

**FOUNDATION INVESTIGATION REPORT
HURONTARIO STREET SOUTH ACCESS ROAD STRUCTURE
AND RETAINING WALLS
HWY 401 WIDENING, HWY 410 TO CREDIT RIVER
MISSISSAUGA, ONTARIO
G.W.P. 2107-05-00, WP 2107-05-03, SITE 24-758**

Geocres Number: 30M12-270

Report to

MMM Group Limited

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PART 1: FACTUAL INFORMATION

1 INTRODUCTION

This report presents the factual findings obtained from a foundation investigation conducted at the site of a grade separation structure to carry the proposed Hurontario Street South Access Road under the existing Hurontario Street at the Highway 401-Hurontario Street interchange in Mississauga, Ontario. The proposed structure and associated RSS walls will be located on the south side of Highway 401.

The purpose of the investigation was to explore the subsurface conditions at the site and, based on the data obtained, provide a borehole location plan, borehole logs, stratigraphic profile and cross-sections and a written description of the subsurface conditions. A model of the subsurface conditions was developed to describe the geotechnical conditions influencing design and construction of the foundations and approach embankments for the structure, as well as for associated retaining walls.

Thurber carried out the investigation as a sub-consultant to MMM Group Limited (MMM) under the Ministry of Transportation Ontario (MTO) Agreement Number 2005-A-000347.

2 SITE DESCRIPTION

The site is located to the southeast of the Highway 401 underpass bridge at Hurontario Street in Mississauga, Ontario. Currently two ramps are located on the north side of the proposed road: Highway 10 N-Highway 401 E ramp and Highway 401 W – Highway 10 N/S ramp.

The lands at the northwest quadrant of Highway 401 and Hurontario Street are generally vacant, undeveloped and/or agricultural. Vegetation is moderate consisting mainly of tall grass and shrubs. To the east of Hurontario Street and south of Highway 401, lands have been developed for commercial and industrial uses. At the site, the ground surface elevation increases towards the east.

The general site area is located within the physiographic region known as the Peel Plain, characterized by a level to undulating cohesive glacial till plain underlain by reddish brown shale of the Queenston Formation with limestone layers.

3 SITE INVESTIGATION AND FIELD TESTING

The site investigation was carried out during the period of September 10 to 14 and October 10 to 22, 2007, and consisted of drilling and sampling a total of twenty-five boreholes. Boreholes for the proposed grade separation structure were numbered HAR-1 to HAR-18 and boreholes for the proposed RSS walls were numbered RW3-1, RW3-2 and RW4-1 to RW4-5. Boreholes were drilled at the structure abutments, approaches and retaining walls along the alignment of the proposed Hurontario Street South Access Road.

Nineteen boreholes were terminated upon auger refusal in shale bedrock at depths of 3.7 m to 10.7 m (elevations 182.7 m to 189.0 m). Six boreholes were further advanced into shale bedrock by coring to depths of 8.5 m to 13.7 m (elevations 183.3 m to 185.3 m), with a minimum 3.0 m of rock cores recovered in each borehole.

The approximate borehole locations are shown on the Borehole Locations and Soil Strata Drawing in Appendix F. The coordinates and elevations of the boreholes are given on these drawings and on the individual Record of Borehole Sheets in Appendix A.

Prior to commencement of drilling, utility clearances were obtained for all borehole locations.

Solid stem augers were used to advance the boreholes in the overburden and into the shale. Samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT). NQ rock coring equipment was used to recover core samples of the underlying bedrock in selected boreholes.

A member of Thurber's engineering staff supervised the drilling and sampling operations on a full time basis. The supervisor logged the boreholes, visually examined the recovered samples, and transported them to Thurber's laboratory for further examination and testing.

All rock cores were logged, and the Total Core Recovery (TCR), Rock Quality Designation (RQD) and the Fracture Indices (FI) were determined.

Groundwater conditions in the open boreholes were observed throughout the drilling operations. Eight standpipe piezometers consisting of 19 mm PVC pipes with screens were installed in selected boreholes to permit monitoring of groundwater levels. Details of the piezometer installations and other borehole completion details are as shown in Table 3.1.

Table 3.1 – Borehole Completion Details

Foundation Unit	Borehole	Piezometer Tip Depth/ Elevation (m)	Completion Details
North Abutment			
West	HAR-02	None installed	Bentonite grout to surface.
	HAR-03	6.1/187.6	Cuttings from 7.3 m to 6.1 m, sand from 6.1 m to 4.3 m, bentonite grout to surface.
Centre	HAR-04	None installed	Bentonite grout to surface.
	HAR-05	11.6/185.1	Sand from 11.6 m to 9.8 m, bentonite grout to surface.
East	HAR-06	None installed	Bentonite grout to 0.9 m, concrete to 0.3 m and cold patch to surface.
	HAR-07	None installed	Bentonite grout to 0.9 m, concrete to 0.15 m and cold patch to surface.
South Abutment			
West	HAR-10	None installed	Bentonite grout to surface.
	HAR-11	None installed	Bentonite grout to surface.
Centre	HAR-12	None installed	Bentonite grout to surface.
	HAR-13	None installed	Bentonite grout to surface.
East	HAR-14	None installed	Bentonite grout to 0.9 m, concrete to 0.15 m and cold patch to surface.
	HAR-15	None installed	Bentonite grout to 0.9 m, concrete to 0.15 m and cold patch to surface.
North Approach	HAR-17	8.2/188.8	Sand from 8.2 m to 6.4 m, bentonite grout to surface.
South Approach	HAR-18	None installed	Bentonite grout to surface.
Retaining Wall			
Northeast	HAR-08	10.7/185.8	Sand from 10.7 m to 8.8 m, bentonite grout to surface.
Northwest	HAR-01	None installed	Bentonite holeplug to surface.
	RW3-1	4.6/186.3	Sand from 4.6 m to 2.7 m, bentonite grout to surface.
	RW3-2	None installed	Bentonite grout to surface.
Southeast	HAR-16	7.6/188.5	Sand from 7.6 m to 5.8 m, bentonite grout to surface.
Southwest	HAR-09	4.3/187.9	Sand from 4.3 m to 2.4 m, bentonite grout to surface.
	RW4-1	4.6/182.6	Sand from 4.6 m to 2.7 m, bentonite grout to surface.
	RW4-2	None installed	Bentonite grout to surface.
	RW4-3	None installed	Bentonite grout to surface.
	RW4-4	None installed	Bentonite grout to surface.
	RW4-5	None installed	Bentonite grout to surface.

4 LABORATORY TESTING

All recovered soil samples were subjected to Visual Identification (VI) and rock samples to geological logging. At least 25% of the recovered samples of soil were also subjected to grain size distribution analyses (sieve and hydrometer) and Atterberg Limits testing where appropriate. Moisture content determinations were carried out on all soil samples. The results of this testing program are shown on the Record of Borehole sheets in Appendix A and on the figures contained in Appendices B and C.

Core samples of the shale bedrock were carefully protected to prevent drying during transport to the laboratory. Point load tests were carried out on selected samples of intact shale, siltstone and limestone interbeds upon arrival at the laboratory to assist in evaluation of the compressive strength of the bedrock. Results of point load tests on the selected rock core samples are shown in Table 1 immediately following the text.

5 DESCRIPTION OF SUBSURFACE CONDITIONS

Reference is made to the Records of Borehole sheets in Appendix A. Details of the encountered soil and rock stratigraphy are presented in this appendix and on the Borehole Locations and Soil Strata Drawing in Appendix F. 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 terms, the soil stratigraphy encountered at this site comprises surficial topsoil or pavement structure overlying fill underlain by native silty clay/clayey silt till and occasional layers of sand and silt till. Weathered shale bedrock was contacted below the till deposits. More detailed descriptions of the individual strata are presented below.

5.1 Proposed Overpass Structure

Boreholes drilled for the proposed structure were numbered HAR-1 to HAR-18.

5.1.1 Pavement Structure

Pavement structure consisting of approximately 110 to 125 mm of asphalt overlying granular (sand and gravel fill) road base was encountered in Boreholes HAR-06, HAR-07 and HAR-13 to HAR-15 drilled on Hurontario Street lanes. The thickness of granular fill measured in the boreholes ranged from 1.1 to 1.4 m and the pavement structure underside is at elevations 195.2 m to 196.0 m.

5.1.2 Topsoil

Topsoil was identified surficially at the locations of boreholes that were drilled outside of existing Hurontario Street lanes. The topsoil thickness generally ranged from 80 mm 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.

5.1.3 Fill

Fill was encountered below the topsoil and pavement structure in all the boreholes. The fill generally consists of intermixed layers of various soils:

- Brown, grey and reddish brown silty clay and clayey silt with trace to some sand trace of gravel,
- Brown sand and gravel with trace of silt and clay;
- Brown fine to medium sand with some gravel to gravelly, trace of silt and trace of clay;
- Brown silt with some sand, trace of clay and trace of gravel;
- Reddish brown highly weathered shale fill was contacted in Boreholes HAR-06, HAR-07, HAR-08, HAR-14 and HAR-15, drilled on the east side of the proposed north and south abutments. The shale fill was 0.7 m to 2.3 m thick.

Based on recorded SPT values ranging from 8 to 51 blows for 0.3 m of penetration, the silty clay/clayey silt fill is described as stiff to hard. SPT values of 65 and 80 blows per 0.3 m penetration and greater than 50 blows per 0.15 m penetration and were observed within the clay fill in Boreholes HAR-02, HAR-04 and HAR-18.

SPT values measured in the cohesionless fill were 10 to 79 blows per 0.3 m penetration indicating a compact to very dense density. SPT values greater than 50 blows per 0.15 m penetration and were observed within the sand fill in Boreholes HAR-12 and HAR-15.

The natural moisture content of the samples obtained from the fill layer ranged from 2% to 19%.

Grain size distribution curves for the cohesionless fill samples tested are presented on the Record of Borehole sheets and on Figures B1 to B3 in Appendix B. Grain size distribution results of the cohesive fill are presented on the Record of Borehole sheets and on Figure B4 in Appendix B. Atterberg Limit test results are presented on Figure B10 of Appendix B.

The results of gradation and Atterberg Limit Tests conducted on cohesive and cohesionless samples of fill are summarized below:

Soil	Cohesive Fill (%)	Cohesionless Fill (%)
Gravel	1 to 9	0 to 46
Sand	16 to 39	44 to 86
Silt and Clay	-	9 to 43
Silt	40 to 68	-
Clay	15 to 25	-

Liquid Limit	22 to 28
Plastic Limit	13 to 15

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

In general the fill extended to depths varying from 0.6 m to 6.1 m (elevations 189.2 m to 193.2 m). Thickness of fill ranged from 0.4 m to 6.0 m.

5.1.4 Silty Clay Till

Native reddish brown, brown to grey silty clay till with sand to some sand, trace gravel and occasional shale fragments was encountered below the fill in all the boreholes. Locally in Borehole HAR-09, a 400 mm thick layer of clayey silt till was contacted at 2.3 m depth.

Based on SPT values ranging from 17 blows for 0.3 m of penetration to greater than 50 and 100 blows per 0.15 m penetration, the silty clay till is described as being predominantly very stiff to hard. Occasional blow counts of 6 to 11 are also noted in the till.

The natural moisture contents of the samples recovered from the silty clay/clayey silt till layer ranged from 10 to 28%. Locally in Borehole HAR-06 moisture content was 3% at 7.6 m depth.

Grain size distribution curves for the sample tested are presented on the Record of Borehole sheets and on Figures B5 to B9 of Appendix B. Atterberg Limit test results are presented on Figures B11 to B13 of Appendix B.

The results of laboratory tests carried out on nineteen soil samples were as follows:

Soil Particles	(%)
Gravel	0 to 16
Sand	8 to 40
Silt	41 to 68
Clay	13 to 29

Liquid Limit	23 to 36
Plastic Limit	12 to 21

The above results show that the silty clay till is typically of low plasticity with a group symbol of CL. One tested sample is of medium plasticity with a group symbol of CI.

The depth to the base of the silty clay till layer ranged from 2.3 m to 9.9 m (Elevations 186.6 m to 190.0 m).

Although not encountered in the boreholes, glacial tills inherently contain cobbles and boulders and the lower part of the till may contain pieces and slabs of bedrock which may account for some high blow counts and resistance to augering.

5.1.5 Silt Till

Silt till with trace of gravel and sand, was contacted at 2.3 m depth in Boreholes HAR-01 and HAR-03, which were located on the northwest side of the proposed structure. The layer thickness ranged from 0.7 m to 1.1 m.

Based on SPT values ranging from 36 to 86 blows for 0.3 m of penetration, the silt till is described as being very dense to dense.

The natural moisture content of the samples obtained from the sand layer ranged from 10 to 19%.

5.1.6 Bedrock

The soils described above were found to be underlain by shale bedrock of the Queenston Formation. The shale encountered in the boreholes is described as thinly bedded and contains numerous hard interbedded siltstone and limestone layers. The shale bedrock is highly to moderately weathered within the upper 2 m below which the degree of weathering decreases with depth. SPT N-values obtained in the upper part of the shale bedrock ranged from 32 to greater than 100 blows per 0.125 m penetration. Moisture contents ranged from 6 to 10%. Depth and elevations of the top of weathered bedrock are shown in Table 5.1.

Table 5.1 – Depth and elevation of Top of Weathered Bedrock

Foundation Element	Borehole	Depth to Weathered Bedrock (m)	Top of Weathered Bedrock Elevation (m)
North Abutment			
West	HAR-02	5.2*	188.7*
	HAR-03	5.2	188.5
Centre	HAR-04	6.1*	189.8*
	HAR-05	6.7*	190.0*
East	HAR-06	8.1	189.1
	HAR-07	9.4*	187.6*
South Abutment			
West	HAR-10	4.9*	188.8*
	HAR-11	5.2	188.8
Centre	HAR-12	6.7	189.1
	HAR-13	7.6	189.1
East	HAR-14	7.9	188.9
	HAR-15	7.3*	189.3*
North Approach	HAR-17	8.2	188.8
South Approach	HAR-18	5.8	189.2
Retaining Wall			
Northeast	HAR-08	9.9	186.6
Northwest	HAR-01	3.0	189.1
Southeast	HAR-16	6.7	189.4
Southwest	HAR-09	2.7	189.4

* Proved by coring below augered depth.

Bedrock cores were collected using NQ sized coring equipment. Total core recovery (TCR) in the bedrock was 100% in all core runs.

RQD values recorded for six of the core runs ranged from 20% to 65% in the upper zones of the shale (elevations 188.3 m to 184.8 m) of initial core runs, indicate poor to fair rock quality. Higher RQD values were obtained in subsequent core runs, generally 50% to 100%, indicating a fair to excellent rock quality. Fracture Index (FI) of the rock, expressed as fractures per 0.3 m of core, ranged from 0 to 10.

Results of the point load tests conducted on the rock core samples are presented in Table 1 immediately following the text. Average values are also shown on the Record of Borehole

sheets. The typical ranges of inferred UCS for various types of rock cores are summarized in Table 5.2.

Table 5.2 – Inferred Unconfined Compressive Strength

Rock Type	Unconfined Compressive Strength (UCS) (MPa)
Shale	3 to 36
Shale/siltstone	12 to 72
Siltstone	40 to 105
Limestone	80 to 130

It must be noted however that point load tests were possible only on less weathered shale or higher strength limestone interbed samples as the more typical weathered shale cores tended to be not suitable for point load testing. Broken zones were observed within the cores at several depths.

The shale bedrock typically contains layers of siltstone and limestone that can be significantly harder than the shale itself. The distribution, thickness and strength of these layers vary from location to location, and these layers typically exhibit less pronounced weathering than the shale. The record of boreholes indicate that within the depths investigated, these hard interbeds range from 20 to 200 mm in thickness. Sampling and interpretation from small diameter boreholes may underestimate the frequency, thickness and strength of the strong layers and therefore geological expertise and past experience must be applied in any decision making process regarding the bedrock.

5.1.7 Water Levels

Water levels were observed in the boreholes during and upon completion of drilling. Standpipe piezometers were installed in six boreholes to monitor water levels after completion of drilling. The water levels measured in the piezometers are summarized in Table 5.3, along with the measurements in the boreholes upon completion of drilling.

Table 5.3 – Measured Groundwater Levels

Foundation Element	Borehole	Date (2007)	Water Level (m)		Comment
			Depth (m)	Elevation (m)	
North Abutment					
West	HAR-02	October 16	4.2	189.6	In open borehole
	HAR-03	October 18 November 15	4.2 4.2	189.5 189.5	In piezometer
Centre	HAR-04	October 15	1.8	194.1	In open borehole
	HAR-05	November 10 November 15	5.8 5.7	190.9 191.0	In piezometer
East	HAR-06	November 18	Dry	-	-
	HAR-07	October 19	Dry	-	-
South Abutment					
West	HAR-10	October 16	7.5	186.2	In open borehole
	HAR-11	October 10	Dry	-	-
Centre	HAR-12	October 10	Dry	-	-
	HAR-13	October 22	Dry	-	-
East	HAR-14	October 18	Dry	-	-
	HAR-15	October 17	4.8	191.8	In open borehole
North Approach	HAR-17	October 18	4.3	192.8	In piezometer
		November 1	4.5	192.6	
		November 15	4.4	192.7	
South Approach	HAR-18	October 9	Dry	-	-
Retaining Wall					
Northeast	HAR-08	September 19	5.9	190.6	In piezometer
		September 28	6.1	190.4	
		October 5	6.1	190.4	
		October 18	6.2	190.3	
		November 1	5.9	190.6	
		November 15	6.1	190.4	
Northwest	HAR-01	October 10	Dry	-	-
Southeast	HAR-16	September 19	4.8	191.3	In piezometer
		September 28	4.5	191.6	
		October 5	4.6	191.5	
		October 18	4.2	191.9	
		November 1	4.5	191.6	
		November 15	4.7	191.4	
Southwest	HAR-09	October 18	1.9	190.3	In piezometer
		November 15	1.9	190.3	

The groundwater levels measured in the piezometers range from elevations 189.5 m to 192.8 m.

The above values are short-term readings 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. Further, perched water may be encountered at higher levels in pockets or zones of more permeable sands and silts within the heterogeneous tills, or within the fill.

5.2 Proposed Retaining Walls 3 and 4

Boreholes for the proposed Retaining Walls 3 and 4, located on the west side of the proposed overpass structure, were numbered RW3-1, RW3-2 and RW4-1 to RW4-5.

5.2.1 Topsoil

Topsoil was identified at ground surface in all the boreholes drilled along the proposed retaining walls. The topsoil thickness generally ranged from 50 mm to 100 mm. The topsoil thickness may vary between and beyond the borehole locations and the data is not intended for the purpose of estimating quantities.

5.2.2 Fill

Fill was encountered below topsoil in Boreholes RW3-1, RW3-2, RW4-1 and RW4-5 drilled along the proposed Retaining Walls 3 and 4. The fill generally consists of brown to grey silty clay with some sand to sandy, trace gravel, occasional shale and asphalt fragments and rootlets. Thickness of the cohesive fill layer varies from 1.4 m to 3.9 m.

A 0.7-m thick layer of shale fill was noted at the surface in Borehole RW4-5.

Based on SPT values ranging from 15 blows for 0.3 m of penetration to greater than 50 blows per 0.10 m penetration, the silty clay fill is described as being very stiff to hard.

The natural moisture contents of the samples recovered from the silty clay till layer ranged from 7 to 21%.

Grain size distribution curves for the fill samples tested are presented on the Record of Borehole sheets and on Figure C1 of Appendix C. Atterberg Limit tests results are presented on Figure C3 of Appendix C.

The results of laboratory tests carried out on three soil samples were as follows:

Soil Particles	(%)
Gravel	0 to 3
Sand	16 to 31
Silt	45 to 54
Clay	22 to 30

Liquid Limit	27 to 38
Plastic Limit	15 to 19

The results of Atterberg limit testing indicate that the silty clay fill is low to medium plastic with group symbol of CL and CI.

The depth to the base of the silty clay fill layer ranged from 1.5 m to 4.0 m (Elevations 185.7 m to 190.1 m).

5.2.3 Silty Clay Till

Native brown, mottled brown and grey silt clay till with sand to some sand, trace gravel and occasional shale fragments and rootlets was encountered below the fill in Borehole RW4-1 and below the topsoil in Boreholes RW4-2 to RW4-4.

Based on SPT values ranging from 10 blows for 0.3 m of penetration to greater than 50 blows per 0.15 m penetration, the silty clay till is described as being stiff to hard.

The natural moisture contents of the samples recovered from the silty clay till layer ranged from 9 to 19%.

Grain size distribution curves for the sample tested are presented on the Record of Borehole sheets and on Figure C2 of Appendix C. The results of Atterberg limit testing are shown on Figure C4 of Appendix C.

The results of laboratory tests carried out on three samples were as follows:

Soil Particles	(%)
Gravel	0 to 6
Sand	22 to 28
Silt	47 to 49
Clay	23 to 26

Liquid Limit	31
Plastic Limit	16

The results of Atterberg limit testing indicate that the silty clay till is low plastic with group symbol of CL.

The depth to the base of the silty clay till layer ranged from 0.6 m to 2.1 m (Elevations 185.1 m to 188.7 m).

Although not encountered in the boreholes, glacial tills inherently contain cobbles and boulders which may account for some high N-values.

5.2.4 Bedrock

The soils described above were found to be underlain by shale bedrock of the Queenston Formation. The shale encountered in the boreholes is described as thinly bedded and contains numerous hard interbedded siltstone and limestone layers. The shale bedrock is highly to moderately weathered within the upper 2 m below which the degree of weathering decreases with depth. SPT N-values obtained in the upper part of the shale bedrock ranged from 42 to greater than 100 blows per 0.1 m penetration. Moisture contents ranged from 5 to 15%.

Depth and elevations of the top of weathered bedrock are shown in Table 5.4.

Table 5.4 – Depth and elevation of Top of Weathered Bedrock

Foundation Element	Borehole	Depth to Weathered Bedrock (m)	Top of Weathered Bedrock Elevation (m)
Retaining Wall			
Northwest	RW3-1	1.5	189.4
	RW3-2	3.1	190.1
Southwest	RW4-1	2.1	185.1
	RW4-2	0.8	186.1
	RW4-3	0.6	187.2
	RW4-4	1.2	188.7
	RW4-5	4.0	188.2

The shale bedrock typically contains layers of siltstone and limestone that can be significantly harder than the shale itself. The distribution, thickness and strength of these layers vary from location to location, and these layers typically exhibit less pronounced weathering than the shale.

5.2.5 Water Levels

Water levels were observed in the boreholes during and upon completion of drilling. Standpipe piezometers were installed in two boreholes to monitor water levels after completion of drilling. The water levels measured in the piezometers are summarized in Table 5.5, along with the measurements in the boreholes upon completion of drilling.

Table 5.5 – Measured Groundwater Levels

Foundation Element	Borehole	Date (2007)	Water Level (m)		Comment
			Depth (m)	Elevation (m)	
Retaining Wall					
Northwest	RW3-1	October 18 October 15	Dry 2.7	- 188.2	In piezometer
	RW3-2	October 11	Dry	-	In open borehole
Southwest	RW4-1	October 18 October 15	Dry 2.7	- 184.5	In piezometer
	RW4-2	October 11	Dry	-	In open borehole
	RW4-3	October 11	Dry	-	In open borehole
	RW4-4	October 11	Dry	-	In open borehole
	RW4-5	October 11	Dry	-	In open borehole

The groundwater levels measured in the piezometers ranged from elevations 184.5 to 188.2 m

The above values are short-term readings 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. Further, perched water may be encountered at higher levels in pockets or zones of more permeable sands and silts within the heterogeneous tills, or within the fill.

6 MISCELLANEOUS

Borehole locations and ground surface elevations were supplied to Thurber by MMM Group Limited. The drilling and sampling equipment was supplied and operated by DBW Drilling of Ajax, Ontario. The field work was supervised on a full time basis by Mr. George Azzopardi of Thurber Engineering Ltd.

Laboratory testing was carried out at Thurber's Laboratory in Oakville, Ontario.

Supervision of the field program, interpretation of the field data and preparation of the investigation report was conducted by Dr. Sydney Pang, P. Eng. and Ms. R. Palomeque Reyna, P.Eng.

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

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Review Principal



TABLE 1 -Point Load and Unconfined Compression Test Results
Huronario Street South Access Road

HAR-02	DEPTH			Is (MPa)	Is50 (MPa)	Inferred UCS (MPa)	Rock Type	Inferred UC Test Average			
	FT.	IN.	(m)								
RUN #1	18	6	5.64	2.321	1.969	47.26	siltstone	RUN #1:			
	20	11	6.38	0.000	0.000	3.00	shale		AVERAGE	MAX	MIN
	23	5	7.14	0.428	0.463	11.12	shale, siltstone	Shale	3.00	3.00	3.00
	22	9	6.93	0.000	0.000	3.00	shale	Siltstone	47.26	47.26	47.26
								Shale/Siltstone	11.12	11.12	11.12
								Limestone			
RUN #2	23	9	7.24	0.674	0.750	18.01	shale, siltstone	RUN #2:			
	24	11	7.59	0.000	0.000	3.00	shale, siltstone	Shale	3.00	3.00	3.00
	25	11	7.90	0.557	0.528	12.68	shale, siltstone	Siltstone	43.45	43.45	43.45
	26	4.5	8.04	0.000	0.000	3.00	shale	Shale/Siltstone	11.23	18.01	3.00
	27	9	8.46	1.509	1.810	43.45	siltstone	Limestone	92.95	92.95	92.95
	24	9	7.54	5.000	3.873	92.95	limestone				
								SUMMARY	AVERAGE	MAX	MIN
								Shale	3.00	3.00	3.00
								Siltstone	45.36	47.26	43.45
								Shale/Siltstone	11.20	18.01	3.00
								Limestone	92.95	92.95	92.95

HAR-04	DEPTH			Is (MPa)	Is50 (MPa)	Inferred UCS (MPa)	Rock Type	Inferred UC Test Average			
	FT.	IN.	(m)								
RUN #1	20	6	6.25	0.000	0.000	3.00	shale	RUN #1:			
									AVERAGE	MAX	MIN
								Shale	3.00	3.00	3.00
								Siltstone			
								Shale/Siltstone			
								Limestone			
RUN #2	30	5	9.27	1.039	0.906	21.73	limestone	RUN #2:			
	30	9	9.37	1.451	1.487	35.69	shale	Shale	35.69	35.69	35.69
	30	11	9.42	7.798	6.041	144.97	shale, siltstone	Siltstone			
	32	2	9.80	0.380	0.356	8.55	shale, siltstone	Shale/Siltstone	76.76	144.97	8.55
	33	6	10.21	0.288	0.310	7.45	limestone	Limestone	12.96	21.73	7.45
	34	8	10.57	0.326	0.404	9.70	limestone				
								SUMMARY	AVERAGE	MAX	MIN
								Shale	19.35	35.69	3.00
								Siltstone			
								Shale/Siltstone	76.76	144.97	8.55
								Limestone	12.96	21.73	7.45

TABLE 1 -Point Load and Unconfined Compression Test Results
 Hurontario Street South Access Road

HAR-05	DEPTH			Is (MPa)	Is50 (MPa)	Inferred UCS (MPa)	Rock Type	Inferred UC Test Average			
	FT.	IN.	(m)								
RUN #1	1	32	10.00	0.501	0.501	12.03	shale, siltstone	RUN #1:			
									AVERAGE	MAX	MIN
								Shale			
								Siltstone			
								Shale/Siltstone	12.03	12.03	0.00
RUN #2								Limestone			
	33	9	10.29	0.844	0.840	20.15	shale	RUN #2:			
	34	10	10.62	7.200	5.091	122.19	limestone	Shale	20.15	20.15	20.15
	34	11	10.64	4.085	3.875	93.00	limestone	Siltstone			
	35	11	10.95	0.000	0.000	3.00	shale, siltstone	Shale/Siltstone	6.88	10.76	3.00
	37	7	11.46	0.401	0.448	10.76	shale, siltstone	Limestone	107.60	122.19	93.00
								SUMMARY	AVERAGE	MAX	MIN
								Shale	20.15	20.15	20.15
								Siltstone			
								Shale/Siltstone	8.60	12.03	3.00
								Limestone	107.60	122.19	93.00

HAR-07	DEPTH			Is (MPa)	Is50 (MPa)	Inferred UCS (MPa)	Rock Type	Inferred UC Test Average			
	FT.	IN.	(m)								
RUN #1	36	1	11.00	0.800	0.566	13.58	limestone	RUN #1:			
	37	5	11.40	0.000	0.000	3.00	shale, siltstone		AVERAGE	MAX	MIN
	38	4	11.68	0.000	0.000	3.00	shale, siltstone	Shale			
	39	4	11.99	0.000	0.000	3.00	shale, siltstone	Siltstone	62.40	62.40	62.40
	38	2	11.63	2.600	2.600	62.40	siltstone	Shale/Siltstone	3.00	3.00	3.00
RUN #2								Limestone	13.58	13.58	13.58
	40	0	12.19	0.000	0.000	3.00	siltstone	RUN #2:			
	41	4	12.60	1.176	1.182	28.37	siltstone	Shale			
	41	10	12.75	1.319	1.626	39.04	siltstone	Siltstone	23.47	39.04	3.00
	42	7	12.98	0.000	0.000	3.00	shale, siltstone	Shale/Siltstone	3.13	3.38	3.00
	43	3	13.18	0.000	0.000	3.00	shale, siltstone	Limestone			
	44	8	13.61	0.119	0.141	3.38	shale, siltstone				
								SUMMARY	AVERAGE	MAX	MIN
								Shale			
								Siltstone	33.20	62.40	3.00
								Shale/Siltstone	3.06	3.38	3.00
								Limestone	13.58	13.58	13.58

TABLE 1 -Point Load and Unconfined Compression Test Results
Huronario Street South Access Road

HAR-10	DEPTH			Is (MPa)	Is50 (MPa)	Inferred UCS (MPa)	Rock Type	Inferred UC Test Average			
	FT.	IN.	(m)								
RUN #1	22	6	6.86	1.044	0.934	22.42	siltstone	RUN #1:			
									AVERAGE	MAX	MIN
								Shale			
								Siltstone	22.42	22.42	22.42
								Shale/Siltstone			
RUN #2								Limestone			
	24	7	7.49	5.212	5.442	130.61	limestone	RUN #2:			
	26	3	8.00	0.557	0.528	12.68	shale, siltstone	Shale	3.00	3.00	3.00
	26	5	8.05	0.000	0.000	3.00	shale	Siltstone			
	27	4	8.33	0.000	0.000	3.00	shale	Shale/Siltstone	12.68	12.68	12.68
								Limestone	130.61	130.61	130.61
								SUMMARY	AVERAGE	MAX	MIN
								Shale	3.00	3.00	3.00
								Siltstone	22.42	22.42	22.42
								Shale/Siltstone	12.68	12.68	12.68
								Limestone	130.61	130.61	130.61

HAR-15	DEPTH			Is (MPa)	Is50 (MPa)	Inferred UCS (MPa)	Rock Type	Inferred UC Test Average			
	FT.	IN.	(m)								
RUN #1	30		9.14	0.418	0.458	10.98	shale, siltstone	RUN #1:			
	30	11	9.42	0.000	0.000	3.00	shale		AVERAGE	MAX	MIN
	31	8	9.65	1.129	0.971	23.31	shale, siltstone	Shale	3.00	3.00	3.00
	32	10.5	10.02	2.961	2.632	63.17	siltstone	Siltstone	63.17	63.17	63.17
								Shale/Siltstone	17.15	23.31	23.31
RUN #2								Limestone			
	33	6	10.21	0.000	0.000	3.00	shale, siltstone	RUN #2:			
	34	4	10.46	4.082	3.415	81.96	limestone/shale	Shale			
	35	15	11.05	4.832	4.402	105.65	siltstone	Siltstone	105.65	105.65	105.65
	36	5	11.10	0.339	0.412	9.89	shale, siltstone	Shale/Siltstone	28.36	72.19	3.00
	37	6	11.43	3.008	3.008	72.19	shale, siltstone	Limestone	86.11	86.11	86.11
	37	8	11.48	3.501	3.588	86.11	limestone				
								SUMMARY	AVERAGE	MAX	MIN
								Shale	3.00	3.00	3.00
								Siltstone	84.41	105.65	63.17
								Shale/Siltstone	23.87	72.19	3.00
								Limestone	86.11	86.11	86.11

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

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

 Water Level
 Shear Strength Determination by Pocket Penetrometer

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

UNIFIED SOILS CLASSIFICATION

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

RECORD OF BOREHOLE No HAR-01

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 632 071.981 E 290 010.469 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
 DATUM Geodetic DATE 2007-11-10 - 2007-11-10 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)							
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa												
192.1								20	40	60	80	100								
0.0	TOPSOIL: (80mm)																			
0.1	Silty CLAY, trace to some sand, trace gravel, occasional rootlets Very Stiff Brown to Mottled Brown-Grey (FILL)		1	SS	24		192													
191.3																				
0.8	Silty CLAY, some sand, trace gravel Hard Mottled Brown-Grey (TILL)		2	SS	69		191													
			3	SS	50/ .150														1 17 53 29	
189.8							190													
2.3	SILT, some sand to sandy, trace gravel, trace clay Very Dense Brown (TILL)		4	SS	86															
189.1							189													
3.0	Highly weathered, thinly bedded, reddish brown SHALE		5	SS	50/ .150															
							188													
			6	SS	100/ .150														0 8 68 24	
							187													
186.3																				
5.8	END OF BOREHOLE AT 5.79m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.																			

+ ³ . X ³ : Numbers refer to Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HAR-02

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road. N 4 832 082.073 E 290 015.967 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
 DATUM Geodetic DATE 2007-10-16 - 2007-10-16 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
193.8								20 40 60 80 100							
0.0 0.1	TOPSOIL: (80mm)		1	SS	65/ 300										
193.1	Silty CLAY, trace sand, trace gravel, occasional rootlets Hard (FILL)		2	SS	79		193								39 47 14 (SI+CL)
0.8	SAND and GRAVEL, trace silt, trace clay Compact to Very Dense Brown Moist (FILL)		3	SS	18		192								
			4	SS	38										
190.8							191								
3.0	Silty CLAY, some sand, occasional rootlets Very Stiff to Hard Dark Grey to Brown (TILL)		5	SS	20		190								0 18 58 24
			6	SS	100		189								
188.7	Highly to moderately weathered, thinly bedded, reddish brown SHALE with occasional green siltstone and limestone interbeds Coring started at 5.6m		1	RUN			188								RUN 1# TCR=100%, SCR=45%, RQD=20%, UCS=10MPa (Shale/Siltstone) UCS = 47 MPa (Siltstone)
5.2	Green siltstone interbeds at 5.66 to 5.72, 5.87, 6.22, 6.45 to 6.65, 6.73 to 6.78 and 6.88 to 6.93m Limestone interbeds at 6.20 and 6.65m Highly broken zones at 5.99 to 6.10, 6.45 to 6.65 and 6.73 to 6.78m Horizontal joints at 5.69 to 5.72, 5.84, 5.87, 5.97, 6.05, 6.07, 6.12, 6.17, 6.22, 6.35, 6.45, 6.65, 6.68, 6.71, 6.73 and 6.91m Weak to strong Siltstone interbeds at 7.16, 7.29, 7.54, 7.62, 7.70, 7.85, 7.87, 8.00, 8.13, 8.23, 8.26, 8.31 and 8.46 to 8.53m Limestone interbeds at 7.11, 7.24, 7.34, 7.54 and 7.90m		2	RUN			187								RUN 2# TCR=100%, SCR=100%, RQD=100%, UCS=10MPa (Shale/Siltstone) UCS = 43 MPa (Siltstone) UCS = 92 MPa (Limestone)
185.3	END OF BOREHOLE AT 8.53m. BOREHOLE OPEN AND WATER LEVEL AT 4.27m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE GROUT TO SURFACE.						186								
8.5															

ONTMT4S 2311.GPJ 2/5/08

+ 3 x 3 : Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HAR-03

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 832 080.604 E 290 021.551 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
 DATUM Geodetic DATE 2007-10-10 - 2007-10-10 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)
								20	40	60			
193.7													
0.0	TOPSOIL: (80mm)												
0.1	SAND, trace silt, trace gravel, occasional rootlets, occasional asphalt at 0.61m		1	SS	42								
192.9	Dense Brown (FILL)		2	SS	30								
0.8	SILT, trace to some sand, trace gravel		3	SS	19								
192.2	Compact Brown (FILL)		4	SS	36								
1.5	SAND, fine to medium grained, some silt, trace clay, trace gravel		5	SS	17								
191.4	Compact Brown (FILL)		6	SS	74								
2.3	SILT, trace sand, trace gravel Compact to Dense Brown (TILL)		7	SS	100/ .150								
190.3	Silty CLAY, some sand, occasional rootlets Very Stiff to Hard Dark Grey to Mottled Brown-Grey (TILL)												
3.4	Highly weathered, thinly bedded, reddish brown SHALE												
188.5													
5.2													
186.4	END OF BOREHOLE AT 7.32m UPON AUGER REFUSAL. BOREHOLE DRY AND OPEN TO 6.10m UPON COMPLETION. Piezometer installation consists of 19mm diameter schedule PVC pipe. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Oct 18/07 4.2 189.5 Nov 15/07 4.2 189.5												
7.3													

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

METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40					
195.9														
								SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100						
								WATER CONTENT (%) 20 40 60						

CONTMT4S 2311.GPJ 2/5/08


+³, X³. Numbers refer to Sensitivity

RECORD OF BOREHOLE No HAR-04

2 OF 2

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 832 092.354 E 290 026.159 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
 DATUM Geodetic DATE 2007-10-15 - 2007-10-15 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
	Continued From Previous Page							20	40	60	80	100					
	9.40 to 9.47, 9.80, 9.98, 10.06 to 10.13, 10.16, 10.19 and 10.21																GR SA SI CL
185.2																	(Shale/Siltstone) UCS = 83 MPa (Siltstone) UCS = 36 MPa (Limestone)
10.6	END OF BOREHOLE AT 10.64m. BOREHOLE OPEN TO 10.64m AND WATER LEVEL AT 1.83m. BOREHOLE BACKFILLED WITH BENTONITE GROUT TO SURFACE.						185										

RECORD OF BOREHOLE No HAR-05

1 OF 2

METRIC

G.W.P. 2107-05-00 LOCATION Huronario St. South Access Road N 4 832 098.165 E 290 038.959 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
 DATUM Geodetic DATE 2007-10-16 - 2007-10-16 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
196.7	TOPSOIL: (80mm)													
0.0 0.1	SAND, some silt, trace clay, trace gravel, occasional rootlets Dense Brown Moist (FILL)		1	SS	35		196							
			2	SS	35									
195.2														
1.5	SILT, clayey, some sand Very stiff to hard Brown Moist (FILL)		3	SS	46		195							
			4	SS	19									
193.6							194							1 16 68 15
3.0	SAND, fine to medium grained Compact Brown Moist (FILL)		5	SS	18		193							
192.1							192							
4.6	Silty CLAY, some sand, trace gravel, occasional rootlets Stiff Dark Grey to Reddish Brown (FILL)		6	SS	14									
191.5														
5.2	Silty CLAY, some sand, trace gravel Hard Mottled Brown-Grey (TILL)						191							
	cobbles		7	SS	50/ .150									4 25 50 21
190.0							190							
6.7	Highly to moderately weathered, thinly bedded, reddish brown SHALE with occasional green siltstone interbeds, occasional limestone interbeds and clay seams		8	SS	100/ .150		189							
	Coring started at 8.5m						188							
	Siltstone interbeds at 8.94, 9.12, 9.25, 9.32, 9.65, 9.80 and 10.01m Limestone interbeds at 9.37, 9.60 to 9.63 and 9.75m Clay seam at 9.96m Highly broken zones at 9.60 to 9.65		1	RUN			187							

Continued Next Page

+ ³ × ³ : Numbers refer to Sensitivity


20
15 10 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HAR-05

2 OF 2

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 832 098.165 E 290 038.959 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
 DATUM Geodetic DATE 2007-10-16 - 2007-10-16 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
	Continued From Previous Page							20	40	60	80	100					
	and 9.80 to 9.86m Horizontal joints at 8.56, 8.94, 8.97, 9.02, 9.60, 9.63, 9.70, 9.75, 9.78, 9.83, 9.86 and 9.91m Slightly weathered to fresh, thinly bedded, weak, reddish brown SHALE occasional silt stone and limestone interbeds Siltstone interbeds at 10.06, 10.11, 10.36, 10.74 to 10.77, 11.07 to 11.13 and 11.56 to 11.58m		2	RUN													RUN 2# TCR=100%, SCR=100%, RQD=100%, UCS=20MPa (Shale) UCS = 8 MPa (Shale/Siltstone) UCS = 107 MPa (Limestone)
185.1	Limestone interbeds at 10.46, 10.62, 10.72 and 11.13m																
11.6	END OF BOREHOLE AT 11.58m. BOREHOLE OPEN AND WATER LEVEL AT 2.74m UPON COMPLETION. Piezometer installation consists of 19mm diameter schedule PVC pipe. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Nov 01/07 5.8 190.9 Nov 15/07 5.7 191.0																

RECORD OF BOREHOLE No HAR-06

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 832 110.692 E 290 044.337 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
 DATUM Geodetic DATE 2007-10-18 - 2007-10-18 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
197.2														
0.0	ASPHALT: (125mm)													
0.1	SAND and GRAVEL, trace clay Dense to Compact Brown Moist (FILL)		1	SS	43		197							
195.9			2	SS	27		196							45 45 9 (SI+CL)
1.2	SHALE, highly weathered, very stiff, reddish brown (FILL)		3	SS	20		195							
			4	SS	17		194							
194.1			5	SS	12		193							
3.0	Silty CLAY, some sand, trace gravel Stiff Mottled Reddish Brown to Brown (FILL)		6	SS	35		192							4 21 47 28
192.6			7	SS	44		191							
4.6	Silty CLAY, some sand, trace gravel Hard Brown to Mottled Brown-Grey (TILL)		8	SS	35		190							
189.1							189							
188.4	Highly weathered, thinly bedded, reddish brown SHALE													
8.2	END OF BOREHOLE AT 8.23m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE TO 0.9m, CONCRETE TO 0.3m AND COLD PATCH TO SURFACE.													

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

RECORD OF BOREHOLE No HAR-07

1 OF 2

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 832 107.251 E 290 047.966 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
 DATUM Geodetic DATE 2007-10-19 - 2007-10-19 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	
197.0												
0.0	ASPHALT: (110mm)						197					
0.1	SAND and GRAVEL Dense Brown (FILL)		1	SS	41							
196.0							196					
1.1	Silty CLAY, trace to some sand, trace gravel Very Stiff to Stiff Reddish Brown (FILL) Layer of highly weathered, reddish brown SHALE (1.5m thick)		2	SS	16							
			3	SS	27		195					
			4	SS	11							
	sand, occasional shale fragment		5	SS	12		194					
							193					
192.5												
4.6	Silty CLAY, some sand Hard Brown (TILL) Occasional silt seam Occasional iron oxidized staining Brown to Mottled Brown-Grey		6	SS	46		192					
			7	SS	61		191					
			8	SS	96/ 225		190					
							189					
	Possible sand seam at 9.1m		9	SS	100/ 100		188					
187.6												
9.4	Moderately weathered to fresh, thinly bedded, weak to strong, reddish brown SHALE with occasional green siltstone interbeds and grey limestone											

Continued Next Page

+³ ×³ Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HAR-07

2 OF 2

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 832 107.251 E 290 047.966 ORIGINATED BY GA
HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
DATUM Geodetic DATE 2007-10-19 - 2007-10-19 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
	Continued From Previous Page														
	Highly weathered, thinly bedded, very weak, reddish brown SHALE														
	Coring started at 10.7m														
	Siltstone interbeds at 10.67, 11.00 to 11.05, 11.13, 11.18, 11.23, 11.25, 11.30, 11.38, 11.53 to 11.58, 11.68, 12.02 and 12.19m		1	RUN											
	Limestone interbeds at 11.15, 11.30 and 11.63 to 11.68m														
	Highly broken zones at 10.67 to 10.97m														
	Horizontal joints at 11.00, 11.07, 11.13, 11.20 and 11.25m														
	Siltstone interbeds at 12.19 to 12.29, 12.40, 12.42, 12.55 to 12.65, 12.73 to 12.83, 12.83 to 12.88, 13.01 to 13.11, 13.18, 13.36 and 13.39m		2	RUN											
	Limestone interbeds at 12.50 and 12.88m														
183.3															
13.7	END OF BOREHOLE AT 13.72m. BOREHOLE OPEN UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE TO 0.9m, CONCRETE TO 0.15m AND COLD PATCH TO SURFACE.														

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

RECORD OF BOREHOLE No HAR-08

1 OF 2

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 832 118.929 E 290 057.007 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007-09-14 - 2007-09-14 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE									
196.5							20	40	60	80	100	20	40	60	kN/m ³	GR SA SI CL		
0.0	TOPSOIL: (100mm)																	
0.1	Fine grained SAND, occasional silt, occasional gravel		1	SS	16													
195.9	Compact Brown Moist (FILL)		2	SS	15													
0.7	Silty CLAY, trace sand, occasional rootlets Very Stiff to Stiff Dark Grey (FILL) Layer of highly weathered, reddish brown SHALE (700mm)		3	SS	16													
	sand, occasional shale fragments Reddish Brown to Brown		4	SS	8											1 21 55 23		
	Occasional iron oxidized stains		5	SS	8											2 39 40 19		
192.0																		
4.6	Silty CLAY, with sand, trace gravel Stiff to Hard Brown (TILL)		6	SS	11											2 40 45 13		
			7	SS	24											2 30 46 22		
	Brown to Reddish Brown		8	SS	57											16 26 43 15		
			9	SS	80													
186.5																		

Continued Next Page

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

RECORD OF BOREHOLE No HAR-08

2 OF 2

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 832 118.929 E 290 057.007 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007-09-14 - 2007-09-14 CHECKED BY RPR

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
							20	40	60	80	100	W _P	W	W _L	kN/m ³	GR SA SI CL
9.9	Continued From Previous Page Highly weathered, thinly bedded, reddish brown SHALE															
185.9																
10.7	END OF BOREHOLE AT 10.7m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY TO 10.7m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Sep 19/07 5.9 190.6 Sep 28/07 6.1 190.4 Oct 05/07 6.1 190.4 Oct 18/07 6.2 190.3 Nov 01/07 5.9 190.6 Nov 15/07 6.1 190.4															

RECORD OF BOREHOLE No HAR-09

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 832 067.557 E 290 023.701 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
 DATUM Geodetic DATE 2007-10-11 - 2007-10-11 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	x LAB VANE							
192.2							20	40	60	80	100							
0.0	TOPSOIL: (150mm)																	
0.2	Silty CLAY, trace to some sand, trace gravel, occasional shale fragments, occasional rootlets		1	SS	20													
191.6	Very Stiff Reddish Brown (FILL)		2	SS	57													
0.6	Silty CLAY, trace to some sand, trace gravel																	
	Hard Mottled Brown-Grey (TILL)		3	SS	50/ .150													
189.9																		
2.3	Clayey SILT, with sand		4	SS	50/ .150													
189.4	Hard Brown (TILL)																	
2.7	Highly weathered, thinly bedded, reddish brown SHALE		5	SS	100/ .150													

RECORD OF BOREHOLE No HAR-10

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 832 077.987 E 290 031.489 ORIGINATED BY GA
HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
DATUM Geodetic DATE 2007-10-15 - 2007-10-16 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
193.7							20	40	60	80	100			
0.0	TOPSOIL: (80mm)		1	SS	66									
0.1	SAND, gravelly, some silt, some clay Compact to Very Dense Brown (FILL)		2	SS	42								28 44 28 (SI+CL)	
			3	SS	10									
191.4	Silty CLAY, trace to some sand, trace gravel Very Stiff to Hard Mottled Brown-Grey to Reddish Brown (FILL)		4	SS	29								7 17 58 18	
2.3			5	SS	25									
189.6	Silty CLAY, trace to some sand, trace gravel Hard Brown (TILL)		6	SS	50/ .100									
4.1	Highly to moderately weathered, thinly bedded, reddish brown SHALE with occasional green siltstone interbeds		1	RUN									RUN 1# TCR=100%, SCR=56%, RQD=35%, UCS=22MPa (Siltstone)	
188.8	Coring started at 5.5m		2	RUN									RUN 2# TCR=100%, SCR=73%, RQD=50%, UCS=3MPa (Shale) UCS = 12 MPa (Shale/Siltstone) UCS the 130 MPa (Limestone)	
4.9	Siltstone interbeds at 5.49 to 5.54, 5.66, 5.94, 6.86 to 6.88 and 6.93m Highly broken zones at 5.49 to 5.56, 5.69 to 5.72, 5.82 to 6.00 and 6.58 to 6.65m Horizontal joints at 5.56, 5.64, 5.69, 5.72, 5.79, 5.92, 5.94, 5.97, 6.10, 6.43, 6.50, 6.55 and 6.76m													
185.2	Siltstone interbeds at 7.09, 7.21, 7.34 to 7.42, 7.49 to 7.57, 7.62 to 7.64, 7.72 to 7.77, 7.85 to 7.87, 8.03 to 8.08 and 8.41 to 8.46m Clay seams at 8.15 to 8.21m Highly broken zones at 7.37, 7.49 and 7.67 to 7.75m Horizontal joints at 7.21, 7.26, 7.34, 7.52, 7.57, 7.62, 7.67, 7.75, 7.80, 7.85, 8.18 and 8.25m													
8.5	END OF BOREHOLE AT 8.46m. BOREHOLE OPEN AND WATER LEVEL AT 7.54m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE GROUT TO SURFACE.													

+ 3 . X 3 : Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HAR-11

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 832 076.517 E 290 037.072 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
 DATUM Geodetic DATE 2007-10-10 - 2007-10-10 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA S1 CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)
194.0								20	40	60	80	100					
0.0	TOPSOIL: (100mm)						194										
0.1	SAND, otrace silt, trace to some gravel		1	SS	37												
193.4	Dense																
0.6	Brown																
	Moist (FILL)		2	SS	48		193										
	Clayey SILT, some sand, trace gravel																
192.5	Hard																
1.5	Brown (FILL)																
	Silty CLAY, trace to some sand, trace gravel		3	SS	11		192										
	Stiff to Very Stiff																
	Dark Grey (FILL)																
	Mottled Brown-Grey to Reddish Brown		4	SS	23												
191.0																	
3.0	Silty CLAY, trace sand, trace gravel, occasional rootlets		5	SS	28		191										
	Very Stiff to Hard																
	Dark Grey to Mottled Reddish Brown (TILL)																
			6	SS	100/ .125		190									1 20 56 23	
188.8																	
5.2	Highly weathered, thinly bedded, reddish brown SHALE																
			7	SS	100/ .125		188										
	Highly to moderately weathered																
			8	SS	100/ .100		187										
185.5																	
8.5	END OF BOREHOLE AT 8.53m UPON AUGER REFUSAL. BOREHOLE DRY AND OPEN UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.																

+ 3 . X 3 . Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HAR-12

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 832 086.283 E 290 039.712 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
 DATUM Geodetic DATE 2007-10-10 - 2007-10-10 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
195.8								20	40	60	80	100		
0.0	TOPSOIL: (100mm)													
0.1	SAND, fine to medium grained, trace silt, trace gravel, trace clay Compact to Very Dense Brown (FILL)		1	SS	25									
			2	SS	46		195							
			3	SS	50/ .150		194							4 82 14 (SI+CL)
193.5	Silty CLAY, trace to some sand, trace gravel, occasional shale fragments Very Stiff Mottled Reddish Brown to Brown (FILL)		4	SS	15		193							
192.7	SILT, trace clay, some sand, trace gravel Dense Brown (FILL)		5	SS	35		192							
							191							
191.2	Silty CLAY, with sand, occasional rootlets Hard Dark Grey to Brown (TILL)		6	SS	35		190							1 32 41 26
			7	SS	100/ .150									
189.1	Highly weathered, thinly bedded, reddish brown SHALE						189							
			8	SS	100/ .125		188							
186.9	END OF BOREHOLE AT 8.84m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.						187							
8.8														

ONTMT4S 2311.GPJ 2/5/08

+³ × 10⁻³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HAR-13

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 832 093.367 E 290 050.225 ORIGINATED BY VS
HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
DATUM Geodetic DATE 2007-10-22 - 2007-10-22 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
196.7	ASPHALT: (110mm)													
0.0														
0.1	SAND and GRAVEL, trace silt, trace clay Compact to Dense Brown Damp to Moist (FILL)		1	SS	16		196							45 44 11 (SI+CL)
			2	SS	47									
195.2														
1.5	SAND, some silt, some clay Compact to Very Dense Brown Moist (FILL)		3	SS	58		195							
			4	SS	27		194							
			5	SS	21									0 81 19 (SI+CL)
							193							
192.1														
4.6	Silty CLAY, with sand, trace gravel Firm to Hard Brown to Grey (TILL)		6	SS	6		192							
							191							
			7	SS	58									2 23 49 26
							190							
189.1														
189.6	Highly weathered, very thinly bedded, reddish brown SHALE		8	SS	32									
7.7	END OF BOREHOLE AT 7.72m. BOREHOLE BACKFILLED WITH BENTONITE TO SURFACE.													

+ 3. X 3. Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HAR-14

1 OF 2

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 832 101.263 E 290 054.562 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
 DATUM Geodetic DATE 2007-10-18 - 2007-10-18 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
196.8							20 40 60 80 100						
0.0	ASPHALT: (125mm)						20 40 60 80 100						
0.1	SAND and GRAVEL Dense Brown Damp (FILL)		1	SS	32		196					51 38 11 (SI+CL)	
195.4			2	SS	34								
1.4	SHALE, highly weathered, thinly bedded Stiff to Hard Reddish Brown Damp (FILL)		3	SS	44		195						
			4	SS	12		194						
193.7													
3.0	Silty CLAY, trace to some sand, trace gravel, occasional shale fragments Stiff Reddish Brown (FILL)		5	SS	14		193						
192.2													
4.6	Silty CLAY, some sand, some gravel, occasional iron oxidized stains Hard Mottled Brown-Grey (TILL)		6	SS	35		192						
							191						
			7	SS	60		190					1 19 56 24	
188.9			8	SS	100/		189						
7.9	Highly weathered, thinly bedded, reddish brown SHALE				.150								
							188						
187.6													
9.1	END OF BOREHOLE AT 9.15m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE TO 0.9m. CONCRETE												

Continued Next Page

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

ONTMT4S 2311.GPJ 12/12/07

RECORD OF BOREHOLE No HAR-14

2 OF 2

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 832 101.263 E 290 054.562 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
 DATUM Geodetic DATE 2007-10-18 - 2007-10-18 CHECKED BY RPR

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa 20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE					W _p	W		
	Continued From Previous Page TO 0.15m AND COLD PATCH TO SURFACE.															

RECORD OF BOREHOLE No HAR-15

2 OF 2

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 832 097.821 E 290 058.189 ORIGINATED BY GA
HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
DATUM Geodetic DATE 2007-10-17 - 2007-10-17 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p	W	W _L		
	Continued From Previous Page							20 40 60 80 100									
	8.81 to 8.99 and 9.20 to 9.32m Weak to strong							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE									
	Green siltstone interbeds at 10.08 to 10.11, 10.90, 10.97, 11.15 to 11.20, 11.25 to 11.28, 11.30 to 11.41 and 11.56 to 11.58m Grey limestone interbeds at 10.26, 10.49 to 10.52, 11.33 and 11.51 to 11.56m		2	RUN			186	20 40 60 80 100					20 40 60			kn/m ³	GR SA SI CL
185.1																	
11.6	END OF BOREHOLE AT 11.58m. BOREHOLE OPEN AND WATER LEVEL AT 4.88m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE TO 0.9m, CONCRETE TO 0.15m AND COLD PATCH TO SURFACE.																

RECORD OF BOREHOLE No HAR-16

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 832 110.129 E 290 065.885 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007-09-14 - 2007-09-14 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE						PLASTIC LIMIT W _P NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L		
196.1							20	40	60	80	100	20	40	60		
0.0	TOPSOIL: (100mm)															
0.1	SAND, some silt, trace clay, trace gravel Compact to Dense Brown (FILL)		1	SS	40											
			2	SS	16											
	Loose		3	SS	9											
193.9																
2.2	Silty CLAY, trace to some sand, trace gravel Stiff Brown to Reddish Brown (FILL)		4	SS	12											
193.2																
3.0	Silty CLAY, with sand, trace gravel, occasional iron oxidized stains Hard Mottled Brown and Grey (TILL)		5	SS	16											
			6	SS	49											
	Brown to Reddish Brown		7	SS	60/ .150											
189.4																
6.7	Highly weathered, thinly bedded, reddish brown SHALE															
188.5																
7.6	END OF BOREHOLE AND AUGER REFUSAL AT 7.6m. BOREHOLE OPEN AND DRY TO 7.6m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Sep 19/07 4.8 191.3 Sep 28/07 4.5 191.6 Oct 05/07 4.6 191.5 Oct 18/07 4.2 191.9 Nov 01/07 4.5 191.6 Nov 15/07 4.7 191.4		8	SS	50/ .000											

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

RECORD OF BOREHOLE No HAR-17

1 OF 2

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 832 109.067 E 290 014.565 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
 DATUM Geodetic DATE 2007-10-10 - 2007-10-10 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		SHEAR STRENGTH kPa			WATER CONTENT (%)			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100		○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	GR SA SI CL		
197.1							197										
0.0	TOPSOIL: (100mm)																
0.1	SILT, some sand, trace gravel, occasional rootlets		1	SS	31												
196.4	Dense Brown (FILL)																
0.6	Silty CLAY, trace to some sand, trace gravel, occasional rootlets		2	SS	25		196										
	Very Stiff to Hard Brown (FILL)																
			3	SS	30												
194.8							195										
2.3	SAND, fine grained, occasional gravel Compact Brown Moist (FILL)		4	SS	16												
			5	SS	18		194										
							193										
	Some silt, some clay		6	SS	10		192									1 56 43 (SI+CL)	
191.0							191										
6.1	Silty CLAY, some sand, trace gravel Very Stiff Reddish Brown to Brown (TILL)		7	SS	25												
			8	SS	50/ .150		190										
188.8							189									0 15 61 24	
8.2	Highly weathered, thinly bedded, reddish brown SHALE		9	SS	100/ .150		188										

Continued Next Page

+ 3 × 3: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HAR-17

2 OF 2

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 832 109.067 E 290 014.565 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
 DATUM Geodetic DATE 2007-10-10 - 2007-10-10 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
	Continued From Previous Page							20 40 60 80 100							
187.0								20 40 60 80 100							
10.1	END OF BOREHOLE AT 10.06m UPON AUGER REFUSAL. BOREHOLE OPEN TO 10.06m AND WATER LEVEL AT 8.23m. Piezometer installation consists of 19mm diameter schedule PVC pipe. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Oct 18/07 4.3 192.8 Nov 01/07 4.5 192.6 Nov 15/07 4.4 192.7						187								

ONTMT4S 2311.GPJ 12/12/07

RECORD OF BOREHOLE No HAR-18

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 832 069.279 E 290 058.058
 HWY 401 BOREHOLE TYPE Solid Stem Augers ORIGINATED BY GA
 DATUM Geodetic DATE 2007-09-10 - 2007-09-10 COMPILED BY ES
 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
195.0														
0.0	TOPSOIL: (100mm)													
0.1	SAND, trace clay, trace silt, trace gravel, occasional rootlets Compact Brown (FILL)		1	SS	24		195							
194.2														
0.8	Silty CLAY, with sand, trace gravel Very Stiff Mottled Dark Grey-Brown (FILL)		2	SS	16		194							
			3	SS	18		193							
			4	SS	13		192							
	Brown to Mottled Brown-Reddish		5	SS	19		191							
							190							
	Hard		6	SS	50/ .150		189							
189.2														
5.8	Highly weathered, thinly bedded, reddish brown SHALE with occasional sand seams		7	SS	100/ .150		188							
187.4														
7.6	END OF BOREHOLE AT 7.62m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.													

ONTMT4S 2311.GPJ 19/11/07

RECORD OF BOREHOLE No RW3-1

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 832 020.551 E 289 930.652
 HWY 401 BOREHOLE TYPE Solid Stem Augers ORIGINATED BY GA
 DATUM Geodetic DATE 2007-10-11 - 2007-10-11 COMPILED BY ES
 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								20 40 60 80 100					
190.9													
0.0	TOPSOIL: (100mm)												
0.1	Silty CLAY, some sand, occasional rootlets Very Stiff to Hard Brown (FILL)		1	SS	16								0 16 54 30
			2	SS	50/ .100								
189.4													
1.5	Highly to moderately weathered, thinly bedded, reddish brown SHALE		3	SS	42								
			4	SS	50/ .150								
			5	SS	109								
	Grinding at 3.66m to 4.27m		6	SS	100/ .150								
185.4													
5.5	END OF BOREHOLE AT 5.49m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. Piezometer installation consists of 19mm diameter schedule PVC pipe. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Oct 18/07 Dry - Nov 15/07 2.7 188.2												

RECORD OF BOREHOLE No RW3-2

1 OF 1

METRIC

G.W.P. 2107-05-02 LOCATION Hurontario St. South Access Road N 4 832 040.894 E 289 977.204
 HWY 401 BOREHOLE TYPE Solid Stem Augers
 DATUM Geodetic DATE 2007-10-11 - 2007-10-11
 ORIGINATED BY GA
 COMPILED BY ES
 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)		
193.2							20	40	60	80	100	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	GR SA SI CL
0.0							20	40	60	80	100	W _P	W	W _L	
0.1	TOPSOIL: (100mm)						20	40	60	80	100				
	Silty CLAY, with sand, trace gravel, occasional rootlets Very Stiff Brown (FILL)		1	SS	27		193								
			2	SS	20		192								
	oxidized stains Brown to Grey		3	SS	15		191								1 31 45 24
			4	SS	19		190								
190.1			5	SS	50/		189								
3.1	Highly weathered, thinly bedded, reddish brown SHALE				.075		188								
			6	SS	100/		187								
					.150		186								
			7	SS	100/		185								
					.125										
			8	SS	100/										
					.100										
184.3															
8.9	END OF BOREHOLE AT 8.89m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.														

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

ONTMT4S 2311.GPJ 7/12/07

RECORD OF BOREHOLE No RW4-1

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 832 017.434 E 289 808.441
 HWY 401 BOREHOLE TYPE Solid Stem Augers ORIGINATED BY GA
 DATUM Geodetic DATE 2007-10-12 - 2007-10-12 COMPILED BY ES
 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
187.2														
0.0	TOPSOIL: (100mm)													
0.1	Silty CLAY, trace to some sand, trace gravel, occasional rootlets Very Stiff to Hard Brown (FILL)		1	SS	16		187							
			2	SS	36									
185.7							186							
1.5	Silty CLAY, with sand, trace gravel Hard Brown (TILL)		3	SS	50/ .150									
185.1														
2.1	Highly weathered, thinly bedded, reddish brown SHALE		4	SS	100/ .150		185							
	Highly to moderately weathered		5	SS	100/ .150		184							
182.7							183							
4.6	END OF BOREHOLE AT 4.57m. BOREHOLE OPEN AND DRY UPON COMPLETION. Piezometer installation consists of 19mm diameter schedule PVC pipe. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Oct 18/07 Dry - Nov 15/07 2.7 184.5													

RECORD OF BOREHOLE No RW4-2

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South Access Road N 4 832 015.087 E 289 854.780 ORIGINATED BY GA
HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
DATUM Geodetic DATE 2007-10-11 - 2007-10-11 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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186.8 0.0 0.1	TOPSOIL: (80mm)		1	SS	12																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			

RECORD OF BOREHOLE No RW4-3

1 OF 1

METRIC

G.W.P. 2107-05-00

LOCATION

Huronlarie St. South Access Road N 4 832 007.315 E 289 904.253

ORIGINATED BY GA

HWY 401

BOREHOLE TYPE Solid Stem Augers

COMPILED BY ES

DATUM Geodetic

DATE

2007-10-11 - 2007-10-11

CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
187.8	TOPSOIL: (80mm)													
0.0														
0.1														
187.2	Silty CLAY, some sand, trace gravel, occasional rootlets Stiff Brown (TILL)		1	SS	10									
0.6														
			2	SS	50/									
					.100									
			3	SS	100/									
					.225									
			4	SS	100/									
					.100									
			5	SS	100/									
					.125									
183.9														
4.0	END OF BOREHOLE AT 3.96m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.													

+ 3 x 3: Numbers refer to
Sensitivity

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15
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


(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No RW4-4

1 OF 1

METRIC

G.W.P. 2107-05-02 LOCATION Hurontario St. South Access Road N 4 832 015.970 E 289 955.559 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
 DATUM Geodetic DATE 2007-10-11 - 2007-10-11 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE					
189.9						20	40	60	80	100						
0.0	TOPSOIL: (50mm)		1	SS	29											
	Silty CLAY, some sand, occasional rootlets Very Stiff to Hard Brown, Mottled Brown/Gray to Reddish (TILL)		2	SS	50/ .150											
188.7																
1.2	Highly weathered, thinly bedded, reddish brown SHALE		3	SS	118											0 26 48 26
	Highly to moderately weathered		4	SS	100/ .150											
			5	SS	100/ .150											
185.9																
4.0	END OF BOREHOLE AT 4.01m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.															

RECORD OF BOREHOLE No RW4-5

1 OF 1

METRIC

G.W.P. 2107-05-02 LOCATION Hurontario St. South Access Road N 4 832 042.246 E 289 998.052 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
 DATUM Geodetic DATE 2007-10-11 - 2007-10-11 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							
192.1							20	40	60	80	100	20	40	60	
0.0 0.1	TOPSOIL: (80mm)														
	Highly weathered, thinly bedded, compact, reddish brown SHALE, trace gravel (FILL)		1	SS	25							○			
191.4															
0.8	Silty CLAY, sandy, trace gravel, occasional rootlets, occasional asphalt fragments Very Stiff to Hard Brown (FILL)		2	SS	16							○			
			3	SS	28							○			
	Mottled Brown-Grey to Reddish Brown		4	SS	41							○			
			5	SS	50/ .150							○			
188.2															
4.0	Highly weathered, thinly bedded, reddish brown SHALE with limestone and siltstone layers		6	SS	143							○			
			7	SS	100/ .150							○			
			8	SS	100/ .125							○			
183.6															
8.5	END OF BOREHOLE AT 8.53m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.														

ONTMT4S 2311.GPJ 7/12/07

Appendix B

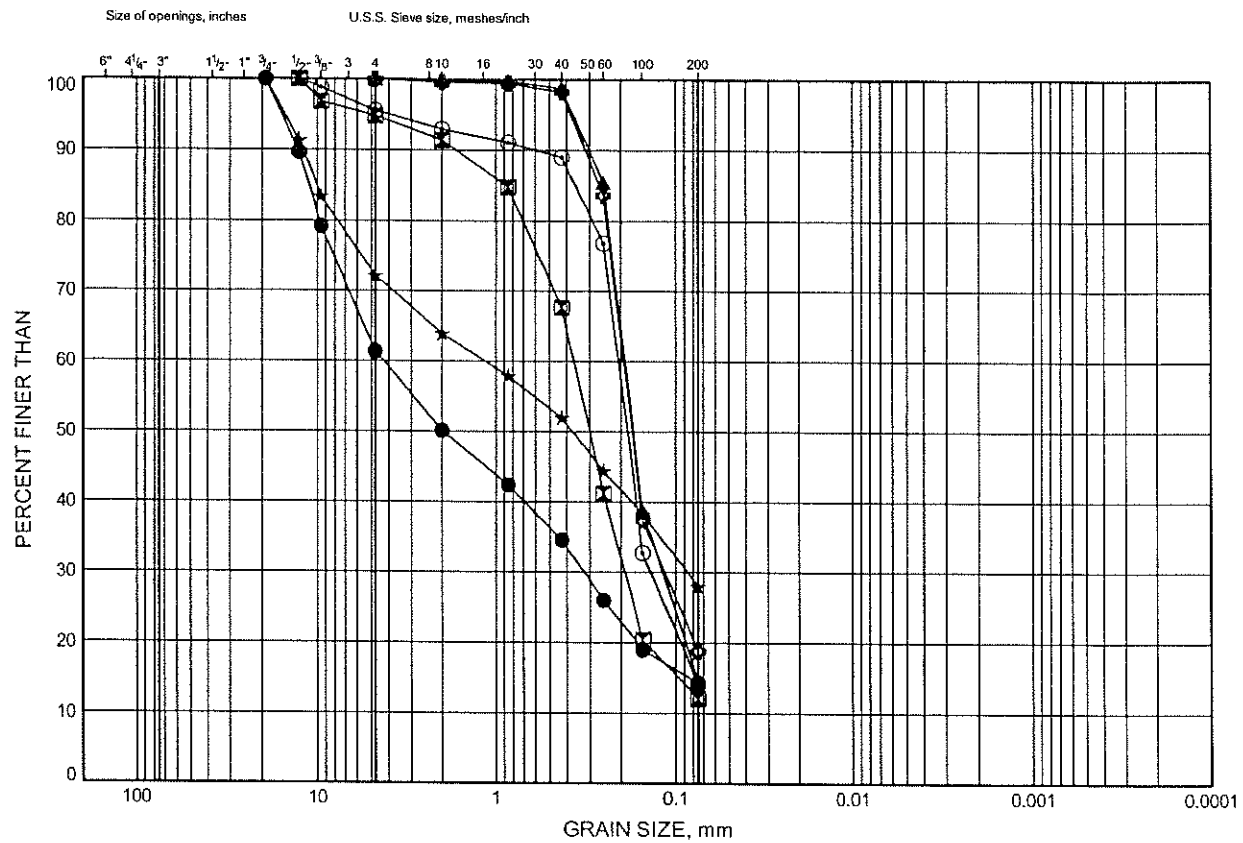
Laboratory Test Results (Proposed Grade Separation)

Hwy 401/410 to Credit River

GRAIN SIZE DISTRIBUTION

FIGURE B1

Sand Fill



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	HAR-02	1.07	192.77
⊠	HAR-03	1.83	191.86
▲	HAR-04	2.68	193.17
★	HAR-10	1.07	192.63
⊙	HAR-12	1.83	193.95
⬢	HAR-13	3.26	193.42

Date November 2007

Project 2107-05-00



Prep'd MFA

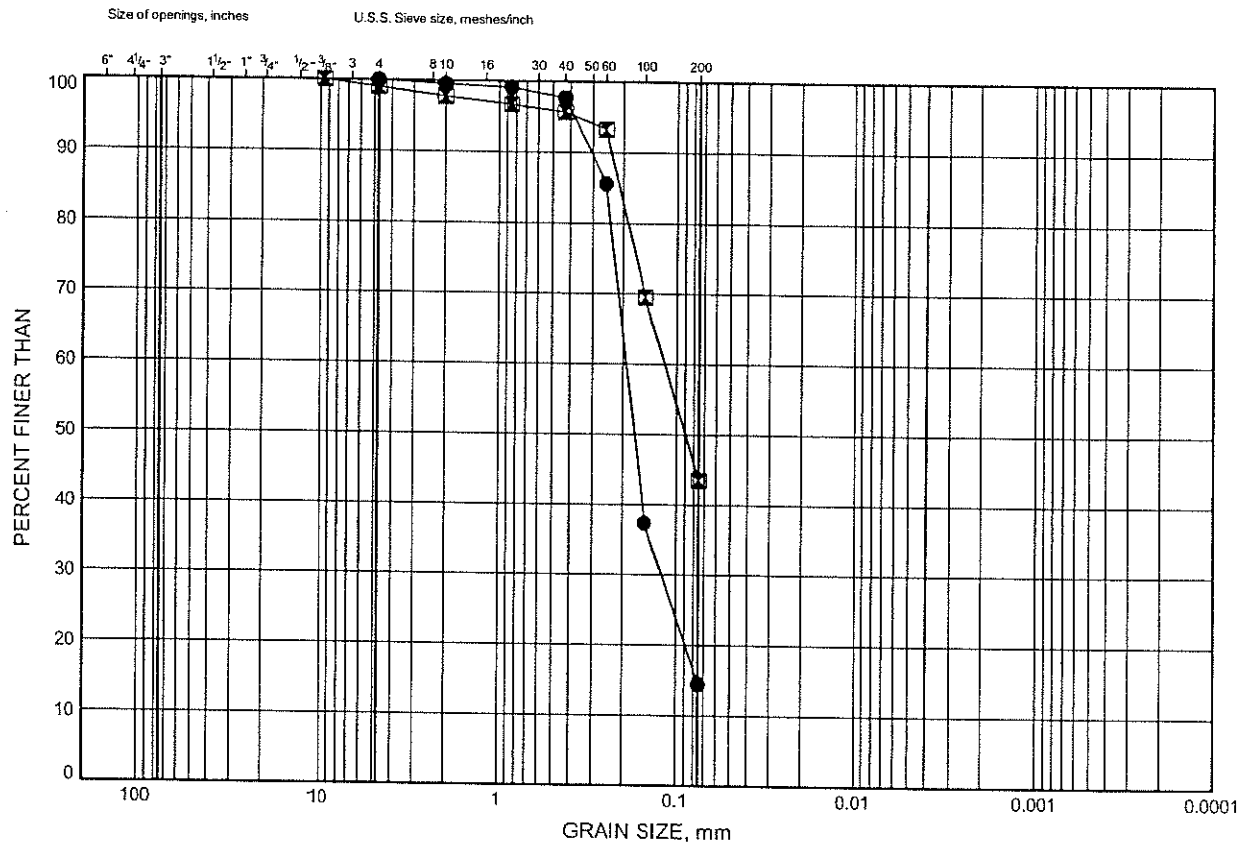
Chkd. RPR

Hwy 401/410 to Credit River

GRAIN SIZE DISTRIBUTION

FIGURE B2

Sand Fill



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	HAR-16	1.83	194.32
□	HAR-17	4.88	192.18

Date November 2007

Project 2107-05-00



Prep'd MFA

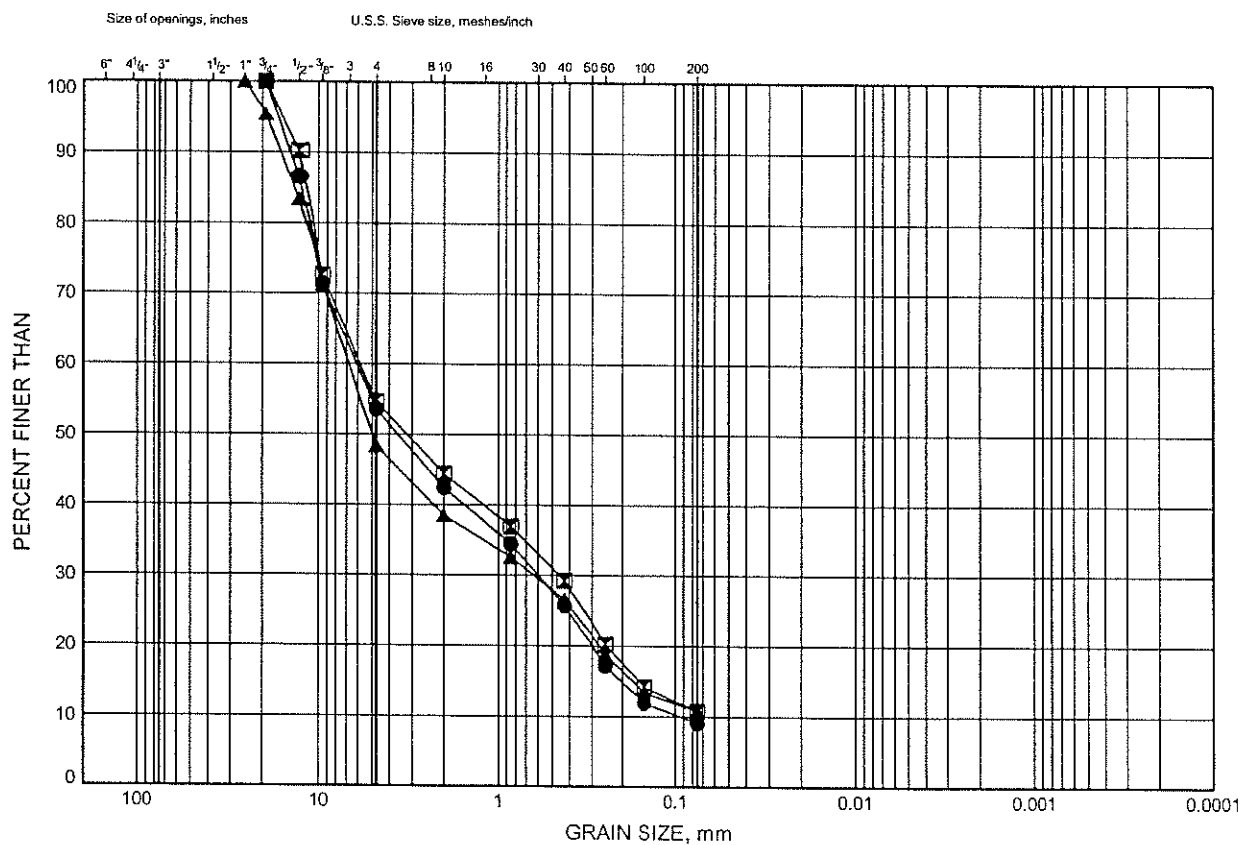
Chkd. RPR

Hwy 401/410 to Credit River

GRAIN SIZE DISTRIBUTION

FIGURE B3

Sand and Gravel Fill



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	HAR-06	1.07	196.08
◻	HAR-13	0.84	195.84
▲	HAR-14	0.38	196.40

Date November 2007

Project 2107-05-00



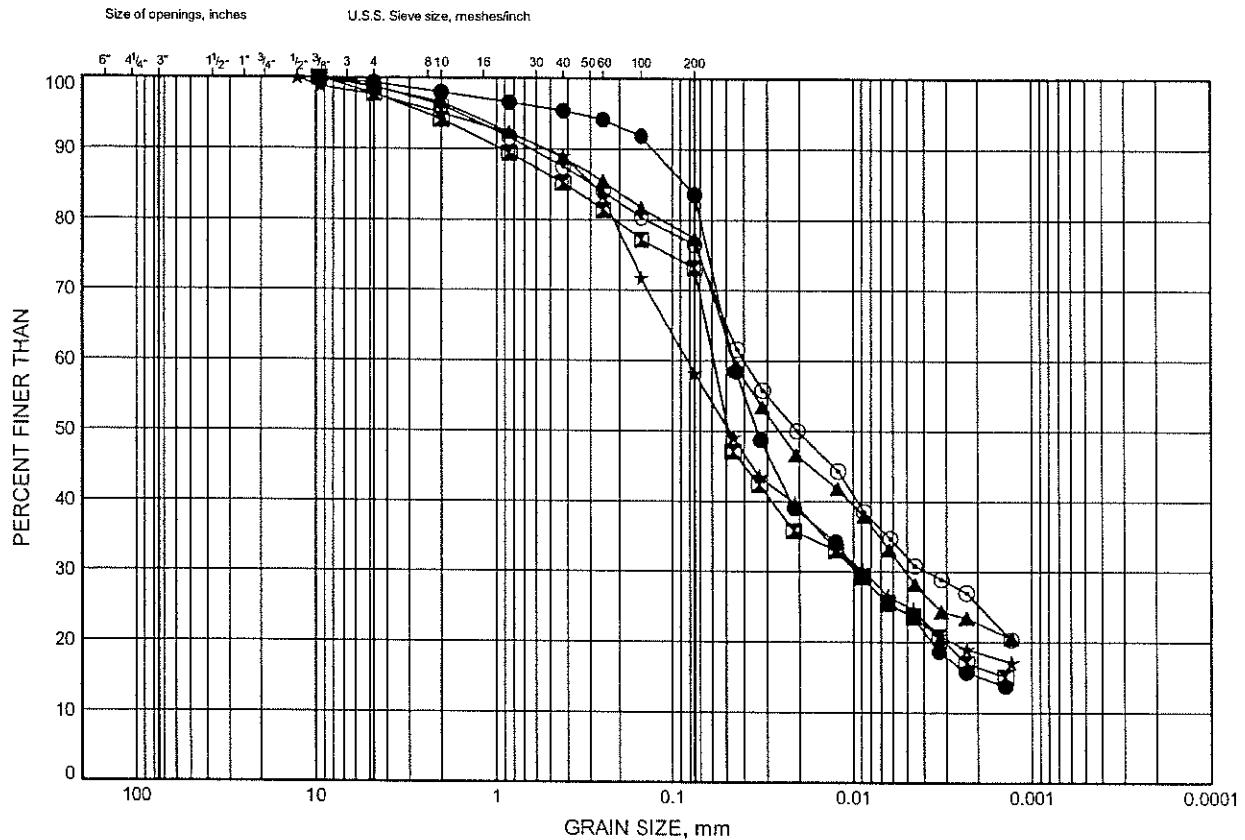
Prep'd MFA

Chkd. RPR

Hwy 401/410 to Credit River GRAIN SIZE DISTRIBUTION

FIGURE B4

Clayey Silt / Silty Clay Fill



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	HAR-05	2.59	194.09
⊠	HAR-07	3.35	193.67
▲	HAR-08	2.59	193.96
★	HAR-08	3.35	193.20
⊙	HAR-15	1.83	194.82

Date December 2007

Project 2107-05-00



Prep'd MFA

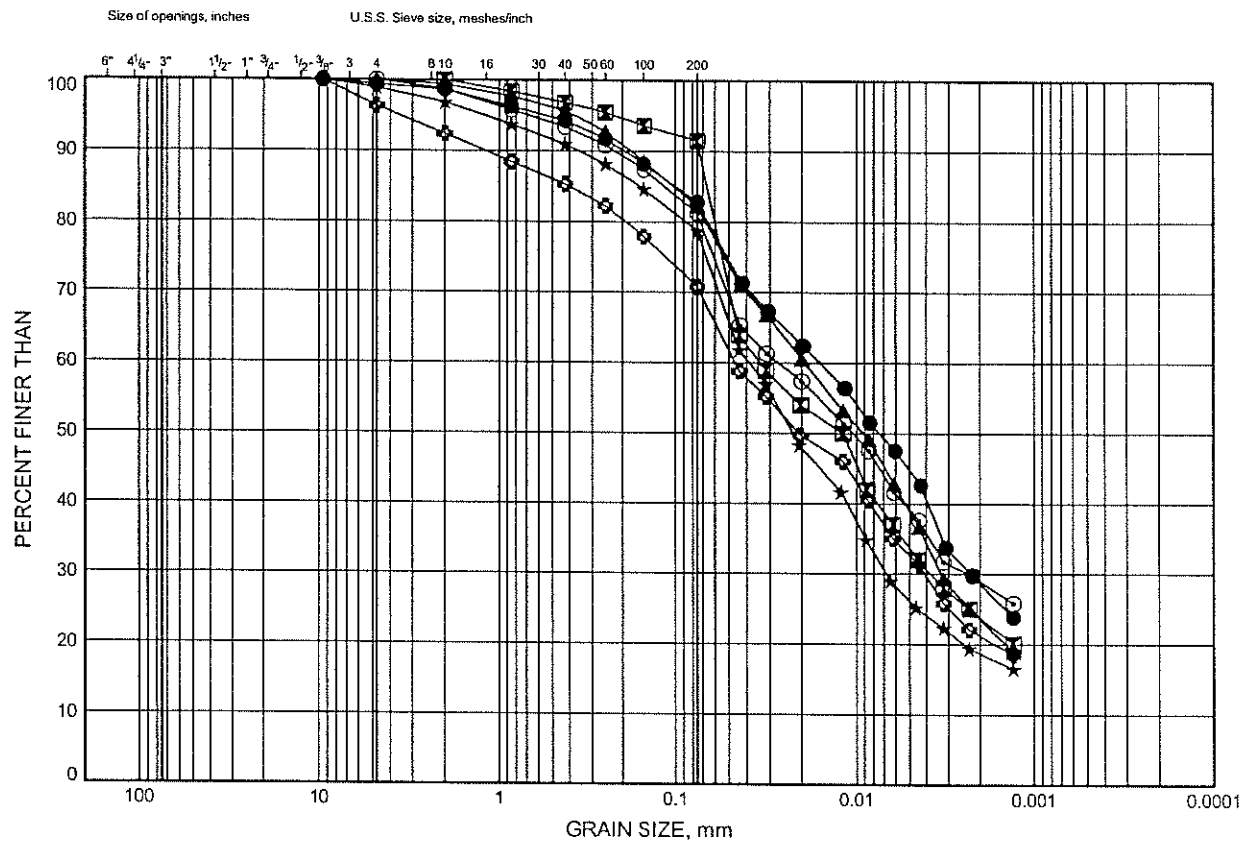
Chkd. RPR

Hwy 401/410 to Credit River

GRAIN SIZE DISTRIBUTION

FIGURE B5

Silty Clay Till



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	HAR-01	1.60	190.45
⊠	HAR-01	4.65	187.41
▲	HAR-02	3.35	190.49
★	HAR-03	4.88	188.81
⊙	HAR-04	4.88	190.98
⊛	HAR-05	6.25	190.43

Date December 2007

Project 2107-05-00



Prep'd MFA

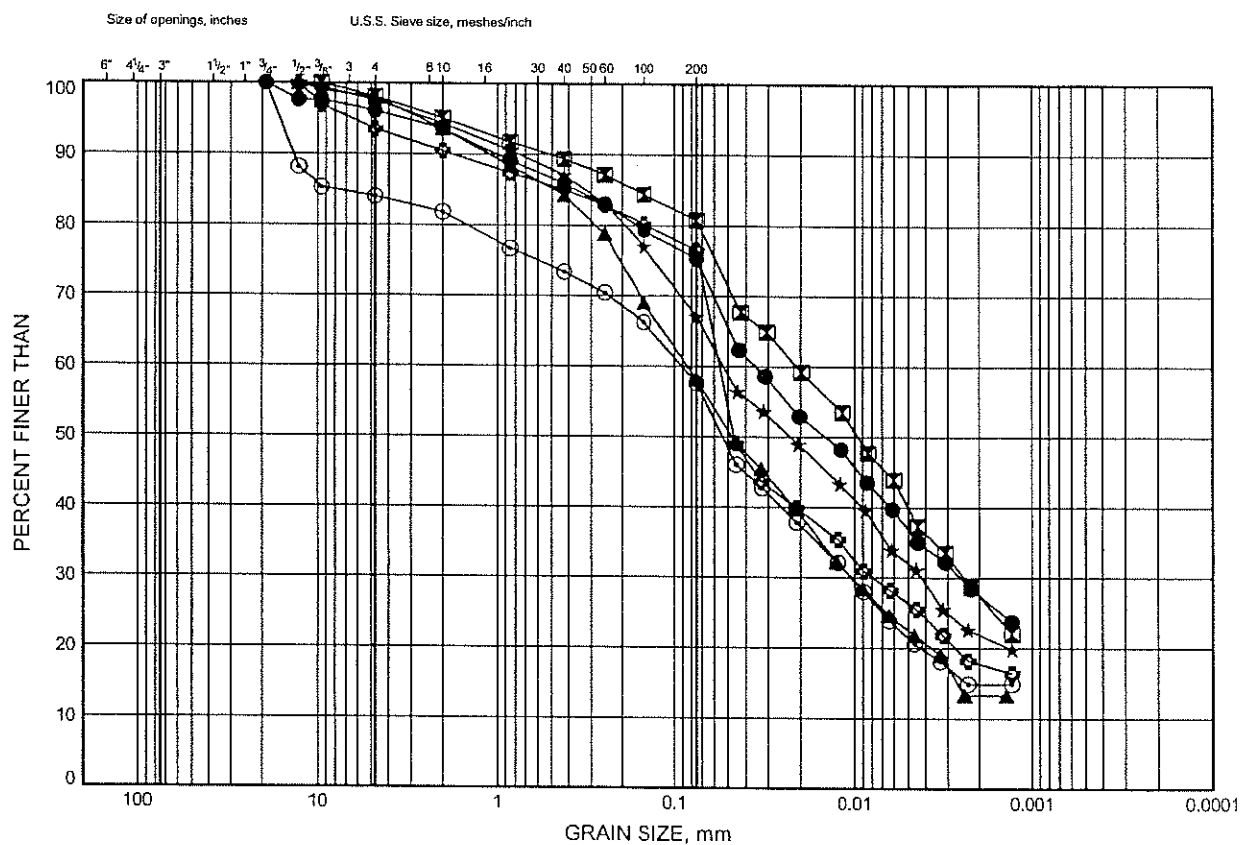
Chkd. RPR

Hwy 401/410 to Credit River

GRAIN SIZE DISTRIBUTION

FIGURE B6

Silty Clay Till



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	HAR-06	4.88	192.27
⊠	HAR-07	6.40	190.63
▲	HAR-08	4.88	191.67
★	HAR-08	6.40	190.15
⊙	HAR-08	7.92	188.62
⊗	HAR-10	2.59	191.10

Date December 2007

Project 2107-05-00



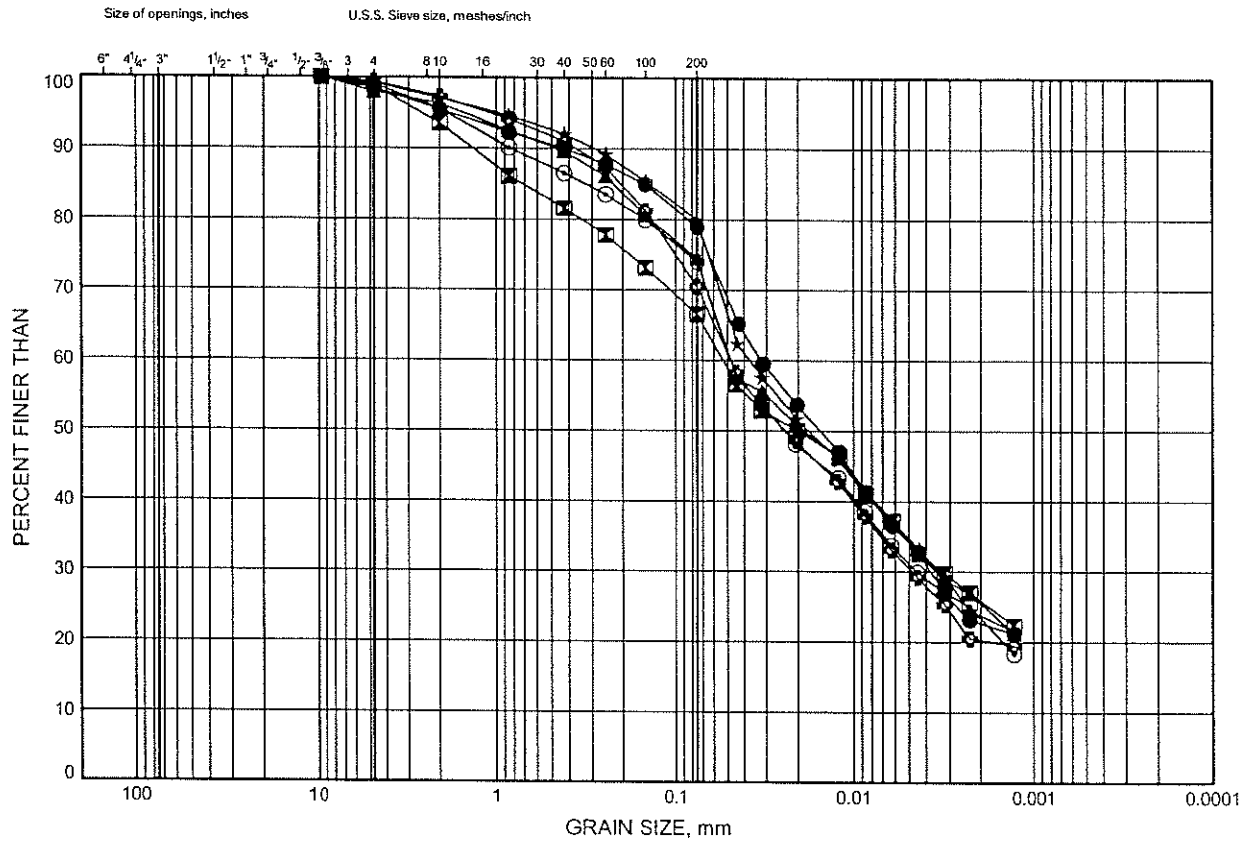
Prep'd MFA

Chkd. RPR

Hwy 401/410 to Credit River
GRAIN SIZE DISTRIBUTION

FIGURE B7

Silty Clay Till



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	HAR-11	4.64	189.37
⊠	HAR-12	6.17	189.60
▲	HAR-13	6.40	190.28
★	HAR-14	6.40	190.38
⊙	HAR-15	6.40	190.25
⊛	HAR-16	4.88	191.27



Date December 2007

Project 2107-05-00

Prep'd MFA

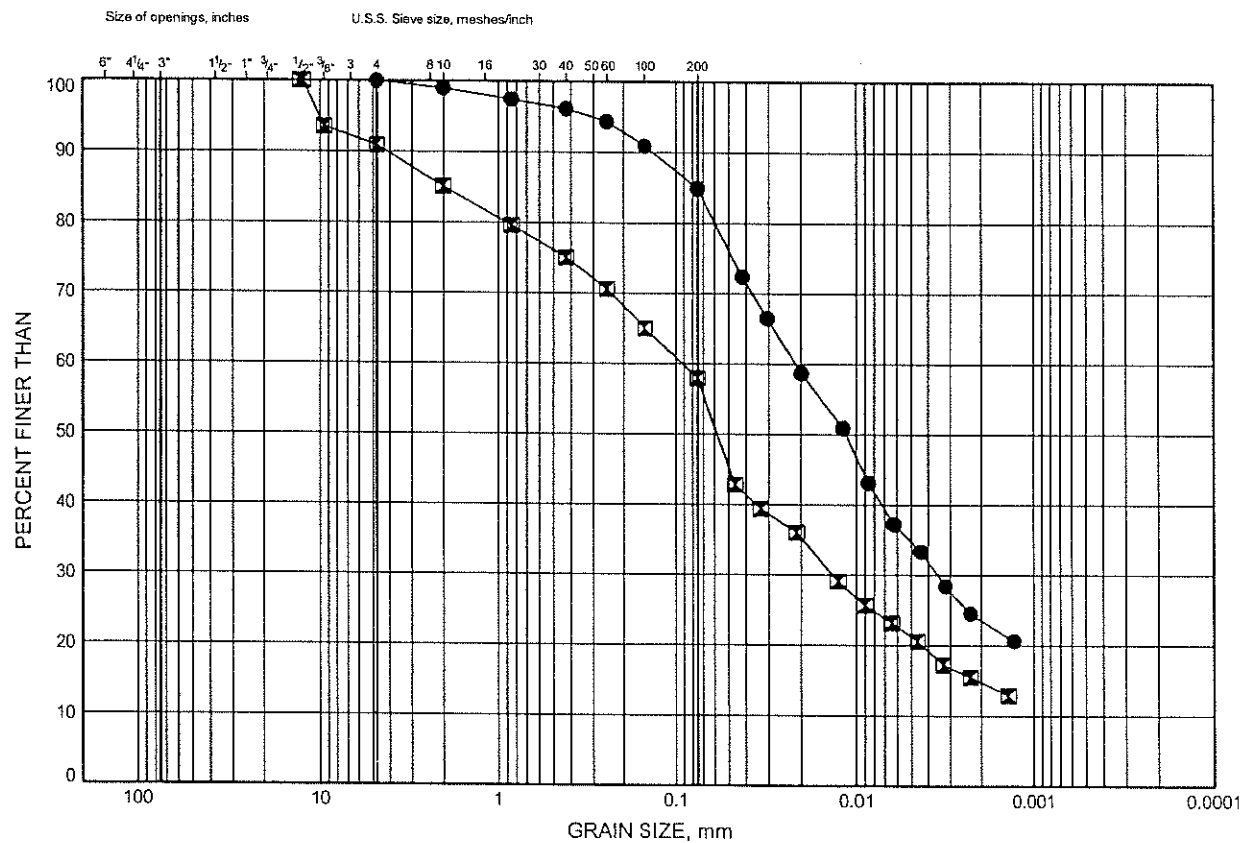
Chkd. RPR

Hwy 401/410 to Credit River

GRAIN SIZE DISTRIBUTION

FIGURE B8

Silty Clay Till



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	HAR-17	7.92	189.13
◻	HAR-18	2.59	192.41

Date December 2007

Project 2107-05-00



Prep'd MFA

Chkd. RPR

FIGURE B9

Grain Size (mm)	Percent Finer (%)
100	100
75	100
60	100
48	100
36	100
30	100
25	100
20	100
16	100
12	100
10	100
8	100
6	100
4.75	100
4	100
3.5	100
3	100
2.5	100
2	100
1.5	100
1.18	100
1.0	100
0.85	100
0.75	100
0.6	100
0.5	100
0.425	100
0.375	100
0.3	100
0.25	100
0.2	100
0.18	100
0.15	100
0.125	100
0.106	100
0.09	100
0.075	100
0.06	100
0.05	100
0.0425	100
0.0375	100
0.03	100
0.025	100
0.02	100
0.018	100
0.015	100
0.0125	100
0.0106	100
0.009	100
0.0075	100
0.006	100
0.005	100
0.00425	100
0.00375	100
0.003	100
0.0025	100
0.002	100
0.0018	100
0.0015	100
0.00125	100
0.00106	100
0.0009	100
0.00075	100
0.0006	100
0.0005	100
0.000425	100
0.000375	100
0.0003	100
0.00025	100
0.0002	100
0.00018	100
0.00015	100
0.000125	100
0.000106	100
0.00009	100
0.000075	100
0.00006	100
0.00005	100
0.0000425	100
0.0000375	100
0.00003	100
0.000025	100
0.00002	100
0.000018	100
0.000015	100
0.0000125	100
0.0000106	100
0.000009	100
0.0000075	100
0.000006	100
0.000005	100
0.00000425	100
0.00000375	100
0.000003	100
0.0000025	100
0.000002	100
0.0000018	100
0.0000015	100
0.00000125	100
0.00000106	100
0.0000009	100
0.00000075	100
0.0000006	100
0.0000005	100
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0.000000375	100
0.0000003	100
0.00000025	100
0.0000002	100
0.00000018	100
0.00000015	100
0.000000125	100
0.000000106	100
0.00000009	100
0.000000075	100
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0.0000000425	100
0.0000000375	100
0.00000003	100
0.000000025	100
0.00000002	100
0.000000018	100
0.000000015	100
0.0000000125	100
0.0000000106	100
0.000000009	100
0.0000000075	100
0.000000006	100
0.000000005	100
0.00000000425	100
0.00000000375	100
0.000000003	100
0.0000000025	100
0.000000002	100
0.0000000018	100
0.0000000015	100
0.00000000125	100
0.00000000106	100
0.0000000009	100
0.00000000075	100
0.0000000006	100
0.0000000005	100
0.000000000425	100
0.000000000375	100
0.0000000003	100
0.00000000025	100
0.0000000002	100
0.00000000018	100
0.00000000015	100
0.000000000125	100
0.000000000106	100
0.00000000009	100
0.000000000075	100

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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	HAR-09	2.36	189.83



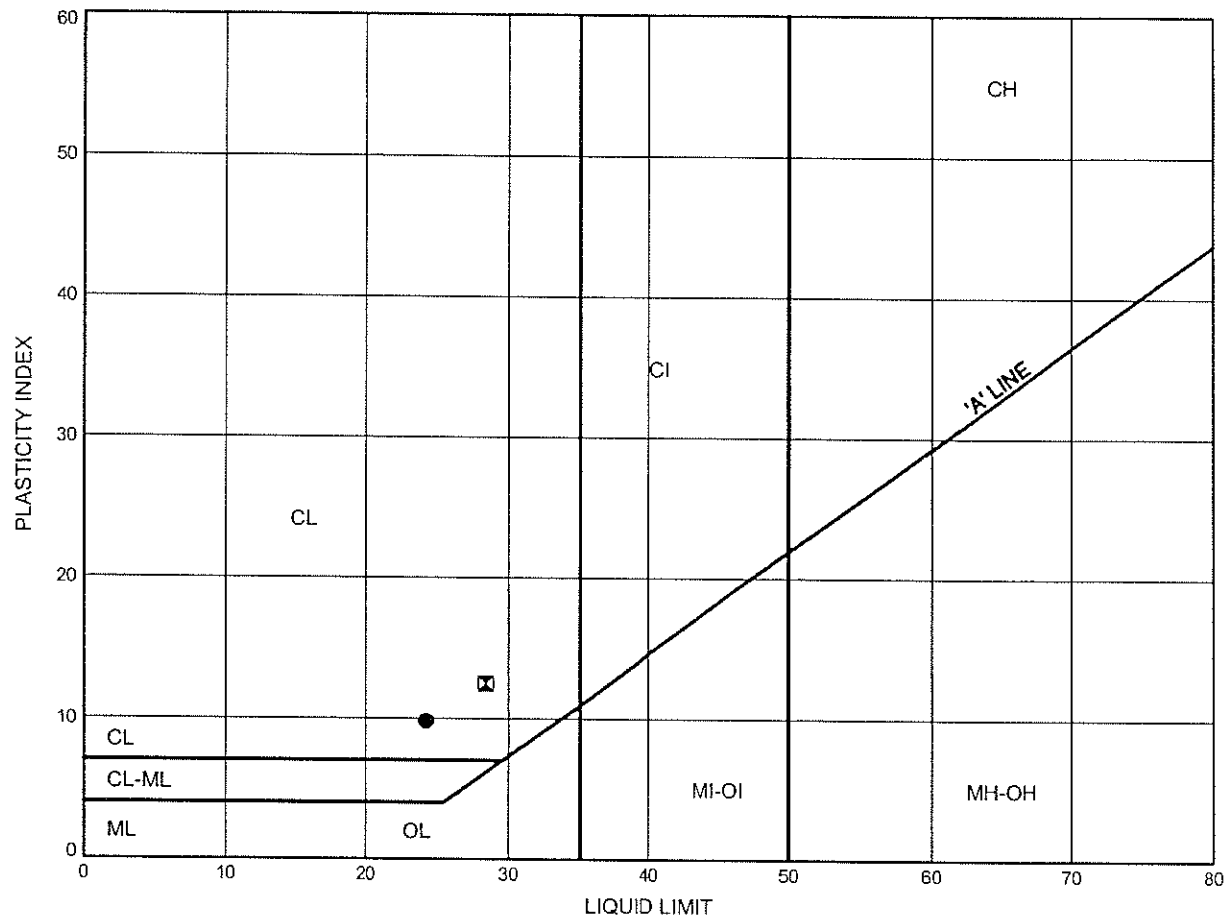
THURBER

Chkd. RPR.....

Hwy 401/410 to Credit River
ATTERBERG LIMITS TEST RESULTS

FIGURE B10

Silty Clay Fill

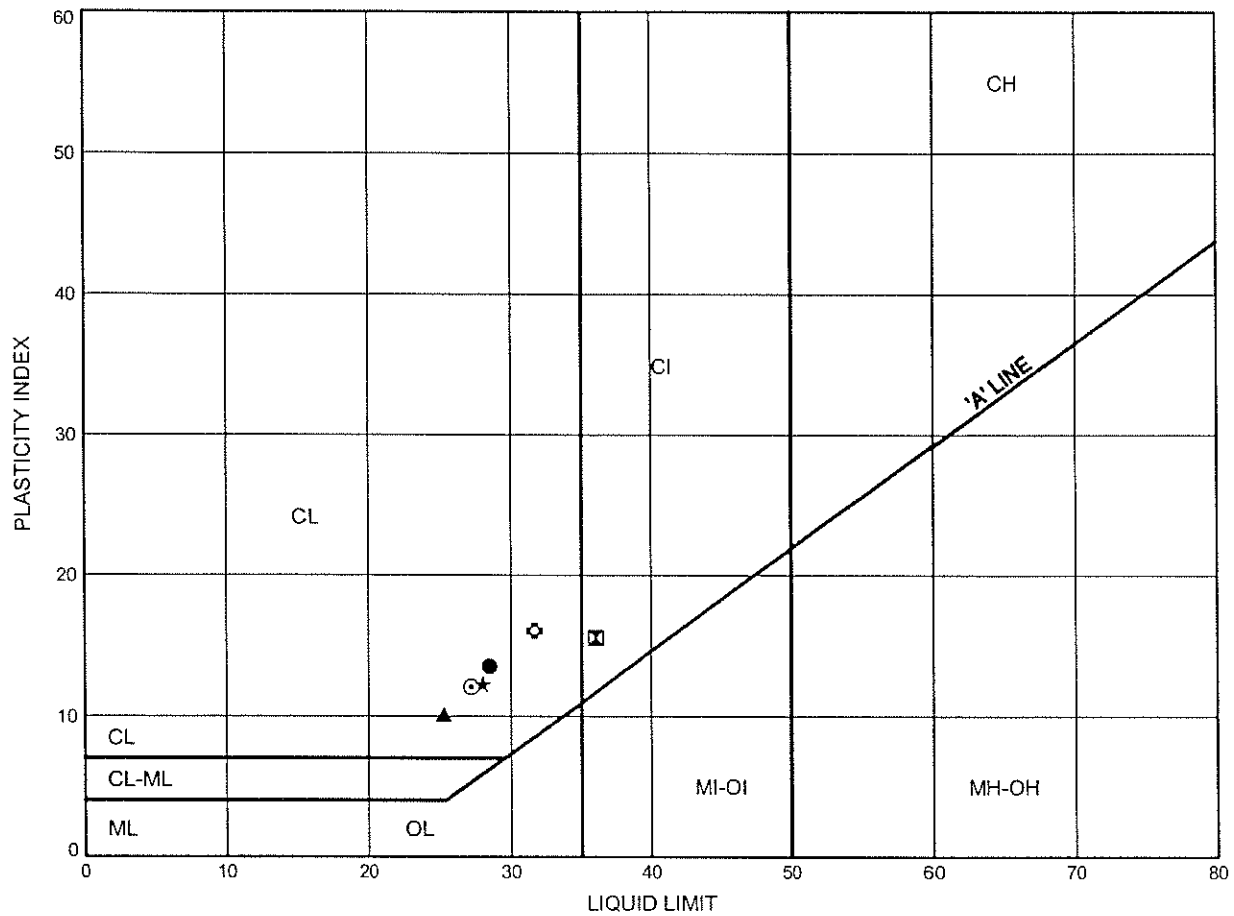


SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	HAR-07	3.35	193.67
⊠	HAR-15	1.83	194.82

Hwy 401/410 to Credit River
ATTERBERG LIMITS TEST RESULTS

FIGURE B11

Silty Clay Till



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	HAR-01	1.60	190.45
⊠	HAR-02	3.35	190.49
▲	HAR-03	4.88	188.81
★	HAR-04	4.88	190.98
⊙	HAR-05	6.25	190.43
⊞	HAR-06	4.88	192.27

Date December 2007

Project 2107-05-00



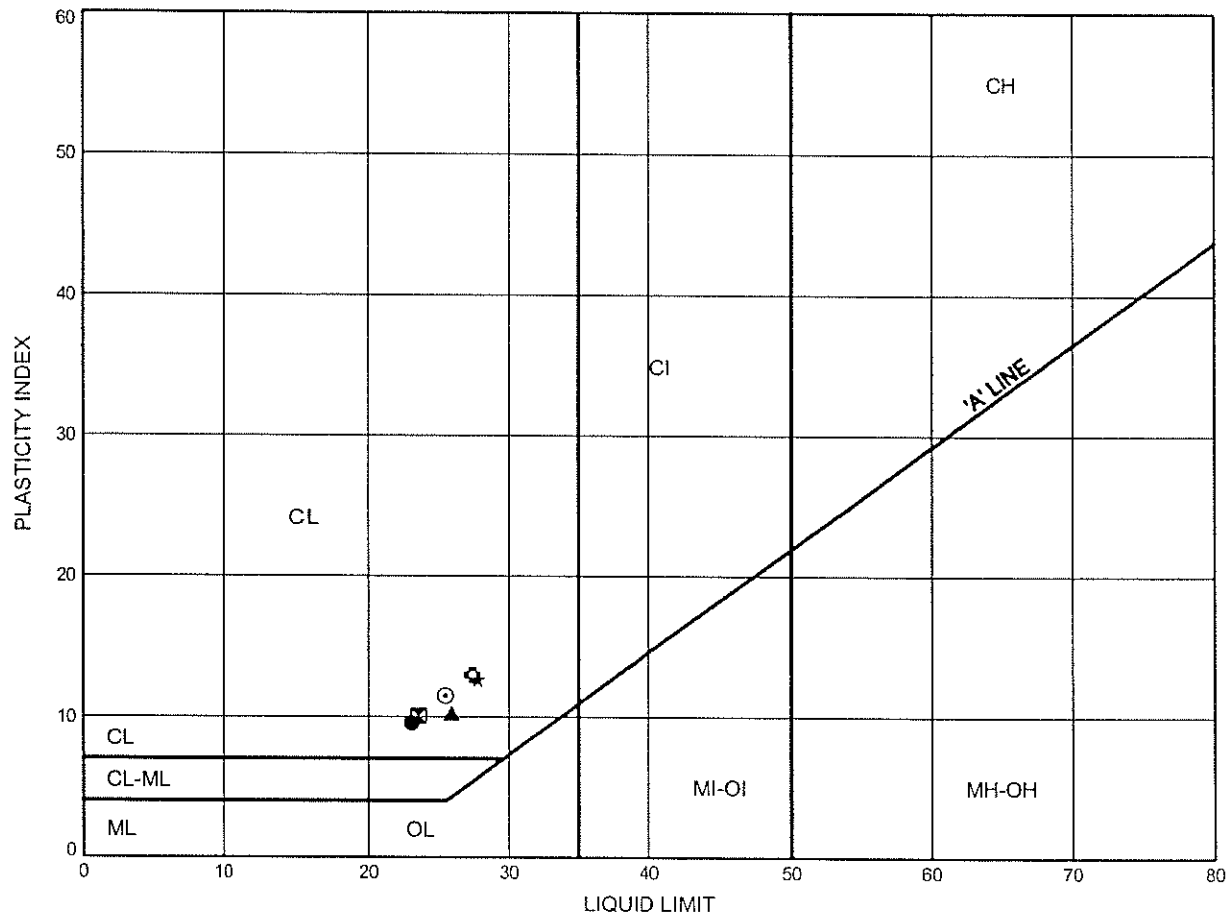
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Chkd. RPR

Hwy 401/410 to Credit River
ATTERBERG LIMITS TEST RESULTS

FIGURE B12

Silty Clay Till



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	HAR-08	4.88	191.67
⊠	HAR-08	7.92	188.62
▲	HAR-10	2.59	191.10
★	HAR-11	4.64	189.37
⊙	HAR-13	6.40	190.28
⊛	HAR-14	6.40	190.38

Date December 2007

Project 2107-05-00



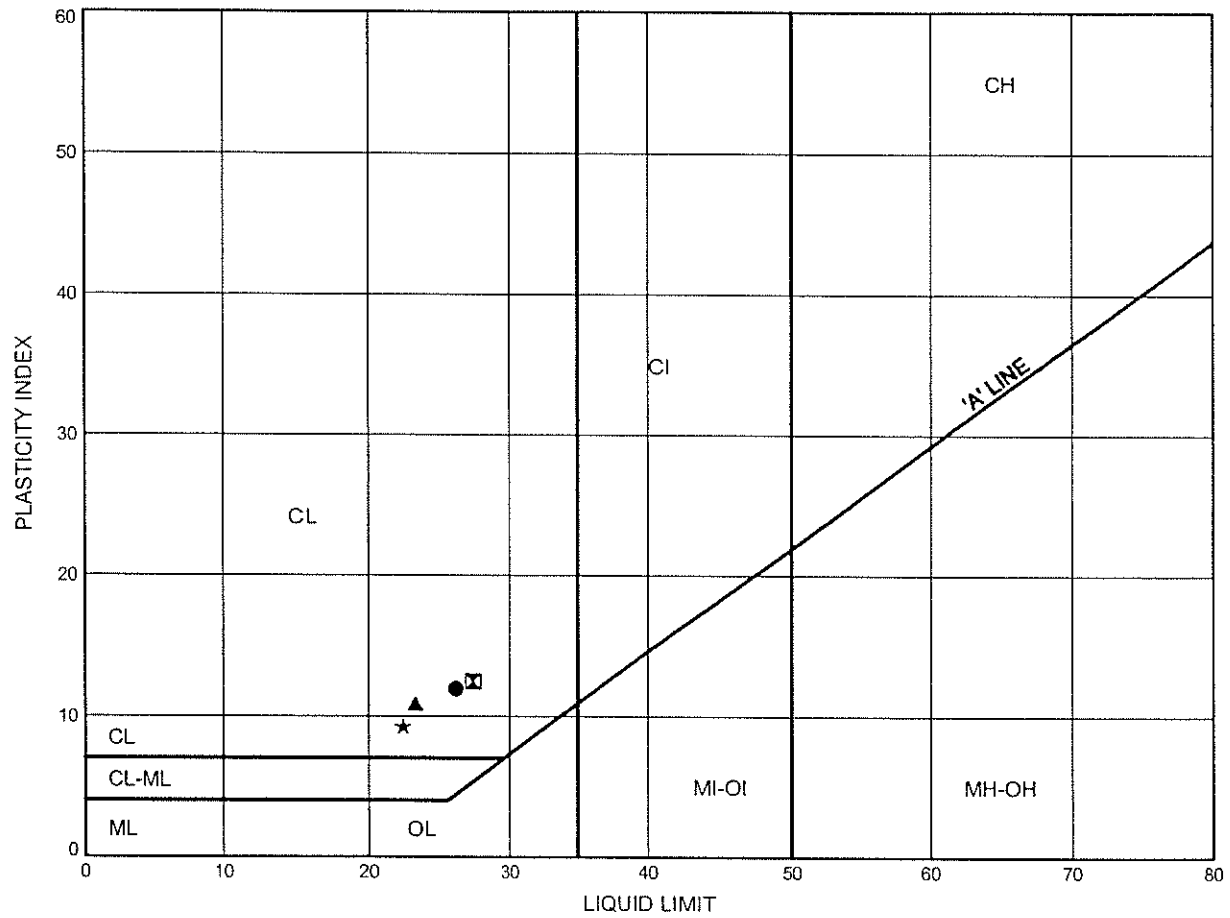
Prep'd MFA

Chkd. RPR

Hwy 401/410 to Credit River
ATTERBERG LIMITS TEST RESULTS

FIGURE B13

Silty Clay Till



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	HAR-15	6.40	190.25
⊠	HAR-16	4.88	191.27
▲	HAR-17	7.92	189.13
★	HAR-18	2.59	192.41

Date December 2007

Project 2107-05-00



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Chkd. RPR

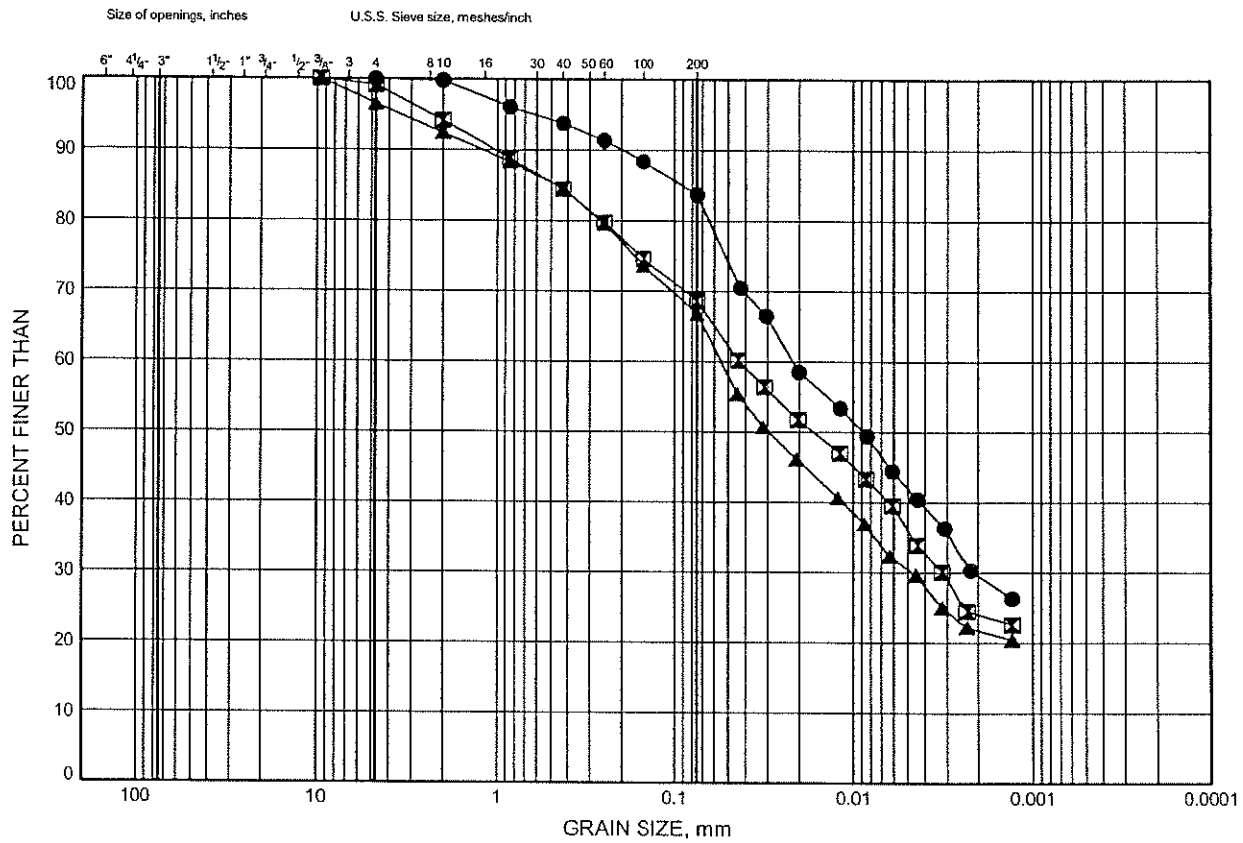
Appendix C

Laboratory Test Results (Proposed Retaining Walls)

Hwy 401/410 to Credit River GRAIN SIZE DISTRIBUTION

FIGURE C1

Silty Clay Fill



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	RW3-1	0.30	190.62
☒	RW3-2	1.83	191.35
▲	RW4-5	3.35	188.76

Date December 2007
Project 2107-05-00

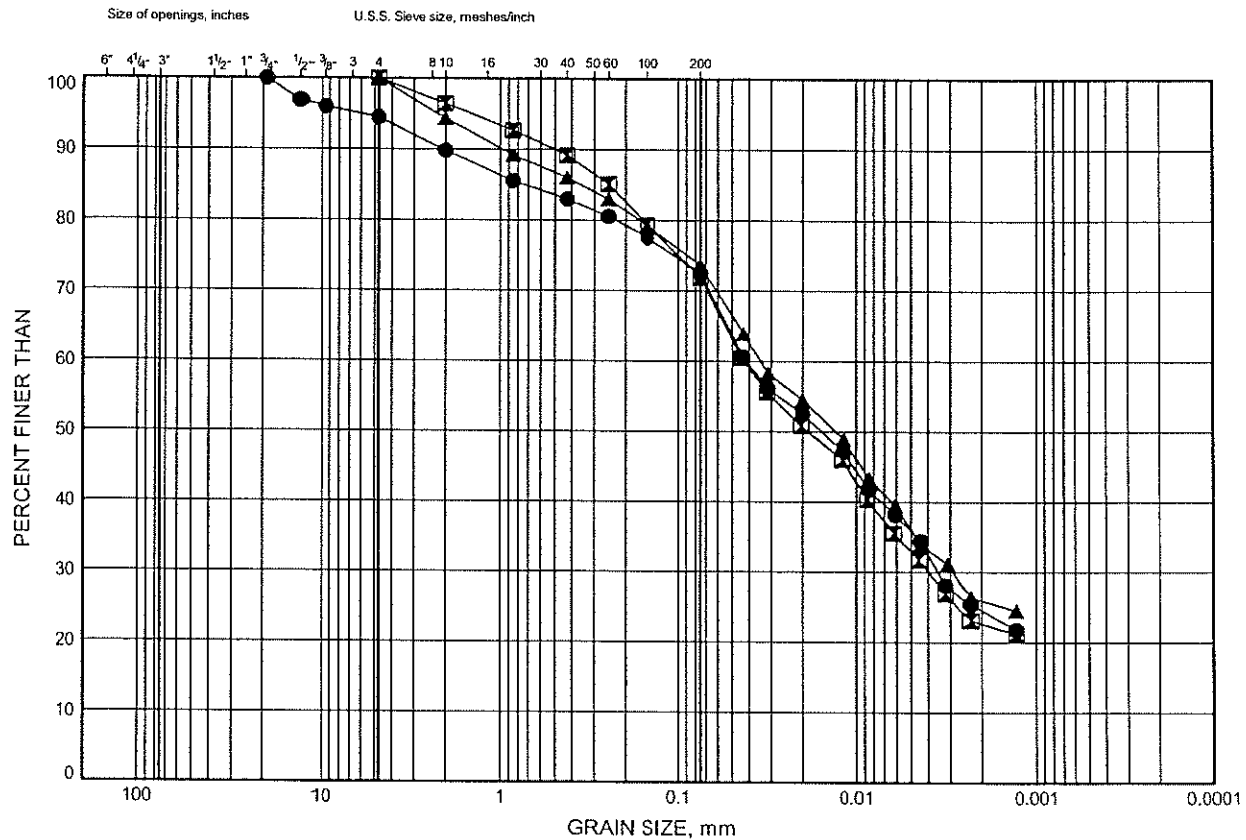


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Chkd. RPR

Hwy 401/410 to Credit River GRAIN SIZE DISTRIBUTION

FIGURE C2

Silty Clay Till



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	RW4-1	1.83	185.40
⊠	RW4-2	0.30	186.53
▲	RW4-4	1.07	188.83

Date December 2007
Project 2107-05-00

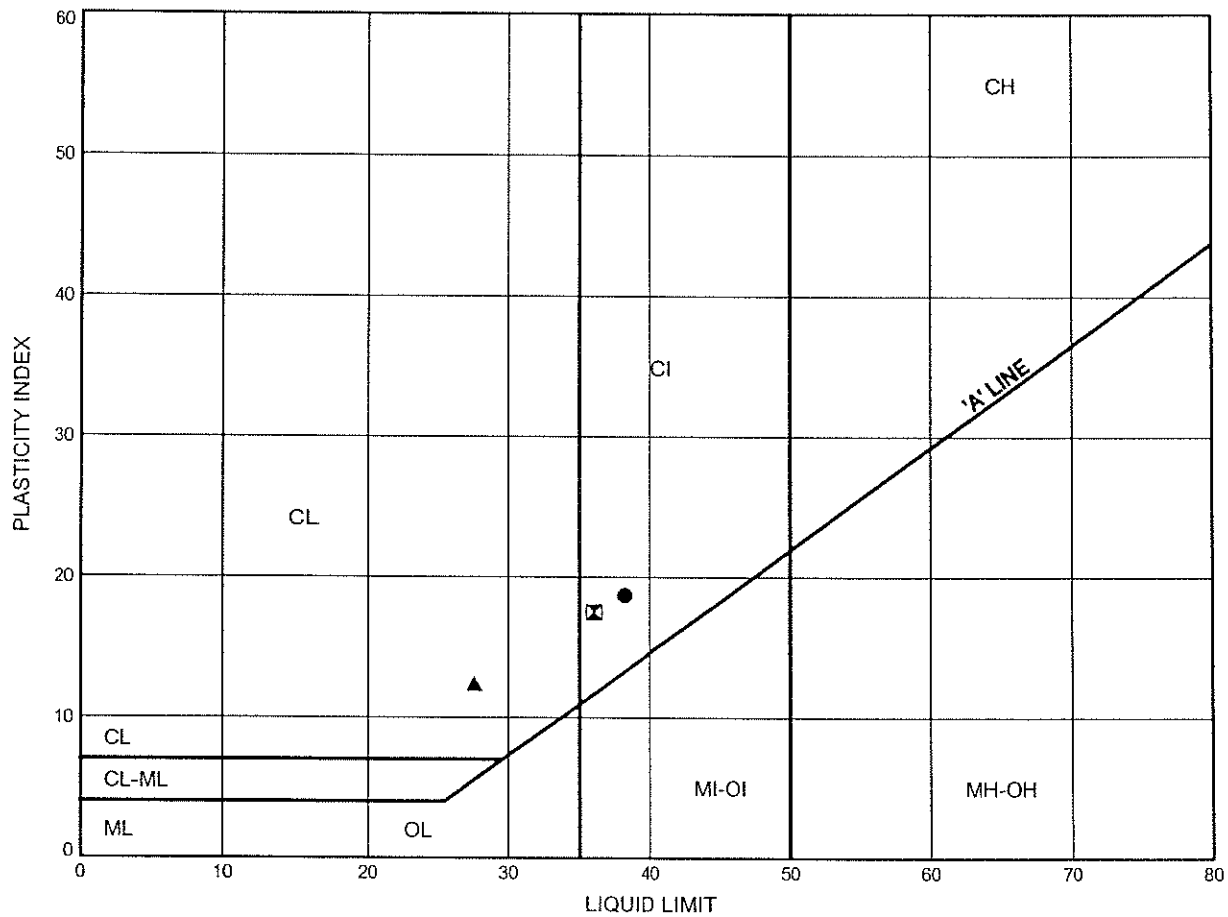


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Chkd. RPR

Hwy 401/410 to Credit River
ATTERBERG LIMITS TEST RESULTS

FIGURE C3

Silty Clay Fill



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	RW3-1	0.30	190.62
⊠	RW3-2	1.83	191.35
▲	RW4-5	3.35	188.76

THURBALT 2311.GPJ 17/12/07

Date ..December 2007....

Project ..2107-05-00..



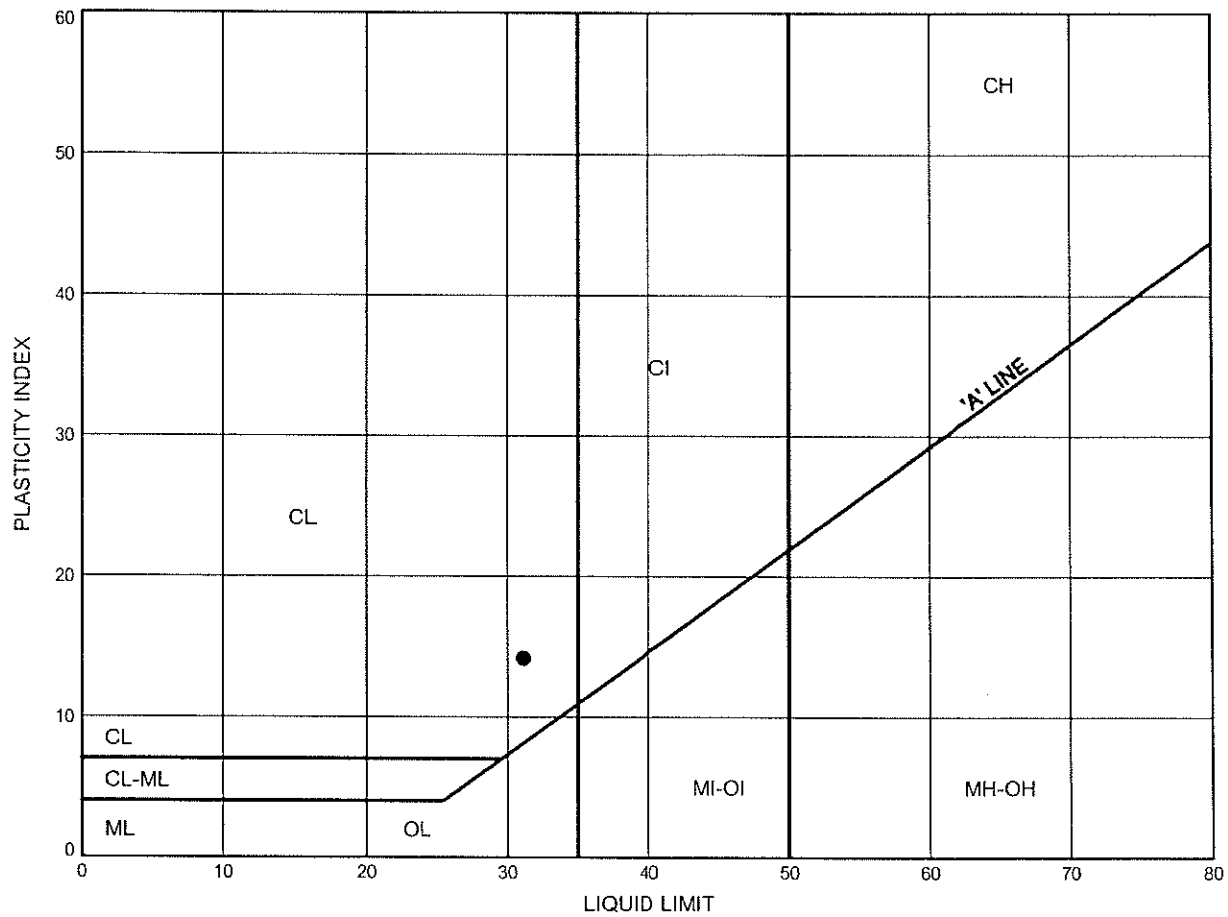
Prep'd ..MFA....

Chkd.RPR....

Hwy 401/410 to Credit River
ATTERBERG LIMITS TEST RESULTS

FIGURE C4

Silty Clay Till



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	RW4-2	0.30	186.53

Date December 2007

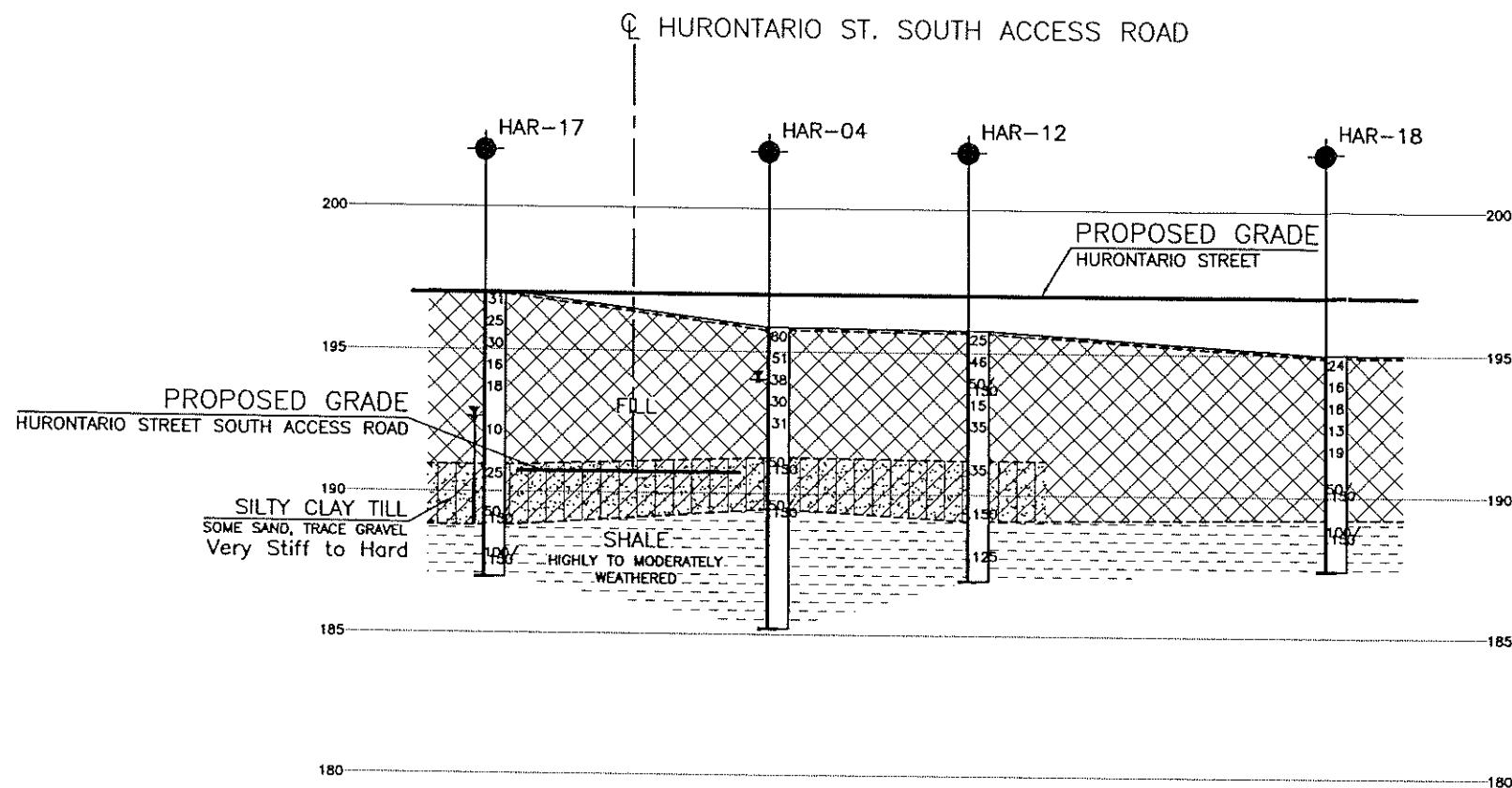
Project 2107-05-00



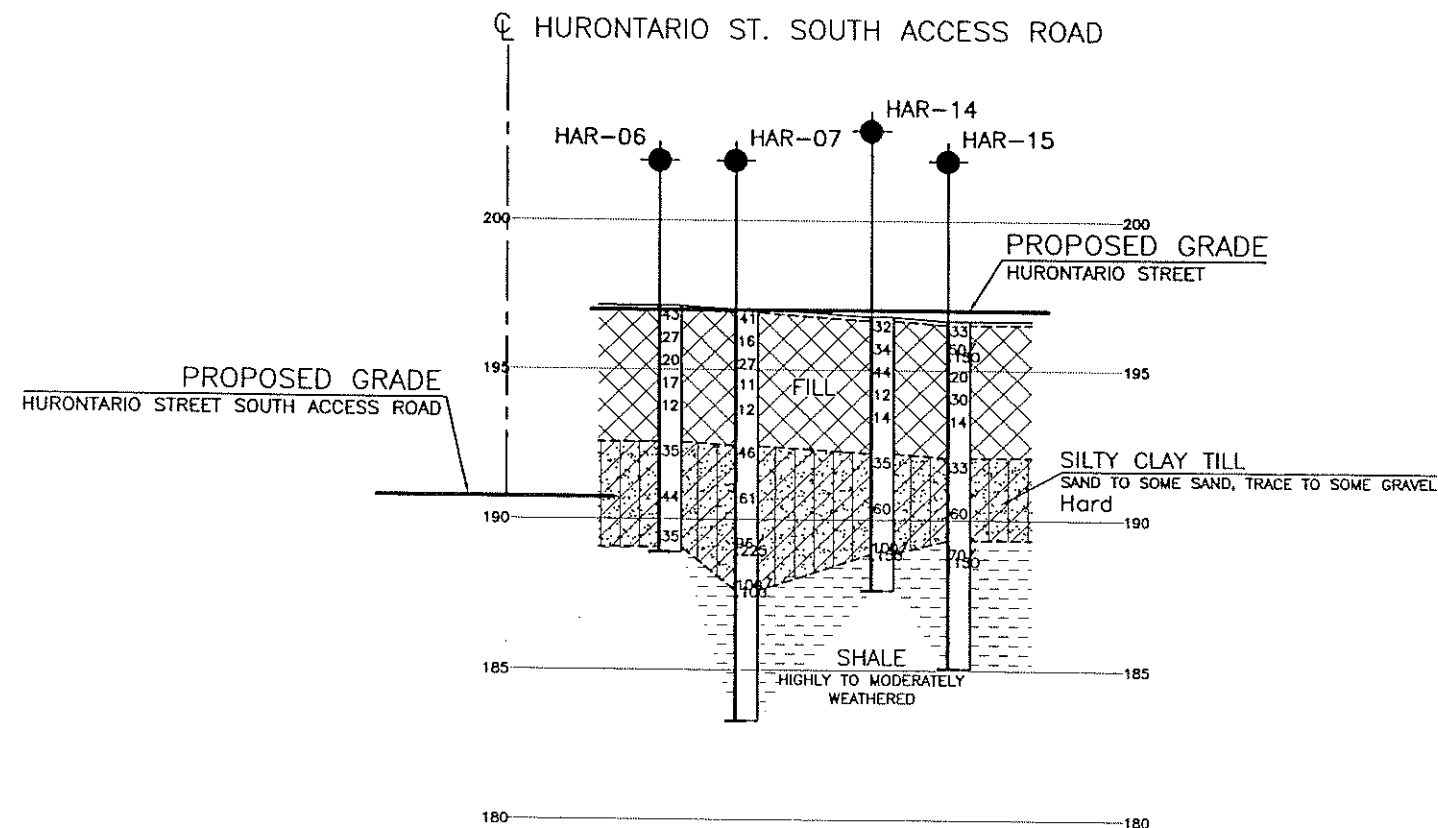
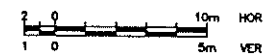
Prep'd MFA

Chkd. RPR

Appendix D
Borehole Locations and Soil Strata Drawing



SECTION A-A



SECTION B-B

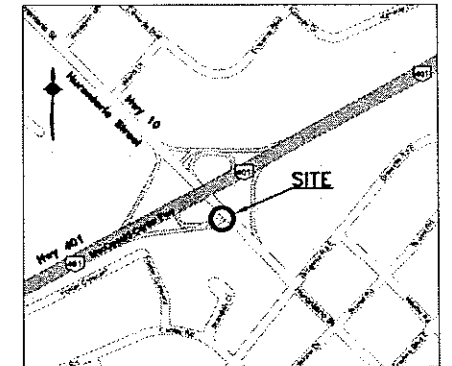


METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

HWY 401
SITE No 24-758
GWP No 2107-05-00






HURONTARIO STREET
SOUTH ACCESS ROAD
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET



KEYPLAN

LEGEND

	Borehole (Present Investigation, 2007)
	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

RW#	DATE	CLEANING	WORKING	DRAINING
RW3-1	190.9	4 832 020.6	289 930.7	HAR-01 192.1 4 832 072.0 290 010.5
RW3-2	193.2	4 832 0040.9	289 977.2	HAR-02 193.8 4 832 082.1 290 016.0
RW4-1	187.2	4 832 0017.4	289 808.4	HAR-03 193.7 4 832 080.6 290 021.6
RW4-2	186.8	4 832 0015.1	289 854.8	HAR-04 195.9 4 832 092.4 290 026.2
RW4-3	187.8	4 832 0007.3	289 904.3	HAR-05 196.7 4 832 098.2 290 039.0
RW4-4	189.9	4 832 016.0	289 955.6	HAR-06 197.2 4 832 110.7 290 044.3
RW4-5	192.1	4 832 0042.2	289 998.1	HAR-07 197.0 4 832 107.3 290 048.0
				HAR-08 196.5 4 832 118.9 290 057.0
				HAR-09 192.2 4 832 067.6 290 023.7
				HAR-10 193.7 4 832 078.0 290 031.5
				HAR-11 194.0 4 832 076.5 290 037.1
				HAR-12 195.8 4 832 086.3 290 039.7
				HAR-13 196.7 4 832 093.4 290 050.3
				HAR-14 196.8 4 832 101.3 290 054.6
				HAR-15 196.6 4 832 097.8 290 058.2
				HAR-16 196.1 4 832 110.1 290 065.9
				HAR-17 197.1 4 832 109.1 290 014.6
				HAR-18 195.0 4 832 069.3 290 058.1

-NOTES-

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

GEOCRES No.

[illegible]