

**FOUNDATION INVESTIGATION REPORT  
RSS SLOPE, KING STREET EAST N-W RAMP  
RECONSTRUCTION AND WIDENING OF HIGHWAY 8  
FROM 1.0 KM NORTH OF GRAND RIVER, SOUTHERLY  
TO SPORTSWORLD DRIVE, KITCHENER, ONTARIO  
G.W.P. 277-97-00**

**Geocres Number: 40P8-157**

**Report to**

**Morrison Hershfield Limited**

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

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**PART 1: FACTUAL INFORMATION**

**1 INTRODUCTION**

This report presents the factual findings obtained from a foundation investigation conducted for a proposed RSS slope along the west side of the North-West ramp of the Highway 8/King Street East interchange in Kitchener, Ontario.

Highway 8 will be widened from four to eight lanes from 1 km north of the Grand River southerly to Sportsworld Drive. As part of the widening project, the King Street East N-W ramp will be shifted west of the current alignment for a length of 350 m. Realignment and steepening of an earth berm using a RSS slope is planned as part of the ramp realignment.

The purpose of this investigation was to explore the subsurface conditions along the RSS slope alignment 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**

A combined cut slope and earth berm of 4 to 8 m in height exists along the west side of the existing King Street East N-W Ramp. Ramp grades rise from near elevation 302 m at the Highway 8 southbound bullnose to elevation 308 at the King Street East bullnose. An approximate 1.0 to 1.5 m deep ditch runs along the west side of the ramp, and a small residential subdivision lies west of the berm/cut slope.

Geologically, the site area is located within the physiographic region known as the Waterloo Hills, which is characterized by sandy hills consisting of ridges of sandy till as well as kames and kame

moraines, with outwash sands occupying the intervening hollows. Locally, the Grand River spillway system contains alluvial terraces of uniform sandy and gravelly materials. The soils overlie Silurian limestone bedrock of the Guelph Formation.

### 3 SITE INVESTIGATION AND FIELD TESTING

The site investigation and field testing for this component of the widening project were carried out during the period May 23 to 27, 2008 and consisted of drilling and sampling nine boreholes (Nos. 08-10 to 08-18) to depths of 8.2 to 11.3 m. Boreholes 08-10 to 08-17 were drilled along the top of the existing berm and borehole 08-18 was drilled near the west toe.

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 this drawing and on the individual Record of Borehole Sheets in Appendix A.

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

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 25 mm PVC pipes with slotted tip, were installed in selected boreholes to monitor groundwater levels. The remaining boreholes were grouted on completion of drilling. The completion details of the boreholes and piezometers are shown in Table 3.1. The piezometers will be decommissioned in accordance with MOE Reg. 903.

**Table 3.1 – Borehole Completion Details**

Borehole	Piezometer Tip (Sand Filter) Details			Backfill
	Depth	Elevation	Stratum	
08-10	-	-	-	Bentonite/cuttings mixture to surface
08-11	-	-	-	Bentonite/cuttings mixture to surface
08-12	10.7 – 9.0	301.4 – 303.1	Sand and gravel	Bentonite seal to 8.7 m, grout to surface
08-13	-	-	-	Bentonite/cuttings mixture to surface
08-14	10.7 – 8.8	303.2 – 305.1	Sand and gravel	Bentonite seal to 8.2 m, grout to surface
08-15	-	-	-	Bentonite/cuttings mixture to surface
08-16	9.8 – 7.8	303.5 – 305.5	Sand	Bentonite seal to 7.3 m, grout to surface
08-17	9.1 – 7.0	299.0 – 301.1	Gravelly sand	Bentonite seal to 6.6 m, grout to surface
08-18	9.1 – 7.3	296.5 – 298.3	Silty clay	Bentonite seal to 6.6 m, grout to 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. Approximately 25% of the recovered samples were also subjected to grain size distribution analyses (sieve and hydrometer) and Atterberg Limits testing where appropriate. 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 a layer of topsoil overlying gravelly sand fill, underlain by a native deposit comprising sand and gravel, sand, and silty sand to sandy silt. Silty clay was encountered locally below the sand/gravel/silt. More detailed descriptions of the individual strata are presented below.

##### **5.1 Topsoil**

A 50 to 225 mm thick layer of topsoil was encountered at the ground surface in all boreholes. A buried topsoil layer, 200 and 100 mm thick, was encountered in boreholes 08-12 and 08-16 at depths of 4.4 and 3.8 m (elevation 307.7 and 309.5 m), respectively.

The topsoil thickness may vary between and beyond the borehole locations and the data is not intended for the purpose of estimating quantities.

##### **5.2 Gravelly Sand Fill**

A layer of non-cohesive granular fill was encountered below the topsoil in all boreholes drilled along the top of the existing berm (borehole 08-10 to 08-17). The fill typically comprised gravelly sand, trace silt to silty, with occasional cobbles and zones of sand and gravel. It was described as moist and brown to grey.

Based on recorded SPT N-values of 12 to 75 blows/0.3 m, the fill is typically compact to very dense. One value of 7 blows/0.3 m was recorded in borehole 08-10, indicating a loose zone. Several tests achieving 50 blows for 75 to 125 mm of penetration likely reflect the presence of cobbles in the fill.

The moisture content of recovered fill samples ranged from 2 to 11%.

The results of grain size analyses conducted on eight samples as follows:

Gravel %	21 to 38
Sand %	42 to 65
Silt & Clay %	7 to 34

The grain size curves for the samples tested are shown in Figures B1 and B2, Appendix B.

The interpreted depth/thickness of the fill ranged from 3.0 to 4.4 m (base at elevation 302.0 to 310.4 m). The boundary between the fill and underlying native soil is difficult to ascertain due to the non-cohesive nature and similarity of the materials. The actual fill depth may vary from that reported.

### 5.3 Sand and Gravel, Sand, and Silty Sand to Sandy Silt Deposit

A native heterogeneous deposit comprising various zones of sand, sand and gravel, silty sand to sandy silt, and locally silt was encountered below the fill in all boreholes drilled upon the existing berm, and below the topsoil in borehole 08-18. These deposits were described as moist to wet and brown to grey.

Recorded SPT N-values in this deposit varied significantly, ranging from 3 blows/0.3 m (very loose) to 83 blows/0.025 m (very dense) of penetration. Loose to very loose zones, indicated by N-values of less than 10, included the upper 0.6 to 2.0 m of the native soil in boreholes 08-11, 08-16, 08-17 and 08-18. Tests achieving 50 blows in 150 mm of penetration or less likely reflect the presence of cobbles in the fill.

The natural moisture content of recovered samples of the native deposits ranged from 2 to 22%, typically less than 10%.

The results of grain size analyses conducted on 19 samples are as follows:

	Sand and Gravel to Gravelly Sand (8 samples)	Sand to Silty Sand (6 samples)	Silt to Sand and Silt (5 samples)
Gravel %	26 to 56	0 to 17	0 to 1
Sand %	33 to 67	63 to 85	14 to 49
Silt %		12 to 32	40 to 75
Clay %	7 to 25		3 to 15

The grain size distribution curves for the samples tested are shown in Figures B3 to B6, Appendix B.

The lower boundary of the sand/gravel/silt deposit was encountered at depths of 7.0 to 9.1 m (elevation 297.1 to 299.0 m) in boreholes 08-10, 08-17 and 08-18 drilled at the north end of the site. In these boreholes, the thickness of the deposit was 4.9 to 6.8 m. The remaining boreholes were terminated in this material at depths of 9.8 to 11.3 m (elevation 300.2 to 303.5 m).

#### 5.4 Silty Clay

In boreholes 08-10, 08-17 and 08-18 drilled at the north end of the site, a cohesive grey silty clay stratum was encountered below the cohesionless deposits at depths of 7.0 to 9.1 m (elevation 297.1 to 299.0 m). The clay contained trace sand to sandy, trace gravel and occasional cobbles.

Based on SPT values of 53 to 61 blows/0.3 m, the cohesive material is described as being hard.

The natural moisture content of recovered samples ranged from 14 to 22%, locally 6% in a sample from borehole 08-18 described as sandy.

The results of grain size analyses conducted on two samples are as follows:

Gravel %	0 to 2
Sand %	5 to 22
Silt %	44 to 59
Clay %	32 to 36
Liquid Limit	26 to 30
Plastic Limit	13 to 15

The grain size distribution curves for the samples tested are shown in Figure B7, Appendix B. The Atterberg Limits are plotted on Figure B8. The results indicate that the silty clay is a CL soil (low plasticity).

Boreholes 08-10, 08-17 and 08-18 were terminated in the silty clay at 8.2 to 9.8 m depth (elevation 295.9 to 298.3 m).

#### 5.5 Groundwater Conditions

Groundwater was not observed in the boreholes during or upon completion of drilling.

Standpipe piezometers were installed in selected boreholes to monitor water levels after completion of drilling. The water levels measured in the piezometers are summarized in Table 5.1.

**Table 5.1 – Measured Groundwater Levels**

Borehole	Date	Water Level (m)	
		Depth	Elevation
08-12	27-May-2008	Dry	-
	19-Aug-2008	Could not locate	-
08-14	19-Aug-2008	Dry	-
08-16	19-Aug-2008	Dry	-
08-17	19-Aug-2008	7.8	300.3
08-18	19-Aug-2008	Could not locate	-

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 zones of more permeable sand and gravel, or sand/silt above silty clay.

## 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. David Elwood and Mr. Keli Shih.

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 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.

Thurber Engineering Ltd.  
Murray R. Anderson, P.Eng., M.Eng.  
Senior Geotechnical Engineer



P.K. Chatterji, P.Eng., Ph.D.  
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 <sup>(1)</sup> 'N' VALUE
Very Soft	12 or less	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	Greater than 200	Greater than 30

NOTE: Hierarchy of Soil Strength Prediction

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



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

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

### 5. LEGEND FOR RECORDS OF BOREHOLES

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

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






 Water Level  
 C<sub>pen</sub> 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.
		Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
		Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
		Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail

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

# RECORD OF BOREHOLE No 08-10

1 OF 1

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr. N 4 808 776.17 E 231 273.83 ORIGINATED BY KS  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2008.05.23 - 2008.05.23 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  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100					
305.0															
0.0	TOPSOIL: (100mm)						305								
0.1	SAND and GRAVEL, trace silt Compact Grey/Brown Moist to Dry (FILL)		1	SS	22										
304.1															
0.9	Gravelly SAND, trace to some silt, occasional cobbles Loose to Compact Moist Brown (FILL)		2	SS	14		304								
			3	SS	22		303								28 65 7 (SI+CL)
			4	SS	7										
302.0							302								
3.0	SAND and GRAVEL, trace silt, occasional cobbles Compact to Dense Grey/Brown Moist		5	SS	14										
			6	SS	35		301								33 57 10 (SI+CL)
			7	SS	36		300								
299.5															
5.5	SAND, some silt, trace gravel Very Dense Mottled Grey/Brown to Brown Wet						299								
			8	SS	72		298								
297.1															
7.9	Silty CLAY, with silt pockets and seams, trace sand		9	SS	57		297								0 79 21 (SI+CL)
296.8	Hard Grey Moist														
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE BACKFILLED WITH MIXTURE OF BENTONITE AND CUTTINGS.														

ONTMT4S 7938.GPJ 10/6/08

# RECORD OF BOREHOLE No 08-11

1 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr. N 4 808 731.50 E 231 332.80 ORIGINATED BY KS  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY VM  
 DATUM Geodetic DATE 2008.05.23 - 2008.05.23 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)		
								○ UNCONFINED    + FIELD VANE		● QUICK TRIAXIAL    × LAB VANE									
310.0							20	40	60	80	100	20	40	60		GR SA SI CL			
0.0	TOPSOIL: (200mm)																		
0.2	SAND, some silt to silty, trace gravel, trace clay Compact Brown Moist (FILL)		1	SS	20							○							
			2	SS	17							○							
308.5																			
1.5	Silty, gravelly SAND, occasional cobbles Very Dense Grey Moist (FILL)		3	SS	68							○				26 42 32 (SI+CL)			
			4	SS	50/ .075							○							
			5	SS	70							○				26 53 21 (SI+CL)			
			6	SS	50/ .125							○							
305.7																			
4.3	Silty SAND to sandy SILT, trace clay Loose to Compact Brown Moist to Wet		7	SS	11							○							
			8	SS	7							○				0 22 75 3			
			9	SS	25							○							
301.5																			
8.5	SILT, some sand, some clay Compact Brown Wet																		
			10	SS	13							○				0 14 74 12			
300.2												○							
9.8																			

Continued Next Page

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

# RECORD OF BOREHOLE No 08-11

2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr. N 4 808 731.50 E 231 332.80 ORIGINATED BY KS  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2008.05.23 - 2008.05.23 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100	20 40 60					
	Continued From Previous Page													
	END OF BOREHOLE AT 9.8m. BOREHOLE BACKFILLED WITH A MIXTURE OF BENTONITE AND CUTTINGS.													

# RECORD OF BOREHOLE No 08-12

1 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr. N 4 806 701.90 E 231 369.77 ORIGINATED BY KS  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2008.05.23 - 2008.05.23 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED    + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE								
312.1							20	40	60	80	100					
0.0	TOPSOIL: (100mm)															
0.1	Silty, gravelly <b>SAND</b> , occasional cobbles Compact to Very Dense Moist Brown to Grey (FILL)		1	SS	20											
			2	SS	34											
			3	SS	56											21 45 34 (SI+CL)
			4	SS	50											
			5	SS	59											
			6	SS	12											
307.7	TOPSOIL: (200mm)															
307.4	Dark Brown															
4.6	Sandy <b>SILT</b> , some clay to clayey Compact Brown		7	SS	12											0 35 50 15
306.6																
5.5	<b>SAND</b> and <b>GRAVEL</b> , trace silt, occasional cobbles Very Dense Grey Moist		8	SS	57											56 33 11 (SI+CL)
			9	SS	56/ .150											
			10	SS	53/ .150											

Continued Next Page

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

20  
15  
10

(%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No 08-12

2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr. N 4 808 701.90 E 231 369.77 ORIGINATED BY KS  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2008.05.23 - 2008.05.23 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT  γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
	Continued From Previous Page													
300.9			11	SS	50/ 100		302							
11.2	END OF BOREHOLE AT 11.2m. Piezometer installation consists of 25.4mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen. WATER LEVEL READINGS DATE DEPTH (m) ELEV. (m) 2008.05.27 dry - 2008.08.19 could not locate -						301							

# RECORD OF BOREHOLE No 08-13

1 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr. N 4 808 668.63 E 231 410.31 ORIGINATED BY KS  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2008.05.26 - 2008.05.26 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT      NATURAL MOISTURE CONTENT      LIQUID LIMIT			UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR   SA   SI   CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)				
313.4								20	40	60	80	100				
0.0	TOPSOIL: (150mm)															
0.2	Silty, gravelly <b>SAND</b> , occasional cobbles Compact to Dense Brown to Grey Moist (FILL)		1	SS	30		313							o		
			2	SS	50		312							o		
			3	SS	42		311							o		
			4	SS	19		310							o		
310.4																
3.0	Silty, gravelly <b>SAND</b> Loose to Very Dense Grey/Brown Moist		5	SS	42		309							o		
			6	SS	43		308							o		
			7	SS	83		307							o		
			8	SS	7		306									
							305									
305.8																
7.6	<b>SAND</b> and <b>GRAVEL</b> , some silt, occasional cobbles Dense to Very Dense Grey Moist		9	SS	66		304							o		
			10	SS	35											

Continued Next Page

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

# RECORD OF BOREHOLE No 08-13

2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr. N 4 808 668.63 E 231 410.31 ORIGINATED BY KS  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2008.05.26 - 2008.05.26 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
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 X LAB VANE						
								20 40 60 80 100						
302.1			11	SS	73		303							
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE BACKFILLED WITH MIXTURE OF BENTONITE AND CUTTINGS.													

# RECORD OF BOREHOLE No 08-14

1 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr. N 4 808 635.58 E 231 447.74 ORIGINATED BY KS  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2008.05.26 - 2008.05.26 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
313.9								20	40	60	80	100				
0.0	TOPSOIL: (175mm)															
0.2	Silty, gravelly SAND, occasional cobbles Compact to Very Dense Brown to Grey Moist (FILL)		1	SS	19											
			2	SS	53											
			3	SS	51											
			4	SS	33											26 44 30 (SI+CL)
			5	SS	50/ .125											
310.2																
3.7	Silty, gravelly SAND, occasional cobbles Compact to Dense Grey/Brown Moist		6	SS	40											
			7	SS	37											28 47 25 (SI+CL)
			8	SS	11											
			9	SS	23											
305.2																
8.7	SAND and GRAVEL, some silt, occasional cobbles Compact Brown Moist		10	SS	22											36 47 17 (SI+CL)

Continued Next Page

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

# RECORD OF BOREHOLE No 08-14

2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr. N 4 808 635 58 E 231 447.74 ORIGINATED BY KS  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2008.05.26 - 2008.05.26 CHECKED BY MRA


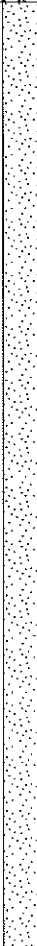
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
							20 40 60 80 100	20 40 60 80 100	20 40 60					
	Continued From Previous Page													
302.6			11	SS	25		303							
11.3	END OF BOREHOLE AT 11.3m. Piezometer installation consists of 25.4mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS DATE DEPTH (m) ELEV. (m) 2008.08.19 dry -													

# RECORD OF BOREHOLE No 08-15

1 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr. N 4 808 603.17 E 231 486.99 ORIGINATED BY KS  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2008.05.27 - 2008.05.27 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT      NATURAL LIMIT                  MOISTURE CONTENT			UNIT WEIGHT  γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20    40    60    80    100					w <sub>p</sub>	w	w <sub>L</sub>					
								SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    x LAB VANE												
313.9																				
0.0	TOPSOIL: (200mm)																			
0.2	Gravelly SAND, some silt to silty, occasional cobbles Compact to Very Dense Brown to Grey Moist (FILL)		1	SS	22															
			2	SS	50/ .125		313													
			3	SS	50/ .075		312													
			4	SS	39		311													
			5	SS	62															
310.2																				
3.7	SAND, some silt, some gravel, occasional sandy silt seams, occasional cobbles Compact to Very Dense Grey Moist		6	SS	47		310													
			7	SS	25		309													
							308													
			8	SS	13		307													
			9	SS	50/ .150		306													
							305													
			10	SS	31															

Continued Next Page

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

# RECORD OF BOREHOLE No 08-15

2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr. N 4 808 603.17 E 231 486.99 ORIGINATED BY KS  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2008.05.27 - 2008.05.27 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT  γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
	Continued From Previous Page							20 40 60 80 100	20 40 60					
302.6			11	SS	30		303							8 74 18 (SI+CL)
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE BACKFILLED WITH MIXTURE OF BENTONITE AND CUTTINGS.													

# RECORD OF BOREHOLE No 08-16

1 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr. N 4 808 573.04 E 231 526.22 ORIGINATED BY KS  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2008.05.27 - 2008.05.27 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
313.3							<div>20 40 60 80 100</div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div>						
0.0	TOPSOIL: (225mm)						<div>20 40 60 80 100</div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div>						
0.2	Gravelly SAND, some silt to silty, occasional cobbles Compact to Very Dense Brown to Grey Moist (FILL)		1	SS	24								
			2	SS	36								
			3	SS	27								
			4	SS	75								
			5	SS	23								
309.5													
308.8	TOPSOIL: (100mm)												
3.9	Silty SAND, trace gravel Loose Brown Wet		6	SS	6								
			7	SS	6								
307.8													
5.5	SAND, some silt, some gravel, occasional silt lenses, occasional cobbles Compact Brown Moist to Wet		8	SS	29								
			9	SS	25								
			10	SS	27								
303.5													
9.8	END OF BOREHOLE AT 9.8m.												

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: 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		UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER			TYPE			
	Continued From Previous Page					○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	WATER CONTENT (%) 20 40 60		GR SA SI

[illegible]

# RECORD OF BOREHOLE No 08-17

1 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr. N 4 808 746.85 E 231 312.54 ORIGINATED BY KS  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2008.05.27 - 2008.05.27 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										
308.1							20	40	60	80	100							
0.0	TOPSOIL: (50mm)																	
0.1	Silty, gravelly SAND, occasional cobbles Dense to Compact Grey Moist (FILL)		1	SS	32													
			2	SS	45													
			3	SS	69													
			4	SS	24													
305.1																		
3.0	SAND and SILT Loose to Compact Brown Moist		5	SS	8													
			6	SS	16													
			7	SS	10													
302.3																		
5.8	Gravelly SAND, trace silt, occasional cobbles Dense to Very Dense Brown to Grey Moist to Wet		8	SS	34													
			9	SS	53													
299.0																		
9.1	Silty CLAY, trace sand Hard Grey		10	SS	53													
298.3																		
9.8	END OF BOREHOLE AT 9.8m.																	

Continued Next Page

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

20  
15 5  
10 (%) STRAIN AT FAILURE

**RECORD OF BOREHOLE No 08-17**

2 OF 2

**METRIC**

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr. N 4 808 746.85 E 231 312.54 ORIGINATED BY KS  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2008.05.27 - 2008.05.27 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT  γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40					
Continued From Previous Page														
	Piezometer installation consists of 25.4mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS DATE      DEPTH (m)      ELEV. (m) 2008.08.19      7.8      300.3													

# RECORD OF BOREHOLE No 08-18

1 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr. N 4 808 721.44 E 231 324.13 ORIGINATED BY KS  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2008.05.23 - 2008.05.23 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
305.6								20	40	60	80	100					
0.0	TOPSOIL: (150mm)																
0.2	Silty SAND to sandy SILT Loose to Very Loose Brown Moist		1	SS	4												
			2	SS	3												
			3	SS	10												
303.6	SAND, some silt Loose to Dense Brown Moist		4	SS	20												
2.0			5	SS	32												
			6	SS	9												
301.1	SAND and GRAVEL, trace silt, occasional layers of silt and clay Compact Brown Wet		7	SS	15												
299.8	SAND and SILT, some clay, trace gravel, occasional cobbles Dense Brown Wet		8	SS	30												
298.6	Sandy, silty CLAY, trace gravel, occasional cobbles Hard Grey Moist		9	SS	55												
295.9	END OF BOREHOLE AT 9.8m.		10	SS	61												
9.8																	

Continued Next Page

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

# RECORD OF BOREHOLE No 08-18

2 OF 2

METRIC

G.W.P. 277-97-00 LOCATION Hwy 8 Widening, Grand River to Sportsworld Dr. N 4 808 721.44 E 231 324.13 ORIGINATED BY KS  
 HWY 8 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2008.05.23 - 2008.05.23 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 $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	IN VALUES			20 40 60 80 100	20 40 60 80 100	W P W W L	20 40 60			
	Continued From Previous Page													
	Piezometer installation consists of 25.4mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS DATE DEPTH (m) ELEV. (m) 2008.08.19 could not locate -													

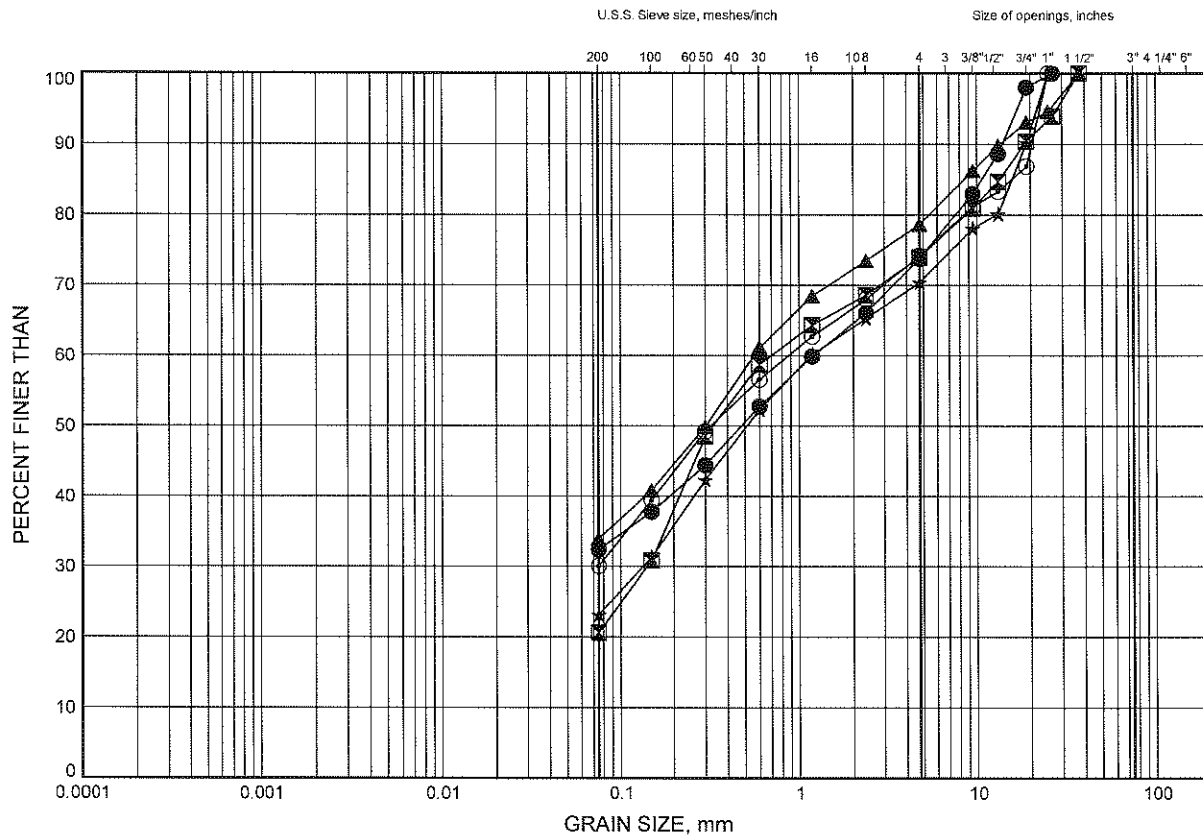
## **Appendix B**

### **Laboratory Test Results**

# Highway 8 Widening Over Grand River GRAIN SIZE DISTRIBUTION

FIGURE B1

## SILTY GRAVELLY SAND FILL



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

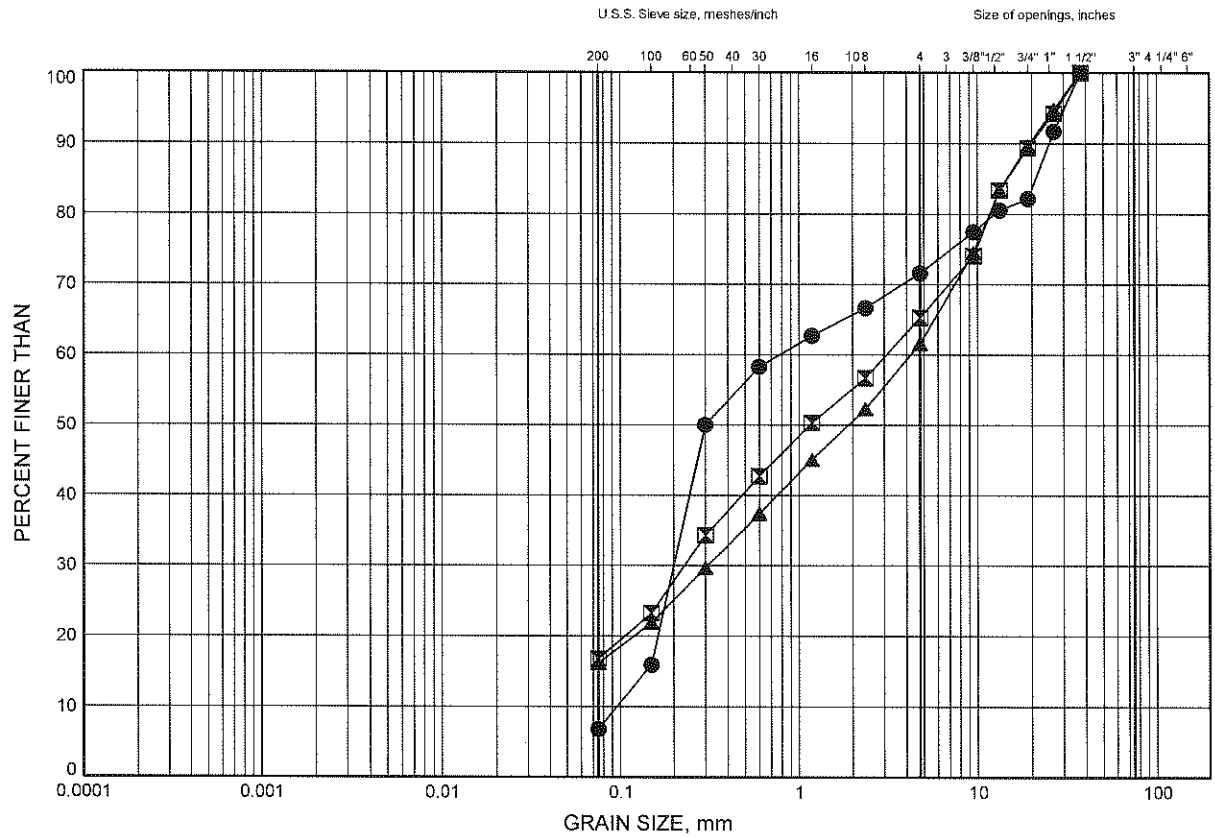
### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-11	1.83	308.17
⊠	08-11	3.35	306.65
▲	08-12	1.83	310.27
☆	08-13	2.59	310.81
⊙	08-14	2.59	311.31

# Highway 8 Widening Over Grand River GRAIN SIZE DISTRIBUTION

FIGURE B2

## GRAVELLY SAND FILL



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

### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-10	1.83	303.17
⊠	08-15	3.35	310.55
▲	08-16	2.59	310.71



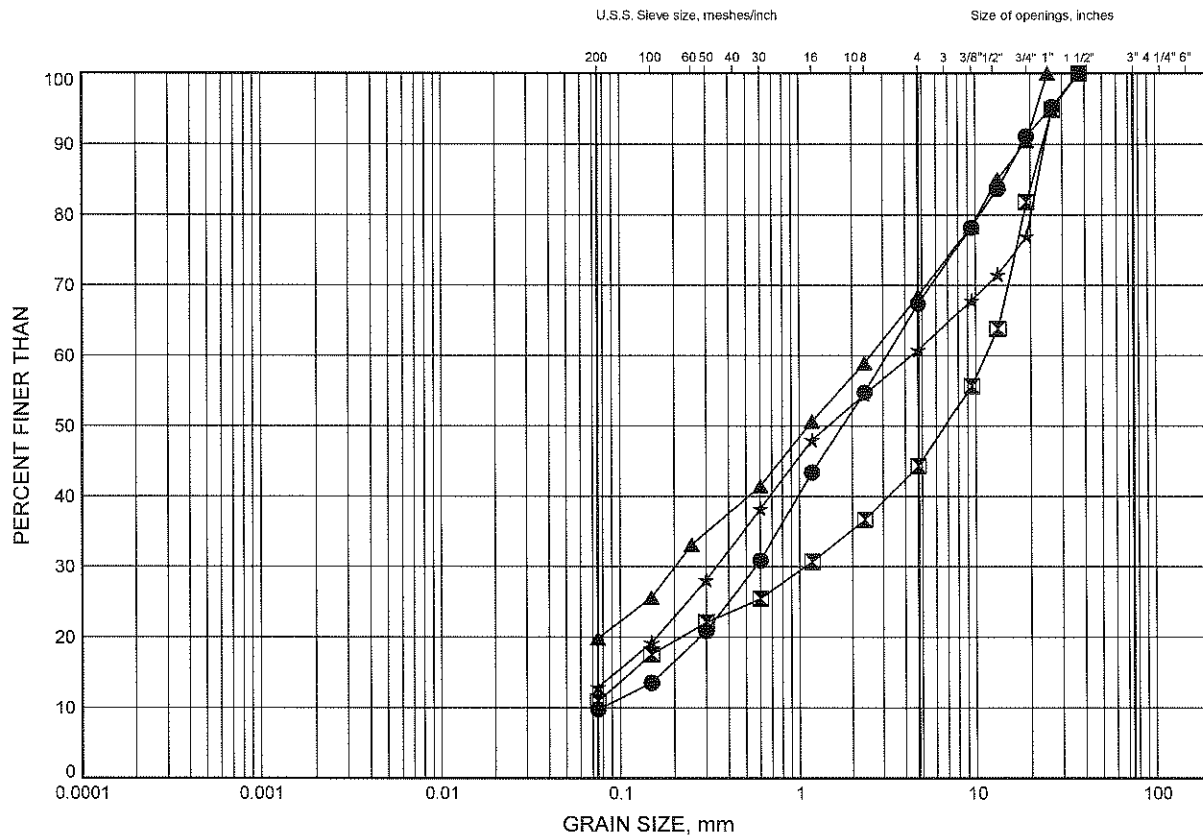
W.P.# 277-97-00  
Prepared By MFA  
Checked By MRA



# Highway 8 Widening Over Grand River GRAIN SIZE DISTRIBUTION

FIGURE B3

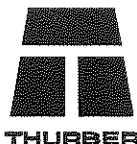
## SAND AND GRAVEL TO GRAVELLY SAND



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

### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-10	4.11	300.89
⊠	08-12	6.40	305.70
▲	08-13	4.88	308.52
★	08-13	9.45	303.95

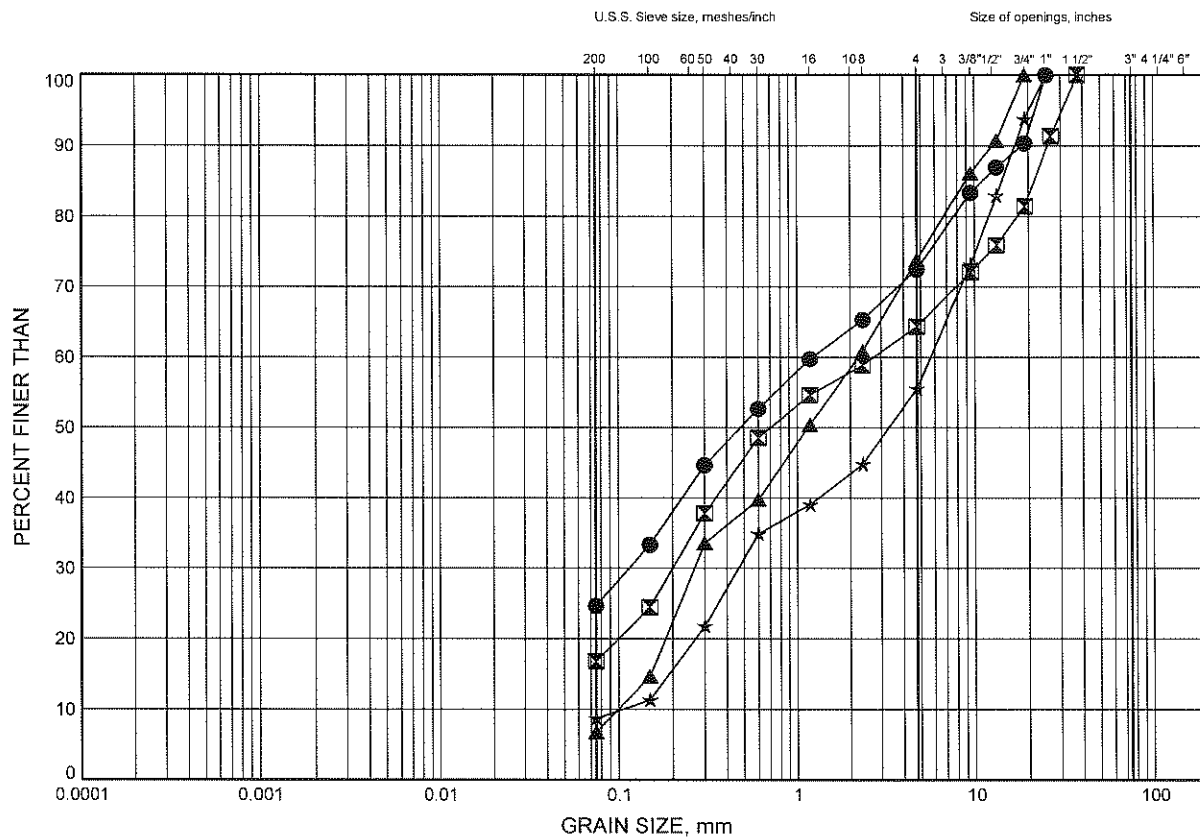


W.P.# 277-97-00.....  
Prepared By MFA.....  
Checked By MRA.....

# Highway 8 Widening Over Grand River GRAIN SIZE DISTRIBUTION

FIGURE B4

## SAND AND GRAVEL TO GRAVELLY SAND



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

### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-14	4.88	309.02
⊠	08-14	9.45	304.45
▲	08-17	6.40	301.70
☆	08-18	4.88	300.73

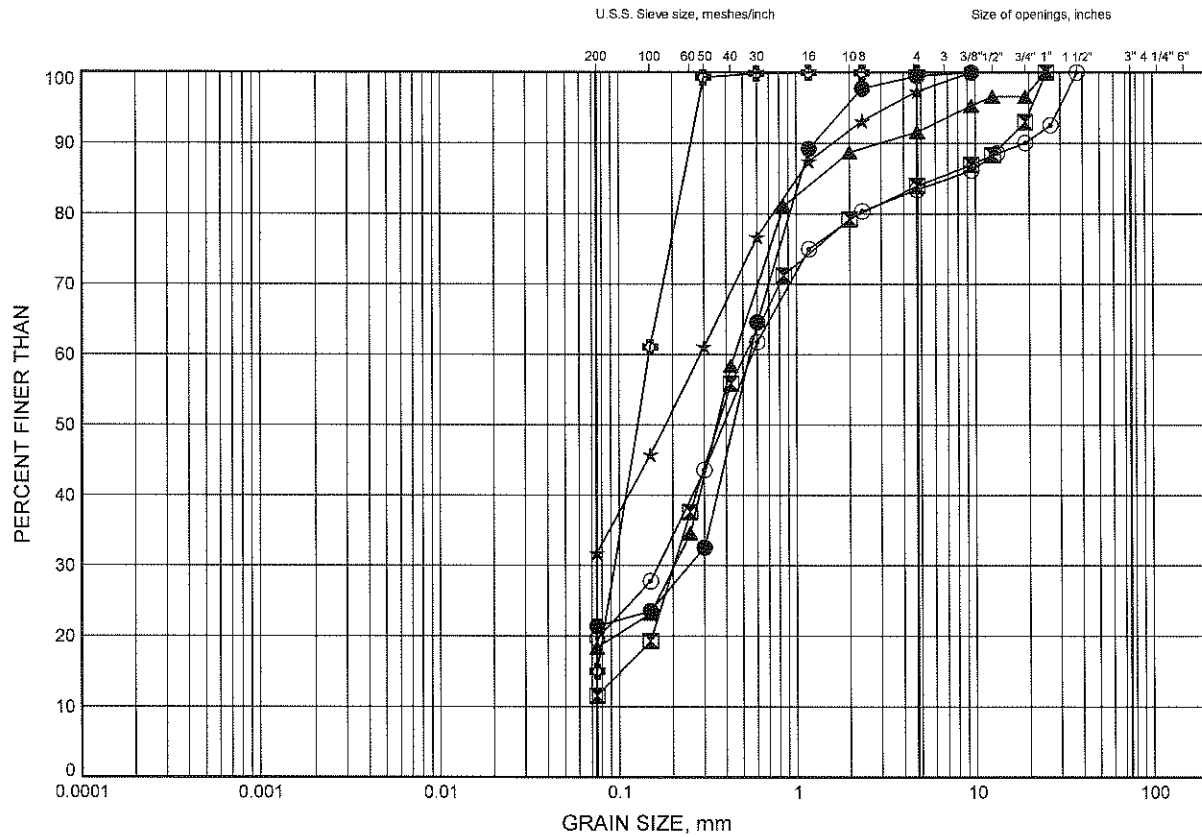


W.P.# 277-97-00  
Prepared By MFA  
Checked By MRA

# Highway 8 Widening Over Grand River GRAIN SIZE DISTRIBUTION

FIGURE B5

## SAND TO SILTY SAND



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

### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-10	7.75	297.25
⊠	08-15	6.40	307.50
▲	08-15	10.97	302.93
☆	08-16	4.88	308.42
⊙	08-16	7.92	305.38
⊕	08-18	2.59	303.02

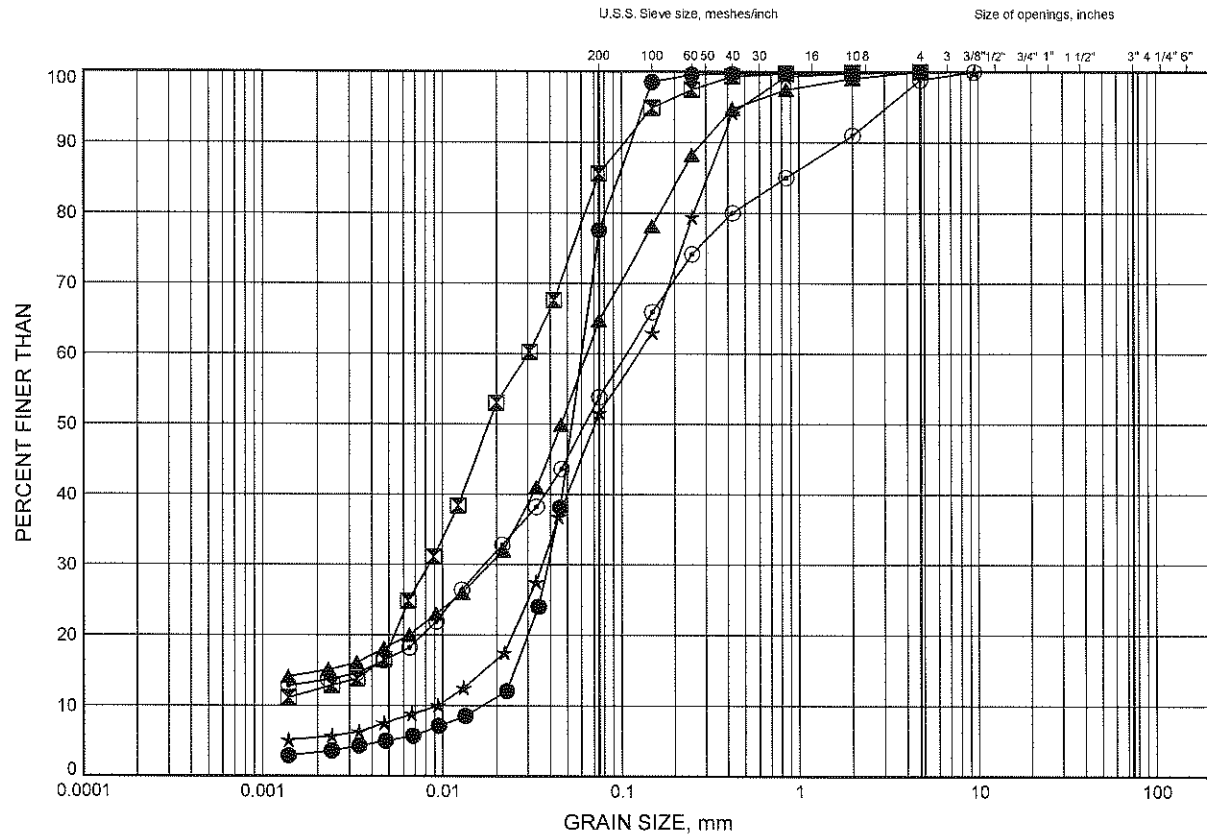


W.P.# 277-97-00  
Prepared By MFA  
Checked By MRA

# Highway 8 Widening Over Grand River GRAIN SIZE DISTRIBUTION

FIGURE B6

## SILT TO SAND AND SILT



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

### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-11	6.40	303.60
⊠	08-11	9.40	300.60
▲	08-12	4.88	307.22
☆	08-17	3.35	304.75
⊙	08-18	6.40	299.21

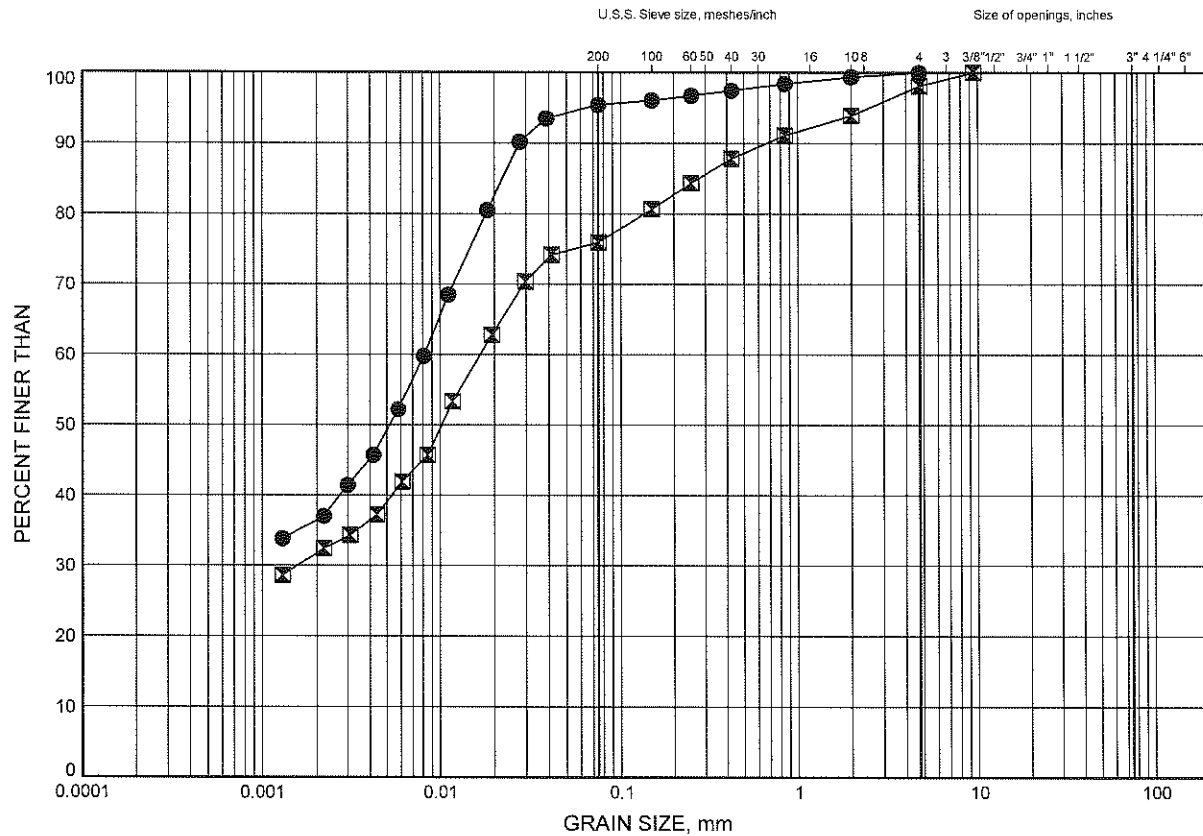


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Prepared By .MFA.....  
Checked By .MRA.....

# Highway 8 Widening Over Grand River GRAIN SIZE DISTRIBUTION

FIGURE B7

## SILTY CLAY



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

## LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-17	9.45	298.65
⊠	08-18	7.92	297.69

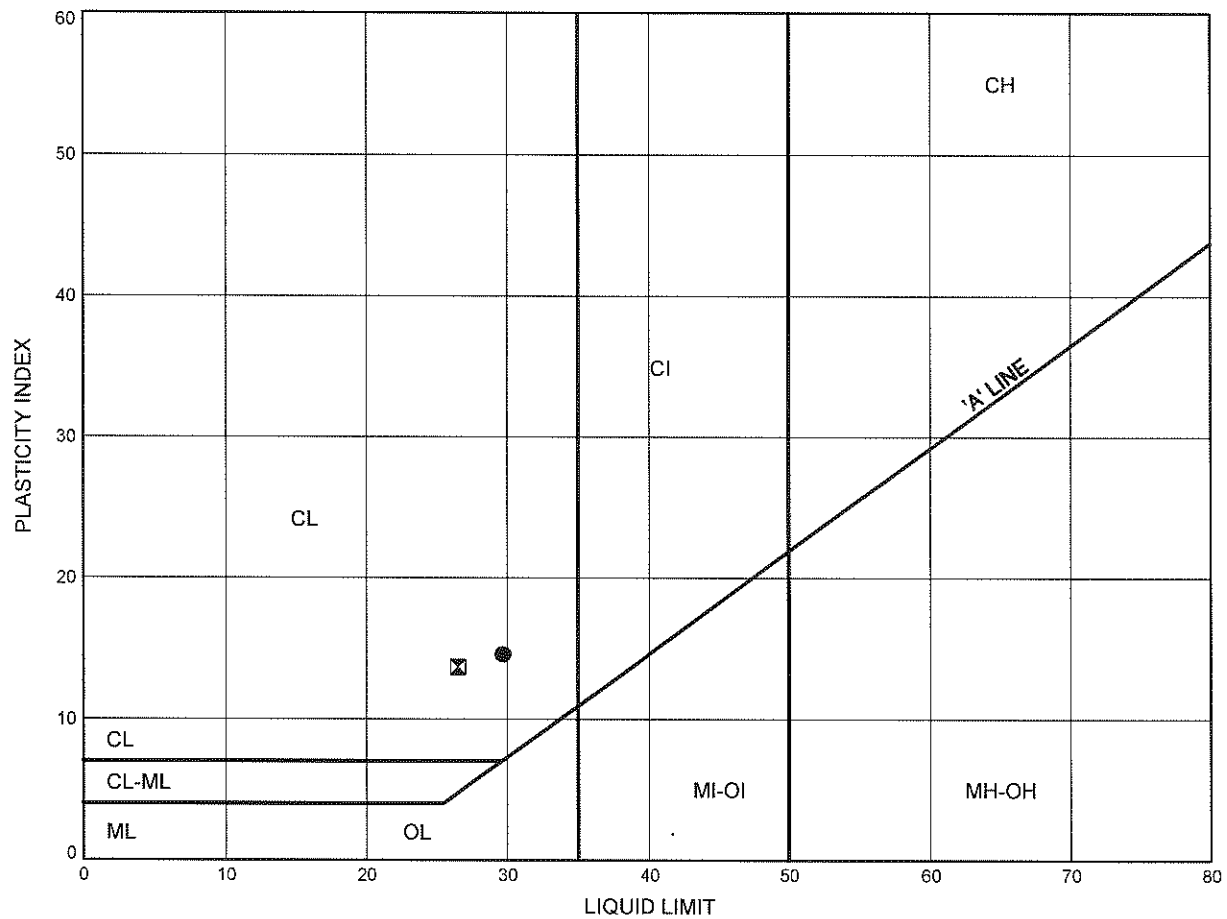


W.P.# 277-97-00  
Prepared By MFA  
Checked By MRA

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

FIGURE B8

**SILTY CLAY**



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	08-17	9.45	298.65
⊠	08-18	7.91	297.70

Date October 2008  
 Project 277-97-00

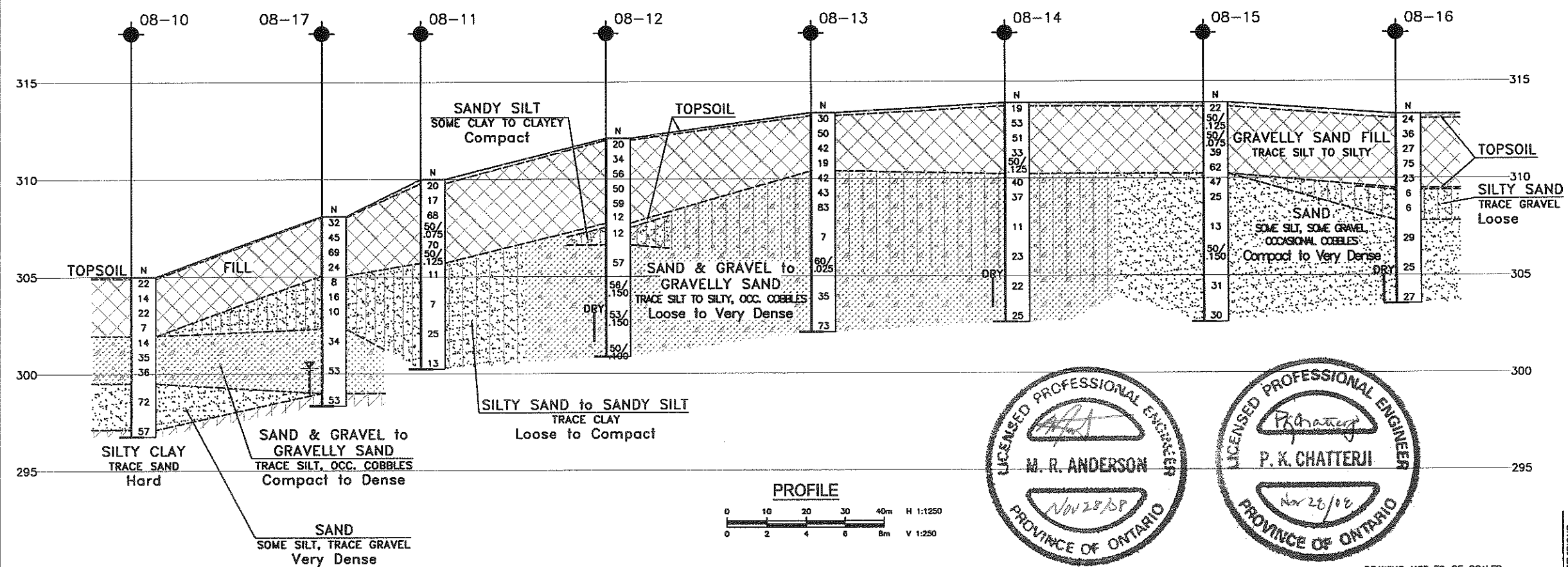
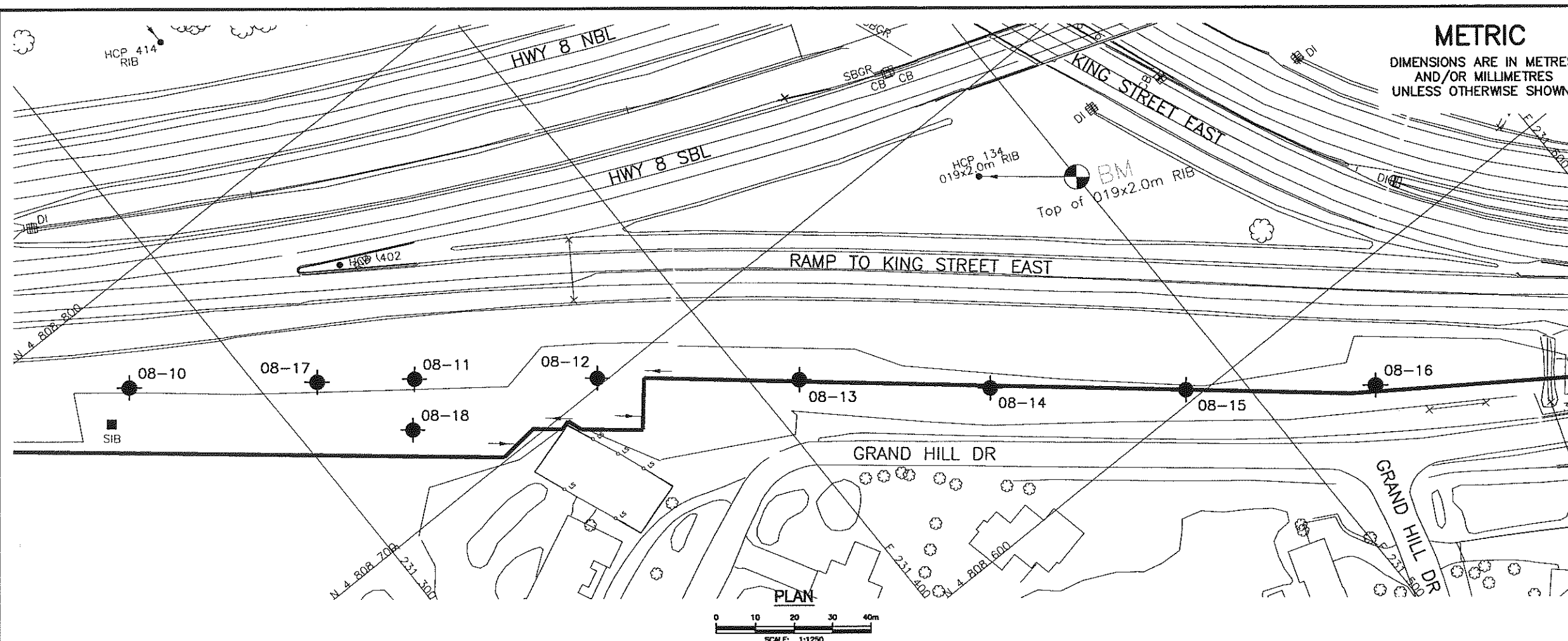


Prep'd MFA  
 Chkd. MRA

## **Appendix C**

### **Drawing**

#### **Borehole Locations and Soil Strata**



DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

CONT No  
GWP No

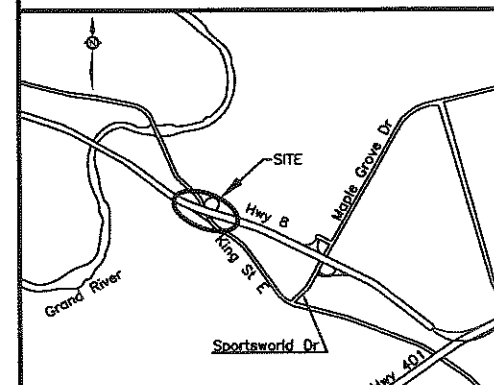
KING STREET EAST RAMP  
HIGHWAY 8 WIDENING  
KITCHENER  
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET






# THE



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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
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
08-10	305.0	4 808 776.2	231 273.8
08-11	310.0	4 808 731.5	231 332.8
08-12	312.1	4 808 701.9	231 369.8
08-13	313.4	4 808 668.6	231 410.3
08-14	313.9	4 808 635.6	231 447.7
08-15	313.9	4 808 603.2	231 487.0
08-16	313.3	4 808 573.0	231 526.2
08-17	308.1	4 808 746.8	231 312.5
08-18	305.6	4 808 721.4	231 324.1

-NOTES-

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

**GEOCRES No. 40P8-157**

[illegible]

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