FOUNDATION INVESTIGATION AND DESIGN REPORT
HIGH MAST LIGHTS, NOISE WALLS AND SIGNS
HIGHWAY 403 IMPROVEMENTS
G.W.P. 2440-04-00

Geocres Number: 30M4-109

Report to

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PART 1: FACTUAL INFORMATION

1 INTRODUCTION

This report presents the factual information obtained from a foundation investigation conducted for proposed improvements along Highway 403 from 1.5 km east of the Lincoln M. Alexander Parkway (LINC) to Wilson Street (Old Highway 2) in Hamilton, Ontario. The proposed improvements include installation of High Mast Light (HML) poles, noise barrier walls, and new signs.

The purpose of the investigation was to explore the subsurface conditions at the site and, based on the data obtained, to provide a borehole location plan, borehole logs, and a written description of the subsurface conditions.

Thurber carried out the investigation as a sub-consultant to McCormick Rankin Corporation (MRC), under the Ministry of Transportation Ontario (MTO) Agreement Number 2004-E-0072.

2 SITE DESCRIPTION

The subject section of Highway 403 lies in the former Town of Ancaster, now in the City of Hamilton, immediately above the Niagara Escarpment to the north. The lands adjacent to the highway corridor predominantly comprise residential subdivisions, with occasional undeveloped properties.

The general site area is located within an area of complex glacial geology, at the northern limits of and boundary between two physiographic regions: the Norfolk Sand Plain to the southwest, and the Haldimand Clay Plain to the southeast. The Norfolk Sand Plain consists of sands and silts deposited as a delta in glacial Lakes Whittlesy and Warren. The Haldimand Clay Plain consists of lacustrine clays deposited in glacial Lake Warren, overlying till moraines and bedrock.

The lands are typically rolling where not levelled for development. In general, the ground surface rises towards the south and west away from the escarpment. A bedrock cut is evident in the area of the LINC interchange.

At present, Highway 403 is a four lane divided highway with side ditches and an approximate 20 m wide, depressed, grass median. A third westbound lane is present at the north end of the study

section, terminating approximately 400 m west of Golf Links Road. Road grades generally rise gently to the south and west.

3 SITE INVESTIGATION AND FIELD TESTING

Thurber carried out site investigation and field testing for this project in two stages. During the period October 2 to 5, 2005, eleven boreholes (numbered P1 to P11) were drilled to depths of approximately 10 m at or near the proposed HML pole locations within the highway median. On December 18 and 22, 2005, eight additional boreholes (designated S1 and S2 for signs, and W1 to W6 for walls) were drilled to about 5 m depth at or near the proposed sign and noise wall locations. The locations of the boreholes are shown on the Borehole Locations Drawings in Appendix C.

The boreholes were positioned relative to site features and stationing along Highway 403 staked in the field by J.D. Barnes Limited. Based on the stationing and offsets provided by Thurber, the corresponding coordinates and ground surface elevations were subsequently determined by MRC. The coordinates and elevations of the boreholes are given on the Borehole Locations Drawings and on the individual Record of Borehole Sheets in Appendix A.

Track and truck-mounted drillrigs equipped with solid stem augers were used to advance the boreholes. Samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT). Dynamic cone penetration tests (DCPT) were conducted adjacent to several boreholes to confirm the denseness of the soils.

Auger refusal was encountered at one borehole location (P11). Adjacent to this location, a second borehole was augered to refusal and bedrock was proven by recovering a 3.0 m length of rock core using NQ rock coring equipment. For safety reasons, the borehole with rock coring was repositioned from the median to the right shoulder of the highway, as equipment access limitations would have required lane closures for parking of a water supply truck near the drill rig.

A member of Thurber's engineering staff supervised the drilling and sampling operations on a full time basis. The inspector logged the soil and groundwater conditions encountered in the boreholes, and collected, labelled and transported the samples to Thurber's laboratory. The rock core samples were described in the field, packaged in a core box, and returned to our laboratory.

Standpipe piezometers consisting of 19 mm PVC pipe were installed in selected boreholes to monitor groundwater levels. The piezometer installation details are shown on the borehole logs, Appendix A. The boreholes were backfilled with bentonite upon completion.

4 LABORATORY TESTING

All recovered soil samples were subjected to visual identification and to natural moisture content determination. The results of this testing are shown on the Record of Borehole sheets in Appendix A.

Selected samples were subjected to gradation analysis (sieve and hydrometer) and Atterberg Limits testing. The results are shown on the Record of Borehole sheets in Appendix A and on the charts in Appendix B.

5 DESCRIPTION OF SUBSURFACE CONDITIONS

Reference is made to the Record of Borehole sheets in Appendix A and to the Borehole Locations Drawings in Appendix C. An overall description of the stratigraphy based on the conditions encountered in the boreholes is given in the following paragraphs. However, the factual data presented in the borehole logs takes precedence over this general description and govern interpretation of the site conditions. Soil conditions may vary between and beyond the borehole locations.

The soil stratigraphy encountered at the borehole locations consists of topsoil, fill or a pavement structure overlying various deposits of cohesionless sands and silts as well as cohesive clayey silt to silty clay. Bedrock was contacted at one location.

More detailed descriptions of the individual strata encountered in connection with each facility are presented below.

5.1 High Mast Light Poles (Boreholes P1 to P11)

5.1.1 Topsoil

A topsoil layer was encountered at all borehole locations in the median except one (P5). The topsoil thickness ranged from 80 to 150 mm. The topsoil thickness may vary between and beyond the borehole locations and the data is not intended for the purpose of estimating quantities.

5.1.2 Fill

Fill was encountered below the surficial topsoil layer in two boreholes. In borehole P2, the fill extended to 3.0 m depth (elevation 239.1 m) and comprised compact (N-values of 13 and 23) sandy silt with occasional wood fibres and black staining, and stiff clayey silt. In borehole P6, the fill consisted of very stiff clayey silt and extended to 1.4 m depth (elevation 233.6 m). Moisture contents ranged from 12 to 17%.

5.1.3 Sands and Silts

Below the topsoil, fill and a local clay unit, cohesionless sands and silts were encountered in all but two boreholes (P8 and P10) and were the predominant soil types in the western half of the study section. The grain size distribution of various samples of the sands and silts are presented on Figures B1 to B3.

SPT N-values obtained in the cohesionless deposits typically varied from about 15 to 50 blows/0.3 m of penetration, indicating a compact to dense condition. N-values less than 10 blows/0.3 m were encountered at isolated locations and are believed to reflect hydraulic disturbance in the boreholes. SPT values exceeding 50 blows/0.3 m were also obtained locally, indicating zones of very dense material.

Natural moisture contents ranged from about 15 to 22%, with lower values of around 10% determined in several samples from the west end of the study section.

5.1.4 Clayey Silt to Silty Clay

Deposits of cohesive clayey silt to silty clay were encountered in all boreholes except one at the west end of the study area (P1). In the western part of the study area (boreholes P2 to P6), the cohesive deposits were 1.0 to 2.6 m thick and encountered within or over the cohesionless sands/silts. The cohesive materials predominated in the eastern half of the study area, ranging in thickness from 2.2 m to over 9.7 m.

SPT N-values obtained in the cohesive deposits varied widely from 9 blows/0.3 m to 50 blows/0.125 m, indicating a stiff to hard consistency. At one borehole location (P7), an N-value of 0 was recorded at 2.6 m depth, indicating a softer zone.

The results of grain size distribution analyses conducted on the clayey silt/silty clay are shown on Figures B4 and B5 in Appendix B. The results of Atterberg Limits tests, presented on Figures B9 and B10, indicate slight to intermediate plasticity (CL-ML to CI). Moisture contents of 12 to 23% were measured in this unit, and 31% in the softer zone in borehole P7.

5.1.5 Bedrock

Auger refusal was encountered on probable bedrock at 6.5 m depth (elevation 221.8 m) in borehole P11 located at the extreme east end of the study area. A second borehole was augered to refusal at 7.1 m depth on the right shoulder of the highway and a 3.0 m length of rock core was recovered. Examination of the recovered core indicates that the bedrock consists of strong to very strong dolostone. The total core recovery (TCR) and Rock Quality Designation (RQD) were 100% in all core runs, indicating an excellent quality rock.

5.1.6 Groundwater

Water was measured upon completion of drilling or in the piezometers installed in the boreholes at all but two locations. The measured water levels are summarized in Table 5.1. Water was not observed in boreholes P9 and P11 during the fieldwork.

Table 5.1 – Measured Water Levels

Borehole No.	Date	Measured Water Level		Type
		Depth (m)	Elevation (m)	
P1	03-Oct-05	6.1	238.7	Open borehole
P2	18-Dec-05	6.9	235.2	Piezometer
P3	03-Oct-05	3.8	236.2	Open borehole
P4	18-Dec-05	4.9	233.3	Piezometer
P5	02-Oct-05	2.0	234.6	Open borehole
P6	18-Dec-05	7.4	227.6	Piezometer
P7	05-Oct-05	2.2	231.6	Open borehole
P8	18-Dec-05	2.2	231.1	Piezometer
P10	18-Dec-05	2.3	228.8	Piezometer

The above water levels are short-term observations and seasonal fluctuations of the groundwater levels are to be expected. In particular, the groundwater level may be at a higher elevation after the spring snowmelt or after periods of heavy rainfall.

5.2 Noise Barrier Walls

5.2.1 Noise Wall East of Hamilton Drive (Boreholes W1 to W3)

A 50 to 75 mm thick layer of topsoil was encountered in boreholes W1 to W3 drilled east of Hamilton Drive. The topsoil is underlain by cohesionless deposits of silt and sand.

The sands and silts are typically loose to compact (N-values of 5 to 13 blows/0.3 m) to a depth of 2.3 m, and become compact to very dense (N-values of 20 blows/0.3 m to 50/0.15 m) below this level. The results of grain size distribution analyses conducted on the silt/sand are presented on Figure B6, Appendix B. Moisture contents ranged from 11 to 27%, typically about 17 to 22%. The boreholes were terminated in the silt/sand at 4.9 to 5.0 m depth.

Water was measured upon completion of drilling or in the piezometer installed in borehole W2 at the levels summarized in Table 5.2.

Table 5.2 – Measured Water Levels

Borehole No.	Date	Measured Water Level		Type
		Depth (m)	Elevation (m)	
W1	22-Dec-05	4.1	240.2	Open borehole
W2	22-Dec-05	4.0	239.7	Open borehole
	14-Jan-06	2.7	241.0	Piezometer
W3	22-Dec-05	2.6	240.1	Open borehole

The above water levels are short-term observations and seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at a higher elevation after the spring snowmelt or after periods of heavy rainfall.

5.2.2 Noise Wall West of Highway 6 New (Boreholes W4 to W6)

Boreholes W4 to W6 were drilled through the paved shoulder of Highway 403. The pavement encountered in the boreholes consisted of 75 to 150 mm of asphalt overlying granular material to depths of 600 to 700 mm.

Fill consisting primarily of sandy silt was encountered below the pavement structure. The fill depth increased in a westerly direction: the lower boundary of the fill was encountered at 1.5 m depth (elevation 242.5 m) in borehole W6, at 3.0 m depth (elevation 240.7 m) in borehole W5, and was not defined within the exploration depth of 5.2 m (elevation 238.7 m) in borehole W4. N-values obtained in the fill ranged from 25 to 68 blows/0.3 m, indicating a compact to very dense condition. The results of grain size distribution analyses conducted on the fill are presented on Figure B7, Appendix B. Moisture contents ranged from 10 to 16%.

The underlying native soil in boreholes W5 and W6 comprises cohesionless silt, sandy silt and sand. SPT N-values obtained in the cohesionless deposits varied from 14 blows/0.3 m to 50 blows/0.15 m of penetration, indicating a compact to very dense condition. The boreholes were terminated in the silt/sand at 5.2 m depth.

The results of grain size distribution analyses conducted on the silt/sand are presented on Figure B7, Appendix B. Moisture contents ranged from 3 to 23%, typically 12 to 18%.

Water was measured at 1.8 m depth (elevation 241.9 m) in borehole W5 upon completion of drilling. This water appears to be perched in the fill. Water was not observed in boreholes W4 and W6 during drilling.

5.3 Signs (Boreholes S1 and S2)

Boreholes S1 and S2 were drilled through the paved shoulder of Highway 403. The pavement encountered in the boreholes consisted of 100 and 150 mm of asphalt overlying crushed limestone to a depth of 600 mm.

Sand and silty sand fill was encountered below the pavement structure and extended to 2.3 m depth in both boreholes. N-values obtained in the fill decreased with depth, from 35 and 22 blows/0.3 m (dense to compact) near 1.0 m depth, to 11 blows/0.3 m (compact) at about 1.8 m depth. The results of grain size distribution analyses conducted on the fill are presented on Figure B8, Appendix B. Moisture contents ranged from 8 to 10%.

The underlying native soil comprised cohesionless sandy silt to silt in borehole S1 and fine to medium grained sand in borehole S2. SPT N-values obtained in the cohesionless deposits varied from 11 to 55 blows/0.3 m of penetration, indicating a compact to very dense condition. The boreholes were terminated in the silt/sand at 5.2 and 5.1 m depth.

The results of grain size distribution analyses conducted on the silt/sand are presented on Figure B8, Appendix B. Moisture contents ranged from 8 to 20%.

Water was measured upon completion of drilling at the levels summarized in Table 5.3.

Table 5.3 – Measured Water Levels

Borehole No.	Date	Measured Water Level	
		Depth (m)	Elevation (m)
S1	18-Dec-05	4.9	244.3
S2	22-Dec-05	3.7	241.2

The above water levels are short-term observations and seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at a higher elevation after the spring snowmelt or after periods of heavy rainfall.

6 MISCELLANEOUS

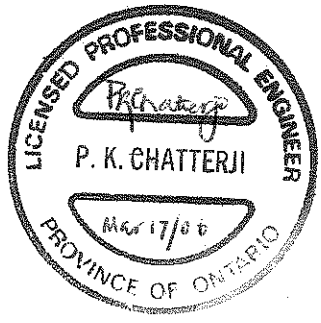
J.D. Barnes Limited provided field layout of the Highway 403 stationing for the site investigation.

DBW Drilling Limited supplied and operated the drilling and sampling equipment. Full time supervision of the field activities, including obtaining utility clearances, was carried out by Mr. Stephane Loranger and Mr. George Azzopardi of Thurber.

Supervision of the field program, interpretation of the field data, and preparation of the report was performed by Mr. Murray Anderson, P.Eng. The report was reviewed by Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

Thurber Engineering Ltd.
Murray R. Anderson, P.Eng., M.Eng.
Senior Geotechnical Engineer

P.K. Chatterji, P.Eng., Ph.D.
Review Principal



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PART 2: ENGINEERING DISCUSSION AND RECOMMENDATIONS

7 INTRODUCTION

This report presents interpretation of the geotechnical data in the factual report and provides geotechnical design recommendations for design of foundations for the proposed HML poles, noise walls and signs.

At the time of the field investigation, the project design called for installation of 11 HML poles, two noise walls, two overhead signs and three ground-mounted signs. Boreholes were drilled at or near the locations of each proposed HML pole, along the alignment of the noise walls, and at two of the sign locations. Foundation recommendations for three signs were based on borehole information from the nearest HML boreholes. As per MTO procedures, the structure locations are not shown on the borehole location plans.

The discussion and recommendations presented in this report are based on our understanding of the project and on the factual data obtained in the course of the investigation.

7.1 Foundation Design Parameters

Design of the HML pole, noise wall and sign foundations should be carried out following the procedures and guidelines provided in the following documents:

- Guidelines for the Design of High Mast Pole Foundations, 3rd Edition, Ministry of Transportation, Bridge Office, February 2003.
- Canadian Highway Bridge Design Code and Commentary (2000), CAN/CSA-S6-00 and S6.1-00.
- Sign Support Manual, Ministry of Transportation, Bridge Office, August 2004.

Conventional pole foundation design comprising a single augered caisson (drilled shaft) is considered appropriate for this project. Augered caissons may also be employed as foundations for the noise walls and signs. Recommended geotechnical parameters for the design of the caisson foundation at each proposed light, wall and sign location are presented in Tables 7.1 to 7.3 following the text of this report. Where a borehole has not

been drilled at the precise facility location, the design parameters have been extrapolated from a representative nearby borehole.

The geotechnical parameters presented in Tables 7.1 to 7.3 are defined as follows:

For cohesionless soil:

ϕ = angle of internal friction of soil (degrees)

n_h = coefficient of horizontal subgrade reaction (MN/m^3)

γ = unit weight of soil (kN/m^3)
below water table, use submerged unit weight: $\gamma' = \gamma - 9.8\ kN/m^3$

For cohesive soil:

q_u = unconfined compressive strength (kPa)
= 2 x undrained shear strength, c_u

The recommended design groundwater levels, inferred from water level observations, soil colouring, and the moisture content profile, are also provided on Tables 7.1 to 7.3.

The passive earth pressure coefficient, K_p, for cohesionless soils may be calculated using the following equations:

For a horizontal ground surface:

$$K_p = \frac{1 + \sin\phi}{1 - \sin\phi}$$

For a sloping ground surface:

$$K_p = \left[\frac{\cos\phi}{1 - v \sin\phi\ (\sin\phi - \cos\phi \tan\beta)} \right] 2$$

where β = slope inclination from horizontal (degrees)

The lateral resistance and sidewall adhesion within the upper 1.2 m below final grade should be neglected in the foundation design to account for frost effects and potential surficial disturbance. Any sloping ground surface or berm slope in front of the caisson will reduce the lateral passive resistance to be considered in design. The length of caisson should be sufficient to withstand all lateral loads including wind loads, and to counteract frost jacking forces.

Load factors and geotechnical resistance factors should be applied for caisson design as per the CHBDC (2000).

7.2 Construction Concerns

Caisson construction is expected to be carried out primarily within cohesionless silt and sand deposits, and within predominant cohesive clayey silt to silty clay in the eastern section of the study area. The soils contain localized loose/soft zones as well as very dense/hard zones. Appropriate caisson augering equipment must be provided to penetrate these materials.

Although not encountered in the boreholes, cobbles and boulders may also be present in the soils. Augering equipment capable of dislodging, removing or penetrating these potential obstructions should be employed.

Instability and caving of the caisson sidewalls should be expected while augering through loose zones within the cohesionless materials. It is therefore recommended that temporary caisson liners be available on site to support the sidewalls.

Groundwater is anticipated at the levels indicated on Tables 7.1 to 7.3. Some sloughing of the sidewalls is likely where loose soils or coarser water-bearing deposits are encountered. Temporary caisson liners should be provided to support the sidewalls in these conditions and provide seepage cut-off where required. The liner should be withdrawn as concrete is placed, maintaining at least 0.6 m of concrete above the bottom of the liner during liner withdrawal.

In general, dewatering of the caisson excavations using sump pumps should be suitable. However, the potential exists that coarse water-bearing deposits may be encountered at the base of the caisson resulting in boiling and increased water inflow. It may be necessary to extend the liner to greater depth to obtain seepage cut-off in less permeable material or to use slurry and tremie concrete methods to construct the caisson in these conditions.

An NSSP should be included in the Contract Package to advise the Contractor of the potential need for dewatering and/or special construction procedures to excavate below the groundwater level, as well as the potential for encountering cobbles and boulders. An NSSP is provided in Appendix D for this purpose.

Strong to very strong bedrock was contacted at 6.5 m depth at one pole location. Rock coring equipment or alternative means will be required to excavate the bedrock if encountered or if foundation design calls for socketing the caisson into bedrock.

7.3 Construction Inspection

Caisson construction should be monitored by qualified geotechnical personnel to verify that the soil conditions encountered during construction are consistent with the design assumptions in this report.

It should be confirmed that the base of the caisson is cleaned of loose and soft materials prior to pouring of concrete.

8 CLOSURE

Engineering analysis and preparation of the foundation design report was conducted by Mr. Murray Anderson, P.Eng. The report was reviewed by Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

Thurber Engineering Ltd.
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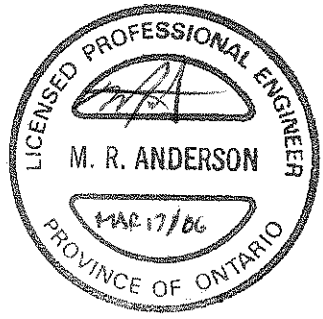

P.K. Chatterji, P.Eng., Ph.D.
Review Principal

TABLE 7.1
HML FOUNDATION DESIGN PARAMETERS
HIGHWAY 403 IMPROVEMENTS, GWP 2440-04-00

HML Pole Number	Station	Subsurface Stratigraphy			Foundation Design Parameters				
		Material	Depth* (m)	Elevation	ϕ (deg.)	n_h (MN/m^3)	γ' (kN/m^3)	q_u** (kPa)	Depth to Groundwater (m)
P1	22+970	Sand, loose to dense	1.2 – 2.9	243.6 - 241.9	31	4.0	20	-	6.1
		Silt, compact	2.9 – 4.4	241.9 - 240.4	30	3.0	20	-	
		Sand, compact	4.4 – 6.1	240.4 - 238.7	31	4.0	20	-	
		Sand, compact	6.1 – 9.8	238.7 - 235.1	31	2.5	10	-	
P2	23+120	Silt fill, compact/stiff	1.2 – 3.0	240.9 - 239.1	28	1.0	18	-	6.9
		Silt, loose	3.0 – 4.3	239.1 - 237.9	29	2.0	19	-	
		Clayey silt, very stiff to hard	4.3 – 6.5	237.9 - 235.7	-	-	19	150	
		Sand, dense to compact	6.5 – 9.8	235.7 - 232.4	34	5.5	11	-	
P3	23+285	Silty clay, very stiff	1.2 – 2.2	238.8 - 237.8	-	-	19	200	4.3
		Sandy silt, dense to very dense	2.2 – 4.3	237.8 - 235.7	33	6.5	20	-	
		Sand, compact to dense	4.3 – 8.1	235.7 - 231.9	33	4.5	11	-	
		Sandy silt, very dense	8.1 – 9.6	231.9 - 230.4	34	5.5	11	-	
P4	23+450	Sandy silt, dense	1.2 – 3.0	237.0 - 235.2	33	6.5	20	-	4.9
		Silt, compact	3.0 – 5.6	235.2 - 232.5	30	3.0	20	-	
		Silty sand, compact	5.6 – 7.3	232.5 - 230.9	32	3.5	10	-	
		Silt, dense	7.3 – 9.8	230.9 - 228.4	33	4.5	11	-	
P5	23+610	Sand, compact	1.2 – 1.4	235.4 - 235.2	33	6.5	20	-	2.2
		Silt, dense	1.4 – 2.2	235.2 - 234.4	33	6.5	20	-	
		Sand, compact	2.2 – 2.7	234.4 - 233.9	31	2.5	10	-	
		Silty clay, hard	2.7 – 3.7	233.9 - 232.9	-	-	10	250	
		Sand, compact	3.7 – 6.1	232.9 - 230.5	33	4.5	10	-	
		Silty sand, compact	6.1 – 9.5	230.5 - 227.1	30	2.0	10	-	
		Sandy silt, very dense	9.5 – 9.8	227.1 - 226.9	34	5.5	11	-	

Notes: * Ignore resistance in upper 1.2 m due to frost effects.
** Shear strength (c_u) = unconfined compressive strength (q_u) / 2.

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TABLE 7.1
HML FOUNDATION DESIGN PARAMETERS
HIGHWAY 403 IMPROVEMENTS, GWP 2440-04-00

HML Pole Number	Station	Subsurface Stratigraphy			Foundation Design Parameters				
		Material	Depth* (m)	Elevation	ϕ (deg.)	n_h (MN/m^3)	γ' (kN/m^3)	q_u** (kPa)	Depth to Groundwater (m)
P6	23+760	Clayey silt fill	1.2 – 1.4	233.8 - 233.7	-	-	18	-	7.4
		Silt, compact	1.4 – 2.9	233.7 - 232.1	30	3.0	20	-	
		Silt, very stiff	2.9 – 4.3	232.1 - 230.8	-	-	20	200	
		Sandy silt, compact	4.3 – 5.8	230.8 - 229.3	30	3.0	20	-	
		Silt, dense to loose	5.8 – 9.8	229.3 - 225.3	32	3.5	10	-	
P7	23+930	Silty clay, very stiff to very soft	1.2 – 5.0	232.6 - 228.8	-	-	19	100	2.2
		Silt, dense to compact	5.0 – 9.8	228.8 - 224.0	33	4.5	11	-	
P8	24+100	Clayey silt, silty clay, very stiff	1.2 – 2.2	232.1 - 231.1	-	-	19	150	2.2
		Clayey silt, silty clay, hard	2.2 - 9.8	231.1 - 223.6	-	-	10	300	
P9	24+270	Clayey silt, very stiff to stiff	1.2 – 2.3	231.4 - 230.3	-	-	19	150	2.3
		Silt, compact	2.3 – 4.1	230.3 - 228.5	30	2.0	10	-	
		Silt, very dense	4.1 – 8.7	228.5 - 223.9	34	5.5	11	-	
		Silty clay, hard	8.7 – 9.8	223.9 - 222.9	-	-	11	300	
P10	24+435	Clayey silt / silty clay, very stiff	1.2 – 2.3	229.9 - 228.8	-	-	20	200	2.3
		Clayey silt / silty clay, stiff	2.3 – 6.1	228.8 - 225.0	-	-	9	150	
		Clayey silt / silty clay, hard	6.1 – 9.6	225.0 - 221.5	-	-	10	250	
P11	24+630	Silt, dense	1.2 – 1.4	227.1 - 226.9	33	6.5	20	-	2.3
		Silt, very stiff to hard	1.4 – 6.5	226.9 - 221.8	-	-	10	250	
		Bedrock, strong to very strong	6.5 – 10.1	221.8 - 218.1	-	-	25	1,000	

Notes: * Ignore resistance in upper 1.2 m due to frost effects.
** Shear strength (c_u) = unconfined compressive strength (q_u) / 2.

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TABLE 7.2
NOISE BARRIER WALL FOUNDATION DESIGN PARAMETERS
HIGHWAY 403 IMPROVEMENTS, GWP 2440-04-00

Location	Borehole Number	Subsurface Stratigraphy			Foundation Design Parameters				
		Material	Depth* (m)	Elevation	ϕ (deg.)	n_h (MN/m^3)	γ' (kN/m^3)	q_u** (kPa)	Depth to Groundwater (m)
Noise Wall East of Hamilton Drive	W1	Silty sand to sandy silt, loose to compact	1.2 – 2.3	243.1 - 242.0	29	2.0	19	-	4.1
		Sand, dense to very dense	2.3 – 4.1	242.0 - 240.2	33	6.5	21	-	
		Sand, dense to very dense	4.1 – 4.9	240.2 - 239.4	33	4.5	11	-	
	W2	Sandy silt, loose	1.2 – 2.3	242.5 - 241.4	29	2.0	19	-	2.7
		Sand, compact	2.3 – 3.0	241.4 - 240.7	33	6.5	20	-	
		Sandy silt, dense	3.0 – 5.0	240.7 - 238.7	33	4.5	10	-	
	W3	Sandy silt, loose to compact	1.2 – 1.5	241.5 - 241.1	30	3.0	20	-	2.6
		Sand, compact	1.5 – 2.3	241.1 - 240.4	30	3.0	20	-	
		Silt, compact	2.3 – 5.0	240.4 - 237.6	30	2.0	10	-	
Noise Wall West of Highway 6 New	W4	Silt fill, dense to very dense	1.2 – 5.2	242.7 - 238.7	32	5.5	21	-	-
	W5	Silt fill, dense/hard	1.2 – 3.0	242.5 - 240.7	32	5.5	21	-	-
		Silt, very dense to dense	3.0 – 5.2	240.7 - 238.5	32	5.5	21	-	
	W6	Sandy silt, very dense	1.2 – 2.3	242.8 - 241.7	32	5.5	21	-	-
		Sandy silt, compact	2.3 – 4.2	241.7 - 239.8	30	3.0	20	-	
		Sand, dense	4.2 – 5.2	239.8 - 238.8	33	6.5	21	-	

Notes: * Ignore resistance in upper 1.2 m due to frost effects.
** Shear strength (c_u) = unconfined compressive strength (q_u) / 2.

THURBER

TABLE 7.3
SIGN FOUNDATION DESIGN PARAMETERS
HIGHWAY 403 IMPROVEMENTS, GWP 2440-04-00

Sign Location	Borehole Number	Subsurface Stratigraphy			Foundation Design Parameters				
		Material	Depth* (m)	Elevation	ϕ (deg.)	n_h (MN/m^3)	γ' (kN/m^3)	q_u** (kPa)	Depth to Groundwater (m)
Sta. 29+950	S1	Silty sand fill, dense to compact Sandy silt to silt, compact to very dense	1.2 – 2.3 2.3 – 5.2	248.0 - 246.9 246.9 - 244.0	30 32	3.0 5.5	20 20	- -	4.9
Sta. 21+521	S2	Sand fill, compact Sand, compact to dense Sand, compact to dense	1.2 – 2.3 2.3 – 3.7 3.7 – 5.0	243.7 - 242.6 242.6 - 241.2 241.2 - 239.9	30 32 32	3.0 5.5 3.5	20 21 11	- - -	3.7
Sta. 23+250	P3	Silty clay, very stiff Sandy silt, dense to very dense Sand, compact to dense Sandy silt, very dense	1.2 – 2.2 2.2 – 4.3 4.3 – 8.1 8.1 – 9.6	238.8 - 237.8 237.8 - 235.7 235.7 - 231.9 231.9 - 230.4	- 33 33 34	- 6.5 4.5 5.5	19 20 11 11	200 - - -	4.3
Sta. 23+425	P4	Sandy silt, dense Silt, compact Silty sand, compact Silt, dense	1.2 – 3.0 3.0 – 5.6 5.6 – 7.3 7.3 – 9.8	237.0 - 235.2 235.2 - 232.5 232.5 - 230.9 230.9 - 228.4	33 30 32 33	6.5 3.0 3.5 4.5	20 20 10 11	- - - -	4.9
Sta. 24+325	P9	Clayey silt, very stiff to stiff Silt, compact Silt, very dense Silty clay, hard	1.2 – 2.3 2.3 – 4.1 4.1 – 8.7 8.7 – 9.8	231.4 - 230.3 230.3 - 228.5 228.5 - 223.9 223.9 - 222.9	- 30 34 -	- 2.0 5.5 -	19 10 11 11	150 - - 300	2.3

Notes: * Ignore resistance in upper 1.2 m due to frost effects.
** Shear strength (c_u) = unconfined compressive strength (q_u) / 2.

Appendix A

Record of Borehole Sheets

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

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

$\overline{\blacktriangledown}$ Water Level

C_{pen} 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

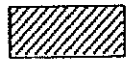
MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, 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			

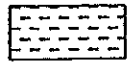
EXPLANATION OF ROCK LOGGING TERMS

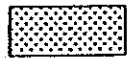
ROCK WEATHERING CLASSIFICATION

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

SYMBOLS


CLAYSTONE


SILTSTONE


SANDSTONE


COAL


Bedrock (general)

DISCONTINUITY SPACING

Bedding	**Bedding Plane Spacing**
Very thickly bedded	Greater than 2m
Thickly bedded	0.6 to 2m
Medium bedded	0.2 to 0.6m
Thinly bedded	60mm to 0.2m
Very thinly bedded	20 to 60mm
Laminated	6 to 20mm
Thinly Laminated	Less than 6mm

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.

STRENGTH CLASSIFICATION

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

THURBER

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RECORD OF BOREHOLE No P1 1 OF 2 METRIC

W.P. 2440-04-00 LOCATION N 4 786 192.61 E 266 957.36 (ST. 22+970, 4m RT) ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 03.10.05 - 03.10.05 CHECKED BY MRA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
244.8											
0.0	**TOPSOIL:** (150 mm)										
0.2	**SAND**, fine grained, some silt to silty, trace gravel, occasional clay lumps Compact to Dense Brown Moist		1	SS	17		244		○		
			2	SS	31		243		○		
241.9			3	SS	5				○		0 72 20 8
2.9	**SILT**, some sand, trace clay Compact Brown Moist		4	SS	21		242		○		
240.4							241				
4.4	**SAND**, fine grained, some silt to silty Compact Brown Moist to Wet		5	SS	21		240		○		0 73 22 5
			6	SS	16		239		○		
			7	SS	10		238				
			8	SS	28		237		○		
235.1							236		○		
9.8	END OF BOREHOLE AT 9.76 m.										

Continued Next Page

÷ ³, × ³ : Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

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THURBER

RECORD OF BOREHOLE No P1 2 OF 2 METRIC

W.P. 2440-04-00 LOCATION N 4 786 192.61 E 266 957.36 (ST. 22+970, 4m RT) ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 03.10.05 - 03.10.05 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	WATER CONTENT (%) 20 40 60		GR SA SI CL
	BOREHOLE OPEN TO 7.16 m AND WATER LEVEL AT 6.10 m UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE UPON COMPLETION.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

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RECORD OF BOREHOLE No P1 (DCPT) 1 OF 1 METRIC

W.P. 2440-04-00 LOCATION ST. 22+970, CL ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM

DATUM Geodetic DATE 03.10.05 - 03.10.05 CHECKED BY MRA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100): ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	Augered to 3.05 m.										
3.0	Dynamic Cone Penetration (DCPT) started at 3.05 m.										
9.1	END DCPT AT 9.15 m. DCPT HOLE BACKFILLED WITH BENTONITE TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$15 \overset{20}{\oplus} 5$ 10 (%) STRAIN AT FAILURE

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RECORD OF BOREHOLE No P2 1 OF 2 METRIC

W.P. 2440-04-00 LOCATION N 4 786 320.93 E 267 035.03 (ST. 23+120, 4m RT) ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 03.10.05 - 03.10.05 CHECKED BY MRA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
242.1									
0.0	**TOPSOIL**: (130 mm)								
0.1	Sandy **SILT**, some clay, trace gravel, occasional black staining Compact Brown (FILL)		1	SS	13		242		
240.7							241		
1.4	Clayey **SILT**, trace sand Stiff Brown (FILL)		2	SS	8				
239.9							240		
2.2	Sandy **SILT**, trace clay, occasional black staining, occasional wood fibers Compact Grey (FILL)		3	SS	23				
239.1							239		
3.0	**SILT**, some sand to sandy, trace to some clay Loose Grey Wet		4	SS	6				0 23 69 8
237.9							238		
4.3	Clayey **SILT**, trace sand Very Stiff to Hard Grey		5	SS	15		237		
235.7			6	SS	75		236		
6.5	**SAND**, fine to medium grained, some silt, trace gravel Dense to Compact Brown Moist					▽	235		
			7	SS	31				0 86 14 (SI+CL)
							234		
			8	SS	23		233		
232.4									
9.8	END OF BOREHOLE AT 9.76 m.								

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L
WATER CONTENT (%) 20 40 60

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 15 10 5 (%) STRAIN AT FAILURE

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THURBER

RECORD OF BOREHOLE No P2 2 OF 2 METRIC

W.P. 2440-04-00 LOCATION N 4 786 320.93 E 267 035.03 (ST. 23+120, 4m RT) ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 03.10.05 - 03.10.05 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	WATER CONTENT (%) 20 40 60		GR SA SI CL
	Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) 18.12.05 6.92										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE
10

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RECORD OF BOREHOLE No P3 1 OF 2 METRIC

W.P. 2440-04-00 LOCATION N 4 786 466.23 E 267 113.63 (ST. 23+285, 4m LT) ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 03.10.05 - 03.10.05 CHECKED BY MRA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
240.0							240				
0.0	**TOPSOIL:** (130 mm)										
0.1	Silty **CLAY**, trace sand, occasional black oxide staining Very Stiff Brown										
			1	SS	26		239		○		
			2	SS	28				⊖		0 7 74 19
237.8							238				
2.2	Sandy **SILT**, trace clay Dense to Very Dense Brown Moist		3	SS	43				○		0 38 54 8
			4	SS	53		237		○		
235.7							236				
4.3	**SAND**, fine grained, trace silt Compact to Dense Brown Moist to Wet		5	SS	24				○		
			6	SS	32		235		○		
			7	SS	48		234		○		
231.9							233				
8.1	Sandy **SILT** Very Dense Grey Moist						232		○		
			8	SS	95/ .275		231		○		0 20 71 9
230.4											
9.6	END OF BOREHOLE AT 9.58 m. BOREHOLE OPEN TO 4.04 m AND WATER LEVEL AT 3.81 m UPON										

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

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RECORD OF BOREHOLE No P3 2 OF 2 METRIC

W.P. 2440-04-00 LOCATION N 4 786 466.23 E 267 113.63 (ST. 23+285, 4m LT) ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 03.10.05 - 03.10.05 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH HOLEPLUG UPON COMPLETION OF DRILLING.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

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THURBER

RECORD OF BOREHOLE No P4 1 OF 2 METRIC

W.P. 2440-04-00 LOCATION N 4 786 607.38 E 267 199.07 (ST. 23+450, 4m LT) ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 03.10.05 - 03.10.05 CHECKED BY MRA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
238.2											
0.0	**TOPSOIL:** (150 mm)						238				
0.2	Sandy **SILT**, trace to some clay Dense Brown Moist		1	SS	43		237				
			2	SS	30		236				
235.2			3	SS	29						0 42 52 6
3.0	**SILT**, some clay to clayey, some sand Very Stiff Brown to Grey Moist		4	SS	27		235				
			5	SS	16	▽	234				0 10 73 17
232.5							233				
5.6	Silty **SAND**, trace clay Compact Grey Wet		6	SS	24		232				
230.9							231				
7.3	**SILT**, trace clay, trace sand Dense Grey Moist to Wet		7	SS	31		230				0 5 89 6
	occasional clayey silt layers		8	SS	34		229				
228.4											
9.8	END OF BOREHOLE AT 9.76 m.										

Continued Next Page

+ ³, × ³ : Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

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THURBER

RECORD OF BOREHOLE No P4 2 OF 2 METRIC

W.P. 2440-04-00 LOCATION N 4 786 607.38 E 267 199.07 (ST. 23+450, 4m LT) ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 03.10.05 - 03.10.05 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) 18.12.05 4.94										

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 / 10 / 5 (%) STRAIN AT FAILURE

ONTMT4S 5188.GPJ 19/01/06

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No P5 1 OF 2 METRIC

W.P. 2440-04-00 LOCATION N 4 786 744.78 E 267 281.07 (ST. 23+610, 5m LT) ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 02.10.05 - 02.10.05 CHECKED BY MRA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
236.6											
0.0	**SAND**, fine grained, some silt, trace clay lumps Compact Brown Moist						236				
			1	SS	29						
235.2											
1.4	**SILT**, trace clay, trace sand Dense Brown Moist						235				
			2	SS	36						
234.4											
2.2	**SAND**, some silt Compact Brown Wet						234				
			3	SS	16						
233.9											
2.7	Silty **CLAY**, trace sand Hard Brown						233				
			4	SS	38						0 7 67 25
232.9											
3.7	**SAND**, trace to some silt Compact Brown Wet						232				
			5	SS	26						
230.5							231				
6.1	Silty **SAND**, fine grained, trace clay Compact Grey Wet		6	SS	16		230				
							229				
			7	SS	10						0 74 22 4
							228				
227.1			8	SS	50						
9.5 226.9	Sandy **SILT** Very Dense						227				
9.8	Grey										

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 5188.GPJ 19/01/06

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No P5 2 OF 2 METRIC

W.P. 2440-04-00 LOCATION N 4 786 744.78 E 267 281.07 (ST. 23+610, 5m LT) ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 02.10.05 - 02.10.05 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
	Moist END OF BOREHOLE AT 9.76 m. BOREHOLE OPEN TO 2.90 m AND WATER LEVEL AT 2.03 m UPON COMPLETION OF DRILLING. BOREHOLE GROUTED WITH BENTONITE UPON COMPLETION.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

15 (20) 5 10 (%) STRAIN AT FAILURE

ONTMT4S 5188.GPJ 19/01/06

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No P5 (DCPT) 1 OF 1 METRIC

W.P. 2440-04-00 LOCATION ST. 23+610 ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM

DATUM Geodetic DATE 02.10.05 - 02.10.05 CHECKED BY MRA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	Augered to 3.05 m.										
3.0	Dynamic Cone Penetration (DCPT) started at 3.05 m.										
9.1	END DCPT AT 9.15 m. DCPT HOLE BACKFILLED WITH BENTONITE TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 5188.GPJ 19/01/06

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No P6 1 OF 2 METRIC

W.P. 2440-04-00 LOCATION N 4 786 868.96 E 267 365.58 (ST. 23+760, 3m RT) ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 04.10.05 - 04.10.05 CHECKED BY MRA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
235.0											
0.0	**TOPSOIL:** (150 mm)						235				
0.2	Clayey **SILT**, some silty sand seams Very Stiff Grey (FILL)		1	SS	30				○		
233.7							234				
1.4	**SILT**, some sand, trace clay Compact Brown Moist		2	SS	27				○		
			3	SS	21		233		○		0 13 79 7
232.1											
2.9	**SILT**, some clay to clayey, trace sand Very Stiff Grey		4	SS	22		232		○		0 8 78 15
230.8							231				
4.3	Sandy **SILT**, trace clay Compact Grey Wet		5	SS	27				○		
229.3							230				
5.8	**SILT**, trace clay, trace sand Dense to Compact Grey Moist to Wet		6	SS	43		229		○		
			7	SS	25	▽	228		○		0 1 93 6
	Becoming Loose		8	SS	8		227		○		
225.3							226				
9.8	END OF BOREHOLE AT 9.76 m.										

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

$15 \overset{20}{\underset{10}{\oplus}} 5$ (%) STRAIN AT FAILURE

ONTMT4S 5198.GPJ 19/01/06

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No P6 2 OF 2 METRIC

W.P. 2440-04-00 LOCATION N 4 786 868.96 E 267 365.58 (ST. 23+760, 3m RT) ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 04.10.05 - 04.10.05 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) 18.12.05 7.45										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\overset{20}{15\text{-}\oplus\text{-}5}$ (%) STRAIN AT FAILURE
$\underset{10}{}$

ONTMT4S 5188.GPJ 19/01/06

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No P6 (DCPT) 1 OF 1 METRIC

W.P. 2440-04-00 LOCATION ST. 23+760 ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM

DATUM Geodetic DATE 04.10.05 - 04.10.05 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	WATER CONTENT (%) 20 40 60	γ kN/m^3	GR SA SI CL
0.0	Dynamic Cone Penetration (DCPT) started at surface.										
7.0	END DCPT AT 7.01 m. DCPT HOLE BACKFILLED WITH BENTONITE TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

ONTMT4S 5188.GPJ 19/01/06

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No P7 1 OF 2 METRIC

W.P. 2440-04-00 LOCATION N 4 787 013.88 E 267 454.47 (ST. 23+930, 4m RT) ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 05.10.05 - 05.10.05 CHECKED BY MRA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
233.8											
0.0	**TOPSOIL**: (100 mm)										
0.1	Silty **CLAY**, trace sand Very Stiff to Very Soft Brown Moist to Wet		1	SS	30		233				
			2	SS	9		232				
			3	SS	0		231				0 3 69 28
			4	SS	23		230				
	Grey										
228.8			5	SS	36		229				
5.0	**SILT**, trace sand, trace clay Dense to Compact Grey Wet						228				
			6	SS	36		227				
			7	SS	26		226				0 0 91 9
							225				
224.0			8	SS	39						
9.8	END OF BOREHOLE AT 9.76 m.										

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+ ^{3}, × ^{3}: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 5188.GPJ 19/01/06

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No P7 2 OF 2 METRIC

W.P. 2440-04-00 LOCATION N 4 787 013.88 E 267 454.47 (ST. 23+930, 4m RT) ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 05.10.05 - 05.10.05 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
	BOREHOLE OPEN TO 5.08 m AND WATER LEVEL AT 2.21 m. BOREHOLE BACKFILLED WITH HOLEPLUG TO SURFACE.										

$+^{3}$, $\times^{3}$: Numbers refer to Sensitivity

20 15 10 5 (%) STRAIN AT FAILURE

ONTMT4S 5188.GPJ 19/01/06

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No P8 1 OF 2 METRIC

W.P. 2440-04-00 LOCATION N 4 787 159.31 E 267 542.50 (ST. 24+100, 4m RT) ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 05.10.05 - 05.10.05 CHECKED BY MRA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
233.3											
0.0	**TOPSOIL**: (130 mm)										
0.1	Clayey **SILT** to Silty **CLAY**, trace sand, some sand seams Very Stiff to Hard Brown										
			1	SS	23		233				
			2	SS	18		232				
			3	SS	75/ .275	▽	231				
	Grey		4	SS	72		230				0 3 79 18
			5	SS	50/ .125		229				
			6	SS	86/ .275		228				
			7	SS	90/ .275		227				0 4 72 23
			8	SS	43		226				
223.6							225				
9.8	END OF BOREHOLE AT 9.76 m.						224				

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$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 5188.GPJ 20/01/06

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No P8 2 OF 2 METRIC

W.P. 2440-04-00 LOCATION N 4 787 159.31 E 267 542.50 (ST. 24+100, 4m RT) ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 05.10.05 - 05.10.05 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) 18.12.05 2.24										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15}\ominus\frac{5}{10}$ (%) STRAIN AT FAILURE

ONTMT4S 5188.GPJ 20/01/06

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No P9 1 OF 2 METRIC

W.P. 2440-04-00 LOCATION N 4 787 305.26 E 267 629.67 (ST. 24+270, 3m RT) ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 05.10.05 - 05.10.05 CHECKED BY MRA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
232.6											
0.0	**TOPSOIL:** (130 mm)										
0.1	Clayey **SILT**, trace sand Very Stiff to Stiff Brown										
			1	SS	18		232		○		
			2	SS	11		231		○		
230.3											
2.3	**SILT**, trace clay, trace to some sand Compact to Very Dense Grey Moist to Wet		3	SS	17		230		○		
			4	SS	16				○		0 12 79 9
							229				
			5	SS	50		228		○		
							227				
			6	SS	76				○		
							226				
			7	SS	63		225		○		0 11 81 9
223.9											
8.7	Silty **CLAY**, trace sand Hard Grey						224				
			8	SS	58				⊣○⊢		0 4 74 22
222.9							223				
9.8	END OF BOREHOLE AT 9.76 m.										

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+ ³, × ³: Numbers refer to Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

ONTM4S 5188.GPJ 20/01/06

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No P9 2 OF 2 METRIC

W.P. 2440-04-00 LOCATION N 4 787 305.26 E 267 629.67 (ST. 24+270, 3m RT) ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 05.10.05 - 05.10.05 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	WATER CONTENT (%) 20 40 60		GR SA SI CL
	BOREHOLE OPEN TO 9.76 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$15 \overset{20}{\oplus} 5$ 10 (%) STRAIN AT FAILURE

ONTMT4S 5188.GPJ 20/01/06

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No P10 1 OF 2 METRIC

W.P. 2440-04-00 LOCATION N 4 787 446.34 E 267 715.19 (ST. 24+435, 3m RT) ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 04.10.05 - 04.10.05 CHECKED BY MRA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
231.1											
0.0	**TOPSOIL:** (130 mm)										
0.1	Clayey **SILT** to Silty **CLAY**, trace sand Stiff to Hard Brown						231				
			1	SS	27		230		○		
			2	SS	26				○		
	Grey					▽	229				
			3	SS	15				○		0 4 78 18
			4	SS	10		228		○		
							227				
			5	SS	14				○		
							226				
			6	SS	31		225		○		
							224				
			7	SS	39				○		0 2 74 25
							223				
			8	SS	84		222		○		
221.5											
9.6	END OF BOREHOLE AT 9.60 m. BOREHOLE OPEN TO 9.60 m AND										

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+ ³, × ³: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 5188.GPJ 20/01/06

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No P10 2 OF 2 METRIC

W.P. 2440-04-00 LOCATION N 4 787 446.34 E 267 715.19 (ST. 24+435, 3m RT) ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 04.10.05 - 04.10.05 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
	DRY UPON COMPLETION. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) 18.12.05 2.30										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$15 \oplus^{20}_{10} 5$ (%) STRAIN AT FAILURE

ONTMT4S 5188.GPJ 20/01/06

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No P11 1 OF 2 METRIC

W.P. 2440-04-00 LOCATION N 4 787 608.22 E 267 823.57 (ST. 24+630, 3m RT) ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 04.10.05 - 05.10.05 CHECKED BY MRA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
228.3											
0.0	**TOPSOIL**: (80 mm)										
0.1	**SILT**, some sand, trace clay Dense Brown Moist		1	SS	44		228		○		
226.9							227				
1.4	**SILT**, some clay to clayey, trace to some sand Very Stiff to Hard Brown		2	SS	20				○		
	Grey		3	SS	32		226		○		
			4	SS	42		225		○		0 7 83 10
			5	SS	38		224		○		
221.8			6	SS	50/.125		223		○		0 12 71 17
6.5	END OF SAMPLING AT 6.45 m. AUGER REFUSAL AT 6.45 m ON PROBABLE BEDROCK.						222				
221.2	MOVED TO RT. SHOULDER OF HWY 403 EBL, NEAR STATION 24+600 AND AUGERED TO REFUSAL AT 7.06 m.										
7.1	Fresh, strong to very strong, grey **DOLOSTONE**		1	RUN			221				RUN 1# TCR=100%, SCR=100%, RQD=100%, UCS=MPa
			2	RUN			220				RUN 2# TCR=100%, SCR=100%, RQD=100%, UCS=MPa
			3	RUN			219				RUN 3# TCR=100%, SCR=100%, RQD=100%, UCS=MPa

ONTMT4S 5188.GPJ 19/01/06

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+ ³, × ³: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No P11 2 OF 2 METRIC

W.P. 2440-04-00 LOCATION N 4 787 608.22 E 267 823.57 (ST. 24+630, 3m RT) ORIGINATED BY SL

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 04.10.05 - 05.10.05 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
218.1											
10.1	END OF BOREHOLE AT 10.11 m. BOREHOLE GROUTED TO SURFACE.						218				

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15}\oplus\frac{5}{10}$ (%) STRAIN AT FAILURE

ONTMT4S 5188.GPJ 19/01/06

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No W1 1 OF 1 METRIC

W.P. 2440-04-00 LOCATION N 4 785 159.28 E 264 086.06 (ST. 28+838, 50.7m LT) ORIGINATED BY GA

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 22.12.05 - 22.12.05 CHECKED BY MRA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
244.3											
0.0	**TOPSOIL:** (75 mm)										
0.1	Silty **SAND** to Sandy **SILT**, trace gravel Loose to compact Brown Damp to Wet		1	SS	8		244		○		
			2	SS	8		243		○		0 27 63 9
			3	SS	11				○		
242.0							242				
2.3	**SAND**, fine to medium grained, some silt Dense to Very Dense Brown Wet		4	SS	44				○		0 74 22 4
			5	SS	50		241		○		
							240				
239.4			6	SS	50/.150				○		
4.9	END OF BOREHOLE AT 4.88 m. BOREHOLE OPEN TO 4.88 m AND WATER LEVEL AT 4.12 m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLE PLUG.										

+³, ×³: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 5188.GPJ 19/01/06

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No W2 1 OF 1 METRIC

W.P. 2440-04-00 LOCATION N 4 785 164.04 E 264 108.05 (ST. 28+860, 56.2m LT) ORIGINATED BY GA

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 22.12.05 - 22.12.05 CHECKED BY MRA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
243.7											
0.0	**TOPSOIL**: (75 mm)										
0.1	Sandy **SILT**, trace gravel Loose Brown Dry		1	SS	6				○		
			2	SS	7		243		○		
242.2											
1.5	Sandy **SILT** Loose Brown Wet		3	SS	6		242		○		0 41 51 7
241.4											
2.3	**SAND**, fine to medium grained, some silt Compact Brown		4	SS	27	▽	241		○		
240.7	Wet										
3.0	Sandy **SILT**, trace gravel Dense Brown Wet		5	SS	41		240		○		
			6	SS	32		239		○		2 24 69 4
238.7											
5.0	END OF BOREHOLE AT 5.03 m. BOREHOLE OPEN TO 5.03 m AND WATER LEVEL AT 3.96 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) 14.01.06 2.70										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15}\oplus\frac{5}{10}$ (%) STRAIN AT FAILURE

ONTMT4S 5188.GPJ 19/01/06

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No W3 1 OF 1 METRIC

W.P. 2440-04-00 LOCATION N 4 785 168.57 E 264 127.53 (ST. 28+879, 61.4m LT) ORIGINATED BY GA

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 22.12.05 - 22.12.05 CHECKED BY MRA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
242.7											
0.0	**TOPSOIL:** (50 mm)										
0.1	Sandy **SILT**, trace gravel, occasional iron oxide staining Loose to Compact Brown Dry		1	SS	5		242				
			2	SS	13						1 27 60 12
241.1											
1.5	**SAND**, fine to medium grained, trace silt, trace gravel Compact Brown Wet		3	SS	12		241				
240.4											
2.3	**SILT**, sandy to some sand, trace gravel Compact Brown Wet		4	SS	21		240				
			5	SS	21						0 14 80 7
							239				
			6	SS	20		238				
237.6											
5.0	END OF BOREHOLE AT 5.03 m. BOREHOLE OPEN TO 5.03 m AND WATER LEVEL AT 2.59 m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLE PLUG.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

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Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No W4 1 OF 1 METRIC

W.P. 2440-04-00 LOCATION N 4 785 437.62 E 266 232.48 (ST. 21+905, 20.0m LT) ORIGINATED BY GA

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 18.12.05 - 18.12.05 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE; ● QUICK TRIAXIAL × LAB VANE	W_P W W_L; WATER CONTENT (%) 20 40 60	γ kN/m^3	GR SA SI CL
243.9											
0.0	**ASPHALT:** (150 mm)										
0.2	**CRUSHER RUN LIMESTONE:** (FILL)		1	SS	47				○		
243.3											
0.6	**SILT,** some sand to sandy, trace gravel Very Dense to Dense Brown Dry (FILL)		2	SS	43		243		○		
			3	SS	61		242		○		2 32 52 15
			4	SS	48		241		○		
			5	SS	54		240		○		
238.7			6	SS	44		239		○		
5.2	END OF BOREHOLE AT 5.18 m. BOREHOLE OPEN TO 5.18 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLE PLUG.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15}\oplus\frac{5}{10}$ (%) STRAIN AT FAILURE

ONTMT4S 5188.GPJ 19/01/06

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No W5 1 OF 1 METRIC

W.P. 2440-04-00 LOCATION N 4 785 479.26 E 266 293.82 (ST. 21+980, 23.0m LT) ORIGINATED BY GA

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 18.12.05 - 18.12.05 CHECKED BY MRA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
243.7											
0.0	**ASPHALT:** (150 mm)										
0.2 / 243.1	**SAND and GRAVEL**, trace silt, occasional black staining, Compact, Brown, (FILL)		1	SS	26				o		
0.6 / 242.3	Sandy **SILT**, some clay, trace gravel, occasional black staining, Very Stiff, Brown, (FILL)		2	SS	25		243		o		
1.4 / 241.5	**SILT**, trace sand, Very Dense, Brown, (FILL)		3	SS	60		242		o		1 9 79 11
2.2 / 240.7	Clayey, Sandy **SILT**, trace gravel, Hard, Brown, (FILL)		4	SS	68		241		o		
3.0	**SILT**, some sand, Very Dense to Dense, Brown, Dry		5	SS	50/ .150		240		o		
238.5			6	SS	45		239		o		0 13 74 13
5.2	END OF BOREHOLE AT 5.18 m. BOREHOLE OPEN TO 5.18 m AND WATER LEVEL AT 1.83 m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLE PLUG.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 5188.GPJ 19/01/06

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No W6 1 OF 1 METRIC

W.P. 2440-04-00 LOCATION N 4 785 523.85 E 266 358.96 (ST. 22+060, 23.0 m LT) ORIGINATED BY GA

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 18.12.05 - 18.12.05 CHECKED BY MRA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
244.0							244				
0.0	**ASPHALT:** (75 mm)										
0.1	**CRUSHER RUN LIMESTONE:** (150 mm)										
0.2	**SAND and GRAVEL**, trace silt Very Dense Brown Dry (FILL)		1	SS	50				○		
243.3											
0.7	Sandy **SILT**, some clay, trace gravel Hard Brown (FILL)		2	SS	36		243		○		
242.4											
1.5	Sandy **SILT** Very Dense to Compact Brown Dry		3	SS	63				○		
			4	SS	15		242		○		0 28 58 14
			5	SS	14		241		○		
239.8							240				
4.2	**SAND**, some silt, trace gravel Dense Brown Dry		6	SS	36				○		8 69 16 6
238.8							239				
5.2	END OF BOREHOLE AT 5.18 m. BOREHOLE OPEN TO 5.18 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLE PLUG, GRAVEL AND ASPHALT AT SURFACE.										

$+^{3}$, $\times^{3}$: Numbers refer to Sensitivity

$\frac{20}{15}\oplus\frac{5}{10}$ (%) STRAIN AT FAILURE

ONTMT4S 5188.GPJ 20/01/06

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S1 1 OF 1 METRIC

W.P. 2440-04-00 LOCATION N 4 785 126.79 E 265 190.62 (ST. 29+950, 20.0m LT) ORIGINATED BY GA

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 18.12.05 - 18.12.05 CHECKED BY MRA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
249.2											
0.0	**ASPHALT:** (150 mm)										
0.2	**CRUSHER RUN LIMESTONE:** (FILL)		1	SS	38		249		○		
248.5											
0.6	Silty **SAND**, trace clay, trace gravel Dense to Compact Brown Dry (FILL)		2	SS	35		248		○		3 59 29 10
			3	SS	11				○		
246.9							247				
2.3	Sandy **SILT**, some sand, trace gravel Compact to Very Dense Brown Damp to Wet		4	SS	24				○		
			5	SS	55		246		○		3 35 55 7
							245				
244.0			6	SS	37				○		
5.2	END OF BOREHOLE AT 5.18 m. BOREHOLE OPEN TO 5.18 m AND WATER LEVEL AT 4.88 m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLE PLUG, GRAVEL AND ASPHALT AT SURFACE.										

+ ^{3}, × ^{3}: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 5188.GPJ 19/01/06

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No S2 1 OF 1 METRIC

W.P. 2440-04-00 LOCATION N 4 785 285.28 E 265 886.06 (ST. 21+521, 24.0m LT) ORIGINATED BY GA

HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM

DATUM Geodetic DATE 22.12.05 - 22.12.05 CHECKED BY MRA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
244.9											
0.0	**ASPHALT:** (100 mm)										
0.1	**CRUSHER RUN LIMESTONE:** (FILL)		1	SS	38				○		
244.3											
0.6	**SAND,** fine to medium grained, some silt, trace gravel Compact Brown Dry (FILL)		2	SS	22		244		○		
			3	SS	11		243		○		5 78 13 4
242.6											
2.3	**SAND,** fine to medium grained, some silt, trace gravel Compact to Dense Brown Wet		4	SS	11		242		○		
			5	SS	19				○		1 72 23 4
							241				
239.9			6	SS	35		240		○		
5.0	END OF BOREHOLE AT 5.03 m. BOREHOLE OPEN TO 5.03 m AND WATER LEVEL AT 3.66 m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLE PLUG, GRAVEL AND ASPHALT AT SURFACE.										

$+^{3}$, $\times^{3}$ Numbers refer to Sensitivity

$\frac{20}{15}\oplus\frac{5}{10}$ (%) STRAIN AT FAILURE

ONTMT4S 5188.GPJ 19/01/06

Appendix B

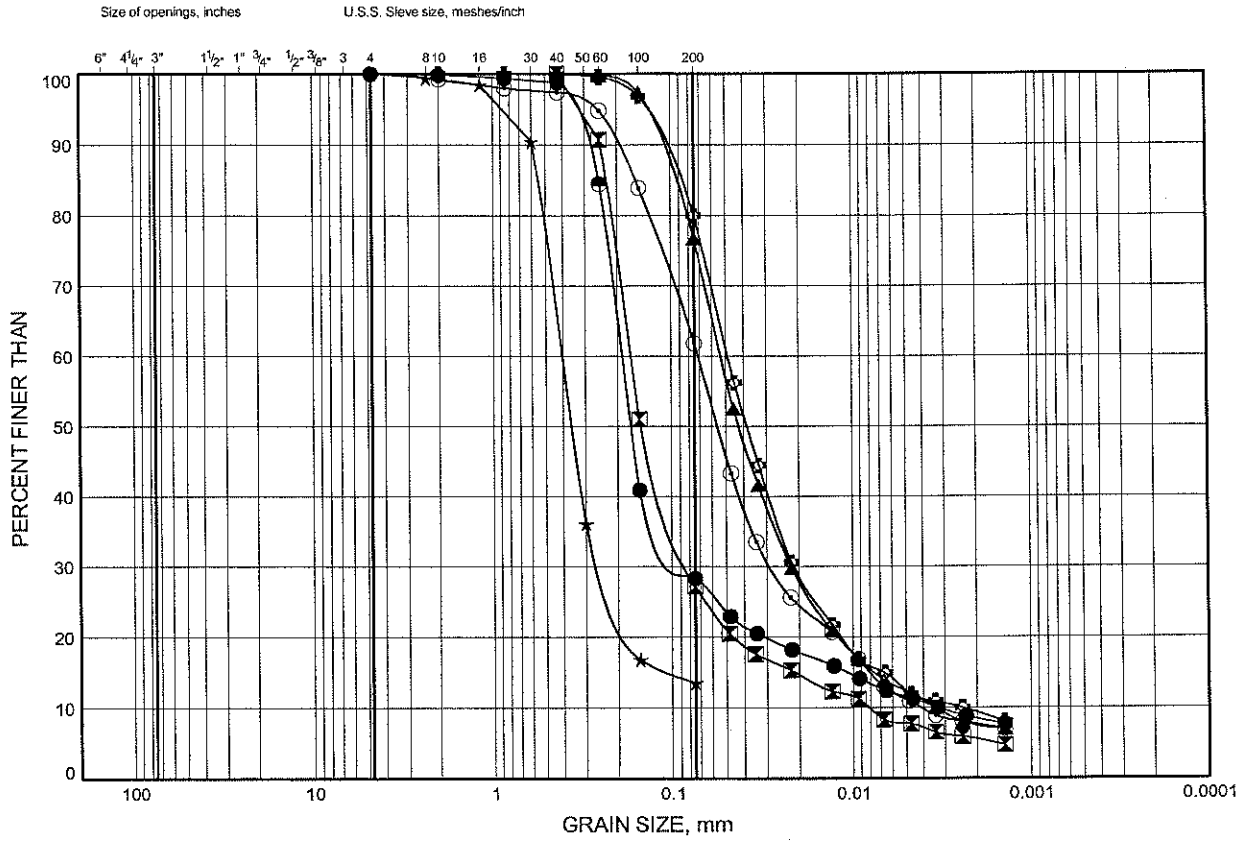
Laboratory Test Results

HWY 403

GRAIN SIZE DISTRIBUTION

FIGURE B1

SILT, Sandy SILT and Silty SAND



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	P1	2.59	242.21
⊠	P1	4.88	239.93
▲	P2	3.35	238.79
★	P2	7.92	234.21
⊙	P3	2.59	237.37
✿	P3	9.37	230.59

Date January 2006

Project 2440-04-00

THURBER

Prep'd WM

Chkd. MRA

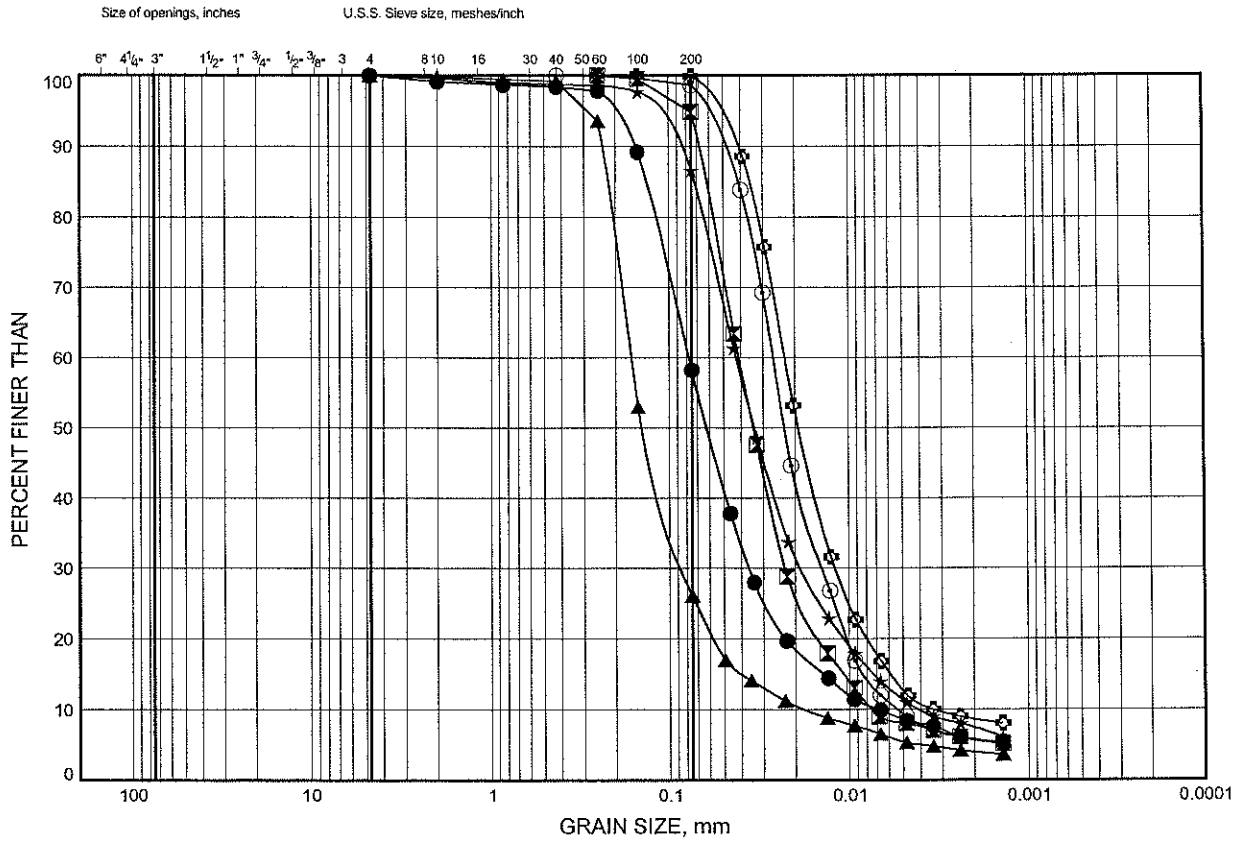
THURBGSD 5188.GPJ 19/01/06

HWY 403

GRAIN SIZE DISTRIBUTION

FIGURE B2

SILT, Sandy SILT and Silty SAND



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	P4	2.59	235.58
⧓	P4	7.92	230.25
▲	P5	7.92	228.68
★	P6	2.59	232.45
⊙	P6	7.92	227.12
✿	P7	7.92	225.87

Date January 2006

Project 2440-04-00

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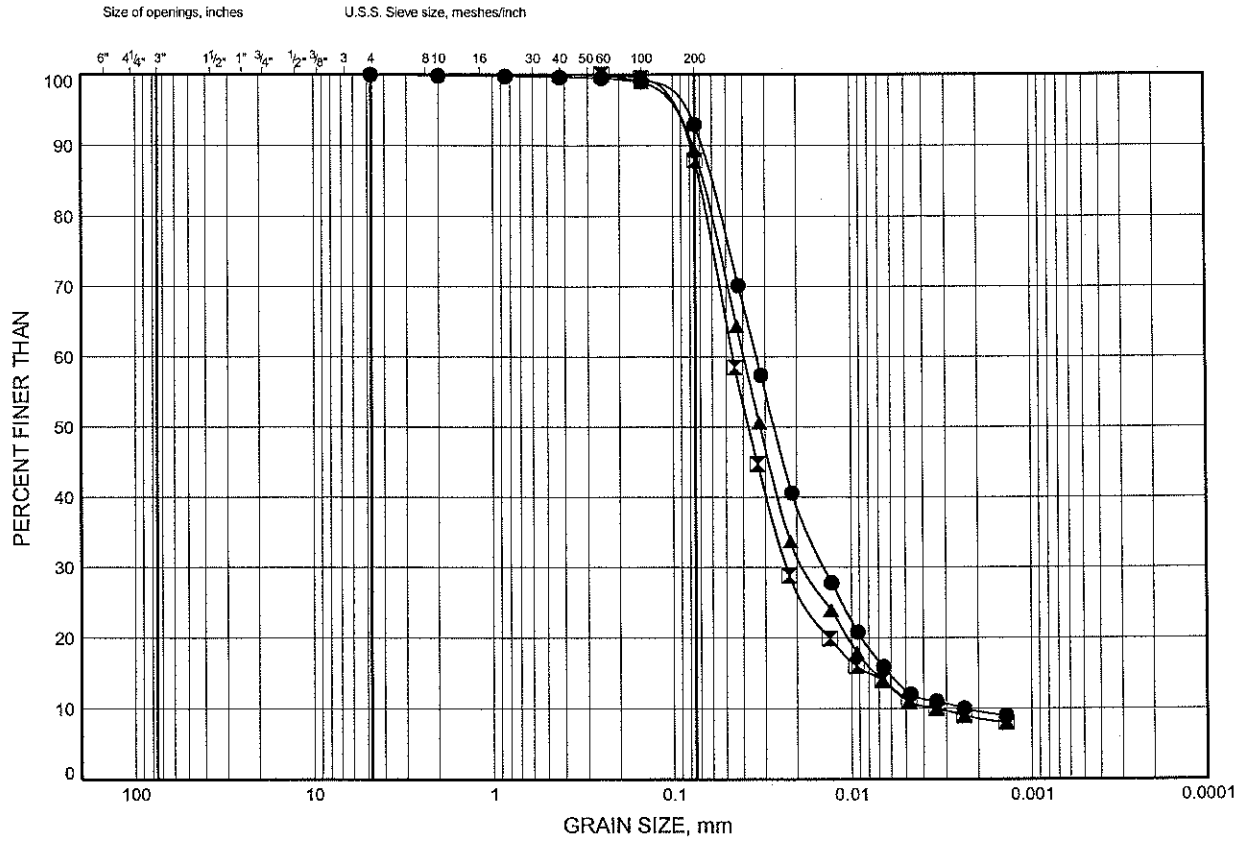
THURBGSD 5188.GPJ 19/01/06

HWY 403

GRAIN SIZE DISTRIBUTION

FIGURE B3

SILT, Sandy SILT and Silty SAND



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	P11	3.35	224.90
⊠	P9	3.35	229.27
▲	P9	7.92	224.70

Date January 2006

Project 2440-04-00

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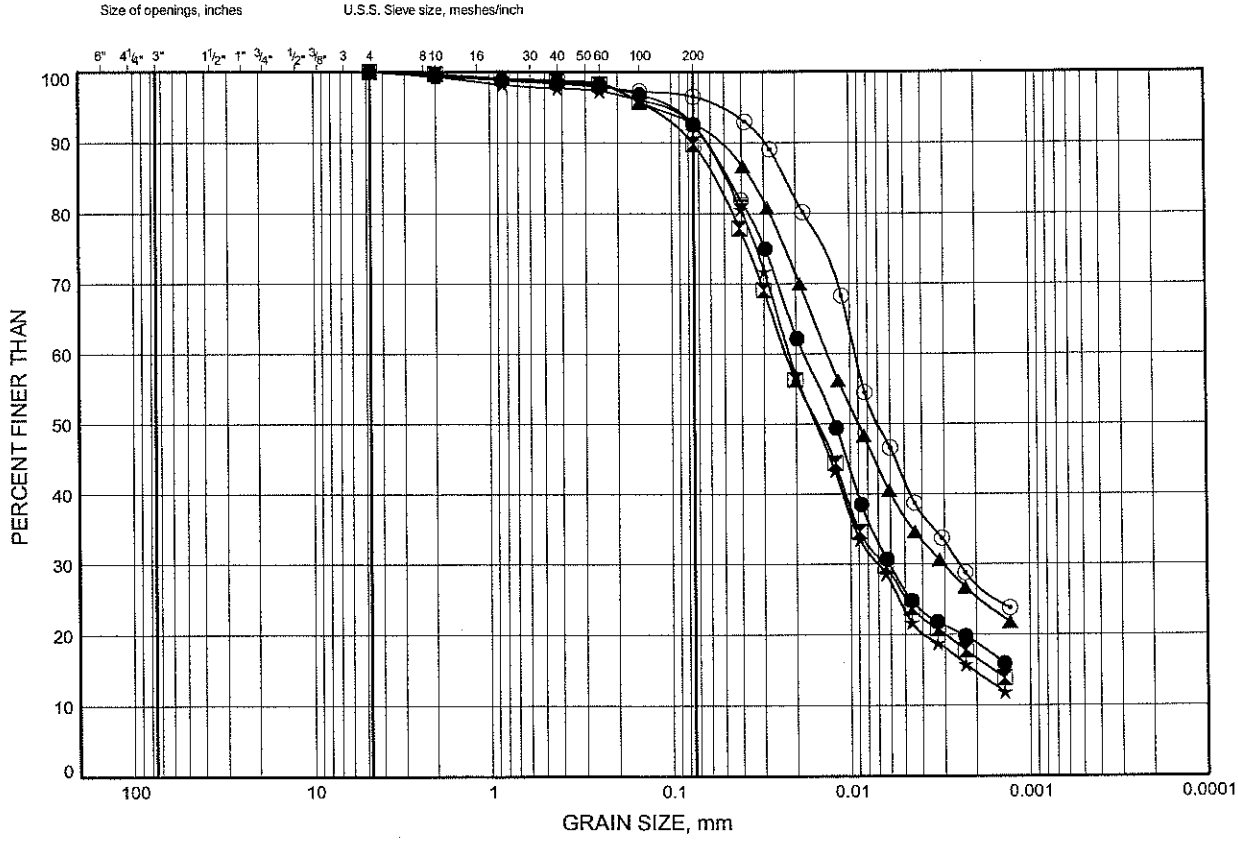
HWY 403

GRAIN SIZE DISTRIBUTION

FIGURE B4

Clayey SILT to Silty CLAY



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	P3	1.83	238.13
⊠	P4	4.88	233.30
▲	P5	3.35	233.26
★	P6	3.35	231.69
⊙	P7	2.59	231.20

Date January 2006

Project 2440-04-00

THURBER

Prep'd WM

Chkd. MRA

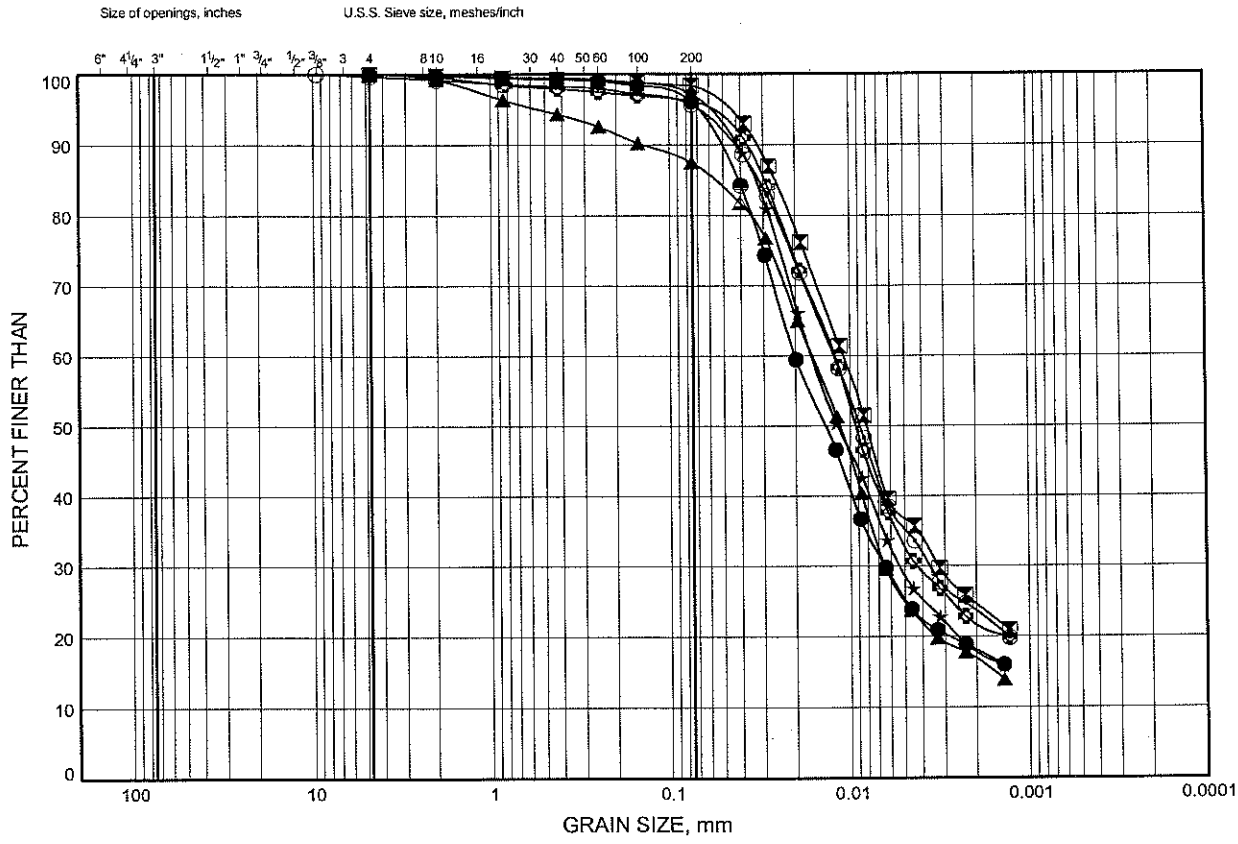
THURBGSD 5188.GPJ 19/01/06

HWY 403

GRAIN SIZE DISTRIBUTION

FIGURE B5

Clayey SILT to Silty CLAY



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	P10	2.59	228.54
⊠	P10	7.92	223.20
▲	P11	6.23	222.02
★	P8	3.19	230.14
⊙	P8	7.85	225.47
✿	P9	9.45	223.17

Date January 2006

Project 2440-04-00

THURBER

Prep'd WM

Chkd. MRA

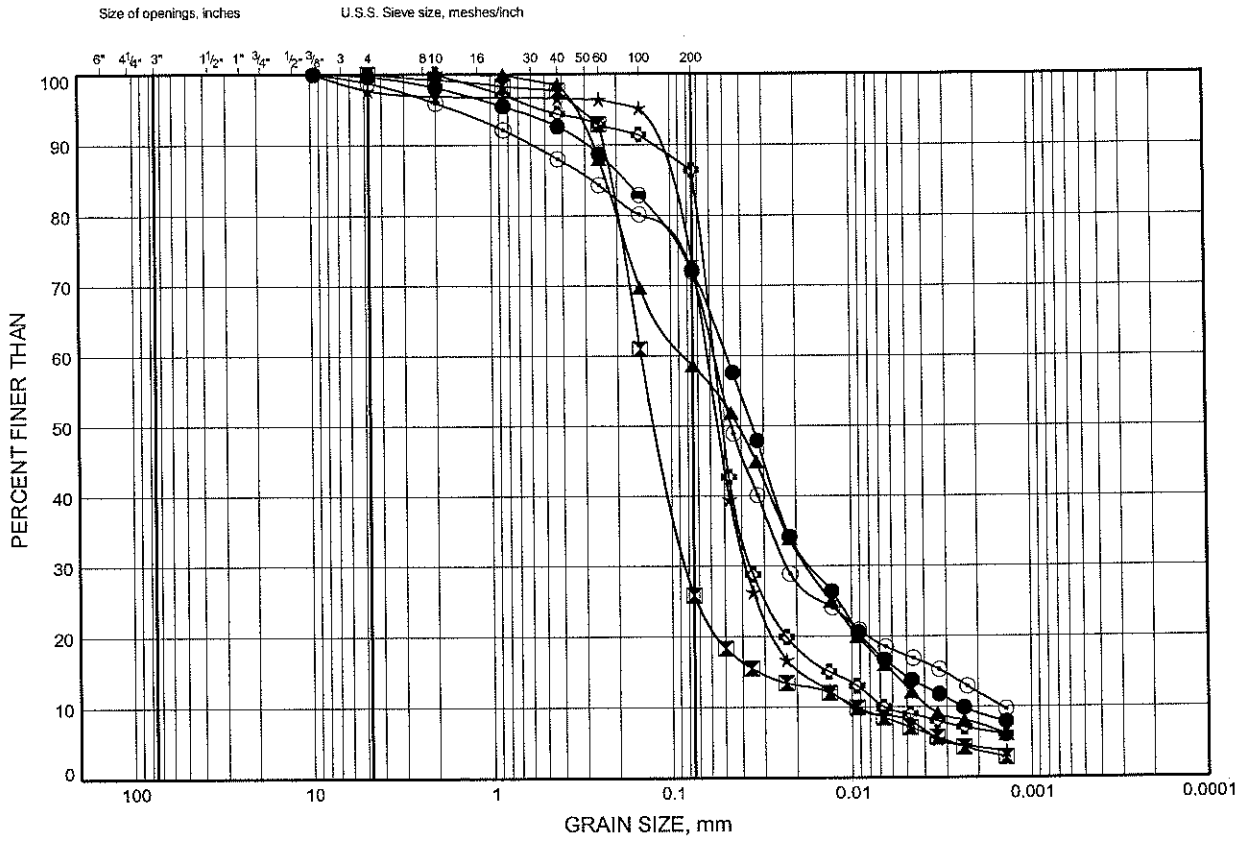
THURBGSD 5188.GPJ 20/01/06

HWY 403

GRAIN SIZE DISTRIBUTION

FIGURE B6

SILT, Sandy SILT and Silty SAND



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	W1	1.07	243.23
⊠	W1	2.59	241.70
▲	W2	1.83	241.90
★	W2	4.80	238.93
⊙	W3	1.07	241.59
✿	W3	3.35	239.30

Date January 2006

Project 2440-04-00

THURBER

Prep'd WM

Chkd. MRA

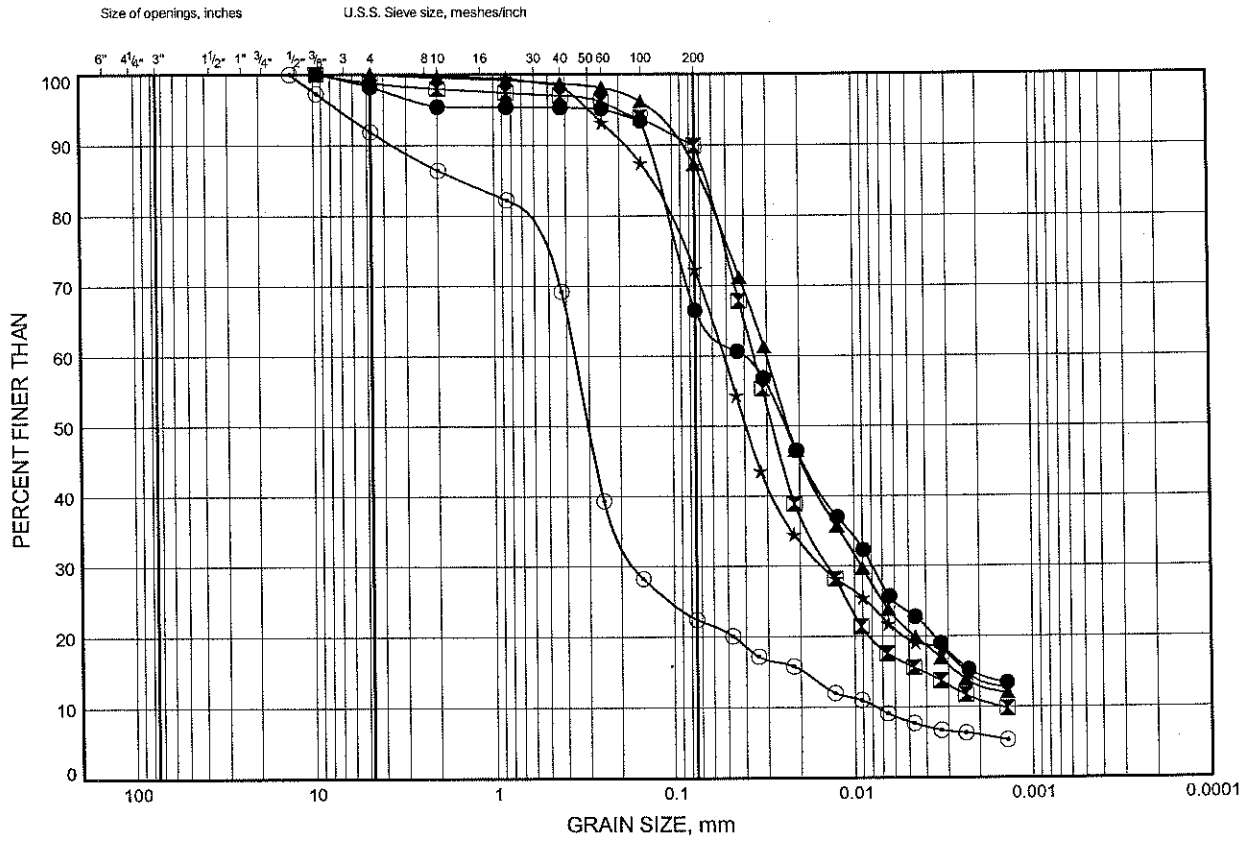
THURBGSD 5188.GPJ 20/01/06

HWY 403

GRAIN SIZE DISTRIBUTION

FIGURE B7

SILT, Sandy SILT and Silty SAND



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	W4	1.83	242.07
⊠	W5	1.83	241.89
▲	W5	4.88	238.84
★	W6	2.59	241.38
⊙	W6	4.88	239.10

Date January 2006

Project 2440-04-00

THURBER

Prep'd WM

Chkd. MRA

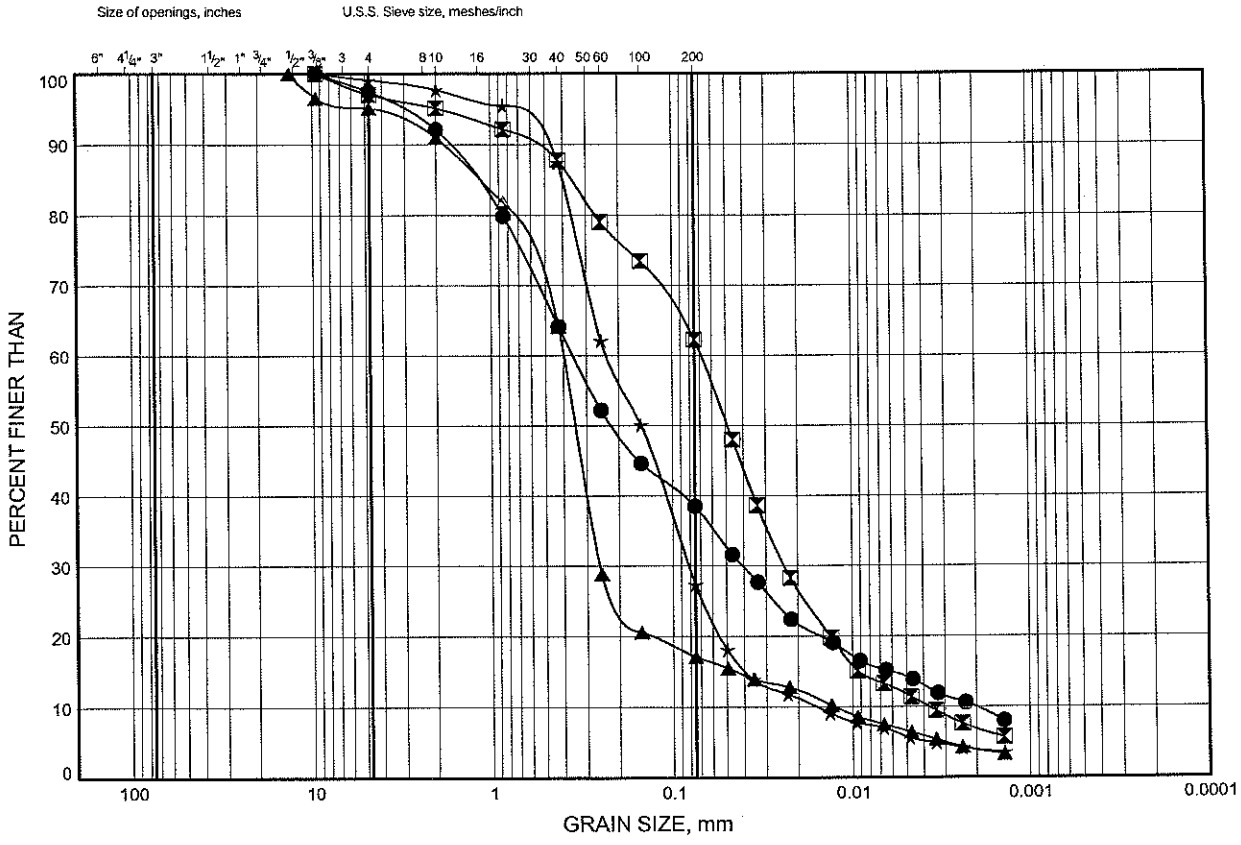
THURBGSD 5188.GPJ 20/01/06

HWY 403

GRAIN SIZE DISTRIBUTION

FIGURE B8

SILT, Sandy SILT and Silty SAND



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	S1	1.07	248.09
⊠	S1	3.35	245.80
▲	S2	1.83	243.05
★	S2	3.35	241.53

Date January 2006

Project 2440-04-00

THURBER

Prep'd WM

Chkd. MRA

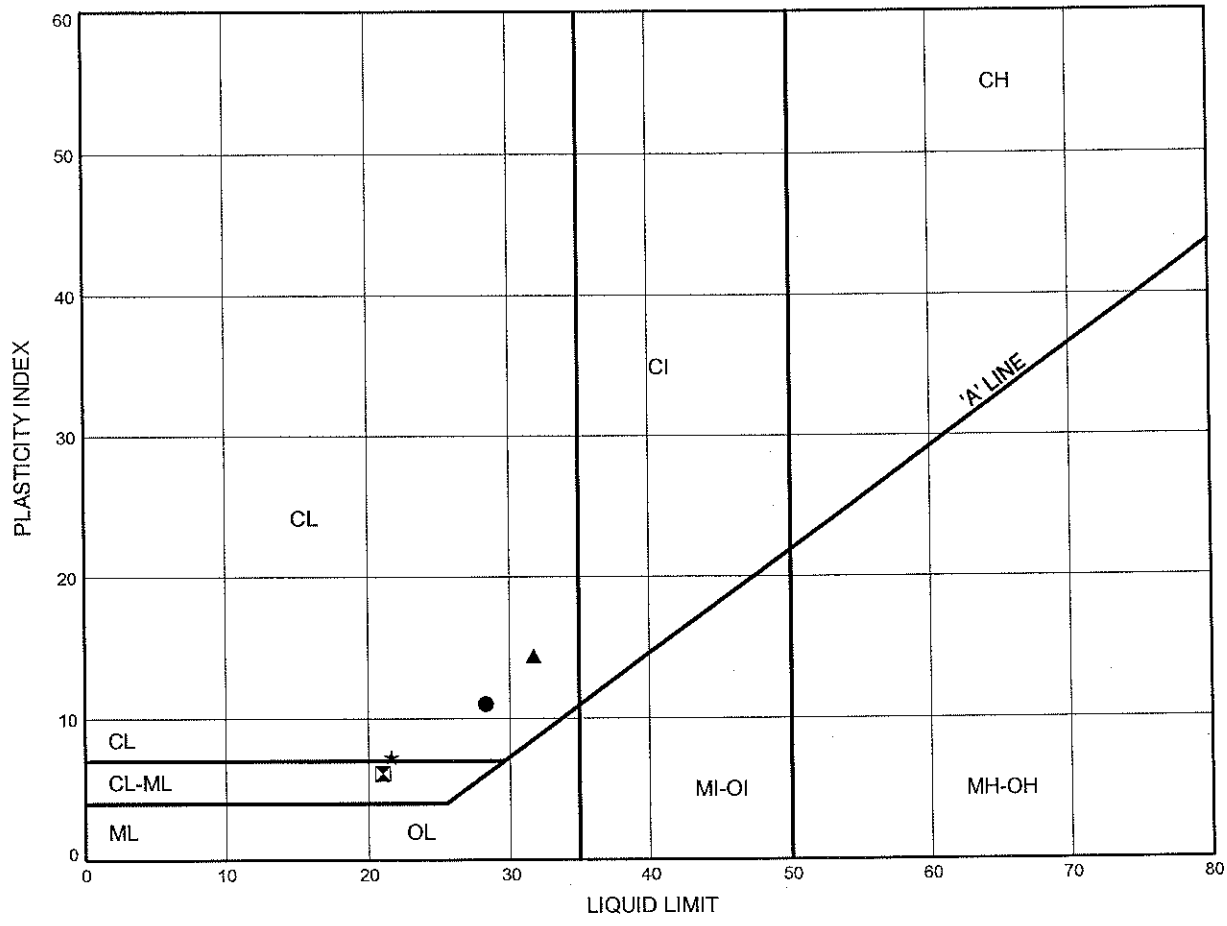
THURBGSD 5188.GPJ 20/01/06

HWY 403

ATTERBERG LIMITS TEST RESULTS

FIGURE B9

Clayey SILT to Silty CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	P3	1.83	238.13
⊠	P4	4.88	233.30
▲	P5	3.35	233.26
★	P6	3.35	231.69

Date January 2006

Project 2440-04-00

THURBER

Prep'd WM

Chkd. MRA

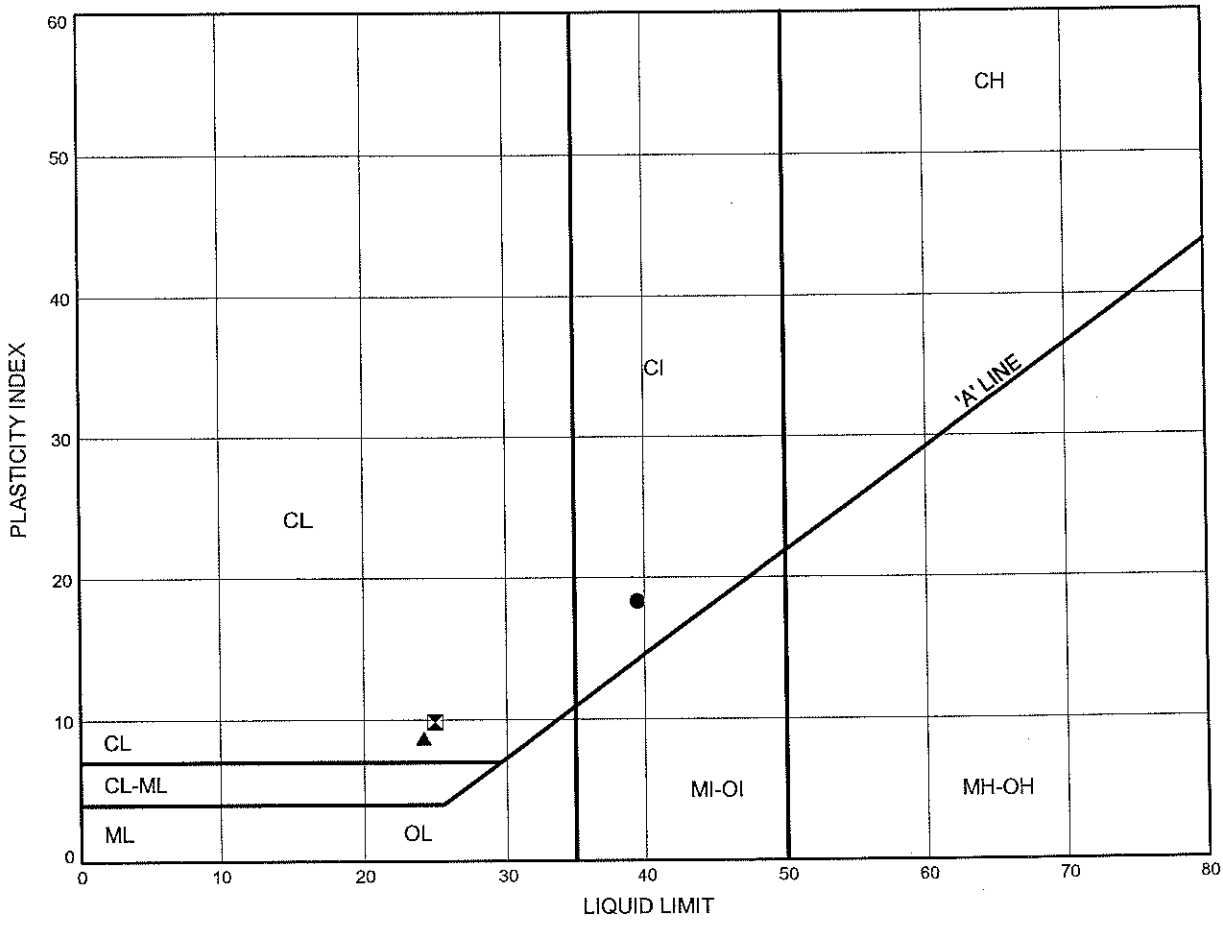
THURBALT 5188.GPJ 19/01/06

HWY 403

ATTERBERG LIMITS TEST RESULTS

FIGURE B10

Clayey SILT to Silty CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	P7	2.59	231.20
⊠	P8	7.85	225.47
▲	P9	9.45	223.17

Date January 2006

Project 2440-04-00

THURBER

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Chkd. MRA

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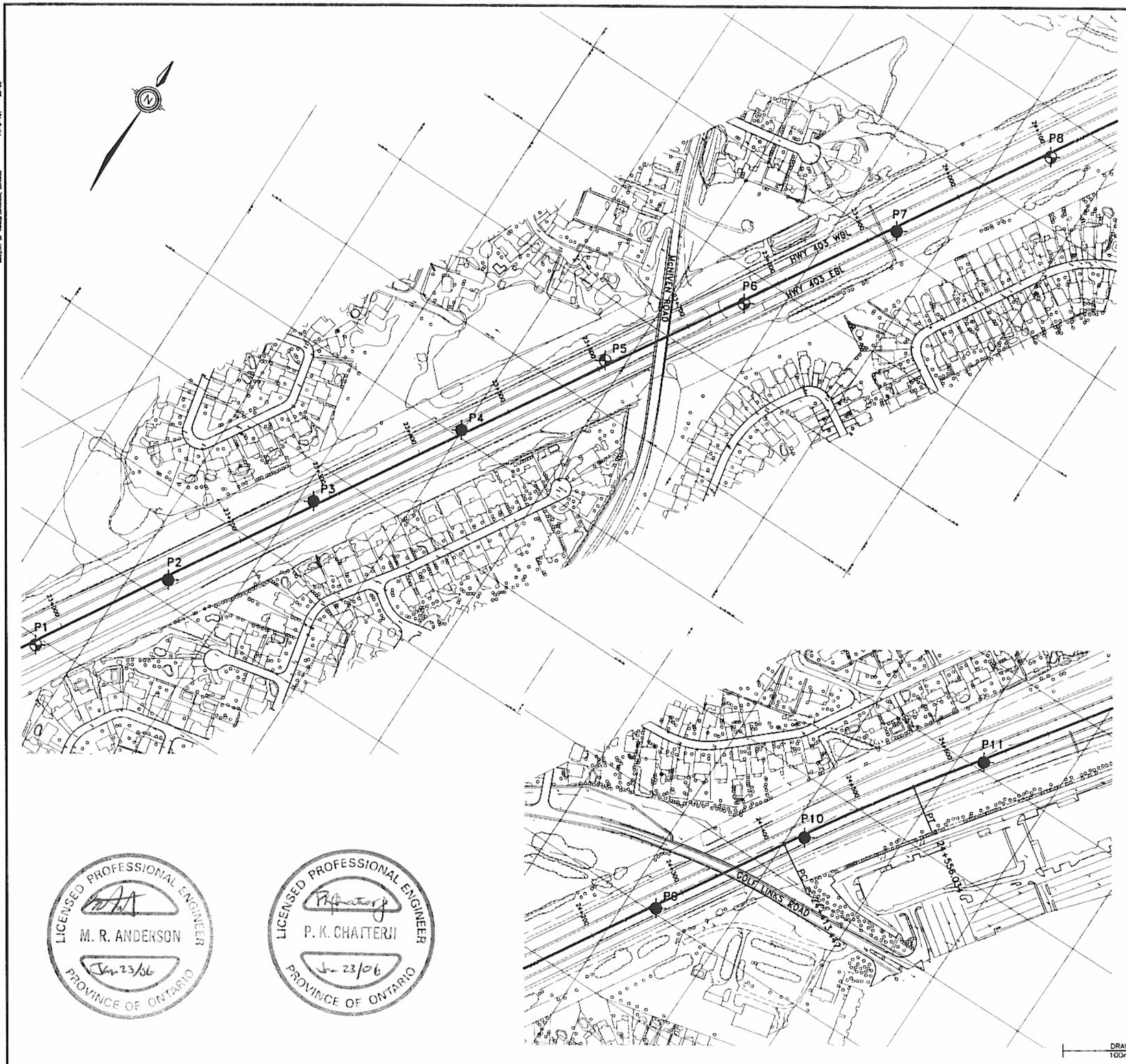
Appendix C

Borehole Locations Drawings



METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 403

GWP No. 2440-04-00

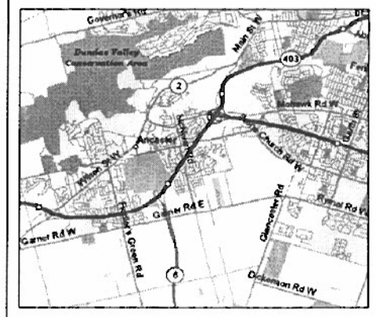
HWY 403 IMPROVEMENTS
LINC TO WILSON STREET

BOREHOLE LOCATION PLAN

SHEET

McCORMICK RANKIN CORPORATION

THURBER ENGINEERING LTD.



KEYPLAN

	LEGEND
●	Bore Hole
⊕	Bore Hole & Cone
N	Blows/ 0.3m (Std Pen Test, 475 J/blow)
CONE	Blows/ 0.3m (60° Cone, 475 J/blow)
PH	Pressure, Hydraulic
▼	WL at Time of Investigation
▼	Head Artesian Water
▏	Piezometer
90%	Rock Quality Designation (RQD)

NO	ELEVATION	NORTHING	EASTING
P1	244.8	4786192.6	266957.4
P2	242.1	4786320.9	267035.0
P3	240.0	4786466.2	267113.6
P4	238.2	4786607.4	267199.1
P5	236.6	4786744.8	267281.1
P6	235.0	4786869.0	267365.6
P7	233.8	4787013.9	267454.5
P8	233.3	4787159.3	267542.5
P9	232.6	4787305.3	267629.7
P10	231.1	4787446.3	267715.2
P11	228.3	4787608.2	267823.6

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

LICENSED PROFESSIONAL ENGINEER
M. R. ANDERSON
Jan 23/06
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. K. CHATTERJI
Jan 23/06
PROVINCE OF ONTARIO

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

REVISIONS	DESCRIPTION	

DESIGN MRA	CHK PKC	CODE	LOAD		DATE	JAN 06
DRAWN JHL	CHK MRA	SITE	STRUCT	SCHEME	DWG	1

MINISTRY OF TRANSPORTATION, ONTARIO

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

HWY 403

GWP No. 2440-04-00

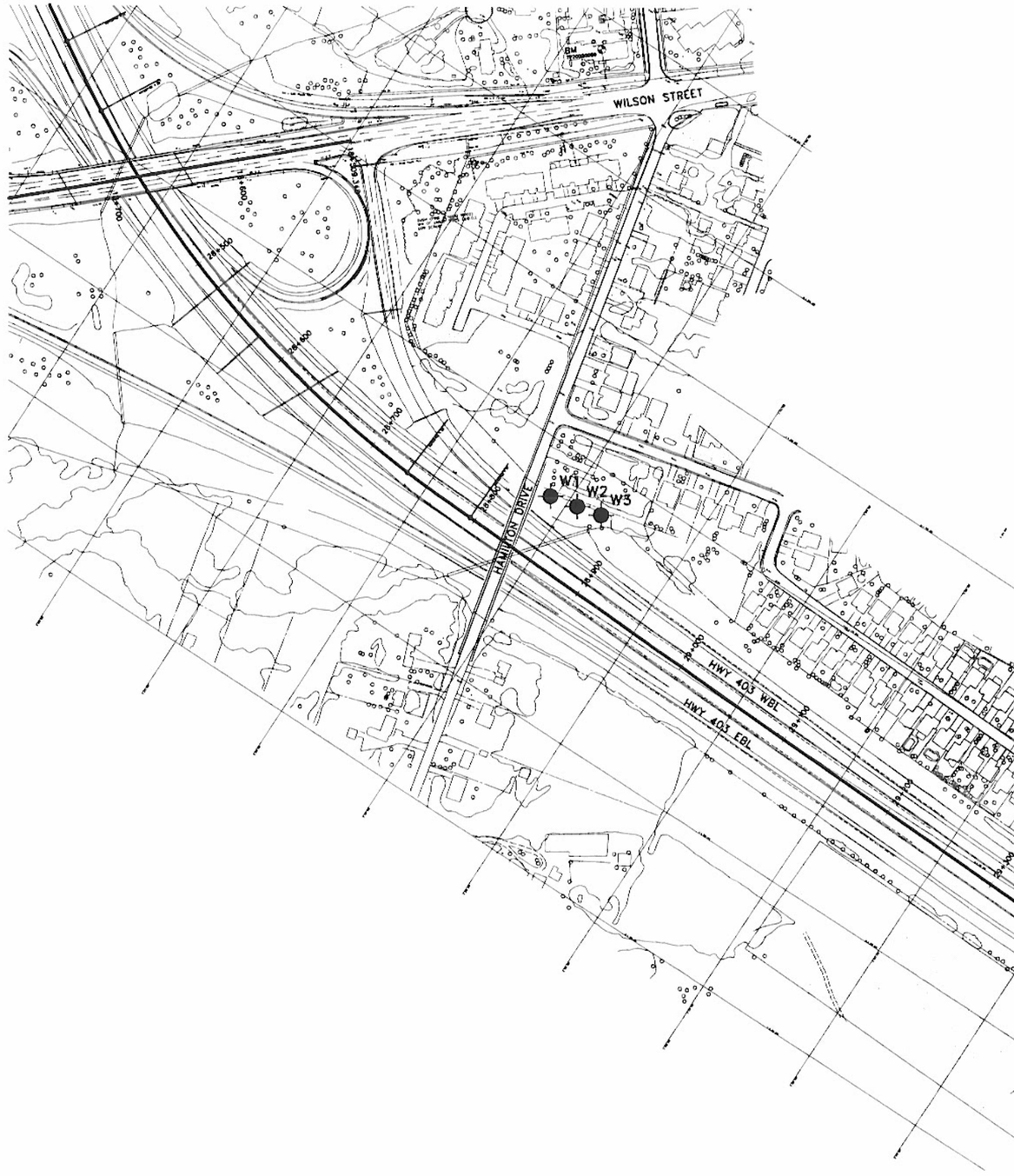
HWY 403 IMPROVEMENTS
LINC TO WILSON STREET

BOREHOLE LOCATION PLAN

SHEET

McCORMICK RANKIN CORPORATION

THURBER ENGINEERING LTD.



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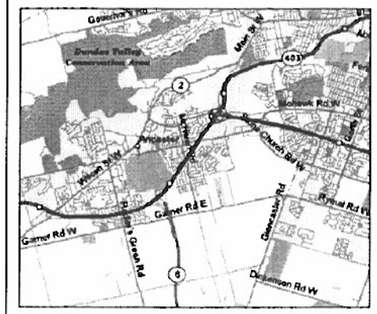
PROVINCE OF ONTARIO



KEYPLAN

LEGEND

	Bore Hole
	Bore Hole & Cone
N	Blows/ 0.3m (Std Pen Test, 475 J/blow)
CONE	Blows/ 0.3m (60° Cone, 475 J/blow)
PH	Pressure, Hydraulic
	WL at Time of Investigation
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)

NO	ELEVATION	NORTHING	EASTING
W1	244.3	4785159.3	264086.1
W2	243.9	4785164.0	264108.1
W3	242.7	4785168.6	264127.5

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

REVISIONS | DESCRIPTION

DESIGN MRA	CHK PKC	CODE		LOAD CL-625-ONT		DATE JAN 06	
DRAWN JHL	CHK MRA	SITE		STRUCT	SCHEME	DWG	2

MINISTRY OF TRANSPORTATION, ONTARIO PS-A-707 89-05

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

HWY 403

GWP No. 2440-04-00

HWY 403 IMPROVEMENTS
LINC TO WILSON STREET

BOREHOLE LOCATION PLAN

SHEET

McCORMICK RANKIN CORPORATION

THURBER ENGINEERING LTD.

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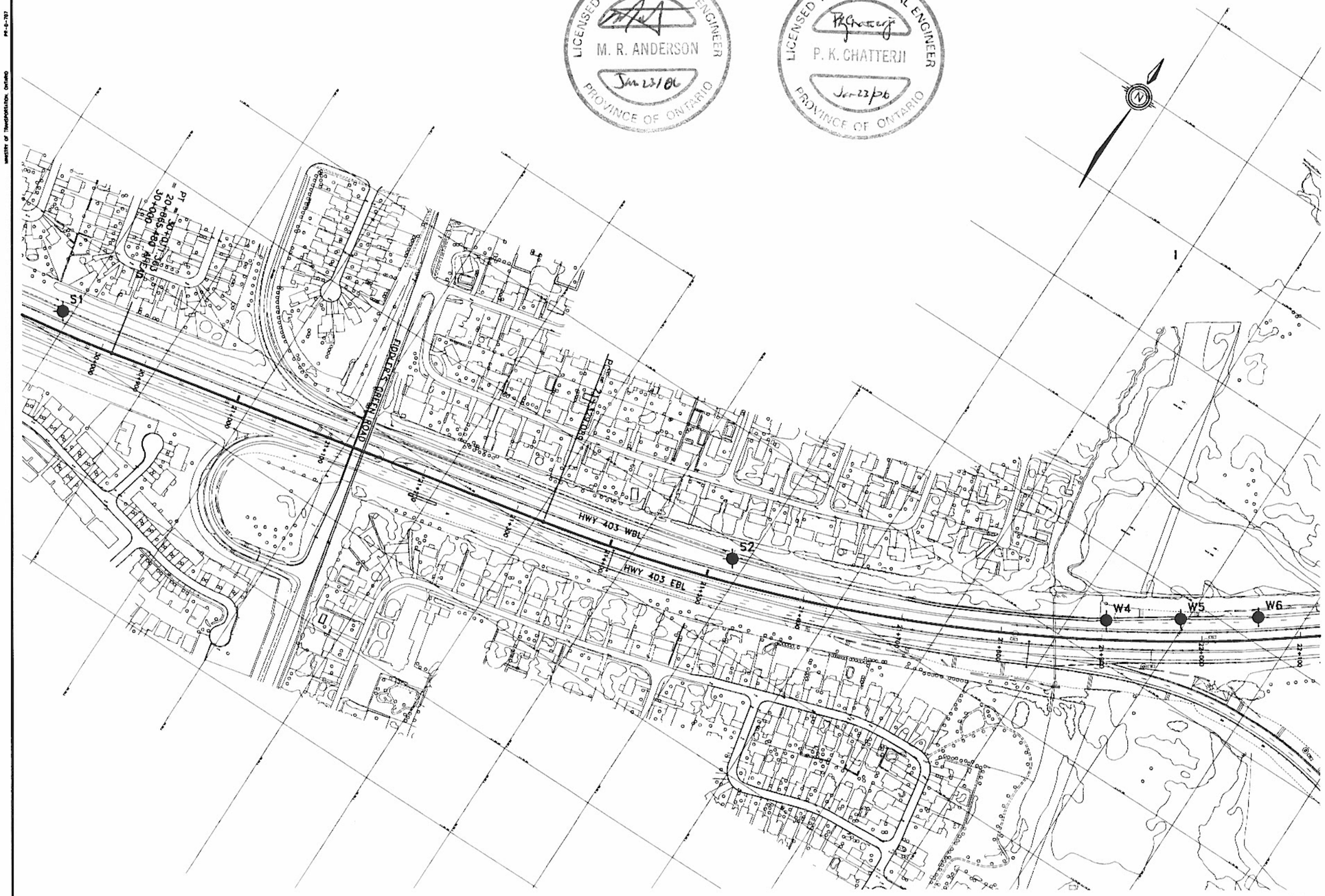
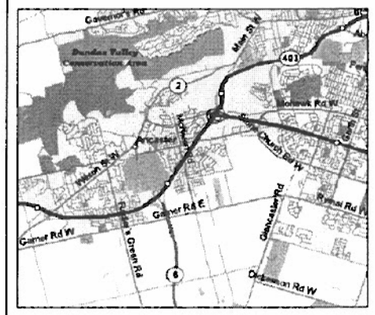
P. K. CHATTERJI
Jan 23/06
PROVINCE OF ONTARIO





KEYPLAN

LEGEND

	Bore Hole
	Bore Hole & Cone
N	Blows/ 0.3m (Std Pen Test, 475 J/blow)
CONE	Blows/ 0.3m (60° Cone, 475 J/blow)
PH	Pressure, Hydraulic
	WL at Time of Investigation
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)

NO	ELEVATION	NORTHING	EASTING
S1	249.2	4785126.8	265190.6
S2	244.9	4785285.3	265886.1
W4	243.9	4785437.6	266232.5
W5	243.7	4785479.3	266293.8
W6	244.0	4785523.8	266359.0

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

REVISIONS					
				DESCRIPTION	
DESIGN MRA	CHK PKC	CODE		LOAD	DATE JAN. 06
DRAWN JHL	CHK MRA	SITE		STRUCT / SCHEME	DWG 3

Appendix D

Non Standard Special Provision

NOISE BARRIER - Item No.
NOISE BARRIER INCLUDING PRECAST NOISE/TRAFFIC BARRIER – Item No.
CONCRETE FOOTINGS FOR HIGH MAST POLES - Item No.
CONCRETE IN GROUND MOUNTED STATIC SIGN SUPPORT FOOTINGS (TRI-CHORD AND CANTILEVER) - Item No.

Special Provision

GENERAL

The following items are expected to affect the installation of the high mast light, overhead sign and noise barrier foundations:

1.1 Control of Overburden Soils and Groundwater

Excavations for the high mast light, overhead sign and noise barrier foundations will be advanced through soils ranging from fill to cohesionless sand and silt, to clayey silt and silty clay. The walls of excavations through cohesionless soils should be expected to be unstable if not supported. Below the groundwater level, there is a significantly increased risk of sloughing of the sides of the excavation and boiling in the base. It should be anticipated that that excavations may have to be advanced using a temporary liner to minimize loss of ground and boiling in the base during drilling and concrete placement.

If the base of the excavation lies in cohesionless soil in which the inflow of water cannot be controlled to allow satisfactory unwatering prior to concrete placement, the excavation shall be deepened to allow a seal to be established around the tip of the liner. Alternatively, concrete shall be placed by tremie methods.

1.2 Cobbles and Boulders

Although cobbles and boulders are not specifically identified on the Record of Borehole sheets, the soils should be expected to possibly contain cobbles and boulders. Appropriate equipment and procedures will be required to penetrate such obstructions during the excavation of the foundations for the high mast light, overhead sign and noise barrier wall foundations.

1.3 Bedrock

Where the excavation for a foundation penetrates bedrock, it should be expected that the bedrock may range from strong to very strong (unconfined compressive strength exceeding 50 MPa). Appropriate rock drilling equipment will be required to penetrate the bedrock.

1.4 Placement of Concrete

The excavation must be unwatered prior to placing concrete.

If unwatering is not practicable, concrete may be placed by tremie methods. The method employed must ensure that there is no intrusion of soil or groundwater into the concrete column.

2.0 PAYMENT

Payment at the contract price for the above item shall be full compensation for all labour, equipment and material to do the work.