

**FOUNDATION INVESTIGATION AND DESIGN REPORT  
HIGH MAST LIGHTING POLES  
OVERHEAD SIGN SUPPORTS  
HIGHWAY 8 WIDENING, KITCHENER  
G.W.P. 277-97-00**

**Geocres Number: 40P8-147**

**Report to**

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**PART 1: FACTUAL INFORMATION**

**1 INTRODUCTION**

This report presents the factual findings obtained from a foundation investigation carried out by Thurber Engineering Ltd. (Thurber) for the detailed design of high mast lighting (HML) poles and overhead sign (OHS) supports along the alignment of the future widening of Highway 8 from 1 km north of the Grand River to Sportsworld Drive in Kitchener, Ontario.

The purpose of the investigation was to explore the subsurface conditions along the alignment of Highway 8, in the general vicinities of the proposed HML poles and OHS supports and, based on the data obtained, to provide a borehole location plan, records of boreholes, laboratory test results and a written description of the subsurface conditions.

Thurber carried out the investigation as a sub-consultant to Morrison Hershfield, under the Ministry of Transportation Ontario (MTO) Agreement Number 3005-E-0035.

**2 SITE DESCRIPTION**

The HML poles and OHS supports are to be located throughout the Highway 8 alignment between 1 km north of the Grand River and Sportsworld Drive. The existing grades along Highway 8 within the project area range from approximate elevations 288.0 m to 318.0 m, with the ground surface generally sloping from the north and south towards the Grand River.

Geologically, the site area is located within the physiographic region known as the Waterloo Hills, which is characterized by sandy hills consisting of ridges of sandy till as well as kames and kame moraines, with outwash sands occupying the intervening hollows. The surficial soils of this region overly Silurian bedrock of the Guelph Formation.

### 3 SITE INVESTIGATION AND FIELD TESTING

The site investigation and field testing for this project were carried out between the period of May 23 to September 28, 2006. Eight boreholes numbered 06-52 to 06-59 pertaining to the HML poles and 4 boreholes numbered 06-64 to 06-67 pertaining to the OHS supports and HML poles were drilled to depths ranging from 6.6 m to 11.1 m. Borehole 06-2, drilled for the north abutment of the proposed Grand River SBL crossing structure, Boreholes 06-14 and 06-24, drilled for the approach embankments of the proposed widened King Street overpass structures and Boreholes 06-70 and 06-72, drilled at the locations of two proposed culvert extensions have been included in this report as they also pertain to the HML poles. At the time of writing, the proposed locations of the HML poles were not available. The locations of Boreholes 06-64 to 06-67 were selected based on the locations of the proposed overhead signs provided by Morrison Hershfield (see Table 3.1 below). All boreholes were drilled on the shoulders of the existing Highway 8, except for Boreholes 06-2 and 06-64, which were drilled at the Highway 8 SBL ditch and at the base of the Highway 8 SBL embankment respectively. The approximate locations of the boreholes are shown on the attached Borehole Location Plan Drawings in Appendix D.

**Table 3.1 – Proposed Overhead Sign Locations**

<b>Overhead Sign Location (Hwy. 8 Construction Chainage)</b>	<b>Reference Borehole</b>
13+950	06-64
14+640	06-65
15+100	06-66
16+000	06-67

Note: All overhead signs are located along Highway 8 SBL.

Thurber located the borehole locations in the field with reference to the Highway 8 construction chainages, which were marked in the field by Callon Dietz Inc. The approximate geodetic coordinates and elevations of the boreholes were subsequently determined from the digital base plan and existing profile information provided by Morrison Hershfield. Morrison Hershfield also provided Thurber with underground utility clearances prior to drilling.

The boreholes were advanced using hollow-stem auger drilling techniques. Samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT) in the overburden soils.

Groundwater conditions in the open boreholes were observed throughout the drilling operations. At selected boreholes, a standpipe piezometer consisting of 25 mm PVC pipe (19 mm PVC pipe at

Borehole 06-64) with a slotted screen was installed and enclosed in filter sand to permit longer term groundwater level monitoring. The locations and completion details of the piezometers are shown in Table A-1 in Appendix A. The borehole completion details are also shown in Table A-1.

The drilling and sampling operations were supervised on a full time basis by a member of Thurber's technical staff. The supervisor logged the boreholes and processed the recovered soil samples for transport to Thurber's laboratory for further examination and testing.

#### **4 LABORATORY TESTING**

The recovered soil samples were subjected to Visual Identification (VI) 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 also subjected to gradation analysis and Atterberg Limit tests and the results of this testing program are shown on the Record of Borehole sheets in Appendix A and on the figures contained in Appendix B.

#### **5 DESCRIPTION OF SUBSURFACE CONDITIONS**

Reference is made to the Record of Borehole sheets in Appendix A. An overall description of the stratigraphy is given in the following paragraphs. However, the factual data presented in the Record of Borehole Sheets governs any interpretation of the site conditions.

In general, the site stratigraphy encountered in the boreholes consists of asphalt and/or granular fill, cohesive silty clay glacial till, deposits of sand, silt and gravel, and non-cohesive glacial till.

##### **5.1 Asphalt, Topsoil and Fill**

The boreholes that were drilled on the paved shoulders of the existing Highway 8 encountered asphalt that ranged in thickness from approximately 25 mm to 190 mm. Underlying the asphalt, and where boreholes were drilled on unpaved highway shoulders, sand and gravel fill was encountered. The fill extended to depths of 0.8 m to 2.4 m or to elevations ranging from 286.9 m to 315.7 m. The sand and gravel fill had a compact to very dense relative density, based on SPT 'N' values ranging from 15 to greater than 50 blows per 0.3 m penetration. Moisture contents in the fill ranged from approximately 2% to 8%. Selected samples of the sand and gravel fill were subjected to grain size distribution tests and the results are presented in Figures B8 and B9 in Appendix B.

At Borehole 06-52, a layer of silt fill with trace to some sand and trace gravel was encountered underlying the sand and gravel to a depth of 1.5 m (elevation 308.0 m). The silt fill was compact (SPT 'N' value of 15 blows per 0.3 m penetration), with a moisture content of approximately 21%.

At Boreholes 06-54 and 06-72, the sand and gravel was underlain by silty clay fill to depths ranging from 3.0 m to 4.1 m or to elevations from 284.6 m to 285.3 m. The silty clay fill is considered to be very stiff, based on SPT 'N' values of 15 to 24 blows per 0.3 m penetration. The moisture content of the material ranged from approximately 10% to 20%. A sample of the silty clay fill was subjected to grain size distribution testing and the results are present in Figure B3 in Appendix B. The result of an Atterberg Limit test on this sample is presented in Figure B10 and indicates that the clay has low plasticity.

Borehole 06-2 was drilled in the ditch adjacent to the existing Highway 8 SBL. This borehole encountered 125 mm of topsoil, underlain by silty clay fill with trace sand and gravel. The fill layer extends to a depth of 0.8 m or to an elevation of 294.1 m. The fill is considered to have a stiff consistency based on a Standard Penetration Test 'N' value of 8 blows per 0.3 m penetration. The moisture content of a sample of this material was 19%.

At Borehole 06-64, at the base of the existing highway embankment, a 150 mm thick layer of topsoil was encountered, which was underlain by a topsoil stained silty clay to a depth of 1.4 m (elevation 283.1 m). The silty clay is considered to be firm to stiff (SPT 'N' values of 5 to 13 blows per 0.3 m penetration), with the moisture content ranging from approximately 20% to 30%.

## **5.2 Silty Clay Till**

Layers of silty clay glacial till with some sand and trace gravel were encountered in the boreholes. The majority of this material was found in the boreholes located north of the King Street overpass (Boreholes 06-2, 06-52, 06-53, 06-54, 06-55, 06-65, 06-70 and 06-72), however the material was also encountered at the bottom of Borehole 06-59 near Sportsworld Drive. The layers ranged in thickness from 1.5 m to greater than 9.6 m and were sometimes encountered in upper and lower layers. The upper layers extended to depths of 3.0 m to 4.6 m or to elevations of 284.1 to 304.9 m. The lower layers were encountered to depths of 7.6 m to 15.2 m or to elevations of 277.2 m to 303.9 m.

Selected samples from this material were subjected to grain size distribution tests and the results are illustrated in Figures B1 and B2 in Appendix B. The results of Atterberg Limit tests conducted on selected samples from this material are shown in Figures B10 and B11 in Appendix B and indicate that the material has low to intermediate plasticity.

SPT 'N' values in this material ranged from 11 to more than 50 blows for 0.3 m penetration, indicating a stiff to hard relative density. Glacial tills inherently contain cobbles and boulders and some of the high SPT 'N' values may represent tests conducted on cobbles and boulders.

The moisture content of samples from this material ranged from approximately 7% to 23%.

### **5.3 Sand**

Occasional sand zones with trace to some silt and gravel were encountered in Boreholes 06-2, 06-56, 06-57, 06-64, 06-66, 06-67, and 06-70. The thickness of the sand deposits ranged from 1.4 m to 8.6 m, and the material extends to depths of 4.6 m to greater than 11.1 m, or to elevations of less than 275.4 m to 307.5 m. Standard penetration tests in these deposits gave 'N' values from 14 to greater than 50 blows per 0.3 m penetration, indicating that the relative density of the material varies from compact to very dense.

Selected samples of this material were subjected to grain size distribution tests and the results are presented in Figure B6 in Appendix B.

The moisture content of samples from this material ranged from approximately 2% to 15%.

### **5.4 Silt**

Boreholes 06-70 and 06-72 encountered zones of silt ranging from sandy silt to sand and silt. The silt deposit was approximately 1.3 m to 1.5 m thick and was encountered to depths ranging from 4.3 m to 6.1 m or to elevations from 284.0 m to 299.7 m. The silt is considered to be loose, based on SPT 'N' values of 7 to 9 blows per 0.3 m penetration. The moisture content of this material was approximately 18% to 19%. The results of a grain size distribution test conducted on a sample of this material is presented in Figure B5 in Appendix B.

### **5.5 Sand and Gravel**

Several of the boreholes (06-14, 06-54, 06-58, 06-59, 06-64, 06-66, 06-67 and 06-72) encountered layers of granular material ranging in thickness from 1.4 m to greater than 9.6 m. The material ranged in composition from gravelly sand to gravel with some sand, but can mainly be classified as sand and gravel. The material also contained trace to some silt and occasional cobbles. The granular material extends to depths of 4.4 m to greater than 11.1 m or to elevations of 278.5 m to 309.7 m.

Selected samples of this material were subjected to grain size distribution tests and the results are presented in Figure B7 in Appendix B.

Standard penetration tests in this material gave 'N' values from 8 to greater than 50 blows per 0.3 m penetration indicating that the relative density of the material varies from loose to very dense.

The moisture content of samples from this deposit ranged from approximately 3% to 17%.

## 5.6 Silty Sand to Silt and Sand Till

A deposit of glacial till ranging in composition from silty sand to silt and sand was encountered in Boreholes 06-2, 06-24, 06-52 to 06-56, 06-64 and 06-70. The till also contains trace to some clay, trace gravel and occasional cobbles and boulders. The thickness of the deposit ranges from 1.0 m to greater than 8.0 m, and it extends to depths ranging from 6.7 m to greater than 19.9 m or to elevations ranging from less than 274.9 m to 310.2 m. Glacial tills inherently contain cobbles and boulders.

Selected samples from this deposit were subjected to grain size distribution tests and the results are presented in Figures B4 and B5 in Appendix B.

SPT 'N' values ranged from 8 to greater than 50 blows per 0.3 m penetration, indicating that the material has a loose to very dense relative density. Some of the SPT 'N' values may represent tests conducted on cobbles and boulders.

The moisture content of samples from this deposit ranged from approximately 4% to 19%.

## 5.7 Groundwater Conditions

A standpipe piezometer was installed in selected boreholes. Water levels were measured on a separate visit made after the completion of drilling. Some piezometers were not locatable during the monitoring visits and were likely destroyed. The water level readings are presented in Table 5.1.

**Table 5.1: Water Level Measurements**

Borehole	Water Level Depth (m)	Water Level Elevation (m)	Date of Reading
06-2	9.9	284.9	January 4, 2007
06-52	7.0 Piezometer Destroyed	302.6 -	May 28, 2006 September 26, 2006
06-53	5.5	295.6	September 26, 2006
06-54	5.2 4.1	283.5 284.6	May 31, 2006 September 26, 2006
06-55	6.2 6.5	288.6 288.3	May 25, 2006 September 26, 2006
06-56	Piezometer Destroyed	-	September 26, 2006
06-57	Piezometer Destroyed	-	September 26, 2006
06-58	Piezometer Destroyed	-	September 26, 2006

06-59	10.1	304.8	September 26, 2006
06-64	1.5 1.4	283.1 283.2	August 16, 2006 September 29, 2006
06-65	Dry	-	September 26, 2006
06-66	Piezometer Destroyed	-	September 26, 2006
06-67	Dry	-	May 27, 2006
06-70	7.3 10.5	298.5 295.4	May 29, 2006 September 26, 2006
06-72	6.0 3.9	282.3 284.4	May 31, 2006 September 26, 2006

Based on these observations, local groundwater levels exist at Elevations 282.3 m to 304.8 m. All groundwater observations at this site are short term and the levels are expected to fluctuate seasonally and after severe weather events.

## 6 MISCELLANEOUS

All-Terrain Drilling Limited of Waterloo, Ontario supplied track and truck mounted CME 75 drill rigs and conducted the drilling, sampling and in-situ testing operations.

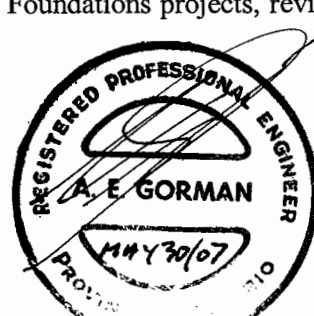
The drilling and sampling operations in the field were supervised on a full time basis by Mr. George Azzopardi, Mr. Stephane Loranger, C.E.T. and Mr. Warren Wunderlick of Thurber.

Mr. Alastair E. Gorman, P.Eng. and Mr. Mark E. Farrant, P.Eng. directed the field operations and prepared the report.

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

Thurber Engineering Ltd.  
Mark E. Farrant, P.Eng.,  
Geotechnical Engineer

Alastair E. Gorman, P.Eng.,  
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Report Reviewed by:  
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**PART 2: ENGINEERING DISCUSSION AND RECOMMENDATIONS**

**7 GENERAL**

This section of the report presents foundation recommendations for the design of the proposed high mast lighting (HML) poles. As per the MTO Terms of Reference, foundation design recommendations are not required for the overhead sign (OHS) supports.

It is understood that the HML poles will be distributed along the entire length of the project. A total of seventeen (17) boreholes were drilled along the alignment of Highway 8 and are considered relevant to the design of the HML poles and OHS supports. At the time of writing, the proposed locations of the HML poles were not available. For design purposes, the conditions at the HML pole locations can be inferred from the nearest borehole location.

All relevant boreholes for the HML poles and OHS supports are included in Appendix A. Table 1 following the text presents the recommended foundation design parameters for the HML foundations.

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

**8 FOUNDATION DESIGN PARAMETERS**

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

- Ministry of Transportation, Ontario (2004) "Guidelines for the Design of High Mast Pole Foundations", Fourth Edition, BRO-009, Engineering Standards Branch, Bridge Office.
- Canadian Highway Bridge Design Code and Commentary (2000). CAN/CSA-S6-00 and S6.1-00.

It is understood that a typical HML pole is supported on a single conventional augered caisson (drilled shaft). Most of the caisson foundations for the HML poles will likely be embedded into dense to very dense / very stiff to hard glacial till or dense to very dense sands and gravels. Table 1 following the text of this report presents the recommended foundation design parameters for caisson foundations at each borehole location.

In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of a caisson within the upper 1.4 m below final grade should be neglected in the foundation design. It is recommended that all topsoil and organics be neglected in determining lateral resistance. It is noted that a downward sloping embankment in front of a caisson will result in reduced lateral passive resistance that should be taken into account during design.

Where an unconfined compressive strength,  $q_u$ , ( $q_u = 2 \times C_u$ , undrained shear strength) is provided for a cohesive soil (silty clay till), the ultimate lateral passive resistance should be calculated in conjunction with the total soil unit weight. When designing for portions of the caissons below the groundwater level in cohesionless soils (sands, gravels and sand and silt tills), the submerged soil unit weight,  $\gamma'$  should be used. The required depth of the drilled shaft will be governed by lateral loads, including wind loads, acting on the pole. The length of the caisson should also be sufficient to counteract frost-jacking (upward) forces.

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

## **9 CAISSON INSTALLATION**

Caisson installation should generally be carried out in accordance with SP 903S01. The contract documents should contain an NSSP alerting the contract bidders of the specific aspects relating to caisson construction for HML pole foundations at this site. Suggested wordings for this NSSP are provided in Appendix C.

Caisson installation equipment should be able to dislodge, handle and remove cobbles and boulders which may be present in the glacial till.

Soil sloughing and water seepage may occur in unsupported holes. Temporary liners should be available to support the caisson sidewalls and to provide seepage cut-off where required.

## **10 CONSTRUCTION CONCERNS**

Concerns during caisson construction mainly involve the handling and removal of cobbles or boulders, soil sloughing and water seepage from caisson sidewalls. Recommendations on how to address these issues have been outlined in the previous section.

## 11 CONSTRUCTION INSPECTION AND TESTING

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

## 12 CLOSURE

Engineering analysis and preparation of the report were carried out by Mr. Mark E. Farrant, P.Eng. and Mr. Alastair E. Gorman, P.Eng.

The report was reviewed by Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

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**TABLE 1**  
**GEOTECHNICAL DESIGN PARAMETERS**  
**HIGH MAST LIGHTING POLES**  
**HIGHWAY 8 WIDENING, KITCHENER**

Borehole <sup>2</sup>	Location	Recommended Subsurface Stratigraphy For Design	Depth Below Existing Ground Surface (m)	Geotechnical Design Parameters <sup>1</sup>					
				q <sub>u</sub> (kPa)	φ' (deg.)	n <sub>b</sub> (MN/m <sup>3</sup> )	γ (kN/m <sup>3</sup> )	γ' (kN/m <sup>3</sup> )	Groundwater Depth (m)
06-2	Stn 13+635	Topsoil/Silty Clay, stiff (FILL)	0.0 – 0.8	75	-	-	17	-	9.9 (below existing ground surface)
		Silt and Sand Till, loose/very dense	0.8 – 4.6	-	34	8.0	21	-	
		Sand, very dense	4.6 – 6.0	-	34	8.0	21	-	
		Sandy Silt Till, very dense	6.0 – 7.6	-	34	8.0	21	-	
		Silty Clay Till, hard	7.6 – 9.9	200	-	-	20	-	
		Silty Clay Till, hard	9.9 – 15.2	200	-	-	-	10	
06-14	Stn 14+875	Sandy Silt Till, very dense	15.2 – 19.9	-	34	6.0	-	11	>11.1 (below existing ground surface)
		Asphalt/Sand and Gravel, very dense (FILL)	0.0 – 1.5	-	34	8	22	-	
06-24	Stn 14+935	Sand and Gravel, dense/very dense	1.5 – 11.1	-	34	8	22	-	>11.1 (below existing Ground surface)
		Asphalt/Sand and Gravel, very dense (FILL)	0.0 – 1.5	-	34	8	22	-	
		Silty Sand, dense to very dense	1.5 – 4.5	-	33	7.0	21	-	
		Silty Sand, loose/compact	4.5 – 9.1	-	31	4.0	20	-	
		Silt Till, very dense	9.1 – 11.1	-	33	7.0	21	-	
06-52	Stn 13+200	Sand and Gravel, compact (FILL)	0.0 – 0.8	-	32	5.5	21	-	7.0 (below existing Ground surface)
		Silt, compact (FILL)	0.8 – 1.5	-	29	2.5	18	-	
		Silty Clay Till, stiff/very stiff	1.5 – 4.6	150	-	-	19	-	
		Sand and Silt Till, compact	4.6 – 7.0	-	31	4.0	20	-	
		Sand and Silt Till, compact/dense	7.0 – 9.8	-	32	4.0	-	10	
		Silty Clay Till, hard	9.8 – 11.1	200	-	-	-	10	

Notes:

1. This table must be read in conjunction with the text of this report.
2. Refer to Records of Boreholes for details.

Note : In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of the caisson within the upper 1.4 m below final grade should be neglected in the foundation design.

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06-53	Stn 13+450	Asphalt/Sand and Gravel, compact/dense (FILL) Silty Clay Till, very stiff Silt and Sand Till, very dense Silt and Sand Till, very dense	0.0 – 1.5 1.5 – 3.0 3.0 – 5.5 5.5 – 11.0	- 175 - -	32 - 34 34	5.5 - 8.0 6.0	21 19 21 -	- - 11 11	5.5 (below existing Ground surface)
06-54	Stn 14+230	Asphalt/Sand and Gravel, compact (FILL) Silty Clay Fill, very stiff Gravel, some sand, very dense Silty Clay Till, stiff Silt and Sand Till, very dense	0.0 – 1.4 1.4 – 4.1 4.1 – 5.5 5.5 – 7.6 7.6 – 10.8	- 175 - 125 -	32 - 34 - 34	5.5 - 6.0 - 6.0	21 19 - - -	- - 12 9 11	4.1 (below existing Ground surface)
06-55	Stn 14+450	Asphalt/Sand and Gravel, dense/very dense (FILL) Silty Sand Till, compact/dense Silty Clay Till, very stiff/hard	0.0 – 1.5 1.5 – 6.7 6.7 – 11.1	- - 200	34 32 -	8.0 5.5 -	22 20 -	- - 9	6.5 (below existing Ground surface)
06-56	Stn 15+350	Sand and Gravel, very dense (FILL) Silty Sand Till, compact Sand, some gravel, dense	0.0 – 2.1 2.1 – 7.6 7.6 – 11.1	- - -	34 31 33	8.0 4.0 7.0	22 20 21	- - -	>11.1 (below existing Ground surface)
06-57	Stn 15+550	Sand and Gravel, dense/very dense (FILL) Sand, some silt, dense/very dense	0.0 – 2.4 2.4 – 11.0	- -	34 33	8.0 7.0	22 21	- -	>11.0 (below existing ground surface)
06-58	Stn 15+715	Sand and Gravel, dense/very dense (FILL) Sandy Gravel, compact Sandy Gravel, dense/very dense	0.0 – 2.4 2.4 – 8.2 8.2 – 11.0	- - -	34 33 35	8.0 7.0 10	22 21 22	- - -	>11.0 (below existing ground surface)
06-59	Stn 15+925	Asphalt/Sand and Gravel, very dense (FILL) Gravelly Sand, compact/very dense Silty Clay Till, hard	0.0 – 2.4 2.4 – 10.1 10.1 – 11.0	- - 200	34 33 -	8.0 7.0 -	22 21 -	- - 10	10.1 (below existing ground surface)
06-64	Stn 13+950	Topsoil/Silty Clay, firm/stiff Sand and Gravel, loose/very dense Sandy Silt Till, very dense Sand, some silt, very dense	0.0 – 1.4 1.4 – 6.0 6.0 – 7.0 7.0 – 9.2	75 - - -	- 34 34 34	- 6.0 6.0 6.0	17 - - -	- 12 11 11	1.4 (below existing ground surface)

Note : In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of the caisson within the upper 1.4 m below final grade should be neglected in the foundation design.

High Mast Lighting Poles and Overhead Sign Supports  
Highway 8 Widening, Kitchener

06-65	Stn 14+640	Asphalt/Sand and Gravel, compact/dense (FILL) Silty Clay Till, very stiff/hard	0.0 – 1.5 1.5 – 11.1	- 200	34 -	8.0 -	21 19	- -	>11.1 (below existing ground surface)
06-66	Stn 15+115	Sand and Gravel, compact (FILL) Gravelly Sand, compact/very dense Sand, compact/dense	0.0 – 1.5 1.5 – 6.1 6.1 – 11.1	- - -	32 33 31	5.5 7.0 4.0	21 21 20	- - -	>11.1 (below existing ground surface)
06-67	Stn 16+000	Asphalt/Sand and Gravel, very dense (FILL) Gravelly Sand, very dense Sand, compact/dense	0.0 – 1.5 1.5 – 4.4 4.4 – 6.6	- - -	34 34 32	8.0 8.0 5.5	22 21 20	- - -	>6.6 (below existing ground surface)
06-70	Stn 13+315	Asphalt/Sand and Gravel, dense/very dense (FILL) Sand, compact/dense Sandy Silt, loose Sand and Silt Till, compact Silty Clay Till, hard Silty Clay Till, hard	0.0 – 1.5 1.5 – 4.6 4.6 – 6.1 6.1 – 9.1 9.1 – 10.5 10.5 – 11.1	- - - - 200 200	34 32 29 32 - -	8.0 5.5 2.5 5.5 - -	22 21 20 20 20 -	- - - - - 10	10.5 (below existing ground surface)
06-72	Stn 14+090	Asphalt/Sand and Gravel, dense (FILL) Silty Clay Fill, very stiff Sand and Silt, loose Sand and Silt, loose Gravel, some sand, very dense Silty Clay Till, hard	0.0 – 1.4 1.4 – 3.0 3.0 – 3.9 3.9 – 4.3 4.3 – 7.3 7.3 – 11.1	- 175 - - - 200	34 - 29 29 34 -	8.0 - 2.5 1.5 6.0 -	22 19 19 - - -	- - - 9 12 10	3.9 (below existing ground surface)

**LEGEND**

- $q_u$  = Unconfined Compressive Strength ( $= 2 \times C_u$ , undrained shear strength) (kPa)  
 $\phi'$  = Angle of Internal Friction (degrees)  
 $n_h$  = Coefficient of Horizontal Subgrade Reaction (MN/m<sup>3</sup> or  $\times 10^3$  kN/m<sup>3</sup>)  
 $\gamma$  = Soil Unit Weight (kN/m<sup>3</sup>)  
 $\gamma'$  = Submerged Soil Unit Weight (kN/m<sup>3</sup>)

Note : In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of the caisson within the upper 1.4 m below final grade should be neglected in the foundation design.

**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 <sup>(1)</sup> 'N' VALUE
Very Soft	12 or less	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	Greater than 200	Greater than 30

NOTE: Hierarchy of Soil Strength Prediction

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


### 4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

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

### 5. LEGEND FOR RECORDS OF BOREHOLES

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

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

 Water Level

$C_{pen}$  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
CLAY SHALE			
SANDSTONE			
SILTSTONE			
CLAYSTONE			
COAL			

**Table A-1 – Borehole Completion Details**

Location	Details	
	Piezometer Tip Depth/ Elevation (m)	Completion Details
06-2	19.9 / 274.9	Piezometer with 1.5 m slotted screen installed with sand filter to 18.0 m, bentonite seal from 18.0 m to 17.4 m, grout from 17.4 m to 0.9 m and bentonite seal from 0.9 m to ground surface.
06-14	None Installed	Grouted with bentonite to ground surface.
06-24	None Installed	Grouted with bentonite to ground surface.
06-52	10.7 / 298.8	Piezometer with 1.5 m slotted screen installed with sand filter to 8.8 m, bentonite seal from 8.8 m to 8.2 m, grout from 8.2 m to 0.9 m, bentonite seal from 0.9 m to 0.3 m and sand and gravel from 0.3 m to ground surface.
06-53	10.7 / 290.3	Piezometer with 1.5 m slotted screen installed with sand filter to 8.8 m, bentonite seal from 8.8 m to 8.2 m, grout from 8.2 m to 0.9 m, bentonite seal from 0.9 m to 0.3 m and concrete from 0.3 m to ground surface.
06-54	10.7 / 278.0	Piezometer with 1.5 m slotted screen installed with sand filter to 8.8 m, bentonite seal from 8.8 m to 8.2 m, grout from 8.2 m to 0.9 m, bentonite seal from 0.9 m to 0.3 m and concrete from 0.3 m to ground surface.
06-55	10.7 / 284.1	Piezometer with 1.5 m slotted screen installed with sand filter to 8.8 m, bentonite seal from 8.8 m to 8.2 m, grout from 8.2 m to 1.2 m, bentonite seal from 1.2 m to 0.3 m and concrete from 0.3 m to ground surface.
06-56	10.7 / 307.1	Piezometer with 1.5 m slotted screen installed with sand filter to 8.8 m, bentonite seal from 8.8 m to 8.2 m, grout from 8.2 m to 0.9 m, bentonite seal from 0.9 m to 0.3 m and sand and gravel from 0.3 m to ground surface.
06-57	10.7 / 307.2	Piezometer with 1.5 m slotted screen installed with sand filter to 8.8 m, bentonite seal from 8.8 m to 8.2 m, grout from 8.2 m to 0.9 m, bentonite seal from 0.9 m to 0.3 m and sand and gravel from 0.3 m to ground surface.
06-58	10.7 / 306.0	Piezometer with 1.5 m slotted screen installed with sand filter to 7.3 m, bentonite seal from 7.3 m to 6.9 m, grout from 6.9 m to 0.5 m and concrete from 0.5 m to ground surface.
06-59	10.7 / 304.2	Piezometer with 1.5 m slotted screen installed with sand filter to 8.7 m, bentonite seal from 8.7 m to 8.1 m and grout from 8.1 m to ground surface.
06-64	9.1 / 275.5	Piezometer with 1.5 m slotted screen installed with sand filter to 7.0 m, bentonite seal from 7.0 m to 6.6 m, grout from 6.6 m to 0.3 m and bentonite seal from 0.3 m to ground surface.
06-65	10.7 / 290.9	Piezometer with 1.5 m slotted screen installed with sand filter to 8.8 m, bentonite seal from 8.8 m to 8.2 m, grout from 8.2 m to 0.9 m, bentonite seal from 0.9 m to 0.3 m and concrete from 0.3 m to

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 Highway 8 Widening, Kitchener

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		ground surface.
06-66	10.7 / 304.3	Piezometer with 1.5 m slotted screen installed with sand filter to 8.8 m, bentonite seal from 8.8 m to 8.2 m, grout from 8.2 m to 0.9 m, bentonite seal from 0.9 m to 0.3 m and sand and gravel from 0.3 m to ground surface.
06-67	6.1 / 308.0	Piezometer with 1.5 m slotted screen installed with sand filter to 4.3 m, bentonite seal from 4.3 m to 3.7 m, grout from 3.7 m to 0.9 m, bentonite seal from 0.9 m to 0.3 m and concrete from 0.3 m to ground surface.
06-70	10.7 / 295.1	Piezometer with 1.5 m slotted screen installed with sand filter to 8.8 m, bentonite seal from 8.8 m to 8.2 m, grout from 8.2 m to 0.9 m, bentonite seal from 0.9 m to 0.3 m and concrete from 0.3 m to ground surface.
06-72	10.7 / 277.6	Piezometer with 1.5 m slotted screen installed with sand filter to 8.8 m, bentonite seal from 8.8 m to 8.2 m, grout from 8.2 m to 0.9 m, bentonite seal from 0.9 m to 0.3 m and concrete from 0.3 m to ground surface.

# RECORD OF BOREHOLE No 06-2

1 OF 3

METRIC

G.W.P. 277-97-00 LOCATION Grand River Overpass SBL N 4 809 407.87 E 230 460.97  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers  
 DATUM Geodetic DATE 2006-09-28 - 2006-09-28  
 ORIGINATED BY GA  
 COMPILED BY WM  
 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
294.8								20 40 60 80 100						
0.0	TOPSOIL (125 mm)							20 40 60 80 100						
0.1	Silty CLAY, trace to some sand, trace gravel, occasional cobbles Stiff Brown (FILL)		1	SS	8									
294.1														
0.8	SILT and SAND, some clay, trace gravel Loose to Very Dense Brown Dry (TILL)		2	SS	8		294							
			3	SS	50/ .100		293							4 38 42 16
			4	SS	101/ .275		292							
			5	SS	105/ .225		291							
290.3														
4.6	SAND, medium to coarse grained Very Dense Brown Moist		6	SS	100		290							
288.8							289							
6.0	Sandy SILT, trace gravel Very dense Brown Damp to dry (TILL)		7	SS	101/ .200		288							
287.2														
7.6	Silty CLAY, some sand to sandy, trace gravel Hard Grey (TILL)(CL)		8	SS	104/ .050		287							
							286							
			9	SS	113									1 20 40 39
							285							

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 06-2

2 OF 3

METRIC

G.W.P. 277-97-00 LOCATION Grand River Overpass SBL N 4 809 407.87 E 230 460.97 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2006-09-28 - 2006-09-28 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE											
	Continued From Previous Page							20 40 60 80 100											
			10	SS	100/ .150		284												
			11	SS	109/ .150		283												
			12	SS	103/ .250		281												
279.6			13	SS	100/ .150		279												
15.2	Sandy SILT, some clay, trace gravel Very Dense Brown (TILL)		14	SS	100/ .225		278												
			15	SS	100/ .275		277												
			16	SS	100/ .275		276												
274.9			16	SS	100/ .275		276												

Continued Next Page

+ 3, × 3: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 06-2

3 OF 3

METRIC

G.W.P. 277-97-00 LOCATION Grand River Overpass SBL N 4 809 407.87 E 230 460.97 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2006-09-28 - 2006-09-28 CHECKED BY MEF

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
19.9	<p>Continued From Previous Page</p> <p>END OF BOREHOLE AT 19.89 m Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.</p> <p>WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 04.01.07 9.89 284.9</p>			.075									

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15 5  
10 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 06-14

1 OF 2

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 713.1 E 231 485.9 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 27.05.06 - 27.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
309.4	ASPHALT (100 mm)													
0.0														
0.1	SAND and GRAVEL, trace to some silt Very Dense Brown Dry (FILL)		1	SS	85		309							
			2	SS	50/ .150									
307.9							308							
1.5	SAND and GRAVEL, some silt Very Dense to Dense Brown Dry		3	SS	50/ .150									
			4	SS	76		306							
			5	SS	43		305							
			6	SS	36		303							
			7	SS	35		302							
			8	SS	41		301							
							300							

Continued Next Page

+ 3, x 3: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 06-14

2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 713.1 E 231 485.9 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 27.05.06 - 27.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%) W <sub>P</sub> W W <sub>L</sub>				
							20	40	60	80	100	20	40	60			
299																	
298.3			9	SS	35												
11.1	END OF BOREHOLE AT 11.13 m. BOREHOLE OPEN TO 11.13 m AND DRY UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.																

# RECORD OF BOREHOLE No 06-24

1 OF 2

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 714.5 E 231 550.0 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 24.05.06 - 24.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								○ UNCONFINED	+ FIELD VANE	×			
311.1							20	40	60	80	100		
0.0	ASPHALT: (190 mm)												
0.2	SAND and GRAVEL crusher run limestone Very Dense Brown Dry (FILL)		1	SS	50/ .150								42 47 11 (SI+CL)
			2	SS	50								
309.6													
1.5	Silty SAND, trace gravel, trace clay Dense to Very Dense Brown Dry to Damp		3	SS	33								
			4	SS	60								
	Becoming Compact to Loose, some silt		5	SS	14								
			6	SS	8								
			7	SS	25								

Continued Next Page

+ 3, x 3: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

ONTMT4S 7938-2 GP J 06/03/07

# RECORD OF BOREHOLE No 06-24

2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 714.5 E 231 550.0 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 24.05.06 - 24.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		
300.0			9	SS	102		301										
11.1	END OF BOREHOLE AT 11.13 m. BOREHOLE OPEN TO 11.13 m AND DRY UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.																



# RECORD OF BOREHOLE No 06-52



2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr N 4 809 622.85 E 230 083.71 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 28.05.06 - 28.05.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
								20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		
298.4	Hard Brown (TILL)		9	SS	40		299										
11.1	END OF BOREHOLE AT 11.13 m. Piezometer installation consists of 25 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen.  WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 29.05.06 6.95 302.55 26.09.06 Piezometer destroyed																

## METRIC

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

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		SHEAR STRENGTH kPa						WATER CONTENT (%)	
							20 40 60 80 100							
301.1	ASPHALT: (75 mm) SAND and GRAVEL, some silt Dense to Compact Brown Dry (FILL)													
0.0 0.1														
299.6	Silty CLAY, some sand, trace gravel Very Stiff Brown (TILL)		1	SS	43									
					2	SS	16							
1.5			3	SS	29									
298.0	SILT and SAND, some clay, trace gravel Very Dense Brown (TILL)		4	SS	50/ .150									
3.0					5	SS	58/ .100							
			6	SS	108									
					7	SS	112							
			8	SS	100/ .150									

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity

CONTM T4S 7938-2.GPJ 06/03/07

RECORD OF BOREHOLE No 06-53

2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr N 4 809 510.02 E 230 308.12 ORIGINATED BY GA  
HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
DATUM Geodetic DATE 29.05.06 - 29.05.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
290.1			9	SS	118		291							
11.0	<p>END OF BOREHOLE AT 10.97 m. BOREHOLE OPEN TO 10.97 m AND DRY UPON COMPLETION.</p> <p>Piezometer installation consists of 25 mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.</p> <p>WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 26.09.06 5.50 295.59</p>													

ONTMT4S 7938-2.GPJ 06/03/07

# RECORD OF BOREHOLE No 06-54

1 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr N 4 809 070.88 E 230 949.61 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 31.05.06 - 31.05.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
288.7	ASPHALT: (25 mm) SAND and GRAVEL, trace silt Compact Brown Dry (FILL)		1	SS	28		20	40	60	80	100	20	40	60	0 18 42 40
287.3	Silty CLAY, some sand Very Stiff Brown (FILL)(CL)		2	SS	18		20	40	60	80	100	20	40	60	
1.4		3	SS	17	20		40	60	80	100	20	40	60		
		4	SS	15	20		40	60	80	100	20	40	60		
284.6	GRAVEL, some sand, trace silt Very Dense Brown Wet		5	SS	50/ .150		20	40	60	80	100	20	40	60	
			6	SS	11		20	40	60	80	100	20	40	60	
283.2	Silty CLAY, some sand, trace gravel Stiff Brown (TILL)		7	SS	90		20	40	60	80	100	20	40	60	
			8	SS	.50		20	40	60	80	100	20	40	60	
281.1	SILT and SAND, some clay, trace gravel, occasional cobbles and boulders Very Dense Brown (TILL)						20	40	60	80	100	20	40	60	
7.6								20	40	60	80	100	20	40	60
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	60	80	100	20	40	60	
							20	40	6						

Continued Next Page

+ 3 x 3: Numbers refer to  
Sensitivity

20  
15 5  
10 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 06-54

2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr N 4 809 070.88 E 230 949.61 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 31.05.06 - 31.05.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W <sub>P</sub> W W <sub>L</sub>				
277.9			9	SS	50/		278							
10.8	END OF BOREHOLE AT 10.82 m. BOREHOLE OPEN TO 10.82 m AND WATER LEVEL AT 8.08 m UPON COMPLETION. Piezometer installation consists of 25 mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 31.05.06 5.24 283.46 26.09.06 4.10 284.60				.150									

# RECORD OF BOREHOLE No 06-55

1 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr N 4 808 944.02 E 231 123.89 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 25.05.06 - 25.05.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
294.8							20 40 60 80 100	PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>		
0.0	ASPHALT: (100 mm)							○ UNCONFINED	+ FIELD VANE			
0.1	SAND and GRAVEL, trace silt Very Dense to Dense Brown Dry (FILL)		1	SS	63			● QUICK TRIAXIAL	× LAB VANE			44 48 8 (SI+CL)
			2	SS	35							
293.3												
1.5	Silty SAND, some gravel, trace clay Dense to Compact Brown Dry to Damp (TILL)		3	SS	30							
			4	SS	11							
			5	SS	18							12 57 25 6
			6	SS	22							
288.1												
6.7	Silty CLAY, sandy, trace gravel Hard to Very Stiff Brown (TILL)(CL)		7	SS	33							1 28 44 27
			8	SS	36							

Continued Next Page

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

RECORD OF BOREHOLE No 06-55

2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr N 4 808 944.02 E 231 123.89 ORIGINATED BY GA  
HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
DATUM Geodetic DATE 25.05.06 - 25.05.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					WATER CONTENT (%) Wp W WL				
							20	40	60	80	100	20	40	60			
283.7			9	SS	27		284										
11.1	END OF BOREHOLE AT 11.13 m. BOREHOLE OPEN TO 11.13 m AND WATER LEVEL AT 6.4 m UPON COMPLETION. Piezometer installation consists of 25 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 25.05.06 6.20 288.60 26.09.06 6.50 288.30																

METRIC

G.W.P.	277-97-00	LOCATION	Hwy 8 Widening, Grand River to Sportsworld Dr N 4 808 583.69 E 231 944.24	ORIGINATED BY	GA
HWY	8	BOREHOLE TYPE	Hollow Stem Augers	COMPILED BY	WM
DATUM	Geodetic	DATE	27.05.06 - 27.05.06	CHECKED BY	MEF

[illegible]

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 06-56

2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr N 4 808 583.69 E 231 944.24 ORIGINATED BY GA  
HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
DATUM Geodetic DATE 27.05.06 - 27.05.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40					
306.7			9	SS	36		307							
11.1	<p>END OF BOREHOLE AT 11.13 m. BOREHOLE OPEN TO 11.13 m AND DRY UPON COMPLETION. Piezometer installation consists of 25 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen.</p> <p>WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 26.09.06 Piezometer destroyed</p>													

# RECORD OF BOREHOLE No 06-57

1 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr N 4 808 468.18 E 232 111.91 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 30.05.06 - 30.05.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100					
317.9	SAND and GRAVEL, some silt Dense to Very Dense Brown Dry (FILL)		1	SS	33		317							34 54 12 (SI+CL)	
			2	SS	41		316								
			3	SS	50/ .150										
315.5	SAND, some silt, trace gravel Dense to Very Dense Brown Dry to Moist		4	SS	37		315								1 84 15 (SI+CL)
2.4							314								
							313								
							312								
			5	SS	46		311								
						310									
			6	SS	59	309									
						308									
			7	SS	65										
			8	SS	73										

Continued Next Page

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

RECORD OF BOREHOLE No 06-57

2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr N 4 808 468.18 E 232 111.91 ORIGINATED BY GA  
HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
DATUM Geodetic DATE 30.05.06 - 30.05.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
306.9			9	SS	100/ 225												
11.0	END OF BOREHOLE AT 11.05 m. BOREHOLE OPEN TO 10.67 m AND DRY UPON COMPLETION. Piezometer installation consists of 25 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen.  WATER LEVEL READINGS: DATE DEPTH 26.09.06 Piezometer destroyed																

## METRIC

[illegible]

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 06-58

2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr N 4 808 419.89 E 232 272.59 ORIGINATED BY WRW  
HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
DATUM Geodetic DATE 23.05.06 - 23.05.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W <sub>P</sub> W W <sub>L</sub>	20 40 60						
305.7			9	SS	50		306										
11.0	<p>END OF BOREHOLE AT 10.97 m. Piezometer installation consists of 25 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen.</p> <p>WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 26.09.06 Piezometer destroyed</p>																

# RECORD OF BOREHOLE No 06-59

1 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr N 4 808 314.78 E 232 454.55 ORIGINATED BY WRW  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 23.05.06 - 23.05.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
314.9	ASPHALT: (50 mm) SAND and GRAVEL, trace silt Very Dense Brown Dry (FILL)		1	SS	73									
312.5	Gravelly SAND, trace silt and clay Compact to Very Dense Brown Dry		2	SS	50/ 100									
			3	SS	22									
			4	SS	40									
			5	SS	31									
			6	SS	39									
			7	SS	98									

22 71 7  
(SI+CL)

Continued Next Page

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

ONTMT4S 7938-2.GPJ 06/03/07

# RECORD OF BOREHOLE No 06-59

2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr N 4 808 314.78 E 232 454.55 ORIGINATED BY WRW  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 23.05.06 - 23.05.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
304.8 10.1	Silty CLAY, some sand, trace gravel Hard Brown (TILL)(CL)		8	SS	67		304						0 14 48 38	
303.9 11.0	END OF BOREHOLE AT 10.97 m. Piezometer installation consists of 25 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen.  WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 29.09.06 10.10 304.80													

# RECORD OF BOREHOLE No 06-64

1 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr. N 4 809 235.31 E 230 718.37 ORIGINATED BY SLL  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY JHL  
 DATUM Geodetic DATE 10.08.06 - 10.08.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
284.6							20 40 60 80 100	○ UNCONFINED + FIELD VANE	PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>		
0.0	TOPSOIL: (150 mm)							● QUICK TRIAXIAL × LAB VANE	WATER CONTENT (%)				
0.1	Silty CLAY, trace sand, topsoil stained Firm to Stiff Dark Brown		1	SS	5								
			2	SS	13								
283.1													
1.4	SAND and GRAVEL, trace silt, occasional cobbles Loose Brown Moist  Becoming Very Dense occasional cobbles and boulders		3	SS	8								
			4	SS	70								
			5	SS	92/ .275								
			6	SS	88								
278.5													
6.0	Sandy SILT, trace gravel, occasional cobbles Very Dense Grey Moist to Wet (TILL)		7	SS	50/ .125								
277.6													
7.0	SAND, some silt, trace gravel, occasional cobbles Very Dense Grey Wet		8	SS	50/ .100								
275.4													
9.2	END OF BOREHOLE AT 9.19 m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		9	SS	50/ .050								

Continued Next Page

+ 3 × 3: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

ONTM74S 7938.GPJ 06/03/07

# RECORD OF BOREHOLE No 06-64

2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr. N 4 809 235.31 E 230 718.37 ORIGINATED BY SLL  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY JHL  
 DATUM Geodetic DATE 10.08.06 - 10.08.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL																	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W <sub>P</sub>	W	W <sub>L</sub>																			
<p>WATER LEVEL READINGS:</p> <table border="1"> <thead> <tr> <th>DATE</th> <th>DEPTH(m)</th> <th>ELEV.(m)</th> </tr> </thead> <tbody> <tr> <td>11.08.06</td> <td>1.34</td> <td>283.24</td> </tr> <tr> <td>14.08.06</td> <td>1.47</td> <td>283.11</td> </tr> <tr> <td>15.08.06</td> <td>1.48</td> <td>283.10</td> </tr> <tr> <td>16.08.06</td> <td>1.49</td> <td>283.09</td> </tr> <tr> <td>29.09.06</td> <td>1.39</td> <td>283.19</td> </tr> </tbody> </table>																	DATE	DEPTH(m)	ELEV.(m)	11.08.06	1.34	283.24	14.08.06	1.47	283.11	15.08.06	1.48	283.10	16.08.06	1.49	283.09	29.09.06	1.39	283.19
DATE	DEPTH(m)	ELEV.(m)																																
11.08.06	1.34	283.24																																
14.08.06	1.47	283.11																																
15.08.06	1.48	283.10																																
16.08.06	1.49	283.09																																
29.09.06	1.39	283.19																																

ONTMT4S 7938.GPJ 06/03/07



# RECORD OF BOREHOLE No 06-65

2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr N 4 808 818.97 E 231 273.96 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 26.05.06 - 26.05.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W <sub>P</sub> W W <sub>L</sub>				
290.5			9	SS	36		291							
11.1	END OF BOREHOLE AT 11.13 m. BOREHOLE OPEN TO 11.13 m AND DRY UPON COMPLETION. Piezometer installation consists of 25 mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.  WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 26.09.06 Dry													

# RECORD OF BOREHOLE No 06-66

1 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr N 4 808 626.79 E 231 711.79 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 30.05.06 - 30.05.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE							
315.0							20	40	60	80	100	20	40	60	GR SA SI CL	
0.0	SAND and GRAVEL, trace silt Compact Brown Dry (FILL)		1	SS	15											
			2	SS	26											
313.5																
1.5	Gravelly SAND, some silt Compact to Very Dense Brown Dry to Moist		3	SS	32											
			4	SS	25										20 64 16 (SI+CL)	
			5	SS	72/ 150											
308.9																
6.1	SAND, trace silt, trace gravel Compact to Dense Brown Moist		6	SS	14											
			7	SS	17											
			8	SS	26											

Continued Next Page

+ 3 x 3: Numbers refer to  
Sensitivity

20  
15  
10  
5  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 06-66

2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr N 4 808 626.79 E 231 711.79 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 30.05.06 - 30.05.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
							20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
303.9			9	SS	34									
11.1	END OF BOREHOLE AT 11.13 m. BOREHOLE OPEN TO 11.13 m AND DRY UPON COMPLETION. Piezometer installation consists of 25 mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.  WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 29.09.06 Piezometer destroyed													

+<sup>3</sup> × 3: Numbers refer to  
Sensitivity

20  
15 5  
10 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 06-67

1 OF 1

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr N 4 808 259.99 E 232 510.57 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 27.05.06 - 27.05.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL						
314.1							20	40	60	80	100	20	40	60		
0.0	ASPHALT: (88 mm)															
0.1	SAND and GRAVEL, trace silt Very Dense Brown Dry (FILL)		1	SS	50/ .150											
			2	SS	50/ .150										31 59 10 (SI+CL)	
312.6																
1.5	Gravelly SAND, trace silt Very Dense Brown Dry		3	SS	50/ .125											
			4	SS	50/ .075											
309.7																
4.4	SAND, trace silt Compact to Dense Brown Dry		5	SS	25										0 95 5 (SI+CL)	
			6	SS	42											
307.5																
6.6	END OF BOREHOLE AT 6.55 m. BOREHOLE OPEN TO 6.55 m AND DRY UPON COMPLETION. Piezometer installation consists of 25 mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.  WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 27.05.06 Dry															

## METRIC

[illegible]

+ 3, X 3: Numbers refer to Sensitivity

ONTMT4S 7938-2.GPJ 06/03/07

# RECORD OF BOREHOLE No 06-70

2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr N 4 809 565.36 E 230 184.39 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 30.05.06 - 30.05.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
							20	40	60	80	100	20	40	60			
294.7			9	SS	100/ 250												
11.1	END OF BOREHOLE AT 11.07 m. BOREHOLE OPEN TO 11.07 m AND WATER LEVEL AT 7.92 m UPON COMPLETION. Piezometer installation consists of 25 mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.  WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 29.05.06 7.28 298.52 26.09.06 10.45 295.35																

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 06-72

1 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr N 4 809 160.74 E 230 842.65 ORIGINATED BY GA  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 30.05.06 - 30.05.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)				
								○ UNCONFINED    + FIELD VANE								w <sub>p</sub> w    w <sub>L</sub>				
								● QUICK TRIAXIAL    × LAB VANE												
288.3							20	40	60	80	100	20	40	60	GR	SA	SI	CL		
0.0	ASPHALT: (100 mm)																			
0.1	SAND and GRAVEL, some silt Dense Brown Dry (FILL)		1	SS	42											41	46	13		
			2	SS	38													(SI+CL)		
286.9																				
1.4	Silty CLAY, some sand, trace gravel Very Stiff Brown (FILL)		3	SS	24															
285.3																				
3.0	SAND and SILT, trace clay, trace gravel, trace organics, occasional cobbles Loose Brown Moist		4	SS	7											1	56	36		
																		7		
284.0																				
4.3	GRAVEL, some sand, trace silt Very Dense Brown Wet		5	SS	52															
			6	SS	50/ .150															
281.0																				
7.3	Silty CLAY, some sand, trace gravel Hard Brown (TILL)		7	SS	62/ .150															
			8	SS	59															

Continued Next Page

+ 3, × 3: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 06-72

2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr N 4 809 160.74 E 230 842.65 ORIGINATED BY GA  
HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
DATUM Geodetic DATE 30.05.06 - 30.05.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	W <sub>P</sub>	W	W <sub>L</sub>	WATER CONTENT (%)		
277.2			9	SS	93		20 40 60 80 100							
11.1	<p>END OF BOREHOLE AT 11.13 m. BOREHOLE OPEN TO 10.67 m AND WATER LEVEL AT 9.87 m ON COMPLETION.</p> <p>Piezometer installation consists of 25 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen.</p> <p>WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 31.05.06 6.01 282.29 26.09.06 3.90 284.40</p>													

## **Appendix B**

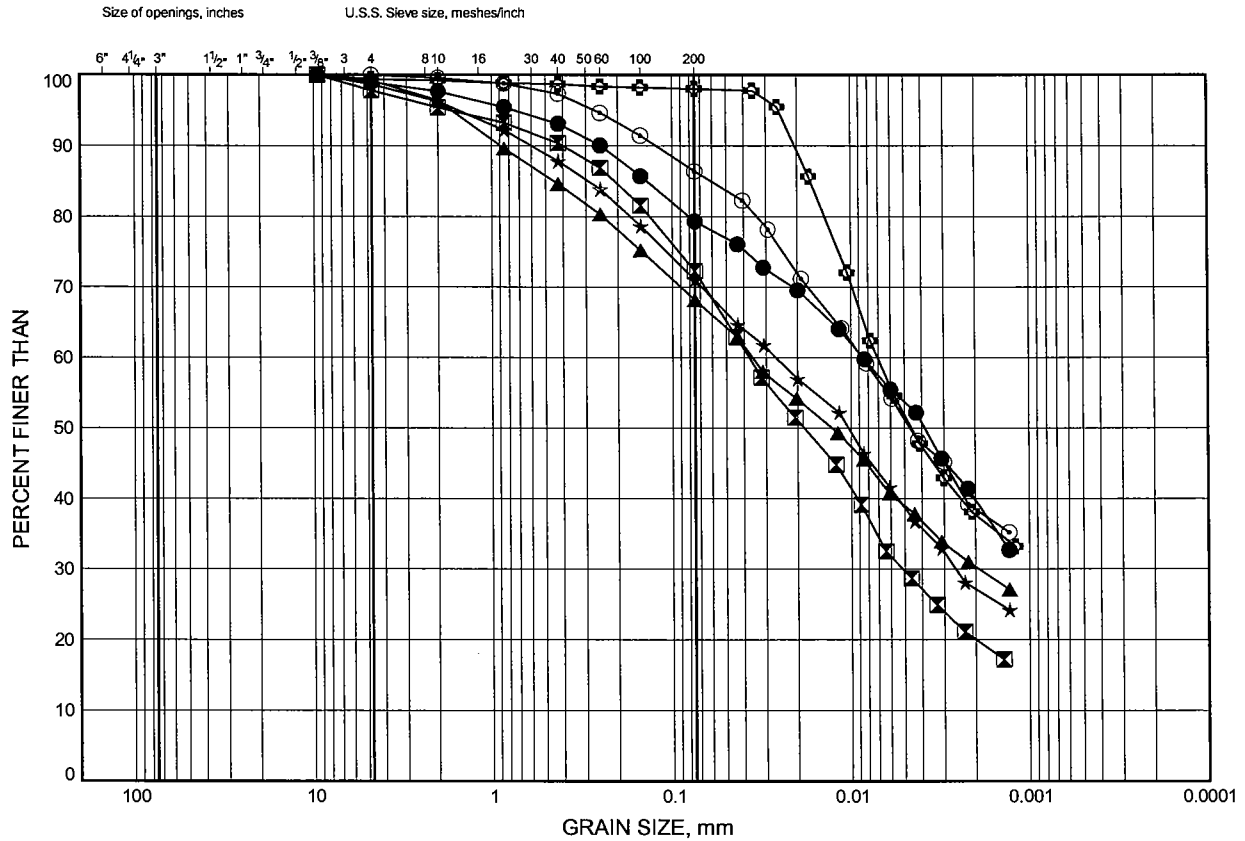
### **Laboratory Test Results**

# Highway 8 Widening Over Grand River

## GRAIN SIZE DISTRIBUTION

FIGURE B1

### SILTY CLAY TILL



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-2	9.30	285.53
⊠	06-2	12.50	282.33
▲	06-52	1.83	307.67
★	06-55	7.85	286.95
⊙	06-59	10.67	304.23
⊕	06-65	3.35	298.25

Date May 2007

Project 277-97-00



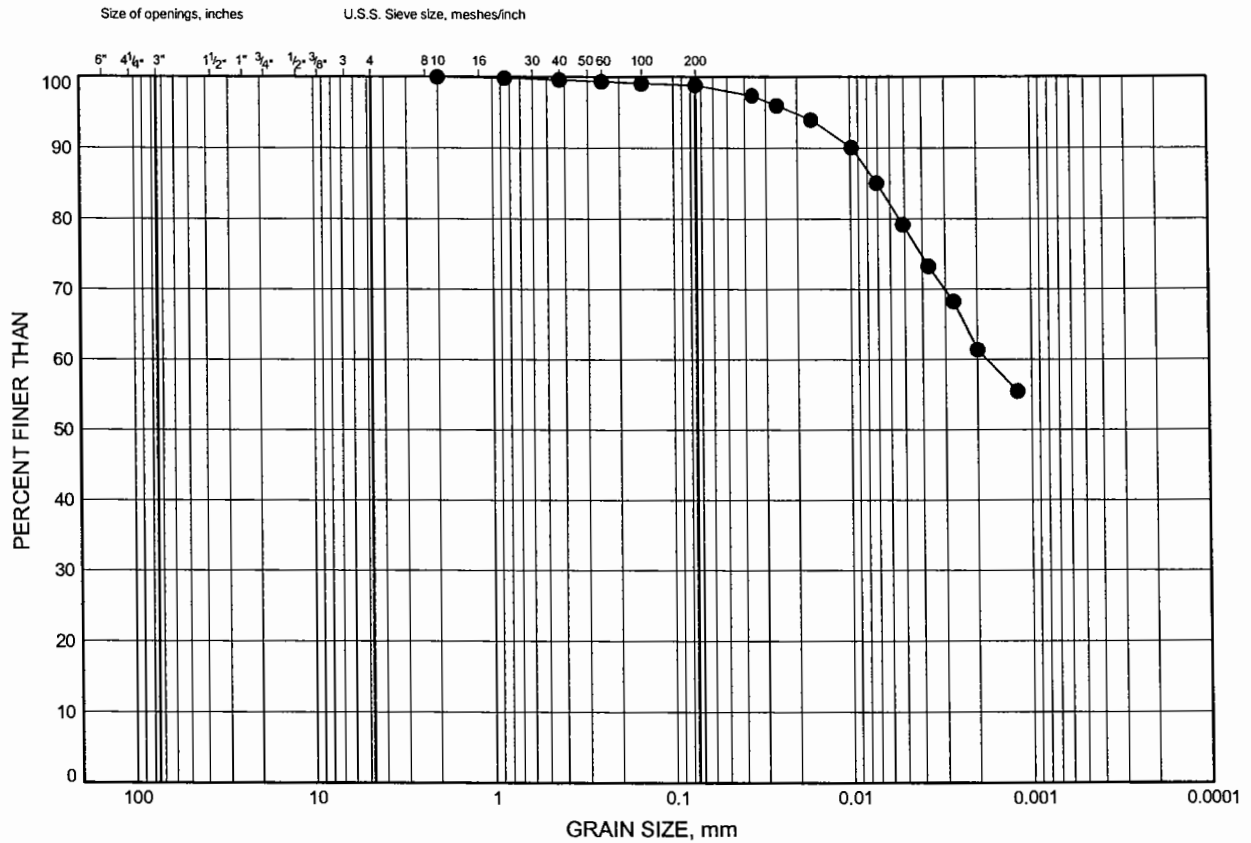
Prep'd MFA

Chkd. MEF

# Geotechnical Investigation GRAIN SIZE DISTRIBUTION

FIGURE B2

## SILTY CLAY TILL



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-65	9.37	292.23

Date March 2007  
Project 277-97-00

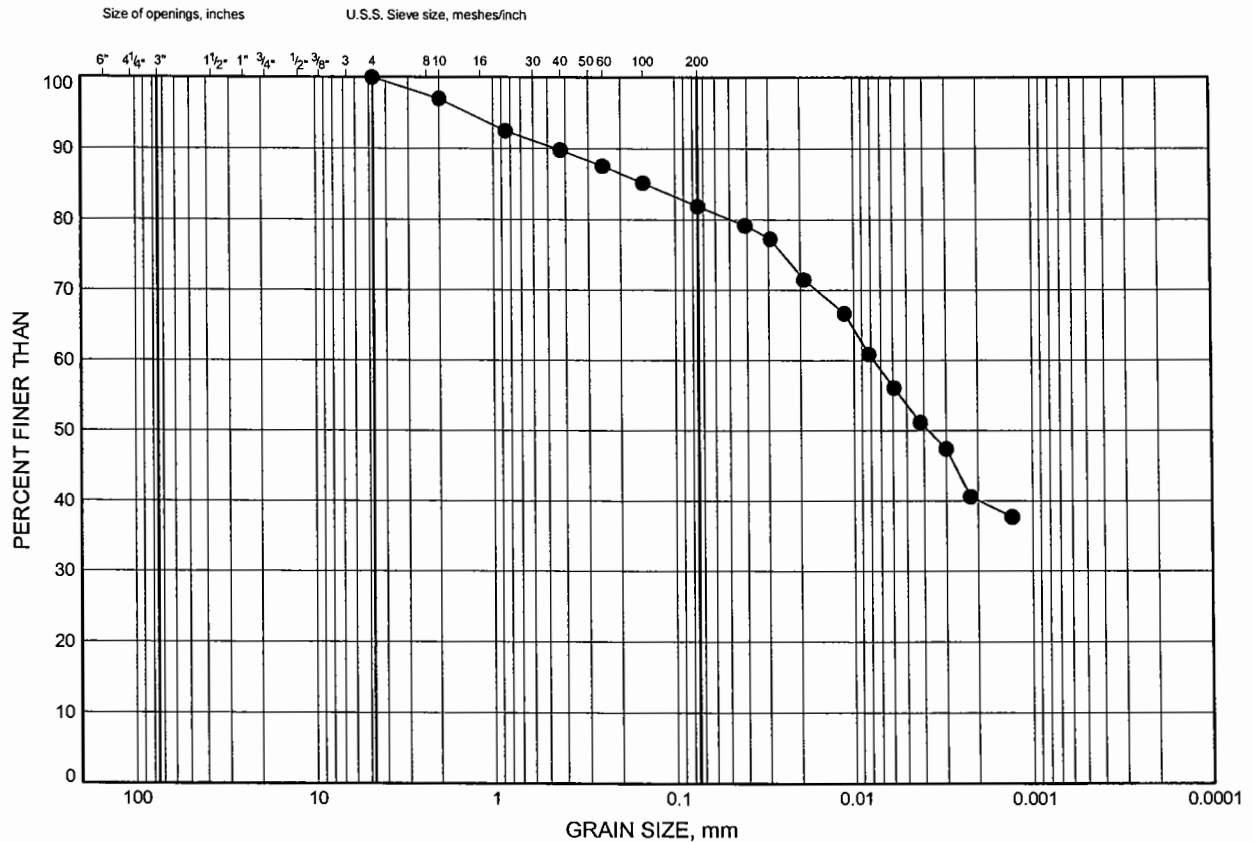


Prep'd MFA  
Chkd. MEF

# Geotechnical Investigation GRAIN SIZE DISTRIBUTION

FIGURE B3

## SILTY CLAY FILL



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-54	1.83	286.87

Date March 2007  
Project 277-97-00

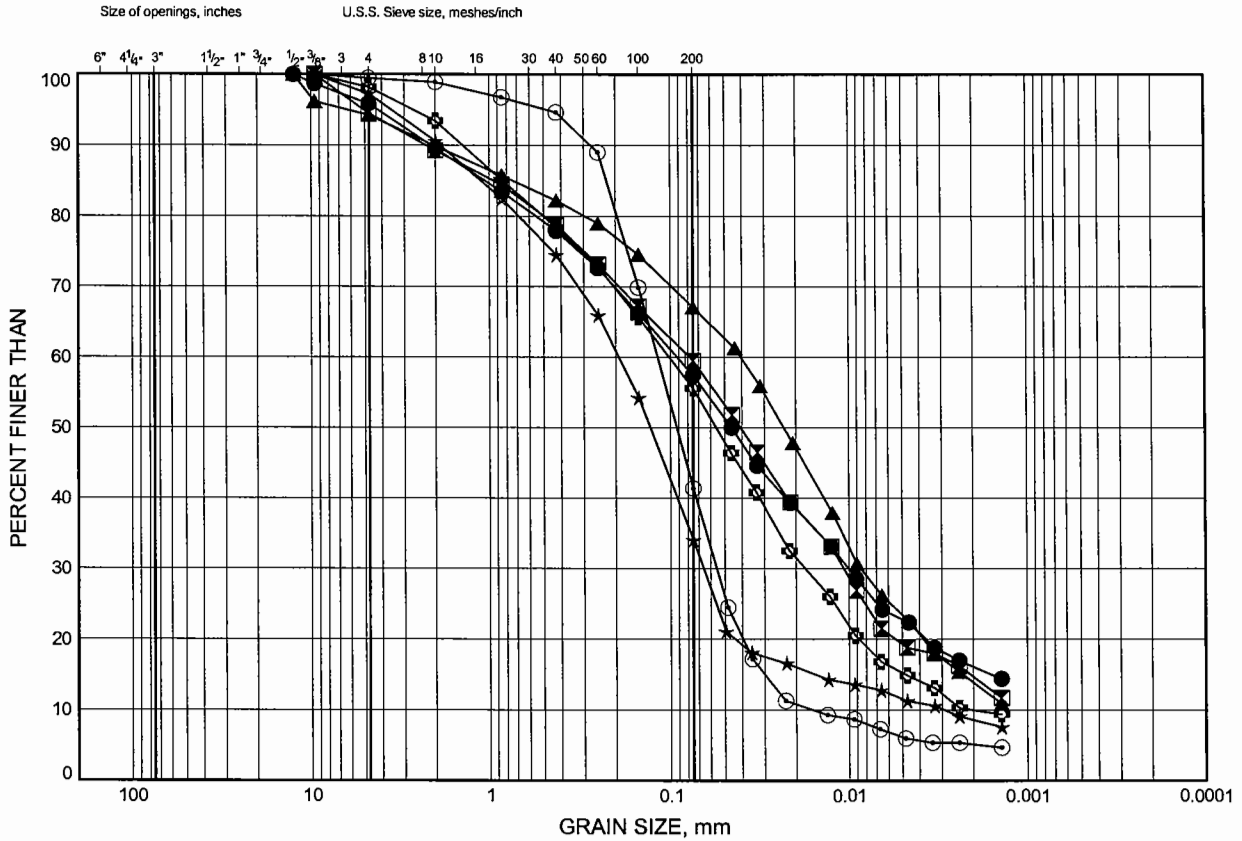


Prep'd MFA  
Chkd. MEF

# Highway 8 Widening Over Grand River GRAIN SIZE DISTRIBUTION

FIGURE B4

## SILTY SAND TO SILT AND SAND TILL



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-2	1.83	293.00
⊠	06-2	17.07	277.76
▲	06-2	18.34	276.49
★	06-24	7.85	303.25
⊙	06-52	4.80	304.70
⊛	06-53	9.37	291.72

Date May 2007

Project 277-97-00



Prep'd MFA

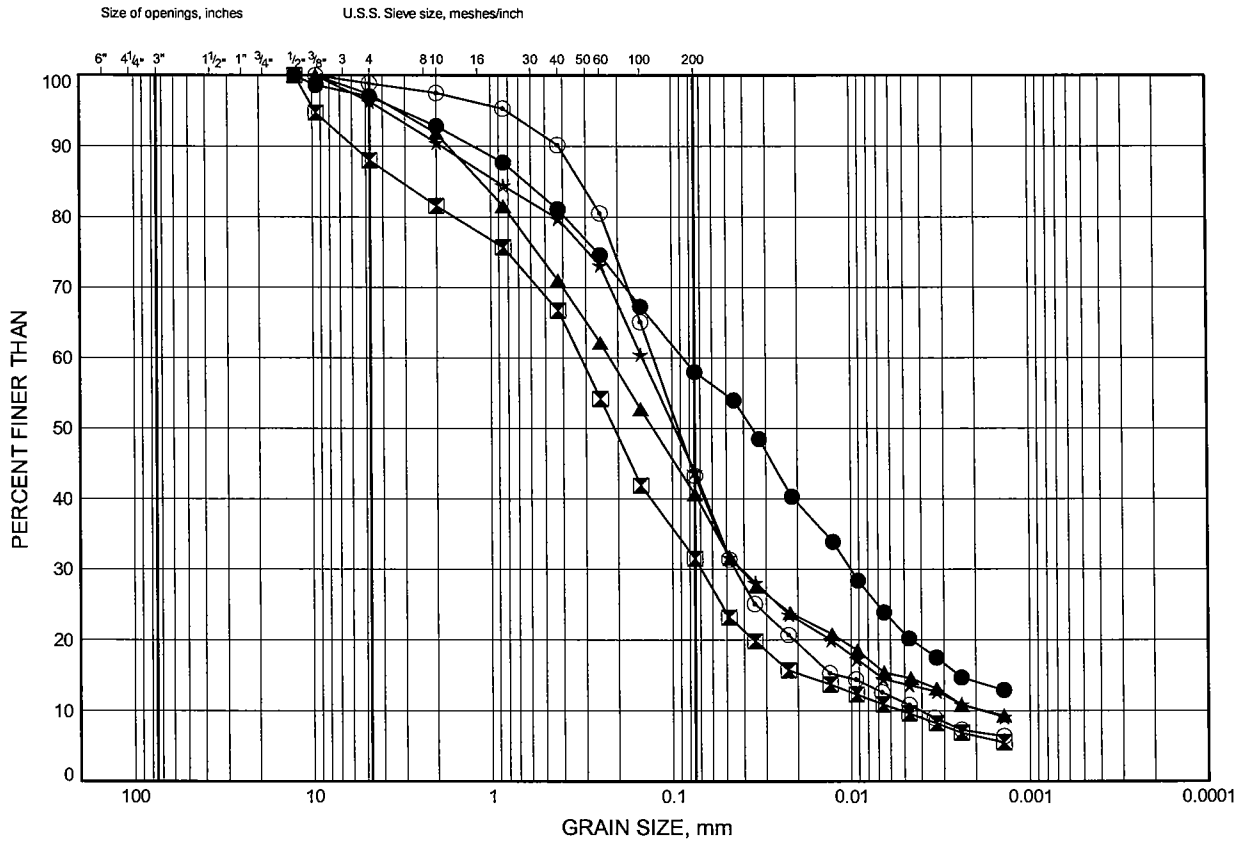
Chkd. MEF

# Highway 8 Widening Over Grand River

## GRAIN SIZE DISTRIBUTION

FIGURE B5

### SILTY SAND TO SILT AND SAND TILL



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-54	7.85	280.85
⊠	06-55	4.80	290.00
▲	06-56	3.35	314.45
★	06-70	7.85	297.95
⊙	06-72	3.35	284.95

Date May 2007

Project 277-97-00



Prep'd MFA

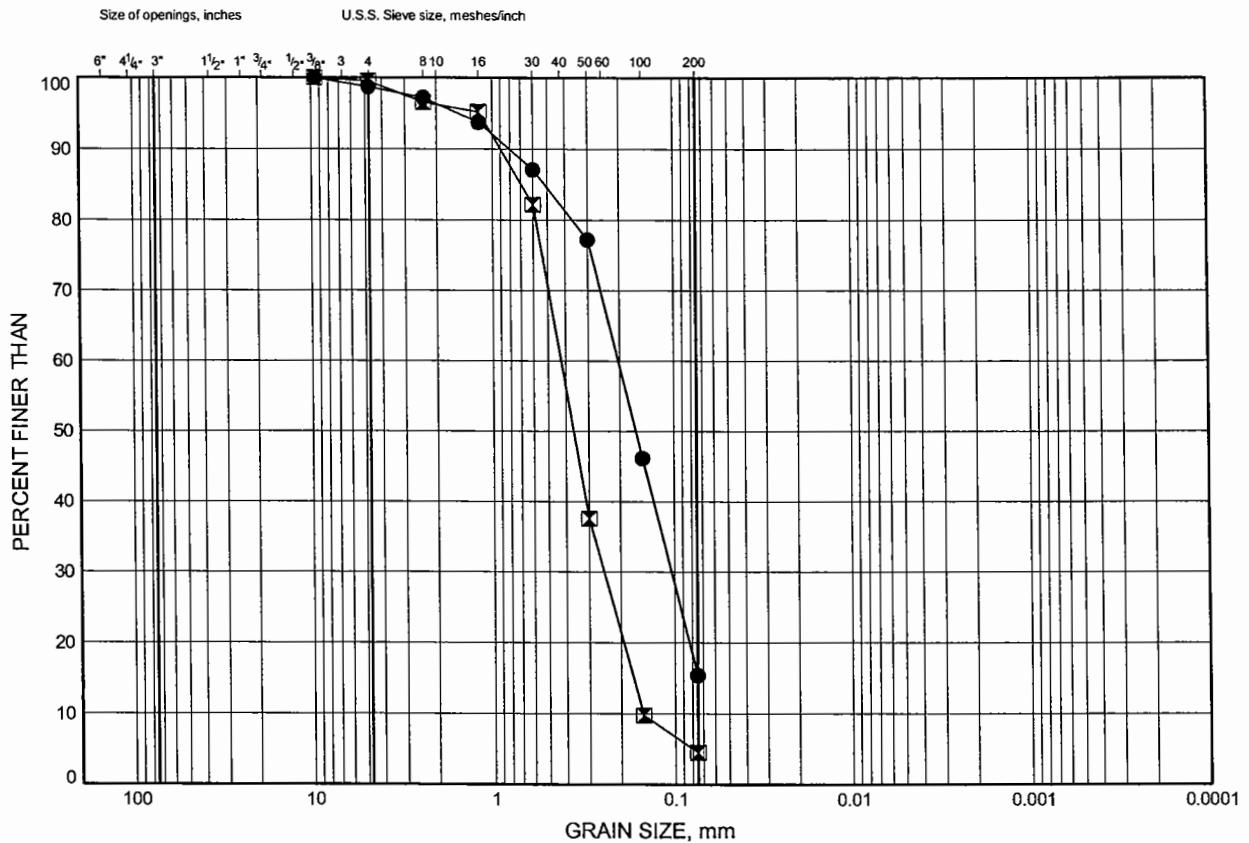
Chkd. MEF

# Geotechnical Investigation

## GRAIN SIZE DISTRIBUTION

FIGURE B6

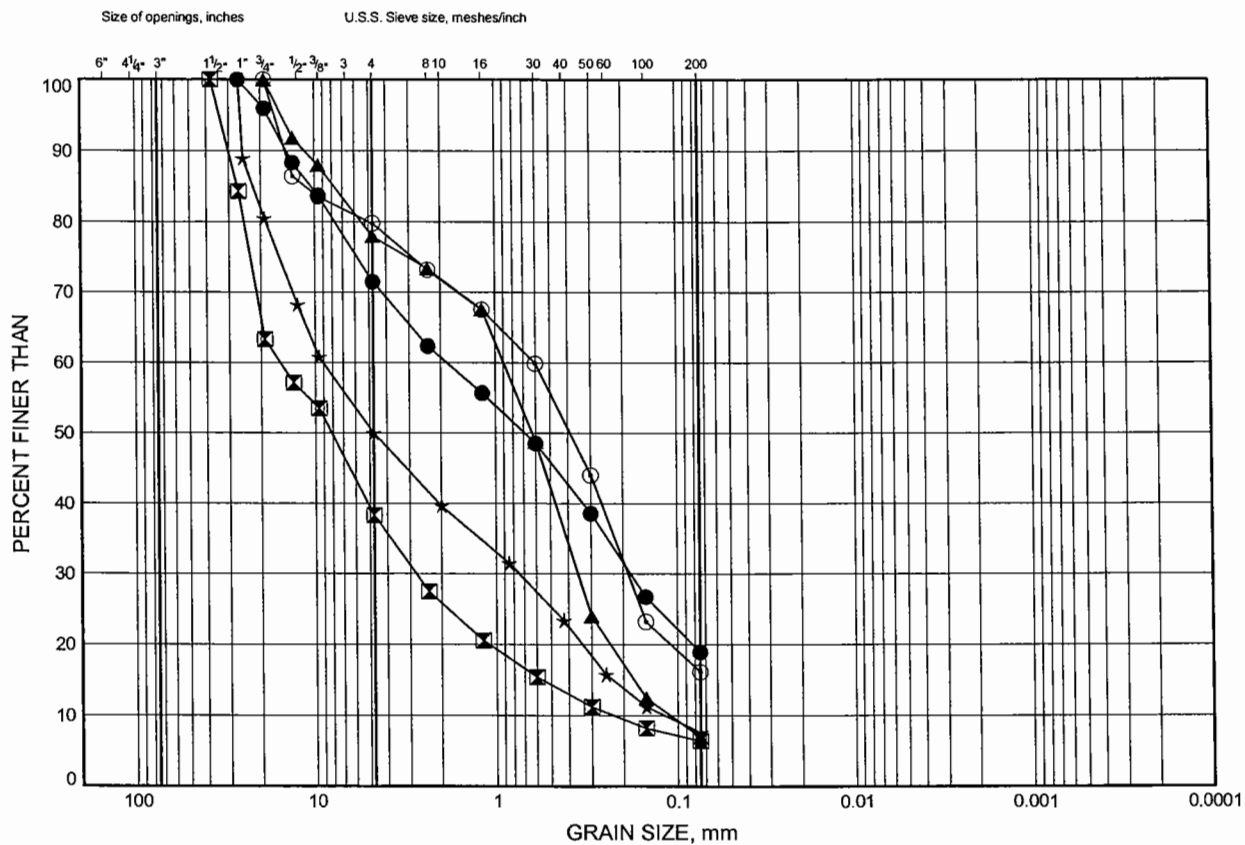
### SAND



# Geotechnical Investigation GRAIN SIZE DISTRIBUTION

FIGURE B7

## SAND AND GRAVEL



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-14	4.80	304.60
⊠	06-58	6.10	310.60
▲	06-59	7.62	307.28
★	06-64	3.25	281.33
⊙	06-66	3.35	311.65

Date March 2007

Project 277-97-00



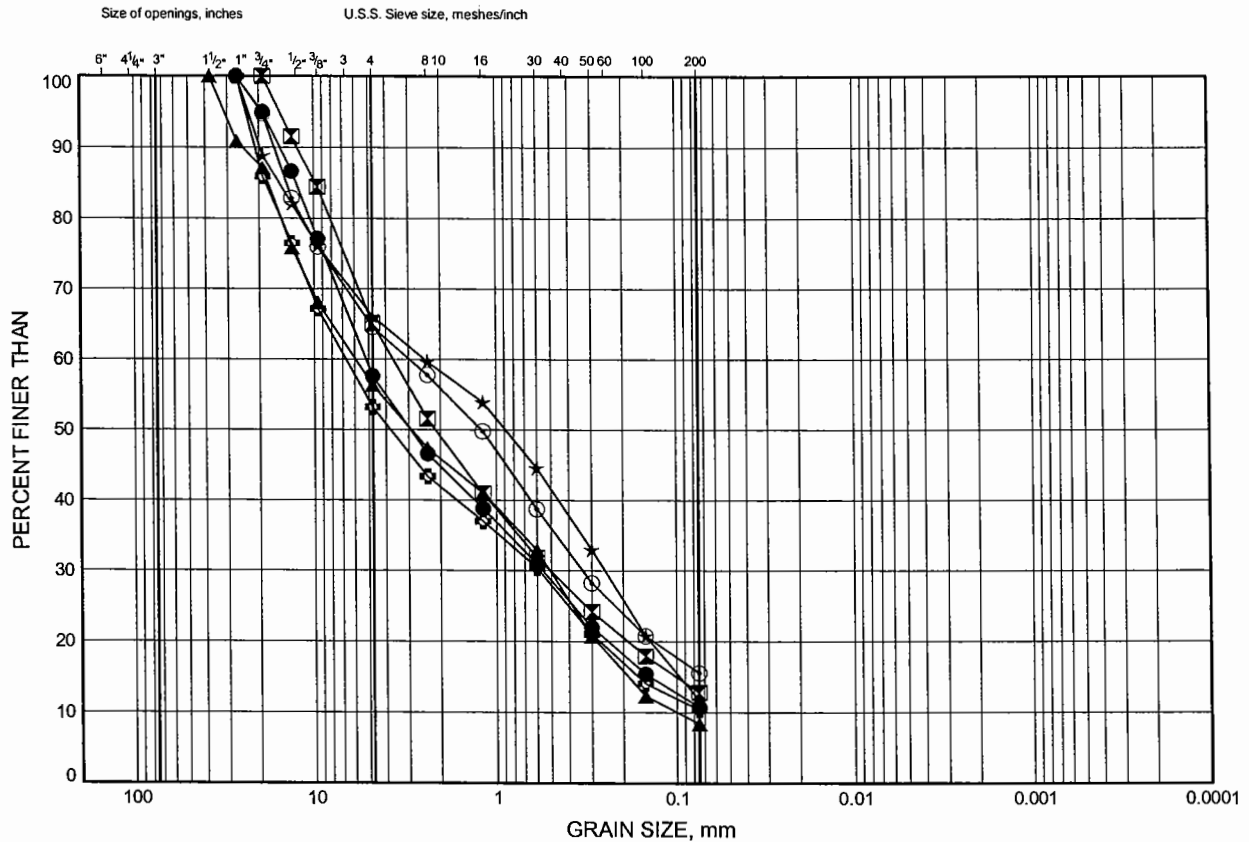
Prep'd MFA

Chkd. MEF

# Geotechnical Investigation GRAIN SIZE DISTRIBUTION

FIGURE B8

## SAND AND GRAVEL FILL



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-24	0.23	310.87
⊠	06-53	0.46	300.63
▲	06-55	0.46	294.34
★	06-57	1.07	316.83
⊙	06-58	0.91	315.79
⊕	06-65	0.46	301.14

Date March 2007  
Project 277-97-00

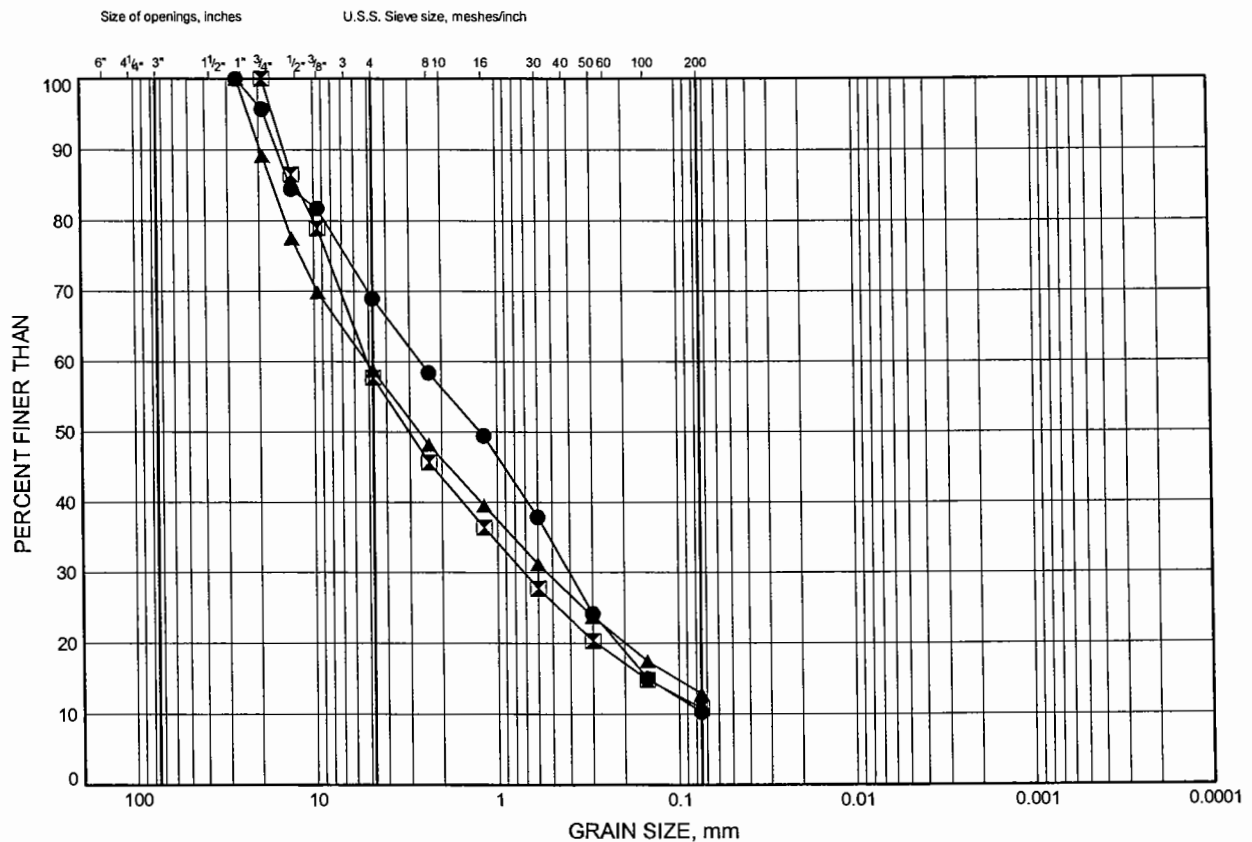


Prep'd MFA  
Chkd. MEF

# Geotechnical Investigation GRAIN SIZE DISTRIBUTION

FIGURE B9

## SAND AND GRAVEL FILL



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-67	1.07	313.03
☒	06-70	0.46	305.34
▲	06-72	0.46	287.84

Date March 2007

Project 277-97-00

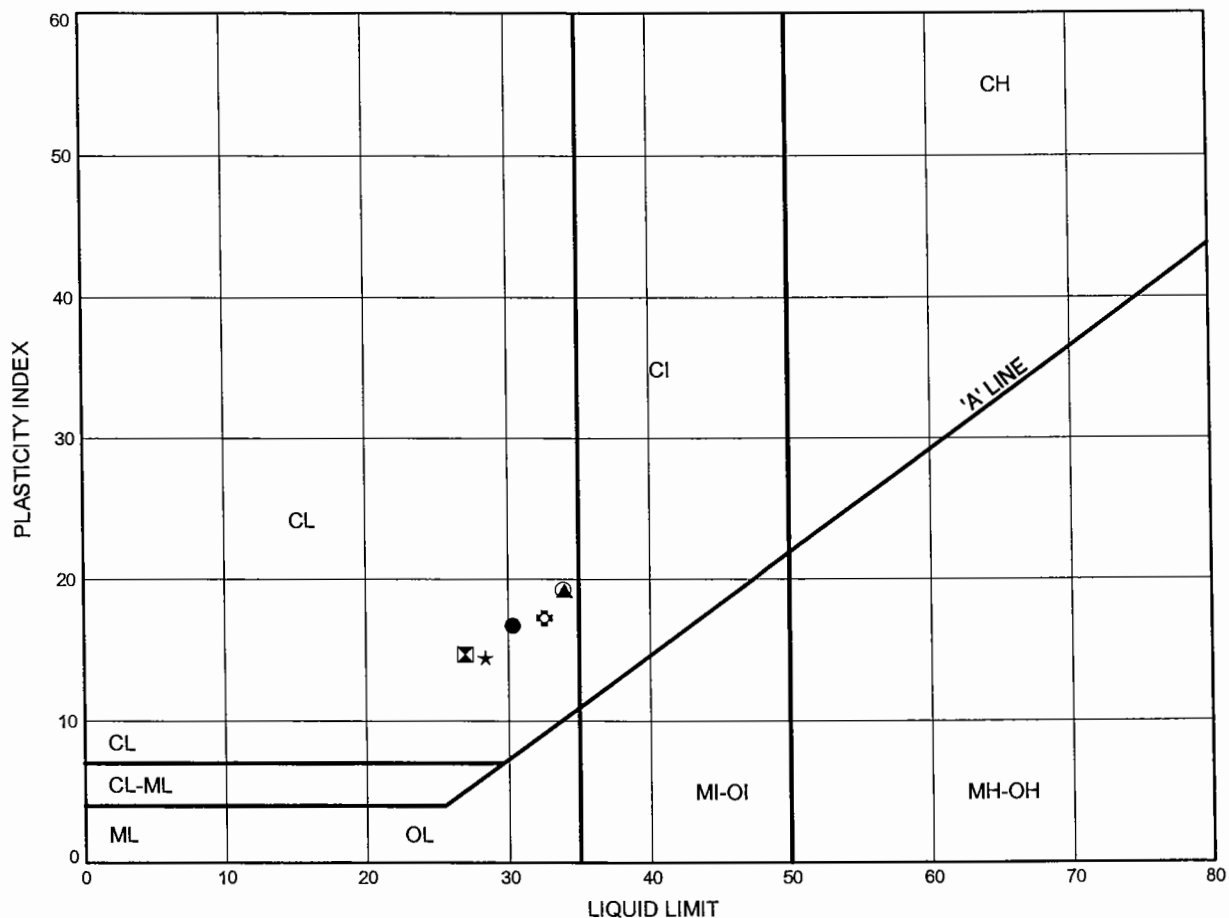


Prep'd MFA

Chkd. MEF

Geotechnical Investigation  
**ATTERBERG LIMITS TEST RESULTS**

FIGURE B10



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-2	9.30	285.53
⊠	06-52	1.83	307.67
▲	06-54	1.83	286.87
★	06-55	7.85	286.95
⊙	06-59	10.67	304.23
⊗	06-65	3.35	298.25

Date March 2007

Project 277-97-00

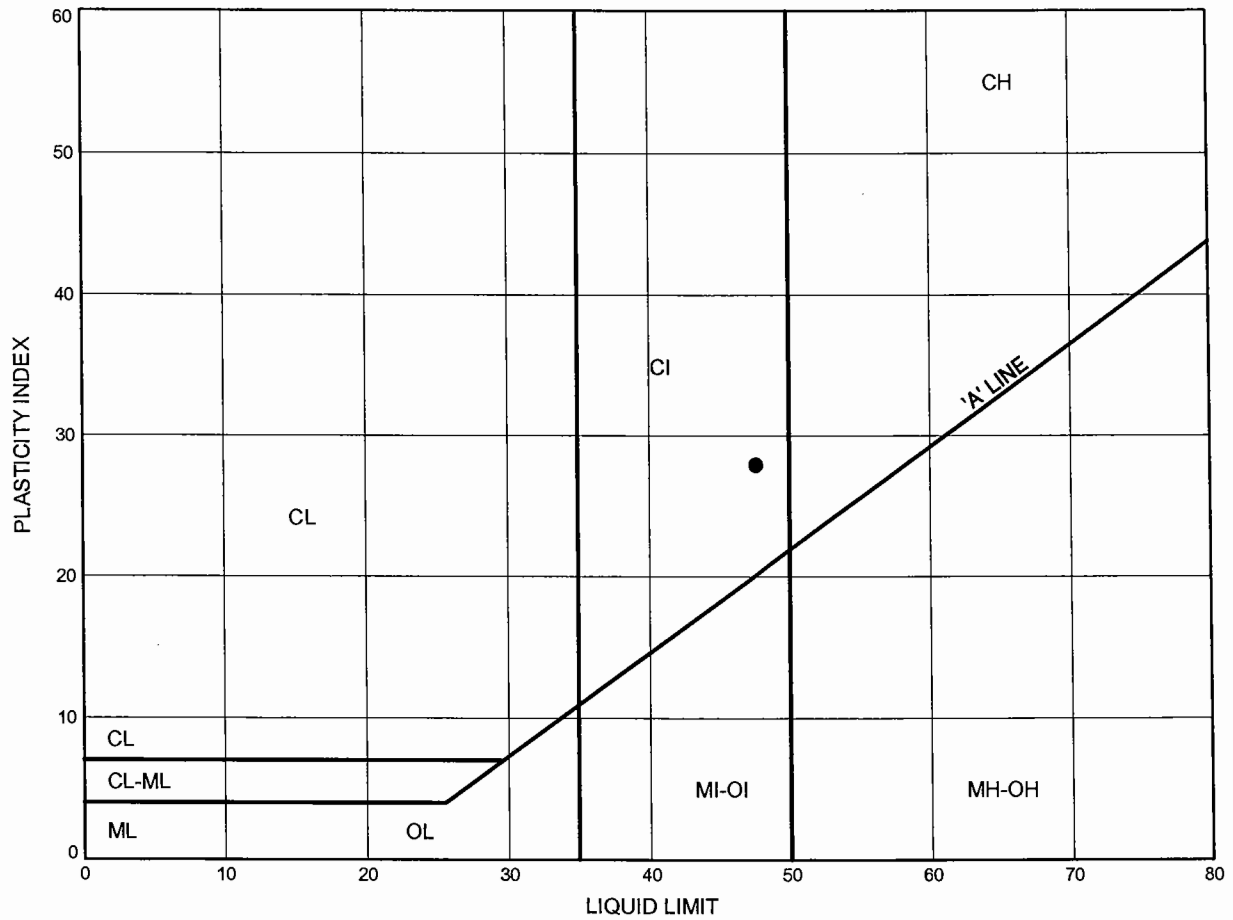


Prep'd MFA

Chkd. MEF

Geotechnical Investigation  
**ATTERBERG LIMITS TEST RESULTS**

FIGURE B11



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-65	9.37	292.23

Date March 2007

Project 277-97-00



THURBER

Prep'd MFA

Chkd. MEF

## **Appendix C**

### **List of Special Provisions and Suggested Text for NSSP**

**List of Special Provisions Referenced in this Report**

SP 903S01

**Suggested Text for NSSP on “Caisson Construction for HML Pole Foundations”**

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

For bidding purposes, the Contractor shall assume the following:

1. The subsurface conditions at a HML location are the same as those encountered in the borehole closest to the subject HML location.
2. There is a probability that occasional cobbles and boulders may be encountered within the glacial till deposits. Obstructions may also be present within the fill. Caisson installation equipment must be able to penetrate these obstructions.
3. Water seepage and/or soil sloughing into the caisson hole will occur from existing fill and cohesionless soils at some locations. The cohesionless soils would be susceptible to disturbance under conditions of unbalanced hydrostatic head. Temporary liners shall be available on site, or be made available on very short notice, to support the caisson sidewalls and provide seepage cut-off where required.

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

## **Appendix D**

### **Drawing**

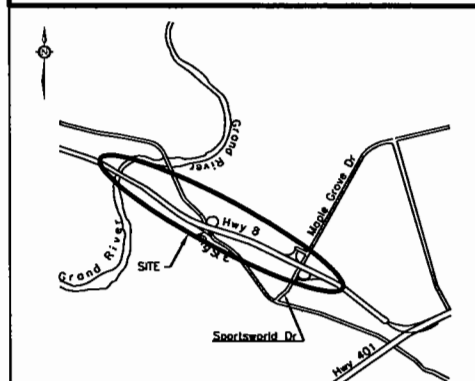
**METRIC**  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

CONT No  
GWP No.277-97-00  
HWY 8 WIDENING, GRAND RIVER  
TO SPORTSWORLD DRIVE  
HML AND OH SIGNS  
BOREHOLE LOCATION PLAN



MORRISON  
HERSHFIELD

THURBER ENGINEERING LTD.  
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS



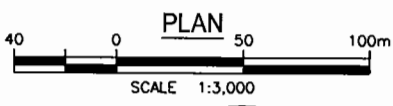
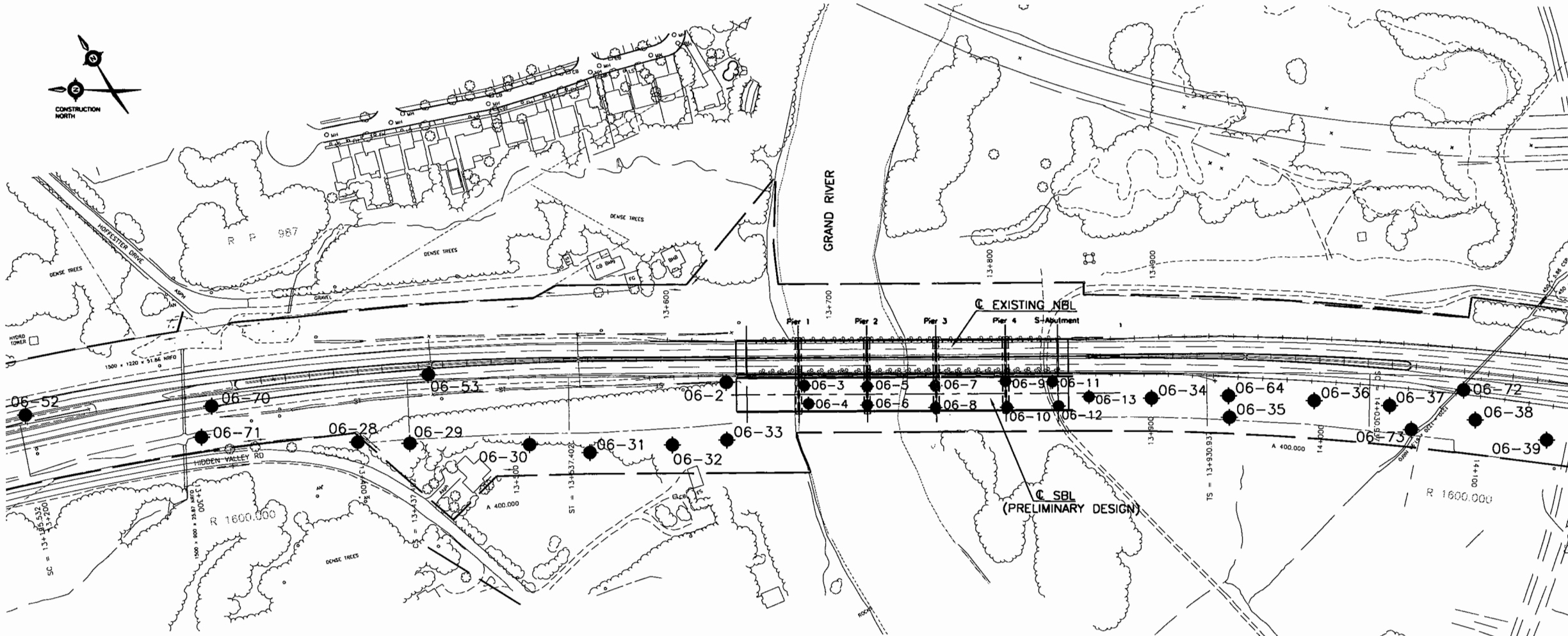
**KEYPLAN**  
**LEGEND**

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

NO	ELEVATION	NORTHING	EASTING
06-2	294.8	4 809 407.9	230 461.0
06-3	282.5	4 809 380.6	230 500.6
06-4	282.5	4 809 369.7	230 496.8
06-5	282.5	4 809 359.3	230 533.5
06-6	282.5	4 809 349.5	230 527.4
06-7	283.4	4 809 337.1	230 569.3
06-8	283.7	4 809 325.7	230 562.1
06-9	283.4	4 809 316.4	230 607.1
06-10	283.8	4 809 302.3	230 599.2
06-11	284.5	4 809 300.8	230 631.3
06-12	284.2	4 809 286.2	230 626.4
06-13	282.3	4 809 280.9	230 645.4
06-28	307.1	4 809 498.2	230 248.8
06-29	308.2	4 809 480.4	230 275.7
06-30	310.5	4 809 440.1	230 337.9
06-31	310.0	4 809 416.0	230 366.9
06-32	309.2	4 809 393.0	230 412.3
06-33	308.0	4 809 377.7	230 442.3

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

GEOCRES No. 40P8-147



NO	ELEVATION	NORTHING	EASTING
06-34	284.5	4 809 259.4	230 677.7
06-35	284.4	4 809 223.9	230 711.7
06-36	284.8	4 809 204.8	230 761.0
06-37	284.9	4 809 177.3	230 798.6
06-38	285.2	4 809 141.3	230 838.7
06-39	284.9	4 809 107.5	230 869.0
06-52	309.5	4 809 622.9	230 083.7
06-53	301.1	4 809 510.0	230 308.1
06-64	284.6	4 809 235.3	230 718.4
06-70	305.8	4 809 565.4	230 184.4
06-71	304.0	4 809 552.6	230 168.7
06-72	288.3	4 809 160.7	230 842.7
06-73	285.1	4 809 157.6	230 802.1

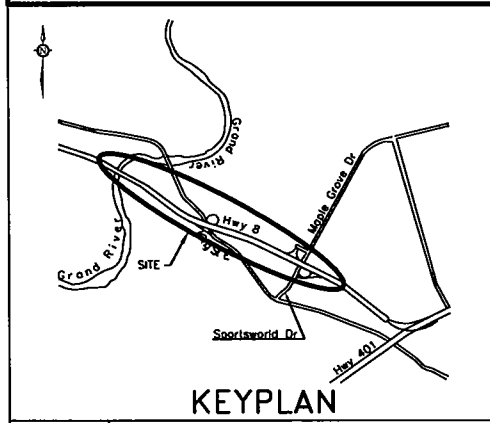
DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

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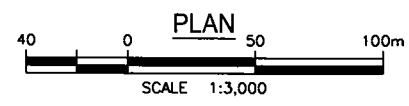
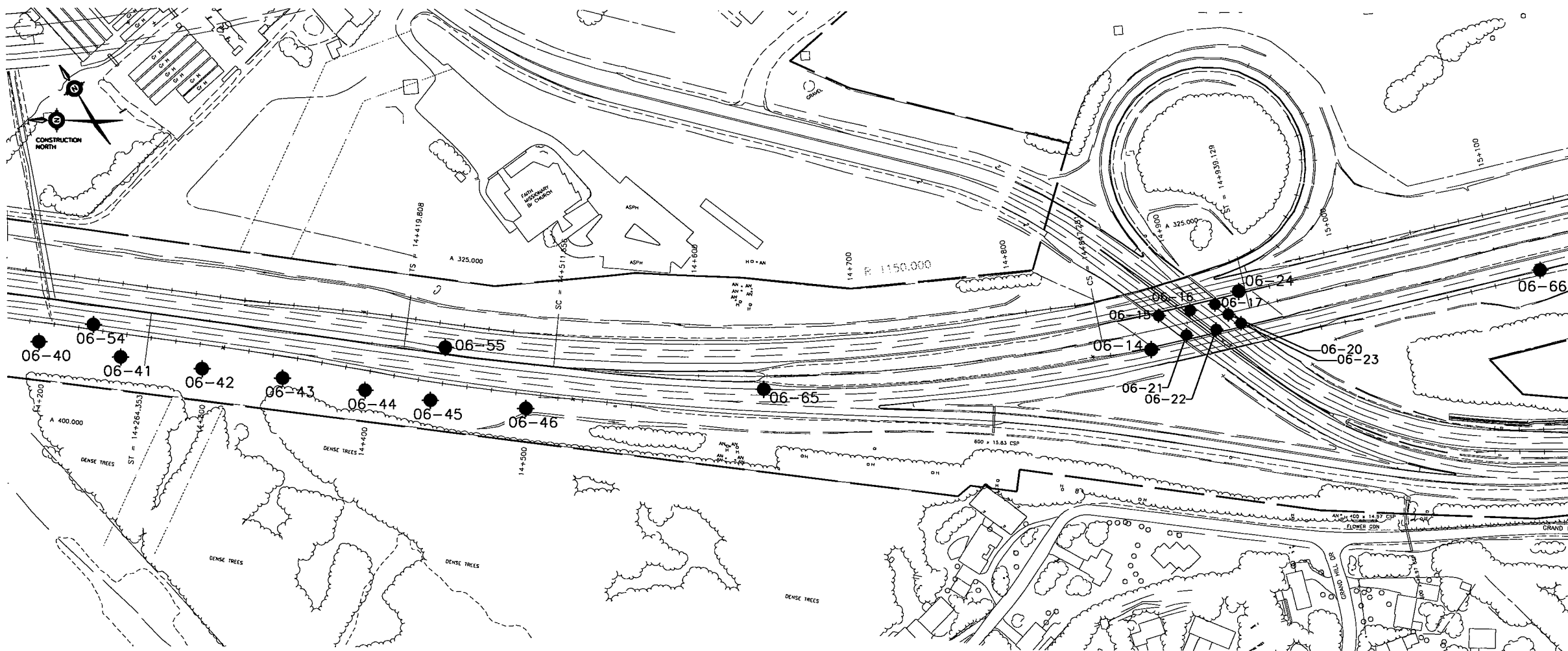
**METRIC**  
 DIMENSIONS ARE IN METRES  
 AND/OR MILLIMETRES  
 UNLESS OTHERWISE SHOWN

CONT No  
 GWP No.277-97-00  
 HWY 8 WIDENING, GRAND RIVER  
 TO SPORTSWORLD DRIVE  
 HML AND OH SIGNS  
 BOREHOLE LOCATION PLAN

**MORRISON  
 HERSHFELD**  
**THURBER ENGINEERING LTD.**  
 GEOTECHNICAL • ENVIRONMENTAL • MATERIALS



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



NO	ELEVATION	NORTHING	EASTING
06-14	309.4	4 808 713.1	231 485.9
06-15	302.3	4 808 728.1	231 500.9
06-16	302.9	4 808 720.6	231 518.7
06-17	302.9	4 808 715.6	231 533.5
06-20	303.2	4 808 706.1	231 537.0
06-21	302.9	4 808 709.1	231 508.7
06-22	303.5	4 808 702.3	231 525.8
06-23	303.5	4 808 697.3	231 540.7
06-24	311.1	4 808 714.5	231 550.0
06-40	287.2	4 809 080.1	230 915.9
06-41	287.5	4 809 045.3	230 953.1
06-42	288.4	4 809 012.8	230 991.3
06-43	289.9	4 808 981.6	231 029.5
06-44	291.7	4 808 948.5	231 068.1
06-45	293.7	4 808 921.4	231 098.8
06-46	295.3	4 808 886.6	231 145.2
06-54	288.7	4 809 070.9	230 949.6
06-55	294.8	4 808 944.0	231 123.9



DRAWING NOT TO BE SCALED  
 100 mm ON ORIGINAL DRAWING

**-NOTES-**

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

**GEOCRES No. 40P8-147**

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	AEG	CHK PKC	CODE
DRAWN	JHL	CHK PKC	SITE
			LOAD
			STRUCT
			DATE MAR 2007

[illegible]