FOUNDATION INVESTIGATION REPORT
RAINY RIVER TRIBUTARY CULVERT REPLACEMENT
HIGHWAY 602
ALBERTON TOWNSHIP
DISTRICT OF RAINY RIVER, ONTARIO

G.W.P. 6938-10-00, SITE No. 45-145/C

Geocres Number: 52C-25

Report to

Hatch Mott MacDonald

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TABLE OF CONTENTS

Appendices

FOUNDATION INVESTIGATION REPORT
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PART 1: FACTUAL INFORMATION

1 INTRODUCTION

This report presents the factual findings obtained from a foundation investigation conducted at the location of a culvert at the Highway 602 crossing of the Rainy River Tributary in the District of Rainy River, Ontario.

The purpose of this investigation was to explore the subsurface conditions at the site and, based on the data obtained, to provide a borehole location plan, records of boreholes, a stratigraphic profile, 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 Hatch Mott MacDonald, under the Ministry of Transportation Ontario (MTO) Agreement Number 6010-E-0010.

2 SITE DESCRIPTION

The Rainy River Tributary culvert is located on Highway 602, approximately 4.2 km west of the intersection of Highway 602 and Highway 11 in Fort Frances, Ontario. This site is located in Alberton Township in the Rainy River District of Ontario.

The existing Rainy River Tributary culvert is a concrete open frame culvert supported on footings. The culvert is 4.5 m wide and 47.7 m long. The water flows through the culvert from west to east.

The road grade is approximately 7.4 m to 8.3 m high above Rainy River Tributary. The surrounding lands are undeveloped and heavily treed.

Photographs in Appendix C show the general nature of the site and the existing structure.

The region is characterized by Precambrian meta-volcanic and meta-sedimentary rocks intruded by later stage diabase dykes. The bedrock is mantled by glaciolacustrine clays and sand and gravel deposits.

3 SITE INVESTIGATION AND FIELD TESTING

The as-drilled borehole locations in Appendix D were selected based on the proposed replacement culvert design shown in a Preliminary General Arrangement drawing (GA drawing) dated June 2011. This original replacement culvert design consisted of two parallel sheet pile walls supporting a precast concrete cap panel. However, a revised/new GA drawing dated January, 2012, shows that the design has been changed to a modular bridge supported on two abutments. The original and the revised GA drawings are attached in Appendix E. The abutments for the modular bridge are about 20.0 m from the borehole drilled through the road for the culvert option. It must be noted that no boreholes were drilled at the proposed abutments for the modular bridge.

The site investigation and field testing for this project was carried out on June 17 and July 21 to 24, 2011 and consisted of drilling and sampling three boreholes (identified as RRTC-01 to RRTC-03) in the area of the existing culvert.

Borehole RRTC-02 was drilled on the Highway 602 shoulder, through the existing highway embankment. Boreholes RRTC-01 and RRTC-03 were drilled at the toe of the highway embankment, near each end of the existing culvert.

Boreholes were advanced within the overburden to depths ranging from 12.2 m to 18.9 m (elevations 317.0 to 318.9).

Dynamic Cone Penetration Tests (DCPT) were conducted from the base of Boreholes RRTC-01 and RRTC-03 to 14.9 m and 16.7 m depth (elevations 314.6 and 313.7).

The approximate borehole and DCPT locations are shown on the attached Borehole Locations and Soil Strata Drawing in Appendix D.

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

Drilling on the highway shoulder was carried out using a truck-mounted CME 75 drill rig and the borehole was advanced with hollow-stem augers. The drilling at the toe of the embankment was carried out using wash-boring methods with casing and tripod. Portable split spoon sampling equipment driven with a standard SPT hammer was used for penetration testing. In general, samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT) in the overburden soils.

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

Groundwater conditions in the open boreholes were observed throughout the drilling operations. Two standpipe piezometers consisting of 19 mm PVC pipe with slotted screen were installed in Boreholes RRTC-02 and RRTC-03, and enclosed in filter sand to permit longer term groundwater level monitoring. The location and completion details of the piezometers and boreholes are shown in Table 3.1.

Table 3.1 – Borehole Completion Details

Location	Borehole	Piezometer Tip Depth/ Elevation (m)	Completion Details
West end of the culvert	RRTC-01	None installed	Borehole backfilled with holeplug to surface.
Middle of the culvert	RRTC-02	18.3/319.5	Sand from 18.3 m to 16.2 m, holeplug from 16.2 m to 12.2 m, auger cuttings from 12.2 m to 3.0 m, holeplug from 3.0 m to 0.9 m, sand from 0.9 m to 0.15m, then asphalt to surface.
East end of the culvert	RRTC-03	11.3/319.1	Sand from 11.3 m to 9.3 m, then grout to surface.

4 LABORATORY TESTING

All recovered soil samples were subjected to Visual Identification (VI) and natural moisture content determination. Selected 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 summarized on the Record of Borehole sheets included in Appendix A and on the figures presented in Appendix B.

5 DESCRIPTION OF SUBSURFACE CONDITIONS

Reference is made to the Record of Borehole sheets included in Appendix A. Details of the encountered soil and rock stratigraphy are presented in these sheets and on the "Borehole Locations and Soil Strata" drawing included in Appendix D. An overall description of the stratigraphy is given in the following paragraphs. However, the factual data presented in the Record of Borehole sheets governs any interpretation of the site conditions.

In general, the soil stratigraphy encountered at this site at the toe of the highway embankment consists of native silty sand and silty clay overlying silt. At the highway embankment, asphalt pavement was contacted over sand fill and silty clay fill. Below the layers of fill, native silty clay was encountered. More detailed descriptions of the individual strata are presented below.

5.1 Pavement structure

Pavement structure was encountered in Borehole RRTC-02 drilled through the existing Highway 602 shoulder. The pavement structure consists of approximately 40 mm of asphalt overlying granular fill.

5.2 Sand Fill

Brown sand fill containing trace to some gravel was contacted below the asphalt in Borehole RRTC-02 drilled through the highway embankment and surficially in Borehole RRTC-01 drilled at the toe of the embankment. Layers of silty clay fill and gravelly sand fill were also encountered within the sand fill in Borehole RRTC-01. The thickness of the sand fill was 1.6 m and 1.8 m, in Boreholes RRTC-01 and RRTC-02, respectively.

The depth to the base of the sand fill was at 1.6 m and 1.9 m (elevations 327.9 and 335.9).

SPT N-values recorded in the sand fill ranged from 1 to 9 blows per 0.3 m of penetration, indicating a very loose to loose relative density.

The moisture content in this layer ranged from 3% to 30%.

5.3 Silty Clay Fill

Grey silty clay fill containing some sand to sandy and trace gravel was encountered below the sand fill at 1.9 m depth (elevation 335.9) in Borehole RRTC-02 drilled from the top of the embankment. Occasional sand pockets were encountered within the silty clay fill near elevation 333.2. The thickness of the silty clay fill was 6.4 m.

The depth to the base of the silty clay fill was 8.3 m (elevation 329.5).

SPT N-values recorded in the silty clay fill ranged from 2 to 10 blows for 0.3 m of penetration, indicating a soft to stiff consistency.

The moisture content of samples collected from the silty clay fill generally varies between 20% and 30%.

Grain size distribution curves for selected silty clay samples are presented in Appendix B, Figure B1. The results are also summarized on the Record of Borehole sheets included in Appendix A. Atterberg Limits test results are presented in Figure B 6 of Appendix B. The results of the laboratory tests are summarized as follows:

Soil Particles	Percentage (%)
Gravel	2 to 7
Sand	18 to 35
Silt	33 to 35
Clay	27 to 45

Index Property	Percentage (%)
Liquid Limit	28 to 57
Plastic Limit	14 to 20

The above results show that the silty clay fill is of medium to high plasticity with group symbols of CI and CH. One sample was low plastic with a group symbol of CL.

5.4 Silty Clay

Native grey silty clay containing trace sand to sandy and trace gravel was encountered below the fill at 8.3 m depth (elevation 329.5) in Borehole RRTC-02 and below the sand fill at 1.6 m depth (elevation 327.9). In Borehole RRTC-03, a 1.3-m thick layer of silty clay mixed with organics was contacted surficially. Silty clay was also encountered at 2.5 m depth (elevation 327.9) in Borehole RRTC-03. The thickness of the silty clay ranged from 7.7 m to 10.0 m

The depths to the base of the silty clay ranged from 9.3 m to 18.3 m (elevations 319.5 to 320.2).

SPT N-values recorded in the silty clay ranged from 5 to 16 blows for 0.3 m of penetration, indicating a firm to very stiff consistency. An SPT N-value of 3 blows per 0.3 m of penetration, indicating a soft consistency, was measured in Borehole RRTC-03 at 3.0 m depth (elevation 327.4).

The moisture content of samples collected from the silty clay layer generally varies between 21% and 44%. A silty clay sample obtained from Borehole RRTC-03 near elevation 320.4, revealed a moisture content of 59%.

Grain size distribution curves for selected silty clay samples are presented in Appendix B, Figures B2 and B3. The results are also summarized on the Record of Borehole sheets included in Appendix A. Atterberg Limits test results are presented in Figure B7 of Appendix B. The results of the laboratory tests are summarized as follows:

Soil Particles	Percentage (%)
Gravel	0 to 2
Sand	2 to 16
Silt	28 to 60
Clay	30 to 70

Index Property	Percentage (%)
Liquid Limit	43 to 67
Plastic Limit	15 to 23

The above results show that the silty clay is of medium to high plasticity with group symbols of CI and CH.

5.5 Silty Sand

A layer of silty sand containing some clay and trace gravel was contacted below the silty clay at 1.3 m depth (elevation 329.0) in Borehole RRTC-03, drilled at the toe of the embankment. Thickness of the silty sand layer was 1.2 m.

The depth to the base of the silty sand was 2.5 m (elevation 327.9).

SPT N-values recorded in the silty sand were 4 and 6 blows for 0.3 m of penetration, indicating a loose relative density.

The moisture content of samples collected from the silty sand layer generally varies between 22% and 26%.

Grain size distribution curve for a silty sand sample is presented in Appendix B, Figure 4. The results are also summarized on the Record of Borehole sheets included in Appendix A. The results of the laboratory tests are summarized as follows:

Soil Particles	Percentage (%)
Gravel	8
Sand	53
Silt	24
Clay	15

5.6 Silt

Grey silt containing trace to some sand and trace clay was contacted below the silty clay at depths ranging from 9.3 m to 18.3 m (elevations 319.5 to 320.2) in the three boreholes.

Boreholes were terminated within the silt layer at depths ranging from 12.2 m to 18.9 m (elevations 317.0 to 318.9).

DCPTs were conducted in Boreholes RRTC-01 and RRTC-03 below borehole termination depths, extending to 14.9 m and 16.7 m depth (elevations 314.6 and 313.7), respectively.

SPT N-values recorded in the silt ranged between 10 and 34 blows for 0.3 m of penetration, indicating a compact to dense relative density. A SPT N-value of 4 blows per 0.3 m of penetration, indicating loose relative density, was measured near elevation 319.5 in Borehole RRTC-01.

The moisture content of samples collected from the silt layer generally varies between 19% and 46%.

Grain size distribution curves for silt samples are presented in Appendix B, Figure 3. The results are also summarized on the Record of Borehole sheets included in Appendix A. The results of the laboratory tests are summarized as follows:

Soil Particles	Percentage (%)
Gravel	0
Sand	2 to 13
Silt	83 to 90
Clay	4 to 8

5.7 Water Levels

Water levels were observed in the boreholes during and upon completion of drilling. Standpipe piezometers were installed in Boreholes RRTC-02 and RRTC-03 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 boreholes upon completion of drilling.

Table 5.1 – Water Level Measurements

Borehole	Date	Water Level		Comment
		Depth (m)	Elev. (m)	
RRTC-02	July 17, 2011 August 27, 2011	17.9 9.4	319.9 328.4	Open borehole Piezometer
RRTC-03	August 26, 2011	4.0	326.4	Piezometer

The piezometric readings indicate that the groundwater level ranges from elevations 326.4 to 328.4.

GA indicates that water level in the Rainy River Tributary was at elevation 328.8 in July 2009.

The above values are short-term readings and seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at a higher elevation after the spring snowmelt or after periods of heavy rainfall.

6 MISCELLANEOUS

Borehole locations were selected and established in the field by Thurber Engineering Ltd. Surveyors retained by Hatch Mott MacDonald provided data and drawings to obtain the co-ordinates and the ground surface elevations for the boreholes.

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

Eastern Ontario Diamond Drilling Ltd. from Hawkesbury, Ontario supplied a truck mounted CME 75 drill rig and conducted the drilling, sampling and in-situ testing operations.

OGS Drilling Inc. of Almonte, Ontario supplied the portable drilling/coring equipment to drill and core boreholes that were not accessible using a truck mounted rig.

The field program was supervised by Ms. Eckie Siu of Thurber.

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

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

Thurber Engineering Ltd

Rocío Palomeque Reyna, P.Eng.
Geotechnical Engineer

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

Appendix A

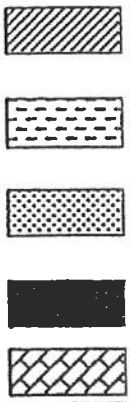
Record of Borehole Sheets

EXPLANATION OF ROCK LOGGING TERMS

ROCK WEATHERING CLASSIFICATION

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

SYMBOLS



DISCONTINUITY SPACING

Bedding	Bedding Plane Spacing
Very thickly bedded	Greater than 2m
Thickly bedded	0.6 to 2m
Medium bedded	0.2 to 0.6m
Thinly bedded	60mm to 0.2m
Very thinly bedded	20 to 60mm
Laminated	6 to 20mm
Thinly Laminated	Less than 6mm

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.

STRENGTH CLASSIFICATION

Rock Strength	Approximate Uniaxial Compressive Strength (MPa)	(psi)	Field Estimation of Hardness*
Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
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

THURBER

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

C_{pen} Shear Strength Determination by Pocket Penetrometer

(1) SPT 'N' Value Standard Penetration Test 'N' Value – refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.

(2) DCPT Dynamic Cone Penetration Test – Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone penetration is the number of hammer blows required for each 0.3 m advance of the conical point into undisturbed ground.

UNIFIED SOILS CLASSIFICATION

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

Ministry of Transportation
Ontario

RECORD OF BOREHOLE No RRTC-01 1 OF 2 METRIC

W.P. 6938-10-00 LOCATION N 5 383 973.2 E 270 126.3 Rainy River Tributary Culvert ORIGINATED BY ES
HWY 602 BOREHOLE TYPE Rotary Mud and Tripod COMPILED BY AN
DATUM Geodetic DATE 2011.07.21 - 2011.07.22 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (O UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
329.5											
0.0	**SAND**, trace to some gravel, occasional wood fibres Very Loose to Loose Dark brown Wet (FILL)		1	SS	1		329				
			2	SS	7						
	Layer of silty clay at 1.0m (150mm)										
327.9	Layer of grey gravelly sand at 1.2m (400mm)		3	SS	9		328				
1.6	Silty **CLAY**, trace to some sand, trace gravel Stiff Grey		4	SS	11						2 16 42 40
			5	SS	12		327				
			6	SS	13						
			7	SS	14		326				
			8	SS	11						0 8 40 52
			9	SS	15		325				
			10	SS	12						
			11	SS	14		324				
			12	SS	14						
			13	SS	16		323				
	Sand pockets Very Stiff		14	SS	16		322				
320.2							321				0 2 28 70
9.3	**SILT**, trace to some sand, trace clay Compact Grey Moist		15	SS	30		320				

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+³, ×³: Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

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Ministry of Transportation
Ontario

RECORD OF BOREHOLE No RRTC-01 2 OF 2 METRIC

W.P. 6938-10-00 LOCATION N 5 383 973.2 E 270 126.3 Rainy River Tributary Culvert ORIGINATED BY ES

HWY 602 BOREHOLE TYPE Rotary Mud and Tripod COMPILED BY AN

DATUM Geodetic DATE 2011.07.21 - 2011.07.22 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	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 20 40 60 80 100	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
	Continued From Previous Page											
	SILT, trace to some sand, trace clay Loose to Dense Grey Moist		16	SS	4							
			17	SS	17		319					
			18	SS	19							
317.3			19	SS	33		318					0 13 83 4
12.2	End of sampling at 12.2m and start DCPT						317					
							316					
314.6							315		122 129 135			
14.9	END OF BOREHOLE AND DCPT AT 14.9m UPON REFUSAL. BOREHOLE BACKFILLED WITH HOLEPLUG TO SURFACE.											

+^{3}, ×^{3}: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

ONTMT4S 5121.GPJ 9/19/11

Ministry of Transportation
Ontario

RECORD OF BOREHOLE No RRTC-02 1 OF 3 METRIC

W.P. 6938-10-00 LOCATION N 5 383 976.0 E 270 151.2 Rainy River Tributary Culvert ORIGINATED BY ES
HWY 602 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.06.17 - 2011.06.17 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (O UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) / WATER CONTENT (%) (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
337.8								20 40 60 80 100		
0.0	**ASPHALT: (40mm)**									
	SAND, some gravel Brown Damp (FILL)		1	GS						
	Loose		1	SS	5		337			
335.9			2	SS	6		336			
1.9	Silty **CLAY**, some sand to sandy, trace gravel Firm to Stiff Grey (FILL)		3	SS	10		335			7 30 33 30
			4	SS	6		334			
	Occasional sand pockets		5	SS	8		333			2 18 35 45
			6	SS	2		332			
	Soft						331			
	Firm		7	SS	7		330			4 35 34 27
329.5										
8.3	Silty **CLAY**, some sand, trace gravel Stiff Grey		8	SS	13	▼	329			
							328			

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+^{3}, ×^{3}: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

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Ministry of Transportation
Ontario

RECORD OF BOREHOLE No RRTC-02 2 OF 3 METRIC

W.P. 6936-10-00 LOCATION N 5 383 976.0 E 270 151.2 Rainy River Tributary Culvert ORIGINATED BY ES
HWY 602 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.06.17 - 2011.06.17 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	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 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, some sand, trace gravel Firm to Stiff Grey										
			9	SS	7		327		○		
							326				
			10	SS	13				⊢○⊣		0 13 36 51
							325				
			11	SS	12		324		○		
							323				
			12	SS	11				○		
							322				
			13	SS	10		321		○		
319.5							320				
18.3	**SILT**, trace clay, trace sand Compact Grey		14	SS	11				○		0 2 90 8
318.9	Moist						319		○		
18.9	END OF BOREHOLE AT 18.9m. WATER LEVEL AT 17.9m UPON COMPLETION. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.										

Continued Next Page

+³, ×³: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 5121.GPJ 9/19/11

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No RRTC-02 3 OF 3 METRIC

W.P. 6936-10-00 LOCATION N 5 383 976.0 E 270 151.2 Rainy River Tributary Culvert ORIGINATED BY ES

HWY 602 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2011.06.17 - 2011.06.17 CHECKED BY RPR

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 20 40 60 80 100	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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Aug.27/11 9.4 328.4										

ONTMT4S 5121.GPJ 9/19/11

$+^3, \times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE
10

Ministry of Transportation
Ontario

RECORD OF BOREHOLE No RRTC-03 1 OF 2 METRIC

W.P. 6938-10-00 LOCATION N 5 383 972.7 E 270 179.8 Rainy River Tributary Culvert ORIGINATED BY ES
HWY 602 BOREHOLE TYPE Portable Tripod COMPILED BY AN
DATUM Geodetic DATE 2011.07.23 - 2011.07.24 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
330.4							
0.0	Silty CLAY, trace sand, mixed with organics Very Soft Dark Brown	1	SS	2	330		
		2	SS	2			
329.0							
1.3	Silty SAND, some clay, trace gravel Loose Brown Wet	3	SS	4	329		
		4	SS	6			8 53 24 15
327.9							
2.5	Silty CLAY, trace to some sand, trace gravel Soft to Firm Grey	5	SS	6	328		
		6	SS	3	327		1 9 60 30
		7	SS	5			
		8	SS	5	326		
		9	SS	6			
		10	SS	5	325		1 10 37 52
		11	SS	8			
		12	SS	7	324		
		13	SS	10	323		
		14	SS	10			
					322		
		15	SS	6	321		0 16 37 47

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100
SHEAR STRENGTH kPa 20 40 60 80 100
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE
PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L
WATER CONTENT (%) 20 40 60

Continued Next Page

+³, ×³: Numbers refer to Sensitivity

20
15 ⊕ 5
10
(%) STRAIN AT FAILURE

ONTMT4S 5121.GPJ 9/19/11

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No RRTC-03 2 OF 2 METRIC

W.P. 6938-10-00 LOCATION N 5 383 972.7 E 270 179.8 Rainy River Tributary Culvert ORIGINATED BY ES

HWY 602 BOREHOLE TYPE Portable Tripod COMPILED BY AN

DATUM Geodetic DATE 2011.07.23 - 2011.07.24 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × 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
	Continued From Previous Page							20 40 60 80 100	20 40 60		
320.0	Silty CLAY, trace sand Firm Grey		16	SS	7						
10.4	Moist SILT, trace sand, trace clay Compact to Dense Grey Wet		17	SS	10		320				
			18	SS	34		319				0 7 87 6
			19	SS	33						
			20	SS	24		318				
317.0			22	SS	18						
13.4	End of sampling at 13.4m and DCPT						317				
							316				
							315				
313.7							314				
16.7	END OF BOREHOLE AND DCPT AT 16.7m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Aug.26/11 4.0 326.4										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$15 \oplus \frac{20}{10} 5$ (%) STRAIN AT FAILURE

ONTMT4S 5121.GPJ 9/19/11

Appendix B

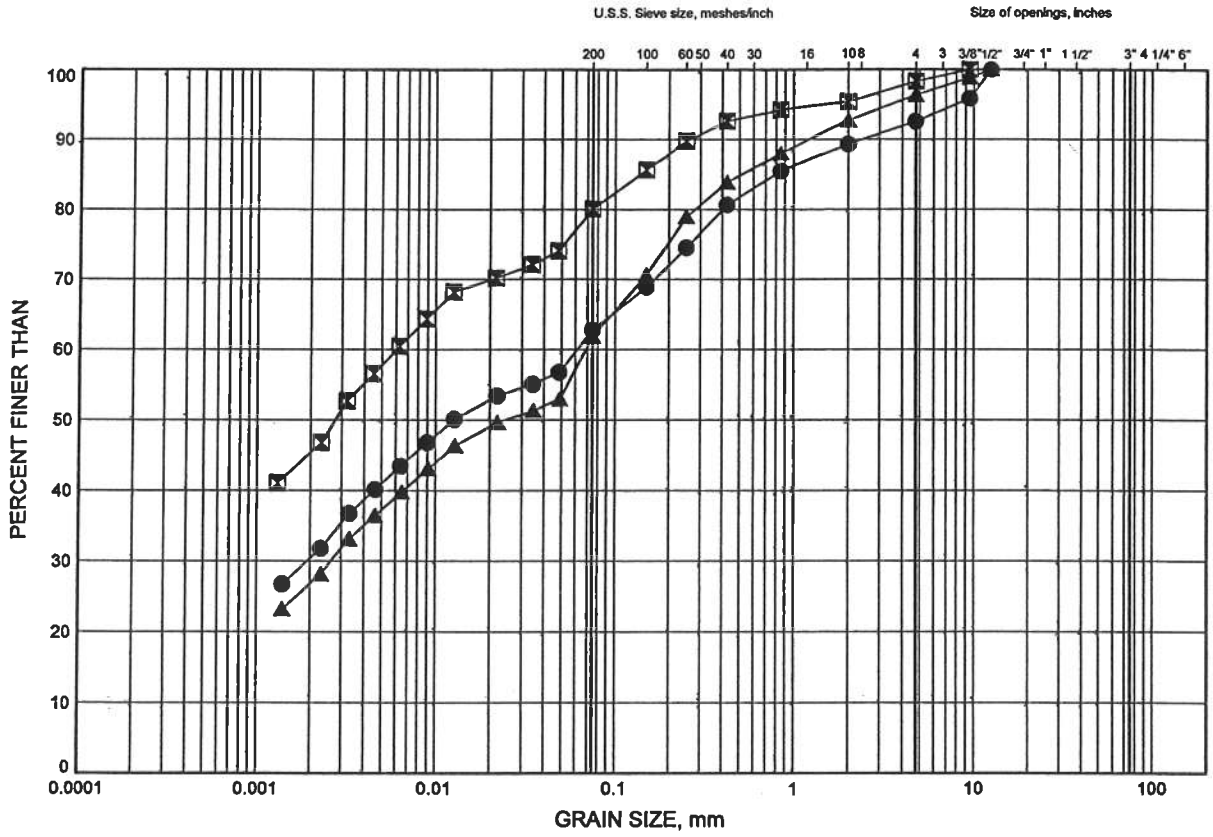
Laboratory Test Results

6010-E-0010 Bridge and Culvert Rehabs NWR

GRAIN SIZE DISTRIBUTION

FIGURE B1

SILTY CLAY FILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	RRTC-02	2.59	335.21
⊠	RRTC-02	4.88	332.92
▲	RRTC-02	7.92	329.87

W.P.# 6938-10-00
Prepared By AN
Checked By RPR

THURBER

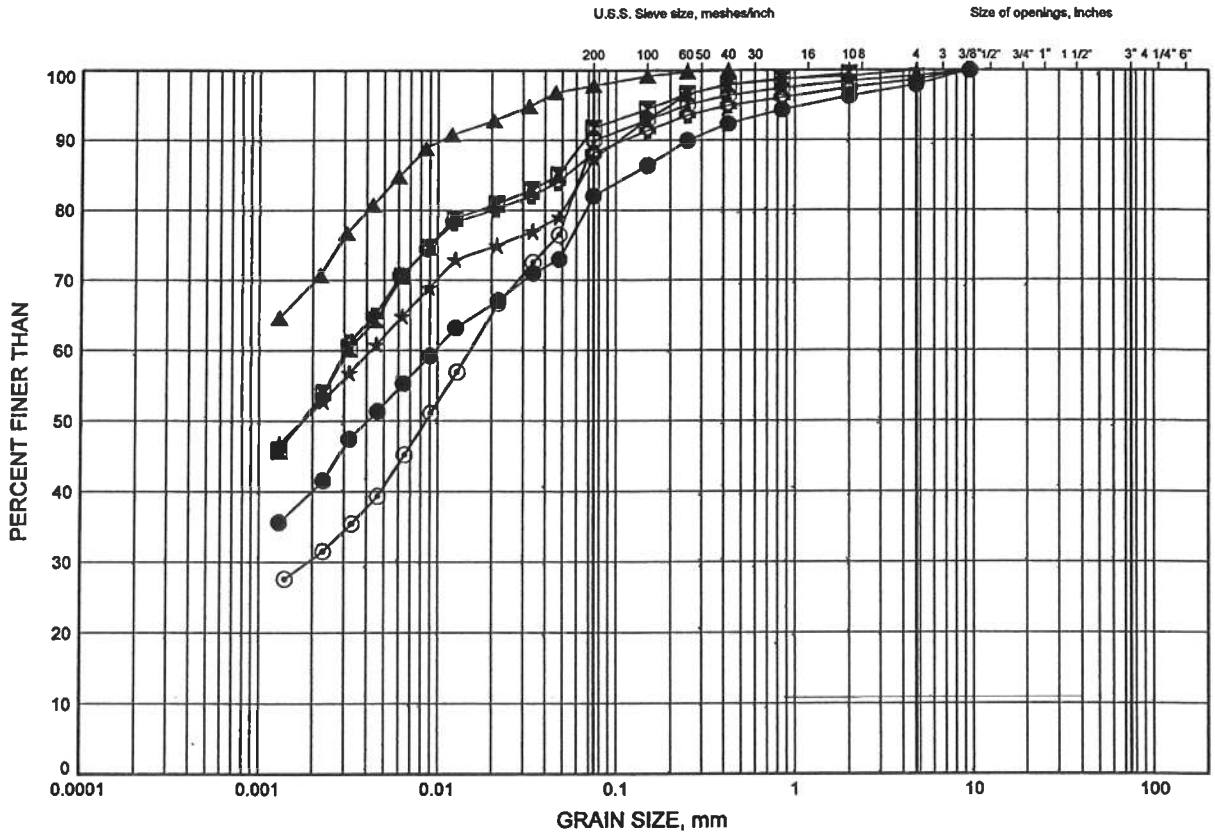
GRAIN SIZE DISTRIBUTION - THURBER 5121.GPJ 9/19/11

6010-E-0010 Bridge and Culvert Rehabs NWR

GRAIN SIZE DISTRIBUTION

FIGURE B2

SILTY CLAY



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	RRTC-01	2.13	327.40
⊠	RRTC-01	4.57	324.96
▲	RRTC-01	8.84	320.69
★	RRTC-02	12.50	325.30
⊙	RRTC-03	3.35	327.03
✿	RRTC-03	5.79	324.59

W.P.# 6938-10-00
Prepared By AN
Checked By RPR

THURBER

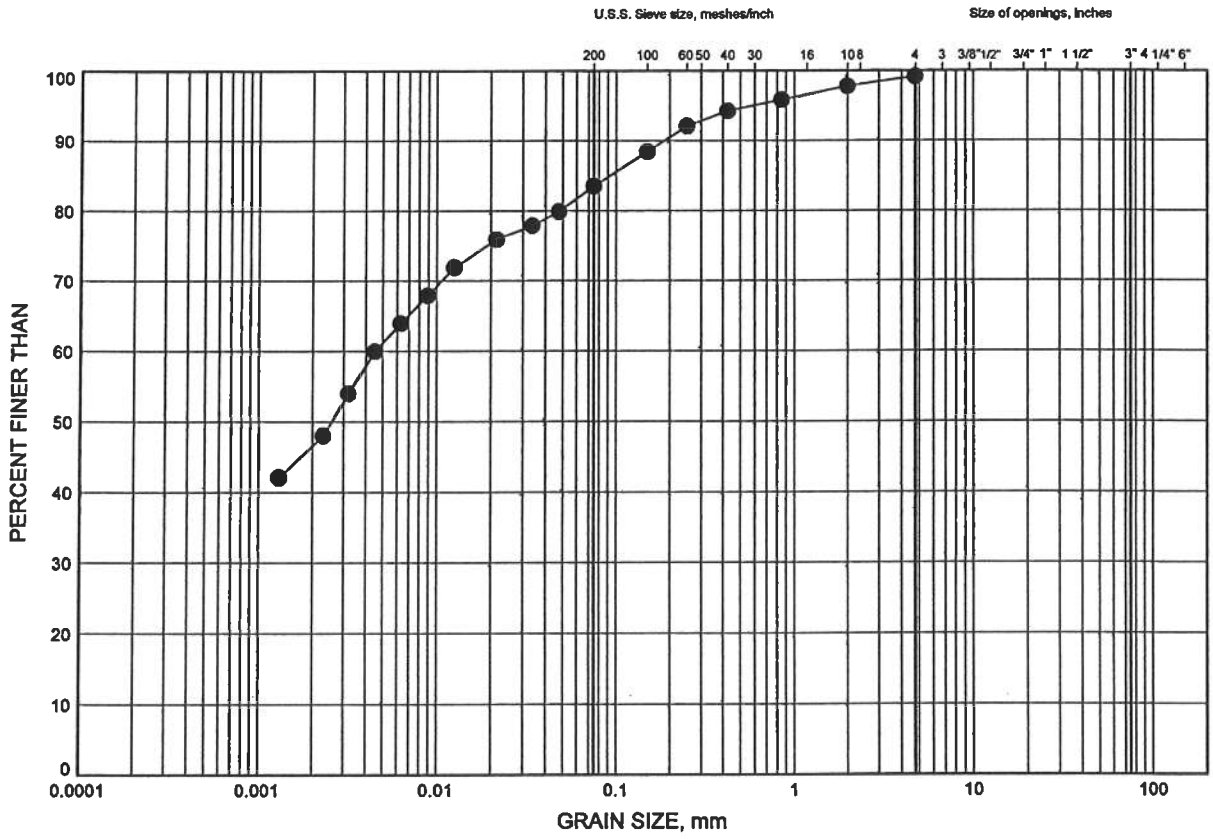
GRAIN SIZE DISTRIBUTION - THURBER 5121.GPJ 9/19/11

6010-E-0010 Bridge and Culvert Rehabs NWR

GRAIN SIZE DISTRIBUTION

FIGURE B3

SILTY CLAY



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	RRTC-03	9.45	320.93

W.P.# 6938-10-00
Prepared By AN
Checked By RPR

THURBER

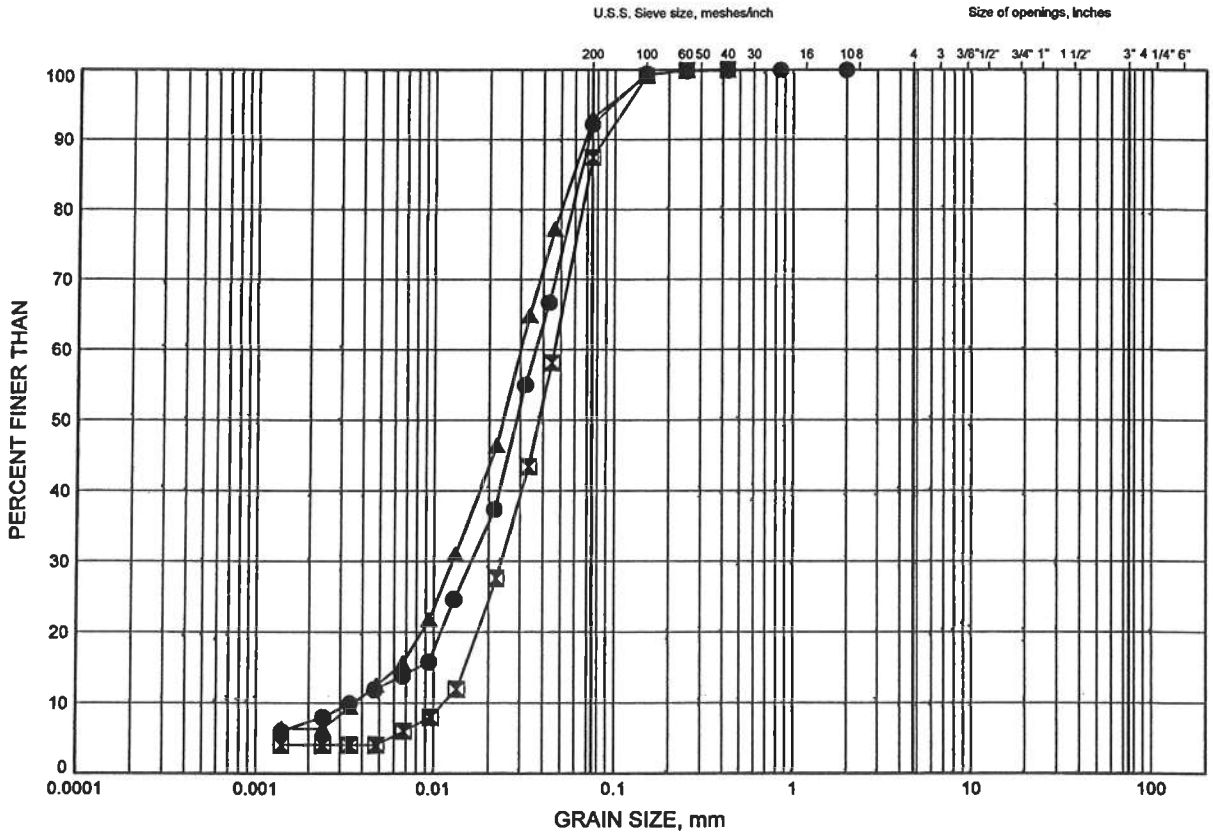
GRAIN SIZE DISTRIBUTION - THURBER 5121.GPJ 9/19/11

6010-E-0010 Bridge and Culvert Rehabs NWR

GRAIN SIZE DISTRIBUTION

FIGURE B4

SILT



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	RRTC-01	10.06	319.47
⊠	RRTC-01	11.89	317.64
▲	RRTC-03	11.28	319.10

W.P.# 6938-10-00
Prepared By AN
Checked By RPR

THURBER

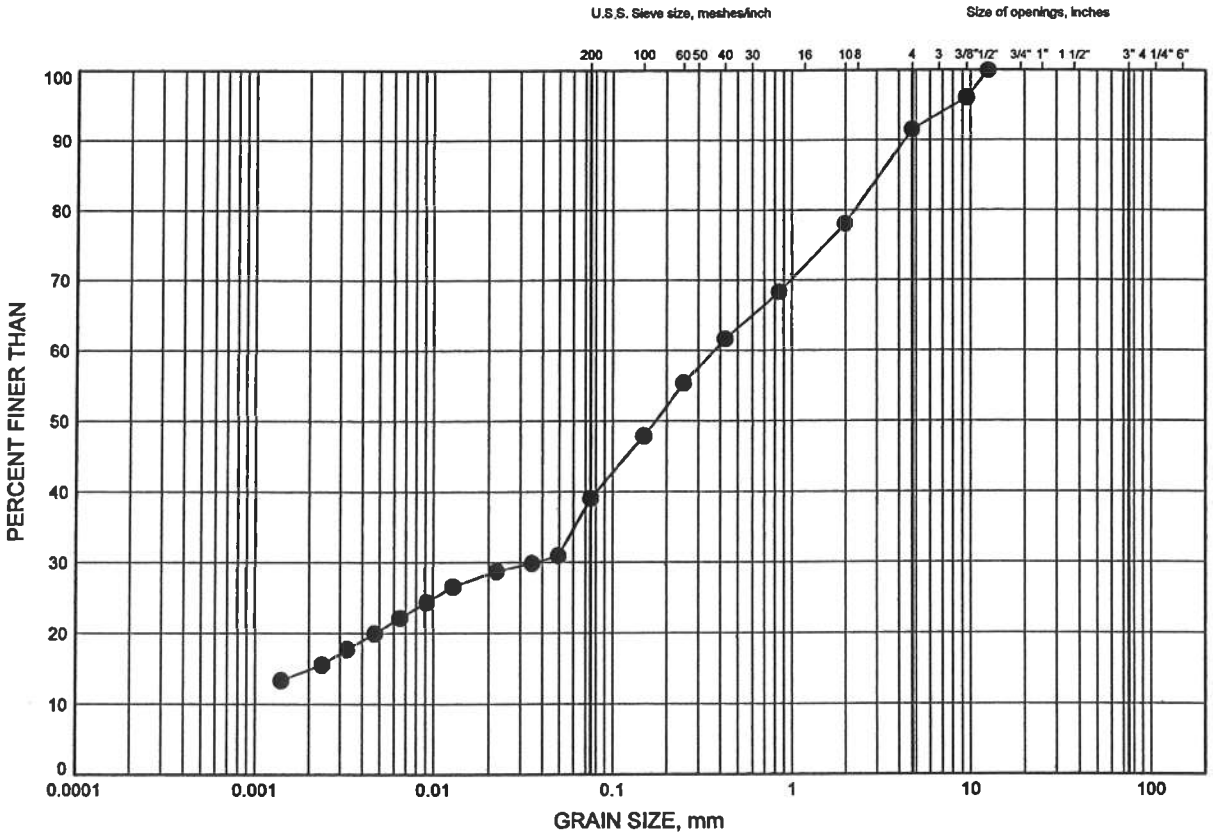
GRAIN SIZE DISTRIBUTION - THURBER 5121.GPJ 9/19/11

6010-E-0010 Bridge and Culvert Rehabs NWR

GRAIN SIZE DISTRIBUTION

FIGURE B5

SILTY SAND



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	RRTC-03	2.13	328.25

W.P.# 6938-10-00
Prepared By AN
Checked By RPR

THURBER

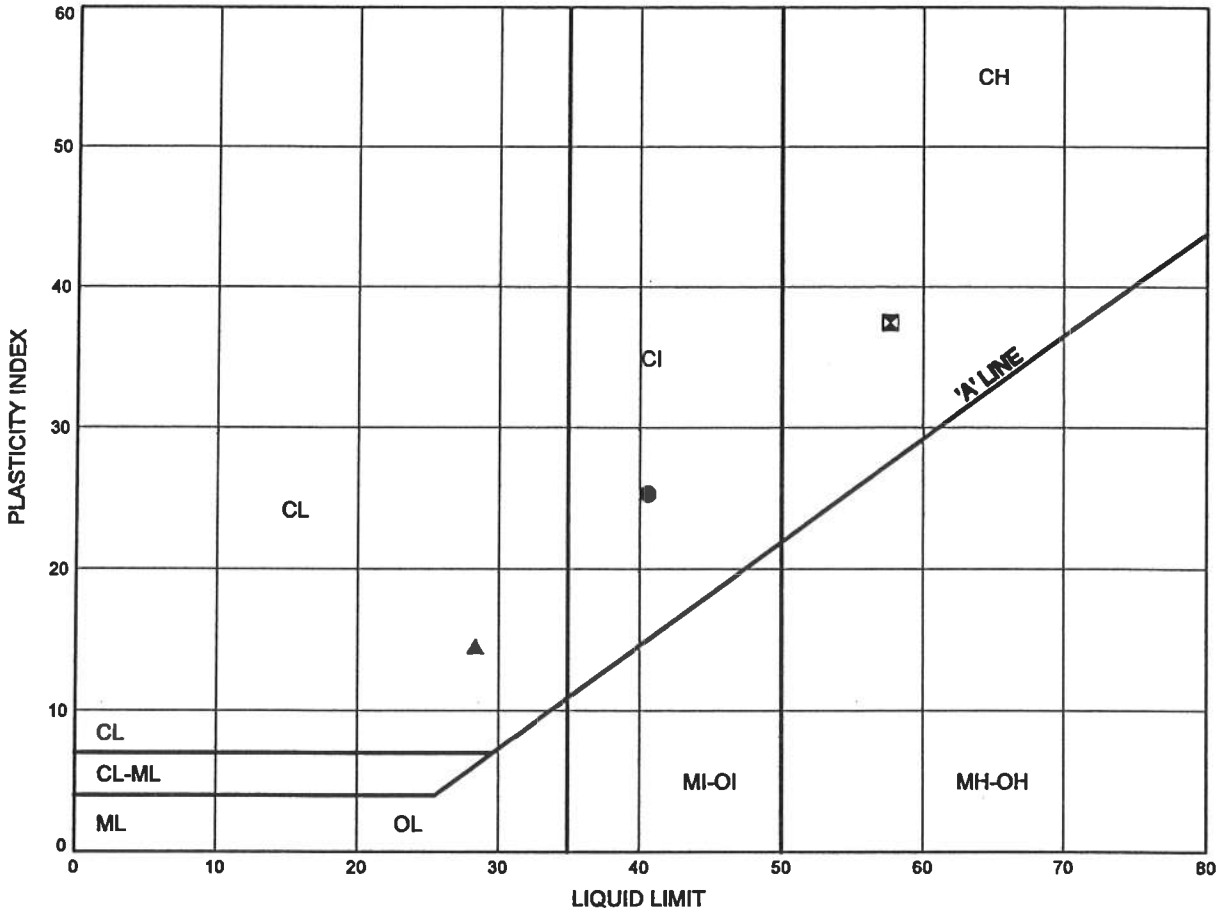
GRAIN SIZE DISTRIBUTION - THURBER 5121.GPJ 9/19/11

6010-E-0010 Bridge and Culvert Rehabs NWR

ATTERBERG LIMITS TEST RESULTS

FIGURE B6

SILTY CLAY FILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	RRTC-02	2.59	335.21
⊠	RRTC-02	4.88	332.92
▲	RRTC-02	7.92	329.87

Date September 2011

Project 6938-10-00

THURBER

Prep'd AN

Chkd. RPR

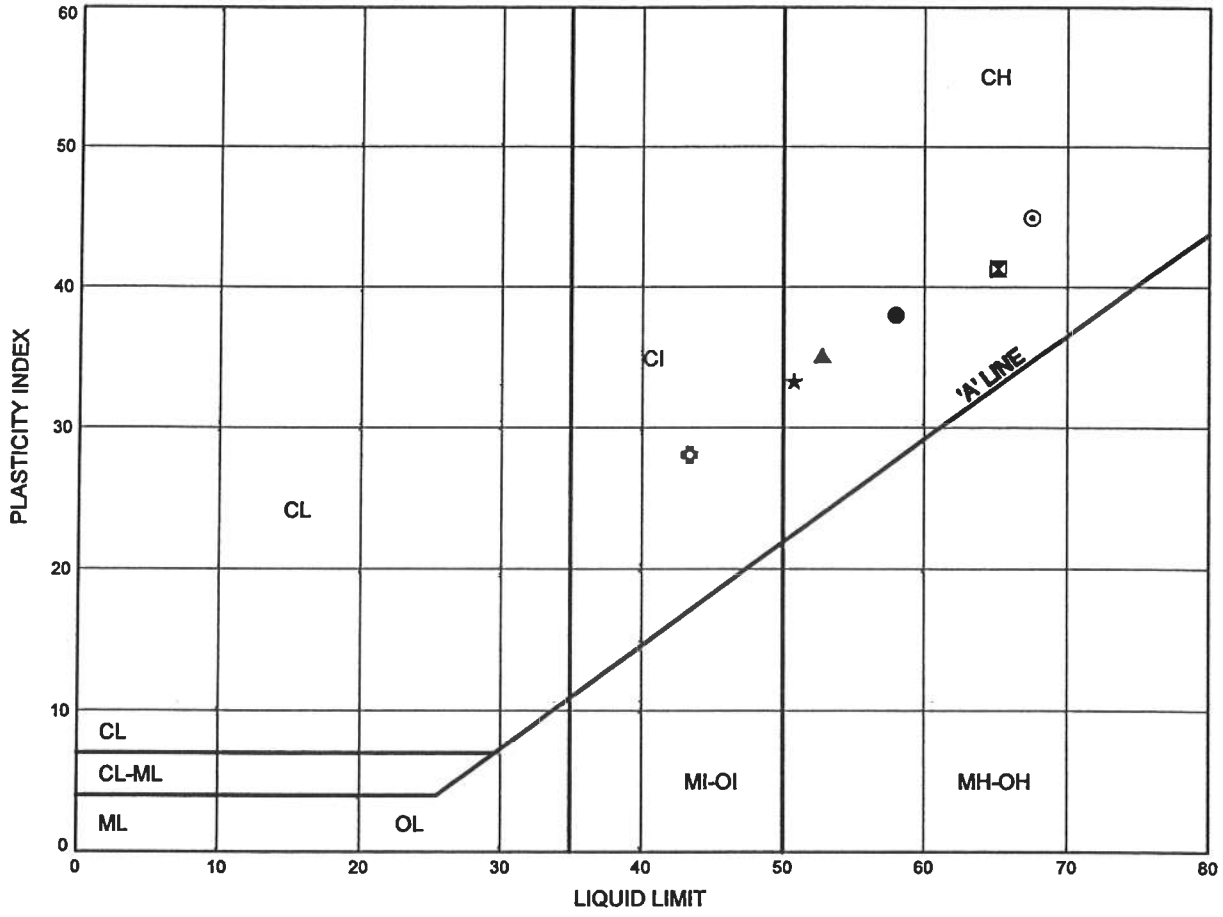
THURBALT 5121.GPJ 9/19/11

6010-E-0010 Bridge and Culvert Rehabs NWR

ATTERBERG LIMITS TEST RESULTS

FIGURE B7

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	RRTC-01	2.13	327.40
⊠	RRTC-01	4.57	324.96
▲	RRTC-02	12.50	325.30
★	RRTC-03	3.35	327.03
⊙	RRTC-03	5.79	324.59
✿	RRTC-03	9.45	320.93

Date September 2011

Project 6938-10-00

THURBER

Prep'd AN

Chkd. RPR

THURBALT 5121.GPJ 9/19/11

Appendix C

Site Photographs

Photographs 1 and 2– Highway 602 and Rainy River Tributary Culvert crossing

Photographs 3and 4 – East side of Highway 602 and Rainy River Tributary Culvert crossing

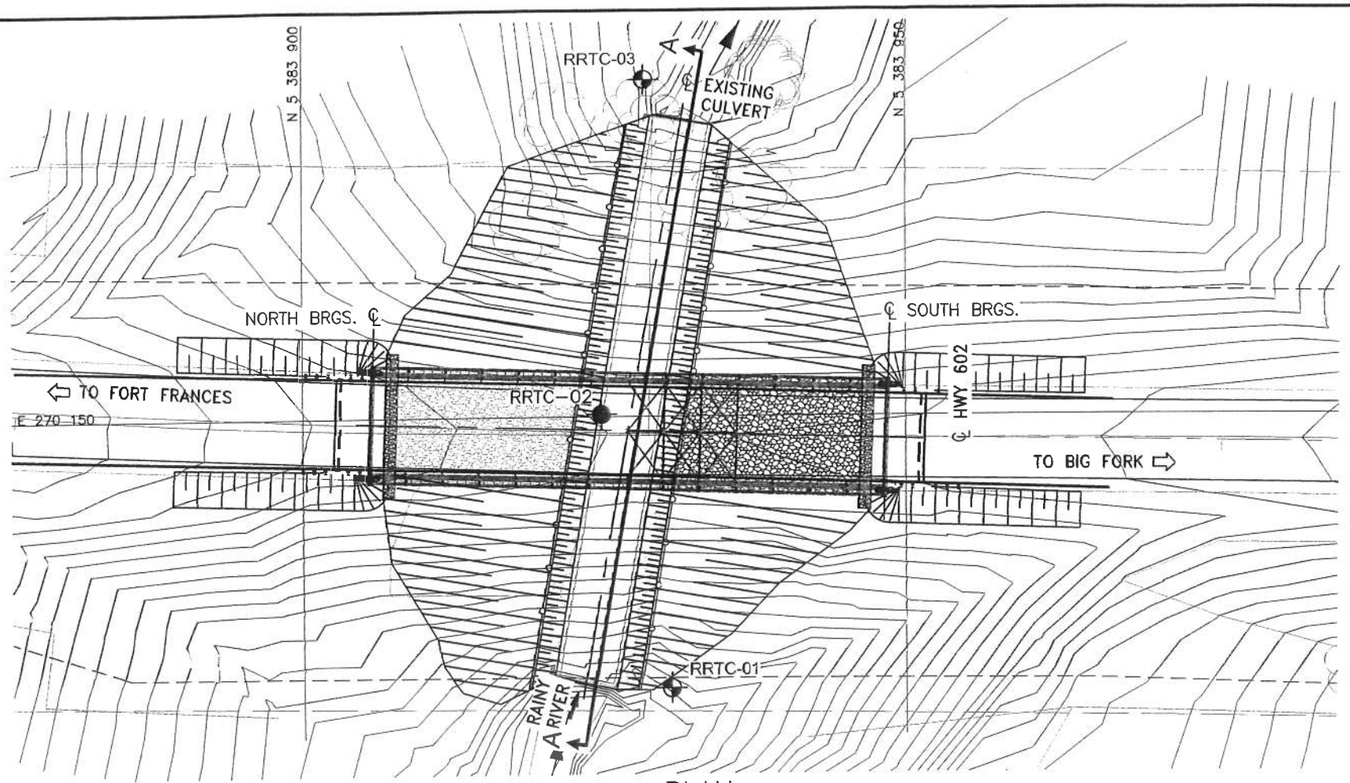
Photographs 5 and 6 – West side of Highway 602 and Rainy River Tributary Culvert crossing

Photographs 7and 8 – East end (outlet) of existing concrete culvert at Highway 602 and Rainy River Tributary crossing

Photograph 9 – West end (inlet) of existing concrete culvert at Highway 602 and Rainy River Tributary crossing

Appendix D

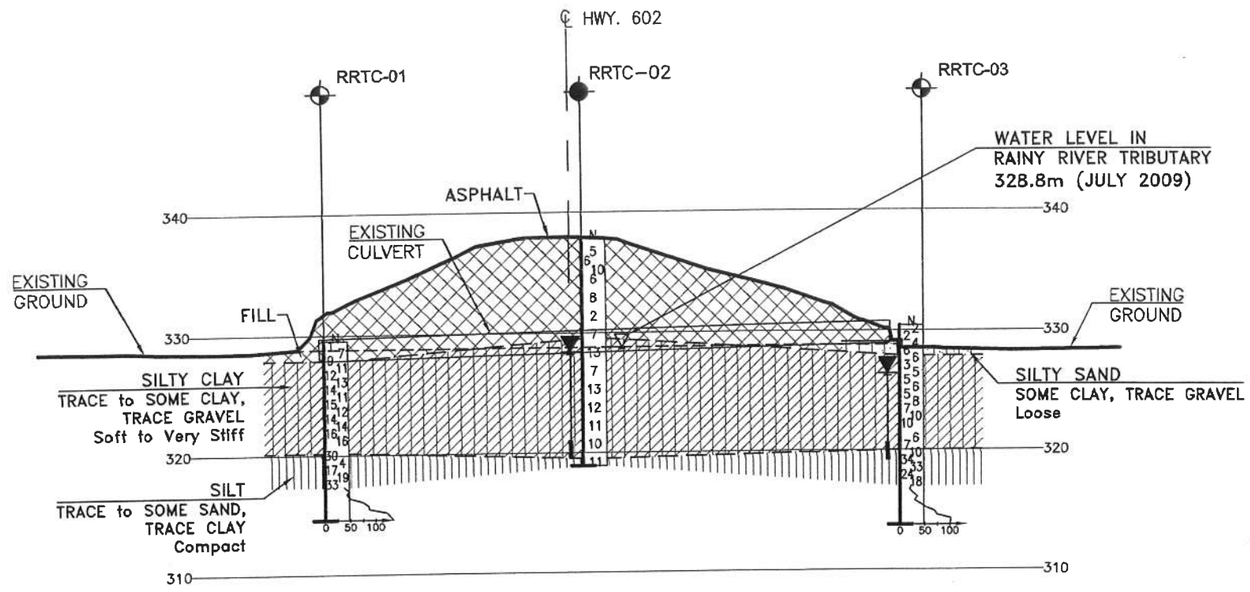
Borehole Locations and Soil Strata Drawings



PLAN

10 0 10 20m

SCALE 1:500



SECTION ALONG A–A

10 0 10 20m

SCALE 1:500

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

LICENSED PROFESSIONAL ENGINEER
P. K. CHAITERJI
Feb 15/12
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
R. Palomeque Reyna
100083209
Feb/15/2012
PROVINCE OF ONTARIO

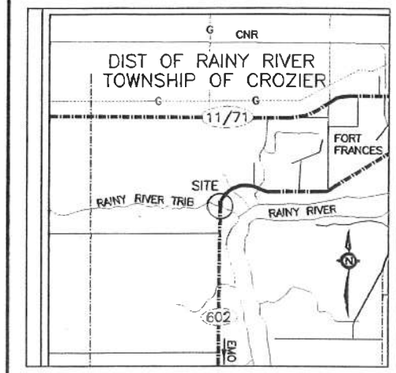
CONT No
WP No 6938-10-00

SHEET

HIGHWAY 602
BRIDGE & CULVERT REHABS
RAINY RIVER BRIDGE
BOREHOLE LOCATIONS AND SOIL STRATA

Hatch Mott MacDonald

THURBER ENGINEERING LTD.



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
RRTC-01	329.5	5 383 973.2	270 126.3
RRTC-02	337.8	5 383 976.0	270 151.2
RRTC-03	330.4	5 383 972.7	270 179.8

-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. 52C-25

REVISIONS		
DATE	BY	DESCRIPTION

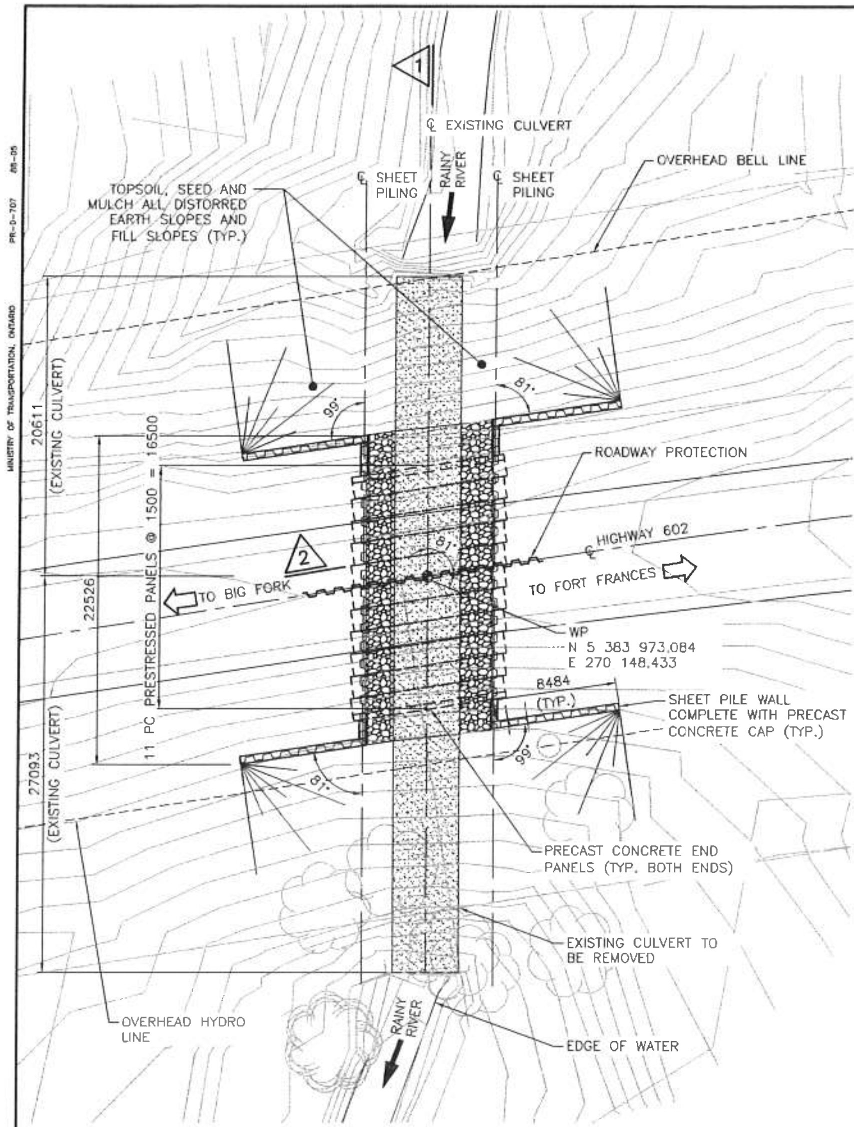
DESIGN	RPR	CHK RPR	CODE	LOAD	DATE FEB. 2012
DRAWN	AN	CHK	SITE	STRUCT	DWG 1

FILENAME: H:\Drafting\19\1603\121\Ied5121-RainyRiverBridge(REVISE).dwg
PLOTDATE: 2/23/2012 9:22 AM

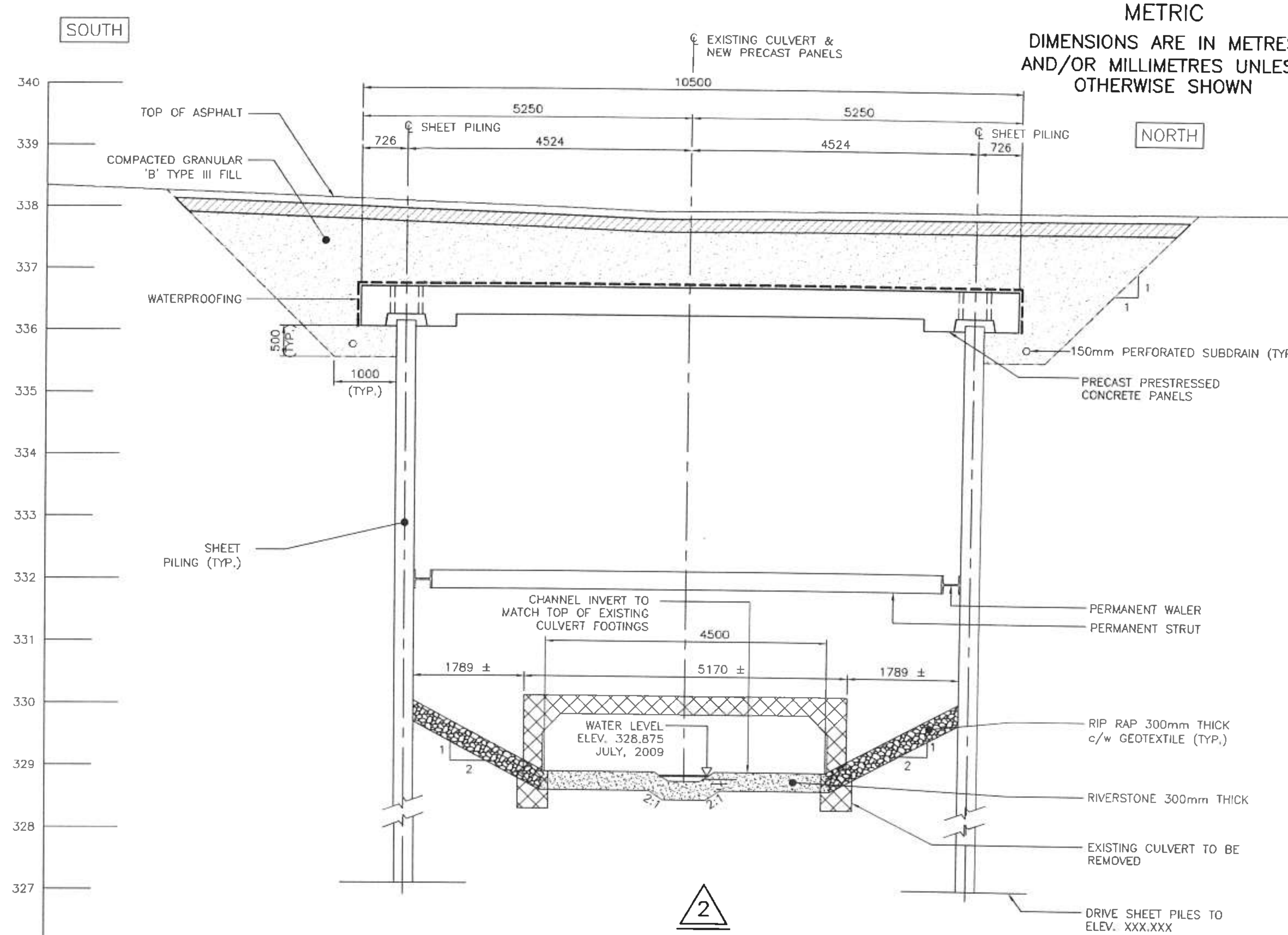
Appendix E

General Arrangement Drawings (GA Drawings)

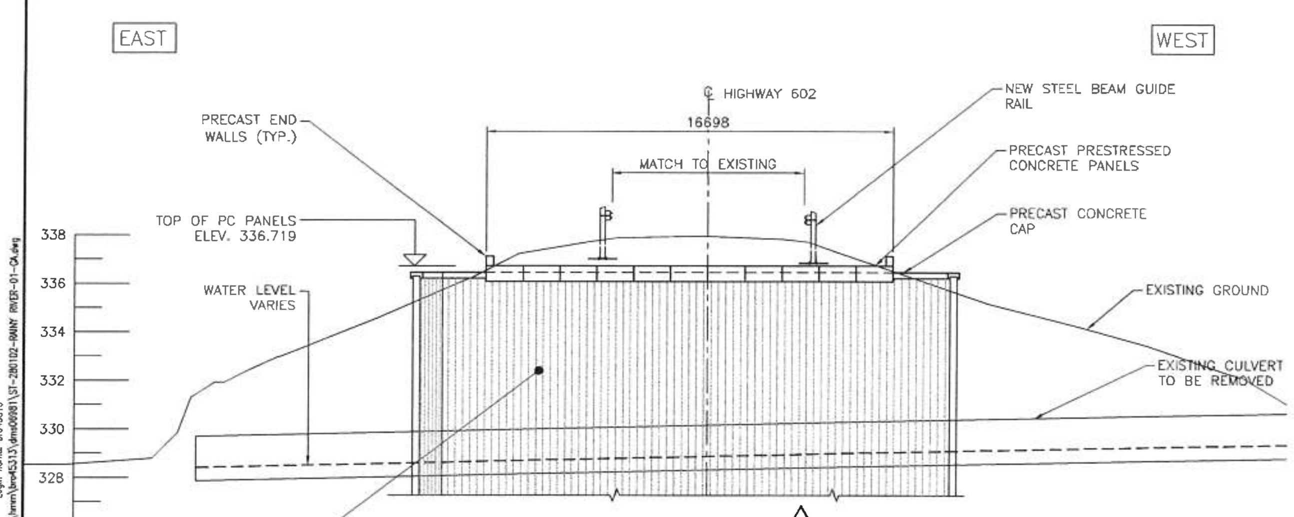
METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN



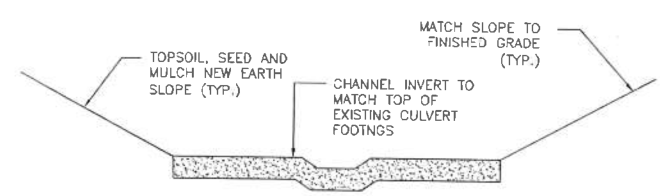
PLAN
1 : 250



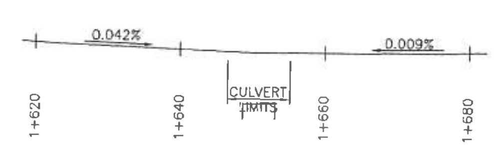
2
NEW CULVERT
1 : 50



1
NEW CULVERT
1 : 150



CHANNEL BEYOND LIMITS OF CULVERT STRUCTURE
1 : 50



HIGHWAY 602 ROAD PROFILE
1 : 500

NOTES

CLASS OF CONCRETE

PRECAST CONCRETE 60MPa

CLEAR COVER TO REINFORCEMENT

PRECAST CONCRETE .... 55mm±5
IF NOT SHOWN OTHERWISE

REINFORCING STEEL

1. REINFORCING STEEL SHALL BE GRADE 400W.
2. UNLESS SHOWN OTHERWISE, LAP LENGTHS NOT INDICATED ON THE CONTRACT DRAWINGS SHALL BE CLASS 'B'.

FRP

1. GFRP REINFORCING BARS SHALL CONSIST OF CONTINUOUS GLASS FIBRE EMBEDDED IN A THERMOSETTING RESIN.
2. GFRP BARS SHALL HAVE THE FOLLOWING MINIMUM STRENGTH (f_{fu}) AND TENSILE MODULUS OF ELASTICITY (E_f).

	f_{fu}	E_f
10mm	765	45.4
16mm	683	48.2

THE MANUFACTURER SHALL PROVIDE CERTIFIED TEST REPORTS FOR EACH BAR SIZE TO VERIFY STRENGTHS.

3. UNLESS SHOWN OTHERWISE, LAP LENGTHS FOR GFRP BARS ON THE CONTRACT DRAWINGS SHALL AS PER CAN/CSA – S6– 06 OR MANUFACTURERS RECOMMENDATIONS.
4. BAR HOOKS, WHERE REQUIRED, SHALL BE MINIMUM LENGTH AND STIRRUPS SHALL HAVE MINIMUM HOOKS AS PER MANUFACTURER'S RECOMMENDATION UNLESS INDICATED OTHERWISE.

CONSTRUCTION NOTES

1. THE CONSTRUCTION SHALL BE COMPLETED IN STAGES AS SHOWN.
2. ROADWAY PROTECTION SHALL BE PERFORMANCE LEVEL 2.
3. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING STABILITY OF EXISTING STRUCTURE THROUGHOUT CONSTRUCTION.
4. SHEET PILING INDICATED ON THE CONTRACT IS REQUIRED AS PART OF THE PERMANENT STRUCTURE. IT IS NOT INTENDED TO REPRESENT A COMPLETE SHORING SYSTEM.
5. THE CONTRACTOR IS ADVISED NOT TO RELY ON THE WATER LEVEL SHOWN ON DRAWINGS. THE WATER LEVEL IS SUBJECT TO VARIATIONS.
6. ACCESS TO THE WORK AREA IS LIMITED TO THE EXISTING ROADBED AREA BEHIND THE TEMPORARY CONCRETE BARRIERS. THE CONTRACTOR IS NOT PERMITTED TO WIDEN THE ROADWAY FOR CONSTRUCTION EQUIPMENT.

LIST OF DRAWINGS

1. GENERAL ARRANGEMENT
2. STRUCTURE REMOVALS
3. SHEET PILING LAYOUT AND DETAILS
4. PRESTRESSED CONCRETE PANELS – TYPE P1 AND LAYOUT
5. PRESTRESSED CONCRETE PANELS – TYPE P0 AND LAYOUT
6. PRECAST CONCRETE END WALLS

PRELIMINARY
NOT FOR CONSTRUCTION

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

CONT	No.XXXX–XXXX
WP	No.6938–10–00

RAINY RIVER TRIBUTARY CULVERT STRUCTURAL REPLACEMENT
GENERAL ARRANGEMENT

SHEET 9

Ontario
Ministry of Transportation
Northwestern Region
Structural Section

Hatch Mott MacDonald

REVISIONS DATE	REV.	DESCRIPTION			
DESIGN CP	CHK PM	CODE CAN/CSA S6–06	LOAD CL–625–ONT	DATE JUNE 2011	
DRAWN BB	CHK BR	SITE 45–145/C		DWG 1	

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

CONT	No.XXXX–XXXX
WP	No.6938–10–00

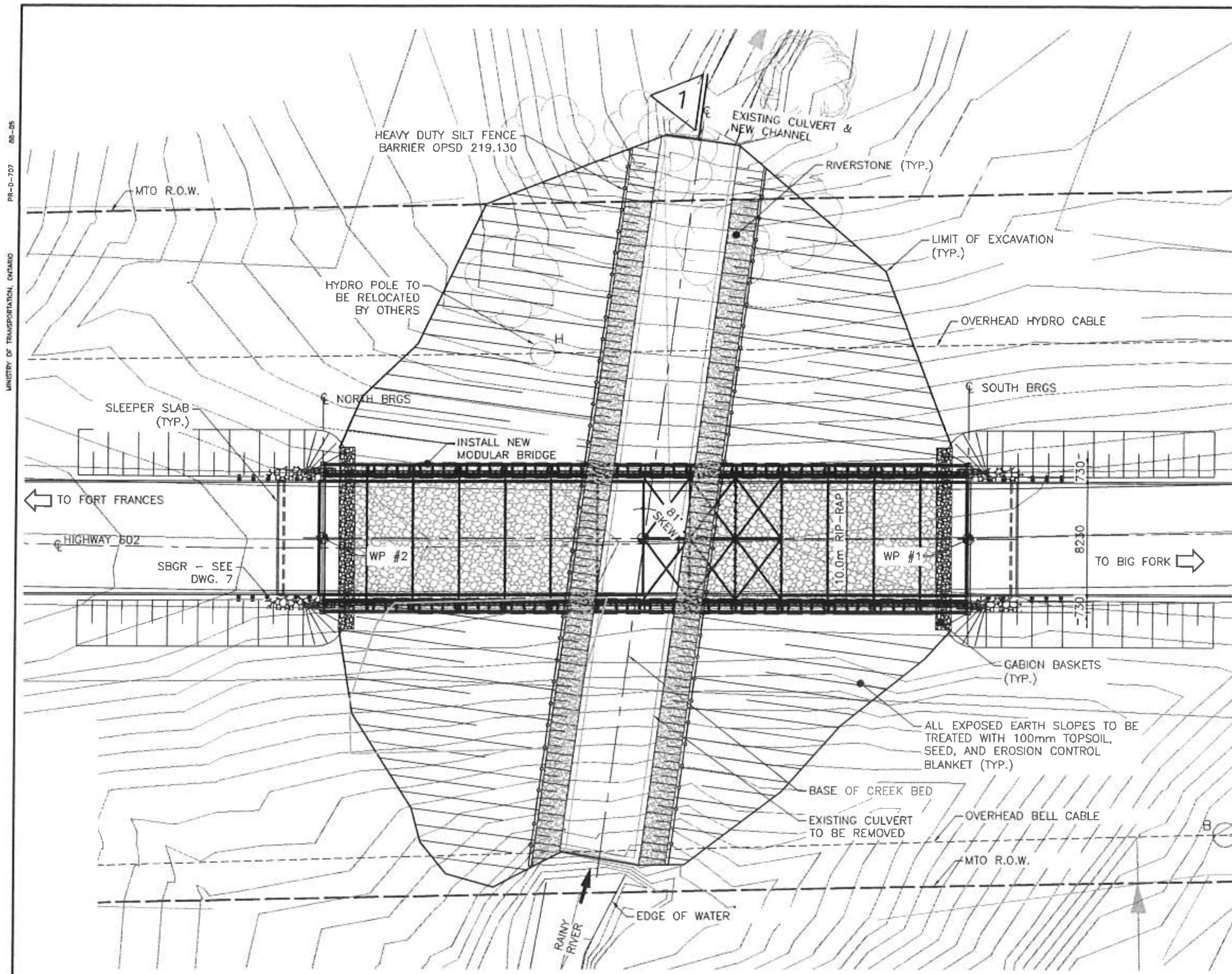
RAINY RIVER TRIBUTARY CULVERT STRUCTURAL REPLACEMENT

GENERAL ARRANGEMENT

SHEET 3

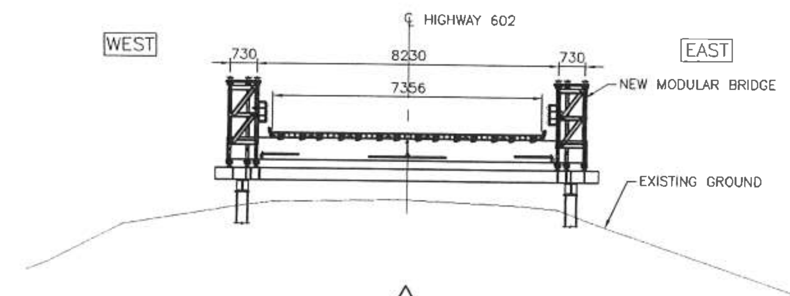
Ontario — Ministry of Transportation, Northwestern Region, Structural Section

Hatch Mott MacDonald



PLAN
1 : 200

WP	NORTHING	EASTING	ELEVATION	STATION
#1	5 383 951.638	240 148.036	339.710	1+672.352
#2	5 383 994.285	270 149.539	339.070	1+629.677



1
1 : 100

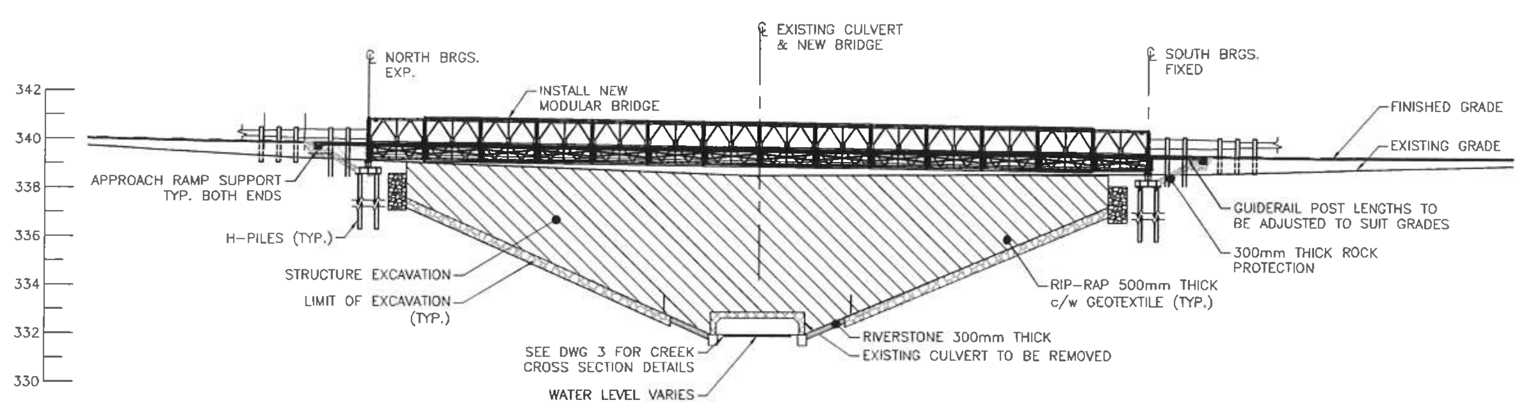
NOTES

MODULAR GENERAL NOTES

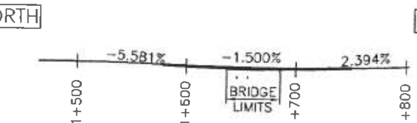
1. ERECTION, LAUNCHING AND RELOCATION OF THE STRUCTURE TO ITS FINAL LOCATION SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS.
2. THE NEW MODULAR STRUCTURE SHALL BE CONSTRUCTED ON THE SAME HORIZONTAL ALIGNMENT AS THE EXISTING ROAD.
3. THE CONTRACTOR IS RESPONSIBLE TO ESTABLISH ALL THE LINES AND GRADES CONSISTENT WITH DRAWINGS.
4. THE APPROACH RAMP SLEEPER SLAB EKKI TIMBERS (50x185) SHALL BE SUPPLIED BY THE MINISTRY.
5. THE MODULAR BRIDGE TO BE CONSTRUCTED AT THIS SITE SHALL BE A MABEY COMPACT 200 CONFIGURATION TSR3++. THE CONTRACTOR IS RESPONSIBLE TO LOAD, SHIP AND UNLOAD THE COMPONENTS AT THE BRIDGE SITE. ALL THE COMPONENTS ARE LOACTED AT THE MTO JAMES STREET COMPLEX.
6. ALL MODULAR INSTALLATION DIMENSIONS SHALL BE VERIFIED PRIOR TO ANY RELATED WORK COMMENCING.
7. THE CONTRACTOR SHALL SUPPLY AND INSTALL THE PRECAST CONCRETE SLEEPER SLAB.

CONSTRUCTION NOTES

1. EXISTING CONDITIONS SHALL BE TAKEN INTO ACCOUNT DURING THE REMOVAL OPERATIONS.
2. CONTRACTOR SHALL INSTALL EROSION AND DESIMENT CONTROL AS PER ENVIRONMENTAL CONTROL–SEE DWG. 3.
3. AFTER REMOVAL OF EXISTING CULVERT, SHAPE CREEK BED AS SHOWN, MAINTAIN EXISTING INVERT ELEVATIONS.



ELEVATION
1 : 200



HIGHWAY 602 ROAD PROFILE
NTS

LIST OF DRAWINGS

1. GENERAL ARRANGEMENT
2. STRUCTURE REMOVALS
3. ENVIRONMENTAL CONTROL AND STRUCTURE EXCAVATION
4. PILE LAYOUT
5. PILE CAP & BEARING PLATE DETAILS
6. APP. RAMP PLANS, SECTIONS & DETAILS
7. THRIE BEAM GUIDE RAIL DETAILS

PRELIMINARY
NOT FOR CONSTRUCTION

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

REVISIONS		
DATE	REV.	DESCRIPTION

DESIGN	CP	CHK	PM	CODE CAN/CSA S6-06	LOAD CL-625-ONT	DATE	FEB. 2012
DRAWN	BB	CHK	CP	SITE	45-145/C	DWG	1

Feb 03, 2012 3:33pm