

**FOUNDATION INVESTIGATION REPORT
PROPOSED CULVERT EXTENSIONS AND NEW CULVERT
HIGHWAY 400 WIDENING
MAJOR MACKENZIE DRIVE TO KING ROAD
YORK REGION, ONTARIO
G.W.P. 192-00-00 AND 2539-04-00
ASSIGNMENT NOS. 2005-E-0036 AND -0037**

GEOCRES Number: 30M13-190

Report to

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PART 1: FACTUAL INFORMATION

1 INTRODUCTION

This report presents the factual findings obtained from a foundation investigation carried out at the locations of the proposed culvert extensions and replacement along the Highway 400 right-of-way between Major MacKenzie Drive and King Road. The project involves widening of the highway to accommodate additional lanes of traffic. It is understood that the Ministry of Transportation Ontario (MTO) requires the design to accommodate the ultimate 10-lane configuration including one HOV lane in each direction, while the current MTO right-of-way is to be maintained.

The purpose of this investigation was to determine the subsurface conditions near the locations of the culvert extensions and replacement, provide borehole location plans and soil strata drawings, records of boreholes, laboratory test results, and a generalized description of the subsurface conditions. A model of the subsurface conditions was developed for each culvert location based on data obtained from this and previous investigations.

Thurber Engineering Ltd. (Thurber) carried out this investigation as a sub-consultant to SNC-Lavalin Inc. (SNC-Lavalin) under MTO Assignment Nos. 2005-E-0036 and 0037.

2 SITE DESCRIPTION

The highway alignment covered in this report extends along Highway 400 from north of Major Mackenzie Drive northerly to just north of the King Road Underpass. The general location of each of the relevant culverts covered in this report is shown on the key plans on the Borehole Locations and Soil Strata drawings in Appendix C.

The project area is located within the physiographic region known as the South Slope of the Oak Ridges Moraine, which comprised predominantly of the Halton 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 till overlies bedrock at depths in the order of 100 m in the vicinity of the project area.

Drainage in the vicinities of the project areas is largely controlled by the Humber River and its tributaries. Localized drainage is facilitated by the creeks flowing within the gullies. Many of the culverts are located in these gullies allowing the creek to flow under the highway embankment.

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 SITE INVESTIGATION AND FIELD TESTING

The site investigation and field testing for this Highway 400 widening project was carried out during several periods, between December 2006 and February 2007, September 2008, March 2009, February 2010 and March 2011. The 2010 and 2011 programs for investigating the culvert areas consisted of drilling and sampling ten (10) and eight (8) boreholes, respectively, in addition to the boreholes completed during previous investigations for this Highway 400 widening project.

Information obtained from other reports from the current and previous investigations have been utilized where appropriate. These reports are listed as follows:

- Thurber report titled “Foundation Investigation Report, High Mast Lighting Poles, Teston Road to North of King Road, Highway 400 Widening, Vaughan, Ontario, G.W.P. 2539-04-00, Agreement 2005-E-0037”, GEOCRE No. 30M13-193, File:19-92-68, dated December 17, 2011 (Reference 1).
- Thurber report titled “Foundation Investigation Report, High Embankments, Teston Road to King Road, Highway 400 Widening, Vaughan, Ontario, G.W.P. 2539-04-00, Assignment 2005-E-0036”, GEOCRE No. 30M13-178, File:19-92-68, dated April 6, 2010 (Reference 2).
- Thurber report titled “Foundation Investigation and Design Report, Culvert Extensions and High Fill, Highway 400 / Teston Road Interchange” (for Region of York), File: 19-1351-66, dated January 26, 2005 (Reference 3).
- Thurber report titled “Foundation Investigation and Design Report, Highway 400 – Retaining Structure, Teston Road Interchange, Region of York, Ontario” (for Region of York), File: 19-1351-66, dated January 26, 2005 (Reference 4).
- AMEC report titled “Foundation Investigation Report, Proposed Kirby Sideroad Overpass Widening, Highway 400 Interim Widening, Vaughan, Ontario”, W.P. 192-00-00, Central Region, GEOCRE No. 30M13-159, File: TT22852A, dated September, 2003 (Reference 5).

The boreholes for the present investigation were initially marked and/or staked in the field by Thurber. Prior to commencement of drilling, utility clearances were obtained for all borehole locations. Right-of-way usage and lane closure permits were also obtained as required. The as-drilled borehole

locations were either tied in by surveyors co-ordinated by SNC-Lavalin and the survey data provided to Thurber, or were established using Thurber's in-house GPS survey unit. Approximate borehole locations are shown on the Borehole Locations and Soil Strata drawings in Appendix C.

Track and truck mounted drill rigs were used to undertake the drilling, sampling and in-situ testing operations.

The depths of the boreholes ranged from approximately 5.2 m to 17.9 m below existing ground surface. Hollow and solid stem augers were used to advance the boreholes. Soil samples were obtained at selected intervals using a 50 mm outside diameter split spoon sampler in conjunction with Standard Penetration Tests (SPT).

Groundwater conditions in the open boreholes were observed throughout the drilling operations. Standpipe piezometers of 19 mm in diameter were installed in selected boreholes for monitoring of groundwater levels. The installation details are presented on the Record of Boreholes in Appendix A. Details of borehole grouting and sealing for boreholes advanced by Thurber relevant to this investigation are presented in Table A1 in Appendix A.

A member of Thurber's technical staff supervised the drilling and sampling operations on a full time basis. The supervisor logged the boreholes, secured the soil samples in labelled and sealed containers, which were then transported to Thurber's laboratory for further examination and testing.

4 LABORATORY TESTING

Visual identification and natural moisture content determination was undertaken on all recovered soil samples returned to the laboratory. Selected soil samples were subjected to grain size distribution analysis. Selected cohesive soil samples underwent Atterberg Limits tests. The results of this testing program are shown on the Record of Borehole sheets in Appendix A and on the accompanying figures in Appendix B.

5 DESCRIPTION OF SUBSURFACE CONDITIONS

Details of the encountered soil stratigraphy are presented on Record of Borehole sheets, and on the "Borehole Locations and Soil Strata" drawings in Appendices A and C, respectively. A general description of the stratigraphy established at relevant boreholes near the culverts is presented in the following paragraphs. Applicable borehole information from previous investigations has also been incorporated. It should be noted that the subsurface conditions may vary between and beyond the borehole locations.

Results of grain size distribution analyses conducted on selected samples of various types of soils from this investigation are presented in Figures B1 to B9 and B13 to B16 in Appendix B. Results of Atterberg Limits tests carried out on selected cohesive soil samples are shown on

the plasticity charts on Figures B10 to B12 and B17 to B19 in Appendix B. The Borehole Locations and Soil Strata Drawings in Appendix C present the inferred subsurface conditions at the culvert locations.

5.1 Topsoil and Asphalt

Topsoil of thicknesses ranging from 25 mm to 180 mm was encountered in Boreholes 06-05W, 06-12W, 06-05E, 06-16E, 06-17E, 10-05, 10-06, C-16A, C-16B, C-17A, C-17B and C-18B. In Boreholes 08-01 and 08-02 located within the Cold Creek floodplain, topsoil mixed with organics and rootlets was between 0.6 and 1.4 m thick. In Borehole C-18A, the topsoil measured 0.4 m in thickness. Topsoil thickness may vary between and beyond the borehole locations.

A 150 mm thick layer of asphalt was encountered at ground surface in Borehole 06-08E.

5.2 Fill

Fill was encountered beneath the topsoil, or occasionally beneath asphalt and at ground surface in Boreholes 06-08E, 06-12W, 06-16E, 06-17E, 10-06 and 09-05W. The thickness and base elevation of the fill are presented in Table 5.2.1.

Table 5.2.1: Fill Thickness and Base Elevation

Borehole Number	Fill Thickness (m)	Base Elevation (m)
06-08E	2.3	271.4
06-12W	0.6	270.9
06-16E	1.2	276.0
06-17E	1.3	276.5
10-06	1.0	262.9
09-05W	1.4	295.4

The fill is comprised predominantly of brown to dark brown silty clay and some clayey silt, trace to some sand and gravel with occasional roots and rootlets. Sand to gravelly sand overlies the cohesive fill in Boreholes 06-08E, 06-12W and 09-05W. SPT 'N' values of the cohesive fill typically ranged from 4 to 26 blows per 0.3 m penetration indicating firm to very stiff conditions. An occasional 'N' value of 38 blows measured in Borehole 06-08E indicated the presence of a hard zone. Moisture contents typically ranged between 9% and 26%.

Figure B1 presents the grain size distribution curves of selected silty clay or clayey silt fill samples. The test results are summarized in the tables below.

Soil Particles	%
Gravel	1 – 2
Sand	18 – 35
Silt	49 to 50
Clay	15 to 31

5.3 Silty Clay and Clayey Silt

Surficial cohesive deposits of silty clay and clayey silt containing trace to some organics, some sand and trace gravel was encountered in Boreholes CV-12A, CV-12B, CV-13A, CV-13B, 06-05E, 06-08E, 10-06, C-14, C-16A, C-17A, C-18A and C-20 on the east side of the highway, CV-12A, 08-01, 08-02, 10-05, 09-05W, C-16B, C-17B and C-18B on the west side of the highway. The thickness and base elevation of these deposits are summarized in Table 5.3.1:

Table 5.3.1 Silty Clay/Clayey Silt Thickness and Base Elevation

Borehole Number	Silty Clay / Clayey Silt Thickness (m)	Base Elevation (m)
CV-12B	1.5	238.5
CV-13A	2.0	227.0
CV-13B	0.7	228.9
06-05E	1.4	241.7
06-08E	1.5	270.0
10-06	1.0	261.9
CV12A	0.8	238.5
08-01	3.7	222.3
08-02	0.4	225.4
10-05	1.2	261.1
09-05W	0.8	294.6
C-14	1.4	243.2
C-16A	0.9	257.1
C-17A	2.0	258.3
C-18A	1.9	258.1
C-20	1.6	275.5
C-16B	1.4	254.0
C-17B	0.9	257.5
C-18B	1.3	260.1

These soils are dark brown, brown to brown and grey in colour, and have a typically firm to hard consistency as indicated by SPT 'N' values of 4 to 35 blows per 0.3 m penetration. Occasional 'N' values of 0 to 3 blows indicate the presence of softened zones immediately

below ground surface. Moisture contents ranged typically between 10% and 25%, with occasional higher values of 28% to 35%.

Figures B2 and B3 present the grain size distribution curves of selected silty clay and clayey silt samples. Figure B10 presents Atterberg limits test results of selected silty clay samples. The test results are summarized in the tables below.

Silty Clay

Soil Particles	%
Gravel	0 – 3
Sand	12 – 29
Silt	49 to 55
Clay	19 to 33

Index Property	%
Liquid Limit	27 – 33
Plasticity Index	11 – 15

The above results show that the silty clay has low plasticity with a group symbol of CL.

Clayey Silt

Soil Particles	%
Gravel	0
Sand	23
Silt	61
Clay	16

5.4 Silty Clay Till

Silty clay till containing some sand and trace gravel was encountered in Boreholes CV-12A, CV-13B, 06-05E, 06-08E, 06-16E, 10-06, C-16A, C-17A and C-18A on the east side of the highway, CV-12B, 06-05W, 06-12W, C-16B, C-17B, C-18B and C20 on the west side of the highway. Some of these boreholes terminated within the till deposit. The thickness and base elevation of this till deposit are summarized in Table 5.4.1:

Table 5.4.1 Silty Clay Till Thickness and Base Elevation

Borehole Number	Silty Clay Till Thickness (m)	Base Elevation (m)
CV-12A	5.3	233.2
CV-13B	4.6	223.1
06-05E	3.6	237.4
06-08E	At least 5.8	Lower than 264.2

10-06	At least 3.0	Lower than 258.9
06-16E	At least 5.3	Lower than 270.7
06-17E	At least 5.3	Lower than 271.2
CV-12B	3.1	235.4
06-05W	2.9	237.9
06-12W	8.6	262.3
C-16A	2.9	251.1
C-17A	At least 6.0	Lower than 252.2
C-18A	At least 5.9	Lower than 252.1
C-16B	At least 6.7	Lower than 247.4
C-17B	6.3	251.2
C-18B	6.4	253.7
C-20	At least 6.6	Lower than 268.9

This till is typically brown in colour, becoming grey with depth. It is generally stiff to hard as indicated by SPT 'N' values ranging between 8 to greater than 75 blows per 0.3 m penetration. Occasional 'N' values greater than 50 blows for less than 0.3 m penetration infer the presence of cobbles or boulders. Moisture contents were typically between 10% and 20%.

Figures B4, B5, B13 and B14 present the grain size distribution curves of silty clay till samples. Figures B11, B12, B17 and B18 present Atterberg limits test results of selected silty clay till samples. The test results are summarized in the tables below.

Soil Particles	%
Gravel	0 – 4
Sand	6 – 31
Silt	43 to 63
Clay	16 to 40

Index Property	%
Liquid Limit	20 – 33
Plasticity Index	8 – 17

The above results show that the silty clay till has low plasticity with a group symbol of CL.

Glacial tills inherently contain cobbles and boulders.

5.5 Clayey Silt Till

Clayey silt till containing some sand and trace gravel was encountered in Boreholes 09-05W, 10-05, C-14 and C-16A. The thickness and base elevation of this till deposit are summarized in Table 5.5.1:

Table 5.5.1 Clayey Silt Till Thickness and Base Elevation

Borehole Number	Clayey Silt Till Thickness (m)	Base Elevation (m)
09-05W	2.1	292.5
10-05	2.7	258.4
C-14	5.3	237.3
C-16	3.1	254.0

This till is typically brown in colour. Its consistency varies from stiff to hard as indicated by SPT 'N' values ranging between 9 and 42 blows per 0.3 m penetration. Moisture contents were typically between 15% and 22%.

Figures B6 and B15 present the grain size distribution curve of clayey silt till samples. The test results are summarized in the tables below. Figure B19 presents Atterberg limits test results of selected clayey silt till samples.

Soil Particles	%
Gravel	0 to 1
Sand	5 to 27
Silt	55 to 86
Clay	9 to 17

Index Property	%
Liquid Limit	22 – 27
Plasticity Index	9 – 12

The above results show that the clayey silt till has low plasticity with a group symbol of CL.

Glacial tills inherently contain cobbles and boulders.

5.6 Sands and Silts

Deposits of sands, silts, silty sands and sandy silts with trace clay and gravel with occasional cobbles were encountered in Boreholes CV-13A, CV-13B, 06-05E, C-14, C-16A and C-18A on the east side of the highway, 08-01, 08-02, 10-05, 09-05W, C-17B and C-18B on the west side of the highway. A number of these boreholes terminated within these cohesionless deposits. The minimum thickness and termination elevation of the boreholes within these soils are summarized in Table 5.6.1:

Table 5.6.1 Sands and Silts Thickness and Base Elevation

Borehole Number	Sands and Silts Minimum Thickness (m)	Borehole Termination Elevation Within Sands and Silts (m)
CV-13A	2.2	219.2
CV-13B	3.2	219.9
06-05E	3.6	233.7
08-01	13.6	208.7
08-02	15.6	209.8
10-05	2.6	255.8
09-05W	2.8	287.0
C-14	0.6 (upper interlayer) \ and 0.8 (lower)	242.6* (upper interlayer) and 236.5 (lower)
C-16A	1.1	250.1
C-18A	0.2 (interlayer)	255.3*
C-17B	1.0	250.1
C-18B	2.0	251.7

* Not end of borehole

These soils are typically brown in colour becoming grey with depth, non-plastic, and in a typically compact to very dense state as indicated by SPT 'N' values ranging between 12 and 73 blows per 0.3 m penetration. The presence of cobbles and/or boulders could be inferred at locations where the 'N' value was greater than 50 blows for less than 0.3 m penetration. Some loose zones, as indicated by 'N' values of less than 10 blows, were encountered in Boreholes 08-01, 08-02 and 10-05. Moisture contents were typically between 10% and 22%, except for Borehole 09-05W where the moisture contents were lower than 5%.

Figures B7, B8 and B16 present the grain size distribution curves of selected samples of silt and sand. The test results are summarized in the tables below.

Silt to Sandy Silt

Soil Particles	%
Gravel	0 – 3
Sand	2 – 47
Silt	48 – 91
Clay	4 – 9

Sand

Soil Particles	%
Gravel	0
Sand	65 – 70
Silt and Clay	30 – 35

5.7 Sandy Silt to Sand and Silt Till

Deposits of sandy silt to sand and silt tills were encountered in Boreholes CV-12A and CV-13A on the east side of the highway, CV-12B, 06-05W, 06-12W and 09-05W on the west side of the highway. Some of these boreholes terminated within the glacial tills. The minimum thickness and base elevation of till or boreholes within these soils are summarized in Table 5.7.1:

Table 5.7.1 Sandy Silt/Sand and Silt Till Thickness and Base Elevation

Borehole Number	Sands and Silts Minimum Thickness (m)	Base Elevation Till or Borehole (m)
CV-12A	3.7	229.6
CV-13A	5.6	221.4
CV-12B	6.3	229.1
06-05W	5.2	232.6
06-12W	2.0	260.3
09-05W	2.7	289.8

These soils are typically brown to grey in colour, non-plastic, and in a typically compact to very dense state as indicated by SPT 'N' values ranging from 15 blows per 0.3 m penetration to greater than 100 blows per 0.3 m penetration. Moisture contents were typically between 10% and 20%.

Figure B9 presents the grain size distribution curves of selected samples of silts and sands. The test results are summarized in the tables below.

Sandy Silt / Sand and Silt Till

Soil Particles	%
Gravel	0
Sand	22 – 36
Silt	61 – 69
Clay	3 – 9

Glacial tills inherently contain cobbles and boulders.

5.8 Groundwater

Free water was encountered in Boreholes 06-05E, 06-05W and C-18A between 1.5 and 5.0 m depths, respectively, upon completion of drilling. A standpipe piezometer was installed in nine selected boreholes and the measured water levels are presented in Table 5.8.1:

Table 5.8.1 Water Level Measurements

Borehole (Screen location)	Date	Depth (m)	Elevation (m)
CV-12B (sandy silt till)	August 4, 2005	10.8	229.2
CV-13B (sand/silty sand)	July 15, 2004 August 5, 2004	1.8 0.6	227.9 229.1
06-12W (silty clay till/ sandy silt Till)	February 20, 2007 March 27, 2007	5.1 4.9	266.5 266.7
10-05 (silt / sand)	April 9, 2010	3.2	259.3
C-14 (Clayey Silt Till / Silt and Sand)	October 5, 2011	3.3	241.3
C-16A (Silty Clay Till / Silt and Sand)	October 5, 2011	5.0	253.2
C-16B (Silty Clay Till)	October 5, 2011	2.2	253.3
C-17B (Silty Clay Till / Sand)	October 5, 2011	3.4	255.0
C-18B (Silty Clay Till / Silt)	October 5, 2011	3.9	257.6
C-20 (Silty Clay Till)	October 5, 2011	2.8	274.3

Based on the above readings, the stabilized groundwater levels varied widely between approximate Elevations 229 and 275 m. These water levels reflect localized terrain and drainage conditions associated with the creek valleys. The groundwater levels are expected to vary seasonally and are subject to climatic events.

6 MISCELLANEOUS

Thurber Engineering Ltd. (Thurber) selected the borehole locations in the field relative to existing site features with consideration of access restraints, terrain conditions, utility locations and previous site investigation data.

DBW Drilling Ltd of Ajax, Ontario and Kodiak Environmental Ltd., of Oakville, Ontario conducted drilling, sampling and in-situ testing operations. Traffic control was provided by Barricade Traffic Services Inc. (BTS) where required. Messrs. Stephane Loranger and

George Azzopardi of Thurber supervised the drilling and sampling operations in the field on a full time basis.

Messrs. Tony Harte, M.Sc., L. Gilarski, E.I.T. and Dr. Sydney Pang, P.Eng. directed the field operations.

Dr. Sydney Pang, P.Eng. prepared this report.

Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations projects, reviewed the report.

THURBER ENGINEERING LTD.



Sydney Pang, P.Eng.
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Review Principal, Designated MTO Contact

Appendix A

Record of Borehole Sheets

19-92-68

Table A1
Borehole Completion Details

Borehole	Piezometer Tip Depth/ Elevation (m)	Completion Details
CV-12B	11.2 / 229.4	Piezometer with 1.5 m slotted screen installed with sand filter to 6.9 m (Elevation 231.1 m), bentonite seal to 6.4 m depth, then grout to surface.
08-01	None installed	Bentonite to surface.
08-02	None installed	Bentonite to surface.
06-05W	None installed	Bentonite to surface.
06-05E	None installed	Bentonite to surface.
06-08E	None installed	Bentonite to surface.
06-12W	11.3 / 260.3	Piezometer with 1.5 m slotted screen installed with sand filter to 7.5 m (Elevation 264.1 m), grout from 7.5 to 1.4 m depths, then bentonite seal to 0.3 m depth, cuttings to ground surface.
06-16E	None installed	Bentonite to surface.
10-05	6.0 / 256.5	Piezometer with 1.5 m slotted screen installed with sand filter to 4.0 m (Elevation 258.5 m), then bentonite seal to 0.2 m, cuttings to surface.
10-06	None installed	Bentonite to surface.
09-05W	None installed	Bentonite to surface.
C-14	7.5 / 237.1	Piezometer with 1.5 m slotted screen installed with sand filter to 5.7 m (Elevation 238.9 m), then bentonite seal to surface.
C-16A	7.6 / 250.6	Piezometer with 1.5 m slotted screen installed with sand filter to 6.0 m (Elevation 252.2 m), then bentonite seal to surface.
C-16B	7.4 / 248.1	Piezometer with 1.5 m slotted screen installed with sand filter to 5.7 m (Elevation 249.8 m), then bentonite seal to surface.
C-17A	None installed	Bentonite to 2.4 m depth, then cuttings to surface.
C-17B	7.4 / 251.0	Piezometer with 1.5 m slotted screen installed with sand filter to 5.7 m (Elevation 252.7 m), then bentonite seal to surface.
C-18A	None installed	Bentonite to 2.5 m depth, then cuttings to surface.
C-18B	9.1 / 252.4	Piezometer with 1.5 m slotted screen installed with sand filter to 7.3 m (Elevation 254.2 m), then bentonite seal to surface.
C-20	7.9 / 269.2	Piezometer with 1.5 m slotted screen installed with sand filter to 6.2 m (Elevation 270.9 m), then bentonite seal to surface.

SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

1. TEXTURAL CLASSIFICATION OF SOILS

CLASSIFICATION	PARTICLE SIZE	VISUAL IDENTIFICATION
Boulders	Greater than 200mm	same
Cobbles	75 to 200mm	same
Gravel	4.75 to 75mm	5 to 75mm
Sand	0.075 to 4.75mm	Not visible particles to 5mm
Silt	0.002 to 0.075mm	Non-plastic particles, not visible to the naked eye
Clay	Less than 0.002mm	Plastic particles, not visible to the naked eye

2. COARSE GRAIN SOIL DESCRIPTION (50% greater than 0.075mm)

TERMINOLOGY	PROPORTION
Trace or Occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH (kPa)	APPROXIMATE SPT ⁽¹⁾ 'N' VALUE
Very Soft	12 or less	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	Greater than 200	Greater than 30

NOTE: Hierarchy of Soil Strength Prediction

- 1) Laboratory Triaxial Testing
- 2) Field Insitu Vane Testing
- 3) Laboratory Vane Testing
- 4) SPT value
- 5) Pocket Penetrometer



4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

DESCRIPTIVE TERM	SPT "N" VALUE
Very Loose	Less than 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

5. LEGEND FOR RECORDS OF BOREHOLES

SYMBOLS AND ABBREVIATIONS FOR SAMPLE TYPE	SS Split Spoon Sample	WS Wash Sample	AS Auger (Grab) Sample
	TW Thin Wall Shelby Tube Sample		TP Thin Wall Piston Sample
	PH Sampler Advanced by Hydraulic Pressure		PM Sampler Advanced by Manual Pressure
	WH Sampler Advanced by Self Static Weight		RC Rock Core SC Soil Core

$$\text{Sensitivity} = \frac{\text{Undisturbed Shear Strength}}{\text{Remoulded Shear Strength}}$$


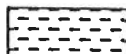



 Water Level
 Shear Strength Determination by Pocket Penetrometer

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

UNIFIED SOILS CLASSIFICATION

MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sands or gravelly sands, little or no fines.
		SP	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS $W_L < 50\%$	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. $(W_L < 30\%)$.
		CI	Inorganic clays of medium plasticity, silty clays. $(30\% < W_L < 50\%)$.
		OL	Organic silts and organic silty-clays of low plasticity.
	SILTS AND CLAYS $W_L > 50\%$	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.
CLAY SHALE			
SANDSTONE			
SILTSTONE			
CLAYSTONE			
COAL			

EXPLANATION OF ROCK LOGGING TERMS

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

DISCONTINUITY SPACING		STRENGTH CLASSIFICATION			
Bedding	Bedding Plane Spacing	Rock Strength	Approximate Uniaxial Compressive Strength (MPa) (psi)	Field Estimation of Hardness*	
Very thickly bedded	Greater than 2m	Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Thickly bedded	0.6 to 2m				
Medium bedded	0.2 to 0.6m	Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Thinly bedded	60mm to 0.2m				
Very thinly bedded	20 to 60mm	Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
Laminated	6 to 20mm				
Thinly Laminated	Less than 6mm	Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.
		Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
		Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
		Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail

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

RECORD OF BOREHOLE No C-14

1 OF 1

METRIC

W.P. 2539-04-00 LOCATION N 4 859 214.9 E 300 433.5 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.03.18 - 2011.03.18 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				
								20 40 60 80 100				
244.6												
0.0	Clayey SILT , some sand, trace roots Very Soft to Soft Dark Brown Moist		1	SS	2							
			2	SS	2							
243.2												
1.4	SILT and SAND , some clay, trace gravel Compact Brown Moist		3	SS	15							
242.6												
2.0	Clayey SILT , some sand, trace gravel Very Stiff to Hard Brown Moist (TILL)		4	SS	24							
	Occasional sand seams, occasional oxide staining		5	SS	24							
			6	SS	84/ 0.250							
	</											

ONTMT4S 9268.GPJ 3/5/12

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No C-16A

1 OF 1

METRIC

W.P. 2539-04-00 LOCATION N 4 860 492.9 E 300 211.0 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.03.21 - 2011.03.21 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						
258.2								20	40	60	80	100		
0.0	TOPSOIL: (75mm)							○ UNCONFINED	+	FIELD VANE				
0.1	Clayey SILT, some sand, trace gravel, trace organics		1	SS	7		258	● QUICK TRIAXIAL	x	LAB VANE				
	Firm													
	Brown													
	Moist													
257.1														
1.0	Clayey SILT, some sand, trace gravel		2	SS	10		257							
	Stiff to Very Stiff													
	Brown													
	Moist													
	(TILL)													
	Mottled Brown/Grey		3	SS	18									0 25 61 14
	Occasional sand seams						256							
			4	SS	17									
255.2														
3.0	Hard		5	SS	31		255							
254.0														
4.1	Silty CLAY, some sand, trace gravel						254							
	Hard													
	Brown		6	SS	61									0 14 60 26
	Moist													
	(TILL)						253							
	Occasional sand seams, occasional oxide staining													
			7	SS	64		252							
251.1														
7.0	SILT and SAND, trace clay, trace gravel						251							
	Very Dense													
	Grey													
	Moist		8	SS	52									1 34 56 9
250.1														
8.1	END OF BOREHOLE AT 8.1m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Oct.05/11 5.0 253.2													

+³ x³: Numbers refer to Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No C-16B

1 OF 1

METRIC

W.P. 2539-04-00 LOCATION N 4 860 480.3 E 300 154.3 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers (Mini Moe) COMPILED BY AN
 DATUM Geodetic DATE 2011.03.18 - 2011.03.18 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 (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						WATER CONTENT (%)			GR	SA	SI	CL
								20 40 60 80 100	w _p w w _L											
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE													
255.5	TOPSOIL: (25mm)		1	SS	5															
	Clayey SILT, some sand, occasional wood fibres Firm to Very Stiff Dark Brown to Brown Moist		2	SS	20															
254.0																				
1.4	Silty CLAY, some sand, trace gravel, occasional oxide staining Stiff to very stiff Brown Moist (TILL)		3	SS	14															
			4	SS	26															
252.5																				
3.0	Occasional sand seams Hard		5	SS	51															
	Becomes Grey		6	SS	48															
			7	SS	57															
247.4			8	SS	45															
8.1	END OF BOREHOLE AT 8.1m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Oct.05/11 2.2 253.3																			

ONTMT4S 9268.GPJ 12/21/11

RECORD OF BOREHOLE No C-17A

1 OF 1

METRIC

W.P. 2539-04-00 LOCATION N 4 860 941.6 E 300 132.9 ORIGINATED BY SLL
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2010.12.16 - 2010.12.16 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 (%)													
260.4							20	40	60	80	100	PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	GR	SA	SI	CL			
0.0	TOPSOIL: (150mm)																				
0.2	Clayey SILT, topsoil stained with rootlets, occasional sand pockets Firm to Hard Brown Moist		1	SS	6								o								
			2	SS	11								o								
			3	SS	35								o								
258.3																					
2.2	Silty CLAY, some sand, trace gravel Hard Brown Moist (TILL)		4	SS	63								o	4	1			0	13	55	32
			5	SS	60								o								
	Becomes grey		6	SS	50								o								
			7	SS	37									4	1			0	20	47	33
			8	SS	30								o								
252.2	Occasional silty sand seams																				
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 2.4m, THEN CUTTINGS TO SURFACE.																				

ONTM14S 9288 GPJ 9/28/11

RECORD OF BOREHOLE No C-17B

1 OF 1

METRIC

W.P. 2539-04-00 LOCATION N 4 860 927.5 E 300 072.3 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers (Mini Moe) COMPILED BY AN
 DATUM Geodetic DATE 2011.03.21 - 2011.03.21 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					w _p			w					w _L					
								○ UNCONFINED + FIELD VANE					● QUICK TRIAXIAL x LAB VANE													
258.4								20	40	60	80	100														
0.0	TOPSOIL: (50mm)																									
	Clayey SILT, some sand, trace roots		1	SS	4		258																			
	Firm																									
	Dark Brown to Brown																									
257.5	Moist																									
0.9	Silty CLAY, some sand, trace gravel, occasional sand pockets		2	SS	17		257														0 21 51 28					
	Very Stiff to Hard																									
	Brown to Grey																									
	Moist																									
	(TILL)																									
			3	SS	23		256																			
			4	SS	38		255																			
			5	SS	47		254																			
			6	SS	34		253														0 13 53 34					
			7	SS	24		252																			
251.2																										
7.2	SAND, fine grained						251																			
	Compact																									
	Grey																									
	Moist																									
			8	SS	28																					
250.1																										
8.2	END OF BOREHOLE AT 8.2m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.																									
	WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Oct.05/11 3.4 255.0																									

ONTMT4S 9268.GPJ 12/21/11

+³, X³: Numbers refer to
Sensitivity

20
15 10 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No C-18A

1 OF 1

METRIC

W.P. 2539-04-00 LOCATION N 4 861 185.1 E 300 092.0 ORIGINATED BY SLL
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2010.12.16 - 2010.12.16 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																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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260.3							20	40	60	80	100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No C-18B

1 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 861 115.5 E 300 049.8 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers (Mini Moe) COMPILED BY AN
 DATUM Geodetic DATE 2011.03.22 - 2011.03.22 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 (%)				
261.5								20 40 60 80 100		20 40 60				
0.0	TOPSOIL: (75mm)							○ UNCONFINED + FIELD VANE						
0.1	Clayey SILT, some organics, trace roots and rootlets		1	SS	5			● QUICK TRIAXIAL x LAB VANE						
	Firm													
	Dark Brown to Brown		2	SS	4									
	Moist													
260.1														
1.4	Silty CLAY, some sand, trace gravel, occasional oxide staining													
	Stiff to Very Stiff		3	SS	12									
	Mottled Brown to Grey													
	Moist (TILL)		4	SS	24									
258.5														
3.0	Hard													
			5	SS	37									
257.4														
4.1														
			6	SS	14									
			7	SS	23									
253.7														
7.8	SILT, some sand, trace clay		8	SS	46									
	Dense to Compact													
	Grey													
	Moist to Wet													
			9	SS	26									
251.7														
9.8	END OF BOREHOLE AT 9.8m.													

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No C-18B

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 861 115.5 E 300 049.8 ORIGINATED BY ES
HWY 400 BOREHOLE TYPE Solid Stem Augers (Mini Moe) COMPILED BY AN
DATUM Geodetic DATE 2011.03.22 - 2011.03.22 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															
	Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.															
	WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Oct.05/11 3.9 257.6															

+³, X³: Numbers refer to Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No C-20

1 OF 1

METRIC

W.P. 2539-04-00 LOCATION N 4 862 554.4 E 299 795.3 ORIGINATED BY SLL
 HWY 400 BOREHOLE TYPE Solid Stem Augers (Mini Moe) COMPILED BY AN
 DATUM Geodetic DATE 2011.03.17 - 2011.03.17 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	20 40 60 80 100		
277.1													
0.0	Clayey SILT, some sand, trace gravel, trace roots Stiff Brown Moist		1	SS	13		277						
	Brown to Dark Brown		2	SS	0		276						
275.5													
1.6	Silty CLAY, some sand, trace gravel Very Stiff to Hard Mottled Brown/Grey Moist (TILL)		3	SS	16		275						
			4	SS	25		274						
			5	SS	33		273						
			6	SS	36		272						
			7	SS	35		271						
			8	SS	34		270						
268.9							269						
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE DRY UPON COMPLETION. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Oct.05/11 2.8 274.3												

ONTMT4S 9268.GPJ 1/18/12

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

RECORD OF BOREHOLE No CV-12A

1 OF 2

METRIC

G.W.P. 2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 857 700.10 E 300 620.00 ORIGINATED BY TK
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY SL/SS
 DATUM Geodetic DATE 2004.07.15 - 2004.07.15 CHECKED BY SMS

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				
239.3							20 40 60 80 100	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT		
0.0	Clayey, SILT, some sand, trace gravel, occasional organic layer Stiff Brown		1	SS	11			○ UNCONFINED	+ FIELD VANE			
238.5								● QUICK TRIAXIAL	x LAB VANE			
0.8	Silty CLAY, with sand, trace gravel Hard Brown (TILL)(CL-ML)		2	SS	37							
			3	SS	86/ 254							
	Becoming Grey		4	SS	79/ 279							
233.2												
6.1	Sandy SILT, trace clay, trace gravel Very Dense Grey (TILL)(ML-NONPLASTIC)		5	SS	87/ 279							
			6	SS	50/ .127							
			7	SS	50/ .102							
229.6												
9.8	END OF BOREHOLE AT 9.8 m.											

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No CV-12A

2 OF 2

METRIC

G.W.P. 2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 857 700.10 E 300 620.00 ORIGINATED BY TK
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY SL/SS
 DATUM Geodetic DATE 2004.07.15 - 2004.07.15 CHECKED BY SMS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			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	20 40 60	W _P W W _L				
	Continued From Previous Page BOREHOLE OPEN TO 9.8 m. BOREHOLE WET AT 6.6 m. BOREHOLE BACKFILLED WITH BENSEAL													

ONTMT4S 9268.GPJ 5/7/10

RECORD OF BOREHOLE No CV-12B

1 OF 2

METRIC

G.W.P. 2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 857 709.0 E 300 687.0 ORIGINATED BY TK
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY SL/SS
 DATUM Geodetic DATE 2004.07.16 - 2004.07.16 CHECKED BY SMS

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		
240.0														
0.0	Clayey SILT, with sand, trace gravel, trace organics Very Stiff Dark Brown		1	SS	17		240							
238.5							239							
1.5	Silty CLAY, with sand, trace gravel, occasional iron oxide staining Hard Brown to Grey (TILL)(CL-ML)		2	SS	56		238							
			3	SS	50/ .150		237							
235.4							236							
4.6	Sandy SILT, trace clay, trace gravel, occasional cobbles Very Dense Grey (TILL)(ML)		4	SS	50/ .102		235							
			5	SS	89		234							
			6	SS	50/ .279		233							
			7	SS	50/ .127		232							
							231							

Continued Next Page

+³, X³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No CV-12B

2 OF 2

METRIC

G.W.P. 2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 857 709.0 E 300 687.0 ORIGINATED BY TK
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY SL/SS
DATUM Geodetic DATE 2004.07.16 - 2004.07.16 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 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		
	Continued From Previous Page															
229.1	Sandy SILT, trace clay, trace gravel, occasional cobbles Very Dense Grey (TILL)(ML)		8	SS	50/											
10.9	END OF BOREHOLE AT 11.0 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) 05.08.04 10.8 229.2				127											

+³, ×³: Numbers refer to
Sensitivity

20
15 10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No CV-13A

1 OF 2

METRIC

G.W.P. 2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 858 645.00 E 300 534.00 ORIGINATED BY TK
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY SL/SS
 DATUM Geodetic DATE 2004-07-14 - 2004-07-14 CHECKED BY SMS

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		
229.0														
0.0	Clayey SILT, some sand, some gravel, some organic pockets Firm to Stiff Brown		1	SS	8		229							
227.0			2	SS	15		228							
2.0	Sandy SILT, trace clay, trace gravel, occasional cobbles Compact Grey (TILL)(ML-NONPLASTIC)		3	SS	15		227							
			4	SS	39		226							
	Becoming Dense to Very Dense		5	SS	50/ .229		225							
221.4			6	SS	50/ .279		224							
7.6	Silty SAND, fine grained, trace gravel, occasional cobbles Very Dense Grey (SM)		7	SS	65		223							
220.4							222							
8.5	SILT, trace sand Very Dense Grey (ML-NONPLASTIC)						221							
219.2							220							
9.8	END OF BOREHOLE AT 9.8 m.													

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15-5
10 (%) STRAIN AT FAILURE

ONTMT4S 9288.GPJ 10/05/07

RECORD OF BOREHOLE No CV-13A

2 OF 2

METRIC

G.W.P. 2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 858 645.00 E 300 534.00 ORIGINATED BY TK
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY SL/SS
 DATUM Geodetic DATE 2004-07-14 - 2004-07-14 CHECKED BY SMS



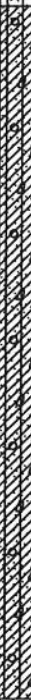


SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _P	W	W _L		
	Continued From Previous Page																
	BOREHOLE OPEN TO 9.8 m. BOREHOLE WET AT 2.1 m. BOREHOLE BACKFILLED WITH BENSEAL.																

RECORD OF BOREHOLE No CV-13B

1 OF 2

METRIC

G.W.P. 2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 858 657.00 E 300 558.00 ORIGINATED BY TK
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY SL/SS
DATUM Geodetic DATE 1899.12.30 - 1899.12.30 CHECKED BY SMS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT 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	W _P	W	W _L			
								● QUICK TRIAXIAL	× LAB VANE						
229.7						20	40	60	80	100	20	40	60		
0.0	Clayey SILT, some sand, some organics, trace rootlets, occasional silt pockets Soft Dark Brown		1	SS	3							○			
228.9															
0.7	Silty SAND, trace clay, occasional silt layers Dense Grey														
227.7			2	SS	41							○			
2.0	Silty CLAY, some sand, trace gravel, occasional silt layers, occasional cobbles Hard Grey (TILL)(CL)														0 12 63 24
			3	SS	48							○			
			4	SS	75							○			4 25 49 21
			5	SS	33							○			
223.1															
6.6	SAND, trace to some silt Compact Brown (SP/SM)														
221.7			6	SS	34							○			
8.0	Silty SAND, trace gravel Dense to Very Dense Grey (SM)														
			7	SS	73							○			
219.9															
9.8	END OF BOREHOLE AT 9.8 m.														

Continued Next Page

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

RECORD OF BOREHOLE No CV-13B

2 OF 2

METRIC

G.W.P. 2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 858 657.00 E 300 558.00 ORIGINATED BY TK
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY SL/SS
 DATUM Geodetic DATE 1899.12.30 - 1899.12.30 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 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																
	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) 15/07/04 1.8 227.9 05/08/04 0.6 229.1																

RECORD OF BOREHOLE No 08-01

1 OF 2

METRIC

G.W.P. 2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 858 612.1 E 300 459.8 ORIGINATED BY LG
HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2008.09.15 - 2008.09.15 CHECKED BY SKP

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				
226.6								20 40 60 80 100				
0.0	TOPSOIL, rootlets, grass							○ UNCONFINED + FIELD VANE				
226.0								● QUICK TRIAXIAL x LAB VANE				
0.6	Clayey SILT, trace sand, trace rootlets, some black staining Firm Brown to Grey Moist		1	SS	5		226					
			2	SS	6		225					
224.3												
2.3	Silty CLAY, trace gravel Very Stiff to Firm Grey Moist to Wet		3	SS	16		224					
			4	SS	6		223					
222.3												
4.3	Sandy SILT, trace clay Very Loose Grey Wet		5	SS	0		222					
							221					
	Compact Grey Wet		6	SS	19		220					
							219					
			7	SS	19							
							218					
			8	SS	25		217					

Continued Next Page

+³, x³: Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 08-01

2 OF 2

METRIC

G.W.P. 2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 858 612.1 E 300 459.8 ORIGINATED BY LG
HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2008.09.15 - 2008.09.15 CHECKED BY SKP

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		
	Continued From Previous Page											
216.5 10.1	Silty SAND, trace clay Dense Grey Wet		9	SS	32							
214.9												
11.7	SAND Compact Grey Wet		10	SS	29							
213.3												
13.3	Dense		11	SS	43							
211.8												
14.8			12	SS	25							
208.7												
17.9	END OF BOREHOLE AT 17.93m BOREHOLE WET AT 4m DEPTH. BOREHOLE SEALED WITH GROUT THEN BENTONITE HOLEPLUG TO SURFACE.											

ONTMT4S 9268.GPJ 8/10/10

+³. X³: Numbers refer to Sensitivity 20 15 10 5 0 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 08-02

1 OF 2

METRIC

G.W.P. 2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 858 604.7 E 300 441.2 ORIGINATED BY LG
HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2008.09.16 - 2008.09.16 CHECKED BY SKP

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				
								\circ UNCONFINED \bullet QUICK TRIAXIAL	$+$ FIELD VANE \times LAB VANE			
227.2 0.0	TOPSOIL and ORGANICS, some silt, trace clay, rootlets Soft Brown to Black Moist		1	SS	3							
225.8 1.4	Clayey SILT, trace sand, trace gravel Stiff Brown		2	SS	12							
225.4 1.8	Wet		3	SS	27							
224.9 2.3	Silty SAND, some gravel Compact Grey Wet		4	SS	29							
	Sandy SILT, trace to some clay Compact to Loose Grey Wet		5	SS	19							
			6	SS	6							
220.0 7.2	Dense		7	SS	39							
218.5 8.7			8	SS	20							

Continued Next Page

+³ x³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 06-05W

1 OF 1

METRIC

G.W.P. 2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 859 131.21 E 300 359.10 ORIGINATED BY SLL
HWY 400 BOREHOLE TYPE Solid Stem Auger COMPILED BY MFA
DATUM Geodetic DATE 2007.02.05 - 2007.02.05 CHECKED BY TJH

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 (%)				
240.9								20 40 60 80 100		20 40 60				
0.0	TOPSOIL: (100mm)							○ UNCONFINED + FIELD VANE						
0.1	Silty CLAY, with sand, some sand seams Stiff to Very Stiff Dark Brown Moist (TILL)(CL)		1	SS	8			● QUICK TRIAXIAL x LAB VANE						
			2	SS	17								0 22 52 26	
			3	SS	27									
237.9														
3.0	SAND and SILT, trace clay Compact to Dense Brown Moist (TILL)		4	SS	34									
			5	SS	26								0 36 61 3	
			6	SS	25									
			7	SS	34									
232.6														
8.2	END OF BOREHOLE AT 8.23m BOREHOLE CAVED TO 5.39m. BOREHOLE BACKFILLED WITH HOLEPLUG UPON COMPLETION. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 05.02.07 5.0 235.9													

ONTMT4S 9268.GPJ 577/10

RECORD OF BOREHOLE No 06-05E

1 OF 2

METRIC

G.W.P. 2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 859 708.59 E 300 349.57 ORIGINATED BY SLL
 HWY 400 BOREHOLE TYPE Solid Stem Auger COMPILED BY MFA
 DATUM Geodetic DATE 2007.02.01 - 2007.02.01 CHECKED BY TJH

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				
243.2								20 40 60 80 100				
0.0 0.1	TOPSOIL: (75mm)							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				
	Silty CLAY, with sand, trace gravel, with roots Firm Dark Brown Moist		1	SS	8		243					3 29 49 19
241.7	topsoil-stained, trace rootlets						242					
1.5	SAND, some silt, trace clay, trace rootlets Loose Dark Brown		2	SS	4							
241.0							241					
2.2	Silty CLAY, some sand, trace gravel Very Stiff to Hard Brown Moist (TILL)		3	SS	25							
			4	SS	51		240					
	Grey						239					
	occasional inferred cobbles		5	SS	90/ 275		238					1 28 51 20
237.4							237					
5.8	Silty SAND, trace clay Dense Grey Wet		6	SS	48		236					0 65 32 3
							235					
			7	SS	48		234					
			8	SS	50/ 130							
233.7												
9.4	END OF BOREHOLE AT 9.45m. BOREHOLE CAVED TO 4.88m, BACKFILLED WITH BENTONITE											

Continued Next Page

+³, x³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 06-05E

2 OF 2

METRIC

G.W.P. 2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 859 708.59 E 300 349.57 ORIGINATED BY SLL
HWY 400 BOREHOLE TYPE Solid Stem Auger COMPILED BY MFA
DATUM Geodetic DATE 2007.02.01 - 2007.02.01 CHECKED BY TJH

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT 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		
	Continued From Previous Page															
	HOLEPUG TO SURFACE.															
	WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 01.02.07 1.5 241.7															

RECORD OF BOREHOLE No 06-08E

1 OF 1

METRIC

G.W.P. 2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 862 025.75 E 299 939.66 ORIGINATED BY SLL
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2007.01.19 - 2007.01.19 CHECKED BY TJH

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					
273.9							20 40 60 80 100	PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT					
0.0	ASPHALT: (150 mm)						274	WATER CONTENT (%)					
0.2	SAND, some gravel Brown Moist (FILL)												
273.2													
0.7	Silty CLAY, some sand, trace gravel Very Stiff to Hard Brown Moist (FILL)		1	SS	26		273						
			2	SS	38		272						
271.4													
2.5	Silty CLAY, with sand, trace roots Stiff Brown Moist		3	SS	14		271						
			4	SS	12								
270.0													
4.0	Silty CLAY, some sand, trace gravel Hard Grey Moist (TILL)(CL)						270						
			5	SS	44		269						
							268						
			6	SS	72								
							267						
			7	SS	46		266						
							265						
			8	SS	14								
264.2													
9.6	END OF BOREHOLE AT 9.75 m.												

ONTM14S 9268.GPJ 5/7/10

+³, X³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 06-12W

1 OF 2

METRIC

G.W.P. 2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 862 017.2 E 299 889.3 ORIGINATED BY SLL
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2007.01.12 - 01/120/7 CHECKED BY TJH

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						
271.6								○ UNCONFINED + FIELD VANE						
0.0	TOPSOIL, black with roots: (100 mm)							● QUICK TRIAXIAL x LAB VANE						
270.3	SAND: (FILL)		1	SS	4									
0.3	Silty CLAY, trace roots and rootlets Dark Brown Moist (FILL)													
270.9							271							
0.7	Silty CLAY, some sand, trace gravel Stiff to Hard Brown Moist (TILL)(CL)		2	SS	12									
			3	SS	34		270							3 18 47 32
			4	SS	32		269							
			5	SS	32		268							
							267							0 6 57 37
			6	SS	26									
	sand seam layer at 5.13 to 5.18 m						266							
			7	SS	17		265							
							264							1 30 47 22
			8	SS	46									
							263							
262.3							262							
9.3	Sandy SILT, trace clay, trace gravel Dense Grey Wet (TILL)		9	SS	43									

Continued Next Page

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

ONTMT4S 9268.GPJ 5/7/10

RECORD OF BOREHOLE No 06-12W

2 OF 2

METRIC

G.W.P. 2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 862 017.2 E 299 889.3 ORIGINATED BY SLI
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM
DATUM Geodetic DATE 2007.01.12 - 01/12/07 CHECKED BY TJH

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 20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					WATER CONTENT (%) W _P W W _L					
260.3	Continued From Previous Page Sandy SILT, trace clay, trace gravel Dense Grey Wet (TILL)		10	SS	47		261											
11.3	END OF BOREHOLE AT 11.28 m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 20.02.07 5.1 266.5 27.03.07 4.9 266.7																	

+³, X³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 06-16E

1 OF 1

METRIC

G.W.P. 2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 862 563.7 E 299 856.8 ORIGINATED BY SLL
HWY 400 BOREHOLE TYPE Solid Stem Auger COMPILED BY MFA
DATUM Geodetic DATE 2006.12.18 - 2006.12.18 CHECKED BY SKP

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				
277.4								20 40 60 80 100				
0.0	TOPSOIL, black: (175 mm)							20 40 60 80 100				
0.2	Silty CLAY, some sand, trace roots and rootlets Soft to Very Stiff Dark Brown (FILL)		1	SS	2		277					1 18 50 31
			2	SS	19							
276.0							276					
1.4	Silty CLAY, some sand, trace gravel Very Stiff to Hard Brown (TILL)(CL)		3	SS	22							
			4	SS	40		275					
	occasional sand seams		5	SS	37		274					
			6	SS	25		273					0 18 52 30
							272					
			7	SS	33		271					
270.7												
6.7	END OF BOREHOLE AT 6.7m. BOREHOLE OPEN AND DRY TO BOTTOM UPON COMPLETION. BOREHOLE GROUTED WITH BENTONITE AND BACKFILLED WITH AUGER CUTTINGS TO SURFACE.											

+³, X³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 10-05

1 OF 1

METRIC

G.W.P. 2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 863 274.9 E 299 659.3 ORIGINATED BY SLL
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2010.02.04 - 2010.02.04 CHECKED BY SKP

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					
262.5								20 40 60 80 100					
0.0	TOPSOIL, with root and rootlets: (150mm)							20 40 60 80 100					
0.2	Silty CLAY Stiff Brown Moist		1	SS	11		262						0 12 55 33
261.1													
1.4	Clayey SILT, some sand, trace gravel Hard Brown Moist (TILL)		2	SS	36		261						
			3	SS	42		260						0 5 86 9
			4	SS	12		259						
258.4													
4.1	SILT, trace sand, trace clay Loose Grey Wet		5	SS	5		258						0 2 91 7
256.9													
5.6	SAND, some silt, some clay Compact Grey Wet		6	SS	12		257						0 70 30 (SI+CL)
255.8							256						
6.7	END OF BOREHOLE AT 6.7m> Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) ELEVATION(m) 04.09.10 3.2 259.3												

+ 3 . X 3: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 10-06

1 OF 1

METRIC

G.W.P. 2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 863 310.9 E 299 733.6 ORIGINATED BY SLL
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2010.02.04 - 2010.02.04 CHECKED BY SKP

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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
264.1								20	40	60	80	100					
0.0	TOPSOIL, with roots and rootlets: (180mm)						264										
0.2	Clayey SILT, with sand, trace gravel Firm Brown Moist (FILL)		1	SS	4		263							○			1 35 49 15
262.9	Clayey SILT, trace roots and rootlets Firm Brown Moist		2	SS	3		262							○			0 23 61 16
261.9	Silty CLAY, some sand, trace gravel Very Stiff Brown Moist (TILL)		3	SS	18		261							○			1 18 54 27
2.2			4	SS	18		260										
			5	SS	16									○			
258.9																	
5.2	END OF BOREHOLE AT 5.2m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 2.3m, THEN CUTTINGS TO SURFACE.						259										

RECORD OF BOREHOLE No 09-05W

1 OF 2

METRIC

G.W.P. 2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 864 671.4 E 299 417.9 ORIGINATED BY WB
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2009.03.09 - 2009.03.09 CHECKED BY SKP

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						
296.8								20 40 60 80 100						
0.0	Gravelly SAND Loose Wet (FILL)							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE						
296.2								20 40 60 80 100						
0.6	Clayey SILT, some sand, trace gravel Stiff Brown Moist (FILL)		1	SS	14		296							
295.4														
1.4	Silty CLAY, some sand, trace gravel Stiff Brown Moist		2	SS	9		295							
294.6														
2.2	Clayey SILT, some sand, trace gravel Stiff Brown Moist (TILL)		3	SS	9		294							
			4	SS	13		293							
292.5														
4.3	Sandy SILT, trace clay, trace gravel Very Dense Brown Moist (TILL)		5	SS	61		292							
							291							
			6	SS	100/ 0.275		290							
289.8														
7.0	SAND, some silt Compact to Very Dense Brown Moist		7	SS	29		289							
							288							
			8	SS	63									
287.0														
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 09-05W

2 OF 2

METRIC

G.W.P. 2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 864 671.4 E 299 417.9 ORIGINATED BY WB
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2009.03.09 - 2009.03.09 CHECKED BY SKP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT 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																
	BOREHOLE DRY UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.																

ONTMT4S 9268.GPJ 57/110

METRIC

[illegible]

Continued Next Page

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No 11-16

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 862 124.3 E 299 902.5 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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					WATER CONTENT (%) w _p w w _L				
	Continued From Previous Page																
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.																

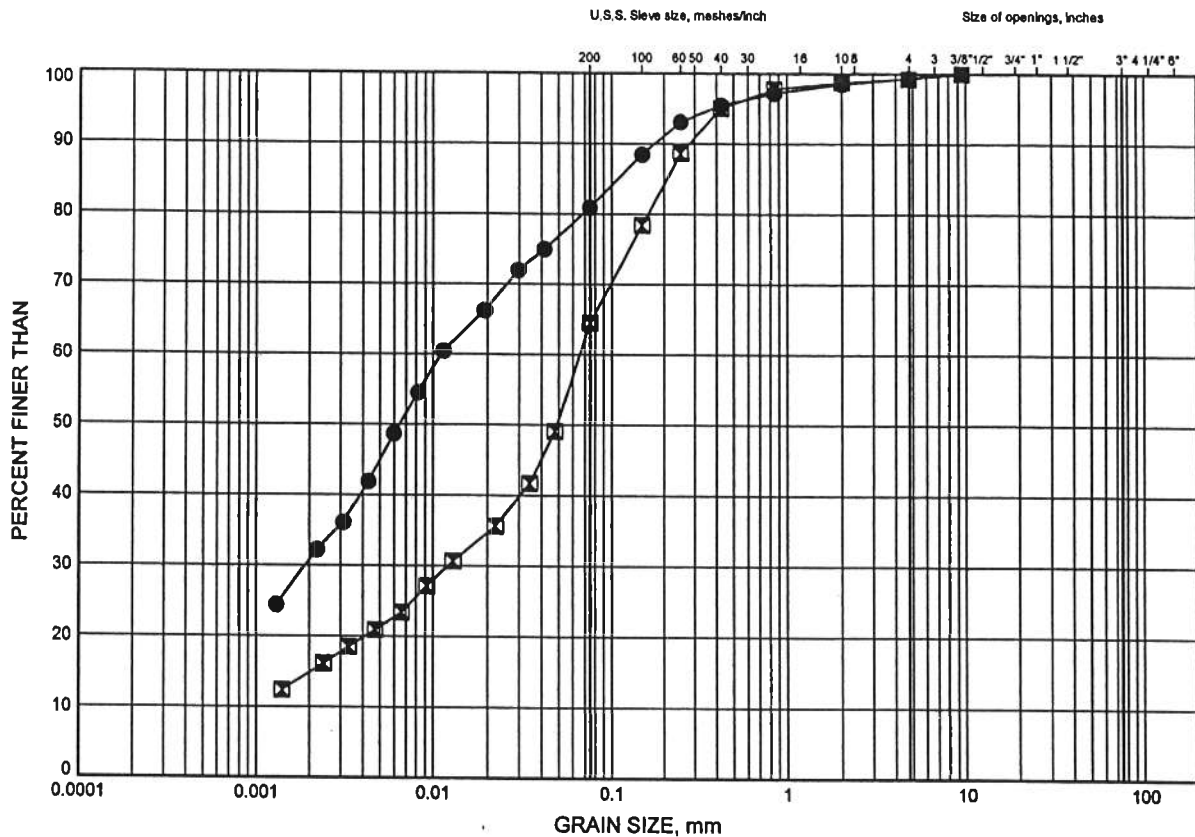
Appendix B

Laboratory Test Results

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

FIGURE B1

SILTY CLAY/CLAYEY SILT FILL



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

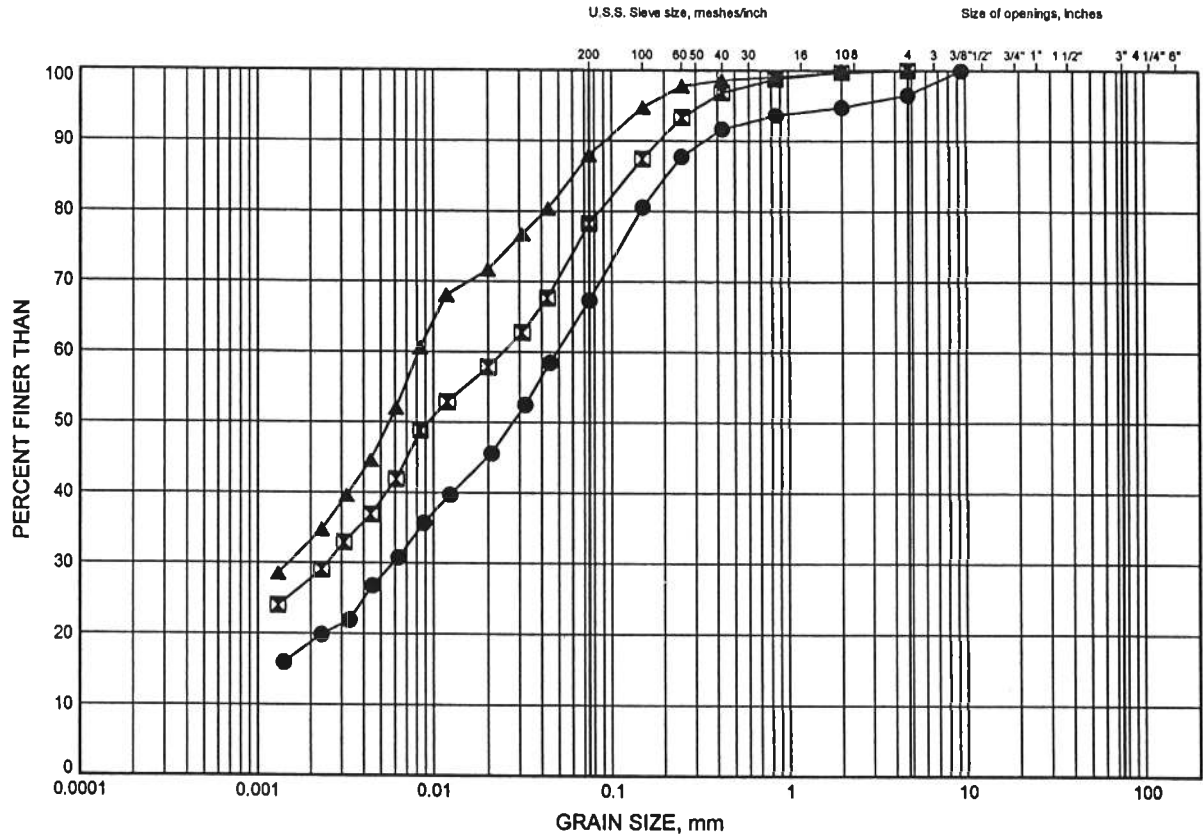
LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	06-16E	1.07	276.35
⊠	10-06	0.99	263.11

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

FIGURE B2

SILTY CLAY



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

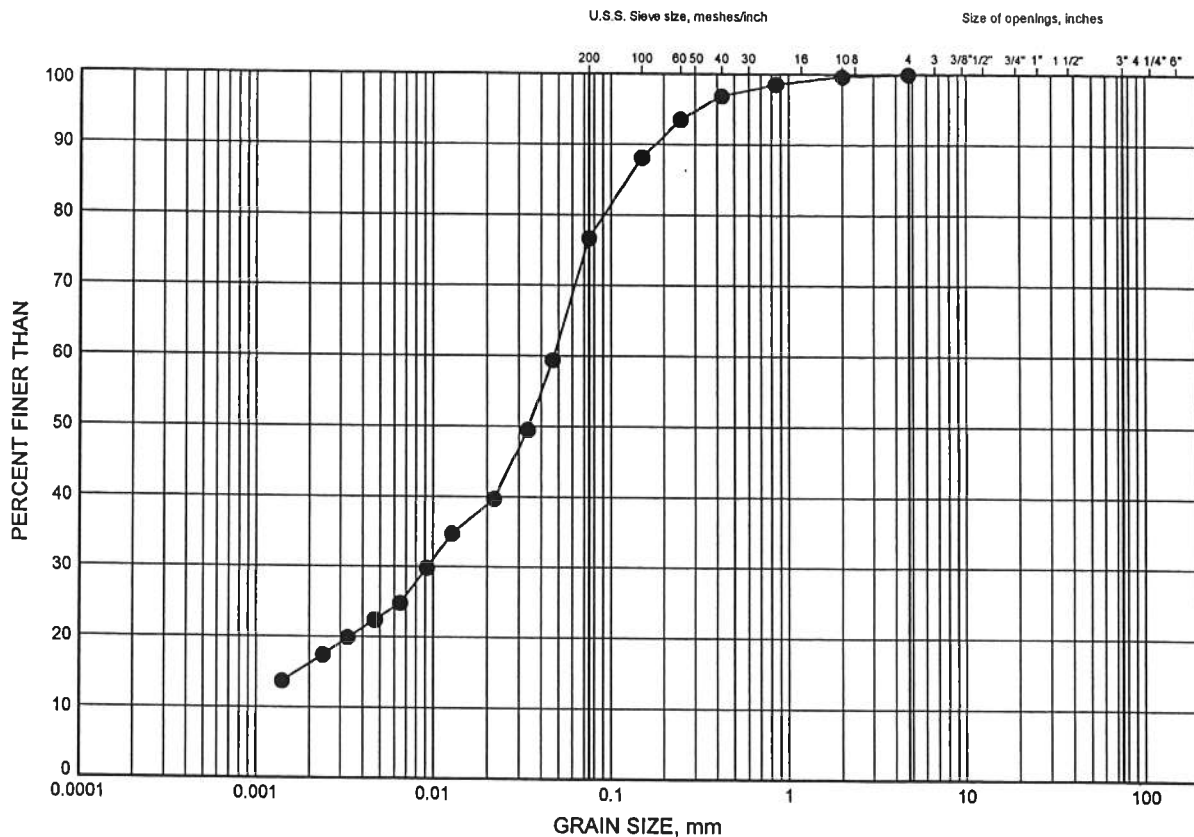
LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	06-05E	1.07	242.10
■	06-08E	3.35	270.58
▲	10-05	1.07	261.45

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

FIGURE B3

CLAYEY SILT



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	10-06	1.83	262.27

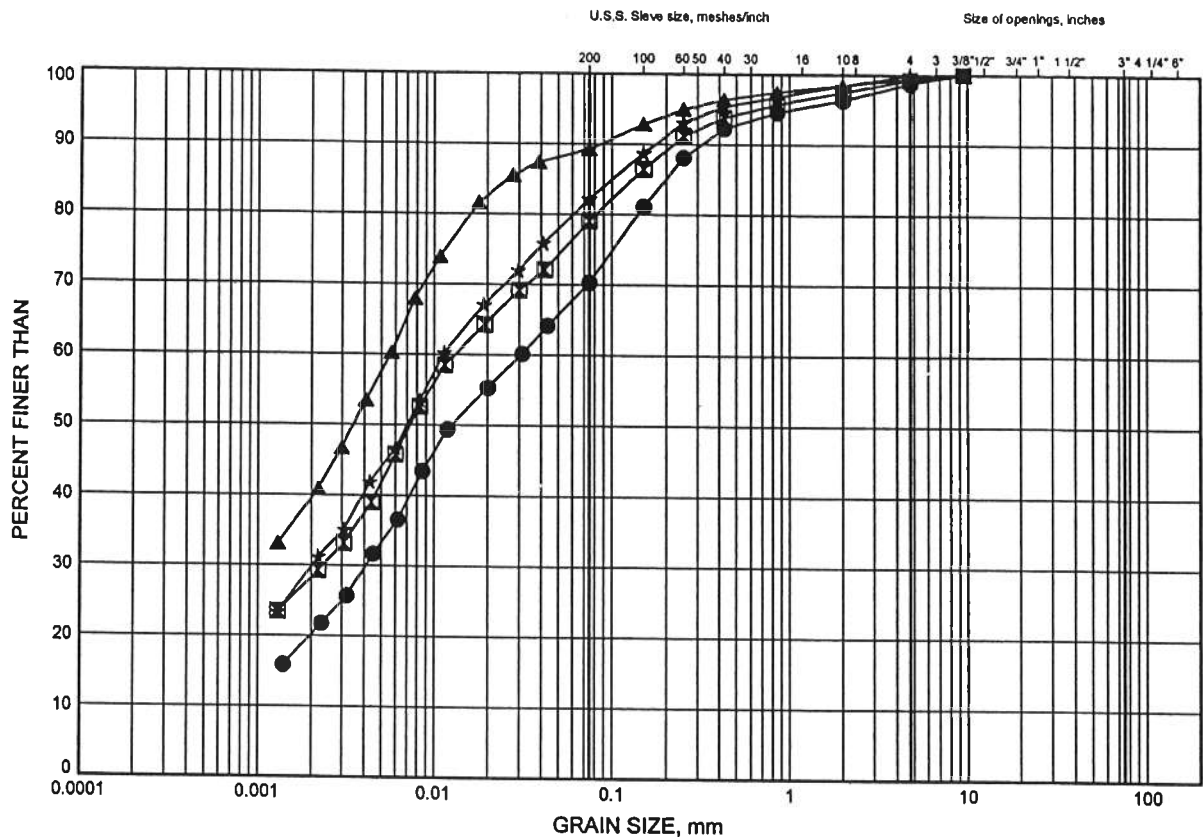


W.P.# 2539-04-00
Prepared By AN
Checked By SKP

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

FIGURE B4

SILTY CLAY TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	06-05E	4.80	238.37
⊠	06-08E	4.88	269.05
▲	06-08E	7.92	266.01
★	06-16E	4.88	272.54

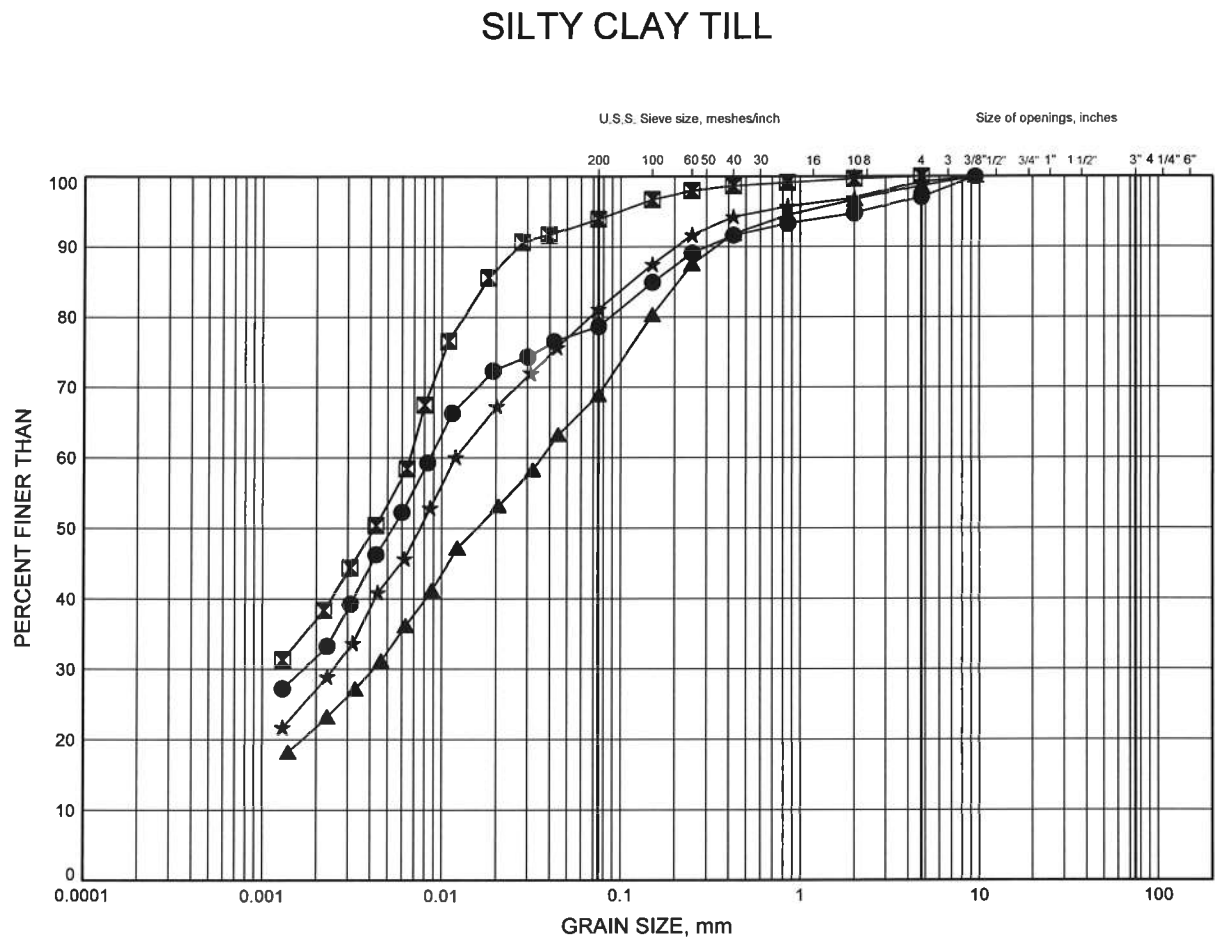


W.P.# .2539-04-00.....
Prepared By .AN.....
Checked By .SKP.....

Widening of Hwy 400, Major Mackenzie to King Road

GRAIN SIZE DISTRIBUTION

FIGURE B5



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	06-12W	1.83	269.77
■	06-12W	4.88	266.72
▲	06-12W	7.92	263.68
★	10-06	3.35	260.75

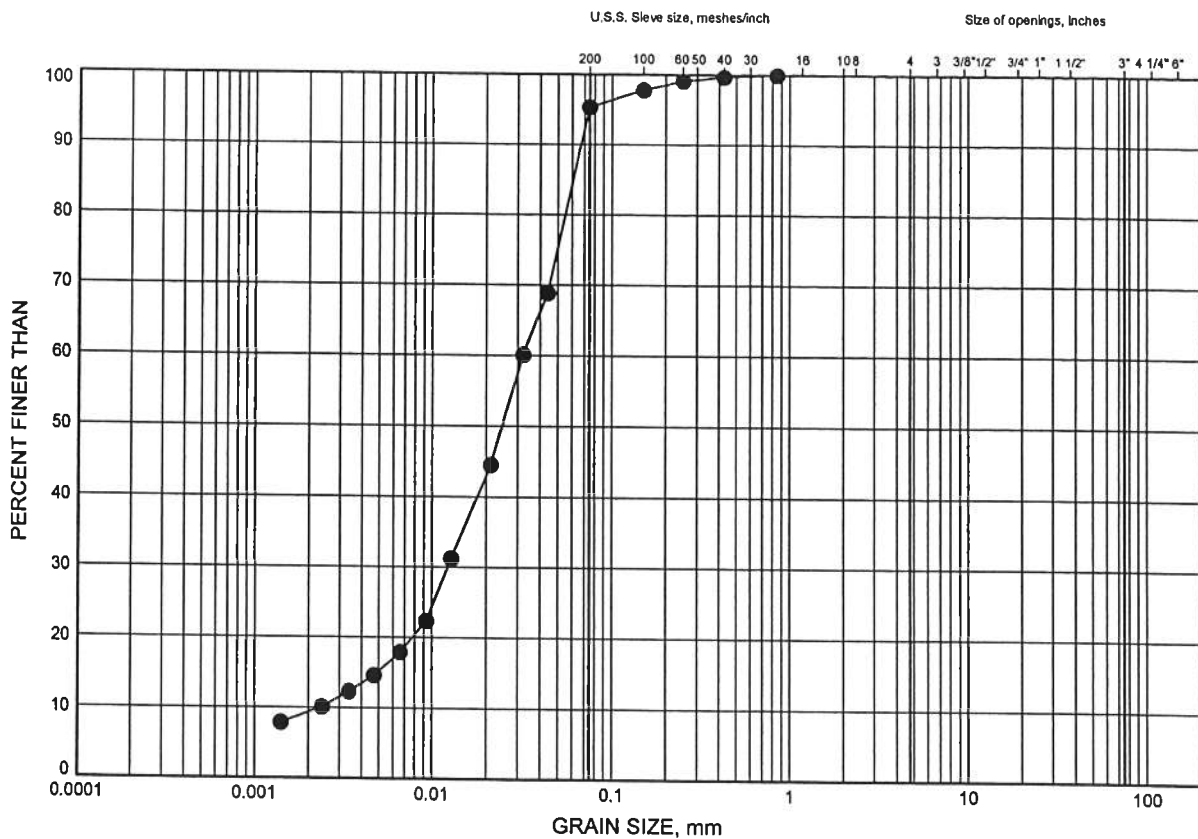


W.P.# 2539-04-00
 Prepared By AN
 Checked By SKP

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

FIGURE B6

CLAYEY SILT TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	10-05	2.59	259.93

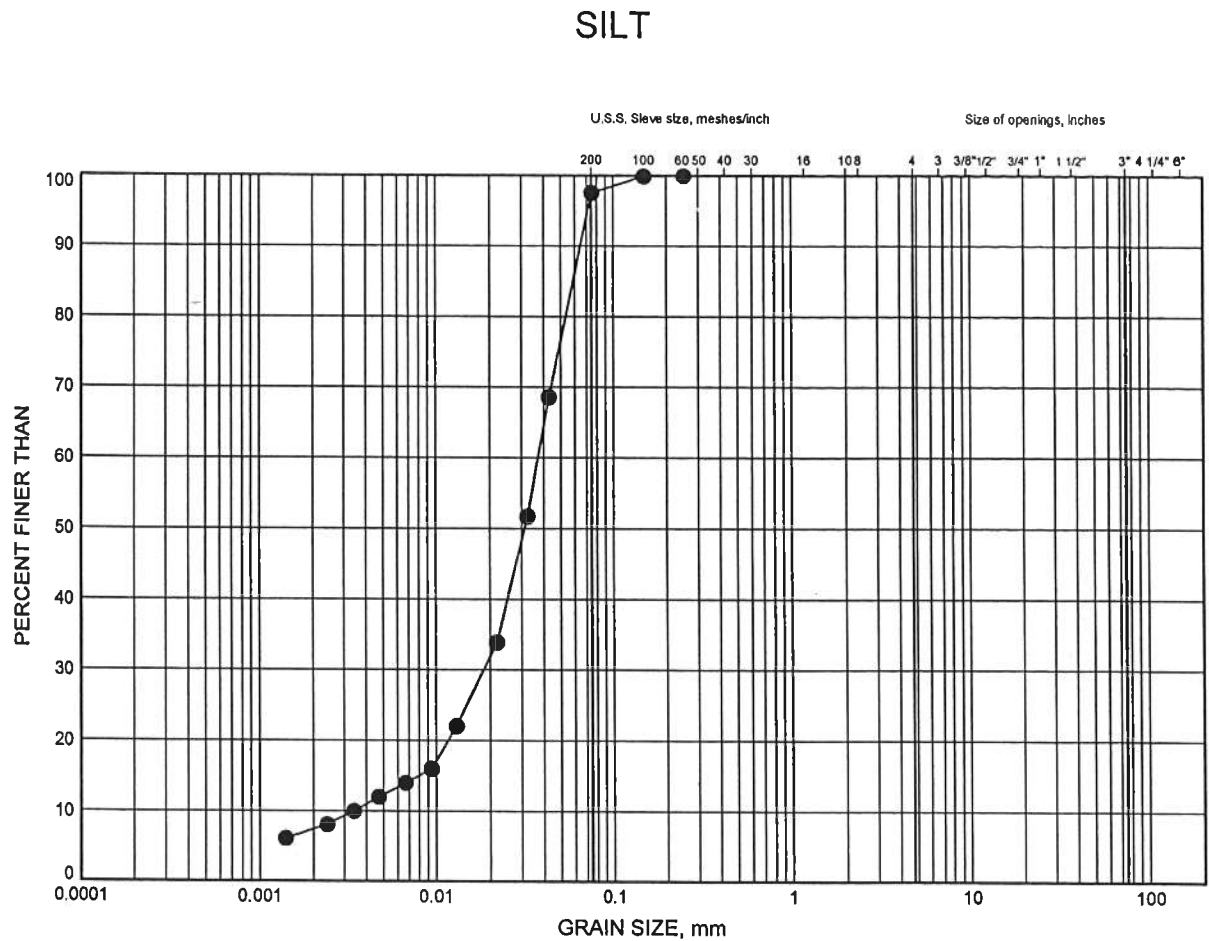


W.P.# 2539-04-00
Prepared By AN
Checked By SKP

Widening of Hwy 400, Major Mackenzie to King Road

GRAIN SIZE DISTRIBUTION

FIGURE B7



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	10-05	4.88	257.64

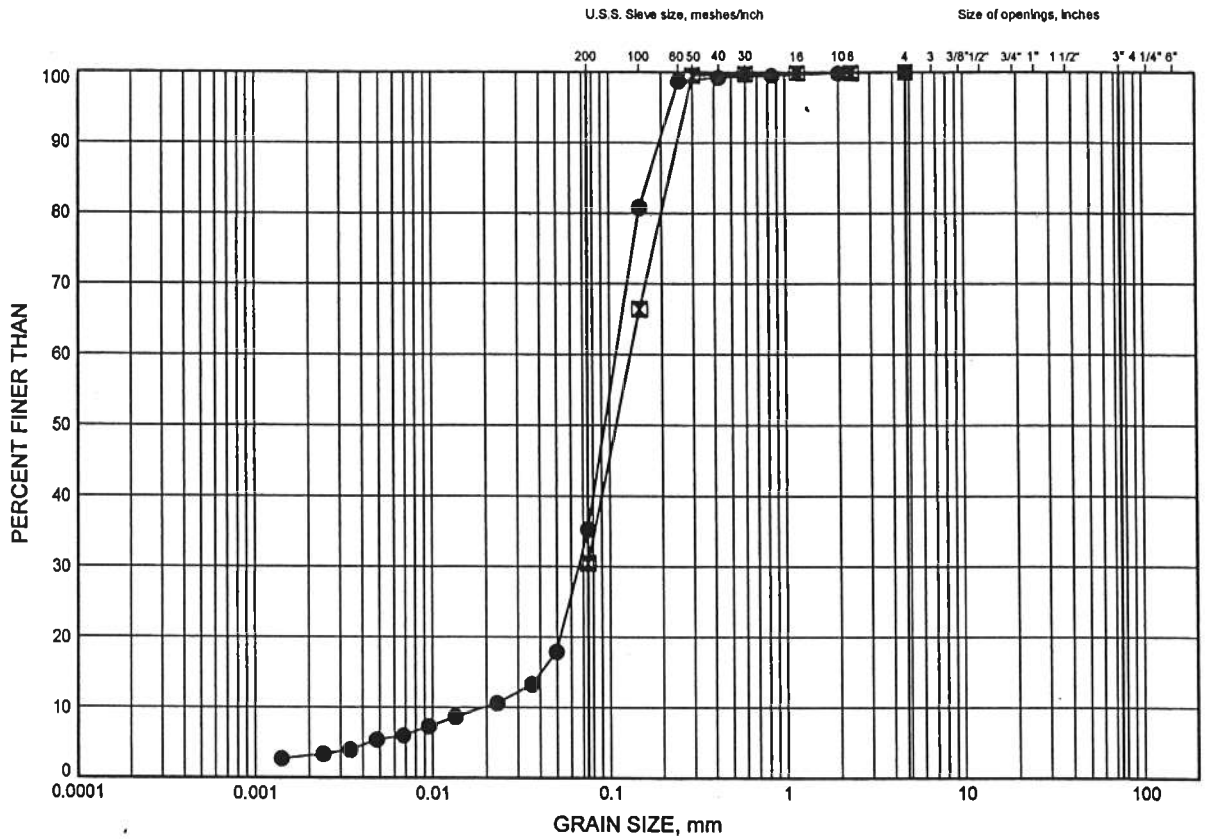


W.P.# 2539-04-00
 Prepared By AN
 Checked By SKP

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

FIGURE B8

SAND to SILTY SAND



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	06-05E	6.40	236.77
⊠	10-05	6.40	256.12

GRAIN SIZE DISTRIBUTION - THURBER 9268.GPJ 8/10/10

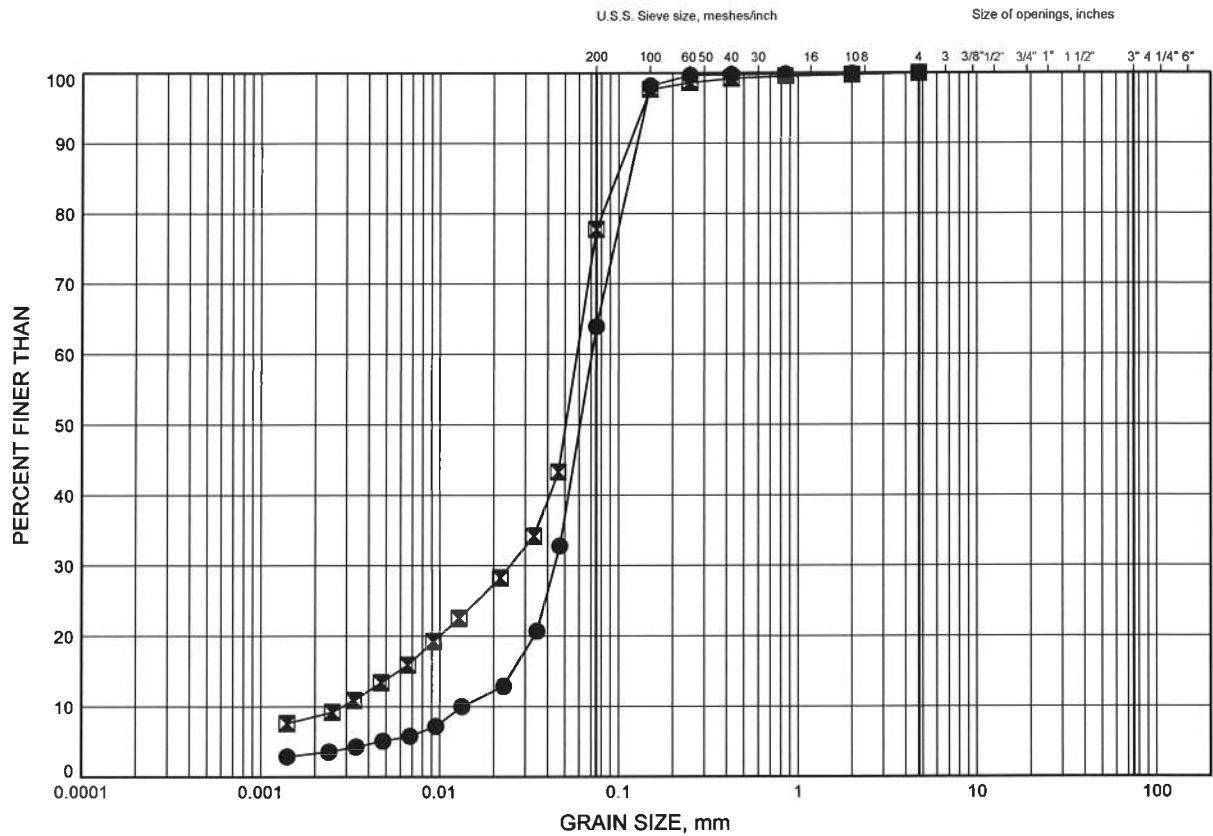
W.P.# 2539-04-00
Prepared By AN
Checked By SKP



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

FIGURE B9

SANDY SILT/SAND & SILT TILL



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

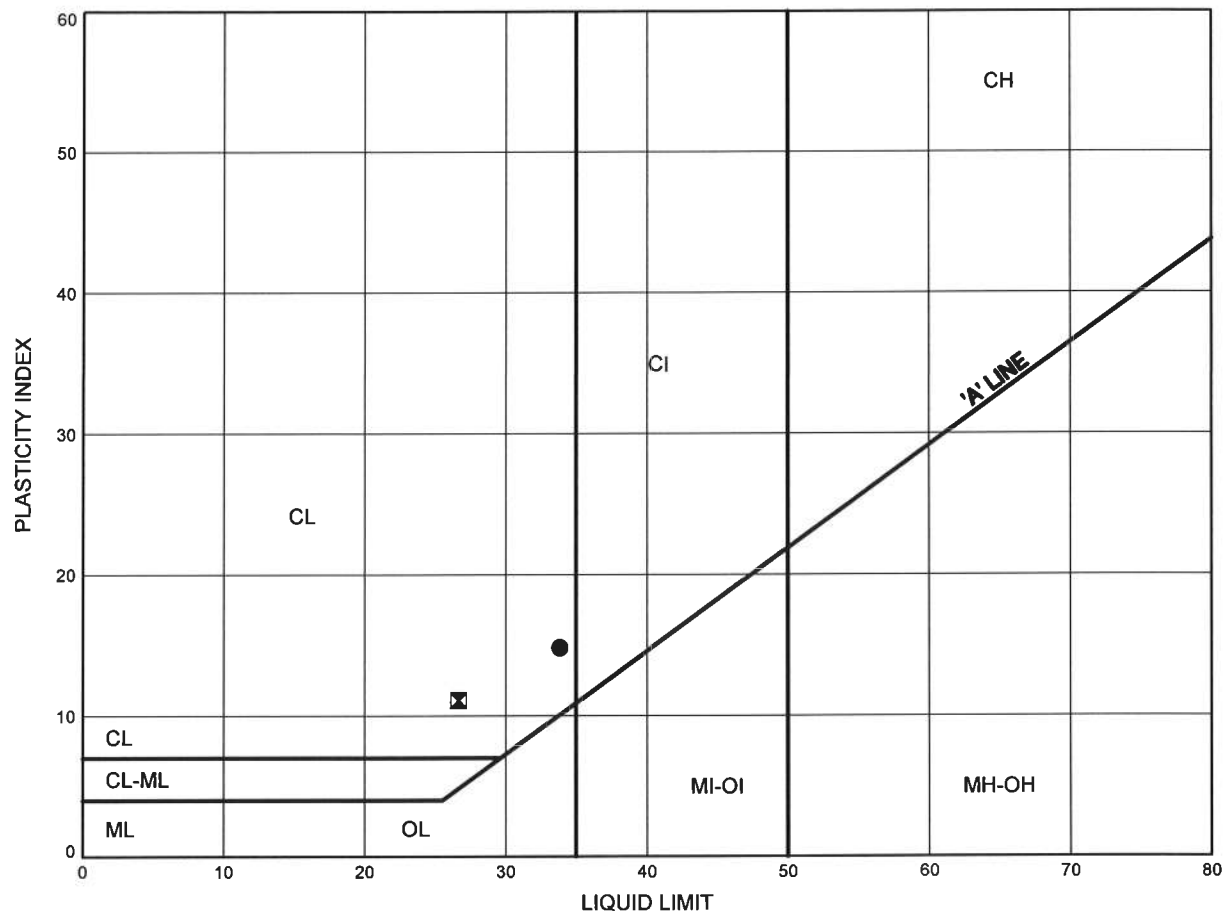
LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	06-05W	4.88	235.99
■	CV-13A	3.35	225.62

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

FIGURE B10

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-08E	3.35	270.58
⊠	10-05	1.07	262.13

Date January 2012
 Project 2539-04-00

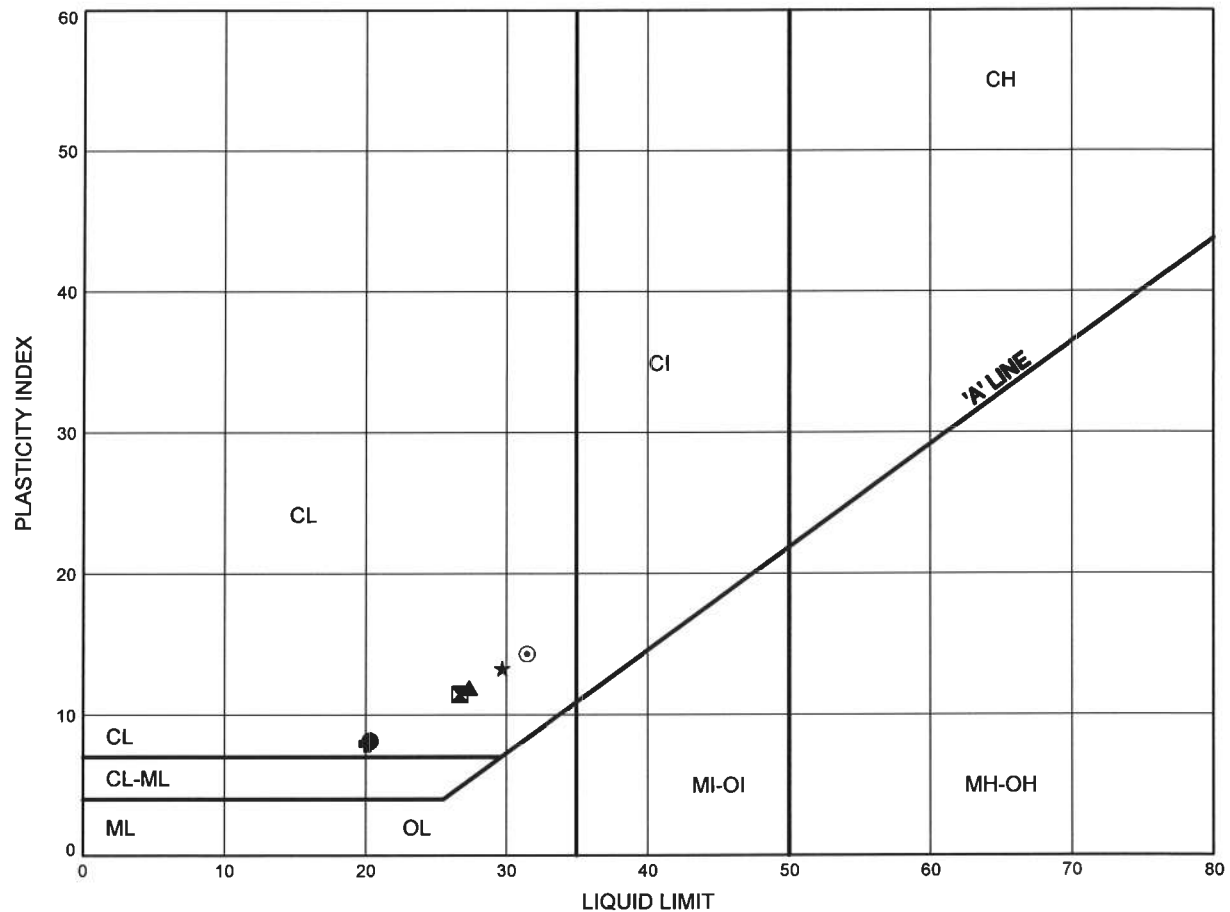


Prep'd AN
 Chkd. SKP

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

FIGURE B11

SILTY CLAY TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-05E	4.80	238.37
⊠	06-08E	4.88	269.05
▲	06-08E	7.92	266.01
★	06-12W	1.83	269.77
⊙	06-12W	4.88	266.72
⊕	06-12W	7.92	263.68

Date January 2012
 Project 2539-04-00

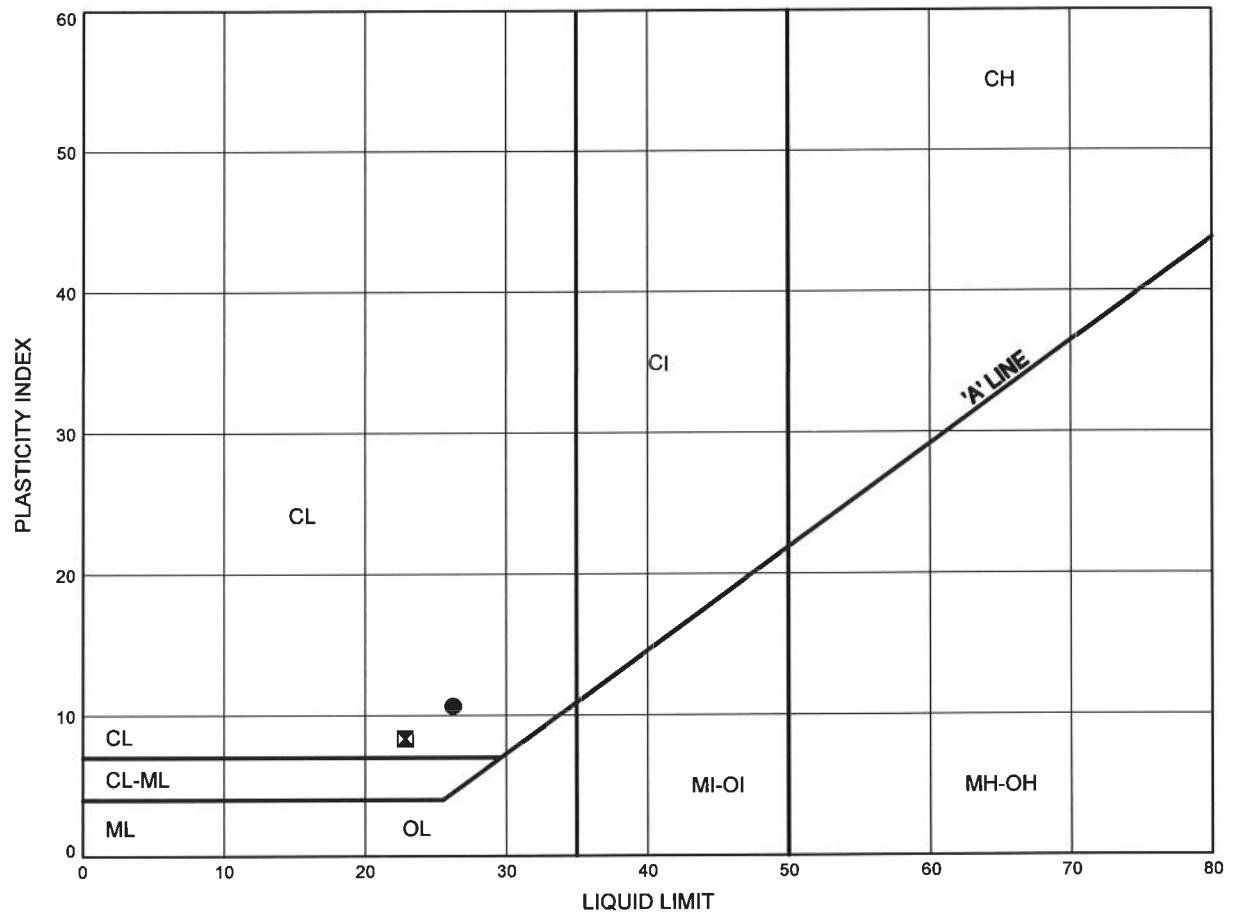


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 Chkd. SKP

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

FIGURE B12

SILTY CLAY TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-16E	4.88	272.54
⊠	10-06	3.35	260.75

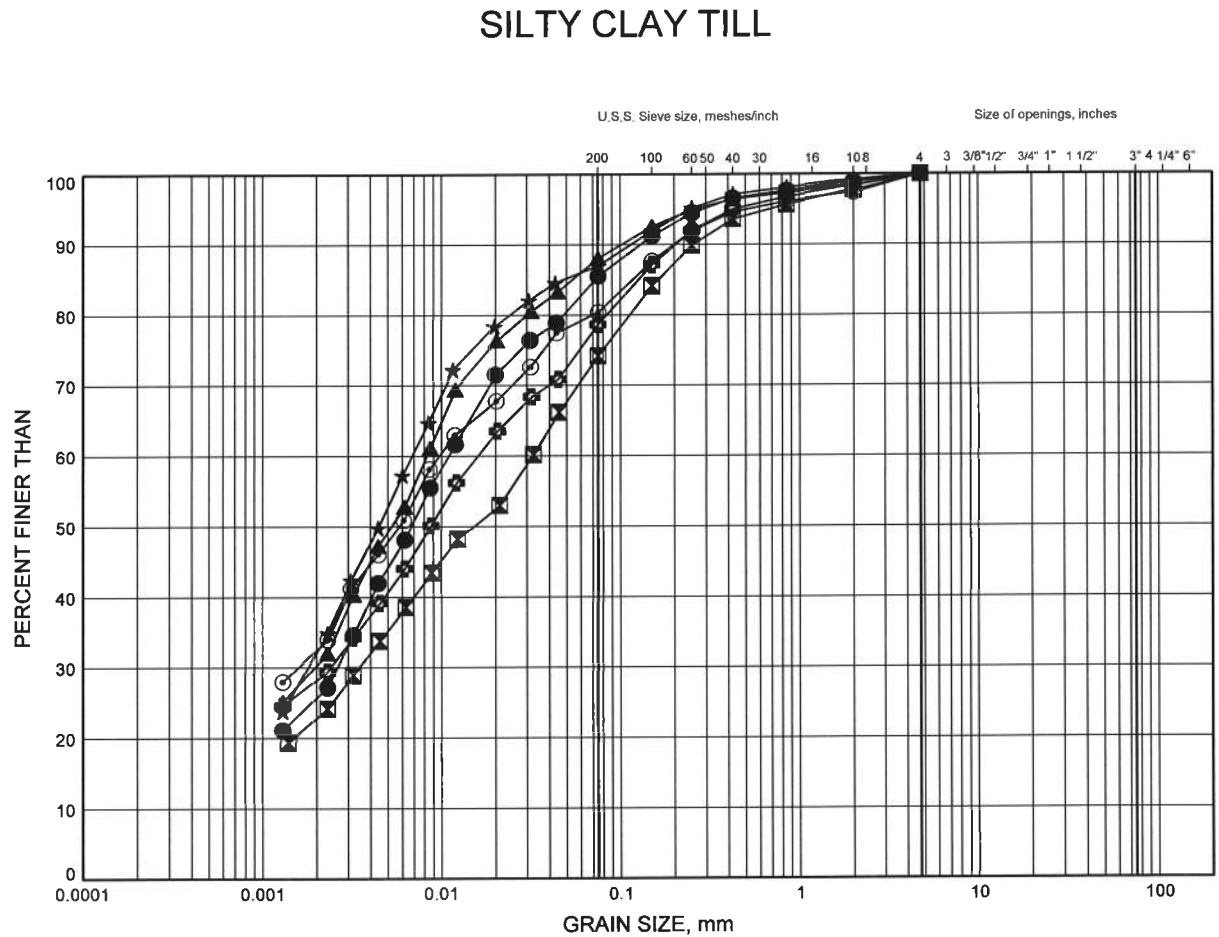
Date January 2012
 Project 2539-04-00



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 Chkd. SKP

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

FIGURE B13



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

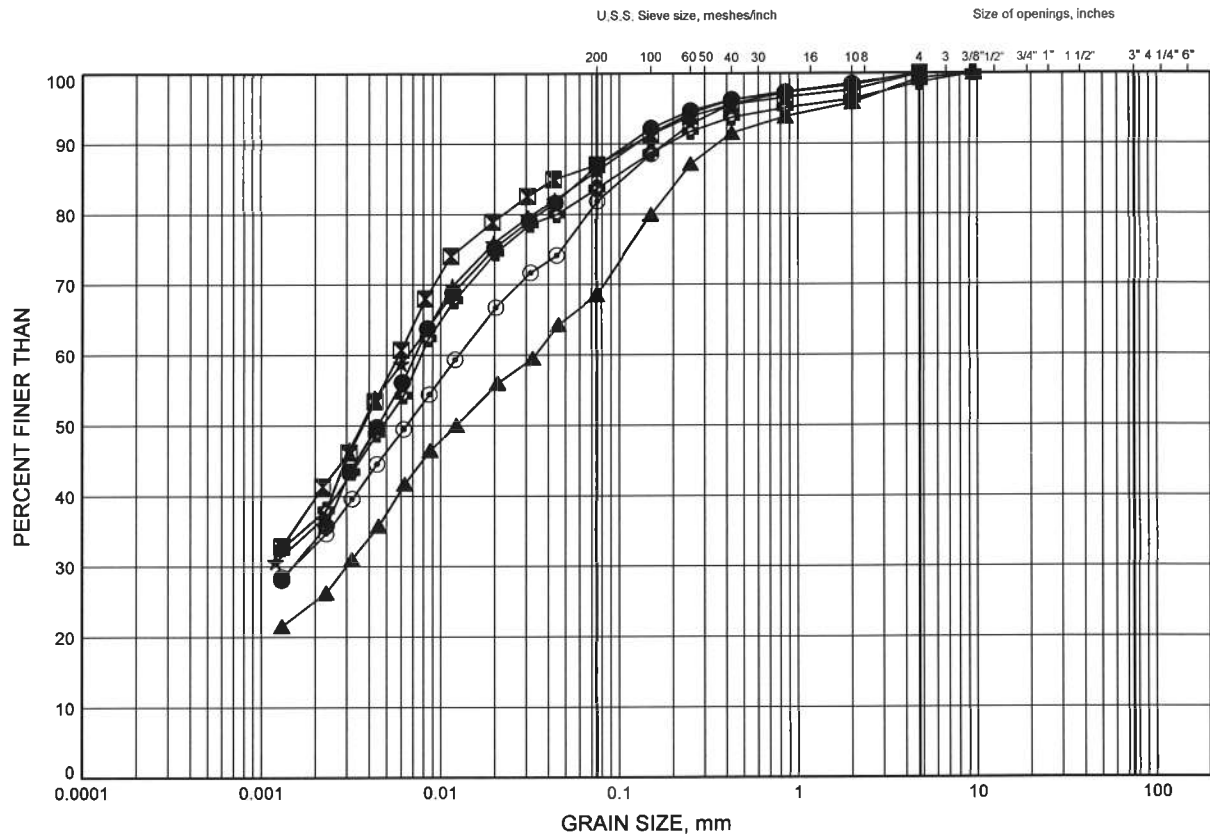
LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	C-16A	4.80	253.36
⊠	C-16B	2.59	252.90
▲	C-16B	6.32	249.17
★	C-17A	2.59	257.85
⊙	C-17A	6.40	254.04
⊕	C-17B	1.07	257.29

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

FIGURE B14

SILTY CLAY TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	C-17B	4.88	253.48
⊠	C-18A	2.59	257.72
▲	C-18A	6.40	253.91
★	C-18B	2.59	258.90
⊙	C-20	3.35	273.75
⊗	C-20	7.92	269.17

GRAIN SIZE DISTRIBUTION - THURBER 9268.GPJ 1/26/12

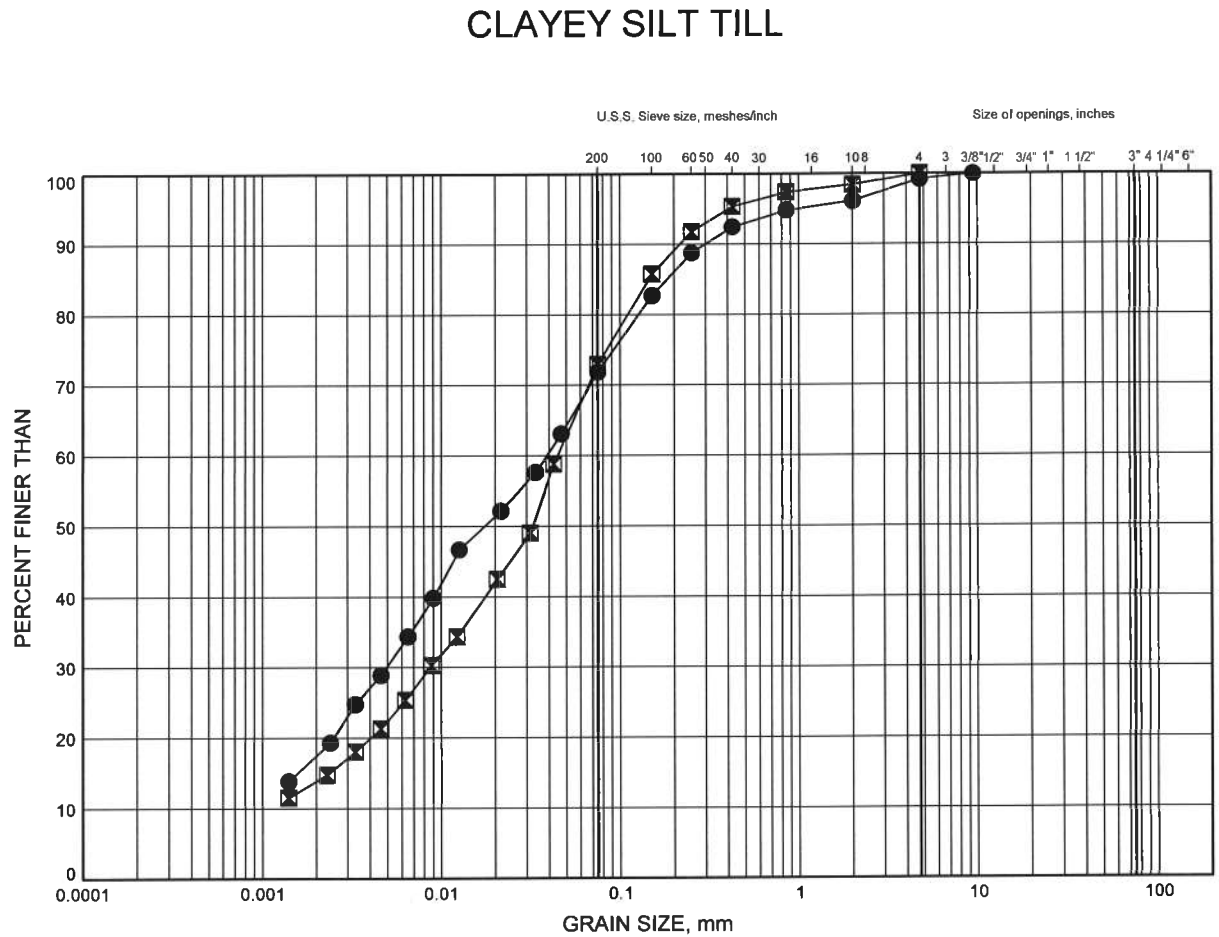
W.P.# 2539-04-00
Prepared By AN
Checked By SKP



Widening of Hwy 400, Major Mackenzie to King Road

GRAIN SIZE DISTRIBUTION

FIGURE B15



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

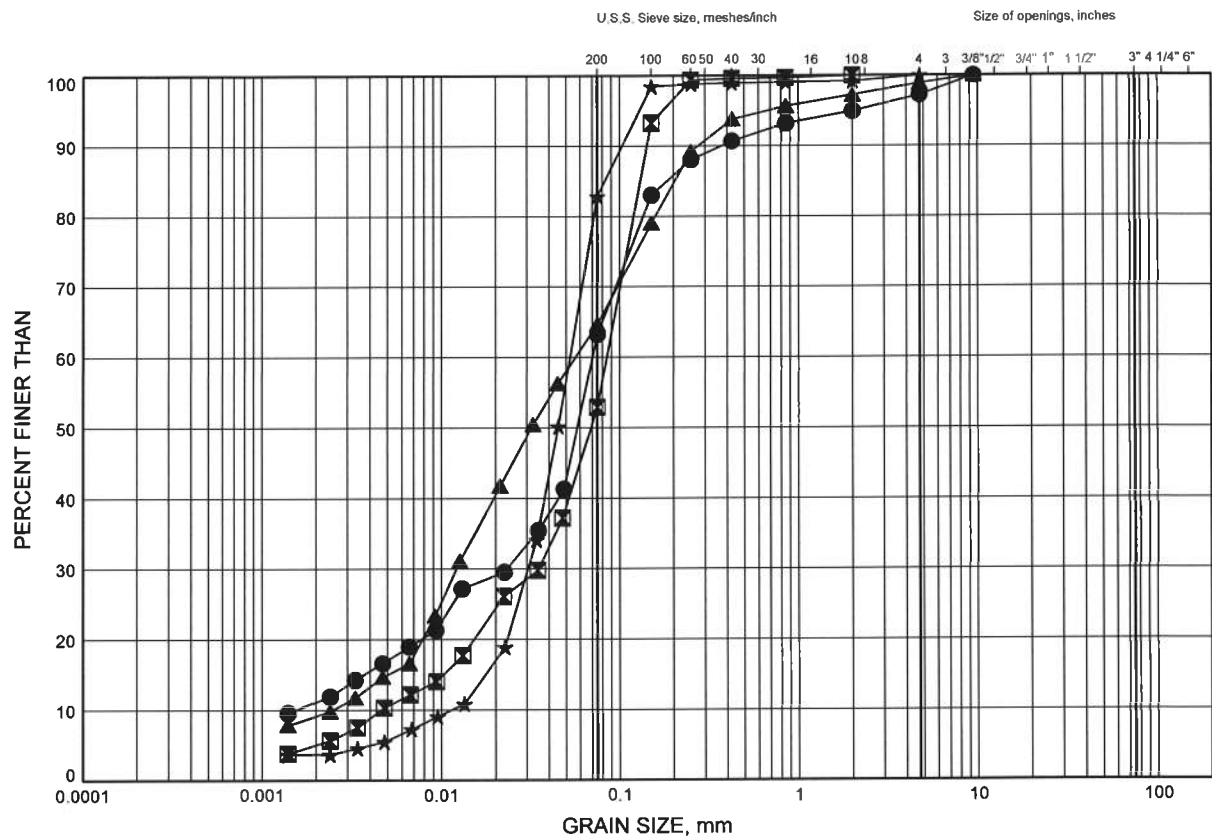
LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	C-14	4.78	239.84
⊠	C-16A	1.83	256.33

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

FIGURE B16

SILT to SILT and SAND



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

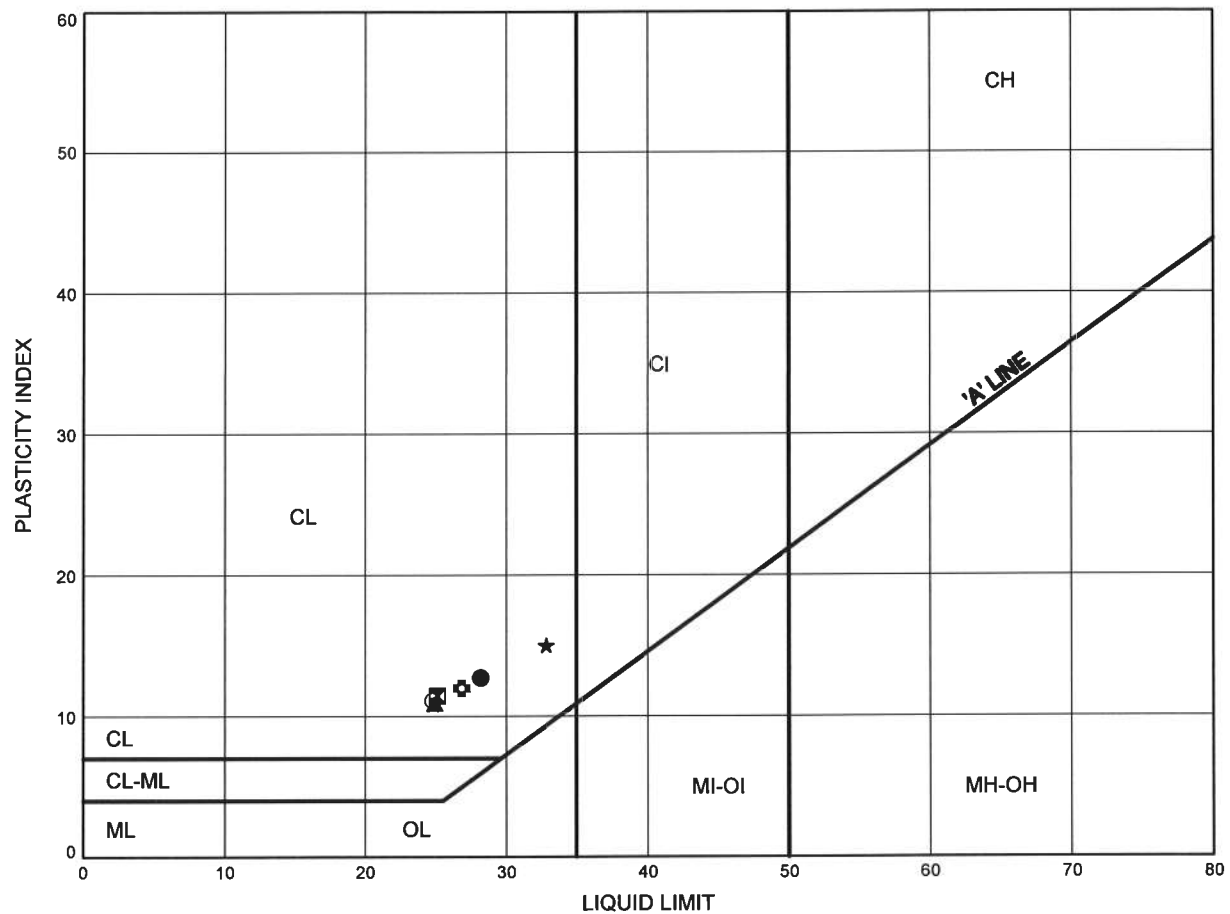
LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	C-14	1.76	242.85
⊠	C-14	7.88	236.74
▲	C-16A	7.85	250.31
★	C-18B	7.92	253.57

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

FIGURE B17

SILTY CLAY TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	C-16A	4.80	253.36
⊠	C-16B	2.59	252.90
▲	C-16B	6.32	249.17
★	C-17A	2.59	257.85
⊙	C-17A	6.40	254.04
⊕	C-17B	1.07	257.29

Date January 2012
 Project 2539-04-00

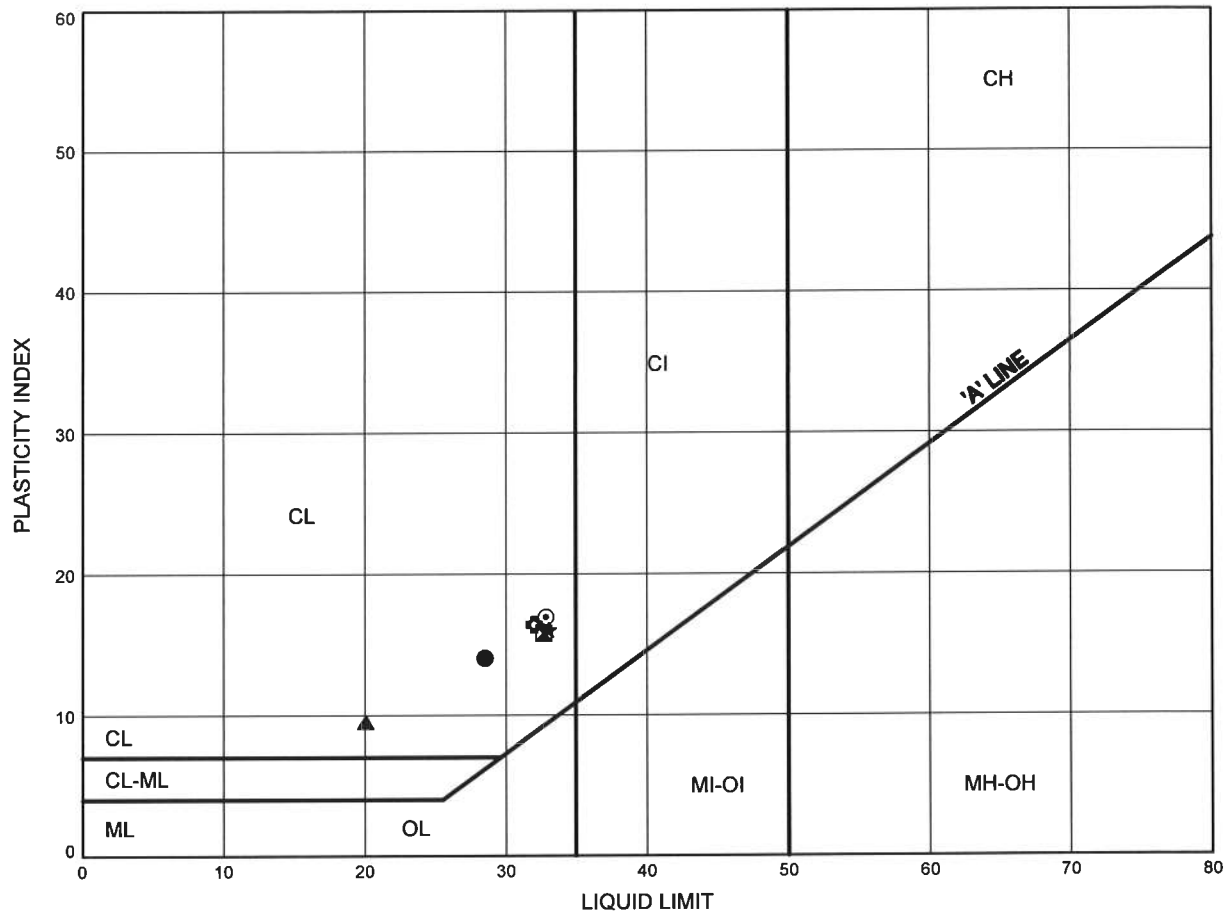


Prep'd AN
 Chkd. SKP

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

FIGURE B18

SILTY CLAY TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	C-17B	4.88	253.48
⊠	C-18A	2.59	257.72
▲	C-18A	6.40	253.91
★	C-18B	2.59	258.90
⊙	C-20	3.35	273.75
⊗	C-20	7.92	269.17

Date January 2012
 Project 2539-04-00

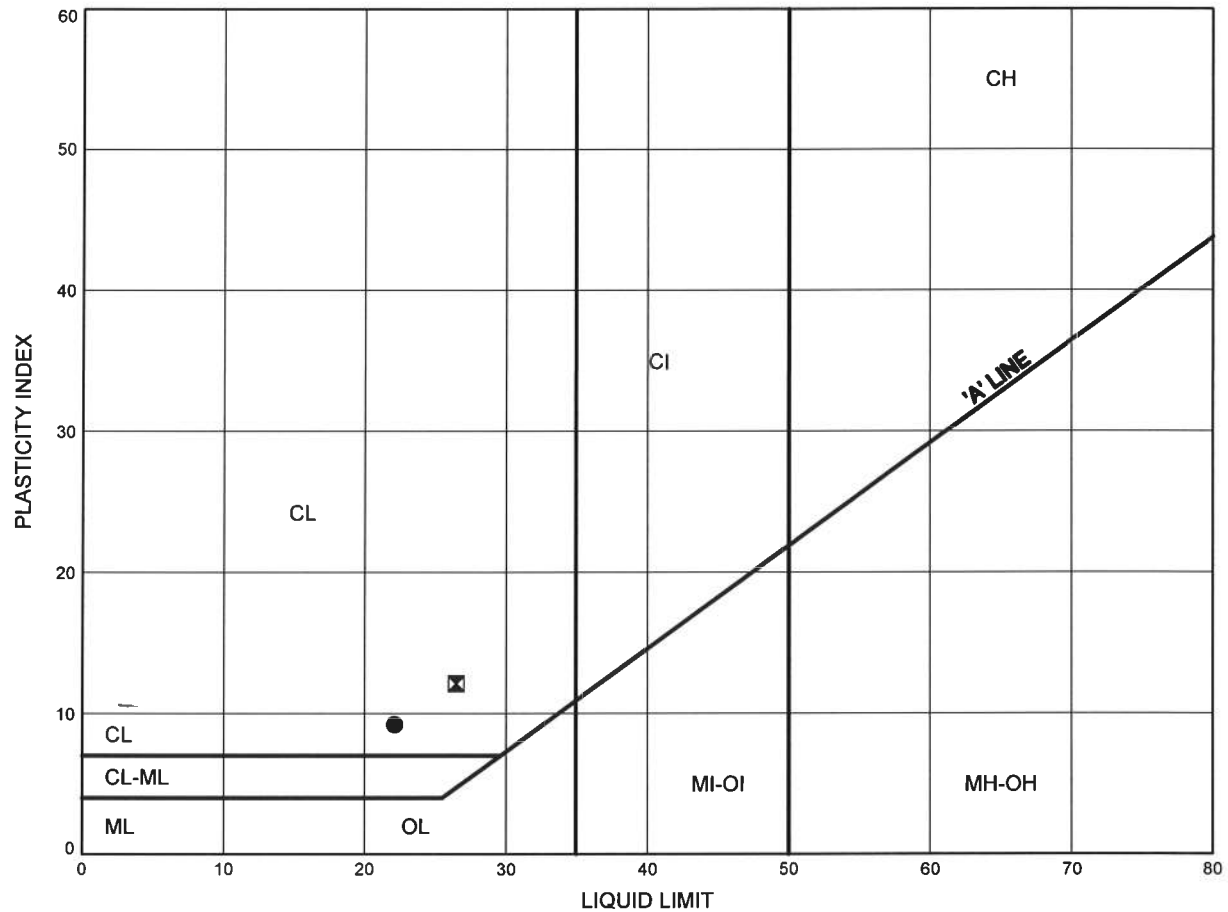


Prep'd AN
 Chkd. SKP

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

FIGURE B19

CLAYEY SILT TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	C-14	4.78	239.84
⊠	C-16A	1.83	256.33

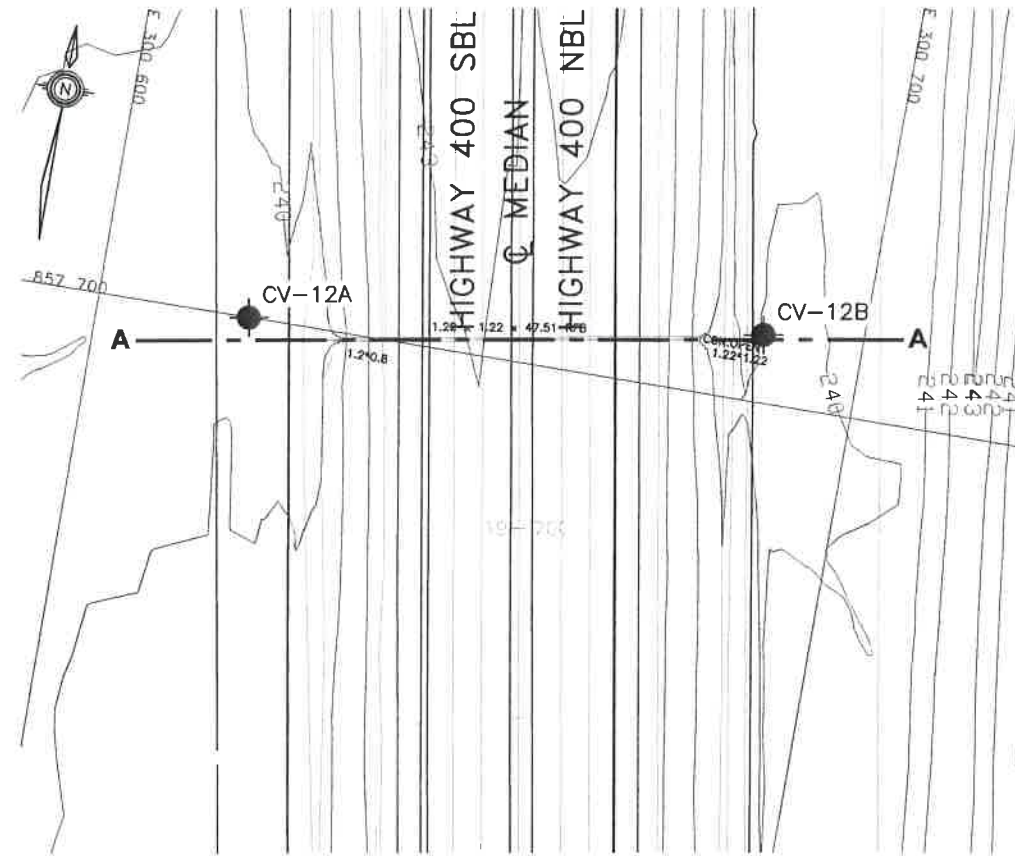
Date January 2012
 Project 2539-04-00



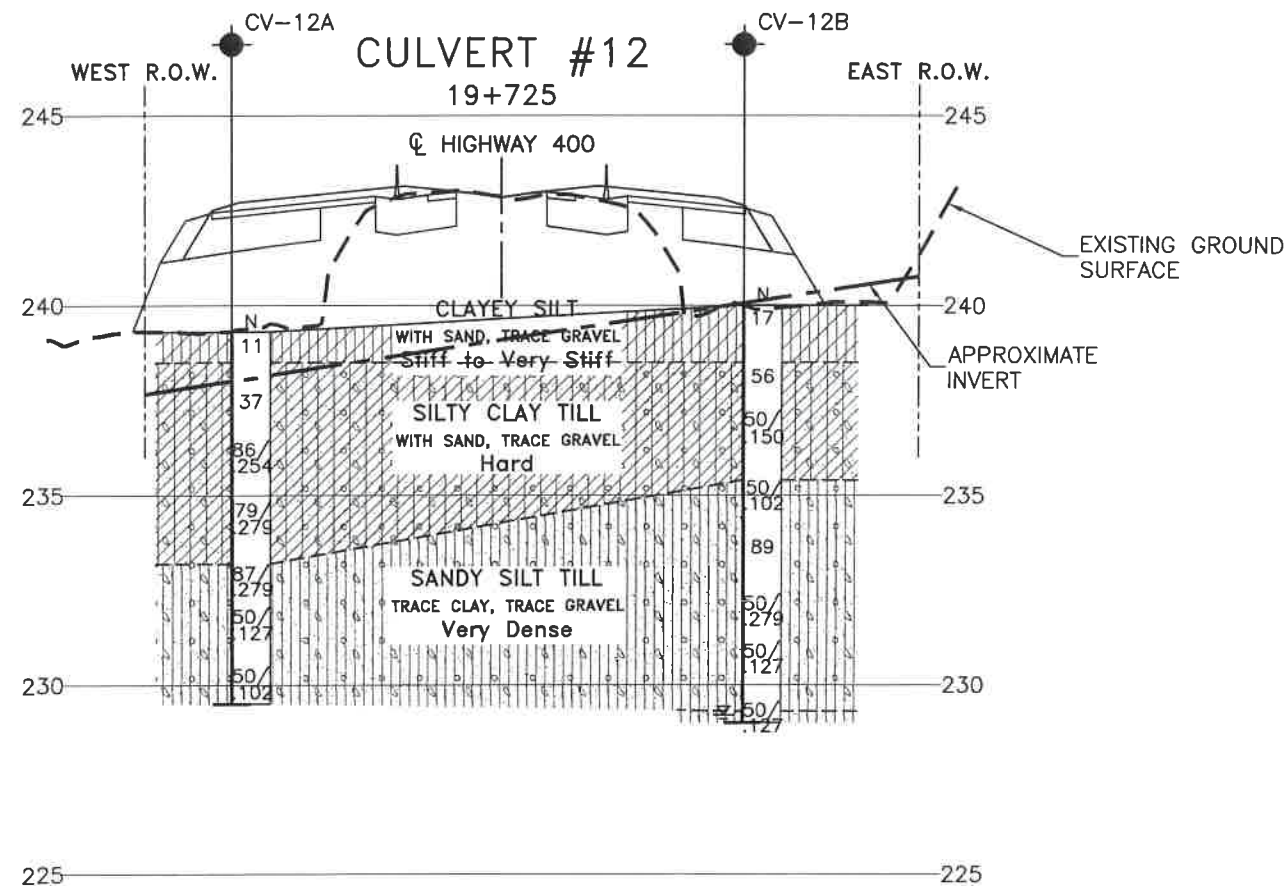
Prep'd AN
 Chkd. SKP

Appendix C

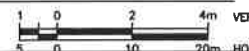
Borehole Locations and Soil Strata Drawings



PLAN



SECTION A-A



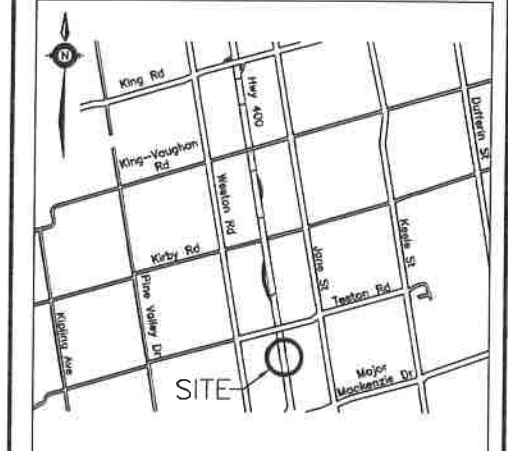
METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No
WP No 2539-04-00

TESTON ROAD TO KING ROAD
CULVERT #12
BOREHOLE LOCATIONS AND SOIL STRATA

SNC-LAVALIN

THURBER ENGINEERING LTD.



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
W	Head Artesian Water
W	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

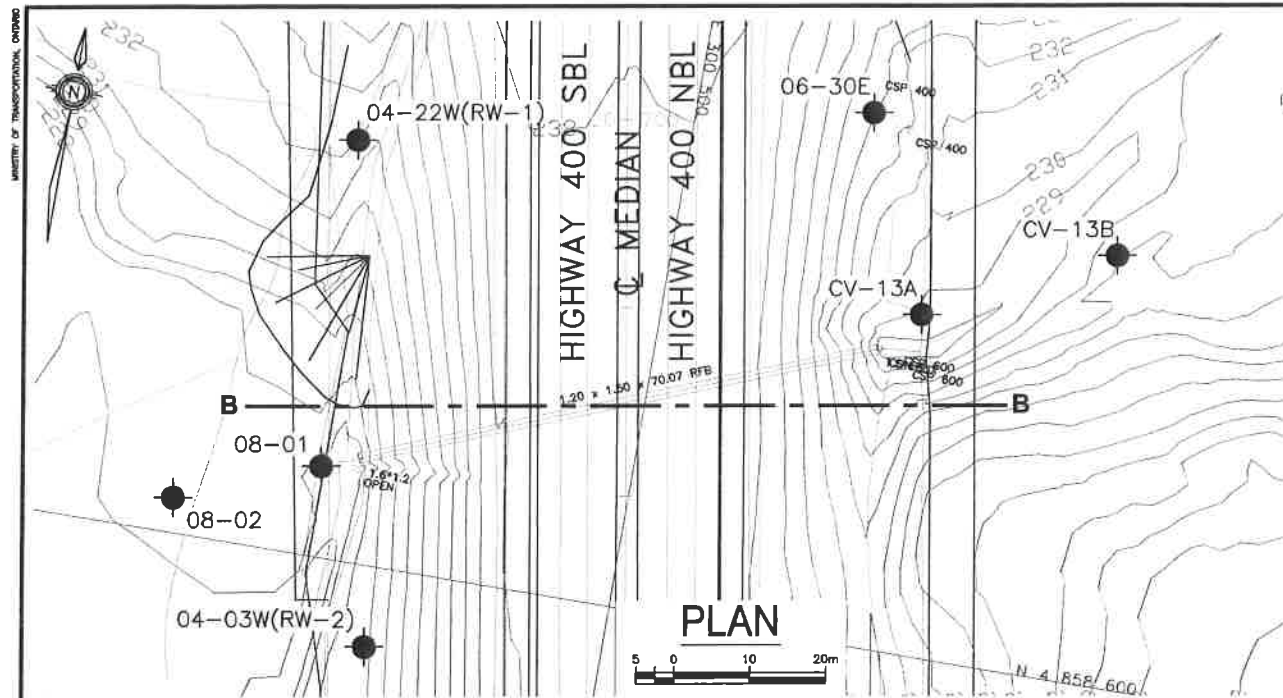
NO	ELEVATION	NORTHING	EASTING
CV-12A	239.3	4 857 700.1	300 620.0
CV-12B	240.0	4 857 709.0	300 687.0

-NOTES-

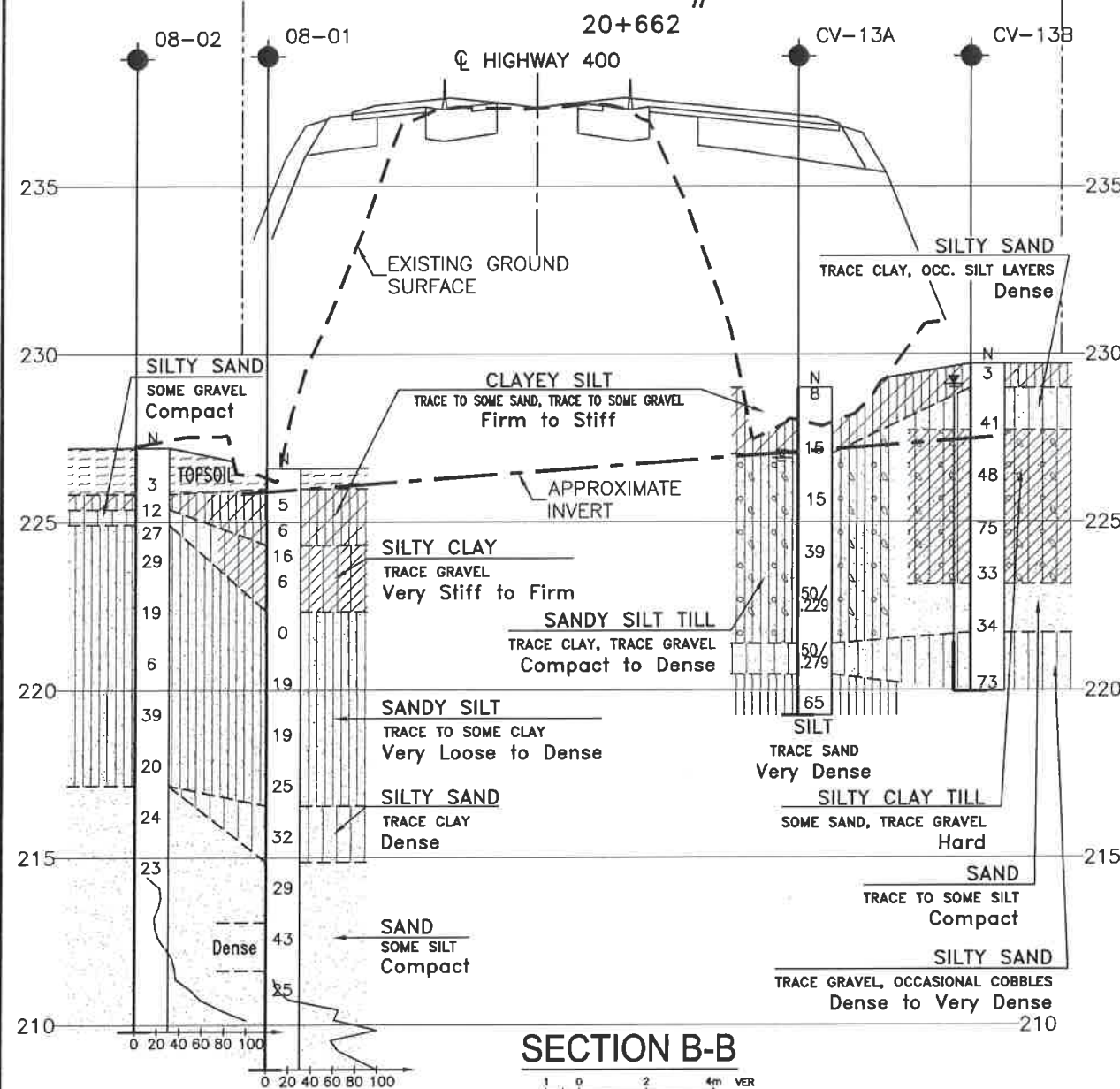
- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCRE No. 30M13-190

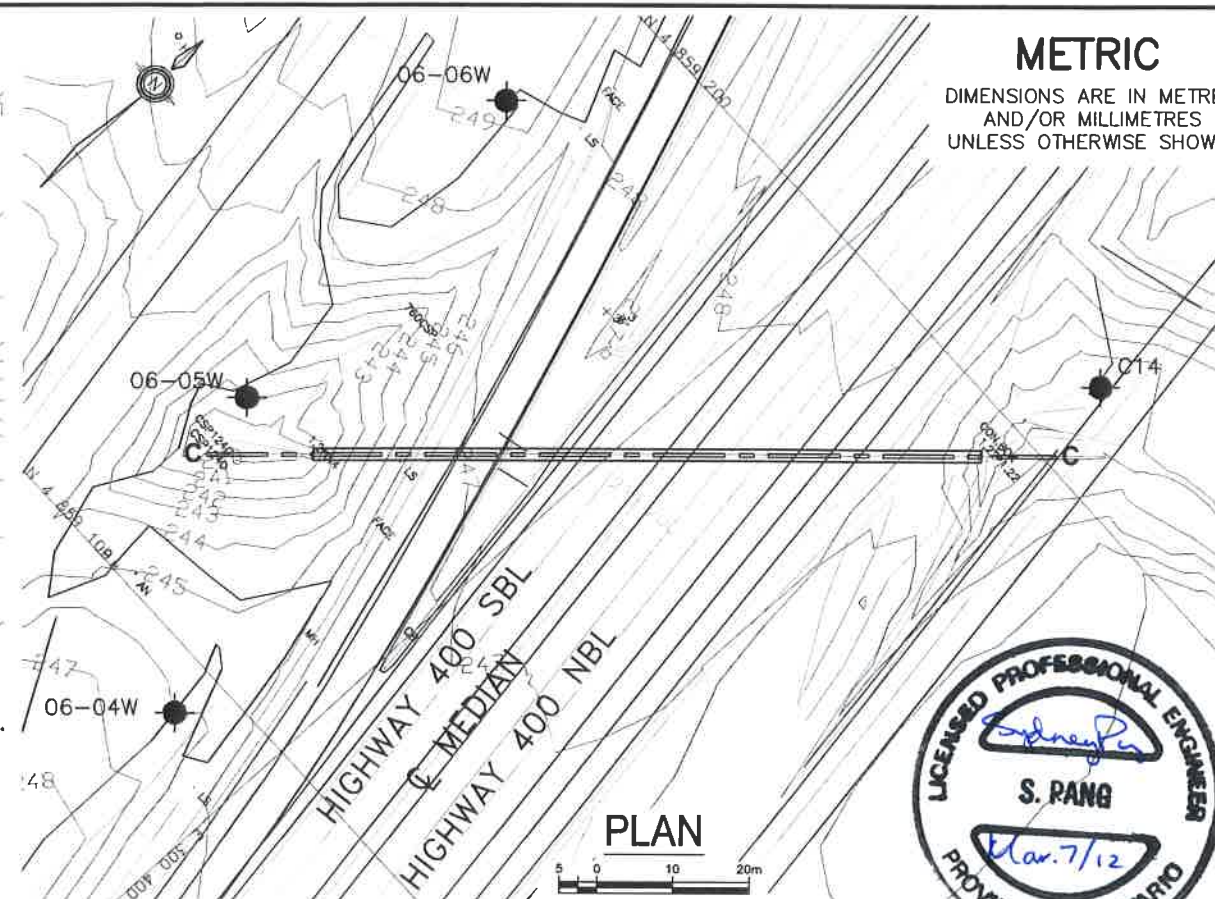
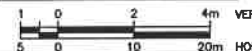
REVISIONS	DATE	BY	DESCRIPTION
DESIGN SKP	CHK	PKC	CODE
DRAWN MFA	CHK	SKP	SITE
			STRUCT
			LDWG



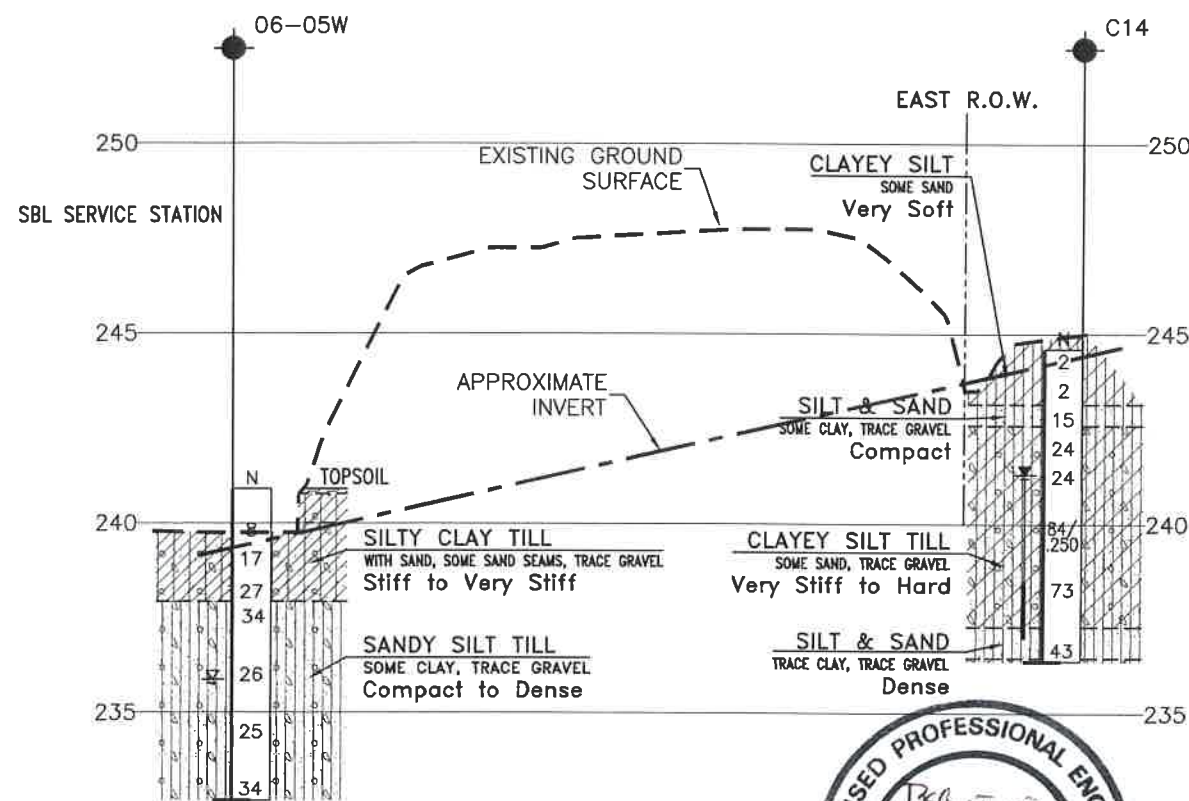
WEST R.O.W. CULVERT #13 20+662 EAST R.O.W.



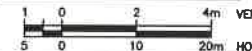
SECTION B-B



CULVERT #14 21+214



SECTION C-C



METRIC

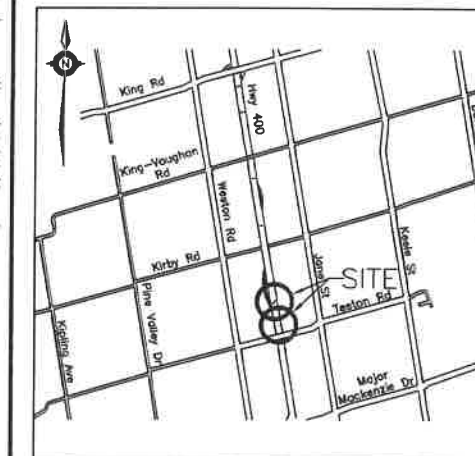
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No
WP No 2539-04-00

TESTON ROAD TO KING ROAD
CULVERTS #13 & #14
BOREHOLE LOCATIONS AND SOIL STRATA

SNC-LAVALIN

THURBER ENGINEERING LTD.



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
W	Head Artesian Water
W	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
04-03W(RW-2)	229.1	4 858 589.5	300 469.5
CV-13A	229.0	4 858 645.0	300 534.0
CV-13B	229.7	4 858 657.0	300 558.0
08-01	226.6	4 858 612.1	300 459.8
08-02	227.2	4 858 604.7	300 441.2
06-04W	246.1	4 859 096.3	300 383.5
06-05W	240.9	4 859 131.2	300 359.1
06-06W	249.5	4 859 182.8	300 352.5
C-14	244.6	4 859 214.9	300 433.5

NOTES

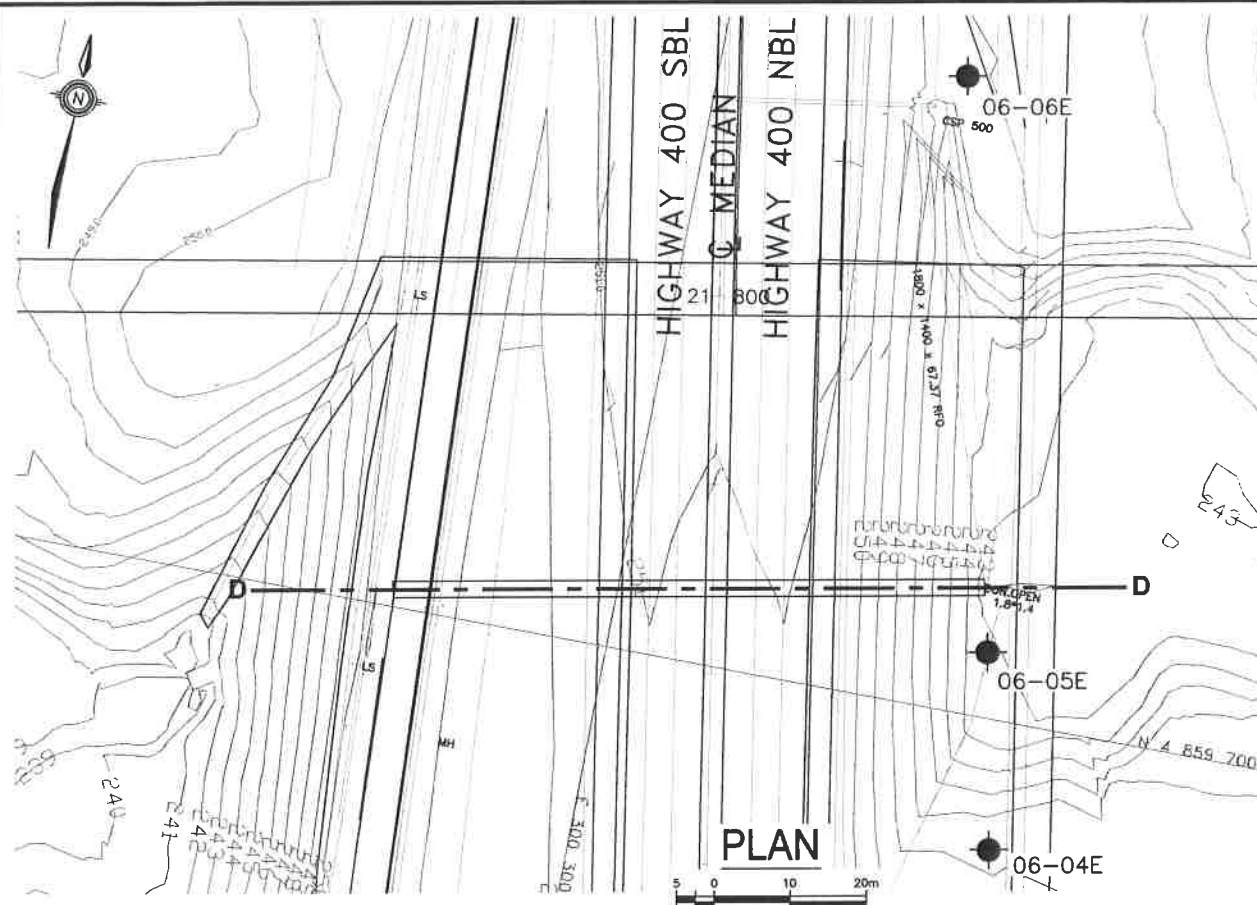
- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCREs No. 30M13-190

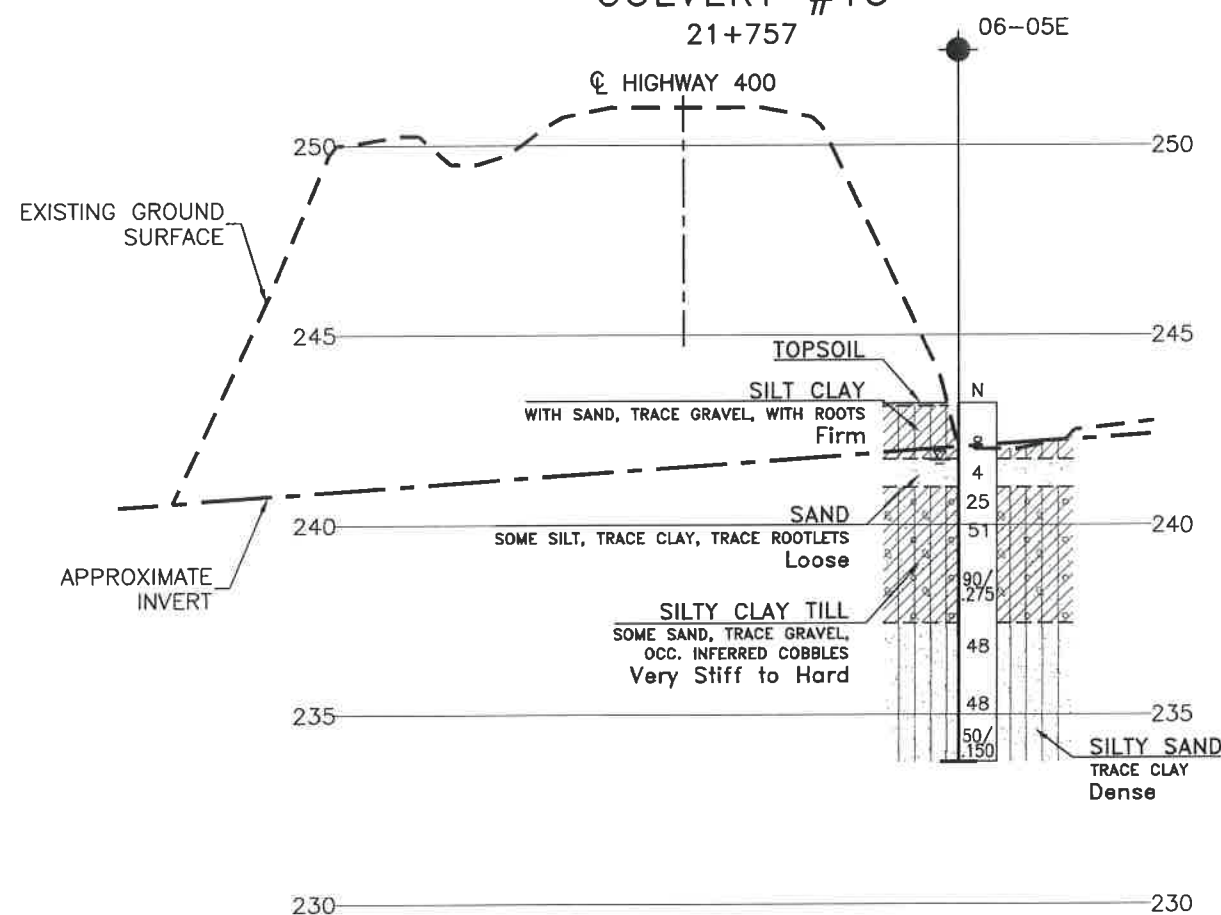


DATE	BY	DESCRIPTION
DESIGN	SKP	CHK PKC
DRAWN	MFA	CHK SKP
		SITE
		STRUCT
		DWG
		DATE MAR. 2012

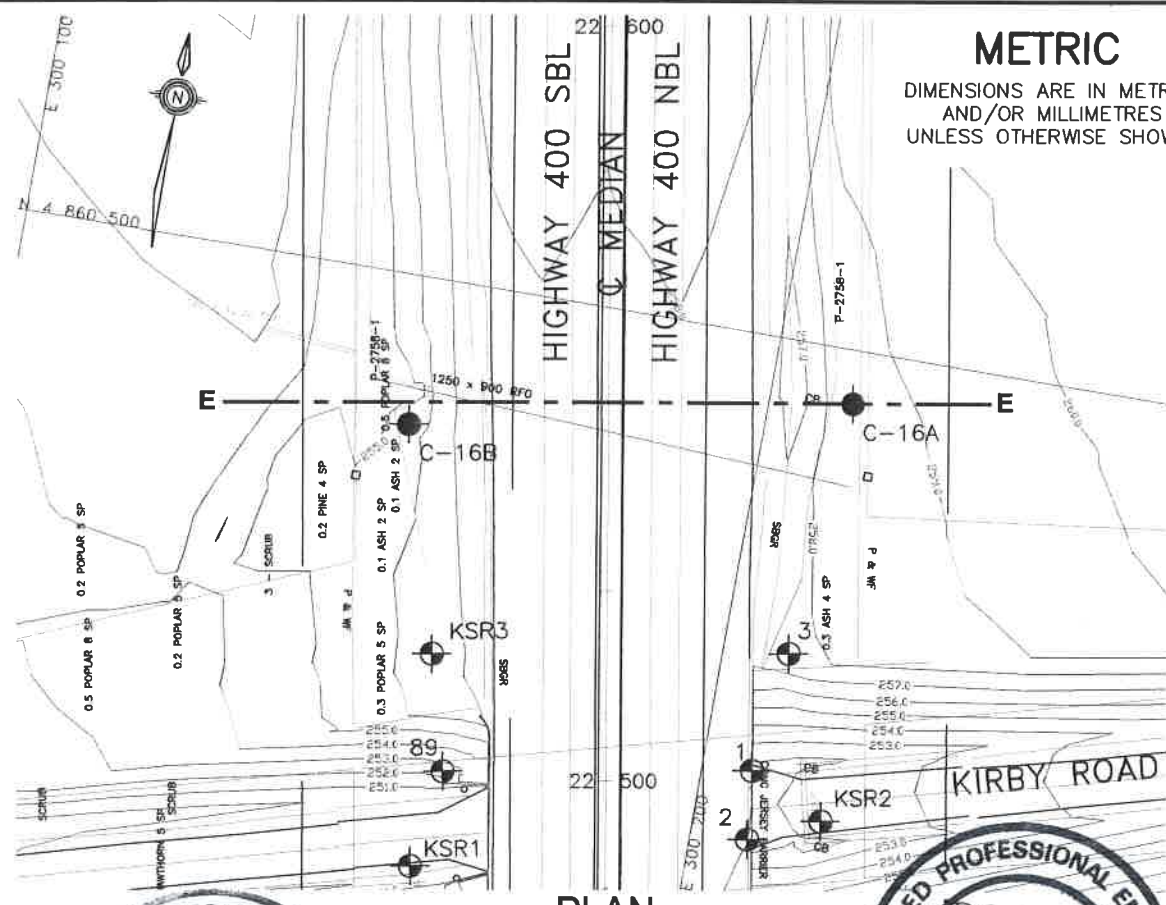
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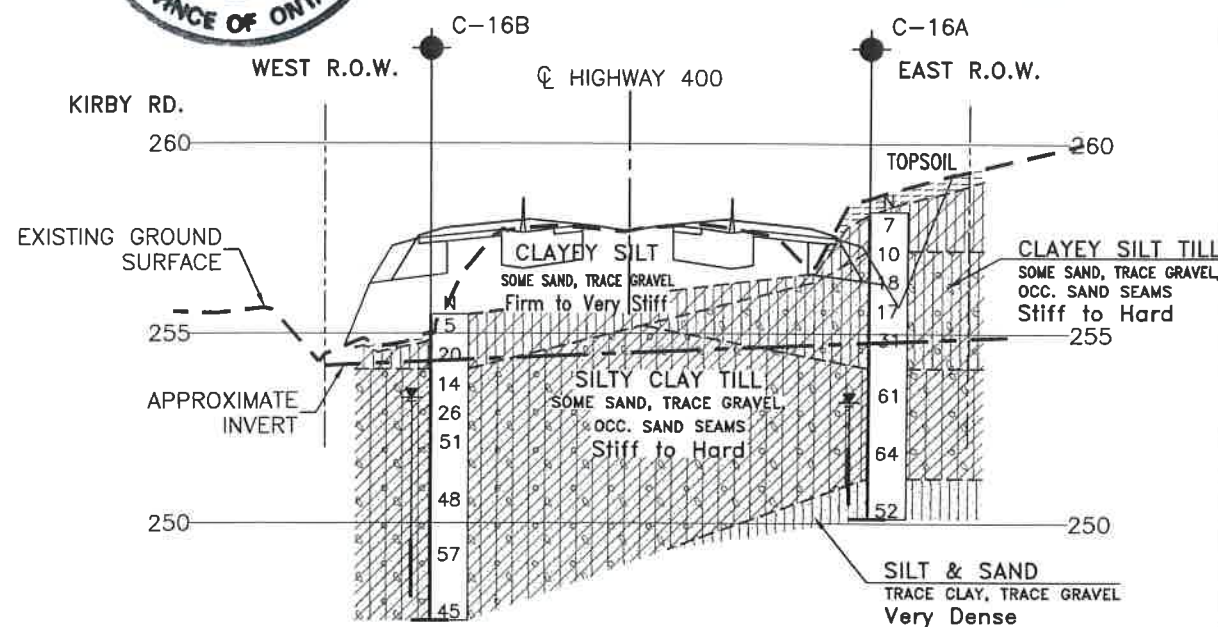
CULVERT #15
21+757



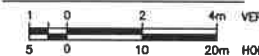
SECTION D-D



CULVERT #16
22+550



SECTION E-E



METRIC

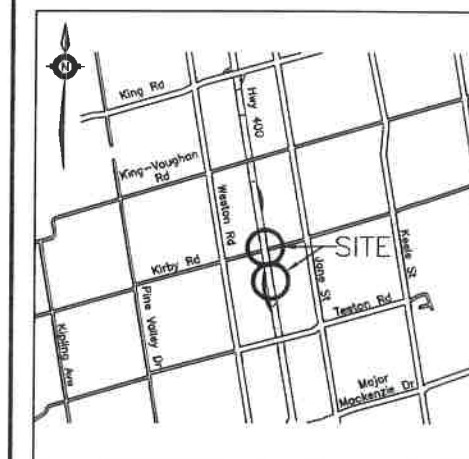
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No
WP No 2539-04-00

TESTON ROAD TO KING ROAD
CULVERTS #15 & #16
BOREHOLE LOCATIONS AND SOIL STRATA

SNC-LAVALIN

THURBER ENGINEERING LTD.



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
W	Head Artesian Water
W	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

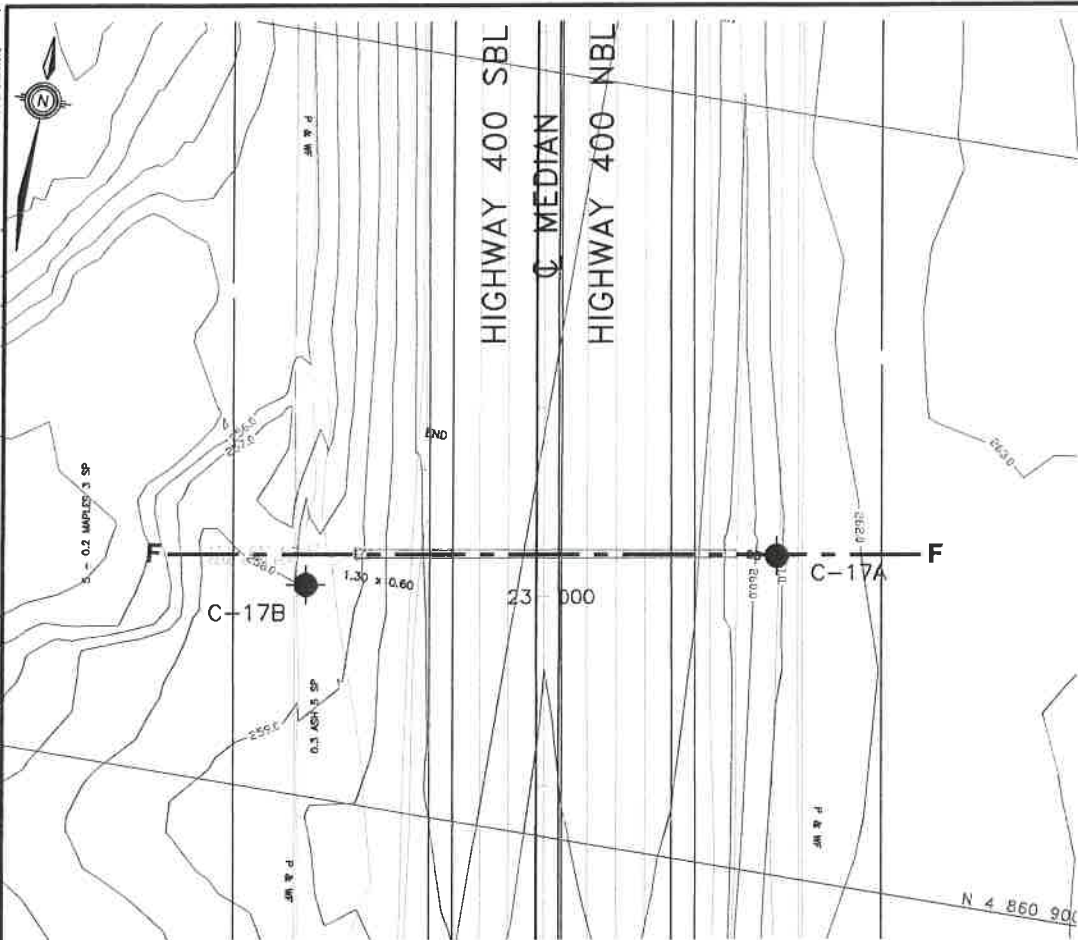
NO	ELEVATION	NORTHING	EASTING
06-04E	247.9	4 859 683.1	300 354.7
06-05E	243.2	4 859 708.6	300 349.6
06-06E	248.5	4 859 783.1	300 332.4
KSR3	256.4	4 860 451.0	300 163.0
3	257.8	4 860 459.0	300 209.0
C-16A	258.2	4 860 492.9	300 211.0
C-16B	255.5	4 860 480.3	300 154.3

-NOTES-

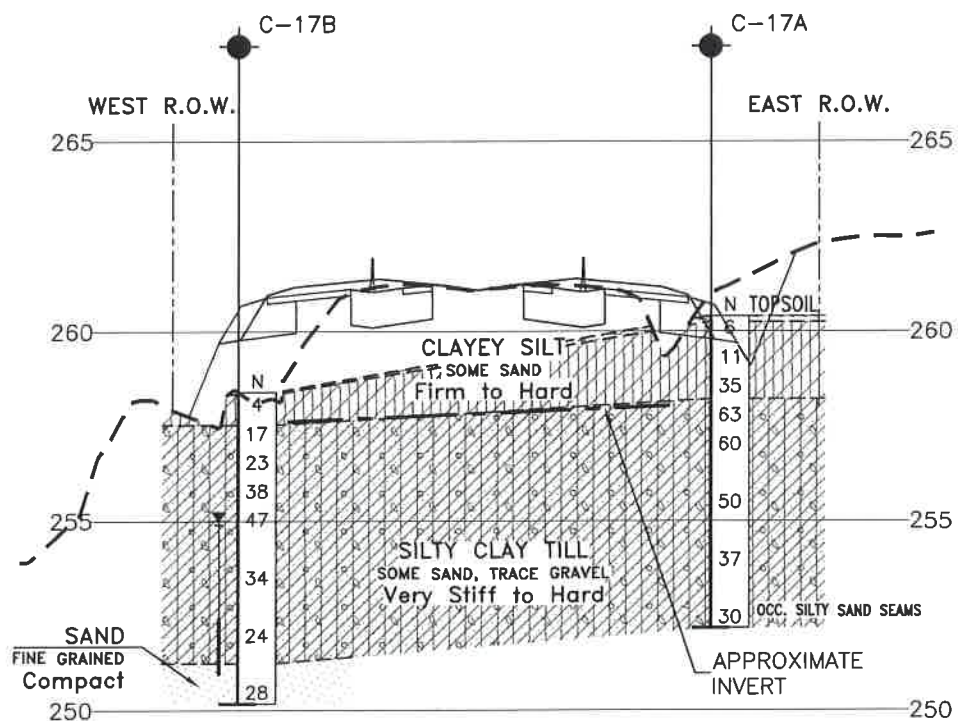
- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCREs No. 30M13-190

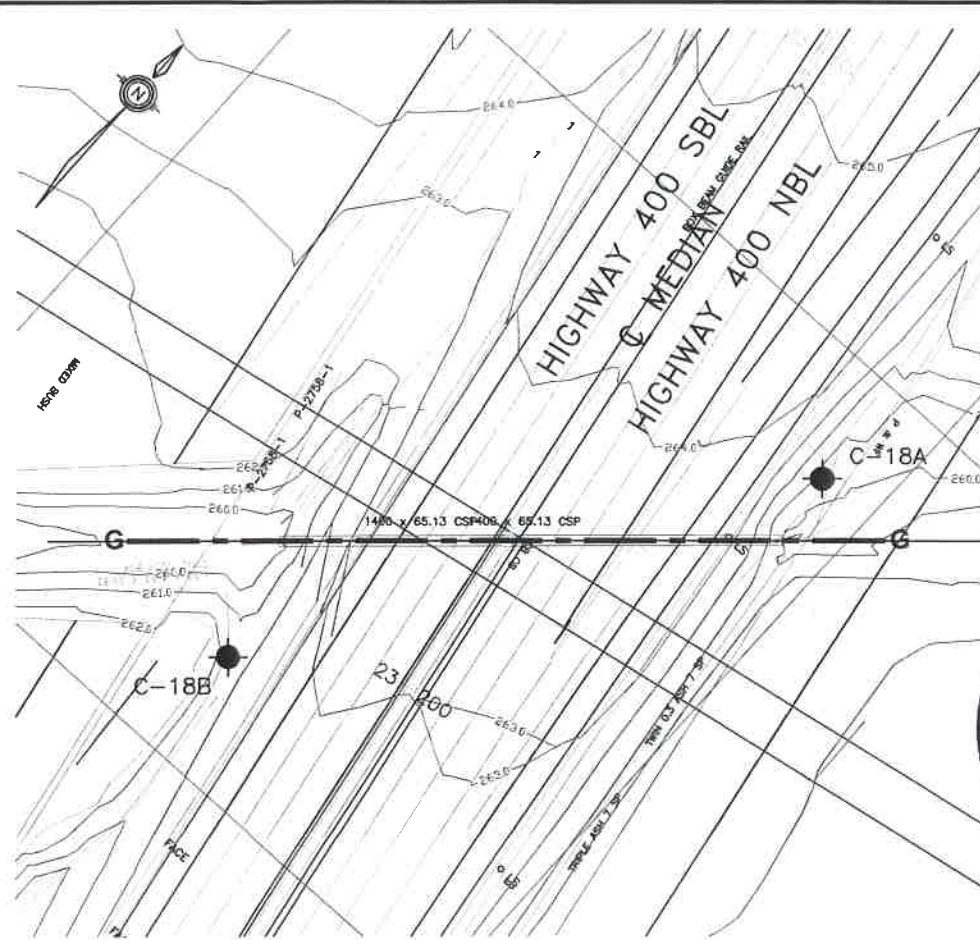
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STRUCT	DATE	MAR. 2012	
DRWG	DATE	MAR. 2012	



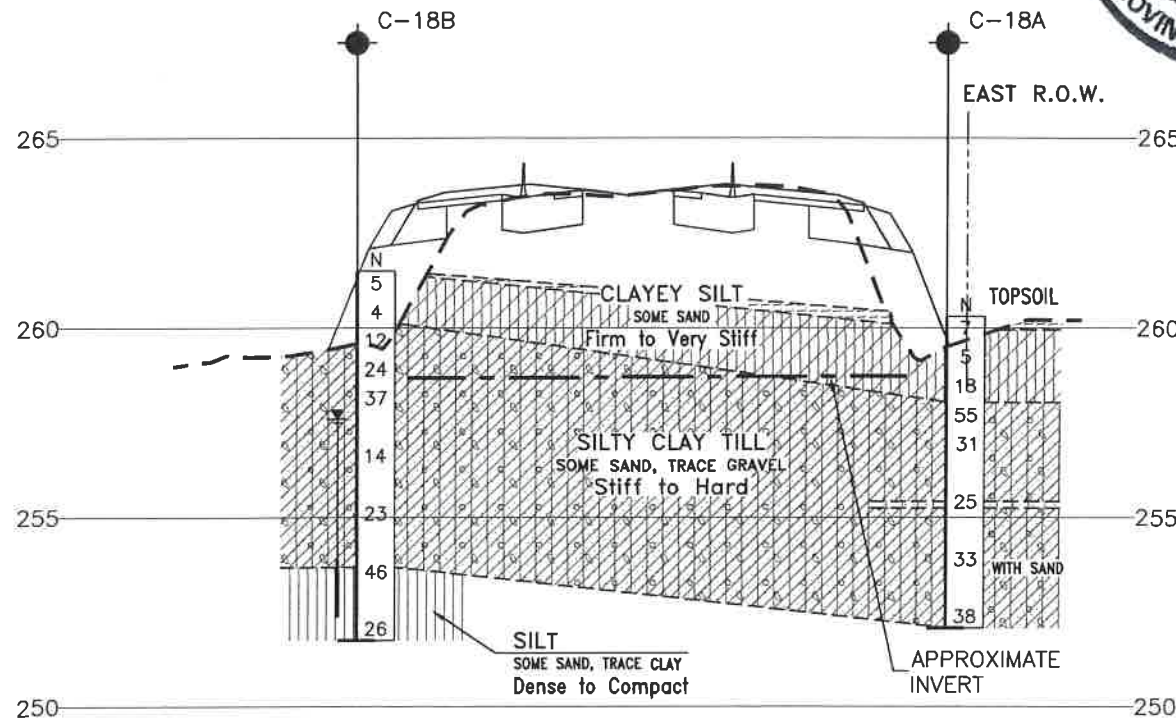
CULVERT #17
23+005



SECTION F-F



CULVERT #18
23+225



SECTION G-G

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

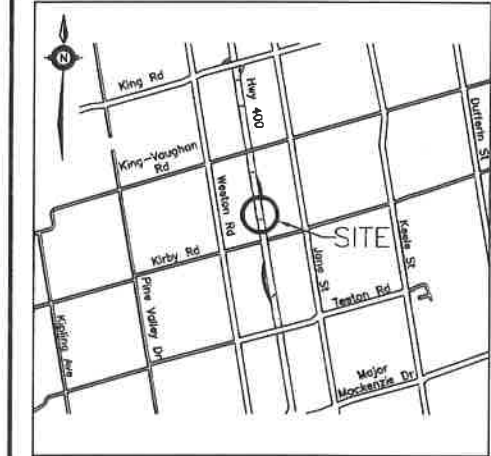


CONT No
WP No 2539-04-00

TESTON ROAD TO KING ROAD
CULVERTS #17 & #18
BOREHOLE LOCATIONS AND SOIL STRATA

SNC-LAVALIN

THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

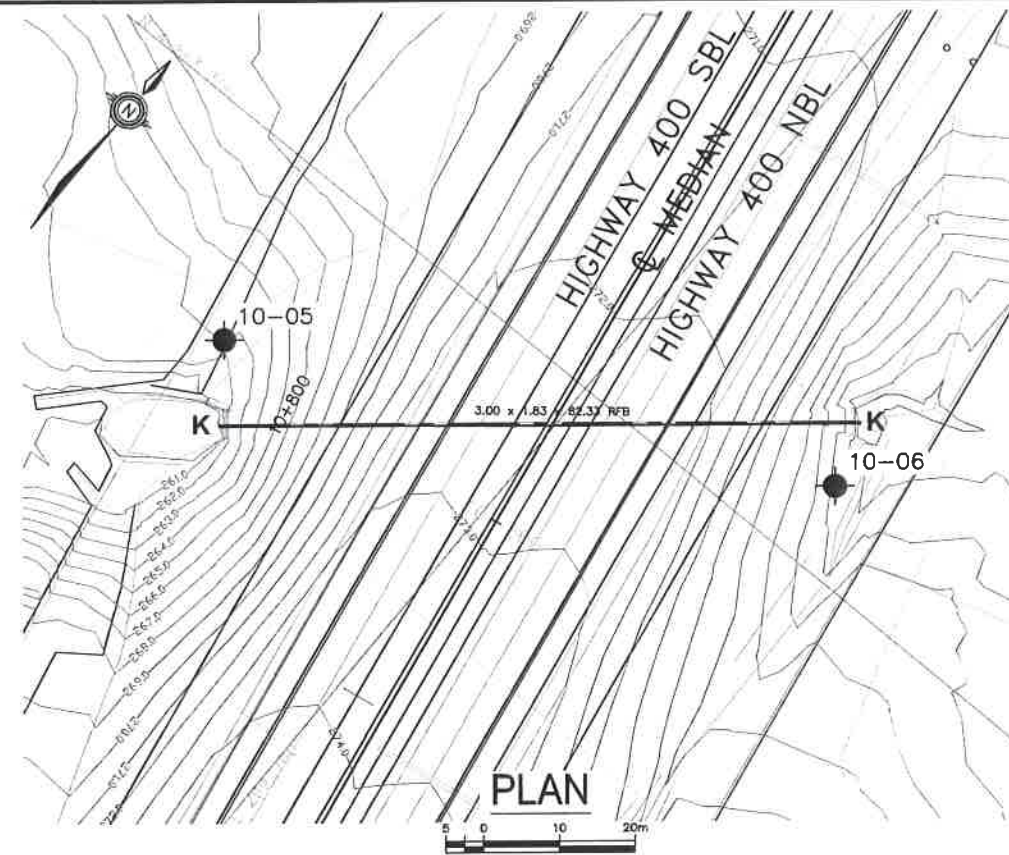
- ◆ Borehole
- ◆ Borehole and Cone
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- W Water Level
- W Head Artesian Water
- W Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
C-17A	260.4	4 860 941.6	300 132.9
C-17B	258.4	4 860 927.5	300 072.3
C-18A	260.3	4 861 185.1	300 092.0
C-18B	261.5	4 861 115.5	300 049.8

- NOTES-**
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GEOCREs No. 30M13-190

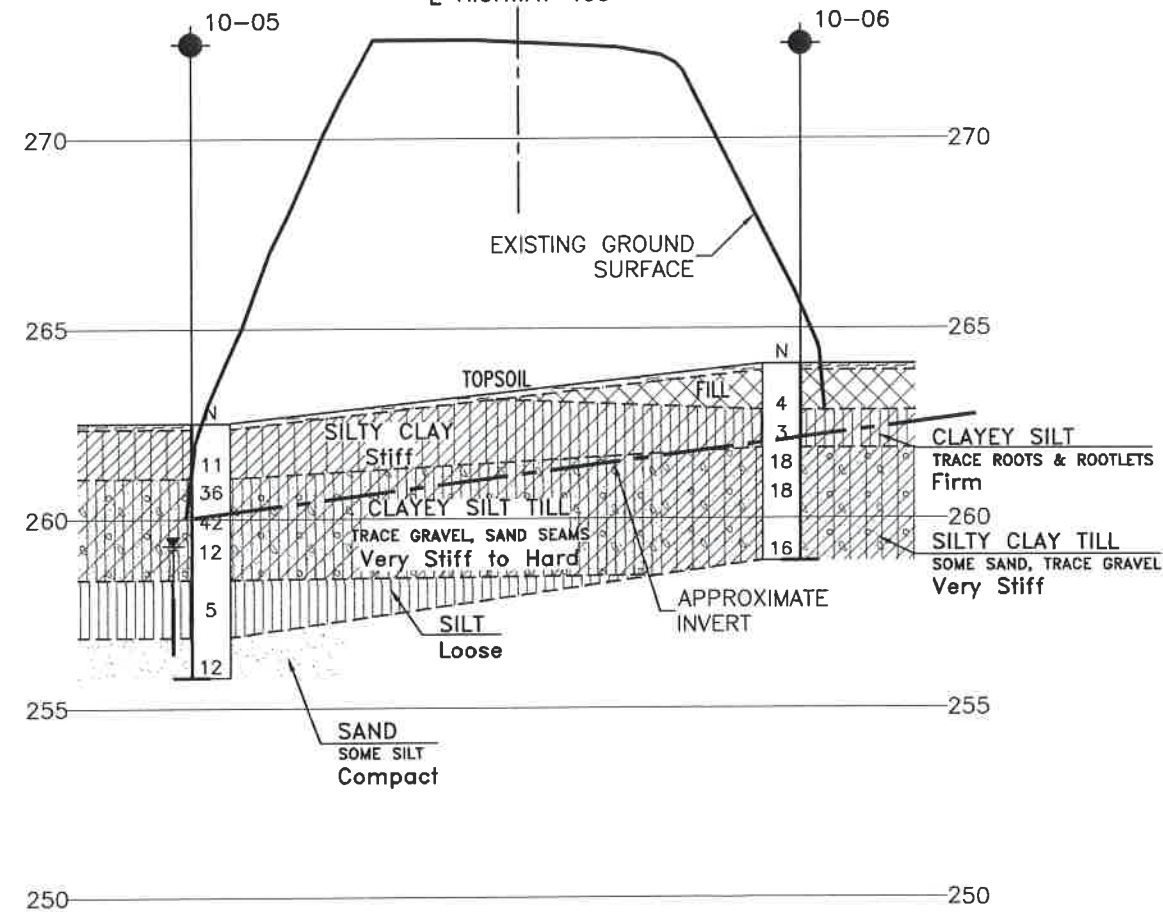
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			STRUCT
			DWG



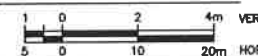
CULVERT #21

10+815

Q HIGHWAY 400



SECTION K-K



METRIC

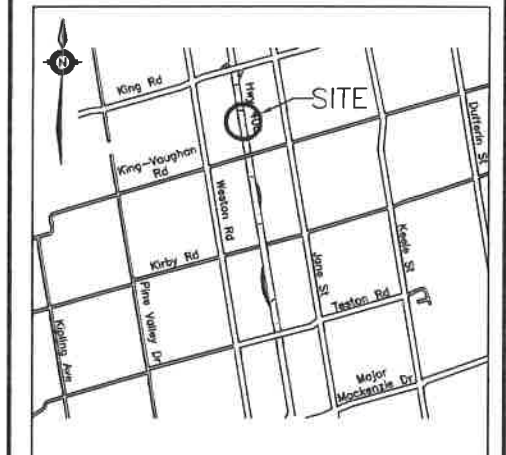
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No
WP No 2539-04-00

TESTON ROAD TO KING ROAD
CULVERT #21
BOREHOLE LOCATIONS AND SOIL STRATA








THURBER ENGINEERING LTD.



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

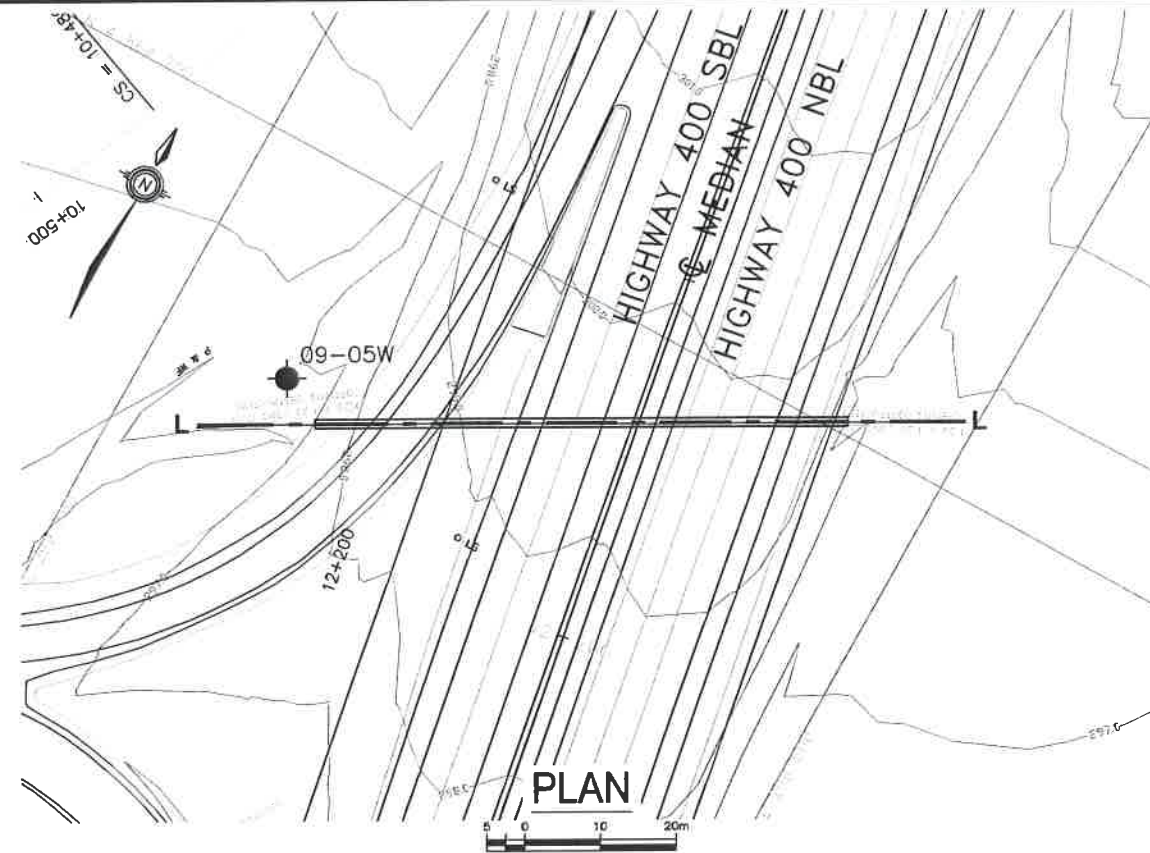
NO	ELEVATION	NORTHING	EASTING
10-05	262.5	4 863 274.9	299 659.3
10-06	264.1	4 863 310.9	299 733.6

-NOTES-

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GEOCRES No. 30M13-190

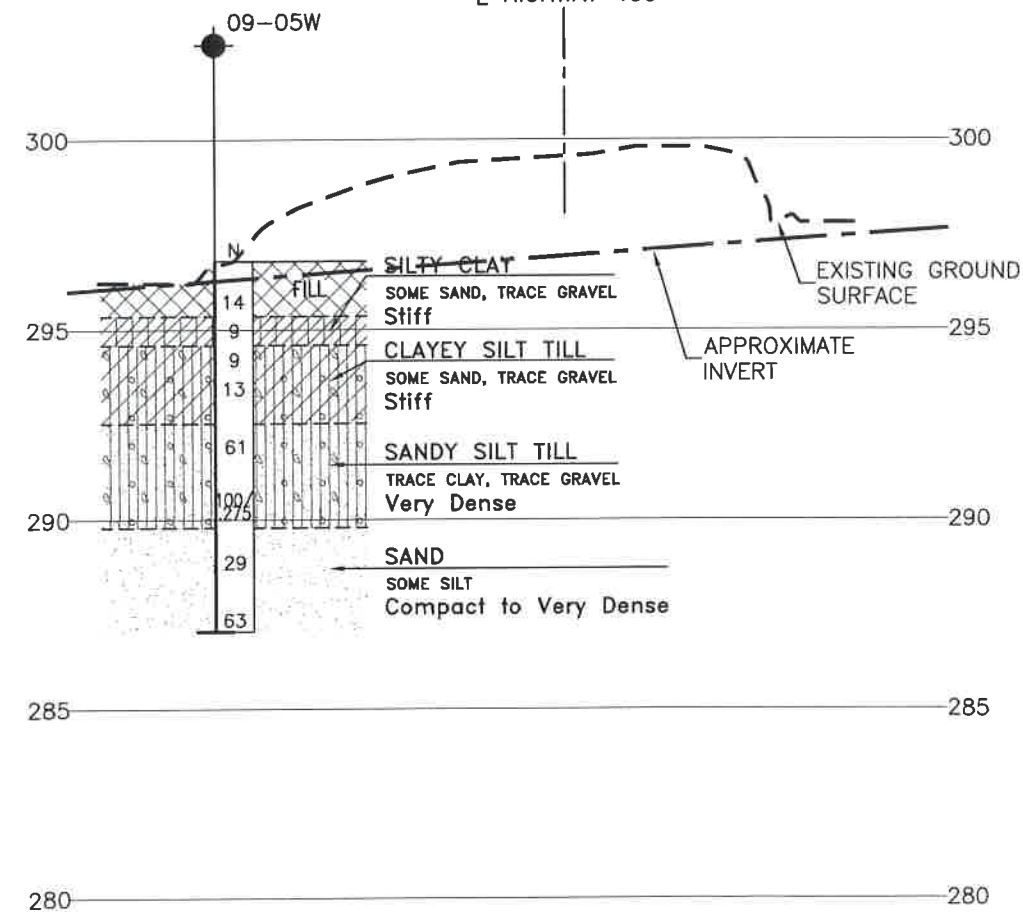
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DRAWN	MFA	CHK	SKP		SITE			



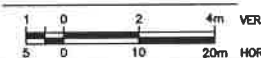
CULVERT #25

 $12+230$

Q HIGHWAY 400



SECTION L-L



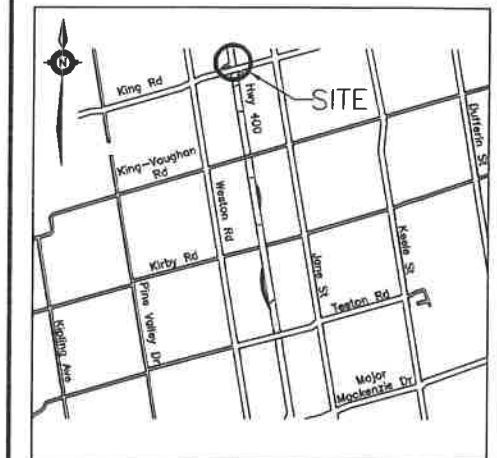
METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No
WP No 2539-04-00

TESTON ROAD TO KING ROAD
CULVERT #25
BOREHOLE LOCATIONS AND SOIL STRATA








THURBER ENGINEERING LTD



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
09-05W	296.8	4 864 671.4	299 417.9

-NOTES-

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GEOCRES No. 30M13-190

REVISIONS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
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