

**FOUNDATION INVESTIGATION REPORT
HIGHWAY 11 SBL OVER STIRLING CREEK TRIBUTARY
HIGHWAY 11, BURK'S FALLS TO SOUTH RIVER
ONTARIO
G.W.P. 742-93-00, W.P. 5100-06-01, SITE: 44-438/2**

Geocres Number: 31E-276

Report to

MMM Group Limited

Thurber Engineering Ltd.
2010 Winston Park Drive, Suite 103
Oakville, Ontario
L6H 5R7
Phone: (905) 829 8666
Fax: (905) 829 1166

April 28, 2008
File: 19-1423-39

\\Torserver1\Projects\19\1423\39 Stirling Creek\Reports &
Memos\SBL\19142339 SBL FR- Final.doc

TABLE OF CONTENTS

PART 1 FACTUAL INFORMATION

1	INTRODUCTION	1
2	SITE DESCRIPTION	1
3	SITE INVESTIGATION AND FIELD TESTING.....	2
4	LABORATORY TESTING	3
5	DESCRIPTION OF SUBSURFACE CONDITIONS	4
5.1	Pavement Structure	4
5.2	Topsoil	4
5.3	Fill.....	4
5.4	Sand.....	5
5.5	Silt.....	6
5.6	Sand and Gravel	6
5.7	Bedrock.....	7
5.8	Water Levels	8
6	MISCELLANEOUS	8

Tables

Table 1	Point Load Test Results
---------	-------------------------

Appendices

Appendix A	Record of Borehole Sheets
Appendix B	Laboratory Test Results
Appendix C	Site Photographs
Appendix D	Drawing titled "Borehole Locations and Soil Strata"

FOUNDATION INVESTIGATION REPORT
HIGHWAY 11 SBL OVER STIRLING CREEK TRIBUTARY
HIGHWAY 11, BURK'S FALLS TO SOUTH RIVER
ONTARIO
G.W.P. 742-93-00, W.P. 5100-06-01, SITE: 44-438/2

Geocres Number: 31E-276

PART 1: FACTUAL INFORMATION

1 INTRODUCTION

This report presents the factual findings obtained from a foundation investigation conducted at the the location of a proposed bridge carrying Highway 11 SBL over Striling Creek Tributary north of Burk's Falls, Ontario.

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 investigation.

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

2 SITE DESCRIPTION

The site lies on the east side of existing Highway 11 approximately 500 m north of the intersection with Pevensey Road.

At present, the creek flows from north to south along the east toe of the Highway 11 embankment and turns westward into a culvert under the existing highway at the proposed bridge site. A smaller creek flows east to west to join the main creek as it turns westward into the culvert. This smaller creek forms a small pond to the east of the proposed bridge, due to what may be an old, overgrown beaver dam.

The footprint of the new bridge partially overlaps the existing Highway 11 embankment.

A Hydro One pole line traverses the site in a generally north-south direction, parallel to existing Highway 11.

The site lies within the Canadian Shield, characterized by low, rounded hills of Pre-Cambrian bedrock mantled by varying thicknesses of overburden. At this site, the bedrock is mantled by cohesionless sand deposits that probably originated from glacial outwash and are typical of the soils encountered in this stretch of the Highway 11 corridor.

There is no development within the immediate vicinity of the site.

Photographs in Appendix C show:

1. A view looking north over the general site of the two structures with the small beaver pond in the middle ground and the Hydro One lines visible.
2. A view of the point where the two streams meet and flow westward under the existing highway.
3. A view looking south on existing Highway 11 over the south approaches to the future structures.
4. A view north along existing Highway 11 over the future SBL structure site. The north approaches are behind the trees to the right.

3 SITE INVESTIGATION AND FIELD TESTING

The site investigation and field testing for this project were carried out between June 24 and July 31, 2007 and consisted of drilling and sampling four boreholes at the foundation elements to depths ranging from 18.4 m to 20.9 m (elevations 292.3 m to 298.6 m) and two boreholes at the approach embankments to depths of 8.2 m and 10.1 m (elevations 310.8 m and 302.5 m). The boreholes were numbered SCS-1 to SCS-6 and their approximate locations are shown on the attached Borehole Locations and Soil Strata Drawing in Appendix D.

The borehole locations were marked in the field and utility clearances were obtained prior to drilling.

Drilling was carried out using a track mounted CME 75 drill rig. A combination of hollow-stem auger drilling techniques and rotary coring methods were used to advance the boreholes and samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT) in the overburden soils. Boreholes SCS-2, SCS-4 and SCS-5 were also advanced 3.2 m, 1.0 and 2.4 m, respectively, into bedrock by NQ size diamond coring.

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.

Groundwater conditions in the open boreholes were observed throughout the drilling operations. Standpipe piezometers consisting of 19 mm PVC pipe with slotted screens were installed and enclosed in filter sand in two boreholes (one at each foundation element) to permit longer term groundwater level monitoring. The locations and completion details of the piezometers are shown in Table 3.1.

Table 3.1 – Borehole Completion Details

Foundation Unit	Borehole	Piezometer Tip Depth/ Elevation (m)	Completion Details
South Approach	SCS-1	None installed	Borehole grouted to surface using Aquagrout bentonite.
South Abutment			
West	SCS-2	None installed	Borehole grouted using bentonite grout to 2.4 m, auger cuttings to 1.5 m, holeplug to 0.6 m, auger cuttings to 0.15 m then asphalt to road surface.
East	SCS-3	19.4/295.6	Sand from 19.4 m to 16.2 m, holeplug from 16.2 m to 15.4 m, Aquagrout from 15.4 m to 0.5 m, holeplug to surface.
North Abutment			
West	SCS-4	None installed	Borehole grouted using bentonite grout to 1.2 m, holeplug to 0.6 m, auger cuttings to 0.15 m then asphalt to road surface.
East	SCS-5	12.2/300.8	Borehole drilled to 20.7 m, elevation 292.3 m but piezometer could not be advanced below 12.2 m, boreholes assumed to then collapse below that depth. Sand from 12.2 m to 10.4 m, holeplug from 10.4 m to 9.8 m, Aquagrout from 9.8 m to 0.9 m and holeplug to surface.
North Approach	SCS-6	None installed	Borehole grouted with bentonite to the surface.

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.

Point load tests were carried out on selected samples of intact bedrock 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 and on the Record of Borehole sheets in Appendix A.

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 these sheets and on the "Borehole Locations and Soil Strata" and "Stratigraphic Sections" drawings 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 terms, the soil stratigraphy encountered at this site consists of topsoil overlying about 17 m to 20 m of cohesionless soils consisting of fill, native sand, occasional layers of silt, and layers of sand with gravel, cobbles and boulders. Migmatitic gneiss bedrock was contacted below the native soils. More detailed descriptions of the individual strata are presented below.

5.1 Pavement Structure

Pavement structure consisting of approximately 125 mm of asphalt overlying granular (sand and gravel fill) road base was encountered in Boreholes SCS-1, SCS-2 and SCS-4 drilled on the Highway 11 SBL existing lanes and shoulders.

5.2 Topsoil

Topsoil was identified at ground surface in Borehole SCS-3. The topsoil thickness generally was 300 mm. The topsoil thickness may vary between and beyond the borehole locations and the data is not intended for the purpose of estimating quantities.

5.3 Fill

Fill was contacted below the pavement structure in Boreholes SCS-1, SCS-2 and SCS-4, and surficially in Borehole SCS-6. The fill generally consists of cohesionless layers of brown sand containing some gravel, trace of silt and clay and occasional cobbles and rootlets. Although not directly encountered in the boreholes, the existing fill may contain boulders.

Fill extended to depths ranging from 2.2 m to 2.4 m (elevation 316.6 m) at the locations of the south abutment and south approach (Boreholes SCS-2 and SCS-1). At the north abutment and north approach (Boreholes SCS-4 and SCS-6), fill extended to depths of 7.7 m and 3.0 m (elevations 309.3 m and 309.5 m), respectively.

SPT N-values recorded in the sand fill ranged from 2 to 40 blows per 0.3 m penetration indicating a very loose to dense relative density. Higher 'N' values (more than 50 blows for under 0.3 m penetration) were also observed within the fill at various depths, indicating a very dense relative density. These high values may be attributed to the presence of

cobbles within the fill. The moisture content of samples collected ranged from 2% to 21%.

The grain size distribution of the cohesionless fill is represented by the data plotted in Figures B1 Appendix B.

The results of gradation conducted on selected samples of fill are summarized below:

Soil	(%)
Gravel	0
Sand	91 – 98
Silt & Clay	2 – 9

Despite no gravel being found in the sieve analysis, field observations and occasional SPT 'N' values exceeding 100 blows for 0.3 m of penetration, indicate scattered gravel and cobble sizes.

5.4 Sand

An extensive deposit of native brown sand containing some gravel to gravelly, trace to some silt and trace of clay was generally contacted below the fill and topsoil, and surficially in Borehole SCS-05. Occasional cobbles and boulders were also noted within the native sand deposit.

Deeper layers of brown and grey sand with occasional cobbles and boulders were also contacted in Boreholes SCS-4 and SCS-6 at 13.0 m and 9.1 m depth (elevations 304.0 m and 303.4 m), respectively.

Layers of cobbles and boulders were also encountered within the native sand as follows:

Location	Borehole	Depth/Elevation (m)	Thickness (mm)
South Abutment	SCS-3	2.4/312.5	600
North Abutment	SCS-5	15.7/297.3	500

Boreholes SCS-1 and SCS-6 were terminated within the sand deposit at 8.2 m and 10.1 m depth (elevations 310.8 m and 302.5 m).

Thickness of the sand layer, determined from Boreholes SCS-2 to SCS-5, generally ranged from 4.4 m to 18.3 m. The depth to the base of the sand deposit ranged from Elevations 304.3 m to 305.1 m at the south abutment and from 294.7 m to 299.6 m at the north abutment.

SPT 'N' values ranged from 11 to 75 blows for 0.3 m penetration in this stratum indicating a compact to very dense relative density. Higher 'N' values (more than 50 blows for under

0.3 m penetration) were observed in Boreholes SCS-2 to SCS-5 at various depths. These high values may be due to the presence of cobbles and boulders within the deposit.

The moisture content of samples from this deposit ranged from 2% to 23%; moisture contents higher than 12% were generally observed below elevation 308.0 m.

Grain size distribution curves for the samples tested are presented on the Record of Borehole sheets and on Figures B2 and B3. The results of laboratory tests carried out on samples of the sand were as follows:

Soil Particles	(%)
Gravel	0 to 32
Sand	66 to 98
Silt & Clay	1 to 9

5.5 Silt

Native brown and grey silt containing some sand to sandy, some clay and trace of rootlets were observed in Boreholes SCS-3 and SCS-4 at 19.4 m and 7.7 m depths (elevations 295.6 m and 309.3 m), respectively.

SPT N-value measured in the silt layer was 8 blows for 0.3 m of penetration in Borehole SCS-4, indicating a loose density. Higher 'N' value (more than 50 blows for under 0.3 m penetration) was measured in Borehole SCS-3, indicating a very dense relative density.

The natural moisture content of one sample recovered from the silt layer was 40%.

5.6 Sand and Gravel

Layers of brown to grey sand and gravel containing occasional cobbles and boulders were observed in Boreholes SCS-2 to SCS-4 and SCS-6 at depths ranging from 6.1 m to 14.5 m (elevations 304.3 m to 308.3 m).

Standard Penetration tests in this deposit gave 'N' values ranging from 32 blows per 0.3 m of penetration to greater than 100 blows for 0.075 m of penetration, indicating a compact to very dense density. Higher 'N' values (more than 50 blows for under 0.3 m penetration) may be due to the probable presence of cobbles and boulders within the deposit.

The moisture content of samples from this deposit varies between 11% and 17%.

Grain size distribution curves for the samples tested are presented on the Record of Borehole sheet and on Figure B4. The results of laboratory tests carried out on samples of the sand and gravel are summarized as follows:

Soil Particles	(%)
Gravel	37 to 50
Sand	45 to 54
Silt & Clay	2 to 11

5.7 Bedrock

The overburden soils described above are underlain by Pre-Cambrian migmatitic gneiss bedrock. Bedrock was proved by coring at both abutments. The migmatitic gneiss bedrock is described as fresh to slightly weathered. Its colour is dark grey to black with occasional pink bands visible in most cores.

Table 5.2 summarizes the bedrock depths and the elevations to the top of bedrock.

Effective refusal, defined as an SPT value exceeding 100 blows for 0.3 m of penetration (or 50 blows for less than 150 mm penetration), was encountered in the sand with cobbles and boulders. The depths at which effective refusal was encountered are also shown in Table 5.2.

Table 5.2 – Depths and Elevations of Refusal and Top of Bedrock

Foundation Unit	Borehole	Refusal		Top of Bedrock	
		Depth (m)	Elevation (m)	Depth (m)	Elevation (m)
South Approach	SCS-1	-	-	-	-
South Abutment					
West	SCS-2	13.6	305.2	17.7	301.1
East	SCS-3	15.2	299.8	19.6*	295.4*
North Abutment					
West	SCS-4	17.0	300.0	17.4	299.6
East	SCS-5	16.2	296.8	18.3	294.7
North Approach	SCS-6	-	-	-	-

*Possible bedrock inferred from refusal to sampling

Core recovery in the bedrock was 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 6 although zones of >10 fractures per 0.3 m of core were recorded in Borehole SCS-5. Horizontal and vertical joints were encountered within the rock mass in all the cores.

The unconfined compressive strength of the rock cores is approximately 120 to 150 MPa indicating a very strong rock. The estimated rock strength value is based on one point load tests conducted on rock cores recovered from Borehole SCS-5. A summary of the Point Load Test Results is presented in Table 1 immediately following the text of this report.

5.8 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 5.3, along with the measurements in the boreholes upon completion of drilling.

Table 5.3 – Water Level Measurements

Foundation Unit	Borehole	Date (2007)	Water Level (m)		Comment
			Depth	Elevation	
South Approach	SCS-1	July 31	-	-	Open borehole
South Abutment					
West	SCS-2	July 30	-	-	Open borehole
East	SCS-3	June 27	4.1	310.9	In piezometer
		June 28	4.1	310.9	
		July 6	4.3	310.7	
		July 23	5.0	310.0	
North Abutment					
West	SCS-4	July 31	-	-	Open borehole
East	SCS-5	July 5	3.1	309.9	Open borehole
		July 23	3.4	309.6	In piezometer
North Approach	SCS-6	July 5	3.1	309.5	Open borehole

The piezometric readings indicate that the groundwater level is near Elevation 310.0 m.

GA Drawing indicates that the water level of the Stirling creek was 311.8 m in December, 1997.

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.

6 MISCELLANEOUS

Borehole locations were selected by Thurber Engineering Ltd. Surveyors from MMM Group Limited staked these locations in the field, confirmed the co-ordinates and obtained the ground surface elevations.

Thurber obtained utility clearances for the borehole locations prior to drilling.

George Downing Estate Drilling Ltd. supplied a track mounted CME 75 drill rig and conducted the drilling, sampling and in-situ testing operations.

The field program was supervised on a full time basis by Mr. George Azzopardi, Mr. Stephane Loranger and Ms. Jessica Lee of Thurber.

Routine laboratory testing was carried out by Thurber Engineering Ltd.

Overall supervision of the field program was conducted by Mr. Alastair E. Gorman, P.Eng. Interpretation of the data and preparation of the report were carried out by Mr. Alastair E. Gorman, P.Eng and Ms. R. Palomeque Reyna, P.Eng.

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

Thurber Engineering Ltd
Rocio Palomeque Reyna, P.Eng.
Geotechnical Engineer



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



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



STIRLING CREEK TRIBUTARY SBL
HIGHWAY 11, BURK'S FALLS TO SOUTH RIVER

[illegible]

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

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


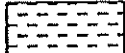



 Water Level
 Shear Strength Determination by Pocket Penetrometer

- (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			

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.

TERMS					
Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length.	Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
Solid Core Recovery: (SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run.	Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
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.	Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail
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 SCS-2

1 OF 3

METRIC

G.W.P. 742-93-00 LOCATION Stirling Creek Tributary SBL N 5 059 690.88 E 310 636.85 ORIGINATED BY SLL
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/NW Casing/NQ Casing COMPILED BY MFA
 DATUM Geodetic DATE 2007.07.30 - 2007.07.30 CHECKED BY AEG

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				
318.8							20 40 60 80 100					
0.0	ASPHALT: (125mm)						20 40 60 80 100					
0.1	SAND, trace to some gravel Compact to Very Dense Brown Moist (FILL)		1	AS								
			1	SS	74/ 275							
			2	SS	29							
316.6												
2.2	SAND, trace silt and clay Compact to Very Dense Brown Moist		3	SS	15							
			4	SS	57							
			5	SS	13							
			6	SS	29							
	occasional cobbles		7	SS	66							
	becoming gravelly		8	SS	75							
											</	

Continued Next Page

+ ³ x ³ : Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No SCS-2

2 OF 3

METRIC

G.W.P. 742-93-00 LOCATION Stirling Creek Tributary SBL N 5 059 690.88 E 310 636.85 ORIGINATED BY SLL
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/NW Casing/NQ Casing COMPILED BY MFA
 DATUM Geodetic DATE 2007.07.30 - 2007.07.30 CHECKED BY AEG

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							
	Continued From Previous Page							20 40 60 80 100							
	SAND, some gravel to gravelly Dense to Very Dense Brown Wet		9	SS	46		308								
							307								
			10	SS	46		306								
	cobbles and boulders		11	SS	100/ .025		305								
304.3															
14.5	SAND and GRAVEL, occasional cobbles and boulders Very Dense Grey Wet		12	SS	100/ .075		304								
							303								
			13	SS	74		302								
301.2															
17.7	MIGMATITIC GNEISS BEDROCK, slightly weathered, dark grey Coring started at 17.7m Horizontal joints at 17.8 and 18.0m		1	RUN			301								
			2	RUN			300								
							299								

Continued Next Page

+ 3, x 3, Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No SCS-2

3 OF 3

METRIC

G.W.P. 742-93-00 LOCATION Stirling Creek Tributary SBL N 5 059 690.88 E 310 636.85 ORIGINATED BY SLL
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/NW Casing/NQ Casing COMPILED BY MFA
 DATUM Geodetic DATE 2007.07.30 - 2007.07.30 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 ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
	Continued From Previous Page							20	40	60	80	100					

+ 3 x 3 Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No SCS-3

1 OF 3

METRIC

G.W.P. 742-93-00 LOCATION Stirling Creek Tributary SBL N 5 059 694.86 E 310 651.95 ORIGINATED BY JHL
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007.06.24 - 2007.06.26 CHECKED BY AEG

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				
								SHEAR STRENGTH kPa				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				
						WATER CONTENT (%)						
						PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT						
						w _p w w _L						
						20 40 60						
315.0												GR SA SI CL
0.0	TOPSOIL: (300mm)						315					
314.7												
0.3	Gravelly SAND, trace silt Compact Brown Moist		1	SS	18		314					
			2	SS	18		313					32 66 2 (SI+CL)
312.5			3	SS	100/ .300							
2.4	BOULDERS and COBBLES						312					
311.9			4	SS	22		311					
3.0												
	occasional cobbles Wet		5	SS	24		310					
309.5												
5.5	SAND, some gravel, trace silt and clay Very Dense Wet		6	SS	70		309					15 82 3 (SI+CL)
							308					
			7	SS	52		307					
							306					
			8	SS	78							
305.0												

Continued Next Page

+³ ×³ : Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No SCS-3

2 OF 3

METRIC

G.W.P. 742-93-00 LOCATION Stirling Creek Tributary SBL N 5 059 694.86 E 310 651.95 ORIGINATED BY JHL
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007.06.24 - 2007.06.26 CHECKED BY AEG

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				
	Continued From Previous Page							20 40 60 80 100				
								○ UNCONFINED + FIELD VANE				
								● QUICK TRIAXIAL x LAB VANE				
								20 40 60 80 100				
								PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT				
								w _p w w _L				
								WATER CONTENT (%)				
10.0	SAND and GRAVEL, trace silt and clay Compact to Very Dense Grey Wet						305					
			9	SS	79		304					
							303					
			10	SS	32		302					
	occasional cobbles						301					
			11	SS	75		300					
	occasional cobbles and boulders						299					
			12	SS	100/ .150		298					
	occasional cobbles and boulders						297					
			13	SS	100/ .100		296					
295.6												
19.4	SILT, some clay, trace sand											
295.4	Very Dense											
19.6	Grey Moist		14	SS	100/							

Continued Next Page

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

RECORD OF BOREHOLE No SCS-3

3 OF 3

METRIC

G.W.P. 742-93-00 LOCATION Stirling Creek Tributary SBL N 5 059 694.86 E 310 651.95 ORIGINATED BY JHL
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007.06.24 - 2007.06.26 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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		WATER CONTENT (%)				
	Continued From Previous Page				100			20 40 60 80 100	20 40 60					
	END OF BOREHOLE AT 19.61m ON POSSIBLE BEDROCK. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.													
	WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 06/27/07 4.1 310.9 06/28/07 4.1 310.9 07/06/07 4.3 310.7 07/23/07 5.0 310.0													

RECORD OF BOREHOLE No SCS-4

1 OF 2

METRIC

G.W.P. 742-93-00 LOCATION Stirling Creek Tributary SBL N 5 059 745.00 E 310 618.54 ORIGINATED BY SLL
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY MFA
 DATUM Geodetic DATE 2007.07.31 - 2007.07.31 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 ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		WATER CONTENT (%)				
317.0								20 40 60 80 100		20 40 60				
0.0	ASPHALT: (125mm)							20 40 60 80 100		20 40 60				
0.1	SAND, trace gravel, trace silt Compact to Very Dense Brown Moist (FILL)		1	AS				20 40 60 80 100		20 40 60				
			1	SS	28			20 40 60 80 100		20 40 60				
			2	SS	40			20 40 60 80 100		20 40 60				
			3	SS	21			20 40 60 80 100		20 40 60				
			4	SS	87/ 275			20 40 60 80 100		20 40 60				
			5	SS	24			20 40 60 80 100		20 40 60				
			6	SS	2			20 40 60 80 100		20 40 60				
309.3	Very Loose Grey Wet		7	SS	8			20 40 60 80 100		20 40 60				
7.7	SILT, some sand to sandy, trace rootlets Loose Dark Brown Moist to Wet		8	SS	52			20 40 60 80 100		20 40 60				
308.3	SAND and GRAVEL, trace silt Very Dense Dark Brown Wet							20 40 60 80 100		20 40 60				
8.7								20 40 60 80 100		20 40 60				

Continued Next Page

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

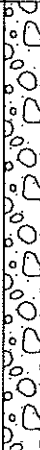


ONTMT4S 2339.GPJ 3/27/08

RECORD OF BOREHOLE No SCS-4

2 OF 2

METRIC

G.W.P. 742-93-00 LOCATION Stirling Creek Tributary SBL N 5 059 745.00 E 310 618.54 ORIGINATED BY SLL
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY MFA
 DATUM Geodetic DATE 2007.07.31 - 2007.07.31 CHECKED BY AEG

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					
	Continued From Previous Page						20 40 60 80 100						
	SAND and GRAVEL , trace silt Very Dense Dark Brown Wet		9	SS	65		○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE						
	occasional cobbles Grey		10	SS	100/ 250		20 40 60 80 100						
304.0							20 40 60						
13.0	SAND , trace gravel, trace silt Dense to Very Dense Grey Wet		11	SS	42		20 40 60 80 100						
			12	SS	72		20 40 60						
			13	SS	100/ 225		20 40 60						
299.6							20 40 60						
17.4	Coring started at 17.4m MIGMATITIC GNEISS BEDROCK , grey, weathered		1	RUN			20 40 60 80 100						
298.6							20 40 60						
18.4	END OF BOREHOLE AT 18.39m. BOREHOLE BACKFILLED WITH AQUAGROUT TO 1.2m, THEN HOLEPLUG TO 0.6m, THEN CUTTINGS TO 0.15m, AND ASPHALT TO SURFACE.						20 40 60						

ONTMT4S 2339.GPJ 3/27/08

RECORD OF BOREHOLE No SCS-5

1 OF 3

METRIC

G.W.P. 742-93-00 LOCATION Stirling Creek Tributary SBL N 5 059 749.98 E 310 637.31 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/NW Casing/NQ Casing COMPILED BY MFA
 DATUM Geodetic DATE 2007.07.05 - 2007.07.06 CHECKED BY AEG

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							
313.0							20	40	60	80	100	PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L			
0.0	SAND, trace gravel, trace silt Compact Brown Dry		1	SS	11												
			2	SS	13												
			3	SS	13												
			4	SS	14												
			5	SS	23												
			6	SS	25												
			7	SS	22												
	Dense		8	SS	39												
	Very Dense		9	SS	50/ .150												
	occasional cobbles																

1 98 1
(SI+CL)

Continued Next Page

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

METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
	Continued From Previous Page																
301.0	SAND, some gravel, trace silt Very Dense Brown Wet		10	SS	50/ .150										16 82 2 (SI+CL)		
11.9	Boulder from 11.28 to 11.94m																
299.9	Gravelly SAND, occasional cobbles and boulders Very Dense Brown Wet		11	SS													
13.1	SAND, trace gravel Very Dense Brown Wet		12	SS	50/ .150												
297.3																	
15.7	COBBLES and BOULDERS																
296.8																	
16.2	Gravelly SAND, trace silt Very Dense Brown Wet		14	SS	50/ .150										21 76 3 (SI+CL)		
294.7	Cobble at 17.68 to 17.81m																
18.3	MIGMATITIC GNEISS BEDROCK, fresh to slightly weathered, massive, coarse grained, grey, pink bands Sub-horizontal joints at 18.34m Horizontal joints at 18.34, 18.41, 18.64, 18.72, 18.98, 19.13, 19.23, 19.38, and 19.43m Rubble zone from 19.43 to 19.81m		1	RUN	50/ .000									FI 3 2 3 >>5 >>10	RUN 1# TCR=100%, SCR=60%, RQD=50%, UCS=150MPa		

+ 3, X 3: Numbers refer to Sensitivity

ONTMT4S 2339.GPJ 3/27/08

RECORD OF BOREHOLE No SCS-5

3 OF 3

METRIC

G.W.P. 742-93-00 LOCATION Stirling Creek Tributary SBL N 5 059 749.98 E 310 637.31 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/NW Casing/NQ Casing COMPILED BY MFA
 DATUM Geodetic DATE 2007.07.05 - 2007.07.06 CHECKED BY AEG




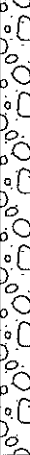

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa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

RECORD OF BOREHOLE No SCS-6

1 OF 2

METRIC

G.W.P. 742-93-00 LOCATION Stirling Creek Tributary SBL N 5 059 765.31 E 310 622.93 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007.07.05 - 2007.07.05 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						PLASTIC LIMIT w _p NATURAL MOISTURE CONTENT w LIQUID LIMIT w _L WATER CONTENT (%)					
312.6 0.0	SAND, trace silt, occasional cobbles Loose to Compact Brown Moist (FILL)		1	SS	9		312												
			2	SS	10		311												
			3	SS	5		310												
			4	SS	15		309												
309.5 3.0	SAND, fine to medium grained, trace silt Compact Brown Wet		5	SS	17		308												
			6	SS	27		307												
306.5 6.1	SAND and GRAVEL, trace silt Very Dense Brown Wet		7	SS	55		306												
			8	SS	85		305												
303.4 9.1	SAND, trace gravel Very Dense Brown Wet		9	SS	120		304												
						303													

Continued Next Page

+³ × 3: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No SCS-6

2 OF 2

METRIC

G.W.P. 742-93-00 LOCATION Stirling Creek Tributary SBL N 5 059 765.31 E 310 622.93 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007.07.05 - 2007.07.05 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 Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
302.5 10.1	Continued From Previous Page END OF BOREHOLE AT 10.06m. BOREHOLE OPEN AND WATER LEVEL AT 3.05m UPON COMPLETION. BOREHOLE GROUTED WITH BENTONITE TO SURFACE.						302							

Appendix B

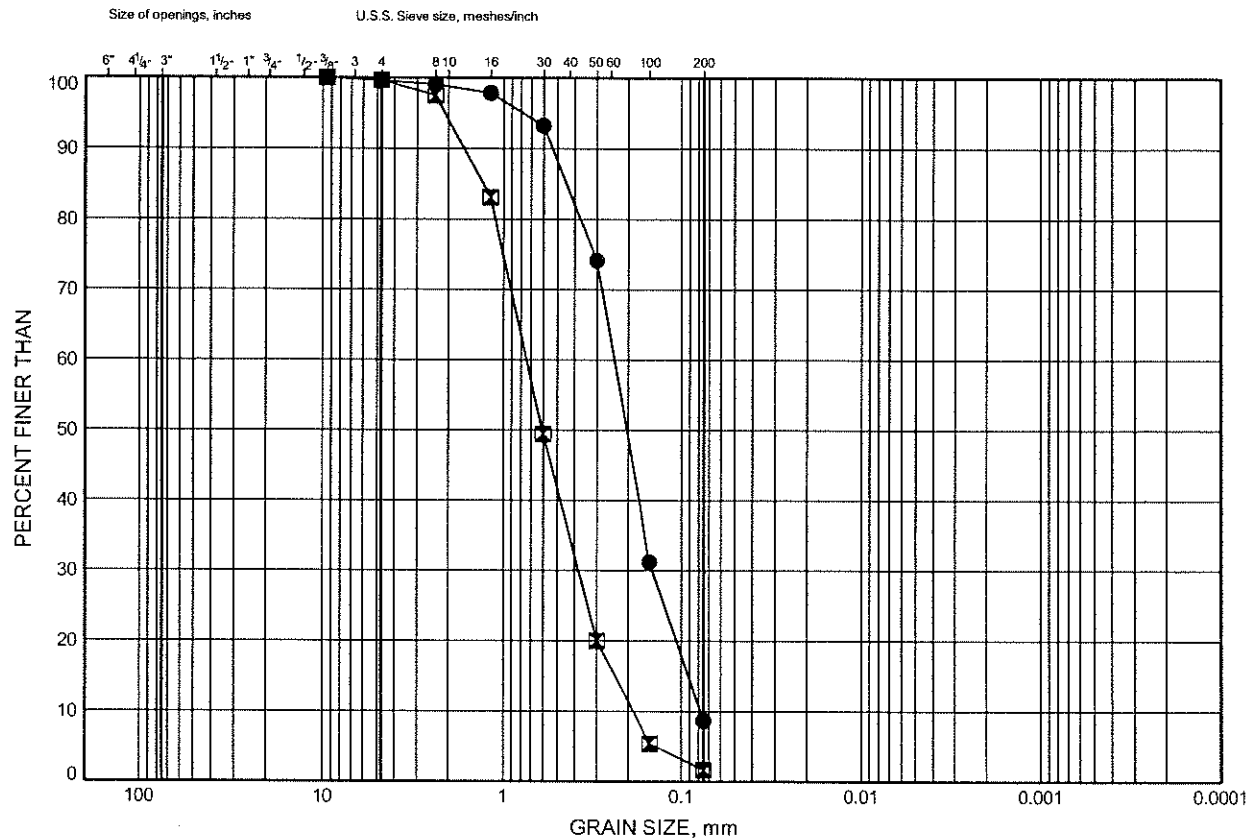
Laboratory Test Results

Stirling Creek Tributary Bridges

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)
●	SCS-4	2.59	314.37
☒	SCS-6	2.59	310.00

Date March 2008

Project 742-93-00



Prep'd MFA

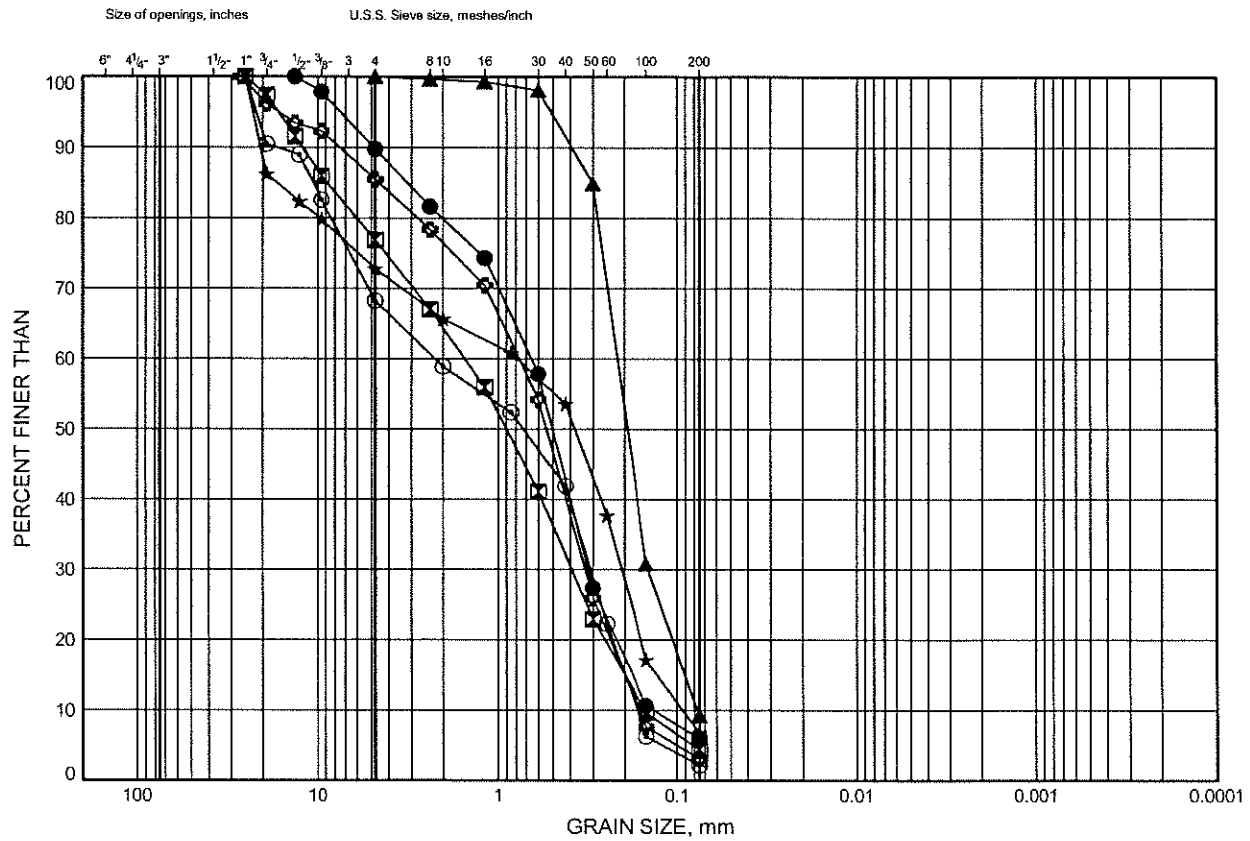
Chkd. RPR

Stirling Creek Tributary Bridges

GRAIN SIZE DISTRIBUTION

FIGURE B2

SAND (SOME GRAVEL TO GRAVELLY)



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	SCS-1	3.35	315.67
⊠	SCS-1	7.92	311.10
▲	SCS-2	3.35	315.49
★	SCS-2	9.45	309.40
⊙	SCS-3	1.83	313.15
⊕	SCS-3	6.40	308.58

Date March 2008

Project 742-93-00



Prep'd MFA

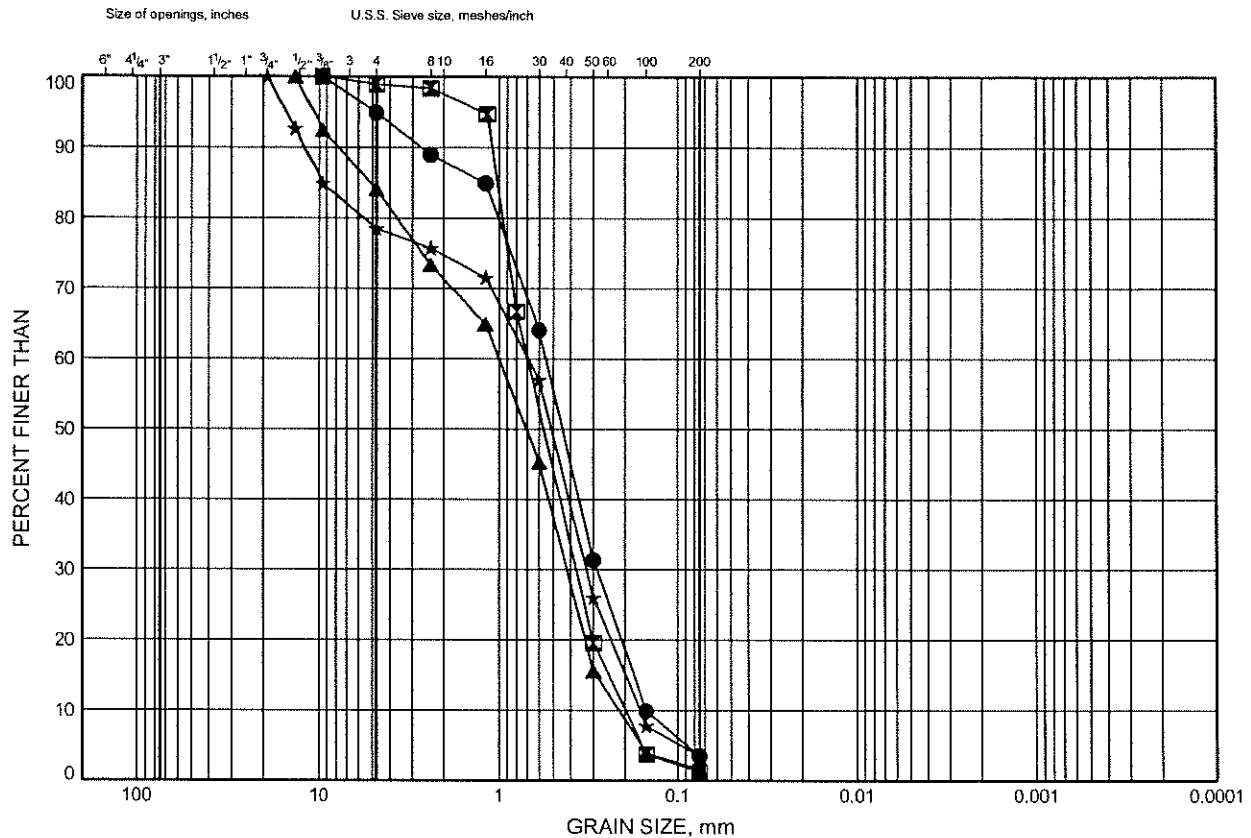
Chkd. RPR

Stirling Creek Tributary Bridges

GRAIN SIZE DISTRIBUTION

FIGURE B3

SAND (SOME GRAVEL TO GRAVELLY)



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	SCS-4	14.02	302.94
⊠	SCS-5	2.59	310.39
▲	SCS-5	10.36	302.62
★	SCS-5	16.46	296.53

Date March 2008

Project 742-93-00



Prep'd MFA

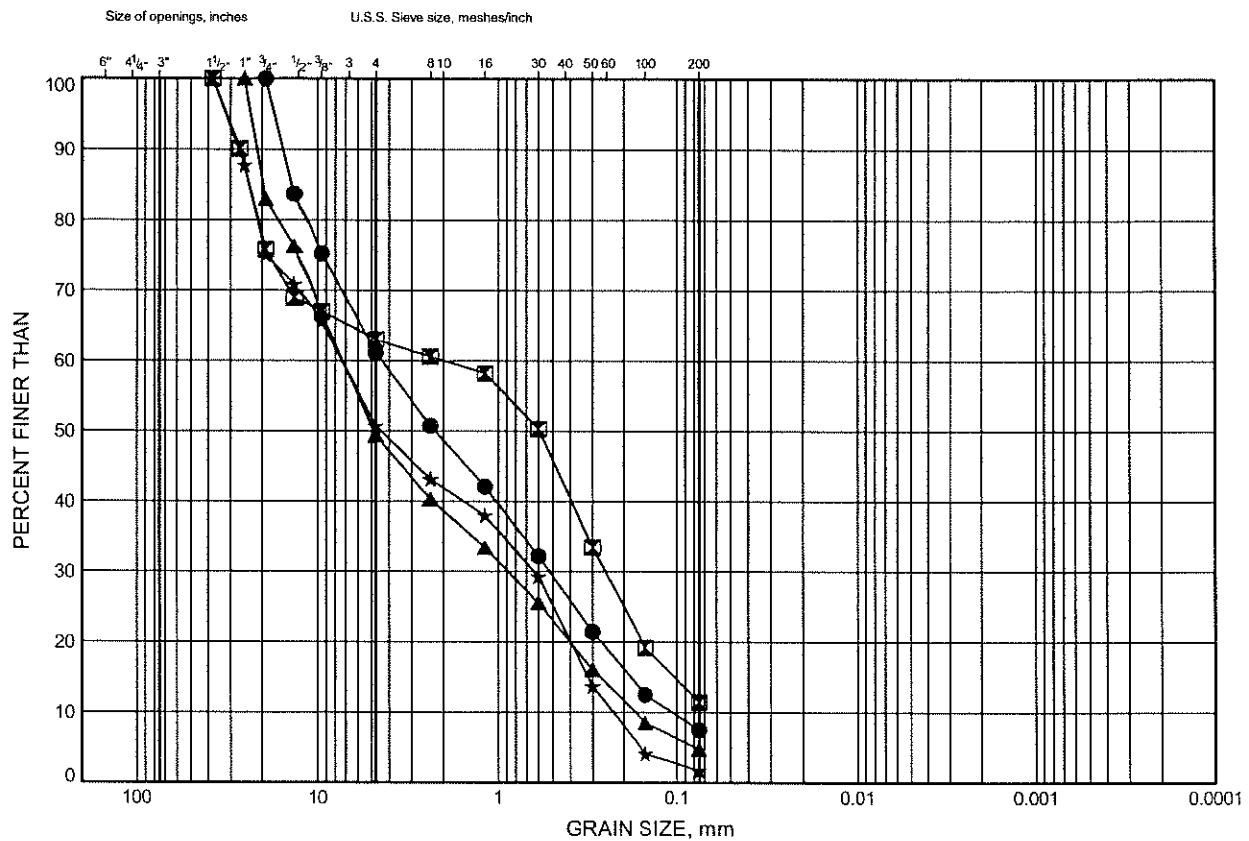
Chkd. RPR

Stirling Creek Tributary Bridges

GRAIN SIZE DISTRIBUTION

FIGURE B4

SAND AND GRAVEL



Highway 11 SBL over Stirling Creek Tributary
Highway 11 Burk's Falls to South River

Appendix C
Site Photographs

Highway 11 SBL over Stirling Creek Tributary
Highway 11 Burk's Falls to South River



Photograph 1 – General view of the site, looking northwards, pond in middle ground.



Photograph 2 – Confluence of the two streams at mouth of culvert.

Highway 11 SBL over Stirling Creek Tributary
Highway 11 Burk's Falls to South River



Photograph 3 – South approach looking south along Highway 11.

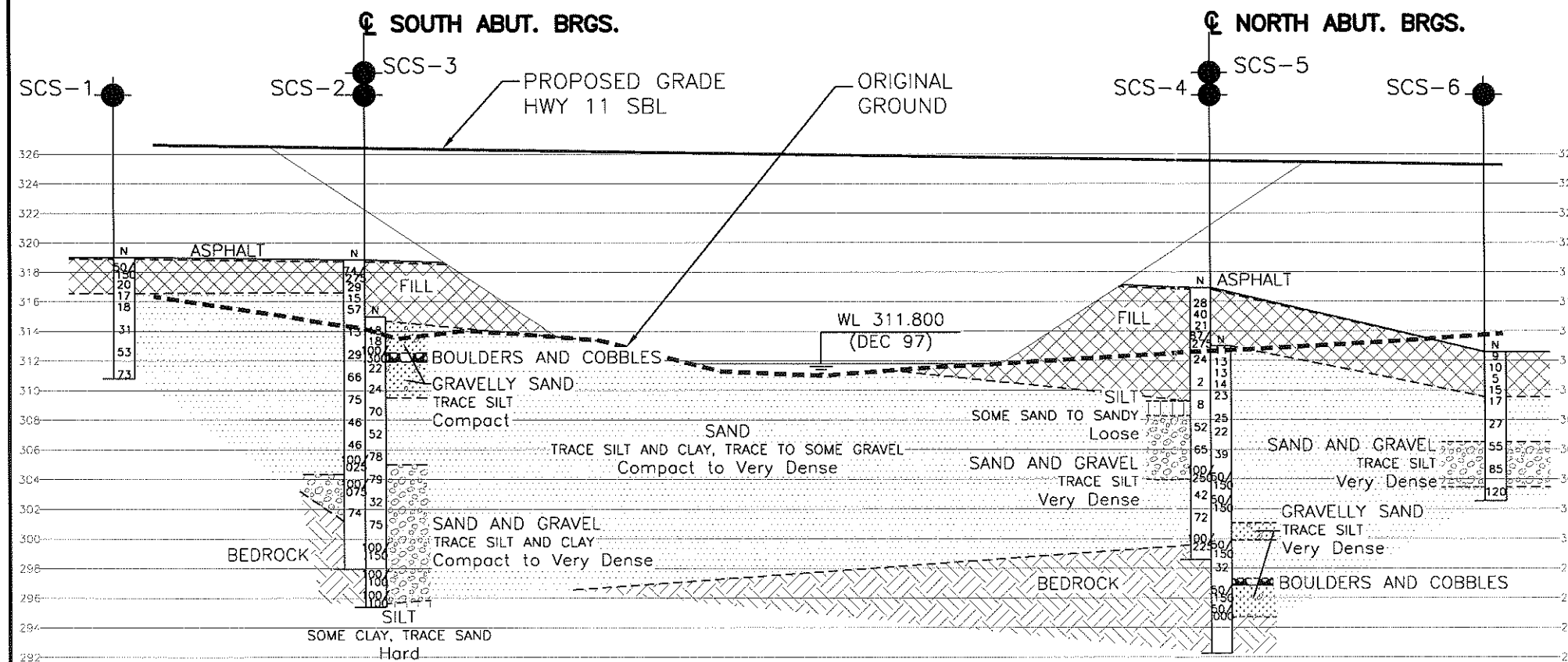
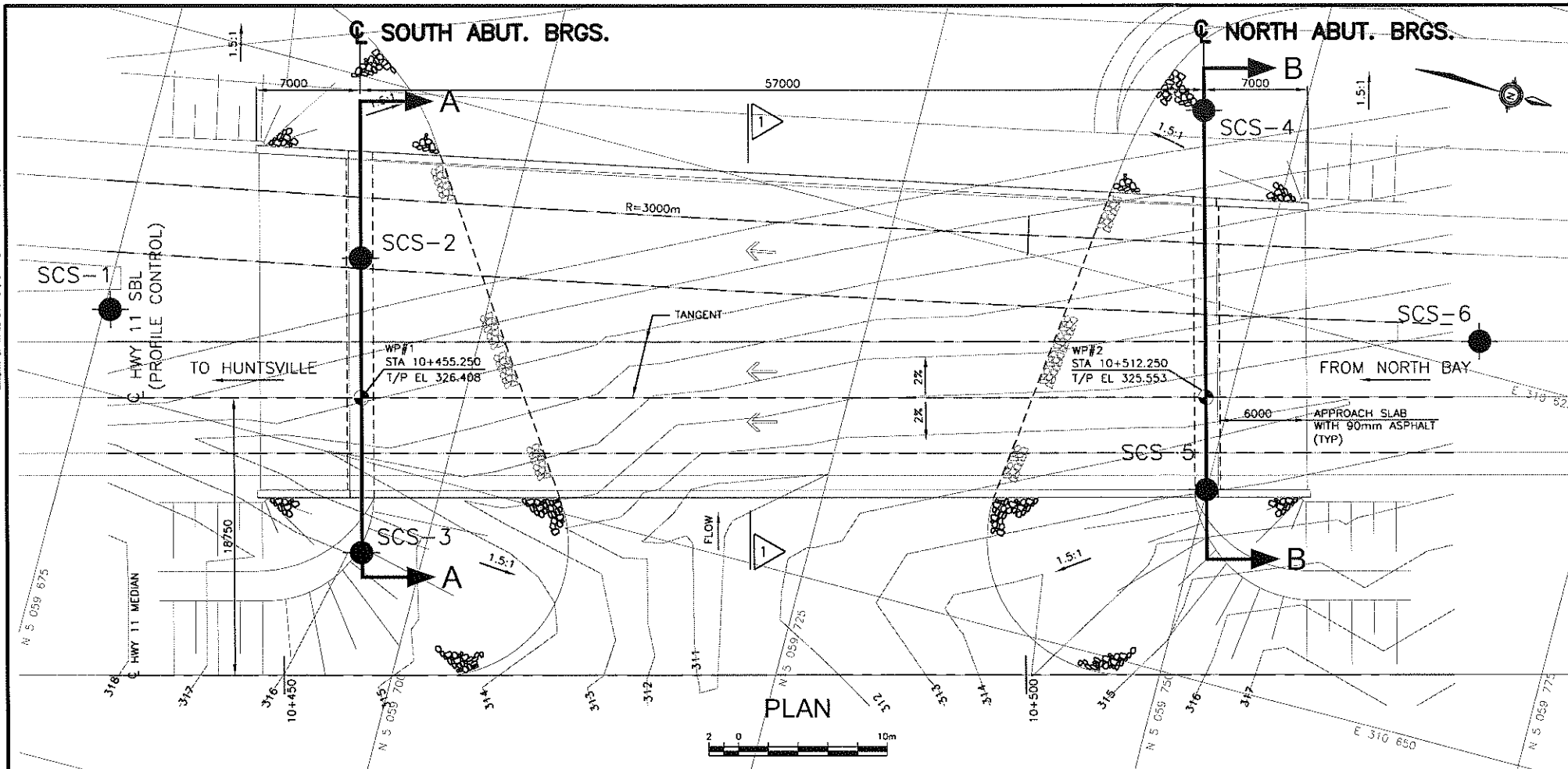


Photograph 4 – Looking north along Highway 11 over future SBL structure site.

Appendix D

Drawing

Borehole Locations and Soil Strata



PROFILE HWY 11 SBL

DHO BENCHMARK 343-67
ELEVATION 329.137
TABLET IN ROCK OUTCROP
49.337m Rt. 24+795.574
TWP OF ARMOIR

Refer to DWG 2 for Sections A-A
and B-B.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No 2008-5113
WP No 5100-06-01

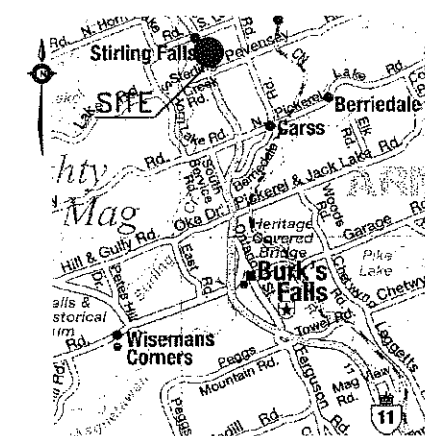
STIRLING CK TRIBUTARY SBL
BOREHOLE LOCATIONS AND SOIL STRATA



SHEET
293







THURBER ENGINEERING LTD.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS



KEYPLAN

LEGEND

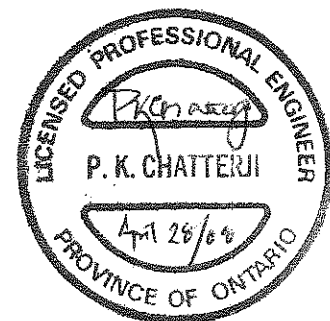
- | | |
|---|---------------------------------------|
|  | Borehole by THURBER |
| N | Blows /0.3m (Std Pen Test, 475J/blow) |
| CONE | Blows /0.3m (60° Cone, 475J/blow) |
| PH | Pressure, Hydraulic |
|  | Water Level |
|  | Head Artesian Water |
|  | Piezometer |
| 90% | Rock Quality Designation (RQD)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

[illegible]

-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. 31E-276

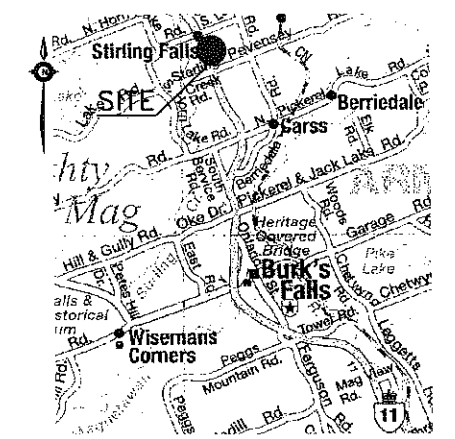


METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No 2008-5113
WP No 5100-06-01

STIRLING CK TRIBUTARY SBL
STRATIGRAPHIC SECTIONS

SHEET
294



KEYPLAN

LEGEND

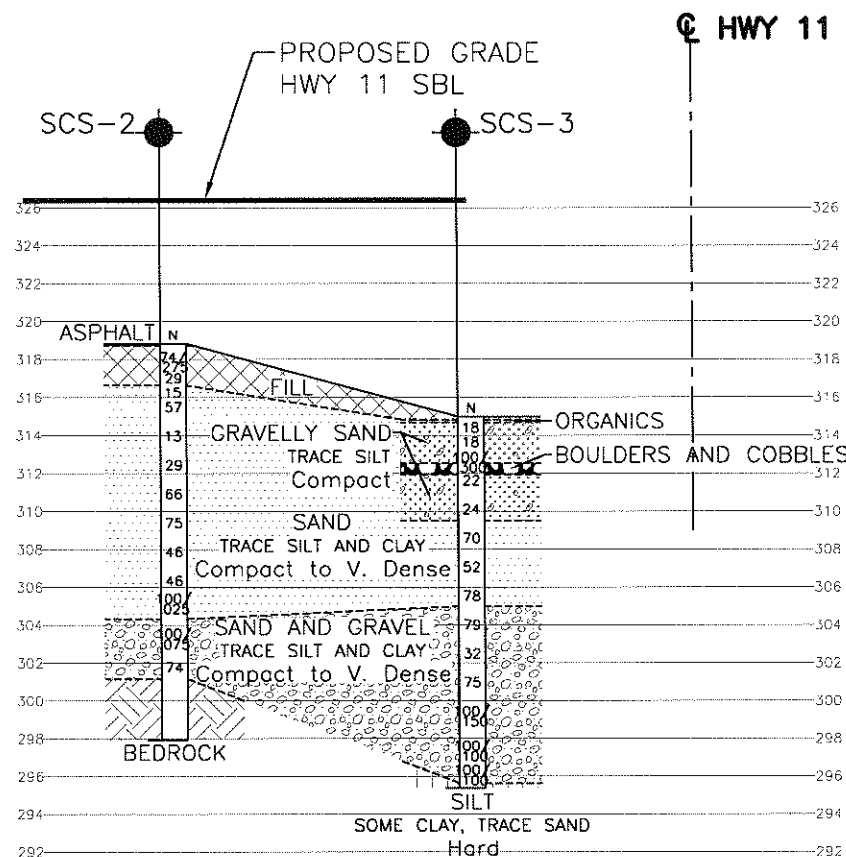
- Borehole by THURBER
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- Water Level
- Head Artesian Water
- Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
SCS-1	319.0	5 059 675.41	310 644.51
SCS-2	318.8	5 059 690.88	310 636.85
SCS-3	315.0	5 059 694.86	310 651.95
SCS-4	317.0	5 059 745.00	310 618.54
SCS-5	313.0	5 059 749.98	310 637.31
SCS-6	312.6	5 059 765.31	310 622.93

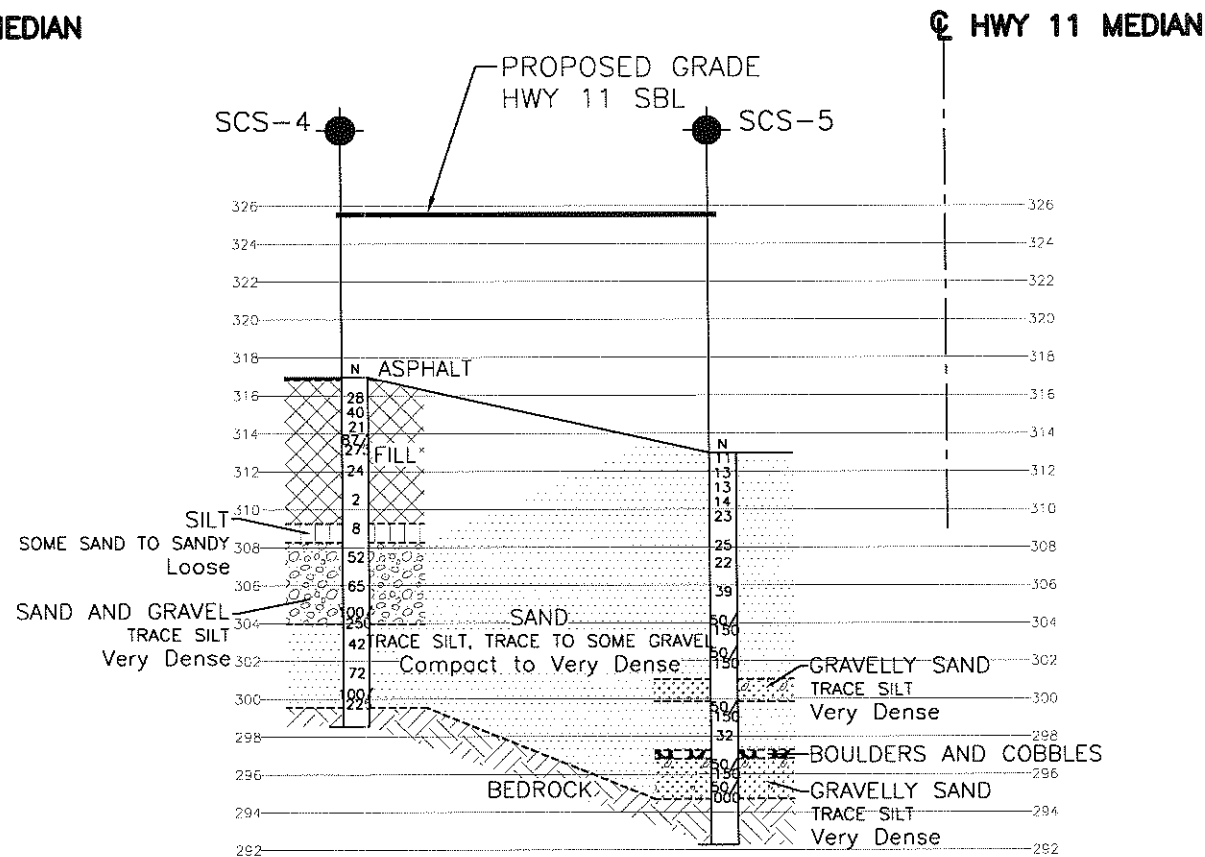
NOTES

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

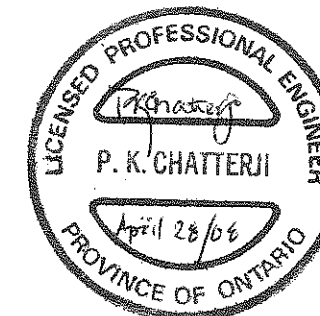
GEOCRES No. 31E-276



SECTION A-A



SECTION B-B



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	AEG	CHK	AEG
DRAWN	MFA	CHK	AEG
DATE	APR 2008		
LOAD			
STRUCT			
SCHEME			
DWG			

DHD BENCHMARK 343-67
ELEVATION 329.137
TABLET IN ROCK OUTCROP
49.337m Rt. 24+795.574
TWP OF ARMOUR