HMLK-3

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 864 698.41 E 299 501.25 ORIGINATED BY LRB
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.05.05 - 2011.05.05 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
	Continued From Previous Page							20 40 60 80 100	20 40 60					
	Moist (TILL)													
	END OF BOREHOLE AT 9.7m. Well installation consists of 50mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Jun. 26, 11 2.7 295.8													

METRIC

[illegible]

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HMLK-4

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 864 596.44 E 299 670.66 ORIGINATED BY ES
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.04.18 - 2011.04.18 CHECKED BY MEF

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
	Continued From Previous Page												
	<p>LEVEL AT 1.4m UPON COMPLETION. Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.</p> <p>WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Jun. 26, 11 0.6 292.1</p>												

RECORD OF BOREHOLE No 11-20

1 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 865 160.65 E 299 383.24 ORIGINATED BY MAT
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.05.03 - 2011.05.03 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)		
								20 40 60 80 100							20 40 60		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE							w _p w w _L		
309.4																	
0.0	ASPHALT: (150mm)																
0.2	SAND, some gravel Compact (FILL)		1	SS	22		309										
308.6																	
0.8	Clayey SILT, trace sand, trace gravel Stiff Grey Moist (FILL)		2	SS	11		308										
			3	SS	12												
307.2																	
2.2	Silty CLAY, some sand, trace gravel Very Stiff to Hard Brown Moist (TILL)		4	SS	16		307										
			5	SS	22		306							0 16 50 35			
			6	SS	27		305										
							304										
			7	SS	36		303										
301.8							302										
7.6	Sandy SILT, trace clay Dense Brown Moist		8	SS	37		301							0 28 66 6			
300.2																	
9.1	Silty CLAY, some sand Hard Grey Moist (TILL)		9	SS	38		300										
299.6																	
9.8																	

Continued Next Page

+³, X³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-20

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 865 160.65 E 299 383.24 ORIGINATED BY MAT
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.05.03 - 2011.05.03 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W _p	W	W _L			
	Continued From Previous Page																
	END OF BOREHOLE AT 9.8m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 1.0m, CONCRETE MIX TO 0.1m, THEN ASPHALT TO SURFACE.																

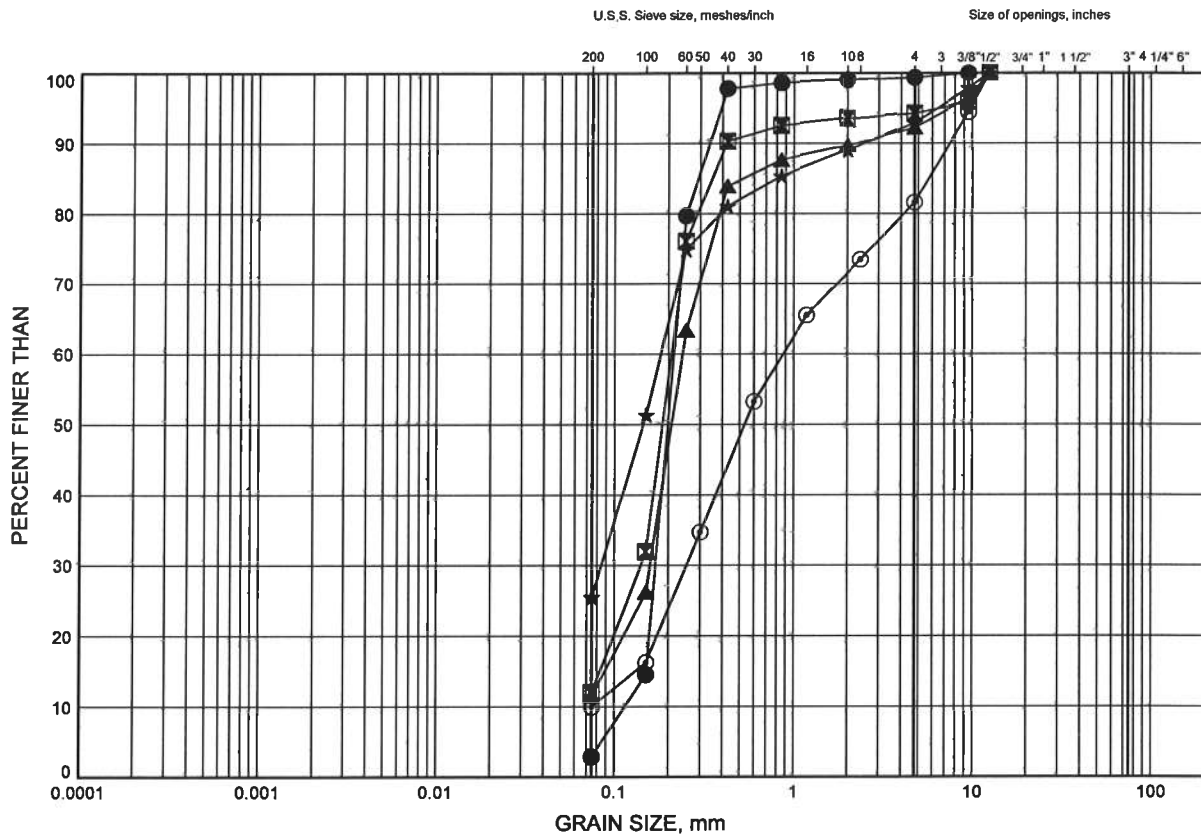
Appendix B

Geotechnical Laboratory Test Results (Present Investigation)



GRAIN SIZE DISTRIBUTION

Sand FILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

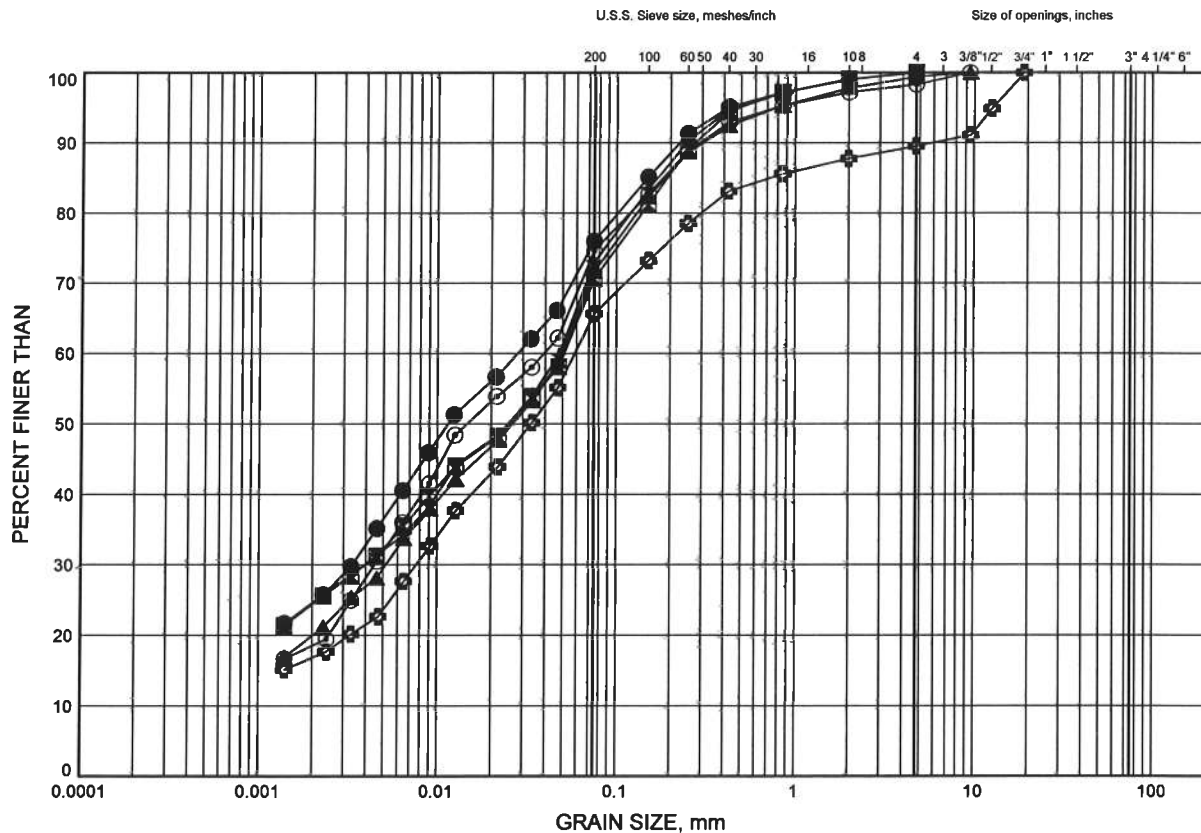
LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HML11-02	0.38	264.25
■	HML11-03	1.07	272.43
▲	HML11-04	0.99	281.15
★	HML11-05	0.91	265.87
⊙	HML11-06	1.07	274.90

Widening of Hwy 400, Major Mackenzie to King Road
GRAIN SIZE DISTRIBUTION

FIGURE B2

Clayey Silt FILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND			GRAVEL		SIZE

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HML11-01	1.83	258.38
⊠	HML11-02	1.83	262.80
▲	HML11-05	3.35	263.43
★	HML11-09	1.83	304.60
⊙	HMLK-1	0.99	286.47
⊗	HMLK-2	1.07	291.90

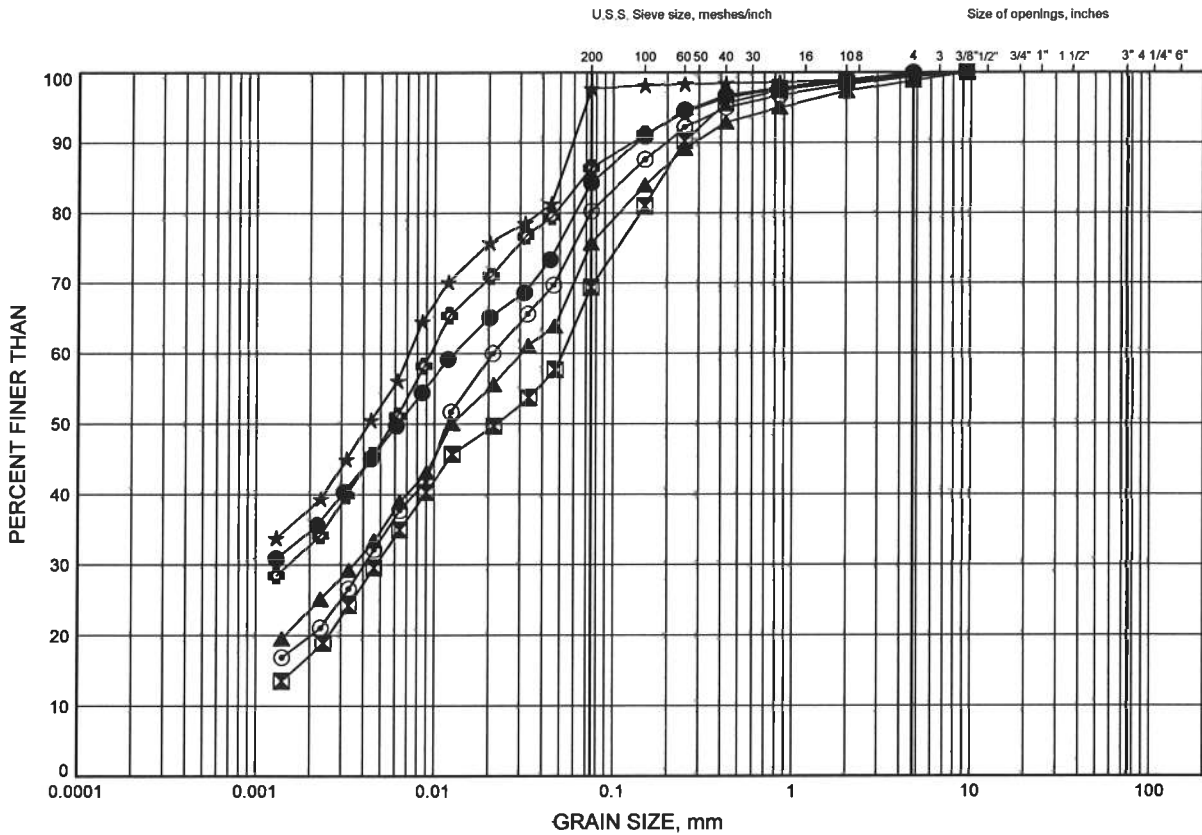


W.P.# 2539-04-00
Prepared By MFA
Checked By SKP

Widening of Hwy 400, Major Mackenzie to King Road
GRAIN SIZE DISTRIBUTION

FIGURE B3

Clayey Silt to Silty Clay TILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	11-20	3.35	306.03
■	HML11-01	3.28	256.93
▲	HML11-01	7.85	252.36
★	HML11-02	6.40	258.23
⊙	HML11-03	2.59	270.91
⊕	HML11-03	6.40	267.10

GRAIN SIZE DISTRIBUTION - THURBER 9288.GPJ 8/15/11

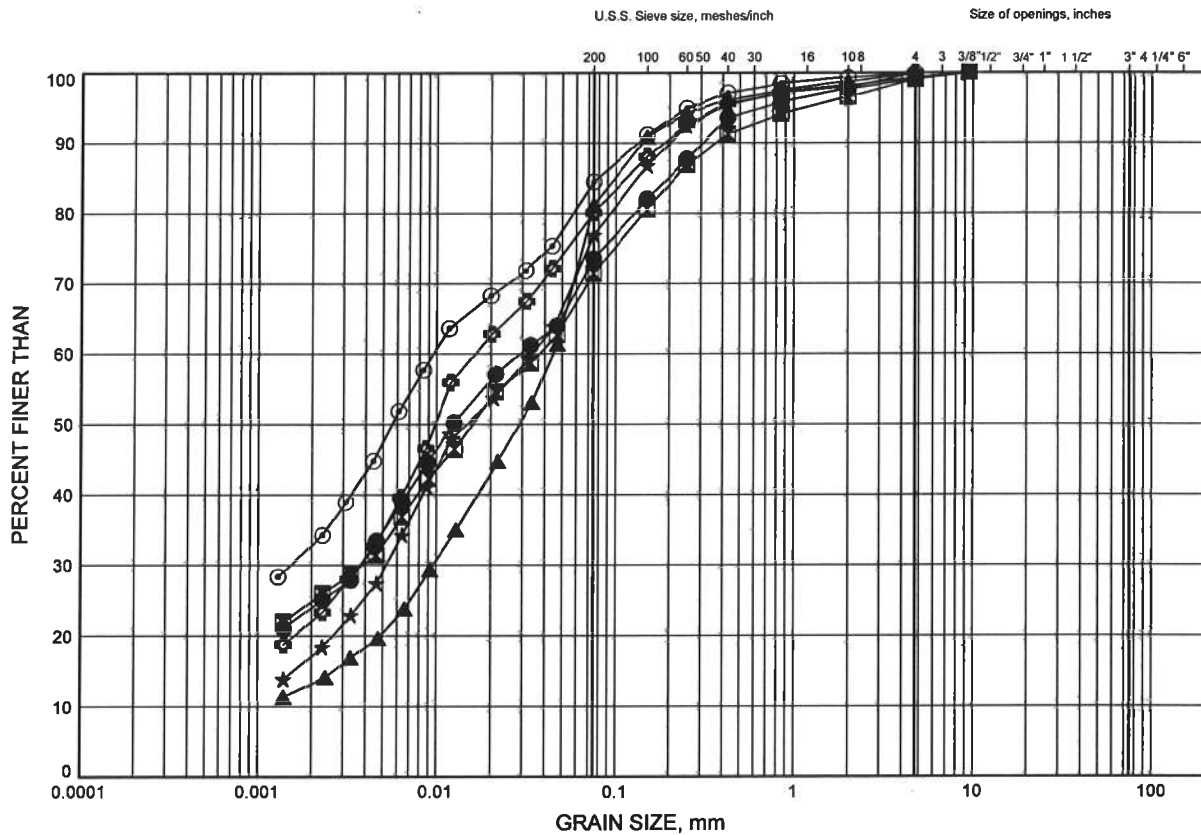
W.P.# 2539-04-00
Prepared By MFA
Checked By SKP



Widening of Hwy 400, Major Mackenzie to King Road
GRAIN SIZE DISTRIBUTION

FIGURE B4

Clayey Silt to Silty Clay TILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HML11-04	4.88	277.27
■	HML11-04	7.92	274.22
▲	HML11-05	9.45	257.34
★	HML11-06	4.88	271.09
⊙	HML11-07	1.83	283.76
⊕	HML11-07	7.92	277.67

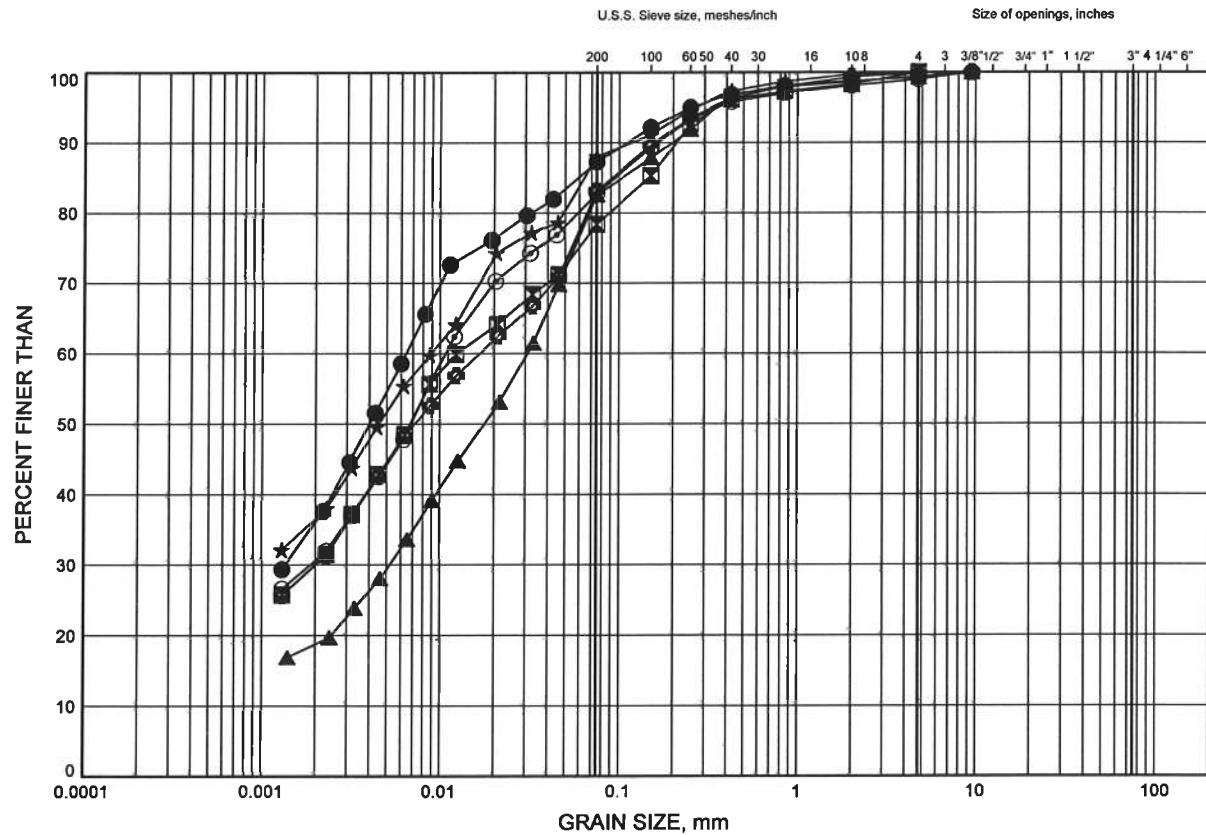
GRAIN SIZE DISTRIBUTION - THURBER 9288.GPJ 8/15/11

W.P.# 2539-04-00
Prepared By MFA
Checked By SKP



GRAIN SIZE DISTRIBUTION

Clayey Silt to Silty Clay TILL



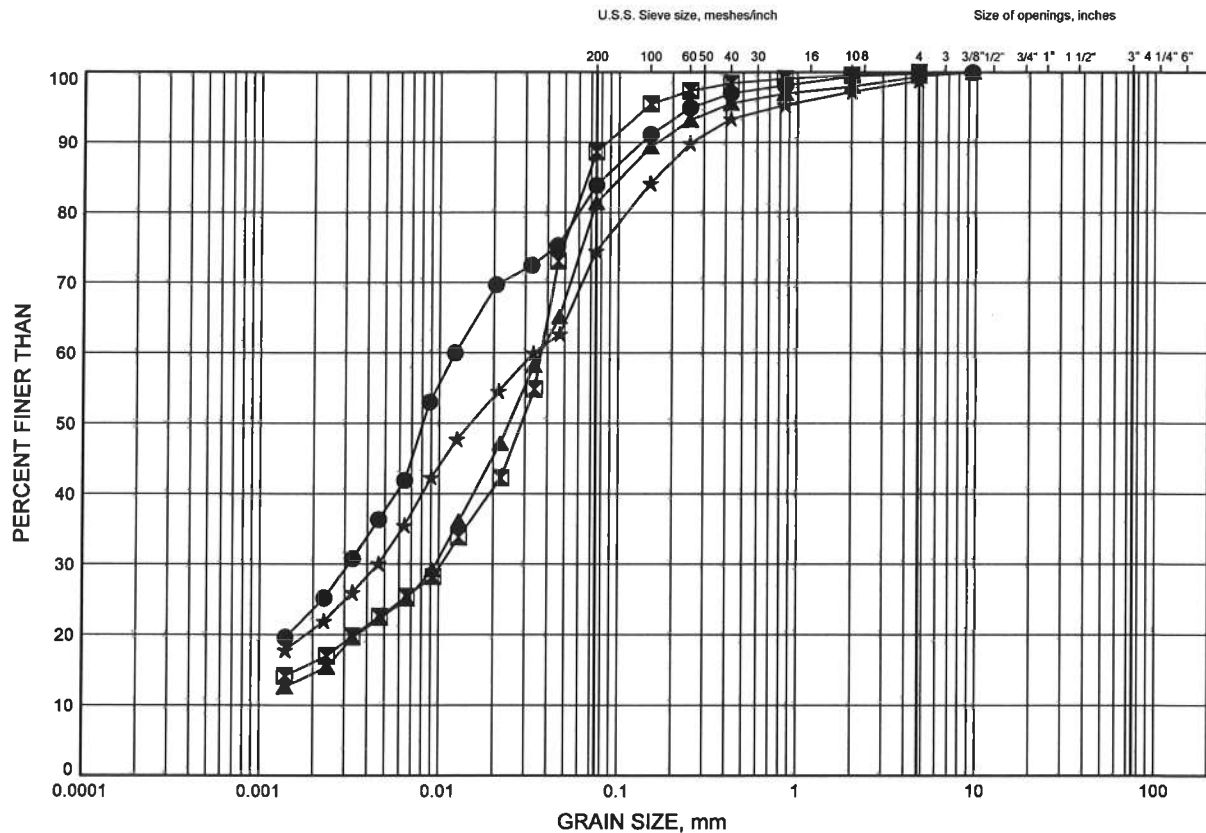
SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HML11-08	1.83	301.76
⊠	HML11-09	7.92	298.50
▲	HMLK-1	9.30	278.16
★	HMLK-2	2.59	290.37
⊙	HMLK-2	7.85	285.12
⊕	HMLK-3	2.59	295.87

GRAIN SIZE DISTRIBUTION

Clayey Silt to Silty Clay TILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HMLK-3	9.60	288.86
■	HMLK-4	2.59	290.13
▲	HMLK-4	4.80	287.92
★	HMLK-4	9.37	283.35

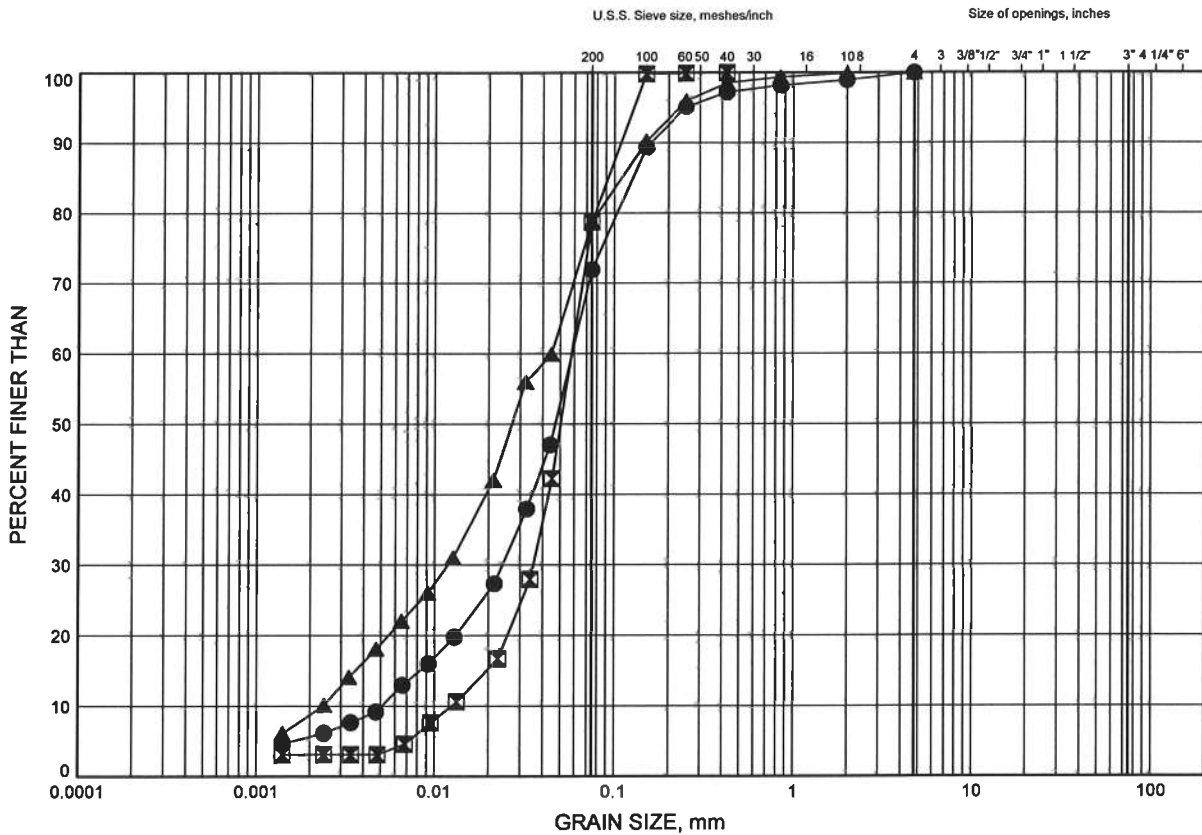


W.P.# 2539-04-00
 Prepared By MFA
 Checked By SKP

Widening of Hwy 400, Major Mackenzie to King Road
GRAIN SIZE DISTRIBUTION

FIGURE B7

Sandy Silt



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

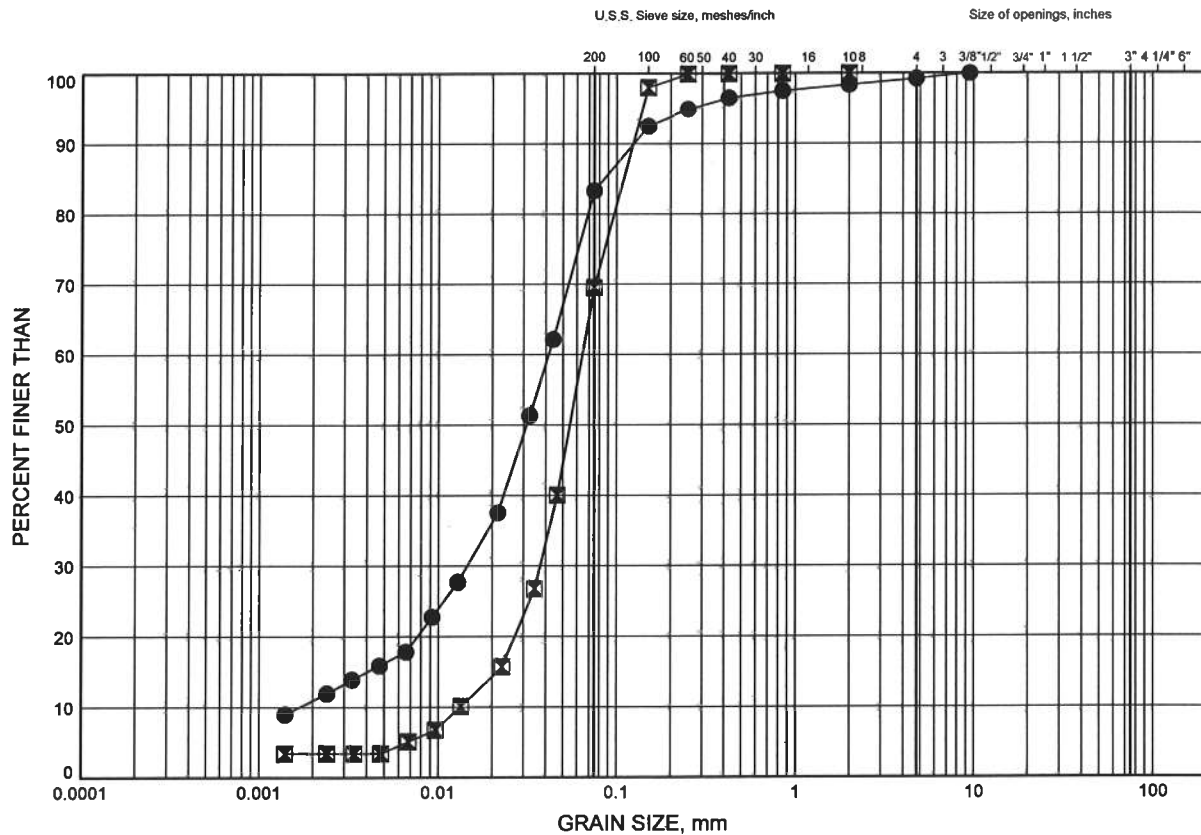
LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	11-20	7.92	301.46
⊠	HML11-08	4.88	298.71
▲	HML11-09	4.88	301.55

Widening of Hwy 400, Major Mackenzie to King Road
GRAIN SIZE DISTRIBUTION

FIGURE B8

Sandy Silt TILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND			GRAVEL		SIZE

LEGEND

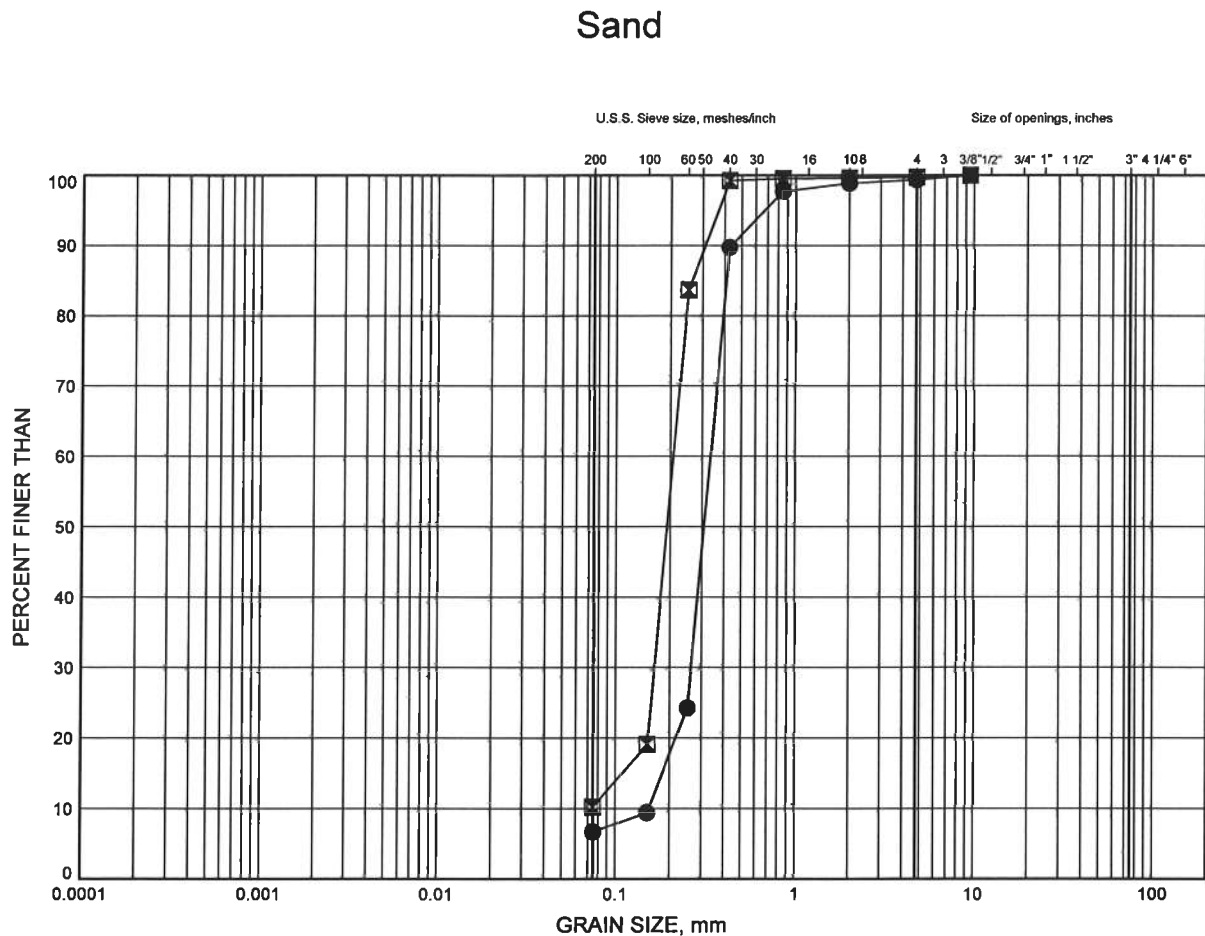
SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HMLK-3	4.88	293.59
■	HMLK-4	7.92	284.80



W.P.# 2539-04-00.....
Prepared By MFA.....
Checked By SKP.....

Widening of Hwy 400, Major Mackenzie to King Road
GRAIN SIZE DISTRIBUTION

FIGURE B9



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HMLK-1	1.83	285.63
⊠	HMLK-1	6.40	281.06

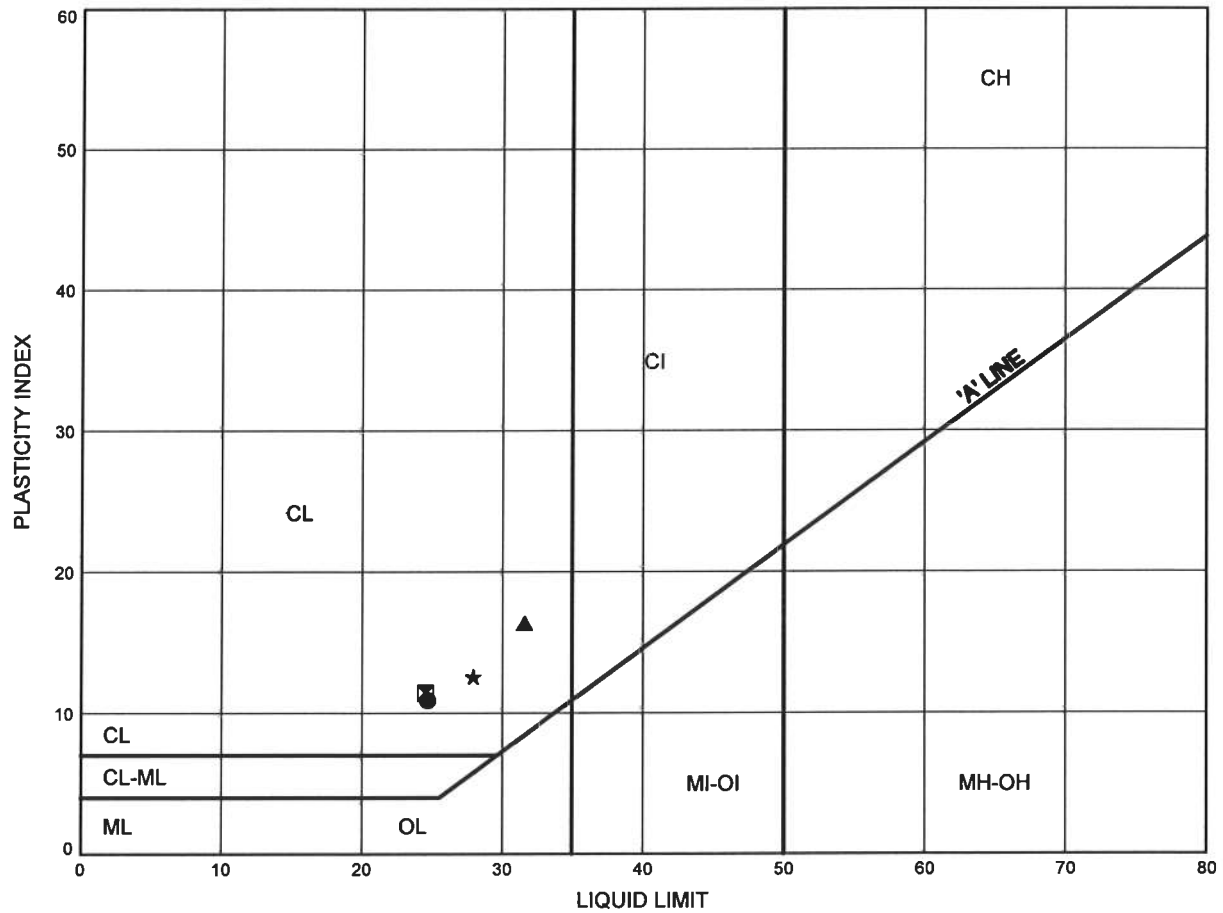


W.P.# .2539-04-00.....
Prepared By .MFA.....
Checked By .SKP.....

Widening of Hwy 400, Major Mackenzie to King Road
ATTERBERG LIMITS TEST RESULTS

FIGURE B10

Clayey Silt FILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	HML11-01	1.83	258.38
⊠	HML11-05	3.35	263.43
▲	HML11-09	1.83	304.60
★	HMLK-1	0.99	286.47

Date August 2011
 Project 2539-04-00

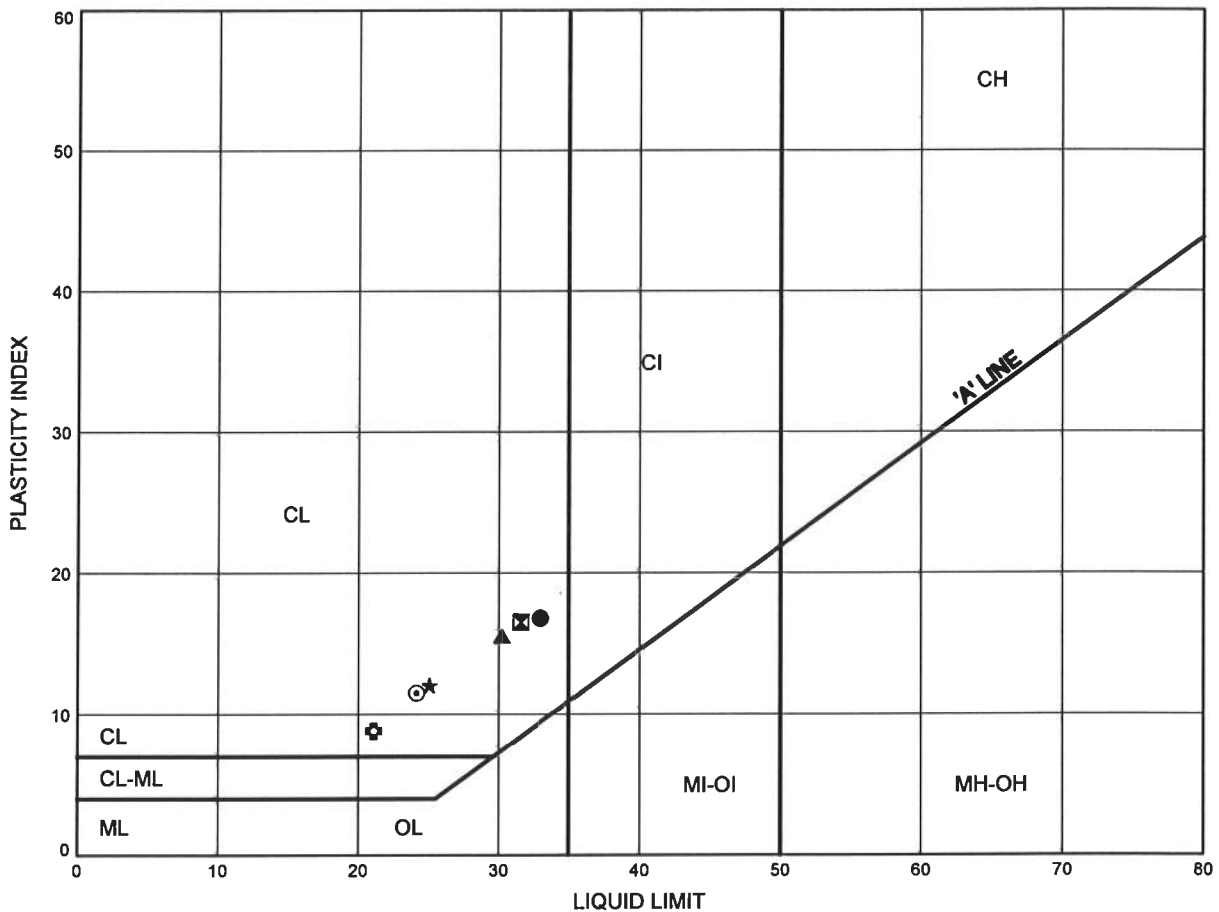


Prep'd MFA
 Chkd. SKP

Widening of Hwy 400, Major Mackenzie to King Road
ATTERBERG LIMITS TEST RESULTS

FIGURE B11

Clayey Silt to Silty Clay TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	11-20	3.35	306.03
⊠	HML11-02	6.40	258.23
▲	HML11-03	6.40	267.10
★	HML11-04	4.88	277.27
⊙	HML11-04	7.92	274.22
⊕	HML11-06	4.88	271.09

Date August 2011
 Project 2539-04-00

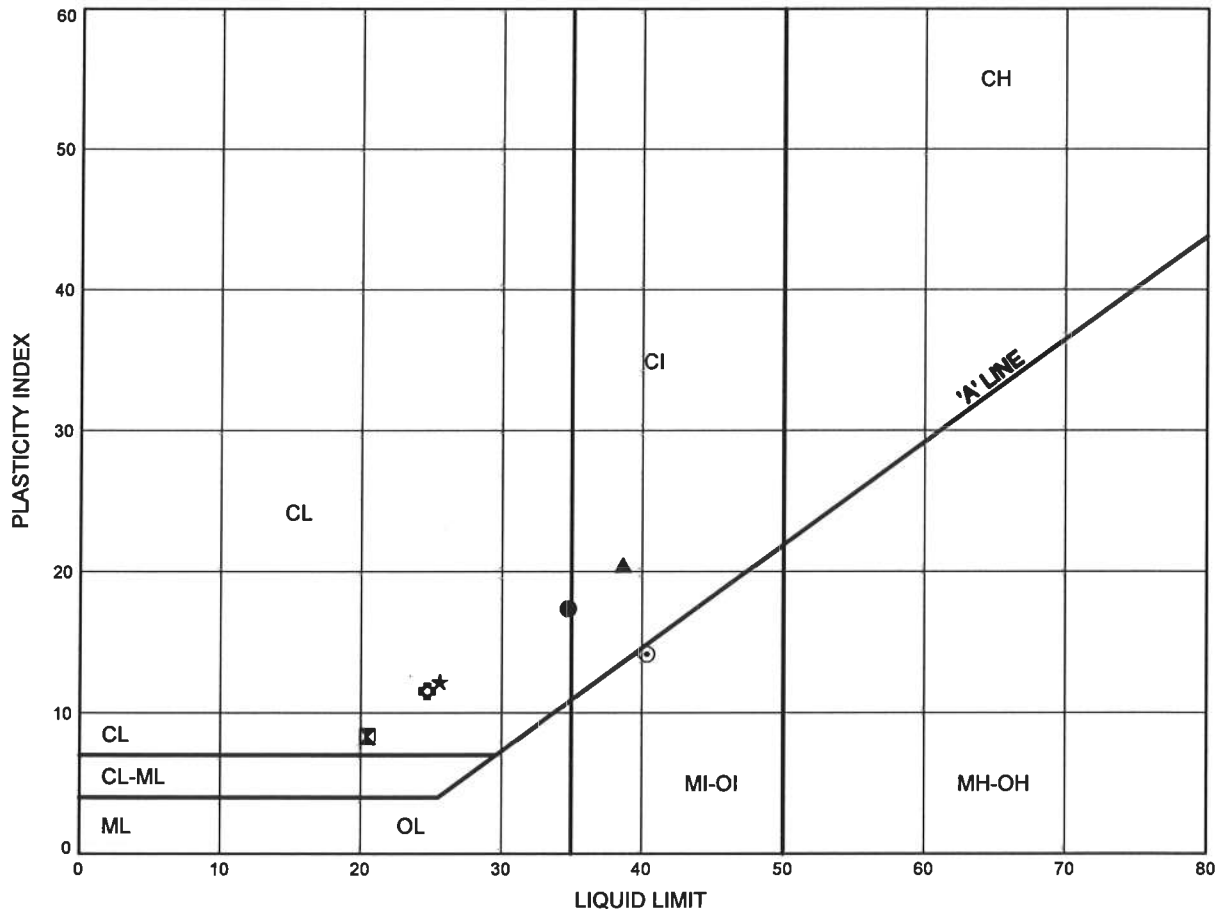


Prep'd MFA
 Chkd. SKP

Widening of Hwy 400, Major Mackenzie to King Road
ATTERBERG LIMITS TEST RESULTS

FIGURE B12

Clayey Silt to Silty Clay TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	HML11-07	1.83	283.76
⊠	HML11-07	7.92	277.67
▲	HML11-08	1.83	301.76
★	HML11-09	7.92	298.50
⊙	HMLK-2	2.59	290.37
⊕	HMLK-2	7.85	285.12

Date August 2011
 Project 2539-04-00

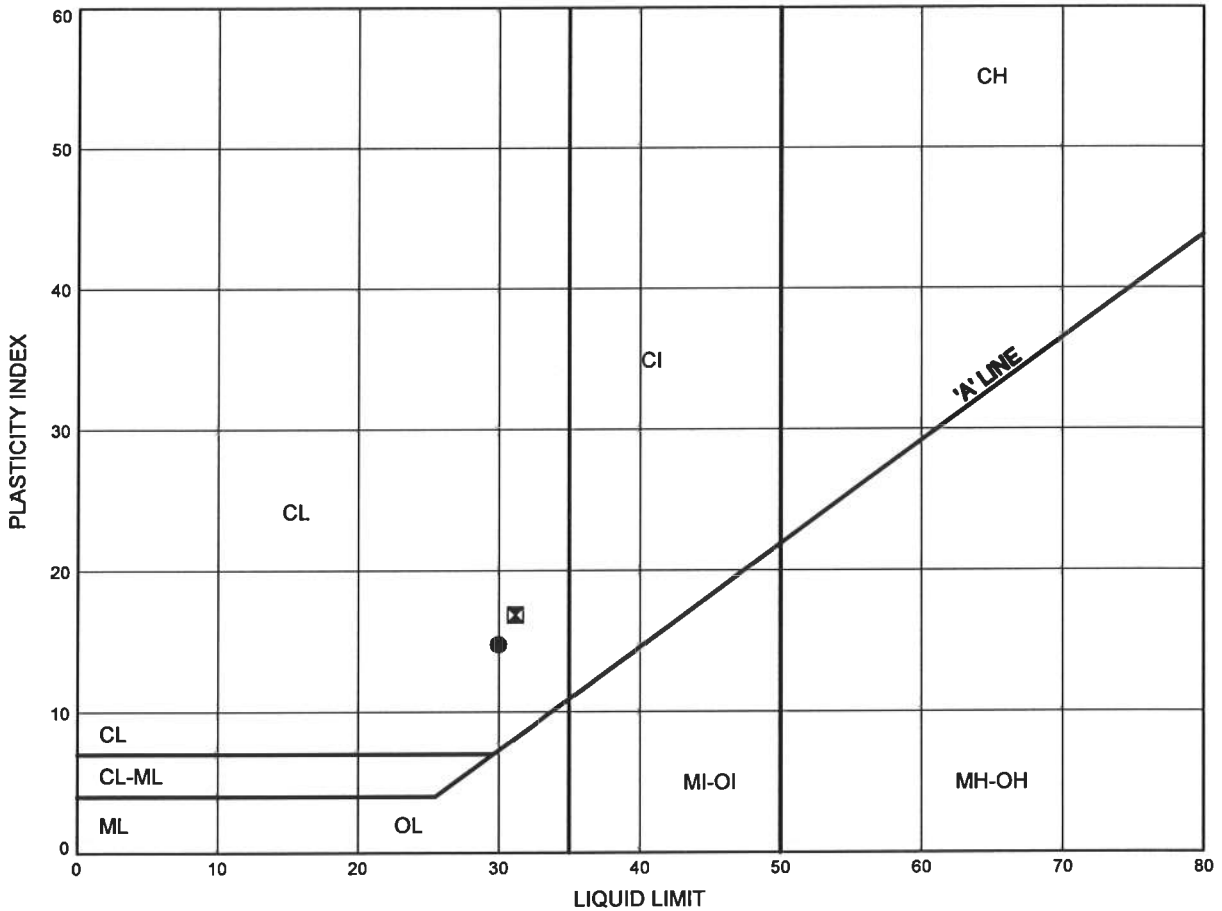


Prep'd MFA
 Chkd. SKP

Widening of Hwy 400, Major Mackenzie to King Road
ATTERBERG LIMITS TEST RESULTS

FIGURE B13

Clayey Silt to Silty Clay TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	HMLK-3	2.59	295.87
⊠	HMLK-4	2.59	290.13

Appendix C

Record of Boreholes (Previous Investigations)



METRIC

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES			
250.0							SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 20 40 60 80 100	WATER CONTENT (%) 20 40 60		

	Description	No.	Type	Depth (ft)	Elevation (ft)	S&W	N	T	Rdwy	Crossing	Mileage	Notes
0.0 249.8	Silty SAND, trace gravel, trace clay, occasional organic pockets Compact Brown	1	SS	17	249.8							
0.2	Clayey, Sandy SILT, trace gravel, occasional iron oxide staining Hard Brown (TILL) (CL-ML) becoming Grey	2	SS	51	249							
		3	SS	72/ .254	248							
		4	SS	52	247							
244.5					246							
5.5	SAND, some to trace silt, trace gravel Very Dense Grey Wet (SP)	5	SS	50/ .152	245							
					244							
242.4					243							
7.6	Sandy SILT, some clay to clayey, trace gravel, occasional cobbles Very Dense Grey (TILL)(ML-NONPLASTIC)	6	SS	54	242							
		7	SS	76	241							
					240							

+ 3, X 3: Numbers refer to Sensitivity

RECORD OF BOREHOLE No HM-2

2 OF 2

METRIC

G.W.P. _____ LOCATION Hwy 400 / Teslon Road, N 4 859 416, E 300 343 ORIGINATED BY TK
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY SL/SS
 DATUM Geodetic DATE 2004.07.19 - 2004.07.19 CHECKED BY SMS

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa	W P	W	W L		
250.0							20 40 60 80 100						
239.3													
10.7	SAND, trace silt		8	SS	92								
238.9	Very Dense												
	Grey												
11.1	Wet (SP)												
	END OF BOREHOLE AT 11.1 m. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 2004.08.05 10.7 239.3												

RECORD OF BOREHOLE No 11-09

1 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 859 400.07 E 300 368.34 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.26 - 2011.01.26 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)			
								○ UNCONFINED	+	FIELD VANE									
								● QUICK TRIAXIAL	×	LAB VANE									
249.4							20	40	60	80	100	20	40	60		GR SA SI CL			
0.0 249.1	ASPHALT: (250mm)																		
0.3 248.8	SAND, some gravel Brown Moist (FILL)		1	GS															
0.6																			
248.2	SAND, fine grained Compact Brown Moist (FILL)		1	SS	11														
1.2																			
	Silty CLAY, with sand, trace gravel Very Stiff to Hard Brown Moist (TILL)		2	SS	28														
			3	SS	19											0 23 55 22			
			4	SS	28														
			5	SS	34														
243.3																			
6.1 242.8	SILT and SAND, trace gravel Very Dense Grey Moist		6	SS	50/ .150														
6.6	Becomes grey																		
																</			

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-09

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 859 400.07 E 300 368.34 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.26 - 2011.01.26 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
	Continued From Previous Page													
238.1			9	SS	58		239							
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 9.7m, CUTTINGS TO 0.9m, BENTONITE HOLEPLUG TO 0.4m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.													

+³, X³: Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

METRIC

W.P.	2539-04-00	LOCATION	N 4 859 723.19 E 300 313.04	ORIGINATED BY	ES
HWY	400	BOREHOLE TYPE	Solid Stem Augers	COMPILED BY	AN
DATUM	Geodetic	DATE	2011.01.27 - 2011.01.27	CHECKED BY	MEF

[illegible]

Continued Next Page

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No 11-10

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 859 723.19 E 300 313.04 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.27 - 2011.01.27 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
							20 40 60 80 100	20 40 60 80 100	20 40 60					
240.9 10.1	Continued From Previous Page Clayey SILT, with sand, trace gravel Hard Grey (TILL)		9	SS	41									0 32 50 18
239.7 11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 9.7m, CUTTINGS TO 0.9m, BENTONITE HOLEPLUG TO 0.4m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.													

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

METRIC

W.P.	2539-04-00	LOCATION	N 4 859 889.89 E 300 284.52	ORIGINATED BY	ES
HWY	400	BOREHOLE TYPE	Solid Stem Augers	COMPILED BY	AN
DATUM	Geodetic	DATE	2011.01.27 - 2011.01.27	CHECKED BY	MEF

[illegible]

+³, X³: Numbers refer to Sensitivity


ONTMT4S 9268.GPJ 8/15/11

RECORD OF BOREHOLE No 11-11

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 859 889.89 E 300 284.52 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.27 - 2011.01.27 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE												
	Continued From Previous Page						20 40 60 80 100													
	Clayey SILT, with sand, trace gravel Hard Grey Moist (TILL)		9	SS	61		242													
240.7							241													
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 10.0m, CUTTINGS TO 0.9m, BENTONITE HOLEPLUG TO 0.4m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.																			

+ 3, X 3: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-12

1 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 860 215.15 E 300 224.23 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.27 - 2011.01.27 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
								○ UNCONFINED + FIELD VANE					w _p w w _L																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
								● QUICK TRIAXIAL x LAB VANE					NATURAL MOISTURE CONTENT																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
255.2							20	40	60	80	100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					</

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-12

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 860 215.15 E 300 224.23 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.27 - 2011.01.27 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
	Continued From Previous Page							20 40 60 80 100									
	Silty CLAY , with sand, trace gravel Very Stiff Grey (TILL)		9	SS	26		245										
243.9																	
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND WATER LEVEL AT 7.9m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 10.0m, CUTTINGS TO 0.9m, BENTONITE HOLEPLUG TO 0.4m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.						244										

METRIC

[illegible]

METRIC

[illegible]

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No 11-14

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 861 542.28 E 299 997.49 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.31 - 2011.03.31 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
	Continued From Previous Page						20	40	60	80	100									
	Silty CLAY , with sand, trace gravel Hard Grey Moist (TILL)		9	SS	49															
260.3																				
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND WATER LEVEL AT 8.8m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 9.9m, CUTTINGS TO 0.4m, BENTONITE HOLEPLUG TO 0.1m, THEN ASPHALT TO SURFACE.																			

+³, X³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-15

1 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 862 050.93 E 299 915.20 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.28 - 2011.01.28 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa			WATER CONTENT (%)				
								20 40 60 80 100							
								○ UNCONFINED + FIELD VANE							
								● QUICK TRIAXIAL × LAB VANE							
								20 40 60 80 100							
									W _p — W — W _L						
274.2							274								
0.0															
274.0	ASPHALT: (250mm)														
0.3	SAND, some gravel		1	GS											
273.6	Brown														
0.6	Moist														
	(FILL)														
	SAND, some silt, trace gravel		1	SS	18									2 84 14	
	Compact													(SI+CL)	
272.9	Brown						273								
1.3	Moist														
	(FILL)														
	Clayey SILT, some sand, trace gravel		2	SS	11										
	Stiff to Firm														
	Brown						272								
	Moist														
	(FILL)														
	Becomes grey		3	SS	5										
			4	SS	4		271								
270.2															
4.0	Silty CLAY, some sand, trace gravel						270								
	Hard to Very Stiff														
	Brown														
	Moist														
	(TILL)		5	SS	33		269								
	Occasional sand seams						268							4 15 44 36	
	Becomes grey		6	SS	53										
							267								
			7	SS	25		266								
							265								
			8	SS	18										

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15-5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-15

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 862 050.93 E 299 915.20 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.28 - 2011.01.28 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
	Continued From Previous Page							20 40 60 80 100						
262.9	Silty CLAY , some sand, trace gravel Very Stiff Grey Moist (TILL)		9	SS	26		264						○	
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND WATER LEVEL AT 3.6m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 9.7m, CUTTINGS TO 0.8m, BENTONITE HOLEPLUG TO 0.4m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.						263							

RECORD OF BOREHOLE No 11-16

1 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 862 124 26 E 299 902.47 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.28 - 2011.01.28 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	
274.5	ASPHALT: (280mm)											
0.0												
274.2												
0.3	SAND, some gravel		1	GS			274					
273.9	Brown											
0.7	Moist (FILL)											
273.3	SAND, trace gravel		1	SS	26		273					
1.2	Compact											
	Brown											
	Moist (FILL)											
	Silty CLAY, with sand, trace gravel		2	SS	16							
	Very Stiff to Firm											
	Brown (FILL)											
	Becomes grey		3	SS	14		272					0 22 52 26
	Occasional roots and rootlets		4	SS	7		271					
270.3												
4.3	Clayey SILT, with sand, trace gravel, occasional clay seams						270					
	Stiff to Hard											
	Brown		5	SS	14							
	Moist (TILL)											
							269					
	Occasional oxide staining		6	SS	39		268					
							267					
	Becomes grey		7	SS	47							
							266					
265.4												
9.1	Silty CLAY, trace sand, trace gravel						265					0 4 36 60
	Very Stiff		8	SS	18							
	Grey											
	Moist (TILL)											

Continued Next Page

+³, x³: Numbers refer to Sensitivity 20 15 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-16

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 862 124.26 E 299 902.47 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.28 - 2011.01.28 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							PLASTIC LIMIT w _p NATURAL MOISTURE CONTENT w LIQUID LIMIT w _L WATER CONTENT (%)					
	Continued From Previous Page							20	40	60	80	100								
263.3	Silty CLAY , trace sand, trace gravel Very Stiff Grey Moist (TILL)		9	SS	21		264													
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND WATER LEVEL AT 3.6m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 10.0m, CUTTINGS TO 0.9m, BENTONITE HOLEPLUG TO 0.4m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.																			

METRIC

[illegible]

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-17

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 862 616.74 E 299 818.61 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.31 - 2011.01.31 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L		
	Continued From Previous Page																
269.1	Silty CLAY, with sand, trace gravel Hard Grey Moist (TILL)		9	SS	39												
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND WATER LEVEL AT 5.1m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 9.7m, CUTTINGS TO 0.9m, BENTONITE HOLEPLUG TO 0.4m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.																

RECORD OF BOREHOLE No 11-18

1 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 863 126 14 E 299 731.09 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.31 - 2011.01.31 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
277.1	ASPHALT: (250mm)						277					
0.0 276.9												
0.3	SAND, some gravel		1	GS								
276.5	Brown											
0.6	Moist (FILL)											
	SAND, trace gravel		1	SS	38							
275.8	Dense						276					
1.3	Brown											
	Moist (FILL)											
	Silty CLAY, some sand, trace gravel		2	SS	19							
	Stiff to Very Stiff											
	Brown						275					
	Moist (TILL)											
			3	SS	11							0 16 46 37
	Occasional oxide staining		4	SS	26		274					
							273					
			5	SS	19		272					
							271					0 78 20 2
271.0	SAND, fine grained, some silt, trace		6	SS	21							
6.1	clay, occasional oxide staining											
270.6	Compact											
6.6	Brown						270					
	Moist											
							269					
			7	SS	23							
							268					0 27 53 21
			8	SS	43							

Continued Next Page

+³ ×³: Numbers refer to
Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-18

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 863 126.14 E 299 731.09 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.31 - 2011.01.31 CHECKED BY MEF

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
						20	40	60	80	100	W _p	W	W _L			
	Continued From Previous Page															
266.2	Silty CLAY, with sand, trace gravel Hard Grey Moist (TILL)		9	SS	55/											
11.0	END OF BOREHOLE AT 11.0m. BOREHOLE OPEN AND WATER LEVEL AT 4.5m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 9.7m, CUTTINGS TO 0.3m, HOLEPLUG TO 0.1m, THEN ASPHALT TO SURFACE.				150											

METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES												
								SHEAR STRENGTH kPa							WATER CONTENT (%)		
							○ UNCONFINED	+	FIELD VANE								
							● QUICK TRIAXIAL	×	LAB VANE								
							20	40	60	80	100	20	40	60			

[illegible]

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No 11-19

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 863 618.00 E 299 647.47 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.02.03 - 2011.02.03 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT							UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											
	Continued From Previous Page							20 40 60 80 100											
257.3																			
10.3	SAND, trace silt, trace gravel Dense Brown Moist		9	SS	35		257											0 89 11 (SI+CL)	
256.3																			
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 9.7m, CUTTINGS TO 0.9m, BENTONITE HOLEPLUG TO 0.4m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.																		

+³, x³: Numbers refer to Sensitivity 20 15 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-21

1 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 865 500.32 E 299 331.61 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.02.01 - 2011.02.01 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	
306.1												
0.0	ASPHALT: (200mm)											
0.2	SAND, some gravel Very Dense Brown Moist (FILL)		1	GS			306					
			1	SS	75							
304.8							305					
1.3	Clayey SILT, some sand, trace gravel Stiff Brown to Dark Grey (FILL)		2	SS	9							
303.9							304					
2.3	Silty CLAY, some sand, trace gravel Stiff to Very Stiff Brown Moist (TILL)		3	SS	18							
			4	SS	18		303					
							302					
			5	SS	23		301					
							300					
	Becomes grey		6	SS	12							
							299					
298.4												
7.7	SAND, fine to coarse grained, some silt, trace to some gravel Dense Brown Moist		7	SS	33		298					
							297					
			8	SS	32							

Continued Next Page

+³, X³: Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-21

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 865 500.32 E 299 331.61 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.02.01 - 2011.02.01 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
	Continued From Previous Page							20 40 60 80 100						
							296							
295.2														
10.9	Silty CLAY, some sand, trace gravel		9	SS	48								0 12 58 30	
294.9	Hard													
294.9	Grey						295							
11.3	(TILL)													
	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND WATER LEVEL AT 7.0m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 10.0m, CUTTINGS TO 0.7m, BENTONITE HOLEPLUG TO 0.4m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.													

+³, X³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

Appendix D
List of Special Provisions
and
Suggested Text for NSSP



List of Special Provisions Referenced in this Report

SP 903S01

Suggested Text for NSSP on:

“Augered Caisson Construction for High Mast Lighting (HML) Pole Foundations”

The Contractor is advised that variable types of subsurface materials may be encountered at the locations of the HML pole foundations. For additional information regarding subsurface conditions, the Contractor is referred to the Foundation Investigation Report.

For bidding purposes, the Contractor shall assume the following:

1. The subsurface conditions at an augered caisson location are the same as those encountered in the borehole closest to the subject caisson location.
2. Cobbles, boulders and rock fragments may be encountered within the glacial till deposits. Obstructions including rubble, cobbles and boulders may also be present within the embankment fills. The soil matrix is anticipated to become harder or denser with depth. Caisson installation equipment must be able to dislodge, handle, remove or otherwise penetrate these obstructions and hard/very dense layers.
3. Water seepage and/or soil sloughing into the caisson hole will occur from existing fill and cohesionless soils at some locations. The cohesionless soils would be susceptible to disturbance under conditions of unbalanced hydrostatic head. Temporary liners shall be available on site, or be made available on very short notice, to support the caisson sidewalls and provide seepage cut-off where required. All concrete should be placed in the dry. The concrete should be placed using the tremie method if it is considered impractical to remove accumulated water inside the hole. Each caisson foundation should be excavated, inspected, approved and concreted in sequence without delay.

The Contractor is responsible for constructing the HML pole foundations without disturbing the material at the sides or bases of the foundations.

