

**FOUNDATION INVESTIGATION REPORT  
MUSKOKA ROAD OVERPASS NBL  
HIGHWAY 11 BURK'S FALLS TO SOUTH RIVER  
G.W.P. 759-93-00, W.P. 758-93-02, SITE: 44-420/1**

**Geocres Number: 31E - 257**

**Report to**

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**FOUNDATION INVESTIGATION REPORT**  
**MUSKOKA ROAD OVERPASS NBL**  
**HIGHWAY 11, BURK'S FALLS TO SOUTH RIVER**  
**ONTARIO**  
**G.W.P. 759-93-00, W.P. 758-93-02, SITE: 44-420/1**

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## **1 INTRODUCTION**

This report presents the factual findings obtained from a foundation investigation conducted at the proposed single-span Muskoka Road Overpass NBL structure on the proposed four-laning of Highway 11 in the Township of Strong, Ontario. A previous foundation investigation was carried out by Thurber at this site for a previous three-span structure design. The design of the structure was subsequently changed to single-span and additional boreholes were drilled to reflect these changes. The factual data from both investigations have been used in preparing this report. An earlier, preliminary report was prepared by Golder Associates and was also referenced in the preparation of this report.

The purpose of this investigation was to explore the subsurface conditions at the site and, based on the data obtained, to provide a borehole location plan, records of boreholes, stratigraphic profile and cross-sections, laboratory test results and a written description of the subsurface conditions. A model of the subsurface conditions was developed from the data obtained in the course of the present and previous investigations.

Thurber carried out the investigation as a sub-consultant to Marshall Macklin Monaghan, under the Ministry of Transportation Ontario (MTO) Agreement Number 5005-A-000188.

## **2 SITE DESCRIPTION**

The site is located south of the existing at grade intersection of Highway 11 and Muskoka Road in the Township of Strong. Bedrock outcrops and a thick cover of vegetation are evident on the west side of the existing Highway 11 and a swampy lowland area with occasional mature trees exists on the east side of the highway where a commercial building structure previously existed.

The east edge of the south abutment foundation encroaches into the existing Highway 11 embankment fill.

The general site area is located within the physiographic region known as the Canadian Shield, characterized by Pre-Cambrian bedrock typically occurring as rounded knobs and ridges where

exposed. Locally, however, the site lies in a gently rolling area with the bedrock obscured by glacio-fluvial soil deposits.

### **3 SITE INVESTIGATION AND FIELD TESTING**

The site investigation and field testing for this project were carried out between the period of November 15 to 16, 2005 for the present investigation and the periods of April 28 to May 03 and August 16 to 25, 2004 for the previous investigation. Six boreholes numbered 420-01, 420-09, 420-12, 420-15, 420-19 and 420-26 pertaining to the single-span structure and approach embankments were drilled to depths ranging from 3.0 m to 10.9 m. Twelve additional boreholes numbered 420-02, 420-06, 420-08, 420-13, 420-16, 420-18 and 420-20 to 25 were drilled in the previous investigation for the three-span structure design to depths ranging from 2.8 m to 11.6 m. The approximate locations of all of the boreholes are shown on the attached Borehole Locations and Soil Strata Drawing in Appendix D.

The borehole locations were marked in the field by surveyors from Marshall Macklin Monaghan Ltd. who also provided Thurber with the coordinates and geodetic elevations. Thurber obtained utility clearances prior to drilling.

A combination of hollow-stem auger drilling techniques and casing and washboring methods were used to advance the boreholes. Samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT) in the overburden soils. In some boreholes auger refusal was observed and diamond coring was required to extend some of these boreholes through cobbles and boulders and into bedrock. The boreholes at each abutment were advanced 2.2 m to 5.1 m into bedrock by NQ size diamond coring techniques.

Groundwater conditions in the open boreholes were observed throughout the drilling operations. At each abutment a standpipe piezometer consisting of 25 mm PVC pipe with a slotted screen was installed and enclosed in filter sand to permit longer term groundwater level monitoring. The locations and completion details of the piezometers are shown in Table 3.1. Additional piezometers were installed in boreholes outside of the foundation elements during the previous investigation. Details of these piezometers are shown on the Record of Borehole sheets in Appendix A. The boreholes in which no piezometers were installed generally caved upon removal of the augers or were grouted with bentonite.

**Table 3.1 – Piezometer Installation Details**

Piezometer Location	Piezometer Details	
	Tip Depth/ Elevation (m)	Completion Details
420-12 South Abutment	8.5/355.6	Piezometer with 1.5 m slotted screen installed with sand filter to 6.7 m, bentonite seal from 6.7 m to 5.8 m, grout from 5.8 m to 0.6 m and bentonite seal from 0.6 m to ground surface
420-15 North Abutment	7.7/357.5	Piezometer with 1.5 m slotted screen installed with sand filter to 5.9 m and bentonite seal from 5.9 m to ground surface.

All remaining boreholes were abandoned in accordance with Reg903, i.e. all boreholes deeper than 3 m were grouted using bentonite grout.

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

#### **4 LABORATORY TESTING**

The recovered soil samples were subjected to Visual Identification (VI) and to natural moisture content determination. The results of this testing are shown on the Record of Borehole sheets in Appendix A. Selected samples were also subjected to gradation analysis and the results of this testing program are shown on the Record of Borehole sheets in Appendix A and on the figures contained in Appendix B. The results of point load tests on rock cores retrieved from the boreholes are shown in Table B1 in Appendix B.

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

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

In general, the site is underlain by 2.7 m to 8.5 m of overburden soils overlying Pre-Cambrian bedrock. The overburden soils generally consist of topsoil and peat, sands and silts, gravel and sand and cobbles and boulders.

### **5.1 Topsoil and Peat**

Across the site 0.1 m to 1.0 m of topsoil was encountered that extends to elevations ranging from 365.5 m to 363.4 m. In Borehole 420-01 a 0.3 m thick layer of peat was encountered, extending to elevation 363.6 m.

The moisture content of samples of this topsoil ranged from 37% to 88% and a sample of the peat had a moisture content of 210%.

### **5.2 Granular Fill**

Boreholes 420-02 and 420-08 were drilled from the granular shoulder of the existing Highway 11. These two boreholes encountered a layer of granular fill that extends to depths ranging from 2.9 m to 3.0 m or to elevations ranging from 363.8 m to 363.7 m.

This fill can be divided into two zones. The upper zone consists of a 0.8 m to 2.4 m thick layer of gravelly sand and the lower zone consists of a 0.6 m to 2.1 m thick layer of sand with trace silt and trace gravel. Cobbles and boulders are inferred to exist within this deposit based on the resistance to augering during drilling and the blow count information obtained from SPT tests.

A sample from this deposit was subjected to a grain size distribution test and the results are presented in Figure B1.

Standard penetration tests conducted in this fill gave 'N' values ranging from 17 to more than 50 blows per 0.3 m penetration. Based on these results the deposit is considered to have a compact to very dense relative density.

The moisture content of samples from this stratum was approximately 2%.

Borehole 420-9 was drilled on the side slope of the existing Highway 11 embankment. This borehole encountered granular fill that extends to a depth of 1.5 m, or to elevation 364.0 m. The upper 0.9 m of this fill consisted of silt with some sand and topsoil. The lower 0.6 m of this fill consisted of sand and gravel with occasional cobbles.

A standard penetration test conducted in the sand and gravel fill gave an 'N' value of 17 blows per 0.3 m penetration indicating a compact relative density.

The moisture content of a sample from the sand and gravel fill was approximately 63%.

### **5.3 Silt**

At the north abutment, a layer of silt with trace sand and occasional rootlets underlies the topsoil. This material extends to depths ranging from 0.6 m to 1.2 m or an elevation of 363.9 m.

Standard penetration tests in this silt gave 'N' values from 4 to 9 blows per 0.3 m penetration indicating a loose relative density.

The moisture content of samples from this material ranged from 42% to 59%.

#### **5.4 Sand**

In the vicinity of the north abutment, the topsoil and silt layers are further underlain by a deposit of well graded sand containing trace to some silt, trace to some gravel and occasional cobbles. This layer extends to depths ranging from 1.4 m to 2.3 m or to elevations varying between 363.5 m and 362.2 m.

Two selected samples from this deposit were subjected to grain size distribution tests and the results are presented in Figure B2.

SPT 'N' values ranged from 11 to 70 blows for 0.3 m penetration but generally, most 'N' values ranged between 11 and 47 blows for 0.3 m penetration. Based on these results this layer is considered to have a generally compact to dense relative density with occasional very dense zones.

The moisture content of samples from this deposit ranged from 15% to 24%.

At the south abutment, the topsoil, granular fill and silt are underlain by a zone of sand and gravel to gravelly sand containing trace to some silt and occasional cobbles. This zone extends to depths ranging from 2.3 m to 4.6 m or to elevations of 361.8 m to 360.9 m.

One sample from this deposit was subjected to grain size distribution testing and the results are presented in Figure B2.

SPT 'N' values in this material ranged from 4 to 43 blows per 0.3 m penetration, but were generally between 39 and 43 blows per 0.3 m penetration, indicating a dense relative density with a loose zone.

The moisture content of this material ranged from 15% to 18%.

#### **5.5 Silt and Sand**

Below the sand described above, a layer of soil was encountered that ranged from a fine, uniform sand to silty sand. This soil contained trace gravel and trace clay. The layer was encountered across the site but was discontinuous at the north end of the site.

The sand and silt layer was encountered at depths ranging from 0.9 m to 2.3 m below ground surface. This deposit extended to depths ranging from 2.2 m (Elev. 363.3 m) to 7.6 m (Elev. 356.5 m).

Samples from this deposit were subjected to grain size distribution tests and the results are illustrated in Figures B3a, B3b, B4a and B4b. The results show a soil consisting of 0 to 3% gravel, 24 to 59% sand, 33 to 72% silt and 4 to 9% clay sized particles.

SPT 'N' values in this deposit ranged from 6 to more than 50 blows for 0.3 m penetration, but generally, most values ranged between 13 and more than 50 blows for 0.3 m

penetration indicating a compact to very dense relative density. Auger resistance and grinding during drilling indicated the presence of occasional cobbles and boulders.

The moisture content of samples from this deposit ranged from 10% to 23%.

## **5.6 Gravel and Sand**

A deposit of gravel and sand was encountered at depths ranging from 1.4 m to 7.6 m below ground surface. Cobbles and boulders were encountered throughout this deposit.

Most of the boreholes were advanced through this deposit and into bedrock at depths ranging from 2.7 to 8.5 m, corresponding to Elevation 362.8 to Elevation 356.6. The remaining boreholes, that were not advanced into bedrock, encountered auger refusal on assumed bedrock at similar elevations.

Selected samples from the gravel and sand matrix in this deposit were subjected to grain size distribution tests and the results are shown in Figure B5. The results show that the soil gradation is variable but generally consists of 42 to 48% gravel, 29 to 39% sand and 14 to 29% silt.

Standard Penetration tests in this deposit gave 'N' values ranging from 37 to more than 50 blows per 0.3 m penetration. Based on these results the deposit is considered to have a dense to very dense relative density.

The moisture content of samples from this stratum generally varies between 14% and 20%.

## **5.7 Bedrock**

The overburden soils described above are underlain by gneiss bedrock. Bedrock was proved by coring at the north and south abutments. Table 5.1 summarizes the bedrock depth and the elevations to the top of bedrock at the foundation elements.

**TABLE 5.1 – Depth to Bedrock at Foundation Elements**

Location	BH Number	Depth to Bedrock (m)	Top of Bedrock Elevation (m)
South Abutment	420-9	7.6	357.9
	420-12	7.8	356.3
North Abutment	420-15	4.9	360.3
	420-19	5.2	359.3

During the previous investigation, bedrock was cored at several other locations in the vicinity of the structure. The bedrock depth and the elevations to the top of bedrock are shown on the Record of Borehole sheets in Appendix A and on the "Borehole Locations and Soil Strata" drawing in Appendix D.

The gneiss bedrock is generally described as fresh to slightly weathered. Its colour is pink with black bands and occasional black blotches visible in most cores.



Core recovery in the bedrock was generally between 87% and 100%. The RQD values generally ranged from 63% to 100% indicating fair to excellent rock quality.

The Fracture Index (FI) of the rock, expressed as fractures per 0.3 m of core, was generally low ranging from 0 to less than 5. Fracture Indices greater than 5 were obtained in some core runs indicating the presence of rubble zones within the rock mass. Sub-vertical to vertical joints were encountered and they were mostly tight with little to no infilling or secondary weathering material.

The unconfined compressive strength of most of the rock cores is estimated to range between 63 and 142 MPa indicating a strong to very strong intact rock. Outside of the foundation elements, at Borehole 420-18 the estimated unconfined compressive strength of the rock cores ranged from 39 to 48 MPa and in run 3 of Borehole 420-06 an estimated unconfined compressive strength of 49 MPa was recorded indicating a moderately strong rock. These estimated rock strength values are based on point load tests that were conducted on rock cores recovered from the boreholes. A summary of the Point Load Test Results is presented in Table B1 in Appendix B.

## 5.8 Groundwater Conditions

A standpipe piezometer was installed at each foundation element in a selected borehole and water levels were measured on separate visits made after the completion of drilling. The water level readings at the foundation elements are presented in Table 5.2.

**Table 5.2: Water Level Measurements**

Date	BH 420-12		BH 420-15	
	Depth (m)	Elev. (m)	Depth (m)	Elev. (m)
November 17, 2005	0.3	363.8	0.6	364.6
November 18, 2005	0.3	363.8	0.5	364.7
November 21, 2005	0.1	364.0	0.4	364.8
November 23, 2005	0.1	364.0	0.4	364.8
November 28, 2005	0.1	364.0	0.6	364.6
November 29, 2005	0.1	364.0	0.5	364.7

Additional water level readings from the piezometers installed in the previous investigation are shown on the Record of Borehole sheets in Appendix A. Based on these observations, local groundwater levels exist at Elevations 363.8 m to 364.8 m. All groundwater observations at this site are short term and the levels are expected to fluctuate seasonally and after severe weather events.

## 6 MISCELLANEOUS

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

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

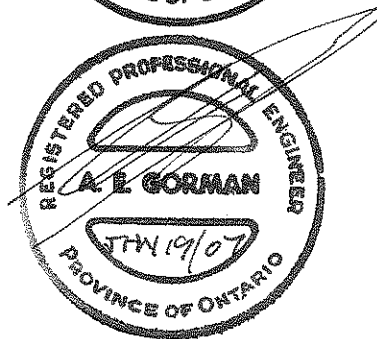
Mr. Alastair E. Gorman, P.Eng. and Mr. Mark E. Farrant, P.Eng. directed the field operations and prepared the report.

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

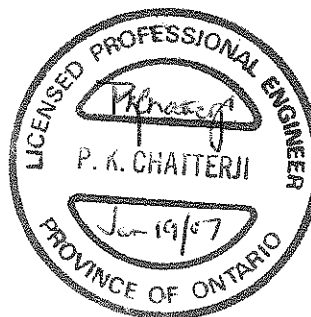
Thurber Engineering Ltd.  
Mark E. Farrant, P.Eng.,  
Geotechnical Engineer



Alastair E. Gorman, P.Eng.,  
Senior Foundations Engineer



Report Reviewed by:  
P.K. Chatterji, P.Eng.,  
Review Principal, Designated MTO Contact



## **Appendix A**

### **Record of Borehole Sheets**

# SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

## 1. TEXTURAL CLASSIFICATION OF SOILS

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

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

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

## 3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

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

NOTE: Hierarchy of Soil Strength Prediction

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

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

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

## 5. LEGEND FOR RECORDS OF BOREHOLES

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

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


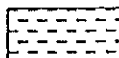



$\overline{Y}$  Water Level  
 $C_{pen}$  Shear Strength Determination by Pocket Penetrometer

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

# UNIFIED SOILS CLASSIFICATION

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

## EXPLANATION OF ROCK LOGGING TERMS

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

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

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

# RECORD OF BOREHOLE No 420-01

1 OF 1

METRIC

W.P. 758-93-02 LOCATION N 5 066 459.0 E 310 795.0 Muskoka Road Overpass (NBL) ORIGINATED BY GA  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM/SS  
 DATUM Geodetic DATE 17.08.04 - 17.08.04 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  Y  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
363.9								20 40 60 80 100	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	
0.0	PEAT, some rootlets								W <sub>P</sub>	W	W <sub>L</sub>	
363.6	Dark Brown		1	SS	4				○ UNCONFINED	+ FIELD VANE		
0.3	SAND and SILT, trace gravel								● QUICK TRIAXIAL	× LAB VANE		
	Dense to Very Dense		2	SS	41		363					
	Brown											
	Wet		3	SS	87/ .250		362					
			4	SS	90							
			5	SS	87/ .250		361					
359.9												
4.0	END OF BOREHOLE AT 3.96 m. AUGER REFUSAL AT 3.96 m. BOREHOLE OPEN TO 3.96 m. WATER ENTERING BOREHOLE FROM SURFACE AND WATER LEVEL AT 3.96 m UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.											

ONTMT4S 420MUSKOKA-1.GPJ 26/06/06

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

20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 420-02

1 OF 2

METRIC

W.P. 758-93-02 LOCATION N 5 066 478.0 E 310 787.0 Muskoka Road Overpass (NBL) ORIGINATED BY GA  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/NQ Coring COMPILED BY WM/SS  
 DATUM Geodetic DATE 25.08.04 - 25.08.04 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  Y  KN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)		
								20	40	60			80	100	20
366.7															
0.0	Gravelly SAND, some silt Compact Brown Dry (FILL)		1	SS	25										
			2	SS	21										
	Possible cobbles between 1.52 and 2.13 m		3	SS	21										
364.3			4	SS	50/ .125										
2.4	SAND, trace silt, trace gravel Very Dense Grey (FILL)														
363.7															
3.0	SAND and SILT, trace gravel Compact Brown Damp		5	SS	22										
363.1															
3.6	GRAVEL and SAND, trace silt, with cobbles and boulders Very Dense Brown Wet occasional cobbles or boulders between 3.66 and 4.27 m														
	possible boulders or cobbles between 5.18 and 6.10 m		6	SS	71										
	becoming sandy		7	SS	66										
	cobbles or boulders between 7.62 and 7.92 m		8	SS	50/ .125										
358.2															
8.5	GNEISS BEDROCK, fresh, massive, pink with subhorizontal black banding, very strong														
	Horizontal joints at 8.6 m, 9.0 m, 9.2 m, 9.8 m, 10.4 m and 10.7 m		1	RUN											

Continued Next Page

+ 3, x 3. Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No 420-02

2 OF 2

METRIC

W.P. 758-93-02 LOCATION N 5 066 478.0 E 310 787.0 Muskoka Road Overpass (NBL) ORIGINATED BY GA  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/NQ Coring COMPILED BY WM/SS  
 DATUM Geodetic DATE 25.08.04 - 25.08.04 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100
								○ UNCONFINED + FIELD VANE	○ UNCONFINED + FIELD VANE	○ UNCONFINED + FIELD VANE	○ UNCONFINED + FIELD VANE	○ UNCONFINED + FIELD VANE	○ UNCONFINED + FIELD VANE	○ UNCONFINED + FIELD VANE	○ UNCONFINED + FIELD VANE	○ UNCONFINED + FIELD VANE	○ UNCONFINED + FIELD VANE
								● QUICK TRIAXIAL × LAB VANE	● QUICK TRIAXIAL × LAB VANE	● QUICK TRIAXIAL × LAB VANE	● QUICK TRIAXIAL × LAB VANE	● QUICK TRIAXIAL × LAB VANE	● QUICK TRIAXIAL × LAB VANE	● QUICK TRIAXIAL × LAB VANE	● QUICK TRIAXIAL × LAB VANE	● QUICK TRIAXIAL × LAB VANE	● QUICK TRIAXIAL × LAB VANE
								20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100
355.1			2	RUN			356									0	RUN 2#
11.6	END OF BOREHOLE AT 11.58 m. BOREHOLE FILLED WITH DRILL WATER AND OPEN TO 11.58m. BOREHOLE GROUTED TO SURFACE.															0	TCR=100%, SCR=100%, RQD=100%, UCS=100MPa
																0	
																0	
																0	
																0	
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# RECORD OF BOREHOLE No 420-06

1 OF 2

METRIC

W.P. 758-93-02 LOCATION N 5 066 466.8 E 310 810.5 Muskoka Road Overpass (NBL) ORIGINATED BY GA  
HWY 11 BOREHOLE TYPE Hollow Stem Augers/NQ Coring COMPILED BY WM/SS  
DATUM Geodetic DATE 16.08.04 - 17.08.04 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	
364.2	TOPSOIL Black						364	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				
0.0								20 40 60 80 100				
363.7												
0.5	SAND and SILT, trace gravel, occasional cobbles Compact to Very Dense Grey Wet		1	SS	28		363					0 51 44 6
			2	SS	50		362					
361.6			3	SS	52		361					
2.6	GRAVEL and SAND, trace silt, with cobbles and boulders Very Dense Brown Wet		4	SS	37		360					
							359					
	BOULDER		5	SS	50/ .125		358					
							357					
	Auger refusal at 4.8 m, borehole extended by coring and wash boring		6	SS	50/ .125		356					
357.8							355					
6.4	GNEISS BEDROCK, fresh, massive pink with horizontal black banding, very strong to strong, moderately strong from 7.9 m to 9.0 m		1	RUN								RUN 1# TCR=100%, SCR=95%, RQD=87%, UCS=125MPa
			2	RUN								RUN 2# TCR=100%, SCR=83%, RQD=83%, UCS=49MPa
			3	RUN								RUN 3# TCR=100%, SCR=100%, RQD=100%, UCS=96MPa
	Horizontal joints at 9.1 m, 9.9 m, 10 m,											

Continued Next Page

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

## METRIC

+ 3, x 3: Numbers refer to Sensitivity

## METRIC

SOIL PROFILE			SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT  γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)						
366.7 0.0	Gravelly SAND, some silt Compact Brown Dry (FILL)		1	SS	29								GR SA SI C	
365.9 0.8	SAND, trace silt, trace gravel Dense to Compact Brown Dry (FILL)		2	SS	37									
			3	SS	17									
	Sampler refusal and resistance to augering at 2.4 m. Possible cobbles and/or boulders		4	SS	50/ .150									
363.8 2.9	SILT and SAND, trace clay, occasional iron oxide staining Compact to Dense Brown Wet		5	SS	21									0 29 61
			6	SS	30									
360.6 6.1	GRAVEL and SAND, trace silt, with cobbles and boulders Very Dense Brown Wet boulders and cobbles between 6.55 and 7.32 m		7	SS	96									FI 1 >5 1 0 0 0 0 0
359.4 7.3	GNEISS BEDROCK, fresh to slightly weathered, massive, strong to very strong, pink with black banding Subhorizontal to horizontal joints at 7.4m, 7.6 m and 8.7 m		1	RUN										
		2	RUN									RUN 2# TCR=100%, SCR=100%, RQD=100%, UCS=98MP		

(%) STRAIN AT FAILURE

ONTMT4S 420MUSKOKA-I.GPJ 26/06/06

# RECORD OF BOREHOLE No 420-08

2 OF 2

METRIC

W.P. 758-93-02 LOCATION N 5 066 491.0 E 310 795.0 Muskoka Road Overpass (NBL) ORIGINATED BY GA  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/NQ Coring COMPILED BY WM/SS  
 DATUM Geodetic DATE 25.08.04 - 25.08.04 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								20	40	60	80	100					
								○ UNCONFINED	+ FIELD VANE								
								● QUICK TRIAXIAL	× LAB VANE								
								20	40	60	80	100					
356.3																0	
10.4	END OF BOREHOLE AT 10.36 m. BOREHOLE FILLED WITH DRILL WATER AND OPEN TO 10.36 m. BOREHOLE GROUTED TO SURFACE.						356										

# RECORD OF BOREHOLE No 420-09

1 OF 2

METRIC

W.P. 758-93-02 LOCATION N 5 066 487.6 E 310 800.3 Muskoka Road Overpass NBL ORIGINATED BY GA  
HWY 11 BOREHOLE TYPE Hollow Stem Augers/NW Casing/NQ Coring COMPILED BY WM  
DATUM Geodetic DATE 15.11.05 - 15.11.05 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								20 40 60 80 100										
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE										
365.5																		
0.0	SILT, some sand, some topsoil, trace rootlets and wood fragment Brown (FILL)					▽	365											
364.6																		
0.9	SAND and GRAVEL, occasional cobbles Brown (FILL)		1	SS	17													
364.0																		
1.5	Sandy SILT, trace clay Loose to Compact Grey Moist to Wet		2	SS	6			364										
			3	SS	24			363							0 24 72 4			
362.6																		
2.9	SAND and GRAVEL, occasional cobbles Dense Grey to Brown Wet		4	SS	43			362										
							361											
360.9																		
4.6	Silty SAND, trace clay, trace gravel, occasional cobbles Very Dense Brown Wet		5	SS	74		360							2 59 30 9				
			6	SS	74/ 200		359											
357.9							358											
7.6	GNEISS BEDROCK Fresh to slightly weathered, thinly bedded, pink, with black banding, very strong to strong, rubble zone from 7.8m to 8.2m, subvertical joint from 9.3m to 9.6m		1	RUN			357							RUN 1# TCR=100%, SCR=83%, RQD=63%, UCS=77MPa				
							356							RUN 2# TCR=100%, SCR=100%, RQD=100%, UCS=85MPa				
			2	RUN														

Continued Next Page

Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

ONTMT4S 420MUSKOKA-I.GPJ 26/09/06

# RECORD OF BOREHOLE No 420-09

2 OF 2

METRIC

W.P. 758-93-02 LOCATION N 5 066 487.6 E 310 800.3 Muskoka Road Overpass NBL ORIGINATED BY GA  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/NW Casing/NQ Coring COMPILED BY WM  
 DATUM Geodetic DATE 15.11.05 - 15.11.05 CHECKED BY AEG

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT   NATURAL MOISTURE CONTENT   LIQUID LIMIT			UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR   SA   SI   CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED   + FIELD VANE ● QUICK TRIAXIAL   × LAB VANE					WATER CONTENT (%) w <sub>p</sub> w   w <sub>L</sub>				
							20	40	60	80	100						
354.8																	
10.7	END OF BOREHOLE AT 10.67m. BOREHOLE OPEN TO BOTTOM AND WATER LEVEL AT 1.52m UPON COMPLETION. BOREHOLE GROUTED WITH BENTONITE TO SURFACE.																

ONTMT4S 420MUSKOKA-I.GPJ 26/06/06

## METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT			UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100				W <sub>P</sub>			W	W <sub>L</sub>
								SHEAR STRENGTH kPa								
							<input type="radio"/> UNCONFINED <input checked="" type="radio"/> QUICK TRIAXIAL	<input type="radio"/> FIELD VANE <input checked="" type="radio"/> LAB VANE		WATER CONTENT (%)						
							20 40 60 80 100			20 40 60						

0.0	0.1	TOPSOIL (75mm)	1	SS	4	364																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			</
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+ 3, x 3: Numbers refer to Sensitivity



# RECORD OF BOREHOLE No 420-12

2 OF 2

METRIC

W.P. 758-93-02 LOCATION N 5 066 487.9 E 310 811.4 Muskoka Road Overpass NBL ORIGINATED BY GA  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/NW Casing/NQ Coring COMPILED BY WM  
 DATUM Geodetic DATE 16.11.05 - 16.11.05 CHECKED BY AEG

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			20 40 60 80 100	20 40 60 80 100					
353.2			2	RUN			354						0	GR SA SI CL UCS=101MPa
10.9	END OF BOREHOLE AT 10.87m. BOREHOLE OPEN TO BOTTOM AND WATER LEVEL AT 0.76m UPON COMPLETION. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) Nov. 17, 05 0.28 Nov. 18, 05 0.25 Nov. 21, 05 0.10 Nov. 23, 05 0.10 Nov. 28, 05 0.10 Nov. 29, 05 0.10													

ONTMT4S 420MUSKOKA-LGPJ 26/06/05

# RECORD OF BOREHOLE No 420-13

1 OF 2

METRIC

W.P. 758-93-02 LOCATION N 5 066 482.5 E 310 815.4 Muskoka Road Overpass (NBL) ORIGINATED BY SL  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS  
 DATUM Geodetic DATE 03.05.04 - 03.05.04 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W <sub>p</sub> W W <sub>L</sub>	20 40 60	GR SA SI CL		
364.3	0.0	TOPSOIL Black					364							
363.4	0.9	SAND and SILT, trace gravel, trace clay, occasional cobbles	1	SS	46		363							
		Dense to Very Dense Grey Wet	2	SS	44		362							
			3	SS	35		361							
			4	SS	56		360							
360.7	3.6	GRAVEL and SAND, silty, with cobbles and boulders Very Dense inferred Grey Wet					359							
			5	SS	60/		358							
					150		357							
356.6	7.7	auger refusal at 7.6m. GNEISS, BEDROCK Fresh to slightly weathered, massive, strong to very strong, pink with black blotches.	1	RUN			356							
			2	RUN			355							

Continued Next Page

+ 3, x 3. Numbers refer to  
Sensitivity

20  
15 5  
10 (%) STRAIN AT FAILURE

ONTMT4S 420MUSKOKA-1.GPJ 26/06/06

# RECORD OF BOREHOLE No 420-13

2 OF 2

METRIC

W.P. 758-93-02 LOCATION N 5 066 482.5 E 310 815.4 Muskoka Road Overpass (NBL) ORIGINATED BY SL  
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS  
DATUM Geodetic DATE 03.05.04 - 03.05.04 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)									
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)								
							20 40 60 80 100	20 40 60 80 100	20 40 60														
353.5			3	RUN									1										
10.7	END OF BOREHOLE AT 10.74m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.												1										
	<p>WATER LEVEL READINGS:</p> <table border="1"> <thead> <tr> <th>DATE</th> <th>DEPTH (m)</th> <th>ELEVATION (m)</th> </tr> </thead> <tbody> <tr> <td>04/05/04</td> <td>0.3</td> <td>364.0</td> </tr> <tr> <td>18/06/04</td> <td>0.5</td> <td>363.8</td> </tr> </tbody> </table>	DATE	DEPTH (m)	ELEVATION (m)	04/05/04	0.3	364.0	18/06/04	0.5	363.8												3	
DATE	DEPTH (m)	ELEVATION (m)																					
04/05/04	0.3	364.0																					
18/06/04	0.5	363.8																					

ONTM74S 420MUSKOKA-I.GPJ 26/06/06

# RECORD OF BOREHOLE No 420-15

1 OF 1

METRIC

W.P. 758-93-02 LOCATION N 5 066 516.4 E 310 829.8 Muskoka Road Overpass NBL ORIGINATED BY GA  
HWY 11 BOREHOLE TYPE Hollow Stem Augers/NW Casing/NQ Coring COMPILED BY WM  
DATUM Geodetic DATE 16.11.05 - 17.11.05 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	
365.2												
0.0	TOPSOIL (75mm)											
0.2	SILT, trace sand, occasional rootlets Loose Brown Wet		1	SS	9		365					
363.9			2	SS	9							
1.2	SAND, some gravel, trace silt Brown Wet						364					
363.4												
1.7	Silty SAND to SAND and SILT, trace clay, trace gravel, occasional cobbles Dense to Very Dense Brown Wet		3	SS	38		363					2 72 25 (SI+CL)
			4	SS	51							
			5	SS	76		362					1 50 44 5
360.6							361					
360.4	BOULDER		6	SS	50/							
360.3	GRAVEL and SAND				.000		360					
4.9	GNEISS BEDROCK Fresh to slightly weathered, thinly bedded, pink, with black banding, very strong to strong		1	RUN			359					RUN 1# TCR=100%, SCR=97%, RQD=87%, UCS=123MPa
			2	RUN			358					RUN 2# TCR=100%, SCR=100%, RQD=100%, UCS=95MPa
357.4												
7.7	END OF BOREHOLE AT 7.72m. BOREHOLE OPEN TO BOTTOM AND WATER LEVEL AT 0.46m UPON COMPLETION. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) Nov. 17, 05 0.56 Nov. 18, 05 0.52 Nov. 21, 05 0.42 Nov. 23, 05 0.41 Nov. 28, 05 0.58 Nov. 29, 05 0.53											









ONTMT4S 420MUSKOKA-I.GPJ 26/06/06

# RECORD OF BOREHOLE No 420-16

1 OF 1

METRIC

W.P. 758-93-02 LOCATION N 5 066 509.8 E 310 828.6 Muskoka Road Overpass (NBL) ORIGINATED BY SL  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS  
 DATUM Geodetic DATE 29.04.04 - 29.04.04 CHECKED BY AEG

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 <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)
								20 40 60 80 100	20 40 60				
365.0													
0.0 364.7	TOPSOIL (250mm)						365						
0.3 363.5	SAND, trace to some silt Dense Brown Moist to Wet		1	SS	32		364						
1.4 362.7	SILT and SAND, trace clay Compact Brown Wet		2	SS	22		363					0 38 57 5	
2.2 360.8	GRAVEL and SAND, silty, occasional cobbles and boulders below 3.7 m Very Dense Brown Wet		3	SS	66		362					42 29 29 (SI+CL)	
	auger refusal at 3.73m.		4	SS	60		361						
4.1 357.6	GNEISS (BEDROCK) Fresh to slightly weathered, massive, pink with black banding, strong to very strong.  Subvertical joint at 4.9m Vertical joint at 5.0m  Rubble zone from 5.7m to 5.9m		1	RUN			360				FI 0 1 2	RUN 1# TCR=100%, SCR=82%, RQD=74%, UCS=115MPa	
			2	RUN			359				1 0 >5	RUN 2# TCR=96%, SCR=87%, RQD=75%, UCS=114MPa	
			3	RUN			358				0 1 1	RUN 3# TCR=100%, SCR=100%, RQD=100%, UCS=63MPa	
7.4	END OF BOREHOLE AT 7.37m. BOREHOLE CAVED AT 3.3m ON COMPLETION OF CORING.												

ONTM74S 420MUSKOKA-1.GPJ 26/06/06

# RECORD OF BOREHOLE No 420-18

1 OF 1

METRIC

W.P. 758-93-02 LOCATION N 5 066 499.8 E 310 831.9 Muskoka Road Overpass (NBL) ORIGINATED BY SL  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS  
 DATUM Geodetic DATE 29.04.04 - 29.04.04 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
364.4														
0.0	TOPSOIL													
363.6														
0.8	SAND, trace to some silt Compact Brown Wet		1	SS	29									
			2	SS	20									
362.2														
2.2	SILT and SAND, trace gravel, trace clay Compact Brown Wet		3	SS	17									1 36 57 5
361.4														
3.0	GRAVEL and SAND, silty, with cobbles and boulders		4	SS	50									
			1	RUN	.051									
			2	RUN										
359.6														
4.9	GNEISS, BEDROCK Fresh, massive, pink with subhorizontal black banding, moderately strong		3	RUN										RUN 3# TCR=87%, SCR=82%, RQD=77%, UCS=39MPa
	Subvertical and vertical joints at 5.7m and 5.8m.													
			4	RUN										RUN 4# TCR=100%, SCR=100%, RQD=100%, UCS=48MPa
357.3														
7.1	END OF BOREHOLE AT 7.13 m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.													
WATER LEVEL READINGS: DATE DEPTH ELEVATION (m) (m) 30/04/04 0 364.4 18/05/04 0 364.4														

ONTMT4S 420MUSKOKA-I.GPJ 25/06/06

# RECORD OF BOREHOLE No 420-19

1 OF 1

METRIC

W.P. 758-93-02 LOCATION N 5 066 504.7 E 310 837.8 Muskoka Road Overpass NBL ORIGINATED BY GA  
HWY 11 BOREHOLE TYPE Hollow Stem Augers/NW Casing/NQ Coring COMPILED BY WM  
DATUM Geodetic DATE 15.11.05 - 15.11.05 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  Y  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								WATER CONTENT (%)					
364.5							20 40 60 80 100	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT			
0.0	SILT, trace sand, occasional rootlets Loose Brown Moist to Wet		1	SS	4								
363.9													
0.6	SAND, fine to medium grained, some silt Very Dense to Dense Brown Wet		2	SS	70								
			3	SS	47								
362.2													
2.3	Sandy SILT, trace clay Compact to Dense Brown Wet		4	SS	27								
			5	SS	37								
360.9													
360.7	BOULDER												
3.9	GRAVEL and SAND, occasional cobbles												
			6	SS	50/ .000								
359.3													
5.2	GNEISS BEDROCK Fresh to slightly weathered, thinly bedded, pink, with black banding, strong, subvertical joints at 7.06m to 7.14m, 7.37m to 7.67m, vertical joint at 7.67m to 7.90m, some sand at joint surfaces		1	RUN									
			2	RUN									
356.3													
8.2	END OF BOREHOLE AT 8.20m. BOREHOLE OPEN TO BOTTOM AND WATER LEVEL AT 0.61m UPON COMPLETION. BOREHOLE GROUTED WITH BENTONITE TO SURFACE.												

ONTMT4S 420MUSKOKA-1GPJ 26/06/06

# RECORD OF BOREHOLE No 420-20

1 OF 1

METRIC

W.P. 758-93-02 LOCATION N 5 066 520.5 E 310 833.2 Muskoka Road Overpass (NBL) ORIGINATED BY SL  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS  
 DATUM Geodetic DATE 30.04.04 - 30.04.04 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
365.2														
0.0 365.0	TOPSOIL (250mm)													
0.3	SAND, some silt, some gravel Compact Brown Wet		1	SS	19		365							20 65 14 (SI+CL)
	Dense		2	SS	38		364							
363.0														
2.2	GRAVEL and SAND, some silt, occasional cobbles Dense Brown Wet		3	SS	47		363							48 39 14 (SI+CL)
362.3														
2.9	END OF BOREHOLE AT 2.95m. AUGER REFUSAL AT 2.95m ON PROBABLE BEDROCK OR BOULDERS. WATER LEVEL AT 1.0m AND HOLE CAVED AT 1.1m ON COMPLETION.													

ONTMT4S 420MUSKOKA-I.GPJ 26/06/06

+ 3 , × 3 : Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No 420-21

1 OF 1

METRIC

W.P. 758-93-02 LOCATION N 5 066 524.3 E 310 836.5 Muskoka Road Overpass (NBL) ORIGINATED BY SL  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS  
 DATUM Geodetic DATE 28.04.04 - 28.04.04 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE							
								● QUICK TRIAXIAL	× LAB VANE							
20	40	60	80	100	20	40	60									
365.5	0.0	TOPSOIL, mixed with silt and sand													GR SA SI CL	
364.6	1.0	SAND, trace silt Loose Brown Moist	1	SS	8											
364.0	1.5	GRAVEL and SAND, some silt, occasional cobbles and boulders Very Dense Brown Wet	2	SS	50/ .076											
362.8	2.7	AUGER REFUSAL AT 2.82 m. GNEISS, BEDROCK Fresh to slightly weathered, massive, pink with subhorizontal black banding, strong Vertical to subvertical joints at 3.2m, 4.2m, 4.3m and 5.4m to 5.9m Rubble zone from 3.2m to 3.3m	3	SS	84/ .280											
			1	RUN												
			2	RUN												
			3	RUN												
359.7	5.9	END OF BOREHOLE AT 5.87m. BOREHOLE FILLED WITH DRILL WATER UPON COMPLETION OF CORING.														





ONTMT4S 420MUSKOKA-I.GPJ 26/05/06

# RECORD OF BOREHOLE No 420-22

1 OF 1

METRIC

W.P. 758-93-02 LOCATION N 5 066 521.3 E 310 839.7 Muskoka Road Overpass (NBL) ORIGINATED BY SL  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS  
 DATUM Geodetic DATE 30.04.04 - 30.04.04 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
365.5 0.0	TOPSOIL							<div>20 40 60 80 100</div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div> <div>20 40 60 80 100</div>				<div>PLASTIC LIMIT w<sub>p</sub></div> <div>NATURAL MOISTURE CONTENT w</div> <div>LIQUID LIMIT w<sub>L</sub></div> <div>WATER CONTENT (%)</div> <div>20 40 60</div>		
365.0 0.5	SAND, trace to some silt, occasional cobbles Very Dense Brown Moist		1	SS	50/ .076		365							
364.1 1.4	SAND and SILT Dense Grey/ Brown Wet		2	SS	34		364							0 52 48 (SI+CL)
363.3 2.2	GRAVEL and SAND, silty, occasional cobbles and boulders Very Dense Grey Wet		3	SS	66		363							
362.7 2.8	END OF BOREHOLE AT 2.82m. AUGER REFUSAL AT 2.82m ON PROBABLE BEDROCK OR BOULDERS. WATER LEVEL AT 1.7m AND HOLE CAVED AT 2.3m ON COMPLETION.													

ONTMT4S 420MUSKOKA-I.GPJ 26/06/06

# RECORD OF BOREHOLE No 420-23

1 OF 1

METRIC

W.P. 758-93-02 LOCATION N 5 066 514.9 E 310 839.3 Muskoka Road Overpass (NBL) ORIGINATED BY SL  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS  
 DATUM Geodetic DATE 30.04.04 - 30.04.04 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
365.4														
0.0	TOPSOIL													
364.5														
0.9	SAND, trace to some silt Compact Brown Wet		1	SS	11									
364.0														
1.4	SILT and SAND, trace gravel, trace clay Very Dense Grey Moist		2	SS	52									3 38 54 6
363.2														
2.2	Inferred GRAVEL and SAND, silty, occasional cobbles and boulders Very Dense		3	SS	50/ .152									
362.2														
			4	SS	50/ .127									
3.2	END OF BOREHOLE AT 3.20m. AUGER REFUSAL AT 3.20m ON PROBABLE BEDROCK OR BOULDERS. WATER LEVEL AT 1.8m AND HOLE CAVED AT 2.2m ON COMPLETION.													

# RECORD OF BOREHOLE No 420-24

1 OF 1

METRIC

W.P. 758-93-02 LOCATION N 5 066 511.3 E 310 843.1 Muskoka Road Overpass (NBL) ORIGINATED BY SL  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS  
 DATUM Geodetic DATE 29.04.04 - 29.04.04 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
365.2 0.0	TOPSOIL													
364.8 0.4	SAND, trace to some silt, trace gravel Dense Brown Moist to Wet		1	SS	31									
363.5 1.7	GRAVEL and SAND, silty, with cobbles and boulders Very Dense inferred Brown Wet		2	SS	50/ .100									
361.5 3.7	GNEISS (BEDROCK) Fresh, massive, strong to very strong, pink with subhorizontal black banding		1	RUN										
			2A	RUN										
			2B	RUN										
359.1 6.1	END OF BOREHOLE AT 6.12m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEVATION (m) 30/04/04 0.6 364.6 18/06/04 0.9 364.3		3	RUN										

+ 3, x 3: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 420-25

1 OF 1

METRIC

W.P. 758-93-02 LOCATION N 5 066 515.2 E 310 846.2 Muskoka Road Overpass (NBL) ORIGINATED BY SL  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS  
 DATUM Geodetic DATE 30.04.04 - 30.04.04 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
365.6														
0.0	TOPSOIL													
365.2														
0.4	SAND, trace to some silt Dense Brown Moist		1	SS	42		365							
364.1														
1.4	GRAVEL and SAND, silty, with cobbles and boulders Very Dense Brown Wet		2	SS	50/ .076		364							
			3	SS	50/ .051		363							
362.6														
3.0	END OF BOREHOLE AT 3.0m. AUGER REFUSAL AT 3.0m ON PROBABLE BEDROCK OR BOULDERS. WATER LEVEL AT 2.1m AND HOLE CAVED AT 2.5m ON COMPLETION.													

ONTMT4S 420MUSKOKA-1.GPJ 26/06/06

# RECORD OF BOREHOLE No 420-26

1 OF 1

METRIC

W.P. 758-93-02 LOCATION N 5 066 529.2 E 310 849.5 Muskoka Road Overpass (NBL) ORIGINATED BY SL  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS  
 DATUM Geodetic DATE 28.04.04 - 28.04.04 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
365.8								SHEAR STRENGTH kPa						
0.0	TOPSOIL							○ UNCONFINED + FIELD VANE						
365.5								● QUICK TRIAXIAL × LAB VANE						
0.3	SAND, trace to some silt Loose to Compact Brown Wet		1	SS	9		365							
			2	SS	11		364							
363.6														
2.2	GRAVEL and SAND Compact Brown Wet		3	SS	13									11 58 31 (SH+CL)
362.8							363							
3.0	END OF BOREHOLE AT 3.0m. AUGER REFUSAL AT 3.0m ON PROBABLE BEDROCK OR BOULDERS. WATER LEVEL AT 1.1m AND HOLE CAVED AT 1.4m ON COMPLETION.													

+ 3, × 3: Numbers refer to  
Sensitivity

20  
15 5  
10 (%) STRAIN AT FAILURE

## **Appendix B**

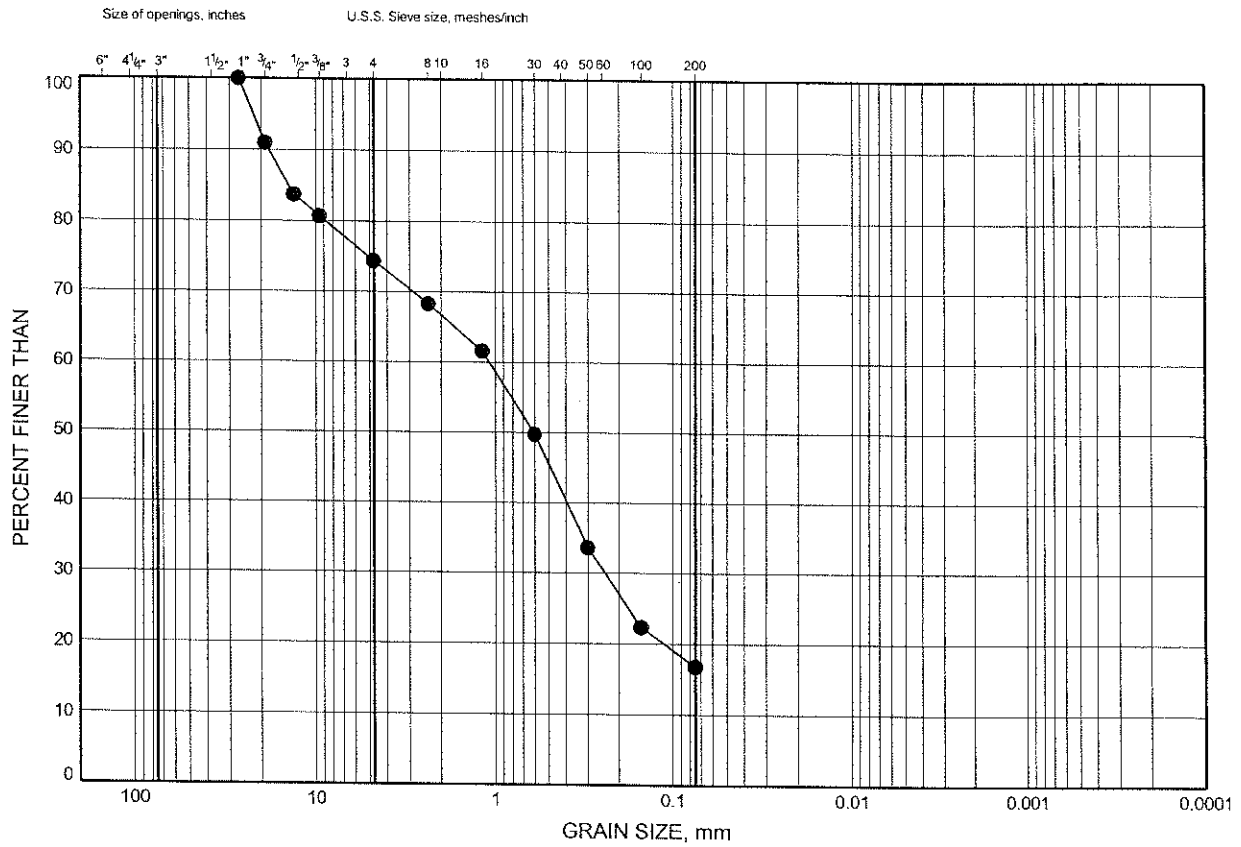
### **Laboratory Test Results**

# Hwy 11 Four Laning

## GRAIN SIZE DISTRIBUTION

FIGURE B1

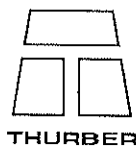
### FILL



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	420-02	1.07	365.63

Date June 2006  
Project 759-93-00



Prep'd JHL  
Chkd. MEF

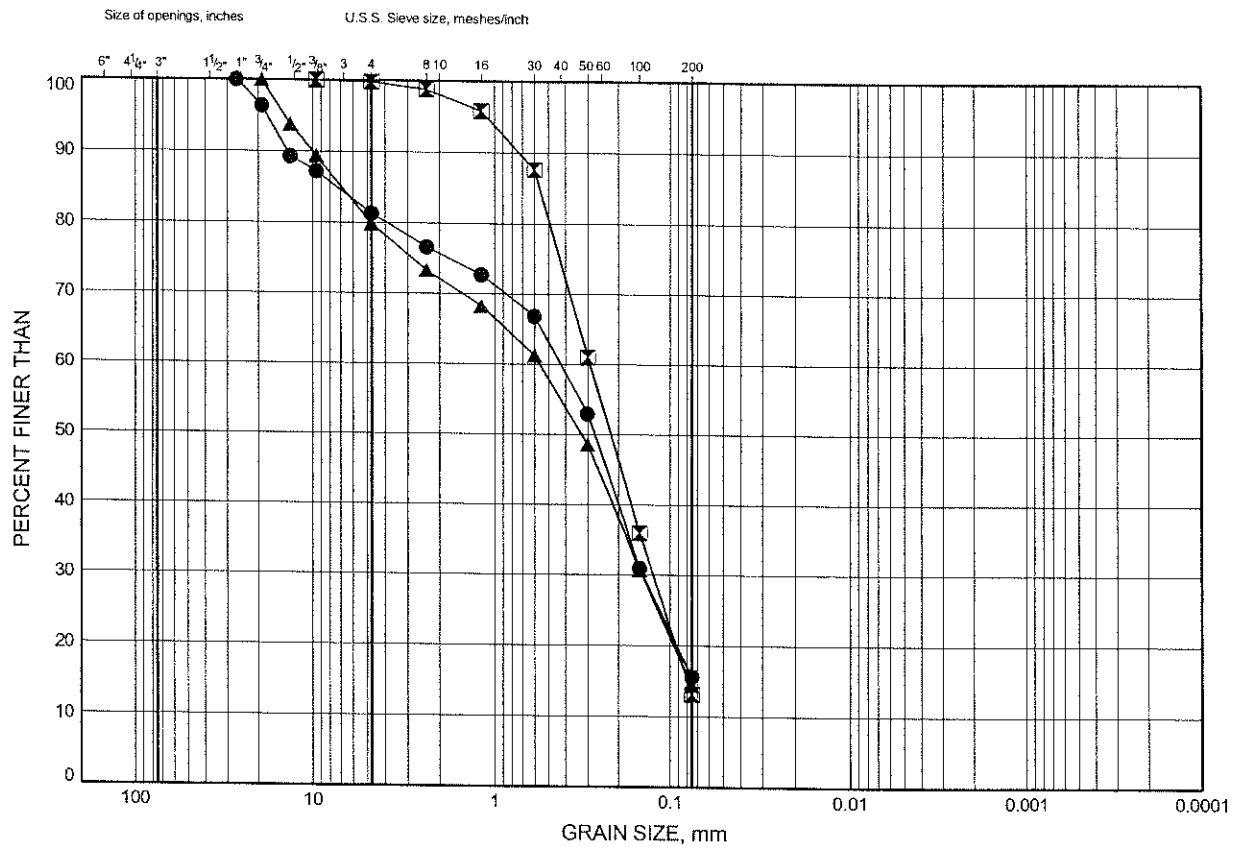


# Hwy 11 Four Laning

## GRAIN SIZE DISTRIBUTION

FIGURE B2

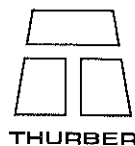
### SAND



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	420-12	1.83	362.26
⊠	420-19	1.83	362.69
▲	420-20	1.07	364.18

Date June 2006  
Project 759-93-00



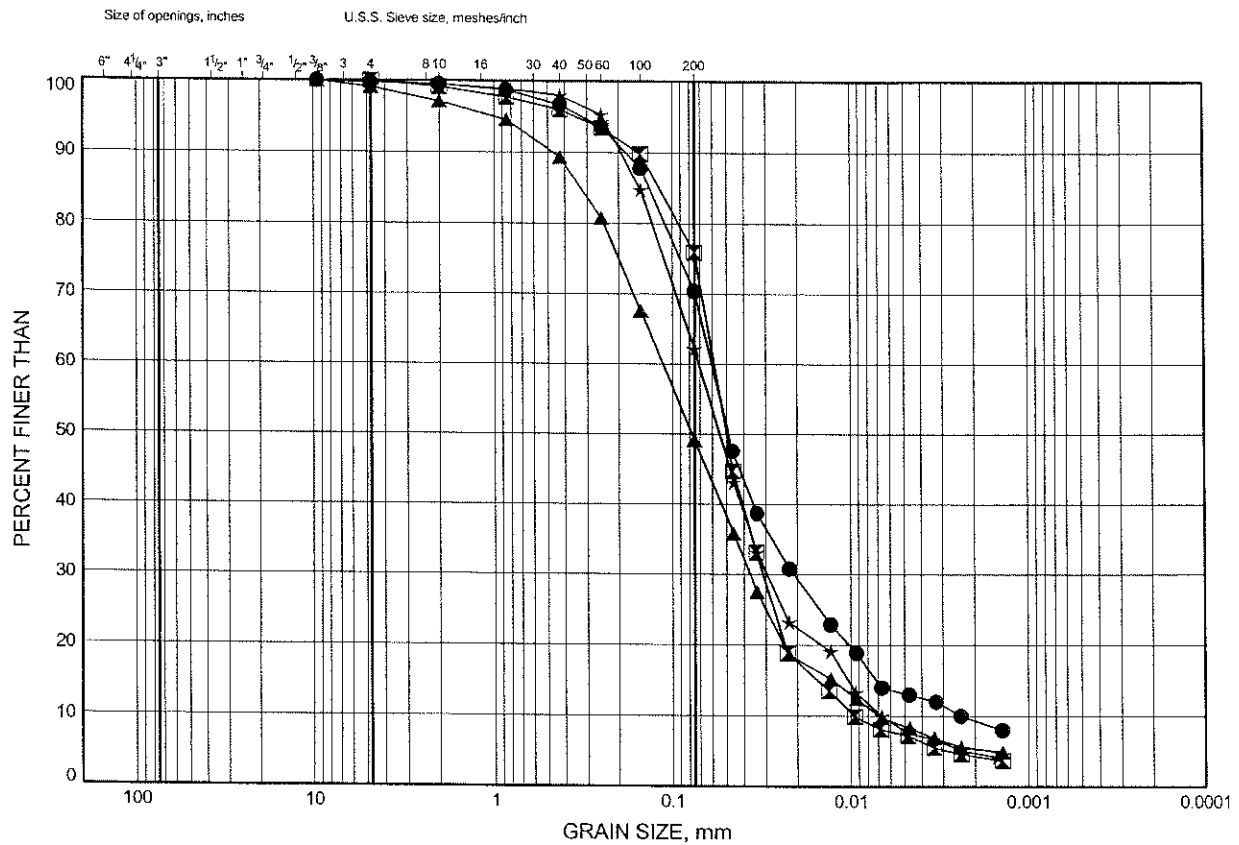
Prep'd JHL  
Chkd. MEF

# Hwy 11 Four Laning

## GRAIN SIZE DISTRIBUTION

FIGURE B3a

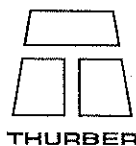
### SILT AND SAND



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	420-08	3.35	363.35
⊠	420-9	2.59	362.90
▲	420-15	3.23	361.92
★	420-16	1.83	363.12

Date June 2006  
Project 759-93-00

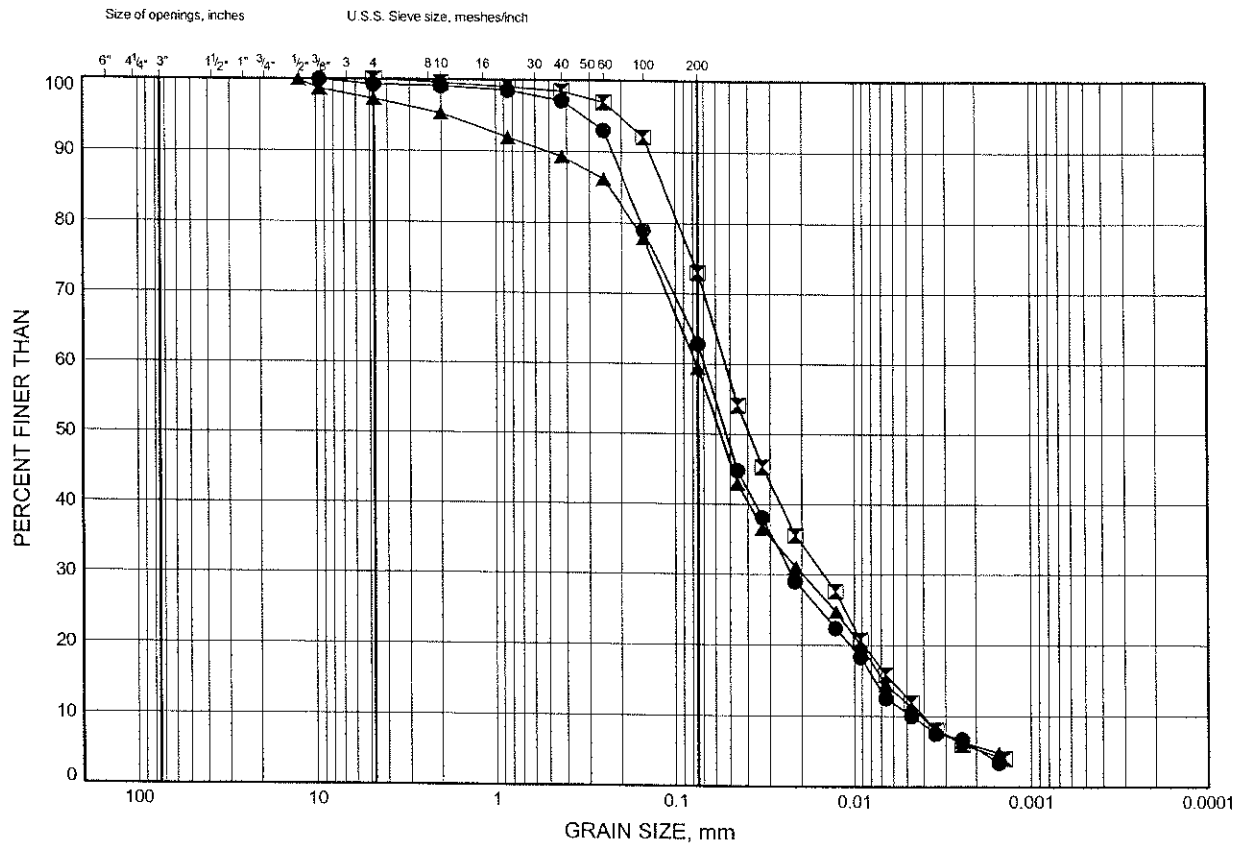


Prep'd JHL  
Chkd. MEF

# Hwy 11 Four Laning GRAIN SIZE DISTRIBUTION

FIGURE B3b

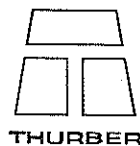
## SILT AND SAND



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	420-18	2.59	361.83
⊠	420-19	2.59	361.93
▲	420-23	1.83	363.59

Date June 2006  
Project 759-93-00



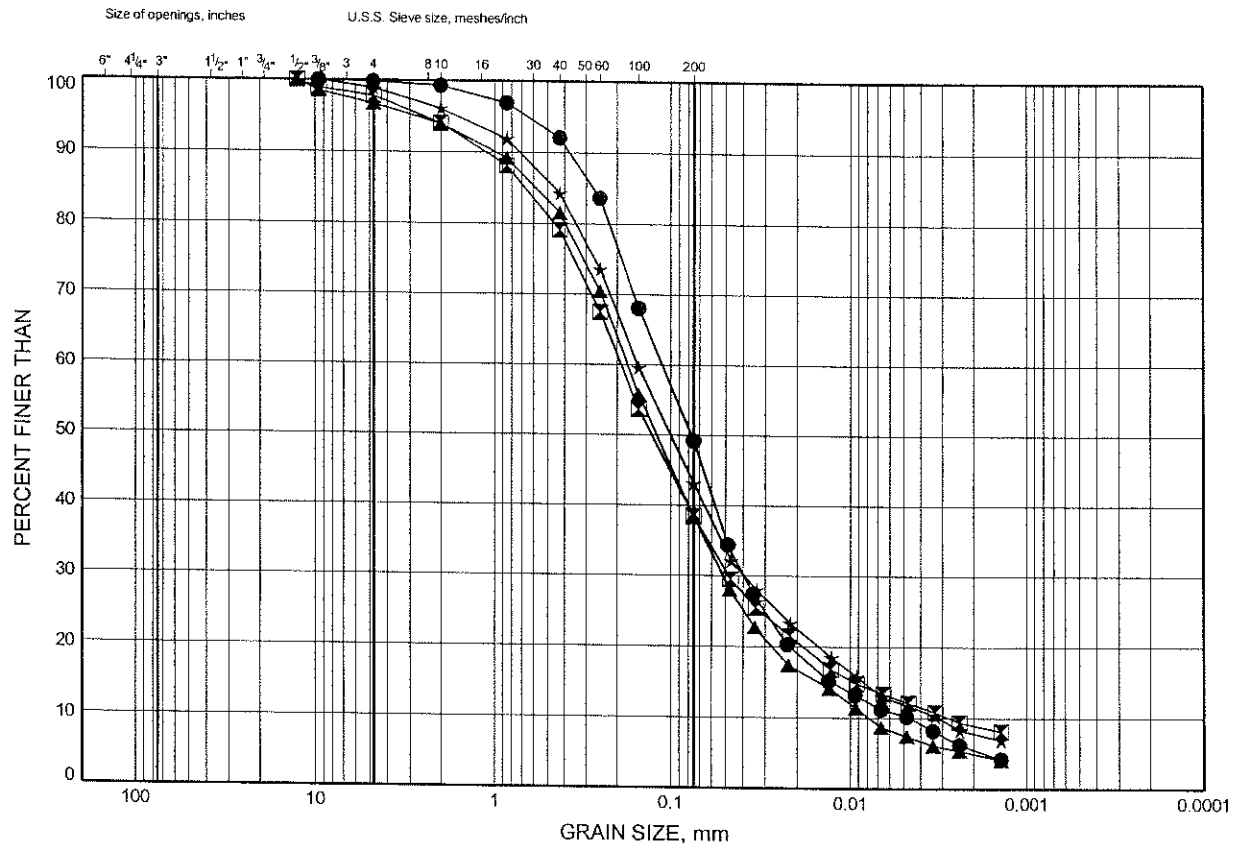
Prep'd JHL  
Chkd. MEF

# Hwy 11 Four Laning

## GRAIN SIZE DISTRIBUTION

FIGURE B4a

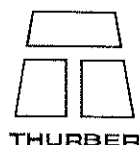
### SAND AND SILT



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	420-06	1.07	363.13
⊠	420-9	4.88	360.62
▲	420-12	3.35	360.73
★	420-12	6.25	357.84

Date June 2006  
Project 759-93-00

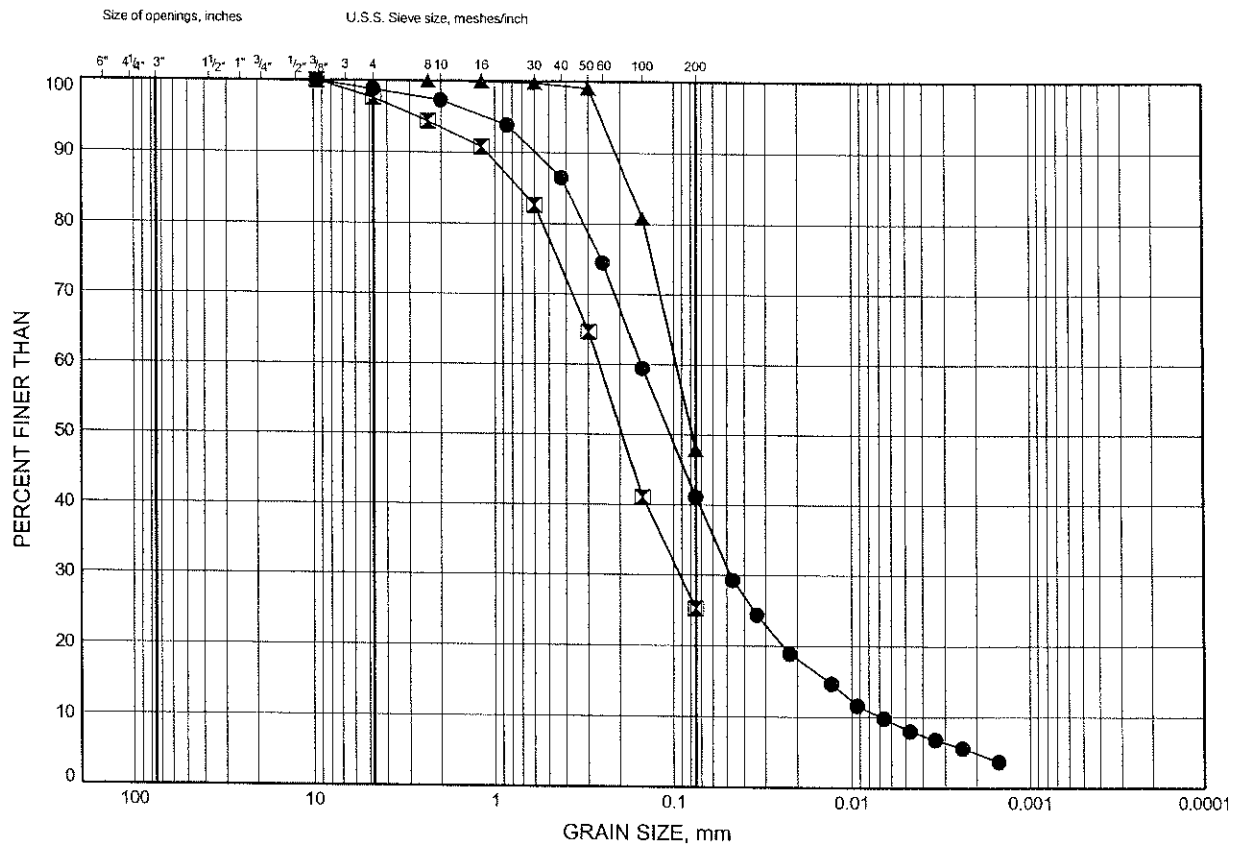


Prep'd JHL  
Chkd. MEF

# Hwy 11 Four Laning GRAIN SIZE DISTRIBUTION

FIGURE B4b

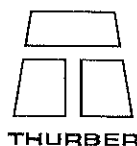
## SAND AND SILT



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	420-13	2.59	361.69
⊠	420-15	1.83	363.32
▲	420-22	1.83	363.66

Date June 2006  
Project 759-93-00

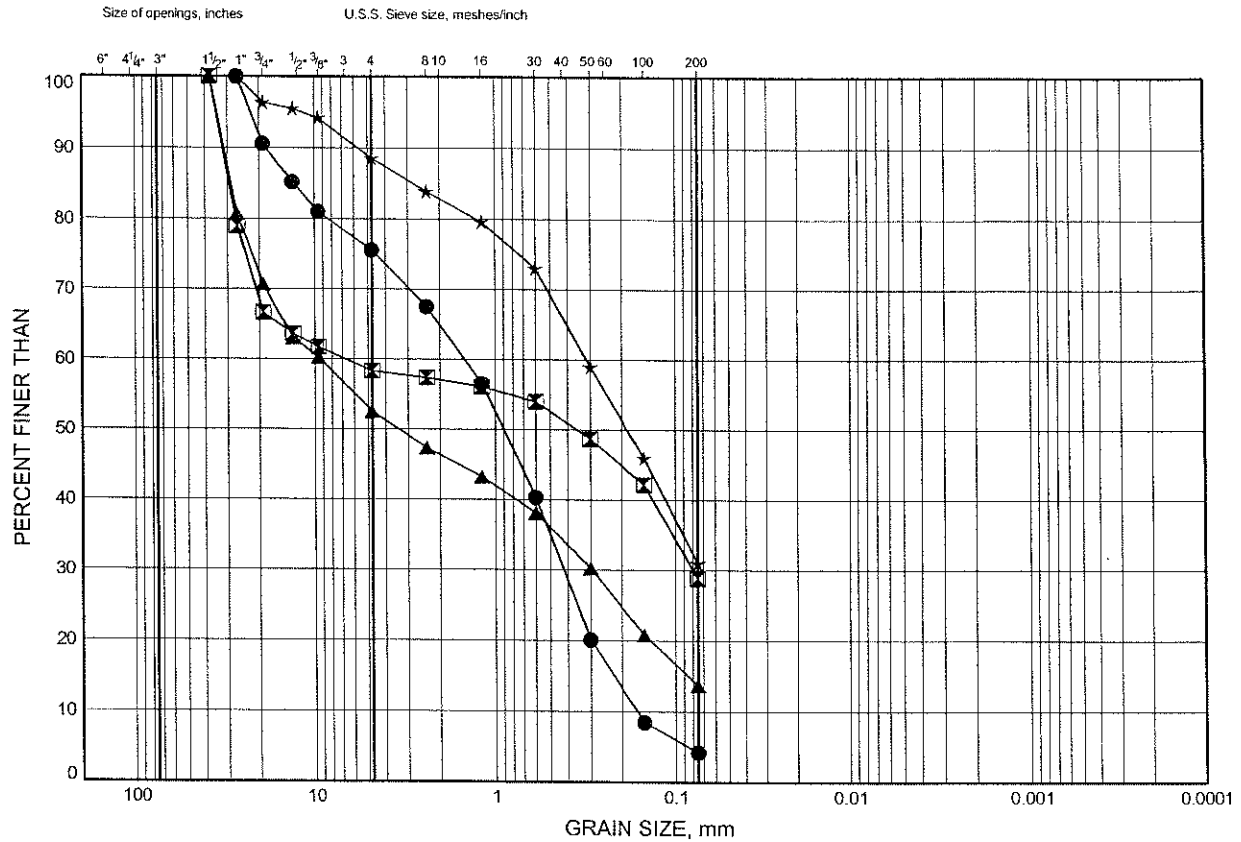


Prep'd JHL  
Chkd. MEF

# Hwy 11 Four Laning GRAIN SIZE DISTRIBUTION

FIGURE B5

## GRAVEL AND SAND

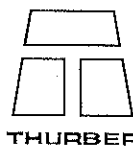


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	420-02	4.88	361.82
⊠	420-16	2.59	362.36
▲	420-20	2.59	362.66
★	420-26	2.59	363.24

Date June 2006

Project 759-93-00



Prep'd JHL

Chkd. MEF

**TABLE B1 - Point Load Test Results  
Muskoka Road Overpass NBL**

Depth			Is50	UCS (MPa)					
feet	Inches	m							
420-02						Total Rock Core			
28	7	8.71	4.36	104.71		Average	Minimum	Maximum	MPa
29	10	9.09	4.58	109.90		102	93	110	
30	7	9.32	3.93	94.35		Run #	Average		
31	7	9.63	4.54	108.86		1	104.71		
32	8	9.96	4.41	105.75		2	100.15		
33	8	10.26	3.93	94.35					
34	8	10.57	3.89	93.31					
35	7	10.85	4.19	100.57					
36	7	11.15	4.36	104.71					
37	7	11.46	4.49	107.82					

Depth			Is50	UCS (MPa)						
feet	Inches	m								
<b>420-06</b>						Total Rock Core				
21	3	6.48	5.10	122.34		Average	Minimum	Maximum	MPa	
22	5	6.83	5.62	134.78		96	25	143		
23	4	7.11	4.88	117.16		Run #	Average			
24	5	7.44	5.96	143.08		1	125.66			
25	7	7.80	4.62	110.94		2	49.07			
27	0	8.23	1.99	47.69	3	96.68				
28	0	8.53	3.11	74.65	4	90.55				
29	2	8.89	1.04	24.88						
30	5	9.27	3.37	80.87						
31	6	9.60	4.28	102.64						
32	8	9.96	3.84	92.27						
33	8	10.26	4.62	110.94						
35	0	10.67	2.81	67.39						
36	2	11.02	4.67	111.97						
37	0	11.28	3.84	92.27						

Note: Point load test at 8.89 m was performed at hidden joint

Depth			Is50	UCS (MPa)					
feet	Inches	m							
420-08						Total Rock Core			
24	9	7.54	5.83	139.97		Average	Minimum	Maximum	MPa
25	8	7.82	3.89	93.31		106	83	140	
26	6	8.08	4.10	98.49		Run #	Average		
27	6	8.38	5.10	122.34		1	113.22		
28	8	8.74	4.67	111.97		2	98.29		
29	8	9.04	4.45	106.79					
30	10	9.40	3.46	82.94					
31	10	9.70	3.54	85.02					
32	10	10.01	4.36	104.71					
33	8	10.26	4.67	111.97					

**TABLE B1 - Point Load Test Results  
Muskoka Road Overpass NBL**

Depth			Is50	UCS (MPa)				
feet	Inches	m						
420-9					Total Rock Core			
25	3	7.70	5.33	128.01	Average	Minimum	Maximum	MPa
27	5	8.36	1.52	36.43	81	36	128	
29	9	9.07	2.82	67.65	Run #	Average		
30	3	9.22	2.82	67.65	1	77.36		
31	9	9.68	4.34	104.07	2	84.99		
33	11	10.34	3.47	83.26				
Depth			Is50	UCS (MPa)				
feet	Inches	m						
420-12					Total Rock Core			
26	2	7.98	3.90	93.66	Average	Minimum	Maximum	MPa
27	7	8.41	0.43	10.41	116	10	168	
30	0	9.14	4.21	100.95	Run #	Average		
31	11	9.73	3.90	93.66	1	68.34		
34	3	10.44	4.77	114.48	2	100.60		
35	4	10.77	3.90	93.66				
Depth			Is50	UCS (MPa)				
feet	Inches	m						
420-13					Total Rock Core			
25	6	7.77	5.36	128.56	Average	Minimum	Maximum	MPa
26	0	7.92	5.27	126.49	133	64	168	
26	8	8.13	5.18	124.41	Run #	Average		
27	8	8.43	7.00	167.96	1	126.49		
28	8	8.74	6.91	165.88	2	142.66		
29	8	9.04	5.01	120.27	3	121.65		
30	4	9.25	6.48	155.52				
31	4	9.55	4.32	103.68				
32	4	9.86	6.22	149.30				
33	4	10.16	2.68	64.28				
34	8	10.57	6.31	151.37				
Depth			Is50	UCS (MPa)				
feet	Inches	m						
420-15					Total Rock Core			
16	4	4.98	4.77	114.48	Average	Minimum	Maximum	MPa
18	5	5.61	5.20	124.89	109	83	130	
20	2	6.15	5.42	130.09	Run #	Average		
21	2	6.45	4.55	109.28	1	123.15		
23	7	7.19	3.90	93.66	2	95.40		
24	10	7.57	3.47	83.26				



**TABLE B1 - Point Load Test Results  
Muskoka Road Overpass NBL**

Depth		m	Is50	UCS (MPa)		Total Rock Core			
feet	Inches								
420-16									
14	0	4.27	4.54	108.96					
15	4	4.67	4.84	116.16					
16	0	4.88	5.01	120.24					
17	0	5.18	4.75	114.00					
17	8	5.38	4.97	119.28					
18	6	5.64	4.97	119.28					
19	6	5.94	3.24	77.76					
20	2	6.15	5.96	143.04					
21	0	6.40	4.32	103.68					
21	8	6.60	3.20	76.80					
22	6	6.86	2.16	51.84					
23	4	7.11	0.86	20.64					
Depth		m	Is50	UCS (MPa)	Total Rock Core				
feet	Inches								
420-18									
17	0	5.18	2.16	51.84					
17	10	5.44	1.38	33.12					
18	8	5.69	1.64	39.36					
19	8	5.99	1.38	33.12					
21	6	6.55	3.54	84.96					
22	2	6.76	1.30	31.20					
23	2	7.06	1.21	29.04					
Depth		m	Is50	UCS (MPa)	Total Rock Core				
feet	Inches								
420-19									
17	8	5.38	2.82	67.65					
19	4	5.89	2.82	67.65					
21	7	6.58	4.12	98.87					
22	10	6.96	4.34	104.07					
24	1	7.34	4.01	96.27					
26	7	8.10	3.90	93.66					
Depth		m	Is50	UCS (MPa)	Total Rock Core				
feet	Inches								
420-21									
9	4	2.84	5.40	129.60					
10	3	3.12	4.84	116.16					
11	3	3.43	1.08	25.92					
11	9	3.58	0.95	22.80					
12	9	3.89	1.90	45.60					
13	7	4.14	3.67	88.08					
15	0	4.57	3.46	83.04					
16	0	4.88	4.49	107.76					
17	0	5.18	3.54	84.96					
17	5	5.31	3.11	74.64					

**TABLE B1 - Point Load Test Results  
Muskoka Road Overpass NBL**

Depth			Is50	UCS (MPa)				
feet	Inches	m						
420-24								
12	10	3.91	4.58	109.92	}	Total Rock Core		
13	8	4.17	4.58	109.92		Average	Minimum	Maximum
14	6	4.42	4.92	118.08		101	42	118
15	8	4.78	4.32	103.68		Run #	Average	
16	6	5.03	4.23	101.52		2B	112.64	
17	4	5.28	4.84	116.16		3	93.74	
18	2	5.54	1.73	41.52				
19	0	5.79	4.41	105.84				

## **Appendix C**

### **Factual Information from Golder's Report**

PROJECT 991-1193		RECORD OF BOREHOLE No 7-1		1 OF 1		METRIC							
W.P. 335-98-00		LOCATION N 5066468.88, E 310835		ORIGINATED BY SB									
DIST 54 HWY 11		BOREHOLE TYPE 108mm I.D. HOLLOW STEM AUGERS		COMPILED BY OKB									
DATUM GEODETIC		DATE Feb 29/00		CHECKED BY ASP									
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC NATURAL LIQUID UNIT WEIGHT REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	N° VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa	WATER CONTENT (%)	UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
364.77	GROUND SURFACE												
0.00	Topsoil		1	SS	2		364						
0.30	Sandy Silt, trace clay and organics												
364.08	Very loose												
0.69	Brown												
	Wet												
	organic content = 5.5%		2	SS	22		363						
	Sand, trace to some silt												
	Compact												
	Brown		3	SS	22								
	Wet												
362.56	Silt and Sand, trace clay.												
2.21	Compact												
	Brown		4	SS	15		362						
	Wet												
361.80	Sand, some gravel, trace silt, occ.		5	SS	55/05								
	cobbles and/or boulders												
	Very dense												
	Brown												
	Wet												
	END OF BOREHOLE												
	Refusal to further auger penetration;												
	probable bedrock												
	Note:												
	Water level measured in open												
	borerhole at 0.8m depth (El. 364.0m)												
	upon completion of drilling.												
	Easting co-ordinate accurate to												
	nearest metre.												

+ 3, X 3: Numbers refer to Sensitivity

O 3% STRAIN AT FAILURE

ON MOT 991-1193.GPJ. ON MOT.GDT 24/4/00


+3, X3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

PROJECT 991-1193		<b>RECORD OF BOREHOLE No 7-3</b>		1 OF 1 <b>METRIC</b>	
W.P. 335-98-00		LOCATION N 5065559.55; E 310803.80		ORIGINATED BY SB	
DIST 54 HWY 11		BOREHOLE TYPE 108mm I.D. HOLLOW STEM AUGERS		COMPILED BY DKB	
DATUM GEODETTIC		DATE Feb.29/00		CHECKED BY ASP	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					w <sub>p</sub>	w	w <sub>L</sub>		
								20 40 60 80 100									
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x REMOULDED									
WATER CONTENT (%) 10 20 30																	
366.14 0.00	GROUND SURFACE Sand and Gravel, trace silt Compact to dense Brown Moist (F8)		1	SS	22												
364.69 1.45	Silt and Sand, trace gravel, trace clay and organics Loose Brown Wet non-plastic Atterberg limit test result for Sample 3A organic content=3.1% Sand, some silt, trace gravel Dense Brown Moist Slightly to moderately weathered, gray and white-brown with black blotches, foliated (30'), moderately jointed, coarse to very coarse grained, medium strong GNEISS.  Bedrock cored from 3.05m to 6.10m depth.  For bedrock coring details refer to Record of Drilling 7-3		2	SS	36												
364.31 1.83			3	SS	8												
363.09 3.05			4	SS	34												
360.04 6.10	END OF HOLE  Note: Open borehole dry upon completion of drilling.																

ON MOT 991-1193.GPJ ON MOT.GDT 24/4/00

PROJECT 891-1193		<b>RECORD OF BOREHOLE No 7-4</b>		1 OF 1		<b>METRIC</b>	
W.P. 335-98-00		LOCATION N 5006579.07; E 310794		ORIGINATED BY SB			
DIST 54 HWY 11		BOREHOLE TYPE 108mm I.D. HOLLOW STEM AUGERS		COMPILED BY DKB			
DATUM GEOCELTIC		DATE Feb. 29/00		CHECKED BY ASP			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X REMOULDED												
367.00	GROUND SURFACE																			
0.00	Sandy Silt, trace clay and organics/decaying wood matter Loose		1	SS	4	366														
366.31	Blackish brown Moist																			
0.69	Sand, some gravel, trace silt, occ. cobbles and/or boulders Very dense Brown Wet		2	SS	59															
365.26			3	SS	100/03															
1.74	END OF BOREHOLE Refusal to further auger penetration; probable bedrock.  Note: Water level measured in open borehole at 0.6m depth (El. 366.4m) upon completion of drilling.  Easting co-ordinate accurate to nearest metre.																			

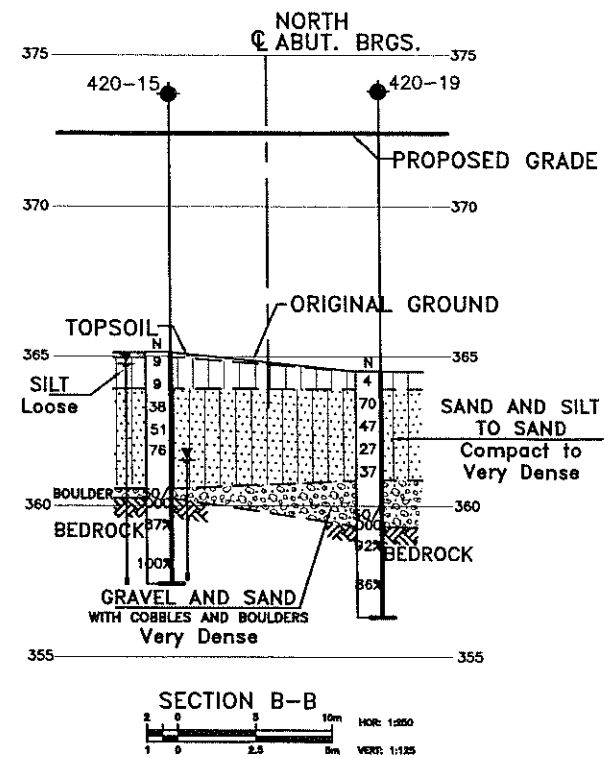
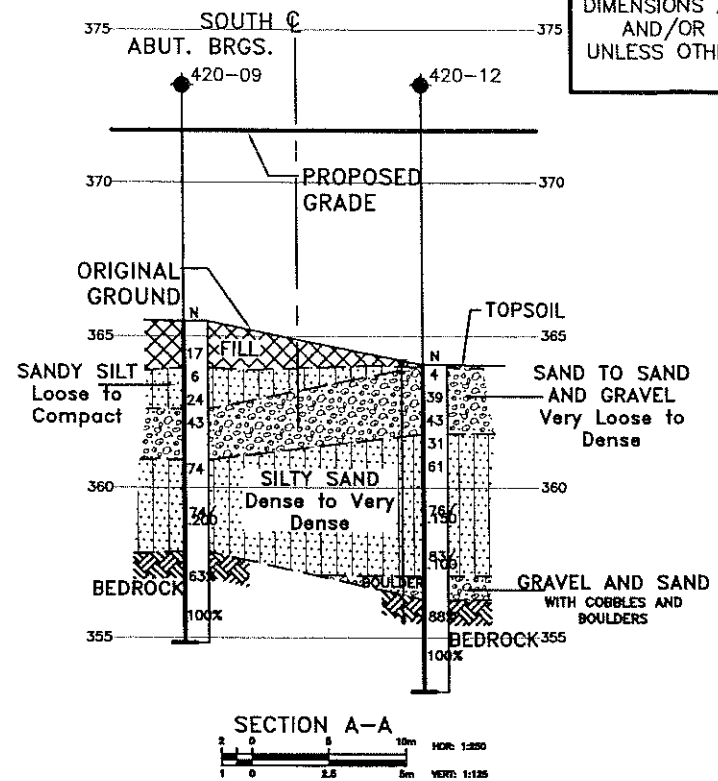
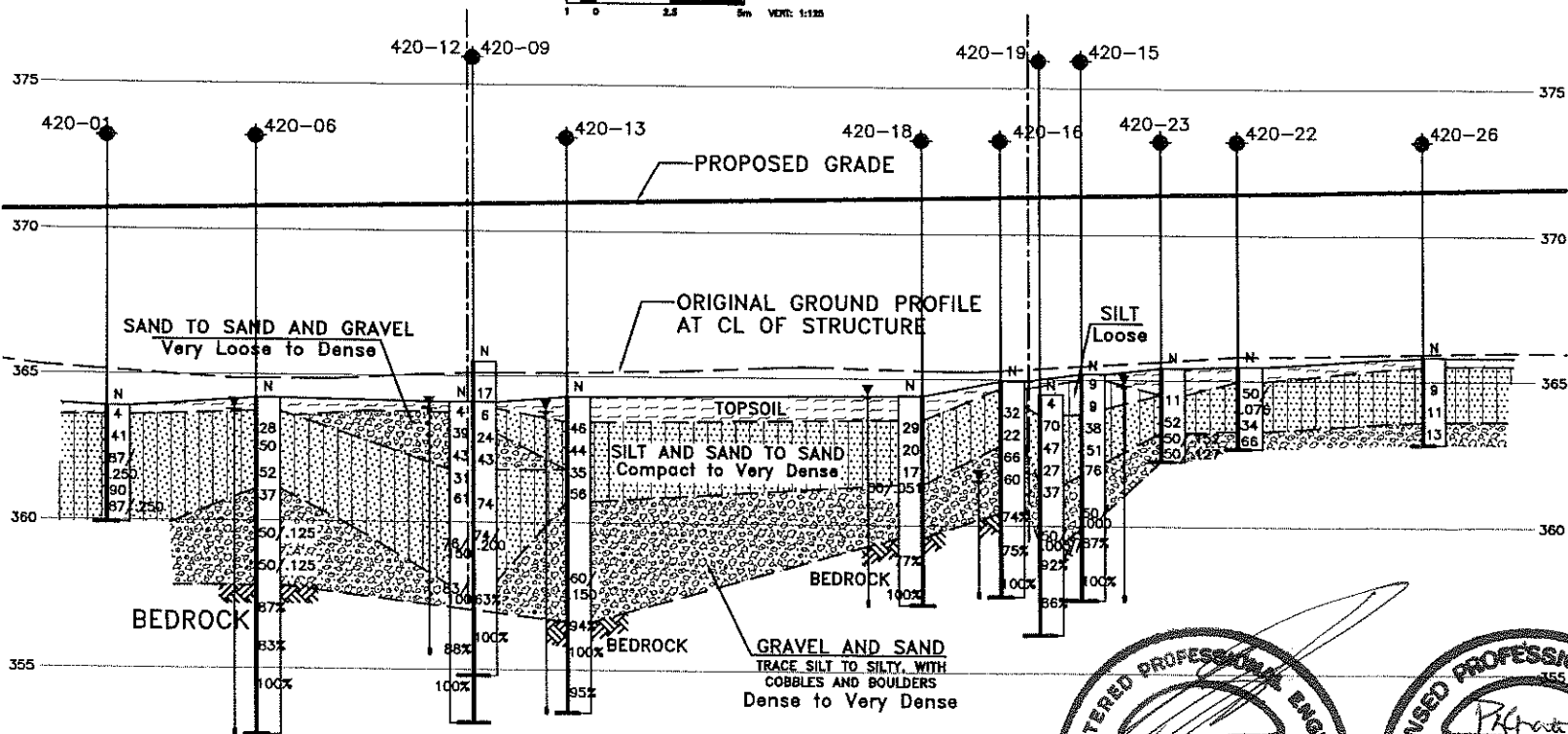
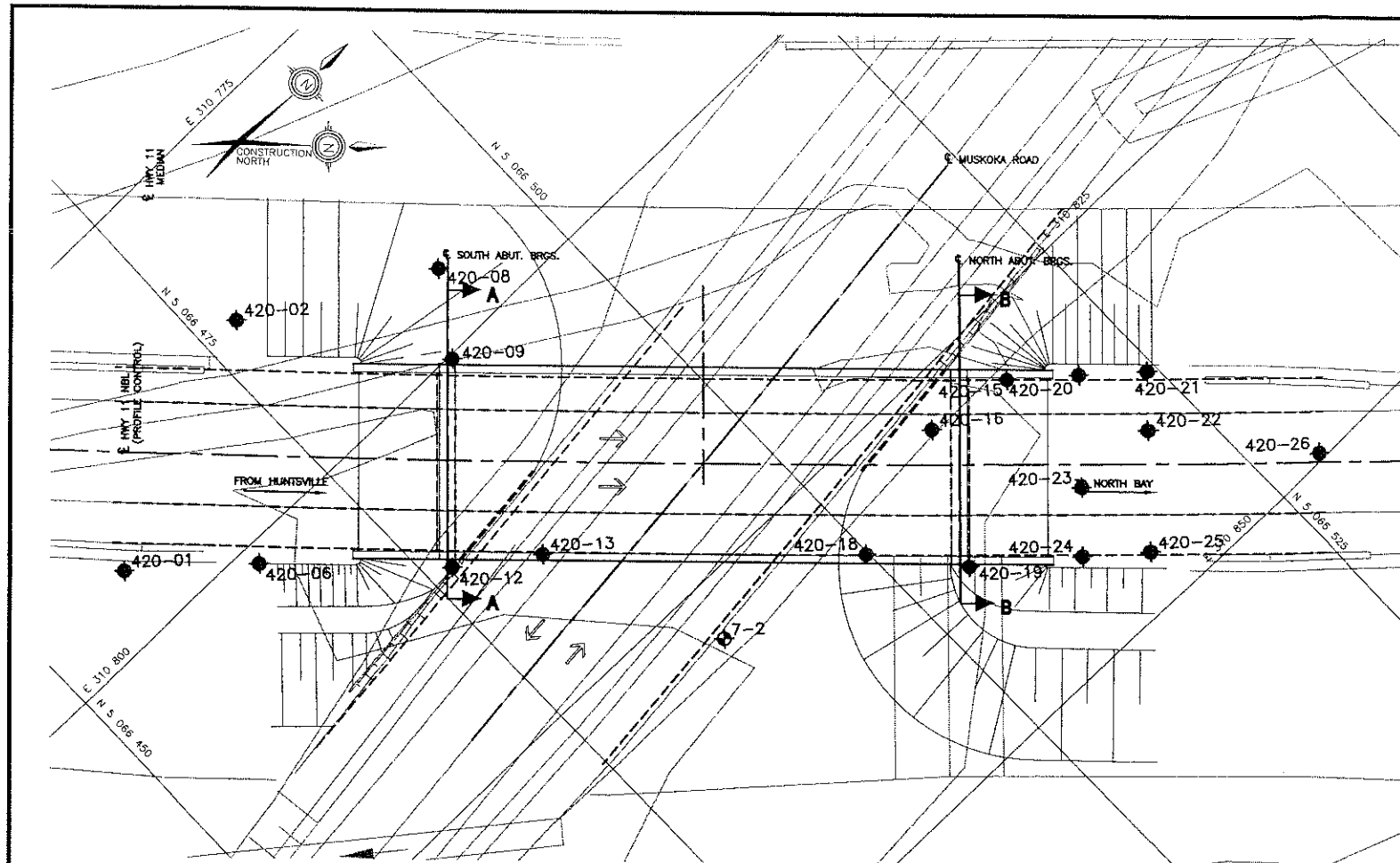
ON MOT 9914193.GPJ ON MOT.GDT 26/4/00

ON MOT 891-1193.GPJ ON MOT.GDT 25/4/00

## **Appendix D**

### **Drawings**





METRIC

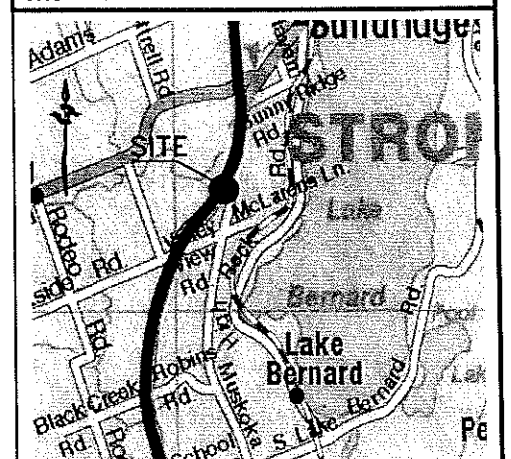
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

HWY 11  
CONT No  
WP No 758-93-02

MUSKOKA ROAD  
OVERPASS NBL  
BOREHOLE LOCATIONS AND SOIL STRATA

**Marshall Macklin Monaghan**  
CONSULTING ENGINEERS - SURVEYORS - PLANNERS

**THURBER ENGINEERING LTD.**



LEGEND

- Borehole by THURBER
- ⊕ Dynamic Cone Penetration Test (cone)
- Borehole by GOLDER
- 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)

NO	ELEVATION	NORTHING	EASTING
420-1	363.9	5 066 459.0	310 795.0
420-2	366.7	5 066 478.0	310 787.0
420-6	364.2	5 066 466.8	310 801.5
420-8	366.7	5 066 491.0	310 795.0
420-9	365.5	5 066 487.6	310 800.3
420-12	364.1	5 066 487.9	310 811.4
420-13	364.3	5 066 482.5	310 815.4
420-15	365.2	5 066 516.4	310 829.8
420-16	365.0	5 066 504.7	310 837.8
420-18	364.5	5 066 509.8	310 828.6
420-19	364.5	5 066 509.8	310 828.6
420-20	365.2	5 066 520.5	310 833.2
420-21	365.5	5 066 524.3	310 836.5
420-22	365.5	5 066 521.3	310 839.7
420-23	365.4	5 066 514.9	310 839.3
420-24	365.2	5 066 511.3	310 843.1
420-25	365.6	5 066 515.2	310 846.2
420-26	365.8	5 066 529.2	310 849.5

**NOTE:**

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

BENCH MARK

DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

DATE	BY	DESCRIPTION
DESIGN AEG	CHK	CODE
DRAWN JHL	CHK	SITE
		LOAD
		STRUCT
		SCHEME
		DWG P1

