

**FOUNDATION INVESTIGATION REPORT
WIDENING OF KING STREET OVERPASS AT HIGHWAY 8
SOUTHBOUND STRUCTURE
KITCHENER, ONTARIO
G.W.P. 277-97-00, SITE: 33-214E**

Geocres Number: 40P8-144

Report to

Morrison Hershfield Limited

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PART 1: FACTUAL INFORMATION

1 INTRODUCTION

This report presents the factual findings obtained from a foundation investigation conducted at the southbound lane structure of the King Street East overpass at Highway 8 in Kitchener, Ontario. The existing structure was constructed in 1987, consists of a two-span girder bridge on an approximate 40-degree skew, and currently carries two lanes of traffic. The proposed project involves widening of the structure to accommodate an additional lane of traffic.

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 investigation.

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

2 SITE DESCRIPTION

The site is located on Highway 8 in Kitchener, Ontario, between the Grand River to the north and Sportsworld Drive to the south. The lands to the east of the site are generally vacant and a small residential subdivision exists to the west. Lands along King Street East to the west of Highway 8 have been developed for commercial and retail use.

The topography is typically rolling. Drainage at the site is generally towards the Grand River, which flows westerly within a deep valley located approximately 1 km to the north of the overpass. Vegetation consists of grass and small shrubs, with mature trees present in the southeast quadrant of the interchange.

The general site area is located within the physiographic region known as Waterloo Hills, characterized by ridges of sandy till and kames or kame moraines, with outwash sands occupying the intervening hollows.

3 SITE INVESTIGATION AND FIELD TESTING

3.1 Current Investigation

The site investigation and field testing for this project were carried in two stages. Initially nine boreholes, including boreholes drilled concurrently for investigation at the northbound structure, were drilled and sampled at the site between May 8 and 27, 2006. Boreholes 06-15 to 06-23 (excluding 06-18 and 06-19) were drilled within the Highway 8 median in line with the existing abutments and pier, and were terminated at depths of 20.1 to 27.7 m. Boreholes 06-14 and 06-24 were drilled to 11.1 m depth in the approaches approximately 20 m from the abutments.

Subsequently on May 5 and 6, 2007, three additional boreholes numbered 07-1 to 07-3 were drilled in line with the existing abutments and pier, on the west side of the southbound structure. These boreholes were drilled to depths of 21.5 to 23.0 m.

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

Prior to commencement of drilling, utility clearances were obtained for all borehole locations. Road occupancy and lane closure permits were also obtained.

Hollow stem augers were used to advance the boreholes. Samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT). A member of Thurber's engineering staff supervised the drilling and sampling operations on a full time basis. The inspector logged the boreholes, visually examined the recovered samples, and transported them to Thurber's laboratory for further examination and testing.

Standpipe piezometers, consisting of 19 or 25 mm PVC pipes with slotted tip, were installed in selected boreholes to monitor groundwater levels. The completion details are shown in Table 3.1. The remaining boreholes were grouted in accordance with the abandonment requirements of MOE Reg. 903.

Table 3.1 – Piezometer Installation Details

Piezometer Location	Tip (Sand Filter) Details			Backfill
	Depth	Elevation	Stratum	
06-15	20.0 – 21.8	282.3 – 280.5	Clayey Silt and Sand Till	Bentonite and grout to 0.3 m, concrete to surface
06-23	25.3 – 27.1	278.2 – 276.4	Silt and Sand Till	Bentonite and grout to 0.3 m, concrete to surface
07-1	19.4 – 21.3	284.1 – 282.2	Silt and Sand Till	Bentonite and grout to 0.6 m, sand to 0.3 m, concrete to surface

3.2 Previous Investigation

A foundation investigation was carried out for the existing overpass structures in 1980 (Foundation Investigation for Freeport Drive Overpass, W.P. 31-76-04/05, Site Nos. 33-214A/B, Mar 1982). The Record of Borehole sheets for that investigation are included in Appendix A, and the approximate borehole locations are indicated on the drawing in Appendix C. The work was carried out prior to construction of the King Street cut and the overpass structure, and will not be referenced further in the current report.

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. Approximately 25% of the recovered samples were also subjected to grain size distribution analyses (sieve and hydrometer) and Atterberg Limits testing. The results of this testing program are shown on the Record of Borehole sheets in Appendix A and on the figures contained in Appendix B.

5 DESCRIPTION OF SUBSURFACE CONDITIONS

Details of the encountered soil stratigraphy are presented on the Record of Borehole sheets in Appendix A and on the Borehole Locations and Soil Strata Drawing in Appendix C. 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 site was found to be underlain by sand and gravel fill overlying, in succession, native sand and gravel, a layer of heterogeneous silt and sand to clayey silt till, a thick deposit of silty clay till, and a second layer of sand and silt to clayey sandy silt till.

More detailed descriptions of the individual strata are presented below.

5.1 Asphaltic Concrete

The boreholes were drilled through the pavement structure on King Street or the shoulder of Highway 8. The asphaltic concrete layer varied in thickness from 50 to 190 mm in the boreholes.

5.2 Sand and Gravel Fill

Sand and gravel fill was encountered below the asphalt in all boreholes. The fill extended to depths of 0.8 to 2.6 m (elevation 300.3 to 302.9 m) in the boreholes drilled on King Street (Boreholes 06-15 to 06-23 and 07-1 to 07-3), and to 1.5 m depth (elevation 307.9 and 309.6 m) in Boreholes 06-14 and 06-24 drilled on the shoulder of Highway 8.

SPT N-values ranged from 50 blows/0.3 m penetration to 50 blows/0.125 m in the fill, indicating a very dense relative density. N-values greater than 50 blows/0.15 m may reflect the presence of cobbles or boulders in the fill. Grain size distribution results for the fill are presented on the Record of Borehole sheets and Figure B1 of Appendix B. The silt content in the tested samples ranged from 6 to 11%. Moisture contents in this material ranged from 2% to 5%.

5.3 Silty Sand to Sand and Gravel

Native deposits of brown silty sand, sand, and sand and gravel were encountered below the granular fill in all boreholes. In Boreholes 06-15 to 06-23 and 07-1 to 07-3 drilled on King Street, the upper boundary of this material was encountered at depths of 0.8 to 2.6 m (elevation 300.3 to 302.9 m), and the lower boundary was encountered at depths of 2.3 to 7.8 m (elevation 295.7 to 300.6 m). In Borehole 06-24 drilled from Highway 8, the upper and lower boundaries were encountered at depths of 1.5 and 9.1 m (elevation 309.6 and 302.0 m), respectively. Borehole 06-14 encountered native sand and gravel at 1.5 m depth (elevation 307.9 m) and was terminated in this material at 11.1 m depth (elevation 298.3 m).

SPT N-values in the silty sand to sand and gravel generally ranged from 21 blows/0.3 m penetration to 50 blows/0.15 m, indicating a compact to very dense relative density. N-values greater than 50 blows/0.15 m may reflect the presence of cobbles or boulders. A loose to compact condition was indicated by N-values of 6 to 14 blows/0.3 m obtained between 0.9 and 2.3 m depth (elevation 302.0 and 300.6 m) in Borehole 06-17, between 3.0 and 4.6 m depth (elevation 300.5 and 298.9 m) in Borehole 06-23, and between 4.5 and 7.5 m depth (elevation 306.6 and 303.6 m) in Borehole 06-24.

Grain size distribution results for the silty sand to sand and gravel are presented on the Record of Borehole sheets and Figures B2 and B3 of Appendix B. The fines content (silt and clay) in the tested samples ranged from 9 to 34%. Moisture contents in this material ranged from 2% to 17%, typically less than 10%.

5.4 Upper Heterogeneous Till (Silt and Sand to Clayey Silt)

A brown heterogeneous till deposit varying in gradation from cohesionless silt and sand, some clay to clayey, to cohesive clayey silt, some sand to sandy, was encountered below the silty sand to sand and gravel deposit in all boreholes except Boreholes 07-1 to 07-3. The results of sieve and hydrometer analyses conducted on samples of this unit, presented on the Record of Borehole Sheets and Figure B4 of Appendix B, indicate the following particle size distribution:

Gravel	1 – 5 %
Sand	30 – 41 %
Silt	44 – 56 %
Clay	11 – 16 %

The thickness of this till deposit in Boreholes 06-15 to 06-23 ranged from 1.5 to 3.0 m. The upper boundary was encountered at 2.3 m depth (elevation 300.0 to 300.6 m) adjacent to the existing northbound lanes structure, at depths of 3.7 to 4.6 m (elevation 298.9 to 299.7 m) adjacent to the southbound lane structure, and at 3.0 m (elevation 300.2 m) in Borehole 06-20 drilled along the highway centreline. The lower boundary was encountered at depths of 3.8 to 4.6 m (elevation 297.7 to 299.1 m) adjacent to the northbound lanes, at depths of 6.1 to 7.6 m (elevation 295.9 to 297.4 m) adjacent to the southbound lanes, and at 5.5 m (elevation 297.7 m) at the centreline.

Borehole 06-24 drilled at the south approach encountered the till at 9.1 m depth (elevation 302.0 m) and was terminated in this unit at 11.1 m (elevation 300.0 m).

SPT N-values obtained in the till deposit ranged from 31 blows/0.3 m to 50 blows/0.15 m penetration, indicating a hard or dense to very dense condition. Moisture contents from this deposit ranged from 5 to 19%.

A pocket of silt was encountered within the till unit at 3.8 m depth in Borehole 06-15. The results of a grain size analysis conducted on the silt are also shown on Figure B4.

Although not encountered in the boreholes, glacial till may contain cobbles and large boulders.

5.5 Silty Clay Till

The sand to sand and gravel deposits and upper heterogeneous till layer are underlain by a thick deposit of brown to grey silty clay till. The silty clay till deposit ranges in thickness from 10.7 to 14.5 m, and has upper and lower boundaries at depths of 3.8 to 7.8 m (elevation 295.7 to 299.1 m) and 16.8 to 21.3 m (elevation 282.2 to 286.7 m), respectively.

Standard Penetration Tests conducted in this deposit typically yielded N-values ranging from 30 to greater than 100 blows/0.3 m penetration, indicating a hard consistency. In Boreholes 06-16 to 06-21, N-values of 20 to 25 blows/0.3 m were obtained at depths of

13.7 to 16.8 m, indicating a very stiff zone. Moisture contents generally ranged from 11 to 22%, with higher values of up to 42% measured in the very stiff zones.

Samples from this deposit were subjected to grain size distribution and Atterberg Limits tests. The results of the grain size analyses are reported on the Record of Borehole Sheets and plotted in Figures B5 to B7 of Appendix B. The Atterbergs Limits, plotted on Figures B10 and B11, indicate that the silt clay till has a low to medium plasticity.

Although not encountered in the boreholes, glacial till may contain cobbles and large boulders.

5.6 Lower Heterogeneous Till (Silt and Sand to Clayey Sandy Silt)

A second deposit of heterogeneous till was encountered below the silty clay till at depths of 16.8 to 21.3 m (elevation 282.2 to 286.7 m). This deposit varies in gradation from cohesionless silt and sand, some clay, to cohesive clayey sandy silt. The results of sieve and hydrometer analyses conducted on samples of this unit, presented on the Record of Borehole Sheets and Figures B8 and B9 of Appendix B, indicate the following particle size distribution:

Gravel	0 – 8 %
Sand	29 – 48 %
Silt	39 – 51 %
Clay	6 – 22 %

SPT N-values obtained in this till deposit were greater than 100 blows/0.3 m penetration, indicating a hard or very dense condition. Moisture contents ranged from 5 to 15%, with one value of 21%. The boreholes were terminated in the till deposit at depths of 20.1 to 27.7 m (elevation 275.8 to 283.4 m).

Although not encountered in the boreholes, glacial till may contain cobbles and large boulders.

5.7 Water Levels

Upon completion of drilling, water was measured at depths of 4.7 to 18.9 m in open Boreholes 06-15, 06-17, 06-20, 06-23, 07-2 and 07-3. In addition, wet conditions and/or a wet split spoon sampler were observed at various depths in the majority of the boreholes during drilling. These observations are believed to reflect the presence of groundwater contained within lenses or pockets of more permeable sands and silts within the heterogeneous tills of overall lower permeability. Water also appears to be perched within the fill locally (such as in Borehole 06-17).

Standpipe piezometers were installed in Boreholes 06-15, 06-23 and 07-1 to monitor water levels after completion of drilling. The water levels measured in the piezometers are summarized in Table 5.1, along with the measurements in the open boreholes upon completion of drilling.

Table 5.1 – Measured Groundwater Levels

Borehole	Date	Water Level (m)		Comment
		Depth	Elevation	
06-15	19-May-2006	18.9	283.4	In open borehole
	19-May-2006	Dry	-	In piezometer
	08-Aug-2006	19.2	283.1	In piezometer
06-17	15-May-2006	7.0	295.9	In open borehole
06-20	11-May-2006	18.9	284.3	In open borehole
06-23	10-May-2006	18.9	284.6	In open borehole
	10-May-2006	20.6	282.9	In piezometer
	18-May-2006	19.9	283.6	In piezometer
	08-Aug-2006	21.2	282.3	In piezometer
07-1	06-Jun-2007	16.7	286.8	In piezometer
	07-Jun-2007	17.2	286.3	In piezometer
07-2	06-Jun-2007	4.7	299.4	In open borehole
07-3	06-Jun-2007	12.3	291.7	In open borehole

The above values are short-term readings and seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at a higher elevation after the spring snowmelt or after periods of heavy rainfall. Further, perched water may be encountered at higher levels in pockets or zones of more permeable sands and silts within the heterogeneous tills, or within the fill locally.

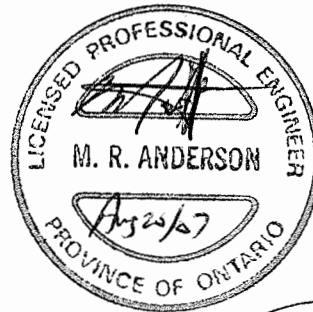
6 MISCELLANEOUS

Thurber Engineering Ltd. selected the borehole locations in the field relative to existing site features with consideration of access restraints, terrain conditions, and utility locations. Callon Dietz Inc., retained by Morrison Hershfield, subsequently established the co-ordinates and ground surface elevations at the staked borehole locations.

All-Terrain Drilling of Waterloo supplied and operated the drilling and sampling equipment used for the investigation. Full time supervision of the field activities, including obtaining utility clearances, was carried out by Mr. George Azzopardi, Mr. Kenneth Hui and Mr. Stephane Loranger of Thurber.

Interpretation of the field data and preparation of the investigation report were conducted by Mr. Murray Anderson, P.Eng. Overall supervision of the field program and review of the report was provided by Mr. Alastair Gorman, P.Eng. The report was reviewed by Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

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Review Principal



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


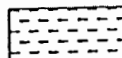



 Shear Strength Determination by Pocket Penetrometer

- (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			Field Estimation of Hardness*
Bedding	Bedding Plane Spacing	Rock Strength	Approximate Uniaxial Compressive Strength		
			(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.



METRIC

[illegible]

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 06-14

2 OF 2

METRIC

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

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT 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	W _P W W _L	20 40 60		
298.3			9	SS	35								
11.1	END OF BOREHOLE AT 11.13 m. BOREHOLE OPEN TO 11.13 m AND DRY UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.												Sampler wet

RECORD OF BOREHOLE No 06-15

1 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 728.1 E 231 500.9 ORIGINATED BY GA
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 18.05.06 - 19.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
302.3	ASPHALT: (75 mm)												
0.0	SAND and GRAVEL, trace silt, occasional cobbles Very Dense Brown (FILL)		1	SS	50/ .150		302						
0.1			2	SS	50/ .150								
300.8							301						53 40 8 (SI+CL)
1.5	Silty SAND, trace gravel Compact Brown (SM)		3	SS	27								
300.0							300						
2.3	Clayey SILT, some sand to sandy, trace gravel Hard Brown (TILL) occasional wet sand seams		4	SS	64								
			5	SS	38		299						Sampler wet
	pocket of silt, some clay		6	SS	100								
297.7							298						0 2 85 13
4.6	Silty CLAY, trace to some sand, trace gravel Hard Brown (TILL)		7	SS	88		297						
			8	SS	53		296						
			9	SS	74		295						
			10	SS	54		294						
							293						

Continued Next Page

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

RECORD OF BOREHOLE No 06-15

3 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 728.1 E 231 500.9 ORIGINATED BY GA
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 18.05.06 - 19.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m 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					
280.5			17	SS	106		282							
281														
281			18	SS	104									
21.8	END OF BOREHOLE AT 21.79 m. BOREHOLE OPEN TO 21.79 m AND WATER LEVEL AT 18.90 m UPON COMPLETION. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) 19.05.06 dry 08.08.06 19.22													

RECORD OF BOREHOLE No 06-16

1 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 720.6 E 231 518.7 ORIGINATED BY KH
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 17.05.06 - 17.05.06 CHECKED BY MRA

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						
								20 40 60 80 100						
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
							WATER CONTENT (%)							
							20 40 60							
302.9														
0.0	ASPHALT: (50 mm)		1	SS	50/									
0.1	SAND and GRAVEL, trace silt Very Dense Brown Moist (FILL)				.125									
302.1			2	SS	67		302							
0.8	Silty SAND, some gravel Very Dense to Compact Brown Dry		3	SS	29		301							
300.6														
2.3	SILT and SAND, some clay to clayey, trace gravel, trace limestone fragments Hard Brown (TILL)		4	SS	64		300						3 41 44 12	
			5	SS	45									
			6	SS	62		299							
298.3														
4.6	Silty CLAY, trace sand Hard Grey Moist (TILL)		7	SS	55		298							
			8	SS	76		297						0 3 61 37	
			9	SS	39		296							
			10	SS	54		295							
							294							
							293							

Continued Next Page

+³ ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 06-16

2 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 720.6 E 231 518.7 ORIGINATED BY KH
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 17.05.06 - 17.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT w _p NATURAL MOISTURE CONTENT w LIQUID LIMIT w _L	WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES							
			11	SS	51		292					0 4 46 50
			12	SS	37		291					
			13	SS	30		289					
	Becoming Very Stiff		14	SS	21		288					
			15	SS	23		286					
285.4							285					
17.5	SILT and SAND, some clay, trace gravel, trace limestone fragments Very Dense Grey (TILL)		16	SS	50/ .150		284					2 44 44 10
							283					

Continued Next Page

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

RECORD OF BOREHOLE No 06-16

3 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 720.6 E 231 518.7 ORIGINATED BY KH
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 17.05.06 - 17.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L		
			17	SS	76/ .150												
281.4							282										
21.5	END OF BOREHOLE AT 21.46 m. BOREHOLE GROUTED TO SURFACE.		18	SS	100/ .125												

RECORD OF BOREHOLE No 06-17

1 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 715.6 E 231 533.5 ORIGINATED BY KH/GA
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 12.05.06 - 15.05.06 CHECKED BY MRA

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						
								20 40 60 80 100						
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
							WATER CONTENT (%)							
							20 40 60							
302.9														
0.0	ASPHALT: (75mm)													
0.1	SAND and GRAVEL, trace silt Very Dense Brown Moist (FILL)		1	SS	95									
302.0														
0.9	SAND, fine grained, some silt Compact to Loose Brown Moist		2	SS	26		302							
			3	SS	6		301							Sampler wet
300.6														
2.3	SILT and SAND, some clay, trace gravel Dense to Very Dense Brown Moist (TILL)		4	SS	31		300							4 41 44 11
			5	SS	61									
299.1														
3.8	Silty CLAY, trace sand Hard Grey (TILL)		6	SS	82		299							
			7	SS	92		298							0 2 60 38
			8	SS	52		297							
			9	SS	58		296							
							295							
			10	SS	78		294							
							293							

Continued Next Page

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

METRIC

G.W.P. <u>277-97-00</u>	LOCATION <u>King Street Overpass N 4 808 715.6 E 231 533.5</u>	ORIGINATED BY <u>KH/GA</u>
HWY <u>8</u>	BOREHOLE TYPE <u>Hollow Stem Augers</u>	COMPILED BY <u>WM</u>
DATUM <u>Geodetic</u>	DATE <u>12.05.06 - 15.05.06</u>	CHECKED BY <u>MRA</u>

[illegible]

+ 3, × 3: Numbers refer to Sensitivity

RECORD OF BOREHOLE No 06-17

3 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 715.6 E 231 533.5 ORIGINATED BY KH/GA
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 12.05.06 - 15.05.06 CHECKED BY MRA

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		
			17	SS	110/ .300		282							
281.3 21.6	END OF BOREHOLE AT 21.56 m. BOREHOLE OPEN TO 21.56 m AND WATER LEVEL AT 7.01 m UPON COMPLETION OF DRILLING. BOREHOLE GROUTED TO SURFACE.		18	SS	100/ .225									

RECORD OF BOREHOLE No 06-20

1 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 706.1 E 231 537.0 ORIGINATED BY GA
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 10.05.06 - 11.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
303.2	ASPHALT: (50 mm)						303						32 58 11 (SI+CL)
0.0	SAND and GRAVEL, some silt		1	SS	57								
302.4	Very Dense to Dense Brown (FILL)												
0.8	SAND, fine to medium grained, trace silt		2	SS	33		302						
	Compact to Dense Brown												
			3	SS	26								
							301						
			4	SS	30								
300.2													
3.0	Clayey SILT and SAND, trace gravel		5	SS	56		300						
	Hard Brown (TILL)												
			6	SS	100		299						
			7	SS	46		298						
297.7	Silty CLAY, some sand, trace gravel						297						
5.5	Hard Brown (TILL)		8	SS	100								
							296						
			9	SS	82		295						
			10	SS	69		294						

Continued Next Page

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

METRIC

G.W.P. <u>277-97-00</u>	LOCATION <u>King Street Overpass N 4 808 706.1 E 231 537.0</u>	ORIGINATED BY <u>GA</u>
HWY <u>8</u>	BOREHOLE TYPE <u>Hollow Stem Augers</u>	COMPILED BY <u>WM</u>
DATUM <u>Geodetic</u>	DATE <u>10.05.06 - 11.05.06</u>	CHECKED BY <u>MRA</u>

[illegible]

+ 3, × 3: Numbers refer to Sensitivity

RECORD OF BOREHOLE No 06-20

3 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 706.1 E 231 537.0 ORIGINATED BY GA
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 10.05.06 - 11.05.06 CHECKED BY MRA

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		
			17	SS	115		283							
281.7														
21.5	END OF BOREHOLE AT 21.49 m. BOREHOLE OPEN TO 21.49 m AND WATER LEVEL AT 18.90 m UPON COMPLETION OF DRILLING. BOREHOLE GROUTED TO SURFACE.		18	SS	104/ .150		282							

+ ³ . x ³ : Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

METRIC

SOIL PROFILE			SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa						WATER CONTENT (%)	
								○ UNCONFINED ● QUICK TRIAXIAL							+ FIELD VANE × LAB VANE
302.9 0.0 0.1	ASPHALT: (50 mm) SAND and GRAVEL, trace silt, trace clay, occasional cobbles Very Dense to Dense Brown Dry (FILL)		1	SS	50/ .150										
300.3 2.6	SAND, some gravel, some silt Dense Brown Moist		2	SS	34										
299.2 3.7	SILT and SAND, some clay to clayey, trace gravel Hard Brown (TILL)		3	SS	38										
296.8 6.1	Silty CLAY, trace sand Hard Brown (TILL)		4	SS	104										
			5	SS	84										
			6	SS	61										
			7	SS	74										

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No 06-21

2 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 709.1 E 231 508.7 ORIGINATED BY GA
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 19.05.06 - 19.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT 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	W P W W L	20 40 60			
			8	SS	60		292							
			9	SS	30		291							
			10	SS	49		290							
			11	SS	25		289							
			12	SS	32		288							
							287							
							286							
							285							
284.6			13	SS	112		284							
18.3	Clayey Sandy SILT Hard Grey (TILL)						283							

Continued Next Page

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

ONTMT4S 7938-2.GPJ 08/01/07

RECORD OF BOREHOLE No 06-21

3 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 709.1 E 231 508.7 ORIGINATED BY GA
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 19.05.06 - 19.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
			14	SS	100/ .225									
281.4							282							
21.5	END OF BOREHOLE AT 21.54 m. BOREHOLE OPEN TO 21.54 m AND DRY UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.		15	SS	100/ .200									

RECORD OF BOREHOLE No 06-22

1 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 702.3 E 231 525.8 ORIGINATED BY GA
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 15.05.06 - 16.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
303.5														
0.0	ASPHALT: (150 mm)													
0.2	SAND and GRAVEL, trace silt, occasional cobbles Very Dense to Dense Brown Moist (FILL)		1	SS	50/ .125		303							
			2	SS	60									
			3	SS	40		302							
301.2														
2.3	SAND, fine grained, trace gravel, trace silt Compact to Dense Brown Moist		4	SS	24		301							
			5	SS	36									
299.7							300							
3.8	Clayey Sandy SILT, trace gravel Hard Brown (TILL)		6	SS	80									
			7	SS	50/ .150		299							5 31 48 16
							298							
297.4														
6.1	Silty CLAY, trace sand Hard Brown (TILL)		8	SS	59		297							
			9	SS	100		296							Sampler wet
			10	SS	76		295							
							294							

Continued Next Page

+ ³ , × ³ : Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 06-22

3 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 702.3 E 231 525.8 ORIGINATED BY GA
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 15.05.06 - 16.05.06 CHECKED BY MRA

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	WATER CONTENT (%)					
283.4			17	SS	110									
20.1	END OF BOREHOLE AT 20.12 m. BOREHOLE OPEN TO 20.12 m AND DRY UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.						283							

ONTMT4S 7938-2.GPJ 08/01/07

RECORD OF BOREHOLE No 06-23

1 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 697.3 E 231 540.7 ORIGINATED BY GA
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 08.05.06 - 10.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60						80	100				
								SHEAR STRENGTH kPa								WATER CONTENT (%)					
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL						× LAB VANE	20	40	60		
303.5																					
0.0	ASPHALT: (50 mm)																				
0.1	SAND and GRAVEL, trace silt Very Dense Brown Damp (FILL)		1	SS	52																
			2	SS	75																
	occasional cobbles																				
301.7																					
1.8	SAND and GRAVEL, some silt Very Dense Brown Damp		3	SS	50/ .075																
			4	SS	68																
300.5																					
3.0	SAND, some silt, trace gravel Compact Brown Moist to Wet (SP)		5	SS	10																
			6	SS	13																
298.9																					
4.6	Sandy SILT, some clay to clayey, trace gravel Hard Brown (TILL)		7	SS	38																
			8	SS	60																
295.9																					
7.6	Silty CLAY, some sand Hard Brown (TILL)		9	SS	102																
			10	SS	74																

Continued Next Page

+ 3, x 3: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 06-23

2 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 697.3 E 231 540.7 ORIGINATED BY GA
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 08.05.06 - 10.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT w _p NATURAL MOISTURE CONTENT w LIQUID LIMIT w _L WATER CONTENT (%)	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES							
			11	SS	80		293					
			12	SS	84		292					
			13	SS	82		291					
			14	SS	36		290					
			15	SS	33		289					
			16	SS	33		288					
							287					
							286					
							285					
							284					

Continued Next Page

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

RECORD OF BOREHOLE No 06-23

3 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 697.3 E 231 540.7 ORIGINATED BY GA
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 08.05.06 - 10.05.06 CHECKED BY MRA

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			20 40 60 80 100									
								SHEAR STRENGTH kPa					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%)				
					20 40 60 80 100					w _p w w _L							
282.2							283										
21.3	SILT and SAND, trace to some clay, trace gravel Very Dense Brown Moist (TILL)		17	SS	100/ .075		282										
							281										
							280										
			18	SS	100/ .225		279					3 48 42 8					
							278										
			19	SS	119		277										
							276										
275.8			20	SS	108		276										
27.7	END OF BOREHOLE AT 27.74 m. BOREHOLE OPEN TO 27.13 m AND WATER LEVEL AT 18.90 m UPON COMPLETION. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) 10.05.06 20.64 18.05.06 19.85 08.08.06 21.23																

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

RECORD OF BOREHOLE No 06-24

1 OF 2

METRIC

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

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	
311.1												
0.0	ASPHALT: (190 mm)											
0.2	SAND and GRAVEL crusher run limestone Very Dense Brown Dry (FILL)		1	SS	50/ .150		311					42 47 11 (SI+CL)
309.6			2	SS	50		310					
1.5	Silty SAND, trace gravel, trace clay Dense to Very Dense Brown Dry to Damp		3	SS	33		309					
							308					
			4	SS	60		307					
							306					
	Becoming Compact to Loose, some silt		5	SS	14		305					
							304					
			6	SS	8		303					
							302					
			7	SS	25							3 63 25 9
302.0												
9.1	SILT, some clay, some sand to sandy, trace gravel Very Dense Brown Dry (TILL)		8	SS	53							

Continued Next Page

+ ³, x ³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 06-24

2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 806 714.5 E 231 550.0 ORIGINATED BY GA
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 24.05.06 - 24.05.06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT 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										WATER CONTENT (%)			
								20 40 60 80 100										20 40 60			
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE														
300.0			9	SS	102		301														
11.1	END OF BOREHOLE AT 11.13 m. BOREHOLE OPEN TO 11.13 m AND DRY UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.																				

RECORD OF BOREHOLE No 07-1

1 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 690.20 E 231 514.88 ORIGINATED BY SLL
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007-06-04 - 2007-06-05 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						WATER CONTENT (%)	
								20 40 60 80 100							
303.5															
0.0	ASPHALT: (60mm)														
0.1	SAND and GRAVEL, trace silt, occasional cobbles Very Dense Brown Moist (FILL)		1	AS										53 38 9 (SI+CL)	
			1	SS	72										
302.1															
1.4	SAND and GRAVEL, some silt, occasional cobbles Dense Brown Moist		2	SS	80/ 275										
			3	SS	36										
			4	SS	38										
299.1															
4.4	Silty SAND, trace gravel, occasional cobbles Dense to Very Dense Brown Moist to Wet		5	SS	39									3 69 28 (SI+CL)	
	Grey		6	SS	55										
295.7															
7.8	Silty CLAY, trace to some sand Hard Grey (TILL)		7	SS	86										
			8	SS	34										

Continued Next Page

+³, X³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 07-1

2 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 690.20 E 231 514.88 ORIGINATED BY SLL
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007-06-04 - 2007-06-05 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
	Continued From Previous Page							SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				
	Silty CLAY, trace to some sand Hard Grey (TILL)		9	SS	96		293					0 13 50 37
							292					
			10	SS	50		291					
							290					
			11	SS	38		289					
							288					
			12	SS	39		287					
							286					
			13	SS	39		285					0 2 45 53
	occasional cobbles		14	SS	100/ .125		284					
284.3												
19.2	SILT and SAND, trace to some clay, trace gravel Very Dense Grey Moist		15	SS	100/ .125							

ONTMT4S 7938.GPJ 8/10/07

Continued Next Page

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

RECORD OF BOREHOLE No 07-1

3 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 690.20 E 231 514.88 ORIGINATED BY SLL
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007-06-04 - 2007-06-05 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m 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					WATER CONTENT (%) W _p W W _L				
	Continued From Previous Page (TILL)				.100												
282.0			16	SS	50/												
21.5	END OF BOREHOLE AT 21.54m. Piezometer installation consists of 25 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 06.06.07 16.7 286.8 07.06.07 17.2 286.3				.050												

RECORD OF BOREHOLE No 07-2

1 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 684.57 E 231 530.88 ORIGINATED BY SLL
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007-06-05 - 2007-06-06 CHECKED BY MRA

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								WATER CONTENT (%)		
304.1								20	40	60	80	100						
0.0	ASPHALT: (150mm)						304											
0.2	SAND and GRAVEL Very Dense Brown Moist (FILL)		1	AS														
			1	SS	50/ .075													
302.9							303											
1.2	SAND and GRAVEL, some silt, with cobbles Compact to Very Dense Brown Moist		2	SS	53											38 50 12 (SI+CL)		
							302											
			3	SS	21													
							301											
			4	SS	55													
							300											
							299											
			5	SS	28													
							298									3 85 12 (SI+CL)		
298.2			6	SS	50													
5.9	SAND, some silt, trace gravel Dense Brown Wet						297											
							296											
296.4			7	SS	48													
7.7	Silty CLAY, trace sand Hard Grey (TILL)						295											
			8	SS	84/ 275													

Continued Next Page

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

RECORD OF BOREHOLE No 07-2

2 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 684.57 E 231 530.88 ORIGINATED BY SLL
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007-06-05 - 2007-06-06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	WATER CONTENT (%) 20 40 60					
Continued From Previous Page														
	Silty CLAY, trace sand Hard Grey (TILL)						294							
			9	SS	52		293							0 4 54 42
							292							
			10	SS	59		291							
							290							
			11	SS	68		289							
							288							0 3 41 56
			12	SS	47		287							
							286							
			13	SS	37		285							
			14	SS	35									
284.7 19.4	Sandy SILT, some clay to clayey, trace gravel, occasional cobbles Very Dense Grey		15	SS	100/									

ONTMT4S 7938.GPJ 8/10/07

Continued Next Page

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

RECORD OF BOREHOLE No 07-2

3 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 684.57 E 231 530.88 ORIGINATED BY SLL
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007-06-05 - 2007-06-06 CHECKED BY MRA

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		
	Continued From Previous Page							SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
								PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT W _P W W _L WATER CONTENT (%)						
281.1	Wet (TILL)		16	SS	100/ .150		284							2 29 52 17
283							283							
282							282							
23.0	END OF BOREHOLE AT 22.99m. WATER LEVEL AT 4.72m UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.		17	SS	100/ .125									

RECORD OF BOREHOLE No 07-3

1 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 678.71 E 231 547.55 ORIGINATED BY SLL
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007-06-06 - 2007-06-06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							
304.0							20 40 60 80 100								
0.0	ASPHALT: (150mm)														
0.2	SAND and GRAVEL, trace silt Brown Moist (FILL)		1	AS											
			1	SS	50/ .150										
302.7	SAND and GRAVEL, trace silt, with cobbles Compact to Very Dense Brown Moist		2	SS	56										55 36 9 (SI+CL)
1.3			3	SS	37										
			4	SS	26										
			5	SS	50/ .125										
			6	SS	50/ .125										
296.7	Silty CLAY, trace to some sand, occasional cobbles Hard Grey (TILL)		7	SS	100/ 275										
7.3	with sandy silt pockets		8	SS	100/ 275										0 12 59 29

Continued Next Page

+³, X³: Numbers refer to
Sensitivity



20
15 10 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 07-3

2 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 678.71 E 231 547.55 ORIGINATED BY SLL
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007-06-06 - 2007-06-06 CHECKED BY MRA

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					WATER CONTENT (%)		
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL			× LAB VANE	W _P	W
	Continued From Previous Page						20 40 60 80 100								
	Silty CLAY , trace to some sand, occasional cobbles Hard Grey (TILL)		9	SS	90										
					10	SS	68								
					11	SS	43								
					12	SS	40								
			13	SS	32										
			14	SS	33										
284.6							285								
19.4	SAND and SILT, trace gravel, trace clay to clayey Very Dense Grey		15	SS	125/										

Continued Next Page

+ 3 . x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

ONTMT4S 7938.GPJ 8/13/07

RECORD OF BOREHOLE No 07-3

3 OF 3

METRIC

G.W.P. 277-97-00 LOCATION King Street Overpass N 4 808 678.71 E 231 547.55 ORIGINATED BY SLL
HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
DATUM Geodetic DATE 2007-06-06 - 2007-06-06 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40					
	Continued From Previous Page													
	Moist (TILL)													
			16	SS	100/ .200									
281.0			17	SS	100/ .150									
23.0	END OF BOREHOLE AT 23.01m. BOREHOLE OPEN TO 21.64m AND WATER LEVEL AT 12.32m UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.													

RECORD OF BOREHOLE No 1

W P 31-76-04/05 LOCATION Co-ords. N 4 808 491; E 231 481. ORIGINATED BY BL
DIST 3 HWY 8N BOREHOLE TYPE Constant Flight Auger; Hollow Stem COMPILED BY BL
DATUM Geodetic DATE 80-02-12 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
308.9	Ground Level																
0.0																	
	Sand and Gravel		1	SS	22												
	Traces of Silt		2	SS	12												
	and Clay		3	SS	14												
	Compact		4	SS	37												
	to		5	SS	41												
	V. Dense		6	SS	57												
			7	SS	50/76 mm												
302.8			8	SS	100/127 mm												
6.2	End of Borehole																

+3, x5; Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE



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RECORD OF BOREHOLE No 2

W P 31-76-04/05 LOCATION Co-ords. N 4 808 490; E 231 504 ORIGINATED BY BL
DIST 3 HWY 8N BOREHOLE TYPE Constant Flight Auger; Hollow Stem COMPILED BY BL
DATUM Geodetic DATE 80-02-13 & 14 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
308.5 0.0	Ground Level												
	Sand and Gravel		1	SS	13		308	Auger to 1.0 m					
	Traces of Silt and Clay		2	SS	96		306		○				57 31 (12)
			3	SS	54								
			4	SS	47								
	Compact to Very Dense		5	SS	47				○				41 49 (10)
			6	SS	63								
			7	SS	63								
			8	SS	114	280 mm	302						
			9	SS	48								
			10	SS	39				○				
300.0 8.5	Silty Clay (Plasticity: Low to Intermediate)		11	SS	100	127 mm	300						
			12	SS	146		298		○				0 0 59 41
	Trace of Gravel		13	SS	166		296		○				
			14	SS	86								
	Very Stiff to Hard		15	SS	70		294						
			16	SS	104		292		○				0 6 49 45
			17	SS	60		290						
			18	SS	34		288						
			19	SS	37		286						
			20	SS	28								
284.4													
24.1	Het. Mixture of Silty Clay Sand and Gravel		21	SS	92	152 mm	284		○				14 51 30 5
283.0	Hard. Glacial Till		22	SS	40	0 mm							
25.5	End of Borehole												

+3, x5: Numbers refer to 20
Sensitivity 15-5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 3

W P 31-76-04 /05 LOCATION Co-ords. N 4 808 487; E 231 542 ORIGINATED BY BL
 DIST 3 HWY 8N BOREHOLE TYPE Constant Flight Auger; Hollow Stem COMPILED BY BL
 DATUM Geodetic DATE 80-02-15 80-02-18 to 20 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40						60	80	100	WATER CONTENT (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
								SHEAR STRENGTH							10			20			30																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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308.3	Ground Level																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										

+3, x5: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 4

W P 31-76-04/05 LOCATION Co-ords. N 4 808 491; E 231 477 ORIGINATED BY BL
DIST 3 HWY 8N BOREHOLE TYPE Constant Flight Auger; Hollow Stem COMPILED BY BL
DATUM Geodetic DATE 80-02-21; 80-02-25 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
308.9																	
0.0	Sand and Gravel						308										
	Traces of Silt and Clay						306										
			1	SS	131		304										
	Very Dense		2	SS	81		302										46 45 (9)
			3	SS	122/292 mm		300										45 46 (9)
			4	SS	51		298										
297.4			5	SS	85		296										
11.6	Silty Clay (Plasticity: Low to Intermediate)		6	SS	119		294										
			7	SS	109		292										
	Some Sand		8	SS	91		290										
	Trace of Gravel		9	SS	76		288										
			10	SS	57		286										
	Hard		11	SS	77		284										0 5 38 57
			12	SS	31		282										
285.5			13	SS	48		280										
23.5	Heterogeneous Mixture of Silty Clay Sand and Gravel		14	SS	124	76 mm	278										8 16 38 28
	Hard		15	SS	100/152 mm		276										
	Glacial Till		16	SS	100/64 mm		274										0 28 49 23
281.4							272										
27.6	End of Borehole						270										



RECORD OF BOREHOLE No 5

W P 31-76-04/05 LOCATION Co-ords. N 4 808 499; E 231 501 ORIGINATED BY BL
DIST 3 HWY 8N BOREHOLE TYPE Constant Flight Auger; Hollow Stem COMPILED BY BL
DATUM Geodetic DATE 80-02-26 & 27 CHECKED BY

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	W _p	W	W _L	
308.8	Ground Level						SHEAR STRENGTH				WATER CONTENT (%)				GR SA SI CL
0.0							Auger to 1.0 m								
	Sand and Gravel		1	SS	9										
	Some Silt		2	SS	18										
	Trace of Clay		3	SS	18										
			4	SS	4										
			5	SS	23										
	Loose		6	SS	22										
	to		7	SS	29										
	Dense		8	SS	20										
			9	SS	32										
			10	SS	33										
299.6															
8.2															
	Silty Clay		11	SS	55										
	(Plasticity: Low to Intermediate)		12	SS	82										
			13	SS	77										
	Some Sand		14	SS	52										
			15	SS	64										
	Hard		16	SS	67										
			17	SS	89										
			18	SS	39										
			19	SS	40										
			20	SS	58										
285.0															
23.8	Heterogeneous Mixture of Clayey Silt Sand and Gravel		21	SS	172/	254 mm									
	Hard		22	SS	103/	127 mm									
	Glacial Till														
281.1			23	SS	100/	114 mm									
27.7	End of Borehole														

+3, x5: Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE



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RECORD OF BOREHOLE No 6

W P 31-76-04/05 LOCATION Co-ords. N 4 808 459; E 231 550 ORIGINATED BY BL
DIST 3 HWY 8N BOREHOLE TYPE Constant Flight Auger; Hollow Stem COMPILED BY BL
DATUM Geodetic DATE 80-02-28 & 29 CHECKED BY _____

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			20 40 60 80 100						
308.5	Ground Level												
0.0	Sand and Gravel		1	SS	9								
			2	SS	26								
			3	SS	60								
			4	SS	61								
	Traces of Silt and Clay		5	SS	68								
	Loose to Very Dense		6	SS	98/	127 mm							
			7	SS	35								
300.0													
8.5	Silty Clay (Plasticity: Low to Intermediate) Occ. Silty Sand Layers Trace of Sand Very Stiff to Hard		8	SS	46								
			9	SS	26								
			10	SS	50/	76 mm							
			11	SS	145								
			12	SS	98								
			13	SS	89								
			14	SS	99								
			15	SS	58								
			16	SS	40								
			17	SS	34								
284.7													
23.8	Heterogeneous Mixture of silty clay Sand and Gravel Hard Glacial Till		18	SS	155/	76 mm							
			19	SS	100/	127 mm							
280.9													
27.6	End of Borehole		20	SS	100/	146 mm							

+3, x5: Numbers refer to
Sensitivity

20
15 + 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

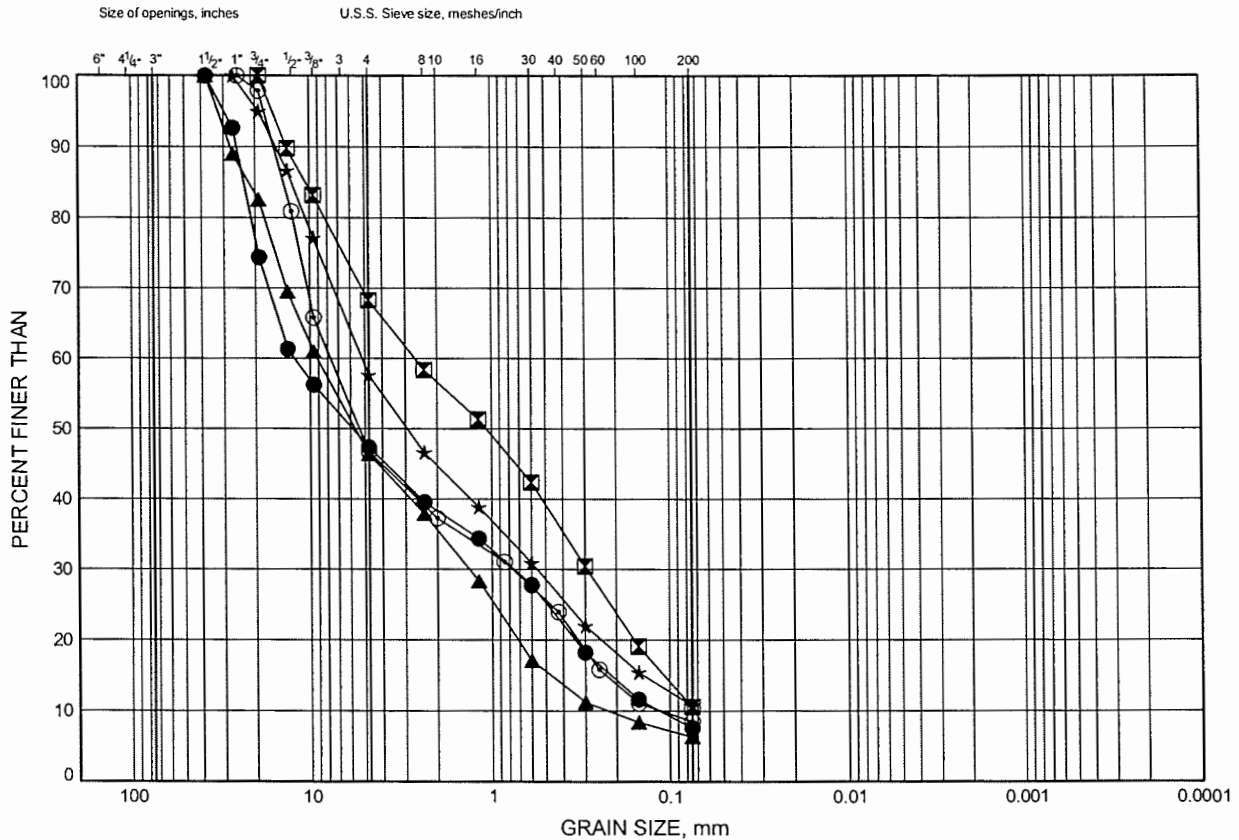
Appendix B

Laboratory Test Results

Highway 8 Widening Over Grand River GRAIN SIZE DISTRIBUTION

FIGURE B1

SAND AND GRAVEL FILL, SAND FILL



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-15	1.07	301.23
⊠	06-20	0.46	302.74
▲	06-21	1.83	301.07
★	06-24	0.53	310.57
⊙	07-1	0.30	303.20

Date August 2007

Project 277-97-00



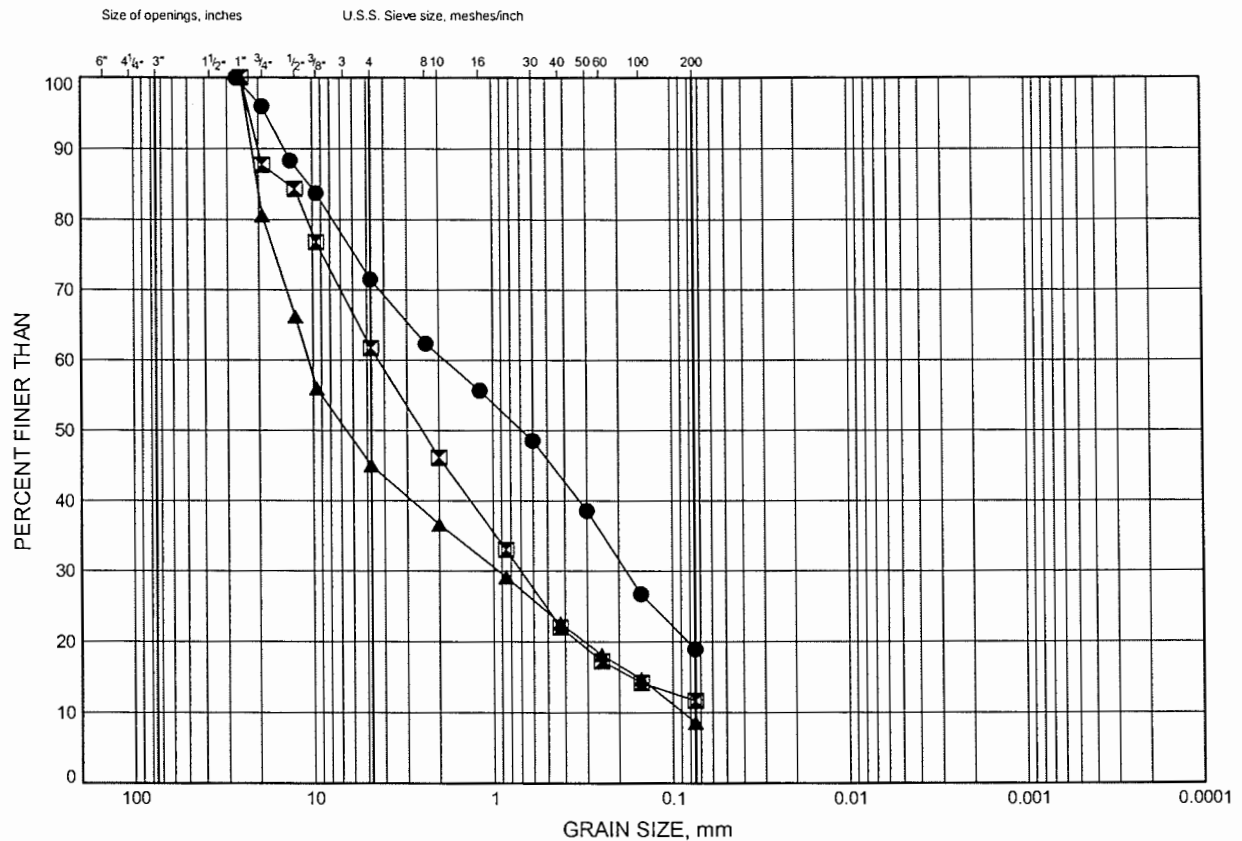
Prep'd MFA

Chkd. MRA

Highway 8 Widening Over Grand River GRAIN SIZE DISTRIBUTION

FIGURE B2

SAND AND GRAVEL



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-14	4.80	304.60
⊠	07-2	1.75	302.35
▲	07-3	1.83	302.17

Date August 2007
Project 277-97-00



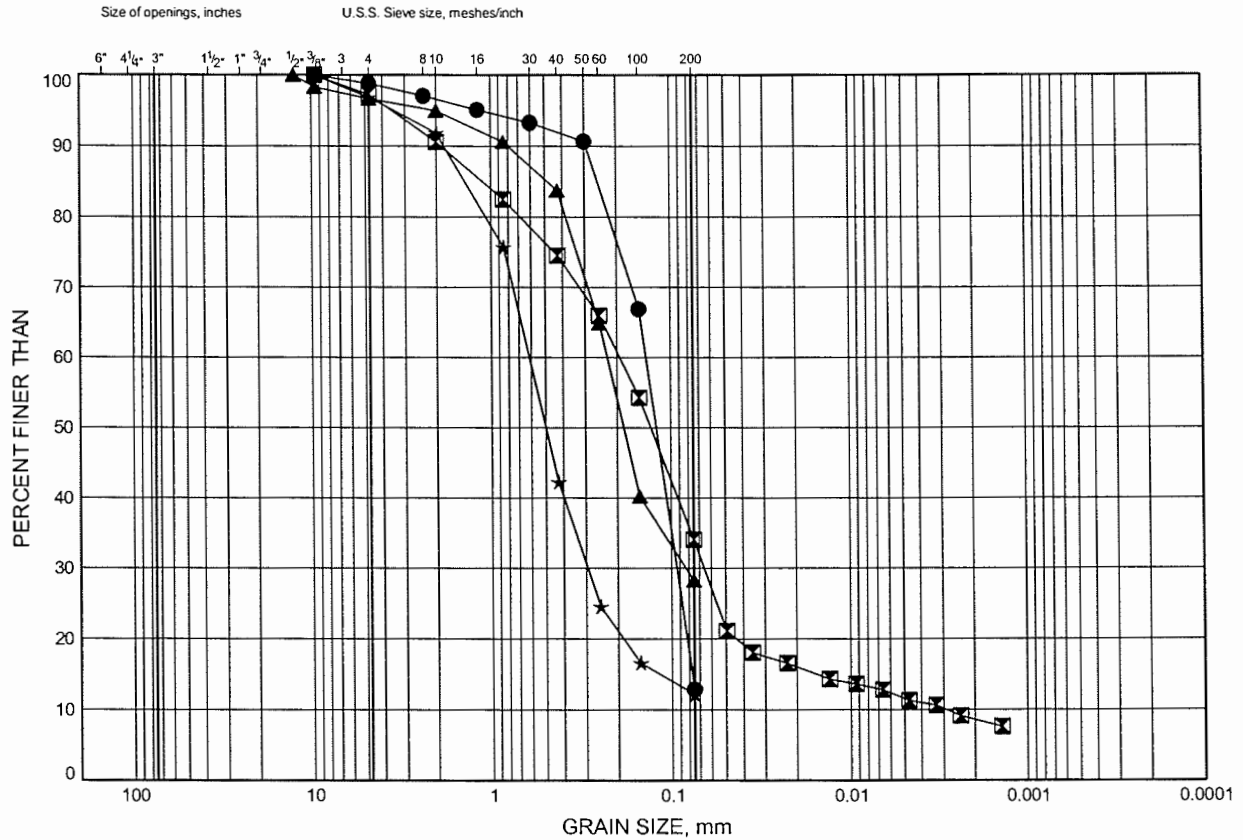
Prep'd MFA
Chkd. MRA

Highway 8 Widening Over Grand River

GRAIN SIZE DISTRIBUTION

FIGURE B3

SAND TO SILTY SAND



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-23	4.11	299.38
⊠	06-24	7.85	303.25
▲	07-1	4.88	298.62
★	07-2	6.40	297.70

Date August 2007
Project 277-97-00



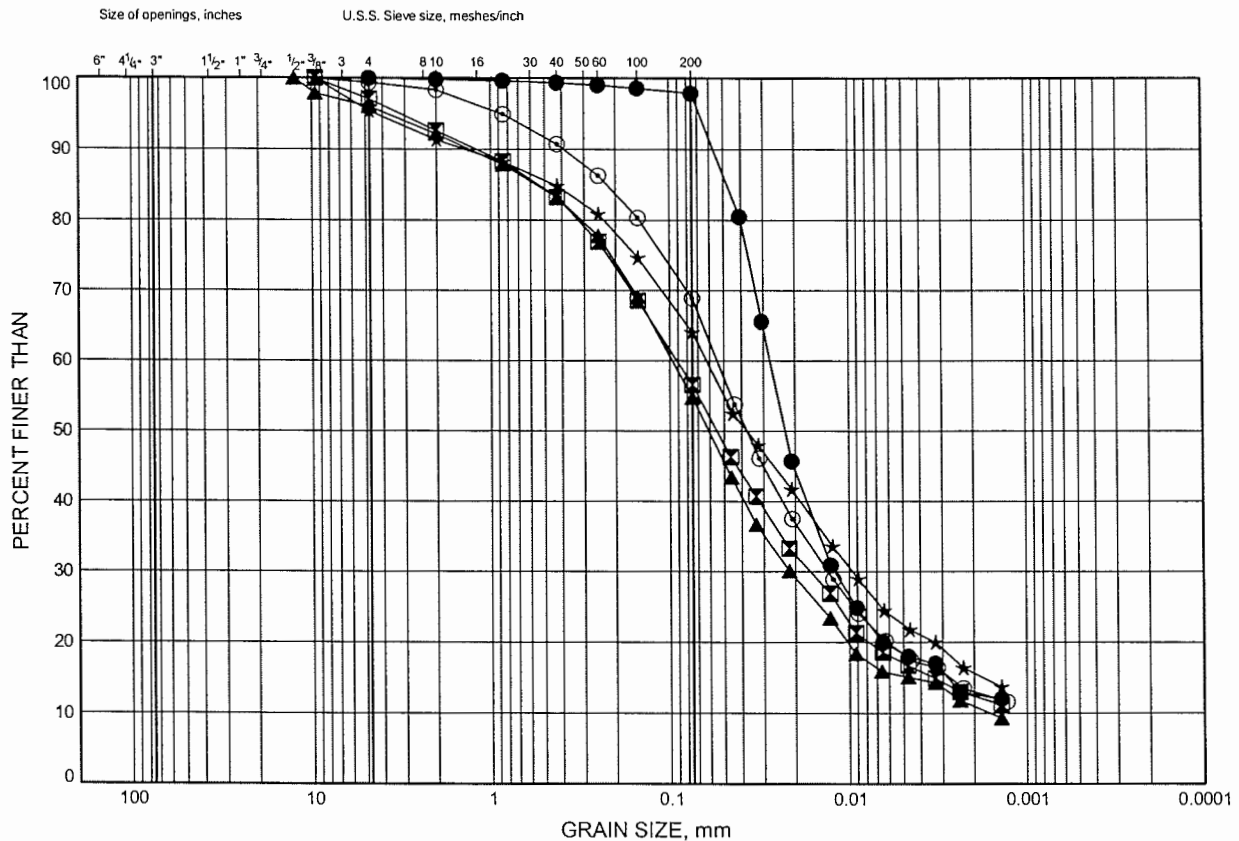
Prep'd MFA
Chkd. MRA

Highway 8 Widening Over Grand River

GRAIN SIZE DISTRIBUTION

FIGURE B4

SILT AND SAND TO CLAYEY SANDY SILT (TILL)



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-15	4.11	298.19
⊠	06-16	2.59	300.31
▲	06-17	2.59	300.31
★	06-22	4.80	298.70
⊙	06-23	6.32	297.17

Date August 2007

Project 277-97-00



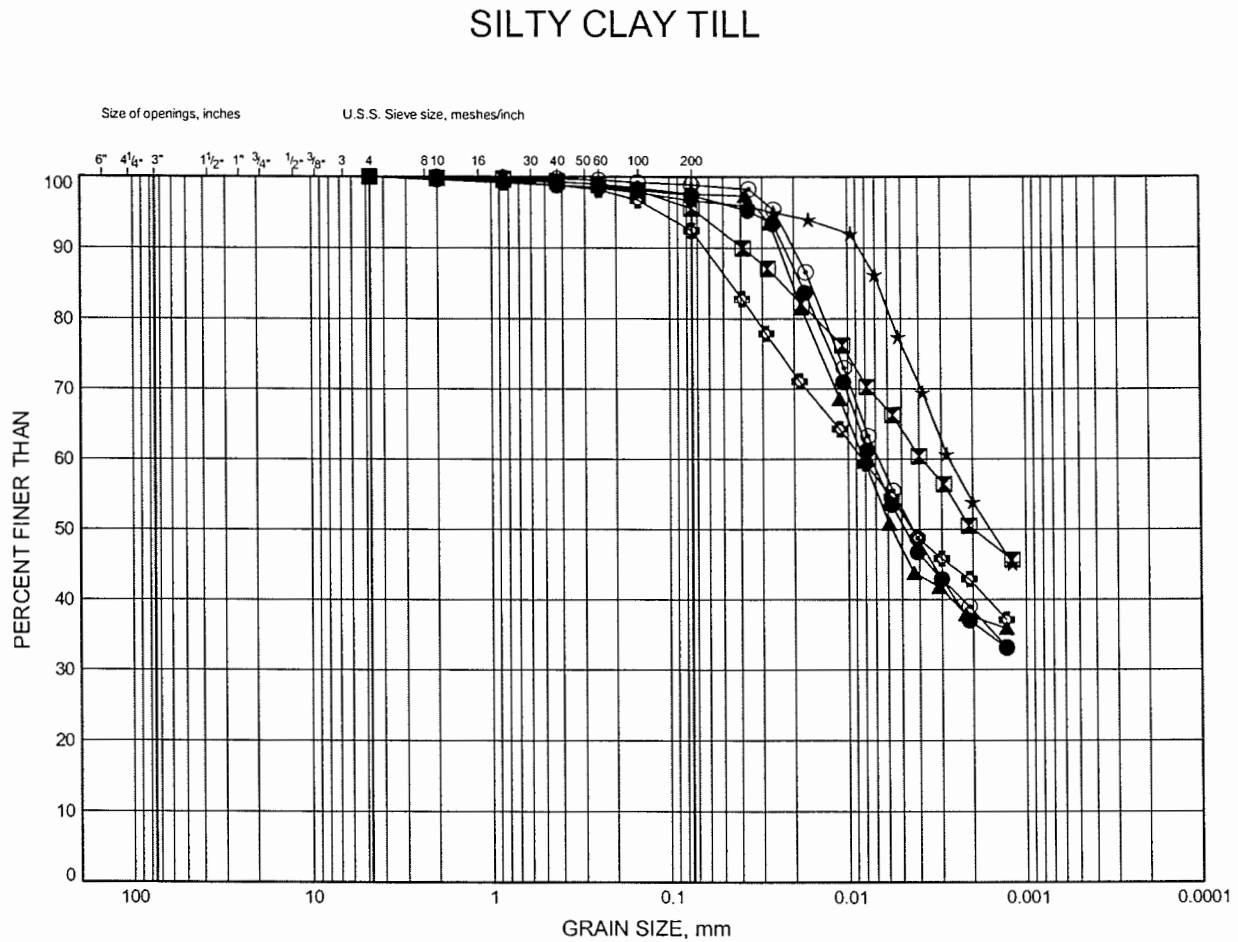
Prep'd MFA

Chkd. MRA

Highway 8 Widening Over Grand River

GRAIN SIZE DISTRIBUTION

FIGURE B5



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-16	6.32	296.58
⊠	06-16	10.90	292.00
▲	06-17	4.80	298.10
★	06-20	16.99	286.21
⊙	06-21	7.85	295.05
⊞	06-22	10.90	292.60

Date August 2007
Project 277-97-00

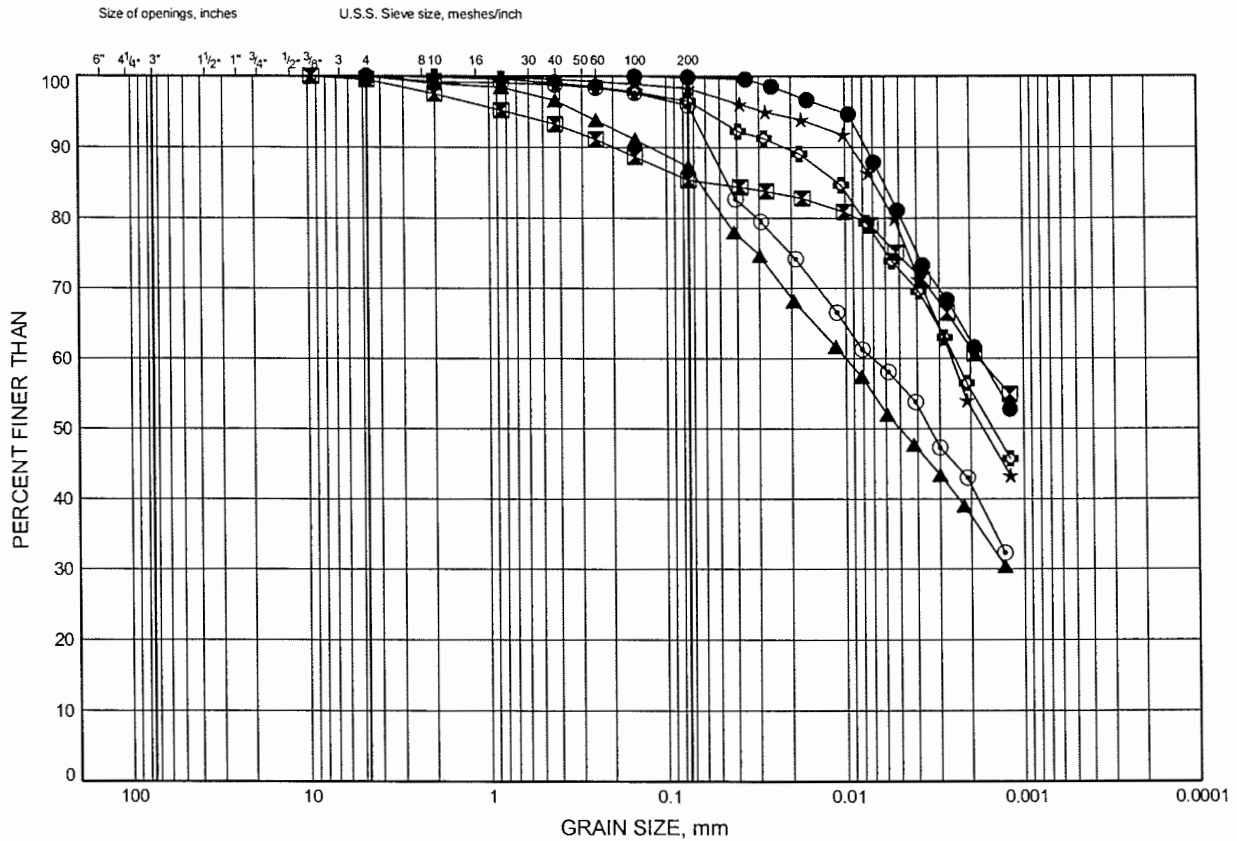


Prep'd MFA
Chkd. MRA

Highway 8 Widening Over Grand River GRAIN SIZE DISTRIBUTION

FIGURE B6

SILTY CLAY TILL



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-22	15.47	288.03
⊠	06-23	18.52	284.98
▲	07-1	10.90	292.60
★	07-1	17.07	286.43
⊙	07-2	10.97	293.13
⊞	07-2	15.77	288.33

Date August 2007

Project 277-97-00



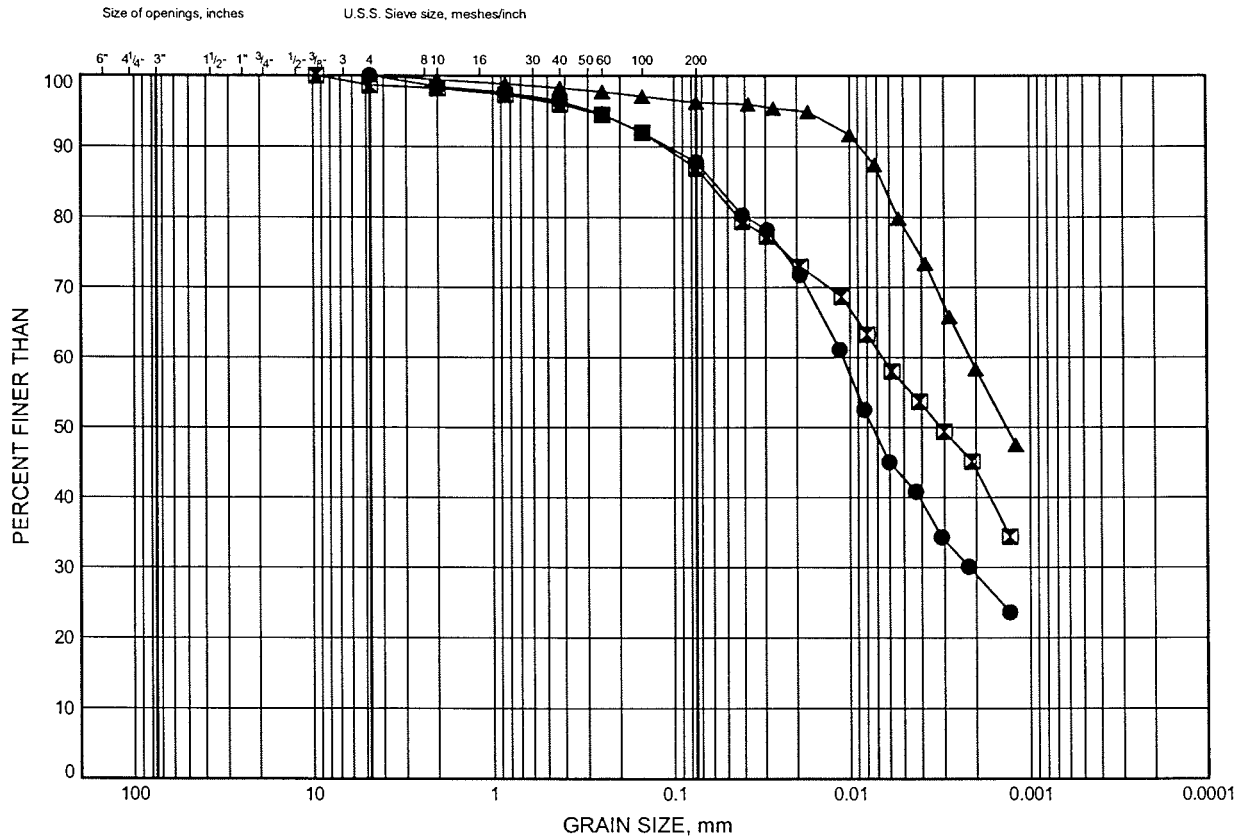
Prep'd MFA

Chkd. MRA

Highway 8 Widening Over Grand River GRAIN SIZE DISTRIBUTION

FIGURE B7

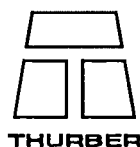
SILTY CLAY TILL



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	07-3	9.37	294.63
☒	07-3	14.02	289.98
▲	07-3	18.59	285.41

Date August 2007
 Project 277-97-00

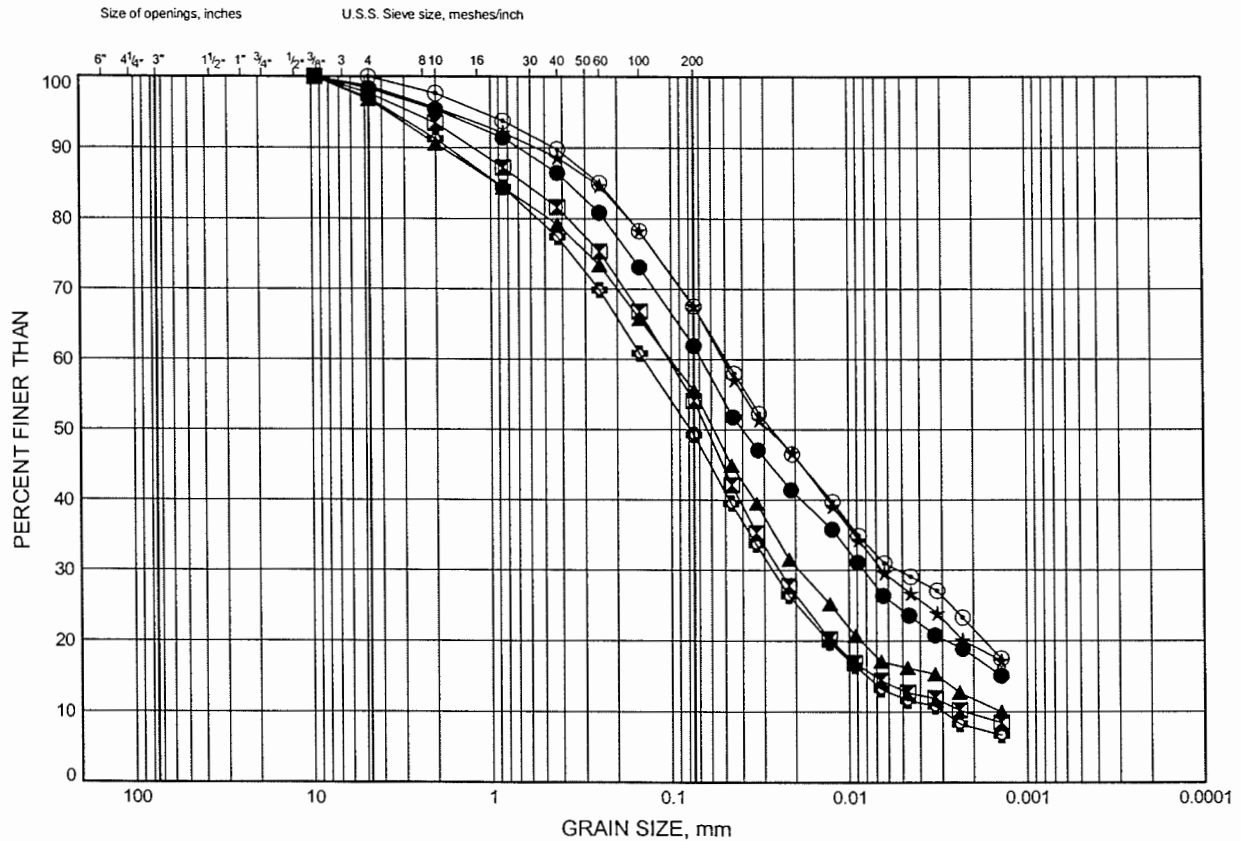


Prep'd WM
 Chkd. MRA

Highway 8 Widening Over Grand River GRAIN SIZE DISTRIBUTION

FIGURE B8

SILT AND SAND TO CLAYEY SANDY SILT (TILL)



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-15	18.52	283.78
⊠	06-16	18.52	284.38
▲	06-17	20.04	282.86
★	06-20	20.04	283.16
⊙	06-21	20.04	282.86
⊕	06-23	24.61	278.89

Date August 2007

Project 277-97-00



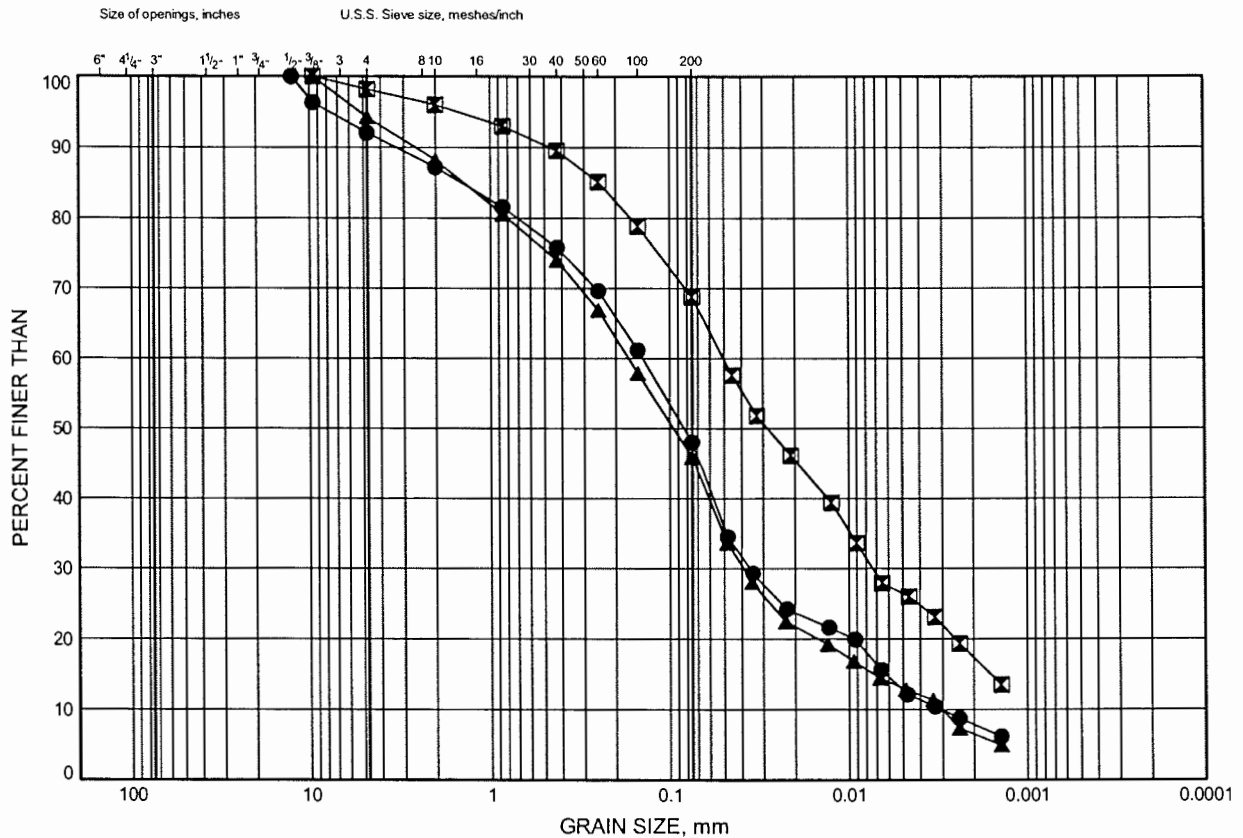
Prep'd MFA

Chkd. MRA

Highway 8 Widening Over Grand River GRAIN SIZE DISTRIBUTION

FIGURE B9

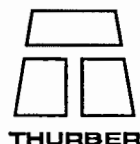
SILT AND SAND TO CLAYEY SILT (TILL)



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	07-1	20.17	283.33
⊠	07-2	21.41	282.69
▲	07-3	19.94	284.06

Date August 2007
Project 277-97-00

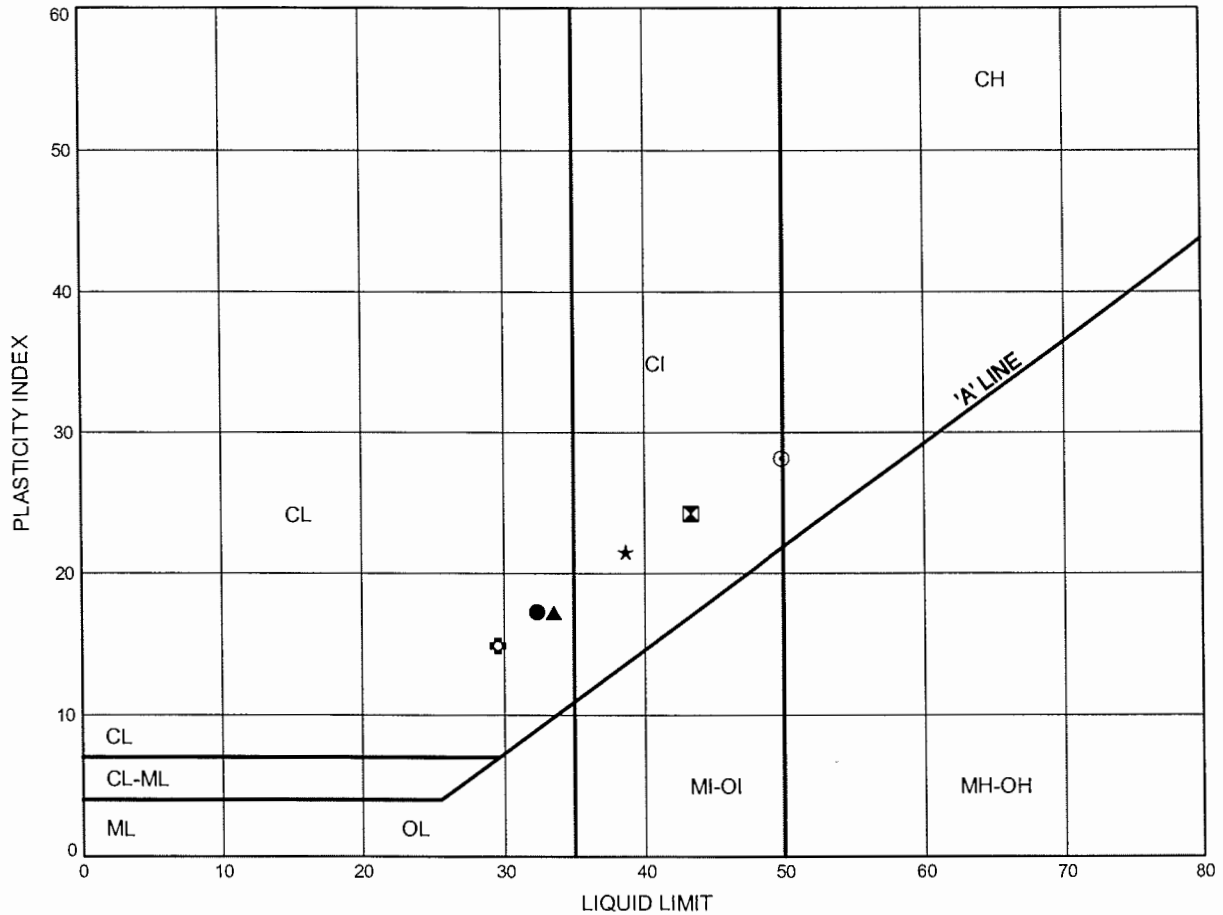


Prep'd WM
Chkd. MRA

Highway 8 Widening Over Grand River **ATTERBERG LIMITS TEST RESULTS**

FIGURE B10

SILTY CLAY TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-17	4.80	298.10
⊠	06-20	16.99	286.21
▲	06-21	7.85	295.05
★	06-22	10.90	292.60
⊙	06-23	18.52	284.98
⊕	07-1	10.90	292.60

Date August 2007
 Project 277-97-00

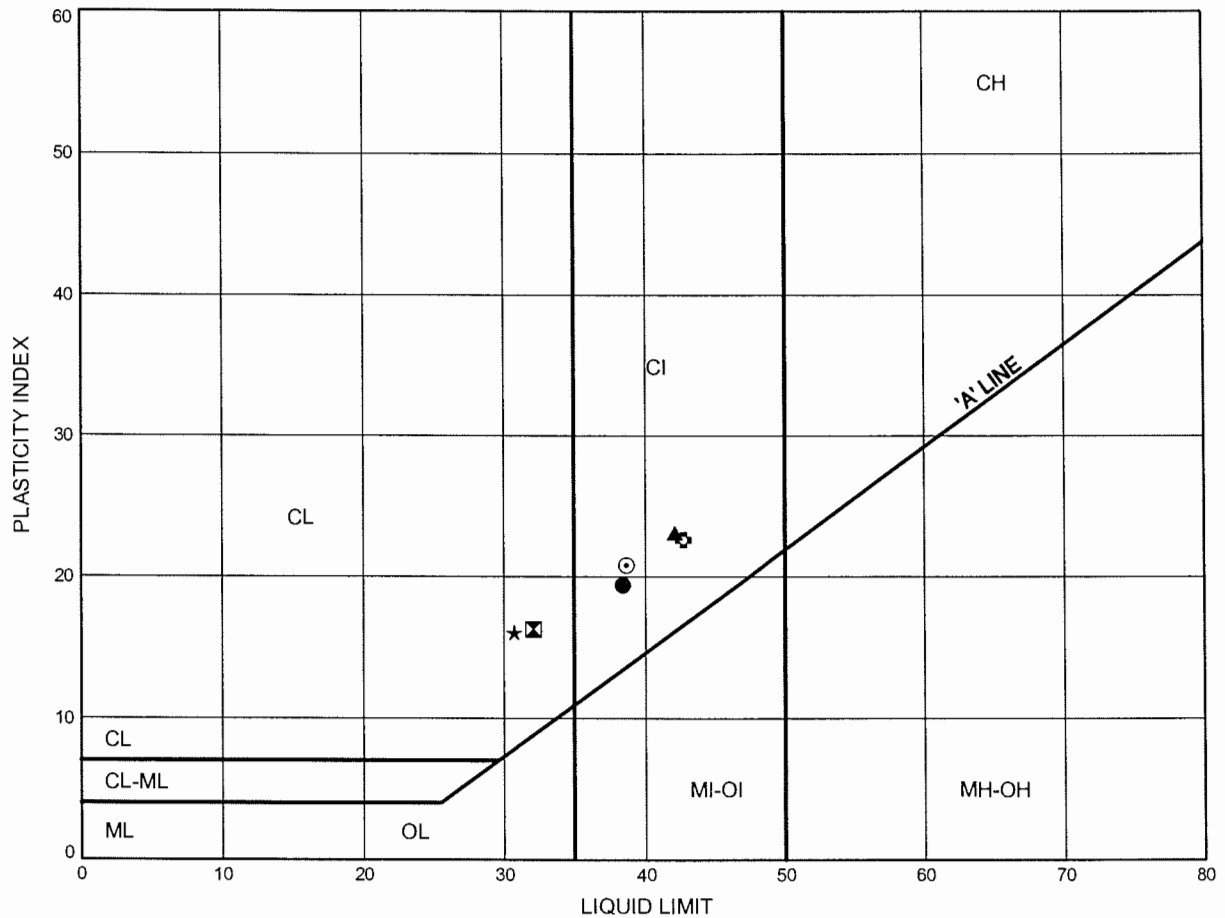


Prep'd MFA
 Chkd. MRA

Highway 8 Widening Over Grand River ATTERBERG LIMITS TEST RESULTS

FIGURE B11

SILTY CLAY TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	07-1	17.07	286.43
⊠	07-2	10.97	293.13
▲	07-2	15.77	288.33
★	07-3	9.37	294.63
⊙	07-3	14.02	289.98
⊕	07-3	18.59	285.41

Date August 2007

Project 277-97-00



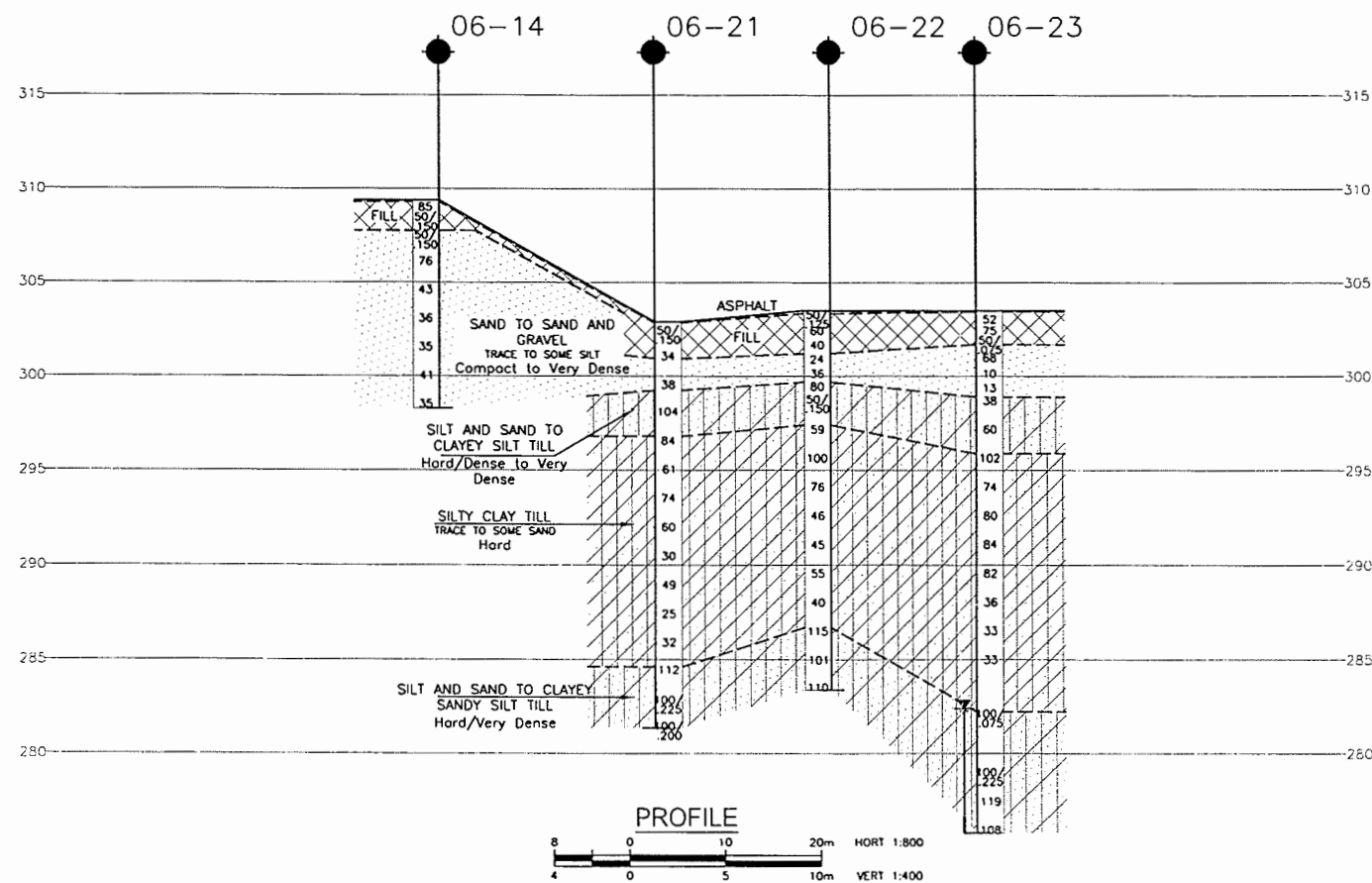
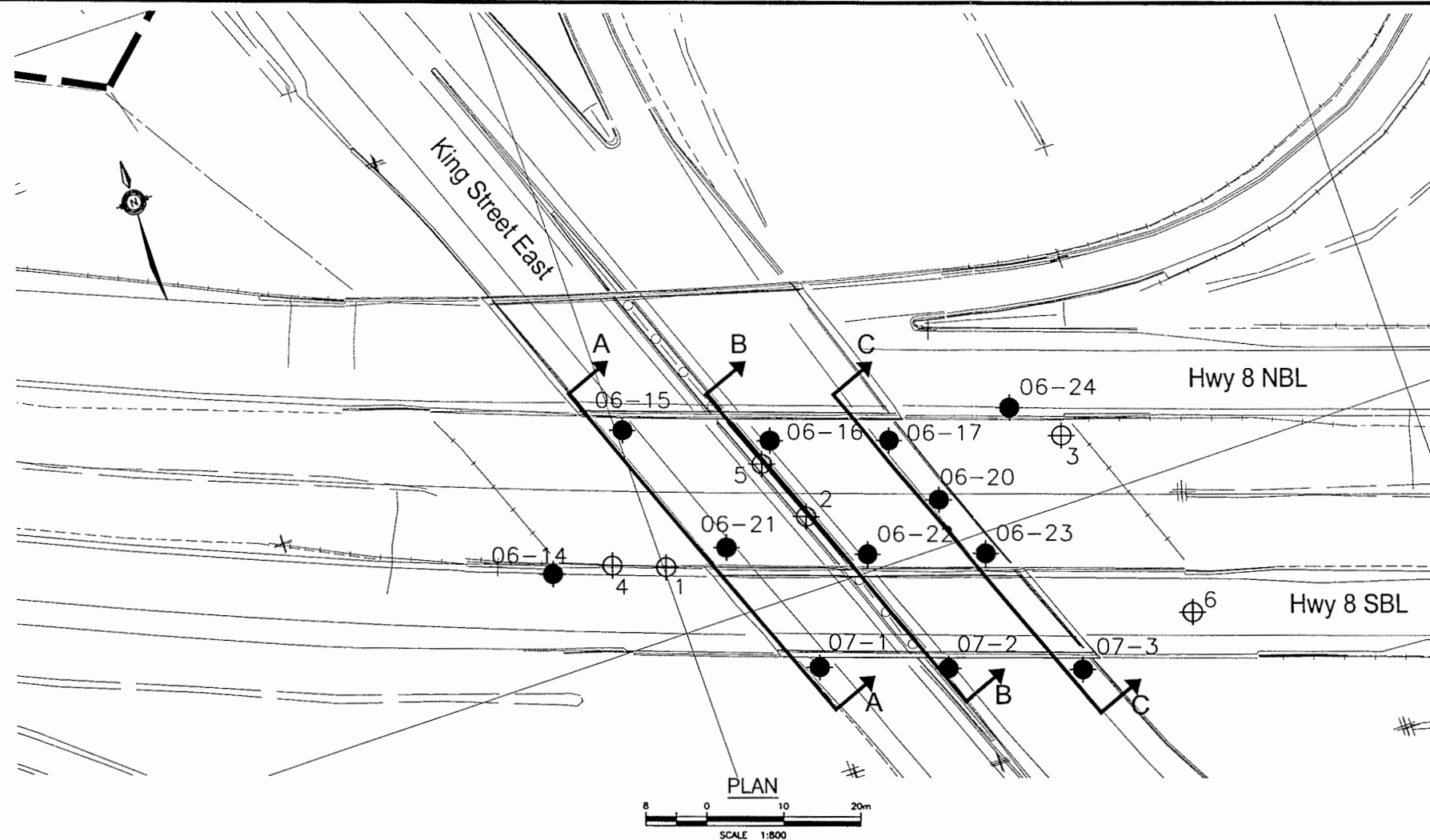
Prep'd MFA

Chkd. MRA

Appendix C

Drawings

Borehole Locations and Soil Strata



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

CONT No
GWP No.277-97-00

KING STREET OVERPASS
HWY 8 WIDENING
KITCHENER
BOREHOLE LOCATIONS AND SOIL STRATA

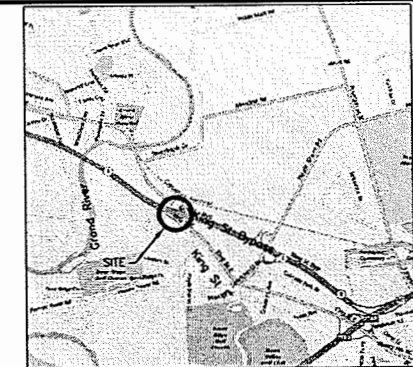


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KEYPLAN LEGEND

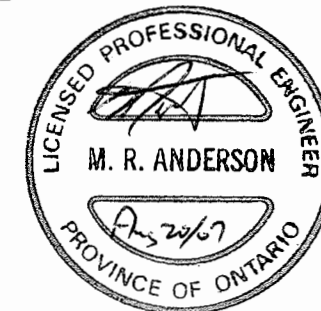
- ◆ BoreHole
- ◆ BoreHole and Cone
- ⊕ BoreHole from Previous Investigation (Approximate)
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- ⬆ Water Level
- ⬆ Head Artesian Water
- ⬆ Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
06-14	309.4	4 808 713.1	231 485.9
06-15	302.3	4 808 728.1	231 500.9
06-16	302.9	4 808 720.6	231 518.7
06-17	302.9	4 808 715.6	231 533.5
06-20	303.2	4 808 706.1	231 537.0
06-21	302.9	4 808 709.1	231 508.7
06-22	303.5	4 808 702.3	231 525.8
06-23	303.5	4 808 697.3	231 540.7
06-24	311.1	4 808 714.5	231 550.0
07-1	303.5	4 808 690.2	231 514.9
07-2	304.1	4 808 684.6	231 530.9
07-3	304.0	4 808 678.7	231 547.5

NOTES-

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

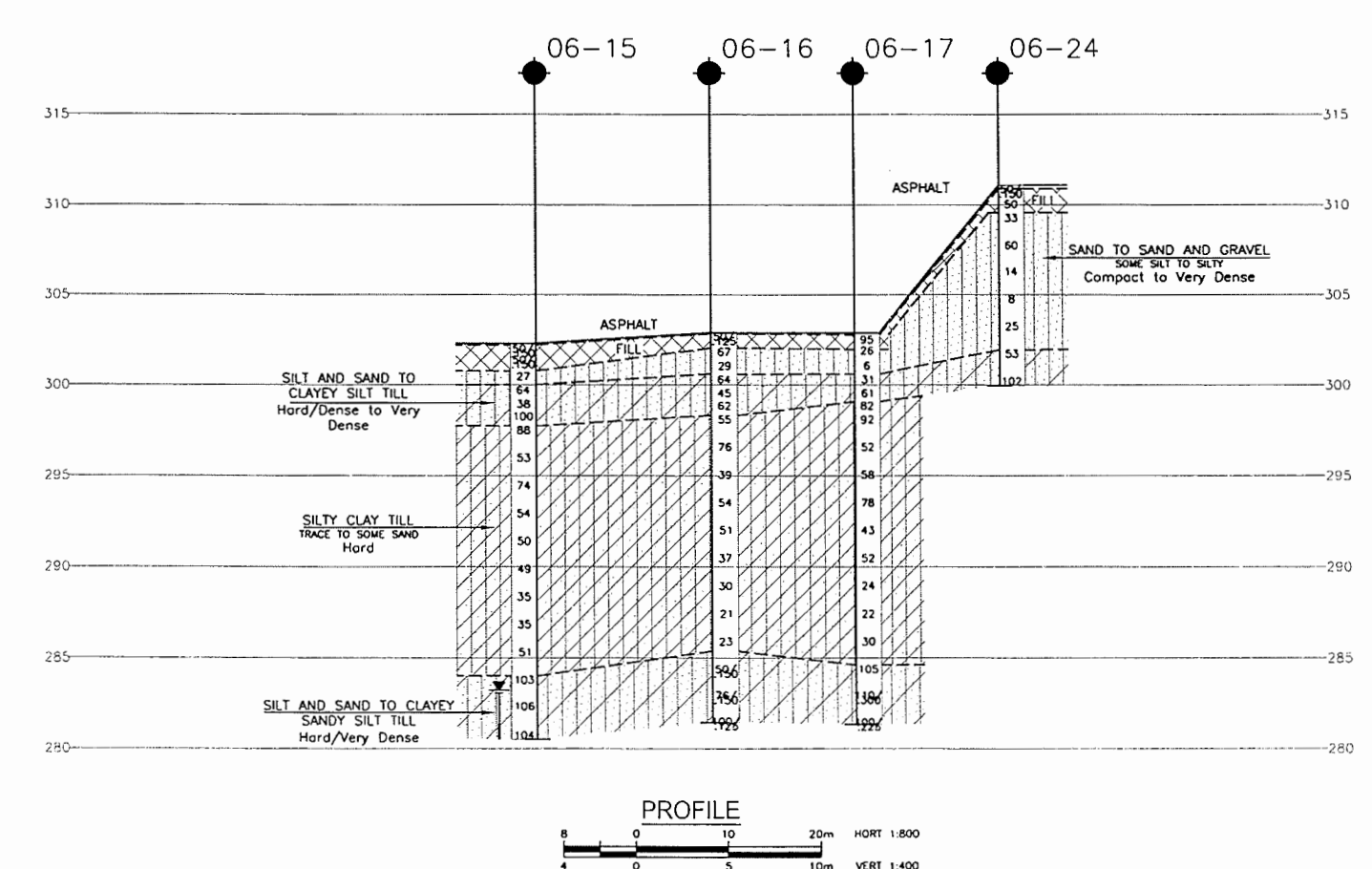
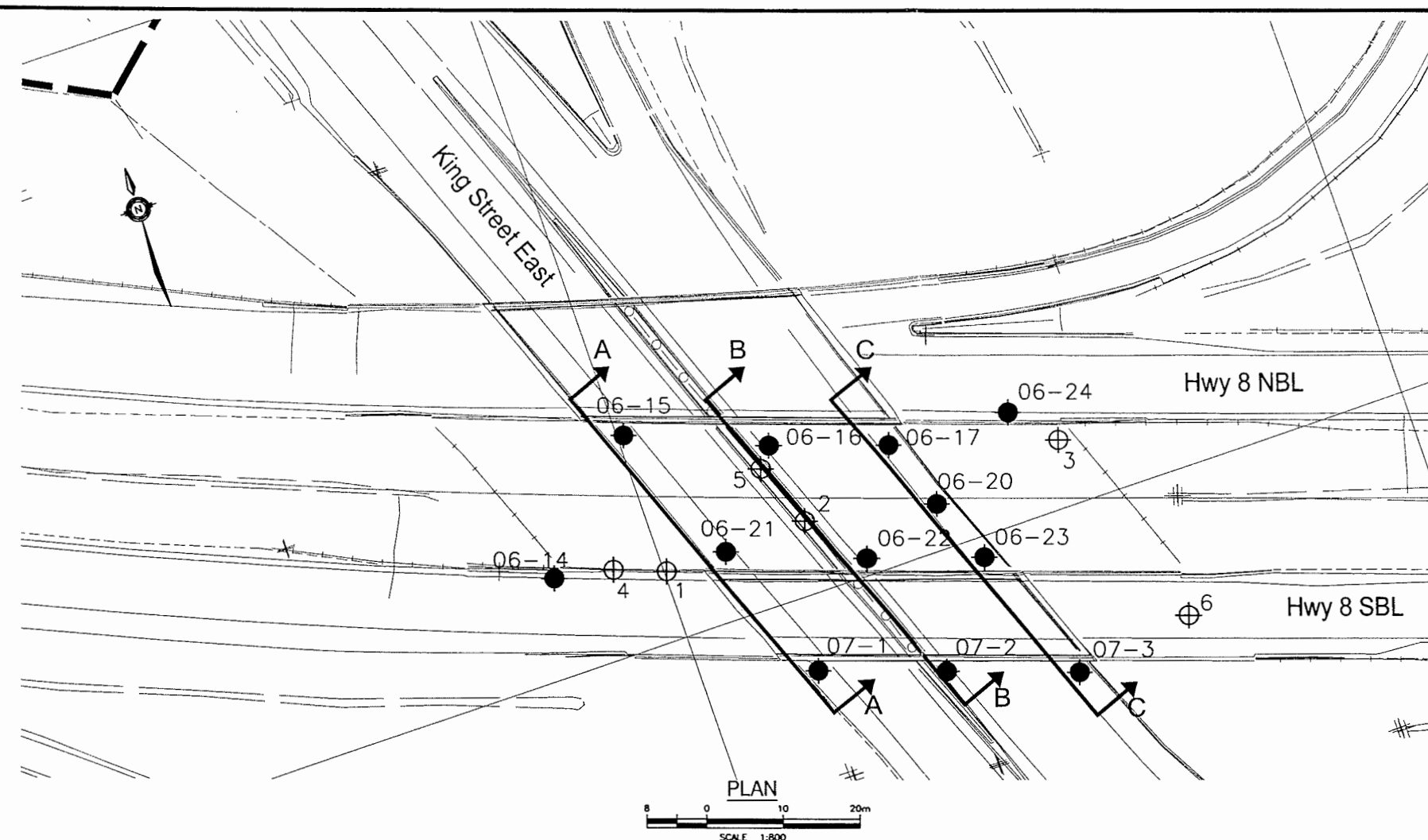
GEOCRES No. 40P8-144



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

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DRAWN	JHL	CHK PKC	SITE 33-214E
LOAD			DATE JAN 2007
STRUCT			DWG 1

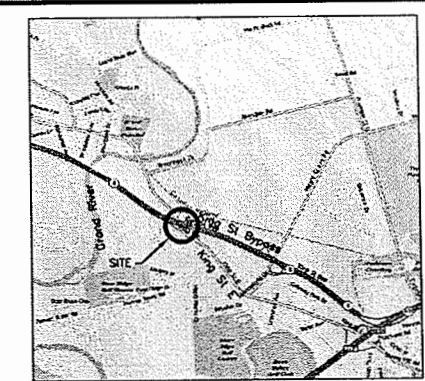
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CREATED: DEC 06
MODIFIED:



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

CONT No
GWP No.277-97-00
KING STREET OVERPASS
HWY 8 WIDENING
KITCHENER
BOREHOLE LOCATIONS AND SOIL STRATA

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LEGEND

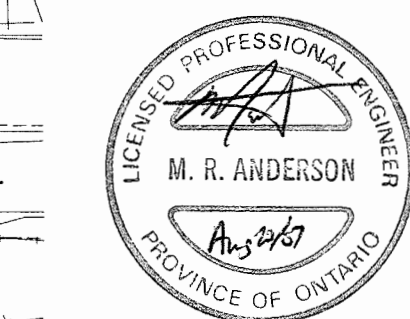
- BoreHole
- BoreHole and Cone
- BoreHole from Previous Investigation (Approximate)
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- Water Level
- Head Artesian Water
- Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
06-14	309.4	4 808 713.1	231 485.9
06-15	302.3	4 808 728.1	231 500.9
06-16	302.9	4 808 720.6	231 518.7
06-17	302.9	4 808 715.6	231 533.5
06-20	303.2	4 808 706.1	231 537.0
06-21	302.9	4 808 709.1	231 508.7
06-22	303.5	4 808 702.3	231 525.8
06-23	303.5	4 808 697.3	231 540.7
06-24	311.1	4 808 714.5	231 550.0
07-1	303.5	4 808 690.2	231 514.9
07-2	304.1	4 808 684.6	231 530.9
07-3	304.0	4 808 678.7	231 547.5

NOTES

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
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GEOCRES No. 40P8-144



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DESIGN	MRA	CHK PKC	CODE
DRAWN	JHL	CHK PKC	SITE 33-214E
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STRUCT			
DWG			

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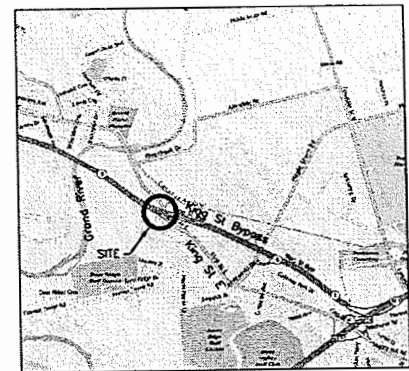
METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No
GWP No.277-97-00
KING STREET OVERPASS
HWY 8 WIDENING
KITCHENER
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

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KEYPLAN

LEGEND

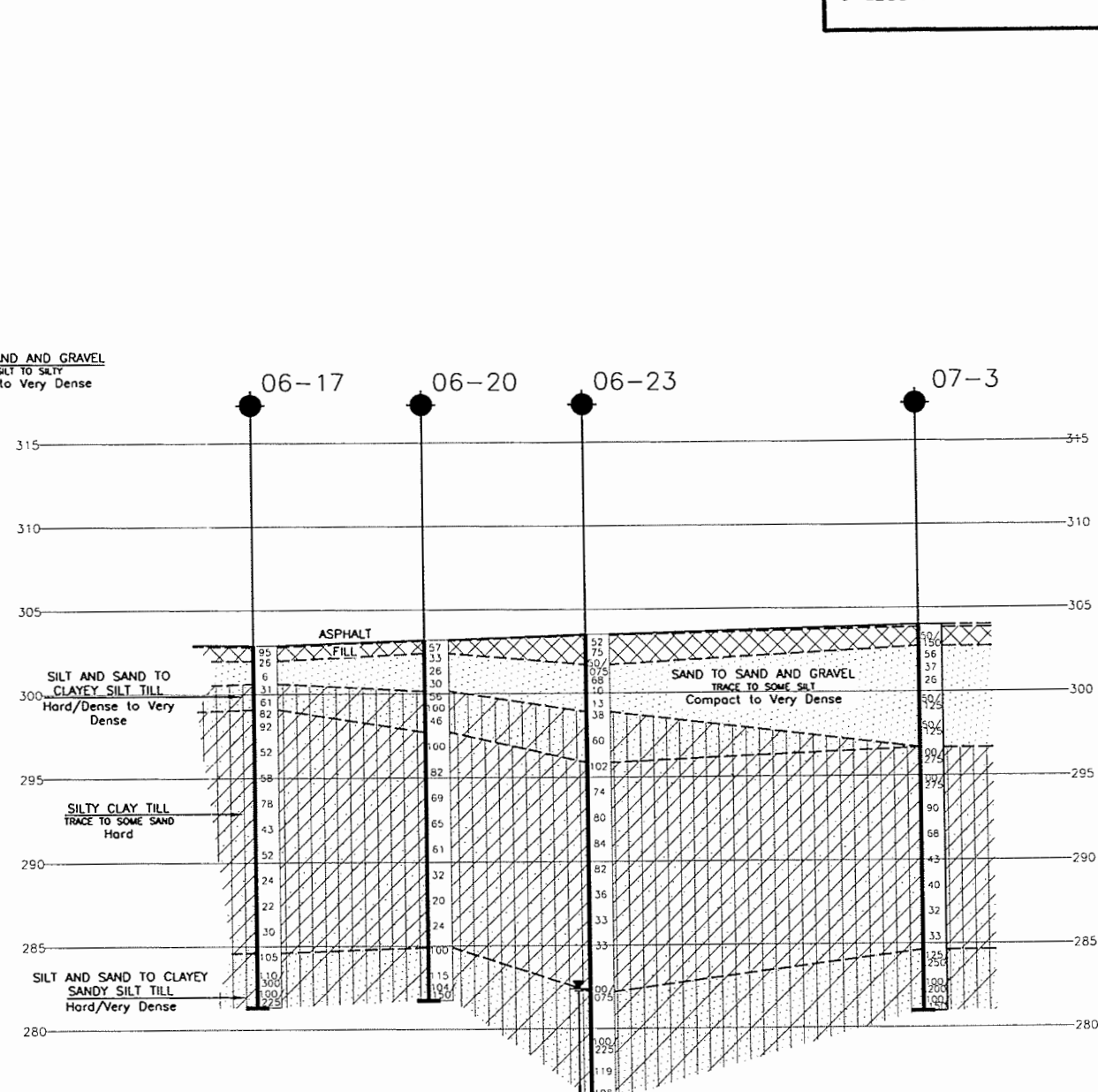
- BoreHole
- BoreHole and Cone
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- Water Level
- Head Artesian Water
- Piezometer
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NO	ELEVATION	NORTHING	EASTING
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07-2	304.1	4 808 684.6	231 530.9
07-3	304.0	4 808 678.7	231 547.5

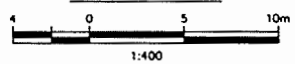
-NOTES-

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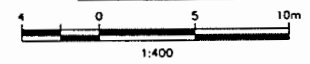
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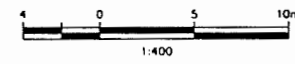
SECTION A-A



SECTION C-C



SECTION B-B



DRAWING NOT TO BE SCALED
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