

DETAIL
FOUNDATION INVESTIGATION REPORT
RAPID RIVER BRIDGE REPLACEMENT
HIGHWAY 129, DISTRICT OF ALGOMA
G.W.P.5321-04-00, W.P. 14-74-07, SITE: 38S-013

Geocres Number: 41J-74

Report to

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January 21, 2008
File: 19-1423-33

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DETAIL
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PART 1: FACTUAL INFORMATION

1 INTRODUCTION

This report presents the factual findings obtained from a foundation investigation conducted at the site of the proposed replacement bridge to carry Highway 129 over the Rapid River in Algoma, Ontario.

The purpose of the 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.

A Preliminary Foundation Investigation was completed by Thurber in the spring of 2007. The factual information obtained in the course of that investigation has been combined with that obtained in the course of the current investigation.

Dominion Soil Investigation Inc. reported a previous investigation in 1977 for a crossing of the Rapid River on an alignment that lay further east than the alignment investigated in the current assignment. The factual data from that investigation is included in Appendix C but it has not been used directly in the analysis or preparation of recommendations contained in this report.

Thurber carried out the investigation as a sub-consultant to Marshall Macklin Monaghan, under the Ministry of Transportation Ontario (MTO) Agreement Number 5005-E-0042.

2 SITE DESCRIPTION

The Rapid River is an east to west flowing tributary of the Mississagi River and it crosses Highway 129 approximately 49 km north of the junction with Highway 554 and approximately 100 m upstream from the confluence with the Mississagi. The Mississagi River runs from north to south. At the site the river is approximately 10 m wide and 1 m deep and is fast flowing in a boulder strewn channel. The river level was recorded as Elevation 317.8 in June 1996 and as Elevation 318.3 in October 2006.

Approximately 250 m south of the bridge site, and again 300 m north, Highway 129 lies close to the top of the east bank of the Mississagi River. The ground rises relatively steeply to the east of the highway.

At 95 m north of the bridge, Lumber Lost Road runs west off Highway 129 and crosses the Mississagi River.

The banks of the rivers are boulder strewn and an exposure immediately north of the bridge reveals a sand and gravel soil containing numerous cobbles and boulders.

Immediately west of the existing bridge are the remnants of two abutments and roadbed from an earlier crossing of the river.

There is no development in the immediate vicinity of the bridge.

Photographs of the site are included in Appendix E and show the existing bridge, the approaches and the soil exposure north of the bridge site.

3 SITE INVESTIGATION AND FIELD TESTING

The site investigation and field-testing for detail design of this project was carried out between September 7 and September 11, 2007. At the structure, four sampled boreholes were drilled to supplement those drilled during the preliminary investigation during the period January 24 to February 17, 2007. The new boreholes were number 07-RR15 through 07-RR18 and ranged in depth from 4.7 to 12.6 m

Six foundation boreholes (numbered 07-RR1 to 07-RR6) that were drilled on three alternative alignments during the preliminary investigation. The depths of these boreholes ranged from 10.7 m to 12.4 m. All six boreholes have been included for reference, though BH 07-RR5 and BH 07-RR6 are the most relevant to the foundations on the selected alignment.

The approximate locations of these boreholes are shown on the attached Borehole Locations and Soil Strata Drawing in Appendix F.

In addition to the ten boreholes drilled at the abutment locations and immediate approaches, a total of eight sampled boreholes were drilled at locations within the project limits to investigate soil conditions affecting embankment realignment. These boreholes are numbered 07-RR7 through 07-RR14. The depths of these boreholes ranged from 0.8 to 3.1 m.

The Record of Borehole sheets for all the boreholes are included in Appendix A and the locations of the boreholes have been plotted on the Borehole Location and Soil Strata drawing.

Prior to commencing the site investigation, clearance was obtained from utility companies having plant in the area.

A combination of hollow-stem auger drilling and diamond coring techniques were used to advance the boreholes. Samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT) in the overburden soils.

Groundwater conditions in the open boreholes were observed throughout the drilling operations. At each abutment one or more standpipe piezometers consisting of 19 mm PVC pipe with a slotted screen were installed and enclosed in filter sand to permit longer term groundwater level monitoring. The locations and completion details of the piezometers are shown in Table 3.1. Boreholes without piezometer installations were grouted with bentonite upon completion. The borehole completion details are shown in Table 3.1. Along the embankment alignment, boreholes less than 3 m deep were backfilled with drill cuttings.

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

Table 3.1 – Borehole Completion Details

Borehole Location	Piezometer Tip Depth/ Elevation (m)	Completion Details
07-RR1 South Abutment	10.5/310.0	Piezometer with 1.5 m slotted screen installed with sand filter to 8.3 m, bentonite seal from 8.3 m to ground surface.
07-RR2 North Abutment	11.0/309.3	Piezometer with 1.5 m slotted screen installed with sand filter to 9.1 m, bentonite seal from 9.1 m to ground surface.
07-RR3 South Abutment	No Installation	Bentonite grout to ground surface.
07-RR4 North Abutment	No Installation	Bentonite grout to ground surface.
07-RR5 South Abutment	10.7/309.9	Piezometer with 1.5 m slotted screen installed with sand filter to 8.3 m, bentonite seal from 8.3 m to ground surface.
07-RR6 North Abutment	4.6/315.7	Piezometer with 1.5 m slotted screen installed with sand filter to 2.7 m, bentonite seal from 2.7 m to ground surface.
07-RR15 South Abutment	12.3/307.6	Piezometer with 1.5 m slotted screen installed at 12.3 m with sand filter to 9.8 m, bentonite seal to 8.7 m, grout to 0.2 m and gravel to ground surface.
07-RR16 North Abutment	12.2/308.9	Piezometer with 1.5 m slotted screen installed at 12.2 m with sand filter to 9.8 m, bentonite seal to 9.5 m, grout to ground surface.
07-RR17 South Abutment	No Installation	Bentonite grout to ground surface.
07-RR18 North Abutment	No Installation	Bentonite grout 300 mm, sand and gravel to ground surface.

4 LABORATORY TESTING

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

5 DESCRIPTION OF SUBSURFACE CONDITIONS

Reference is made to the Record of Borehole sheets in Appendix A. Details of the encountered soil stratigraphy along the alternate alignments are presented in this appendix and on the “Borehole Locations and Soil Strata” drawing in Appendix F. 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.

The description presented below relates to the selected alignment and is based on the boreholes specifically drilled on that alignment.

In general, the site is underlain by granular fill overlying cohesionless deposits of sand and gravel with cobbles and boulders.

5.1 Topsoil

Topsoil was encountered at the south abutment location and south approach (RR5, RR15 and RR17) ranging from 50 mm to 200 mm in thickness. Topsoil was also encountered at the north approach (RR18) in a thickness of 150 mm. Topsoil was not encountered at the road alignment boreholes (RR7 to RR14).

5.2 Fill

Sand and gravel fill was encountered at the north abutment in thickness ranging from 1.4 to 2.4 m and the underside of the fill layer was recorded at elevations between 317.9 m and 319.7 m.

‘N’ values ranging from 26 to greater than 100, derived from Standard Penetration Tests conducted in the sand and gravel fill, indicate a compact to very dense relative density. In some cases, the high SPT values may reflect the presence of cobbles or boulders.

Moisture content ranged from approximately 8 to 19 %.

The results of laboratory tests carried out on four samples were as follows:

Gravel (%)	0 to 37
Sand (%)	52 to 57
Silt and Clay (%)	11 to 42

The grain size distribution curves for the samples tested are shown in Figure B1 in Appendix B.

Fill was encountered in all alignment boreholes except for RR9 and RR12. Thicknesses vary from 0.3 m to 2.1 m. Borehole RR10 terminated in this layer at Elevation 317.9. The fill material predominantly consisted of layers of sand and sand and gravel that exhibited

compact to very dense relative density. Silty clay and silty sand fill was encountered from 0 to 1.5 m in RR7, the underside of the fill layer was recorded at elevation 316.0.

5.3 Peat

A layer of amorphous peat was encountered in alignment borehole RR9 from ground level to termination of the borehole on auger refusal at 0.8 m. Moisture content of 109 % was recorded. The extent of peat was not established.

5.4 Sand and Gravel

Sand and gravel with cobbles and boulders was encountered at both the north and south abutment locations and at the north and south approaches. At the south approach and one borehole at the south abutment, a layer of hard, silty, organic (peaty) clay is interbedded in the sand and gravel.

The overall thickness of sand and gravel recorded on the preferred alignment ranged from 2.2 m at the north abutment to 12.3 m at the south abutment. The elevations of the base of the layer ranged from 315.7 to 311.3, where it was fully penetrated.

SPT 'N' values generally between 38 and greater than 100 were recorded in this stratum, indicating dense to very dense relative density. Occasional lower SPT values were recorded, typically in the fill, but are not considered to influence the design. In some cases, the high SPT values may reflect the presence of cobbles or boulders.

The results of laboratory tests carried out on eighteen samples were as follows:

Gravel (%)	7 to 53
Sand (%)	46 to 78
Silt (%)	1 to 29

The grain size distribution curves for the samples tested are shown in Figures B2 to B4 in Appendix B.

The natural moisture content ranged from 5 to 40%.

The alignment boreholes encountered layers of sand and sand and gravel that predominantly exhibited compact to very dense relative density.

5.5 Clay mixed with Sandy Silt and Peat

At the east side of the south abutment and in the south approach, Boreholes 07-RR15 encountered a 1.5 m thick layer of hard, silty clay mixed with and interbedded with peat. At the south approach, Borehole 07-RR17 penetrated 2.3 m into this soil and was terminated in this layer.

The deposit contains layers of hard, amorphous peat and rootlets and is black in colour. SPT values greater than 100 blows for 0.3 m of penetration indicate that the clay is hard. The results of laboratory tests carried out on two samples were as follows:

Gravel (%)	0 to 3
Sand (%)	2 to 59
Silt (%)	28
Clay (%)	30 to 70

The grain size distribution curves for the samples tested are shown in Figure B5 in Appendix B.

5.6 Sand

A layer of sand was encountered below the sand and gravel layer at the north and south abutments and at the north approach. The thickness of the sand layer proved in the boreholes ranged from at least 1.5 to greater than 6.3 m. Based on SPT values ranging from 29 to greater than 100 blows for 0.3 m of penetration, the deposit is described as compact to very dense. The sand is very dense below Elevation 314 in all boreholes.

The results of laboratory tests carried out on four samples were as follows:

Gravel (%)	1 to 15
Sand (%)	50 to 83
Silt (%)	2 to 22
Clay (%)	0 to 17

The grain size distribution curves for the samples tested are shown in Figure B6 in Appendix B.

Moisture content ranged from 15 to 26 %.

5.7 Groundwater Conditions

Standpipe piezometers were installed in selected boreholes and water levels were measured after completion of drilling, prior to demobilization from the site and again on September 12, 2007. The water level readings are presented in Table 5.2.

The data collected indicates that the groundwater level was stabilizing close to Elevation 314.7. This elevation is below the level of the Rapid River, recorded at Elevation 317.8 in October 2006. This is an unexpected result and may indicate under-drainage of the site, controlled by the lower level of the Mississagi River, which lies at approximately Elevation 314.2 at the confluence with the Rapid River.

Due to the proximity of the river, local groundwater levels must be assumed to be at the river level for design and construction.

Based on these observations, local groundwater levels exist at Elevations 317.1 m to 314.7 m. All groundwater observations at this site are short term and the levels are expected to fluctuate seasonally and after severe weather events.

6 MISCELLANEOUS

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

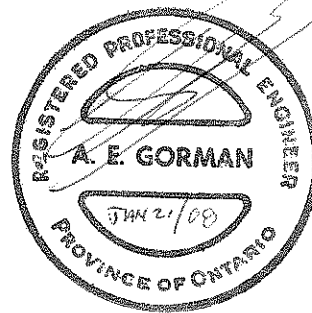
The drilling and sampling operations in the field were supervised on a full time basis by Mr. Stephane Loranger and Mr. George Azzopardi of Thurber.

The coordinates for the boreholes and the ground surface elevations were provided by Marshall Macklin Monaghan.

Mr. Alastair E. Gorman, P.Eng. directed the field operations and prepared the Foundation Investigation Report.

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

Thurber Engineering Ltd.



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



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

Table 5.2: Water Level Measurements at Bridge Abutments

Date	BH 07-RR1		BH 07-RR2		BH 07-RR5		BH 07-RR6		BH 07-RR15		BH 07-RR16	
	Depth (m)	Elev.	Depth (m)	Elev.	Depth (m)	Elev.	Depth (m)	Elev.	Depth (m)	Elev.	Depth (m)	Elev.
07-01-31							1.5	318.8				
07-02-01			4.9	315.5								
07-02-03			4.9	315.5			Dry					
07-02-05	1.7	318.8										
07-02-07			5.0	315.4			Dry					
07-02-14			5.3	315.1			2.6	317.7				
07-02-28	3.7	316.8			3.7	316.9						
07-03-14	4.6	315.9	Blocked		3.7	316.9	Blocked					
07-09-08	5.7	314.8			3.4	317.2						
07-09-12	5.8	314.7			3.5	317.1			3.8	316.1	1.9	319.2

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

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


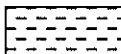



 Water Level
 Shear Strength Determination by Pocket Penetrometer

- (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
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 07-RR01

1 OF 2

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 388.06 E 350 901.97 ORIGINATED BY SLL
 HWY 129 BOREHOLE TYPE Hollow Stem Auger / NQ Core Barrel COMPILED BY JHL
 DATUM Geodetic DATE 2007.02.14 - 2007.02.16 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)	
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE							
320.5																		
0.0	TOPSOIL: (25 mm)																	
319.8	SAND, some gravel, occasional cobbles and asphalt fragments (FILL)																	
0.7	SAND AND GRAVEL, occasional cobbles and boulders Dense to Very Dense Brown Dry to Moist		1	SS	50/ .100											34 54 12 (SI+CL)		
			2	SS	59													
			3	SS	66													
			4	SS	5													
	Boulder at 3.66m Wet																	
			5	SS	70/ .050													
			6	SS	46													
			7	SS	50/ .050													
311.2	Cobble at 9.14m																	
9.3	SAND, silty, trace gravel, occasional cobbles Very Dense Grey		8	SS	100/ .150													

Continued Next Page

+³, X³: Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 07-RR01

2 OF 2

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 388.06 E 350 901.97 ORIGINATED BY SLL
 HWY 129 BOREHOLE TYPE Hollow Stem Auger / NQ Core Barrel COMPILED BY JHL
 DATUM Geodetic DATE 2007.02.14 - 2007.02.16 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
	Continued From Previous Page													
309.8	Moist SAND, silty, trace gravel, occasional cobbles Very Dense Grey Moist		9	SS	100/ .150		310							
10.7	END OF BOREHOLE AT 10.67 m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 05/02/07 1.70 318.80 14/03/07 4.63 315.87 08/09/07 5.67 314.83 12/09/07 5.80 314.70													

+³, ×³: Numbers refer to
Sensitivity



20
15
10
5
0
5
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 07-RR02

1 OF 2

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 397.60 E 350 919.23 ORIGINATED BY GA
 HWY 129 BOREHOLE TYPE Hollow Stem Auger COMPILED BY JHL
 DATUM Geodetic DATE 2007.01.28 - 2007.01.30 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								WATER CONTENT (%)						
320.4						20 40 60 80 100	PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L					
0.0	SAND AND GRAVEL, occasional cobbles Dense Brown Dry (FILL)		1	SS	30									
318.1														
2.3	SAND AND GRAVEL, occasional cobbles and boulders Dense to Very Dense Brown Wet Boulder: (600 mm)		4	SS	50									
								</						

Continued Next Page

+ 3 X 3 Numbers refer to
Sensitivity 20
15 10 6 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 07-RR02

2 OF 2

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 397.60 E 350 919.23 ORIGINATED BY GA
 HWY 129 BOREHOLE TYPE Hollow Stem Auger COMPILED BY JHL
 DATUM Geodetic DATE 2007.01.28 - 2007.01.30 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
	Continued From Previous Page															
309.3			10	SS	118		310									
11.0	END OF BOREHOLE AT 11.05m. BOREHOLE OPEN TO 11.05m. WATER LEVEL AT 2.74m UPON COMPLETION. BOREHOLE GROUTED WITH BENTONITE TO 0.91m AND BACKFILLED WITH HOLEPLUG TO SURFACE. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 01/02/07 4.93 315.47 03/02/07 4.94 315.46 07/02/07 5.00 315.40 14/03/07 BLOCKED AT SURFACE 08/09/07 DESTROYED															

RECORD OF BOREHOLE No 07-RR3

1 OF 2

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 382.95 E 350 905.45 ORIGINATED BY GA
 HWY 129 BOREHOLE TYPE Hollow Stem Auger COMPILED BY JHL
 DATUM Geodetic DATE 2007.02.02 - 2007.02.04 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE								WATER CONTENT (%)
320.4 0.0	SAND, trace gravel, frequent cobbles and boulders Dense Brown Wet (FILL)		1	SS	37											
			2	SS	30											
318.9 1.5	SAND AND GRAVEL, some silt, frequent cobbles and boulders Very Dense Brown Wet		3	SS	50/ .100											
			4	SS	50/ .000											
			5	SS	50/ .075											
			6	SS	42											
			7	SS	85											
			8	SS	105											
			9	SS	126											

Continued Next Page

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

RECORD OF BOREHOLE No 07-RR3

2 OF 2

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 382.95 E 350 905.45
 HWY 129 BOREHOLE TYPE Hollow Stem Auger
 DATUM Geodetic DATE 2007.02.02 - 2007.02.04
 ORIGINATED BY GA
 COMPILED BY JHL
 CHECKED BY AEG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
	Continued From Previous Page												
309.5			10	SS	140	310							39 60 1
11.0	END OF BOREHOLE AT 10.97 m. BOREHOLE OPEN TO 9.14 m AND WATER LEVEL AT 3.05 m UPON COMPLETION. BOREHOLE GROUTED WITH BENTONITE TO 1.83 m AND BACKFILLED WITH HOLEPLUG TO SURFACE. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 04/02/07 3.05 317.35												(SI+CL)

RECORD OF BOREHOLE No 07-RR4

1 OF 2

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 392.46 E 350 922.13
 HWY 129 BOREHOLE TYPE Hollow Stem Auger / NQ Core Barrel
 DATUM Geodetic DATE 2007.01.24 - 2007.01.27
 ORIGINATED BY GA
 COMPILED BY JHL
 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								20 40 60 80 100										
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE										
320.7																		
0.0	SAND AND GRAVEL, cobbles Dense to Very Dense Brown Dry (FILL)		1	SS	45													
			2	SS	82													
			3	SS	50/ .000													
			4	SS	50/ .125													
317.7																		
3.0	SAND AND GRAVEL, trace silt, occasional cobbles Compact to Very Dense Brown Wet		5	SS	78													
			6	SS	22													

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 07-RR4

2 OF 2

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 392.46 E 350 922.13 ORIGINATED BY GA
 HWY 129 BOREHOLE TYPE Hollow Stem Auger / NQ Core Barrel COMPILED BY JHL
 DATUM Geodetic DATE 2007.01.24 - 2007.01.27 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					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	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
	Continued From Previous Page													
			10	SS	102		310							
							309							
308.3			11	SS	107/									21 75 4
12.4	END OF BOREHOLE AT 12.42 m. BOREHOLE OPEN AND WATAER LEVEL AT 2.74 m UPON COMPLETION. BOREHOLE GROUTED WITH BENTONITE TO SURFACE. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 27/01/07 2.74 317.96				.075									(SI+CL)

RECORD OF BOREHOLE No 07-RR05

1 OF 2

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 369.20 E 350 910.60 ORIGINATED BY SLL
 HWY 129 BOREHOLE TYPE Hollow Stem Auger COMPILED BY JHL
 DATUM Geodetic DATE 2007.02.17 - 2007.02.17 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
320.6	TOPSOIL: (50 mm) SAND AND GRAVEL, with cobbles													
320			1	SS	90/ .175									
319			2	SS	50/ .050									
318	Very Dense Brown Wet		3	SS	50/ .125									35 36 29 (SI+CL)
317			4	SS	50/ .125									
316			5	SS	50/ .075									
315			6	SS	50/ .125									
314	Boulder		7	SS	50/ .125									
313			8	SS	100/ 275									22 59 19 (SI+CL)
311.3	SAND, trace to some gravel Very Dense Grey Moist													

Continued Next Page

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

RECORD OF BOREHOLE No 07-RR05

2 OF 2

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 369.20 E 350 910.60 ORIGINATED BY SLL
 HWY 129 BOREHOLE TYPE Hollow Stem Auger COMPILED BY JHL
 DATUM Geodetic DATE 2007.02.17 - 2007.02.17 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES								
	Continued From Previous Page												
309.8			9	SS	50/		310						2 49 32 17
10.8	END OF BOREHOLE AT 10.79 m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 14/03/07 3.70 316.90 08/09/07 3.67 316.93 12/09/07 3.52 317.08				125								

RECORD OF BOREHOLE No 07-RR06

1 OF 2

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 381.26 E 350 933.03 ORIGINATED BY GA
 HWY 129 BOREHOLE TYPE Hollow Stem Auger COMPILED BY JHL
 DATUM Geodetic DATE 2007.01.31 - 2007.02.01 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED + FIELD VANE									
								● QUICK TRIAXIAL × LAB VANE									
							20 40 60 80 100					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT w _p w w _L WATER CONTENT (%)					
320.3																	
0.0	SAND AND GRAVEL, occasional cobbles Compact Dark Brown Wet (FILL) Boulder		1	SS	26		320										
			2	SS	27												
			3	SS	50/ .050		319										
317.9																	
2.4	SAND AND GRAVEL, trace to some cobbles and boulders Dense to Very Dense Brown Wet		4	SS	38		318										
			5	SS	50/ .175		317										
							316										
315.7																	
4.6	SAND, trace to some gravel, trace silt, occasional cobbles and boulders Compact to Very Dense Brown Wet		6	SS	29		315										
			7	SS	76		314										
							313										
			8	SS	112/ .275		312										
			9	SS	133		311										

Continued Next Page

+³ X³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 07-RR06

2 OF 2

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 381.26 E 350 933.03 ORIGINATED BY GA
 HWY 129 BOREHOLE TYPE Hollow Stem Auger COMPILED BY JHL
 DATUM Geodetic DATE 2007.01.31 - 2007.02.01 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40					
	Continued From Previous Page													
309.4			10	SS	108/ .200		310							
10.9	END OF BOREHOLE AT 10.87 m. BOREHOLE OPEN TO 10.67 m AND WATER LEVEL AT 1.52 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS FROM 10.9m TO 4.6m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 31/01/07 1.52 318.78 14/03/07 BLOCKED AT 2.78 08/09/07 DRY but only 12" of pipe 12/09/07 DRY													

RECORD OF BOREHOLE No 07-RR07

1 OF 1

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 274.17 E 350 729.23 ORIGINATED BY GA
 HWY 129 BOREHOLE TYPE Hollow Stem Auger COMPILED BY WM
 DATUM Geodetic DATE 2007.02.07 - 2007.02.07 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								WATER CONTENT (%)						
317.5								20	40	60	80	100		
0.0	Silty CLAY , trace sand, trace gravel Very Stiff Brown (FILL)		1	SS	19									
317.0														
0.5	SAND and SILT , trace clay Dense Moist (FILL)		2	SS	31									0 57 38 5
316.0														
315.5	SAND , trace silt, trace gravel Very Dense Wet		3	SS	50/									
1.7	END OF BOREHOLE AT 1.68 m. AUGER REFUSAL AT 1.68 m. BOREHOLE OPEN TO 1.68 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.				.150									

+³ . X³ : Numbers refer to
Sensitivity

20
15
10


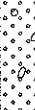
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 07-RR8

1 OF 1

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 302.14 E 350 773.00 ORIGINATED BY GA
 HWY 129 BOREHOLE TYPE Hollow Stem Auger COMPILED BY WM
 DATUM Geodetic DATE 2007.02.07 - 2007.02.07 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											
								○ UNCONFINED	+	FIELD VANE									
								● QUICK TRIAXIAL	×	LAB VANE									
							20	40	60	80	100		20	40	60				
317.8																			
0.0	SAND and GRAVEL, trace to some silt Dense Brown Dry (FILL)		1	SS	38														
			2	SS	40														
316.3																			
1.5	SAND and GRAVEL, trace silt Compact Brown to Grey Damp		3	SS	24														
315.5																			
2.3	END OF BOREHOLE AT 2.29 m. AUGER REFUSAL AT 2.29 m. BOREHOLE OPEN TO 2.29 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.																		

RECORD OF BOREHOLE No 07-RR9

1 OF 1

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 325.10 E 350 816.42 ORIGINATED BY GA
 HWY 129 BOREHOLE TYPE Hollow Stem Auger COMPILED BY WM
 DATUM Geodetic DATE 2007.02.07 - 2007.02.07 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
319.4								20 40 60 80 100						
0.0	PEAT, amorphous, some rootles, frequent cobbles and boulders Compact Black Wet		1	SS	20		319	○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
318.6								20 40 60 80 100						
0.8	END OF BOREHOLE AT 0.76 m. AUGER REFUSAL AT 0.76 m. BOREHOLE OPEN TO 0.76 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BOREHOLE CUTTINGS.													

ONTMT4S 2333.GPJ 27/04/07

RECORD OF BOREHOLE No 07-RR10

1 OF 1

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 345.70 E 350 881.75 ORIGINATED BY GA
HWY 129 BOREHOLE TYPE Hollow Stem Auger COMPILED BY WM
DATUM Geodetic DATE 2007.02.07 - 2007.02.07 CHECKED BY AEG






SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
320.0								20 40 60 80 100					
0.0	SAND, trace silt, trace gravel, occasional cobbles Compact Brown Dry to Damp (FILL) Gravelly SAND, some silt Dense to Very Dense Moist (FILL)		1	SS	29		320						
319.4													
0.6													
			2	SS	41		319						
			3	SS	84								
317.9							318						28 60 12 (SI+CL)
2.1	END OF BOREHOLE AT 2.13 m. AUGER REFUSAL AT 2.13 m. BOREHOLE OPEN TO 2.13 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.												

RECORD OF BOREHOLE No 07-RR11

1 OF 1

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 395.65 E 350 948.39 ORIGINATED BY GA
 HWY 129 BOREHOLE TYPE Hollow Stem Auger COMPILED BY WM
 DATUM Geodetic DATE 2007.01.31 - 2007.01.31 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
								20 40 60 80 100							
								20 40 60 80 100							
						UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE			WATER CONTENT (%)						
321.5															
0.0	SAND and GRAVEL, occasional asphalt fragments, trace silt Compact Brown Moist (FILL)		1	SS	22		321								
			2	SS	20										
320.0															
1.5	SAND and GRAVEL, some silt, occasional cobbles and boulders Very Dense Brown Damp		3	SS	86		320								
			4	SS	78/ 200		319								
318.4			4	SS	50/ .100										30 57 13 (SI+CL)
3.1	END OF BOREHOLE AT 3.15 m. BOREHOLE OPEN TO 2.13 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG AND DRILL CUTTINGS TO SURFACE.														

RECORD OF BOREHOLE No 07-RR12

1 OF 1

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 407.13 E 350 999.32 ORIGINATED BY GA
HWY 129 BOREHOLE TYPE Hollow Stem Auger COMPILED BY WM
DATUM Geodetic DATE 2007.01.31 - 2007.01.31 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y 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									
322.4																	
0.0	SAND AND GRAVEL, trace silt, occasional rootlets Compact to Very Dense Brown Dry to Damp		1	SS	16												
			2	SS	16												
	trace to some cobbles and boulders		3	SS	86												
320.1			4	SS	50/ .000												
2.3	END OF BOREHOLE AT 2.29 m. AUGER REFUSAL ON PROBABLE BEDROCK OR BOULDERS. BOREHOLE BACKFILLED WITH HOLEPLUG AND DRILL CUTTINGS TO SURFACE.																

RECORD OF BOREHOLE No 07-RR13

1 OF 1

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 446.34 E 351 034.22 ORIGINATED BY GA
 HWY 129 BOREHOLE TYPE Hollow Stem Auger COMPILED BY WM
 DATUM Geodetic DATE 2007.01.31 - 2007.01.31 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
321.3	SAND, some gravel, some silt Dense Brown (FILL) SILT, some sand, some gravel Very Dense Dark Brown Dry to Damp		1	SS	42	321	20 40 60 80 100				PLASTIC LIMIT w _p NATURAL MOISTURE CONTENT w LIQUID LIMIT w _L			
0.0							○ UNCONFINED + FIELD VANE				WATER CONTENT (%)			
321.0			● QUICK TRIAXIAL × LAB VANE				20 40 60 80 100				20 40 60			
0.3														
319.8			2	SS	90	320								
1.5	END OF BOREHOLE AT 1.52 m. BOREHOLE OPEN TO 1.22 m AND DRY TO BOTTOM UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.													

RECORD OF BOREHOLE No 07-RR14

1 OF 1

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 460.13 E 351 094.86 ORIGINATED BY GA
 HWY 129 BOREHOLE TYPE Hollow Stem Auger COMPILED BY WM
 DATUM Geodetic DATE 2007.01.31 - 2007.01.31 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) 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					
320.2								20 40 60 80 100							
0.0	SAND, some gravel, some silt Very Dense Brown Dry (FILL) SAND AND GRAVEL, trace silt, occasional cobbles and boulders Very Dense Brown Dry		1	SS	51										
319.9															
0.3															
			2	SS	50/ .075										
318.8															
1.4	END OF BOREHOLE AT 1.37 m. AUGER REFUSAL ON PROBABLE BEDROCK OR BOULDERS. BOREHOLE OPEN AND DRY TO BOTTOM UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.														

ONTMT4S 2333.GPJ 20/04/07

METRIC

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 07-RR15

2 OF 2

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 367.47 E 350 916.47 ORIGINATED BY SU
 HWY 129 BOREHOLE TYPE Hollow Stem Auger COMPILED BY ES
 DATUM Geodetic DATE 2007.09.09 - 2007.09.10 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
	Continued From Previous Page													
			2	RUN			309							
			3	RUN			308							
307.6														
12.3	END OF BOREHOLE AT 12.3m. BOREHOLE BACKFILLED WITH BENTONITE TO SURFACE. Piezometer installation consists of 19mm diameter schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 09/12/07 3.80 316.10													

RECORD OF BOREHOLE No 07-RR16

1 OF 2

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 387.22 E 350 932.58 ORIGINATED BY SU
 HWY 129 BOREHOLE TYPE Hollow Stem Auger/ NW Casing COMPILED BY ES
 DATUM Geodetic DATE 2007.09.08 - 2007.09.07 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						WATER CONTENT (%) w _p w w _L		
321.1							20	40	60	80	100	20	40	60		
0.0	SAND, trace gravel, occasional cobbles and boulders Dense Brown Moist (FILL)		1	SS	32											
319.7																
1.4	SAND and GRAVEL, occasional cobbles and boulders Very dense Brown Moist		2	SS	50/ .125											
			3	SS	50/ .075											
	HSA to 3.05m then switched to NW Casing		4	SS	75/ .125											9 81 10 (SI+CL)
			5	SS	50/ .100											
			6	SS	55											7 87 6 (SI+CL)
	More frequent cobbles and boulders below elev. 315.0		7	SS	100/ 250											
			8	SS	100/ 225											29 65 6 (SI+CL)

Continued Next Page

+³, X³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 07-RR16

2 OF 2

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 387.22 E 350 932.58 ORIGINATED BY SU
 HWY 129 BOREHOLE TYPE Hollow Stem Auger/ NW Casing COMPILED BY ES
 DATUM Geodetic DATE 2007.09.08 - 2007.09.07 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
	Continued From Previous Page							20 40 60 80 100						
			9	SS	100/ 275		311							
							310							
			10	SS	147		309							
308.5	END OF BOREHOLE AT 12.65m. Piezometer installation consists of 19mm diameter schedule 40 PVC pipe with a 1.52m slotted screen.													
12.6	WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 12/09/07 1.90 319.20													

+³ × 3³: Numbers refer to
Sensitivity

20
15
10
5
0
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 07-RR17

1 OF 1

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 363.46 E 350 916.47 ORIGINATED BY SU
 HWY 129 BOREHOLE TYPE NW Casing COMPILED BY ES
 DATUM Geodetic DATE 2007.09.10 - 2007.09.11 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W		
320.3																
0.0	TOPSOIL (200mm), black with roots and rootlets															
0.2	SAND and GRAVEL, occasional cobbles and boulders Very dense Brown Moist															
317.9	Cobble (150mm)															
2.4	CLAY, peat, trace rootlets Hard Black Moist		2	SS	72/ 225											4 38 29 29
315.6																
4.7	END OF BOREHOLE AT 4.70m. BOREHOLE BACKFILLED WITH BENTONITE TO SURFACE.		3	SS	50/ .125											

+ 3, X 3, Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 07-RR18

1 OF 2

METRIC

G.W.P. 5321-04-00 LOCATION Rapid River N 5 178 392.50 E 350 946.44 ORIGINATED BY SU
 HWY 129 BOREHOLE TYPE Hollow Stem Auger/ NW Casing COMPILED BY ES
 DATUM Geodetic DATE 2007.09.09 - 2007.09.09 CHECKED BY AEG



SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
321.1								20 40 60 80 100				
0.0	TOPSOIL (150mm) Organics											
0.2	SAND and GRAVEL, occasional cobbles and boulders Very dense Brown Moist Boulder and cobble											
			1	SS	62							
	Switched to NW Casing		2	SS	73/ .225							
			3	SS	50/ .075							
	Boulder (300mm)											
			4	SS	50/ .075							
315.0												
6.1	SAND, trace gravel Very dense Brown Wet		5	SS	70							
			6	SS	50/ .150							
			7	SS	80							
311.5												
9.7	END OF BOREHOLE AT 9.65m. BOREHOLE BACKFILLED WITH											

Continued Next Page

+³ ×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 		UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER						
	Continued From Previous Page					SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 20 40 60 80 100	WATER CONTENT (%) 20 40 60		GR SA SI

[illegible]

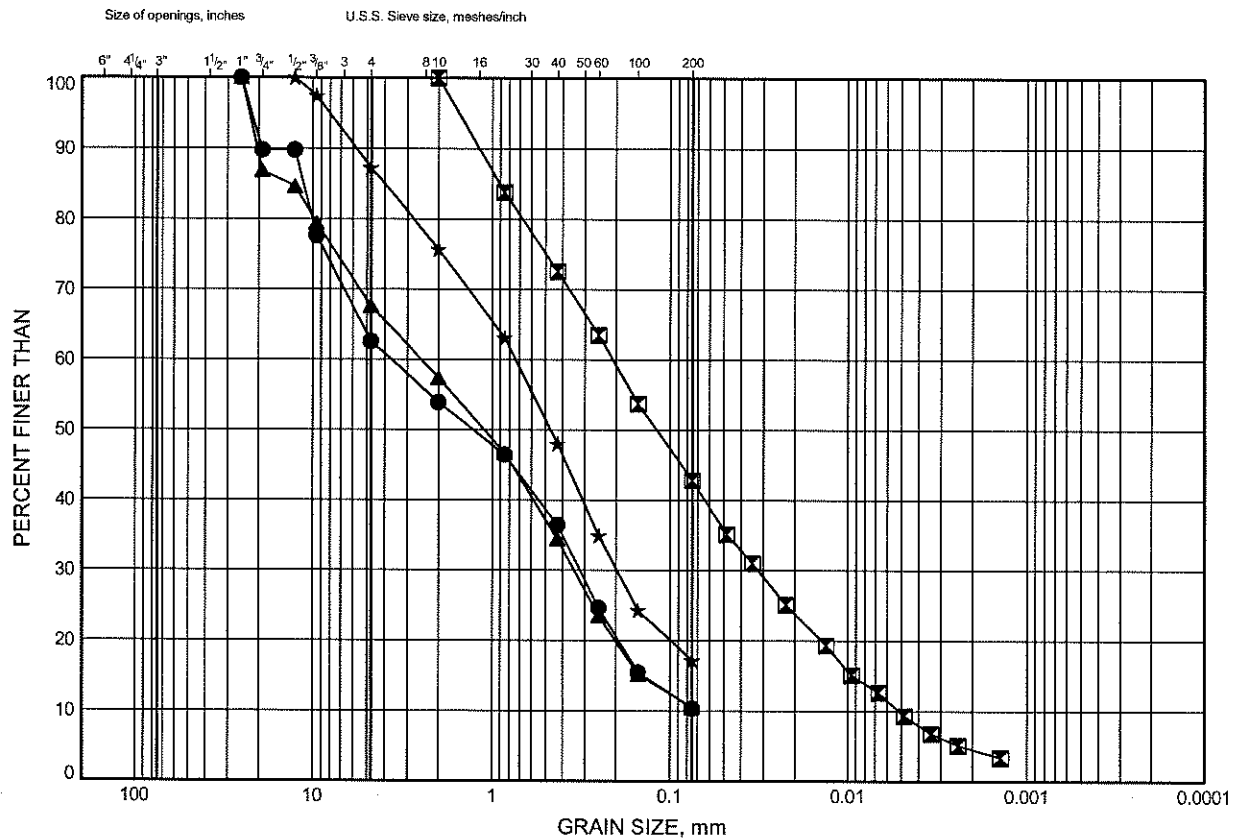
+³, ×³: Numbers refer to Sensitivity

Appendix B
Laboratory Test Results

Rapid River GRAIN SIZE DISTRIBUTION

FIGURE B1

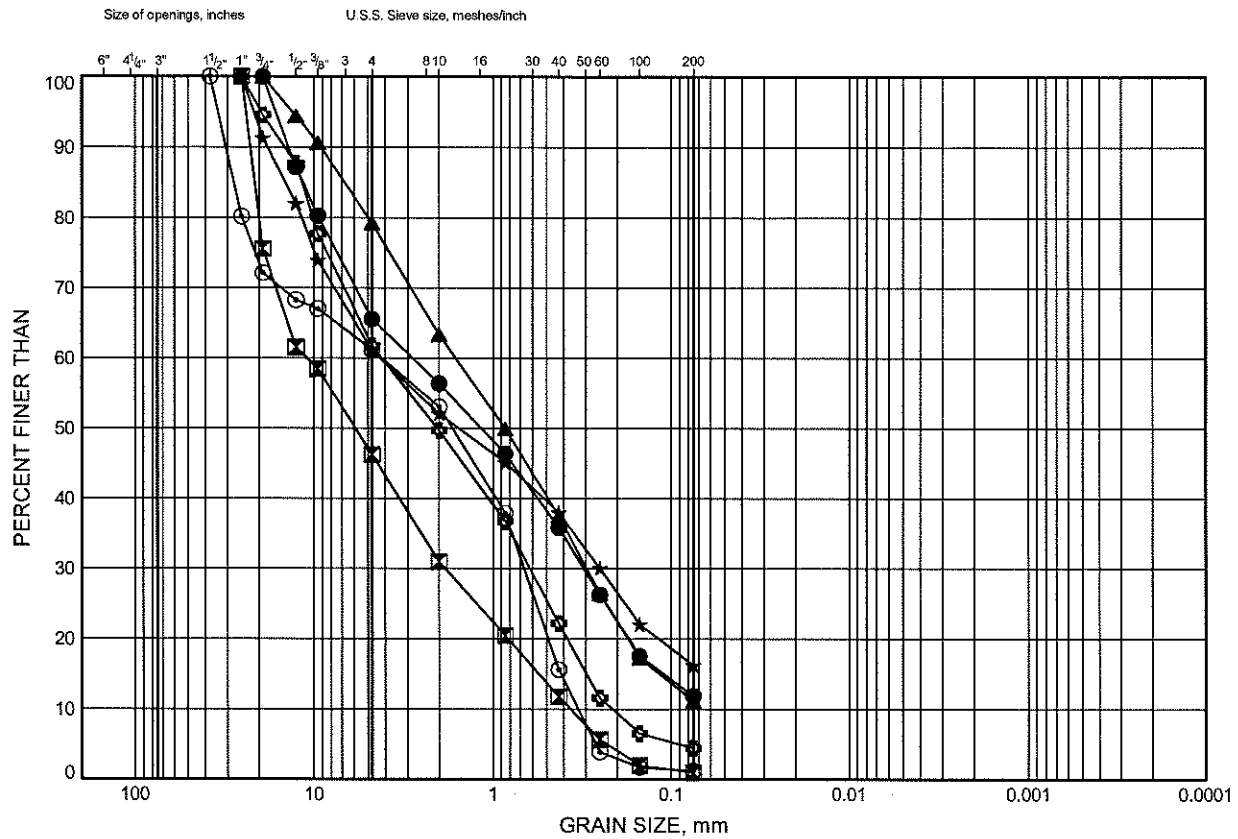
FILL



Rapid 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)
●	07-RR01	1.07	319.44
⊠	07-RR02	4.88	315.48
▲	07-RR03	3.35	317.09
★	07-RR03	7.92	312.52
⊙	07-RR03	10.82	309.62
⊕	07-RR04	4.88	315.86

Date November 2007
Project 5321-04-00

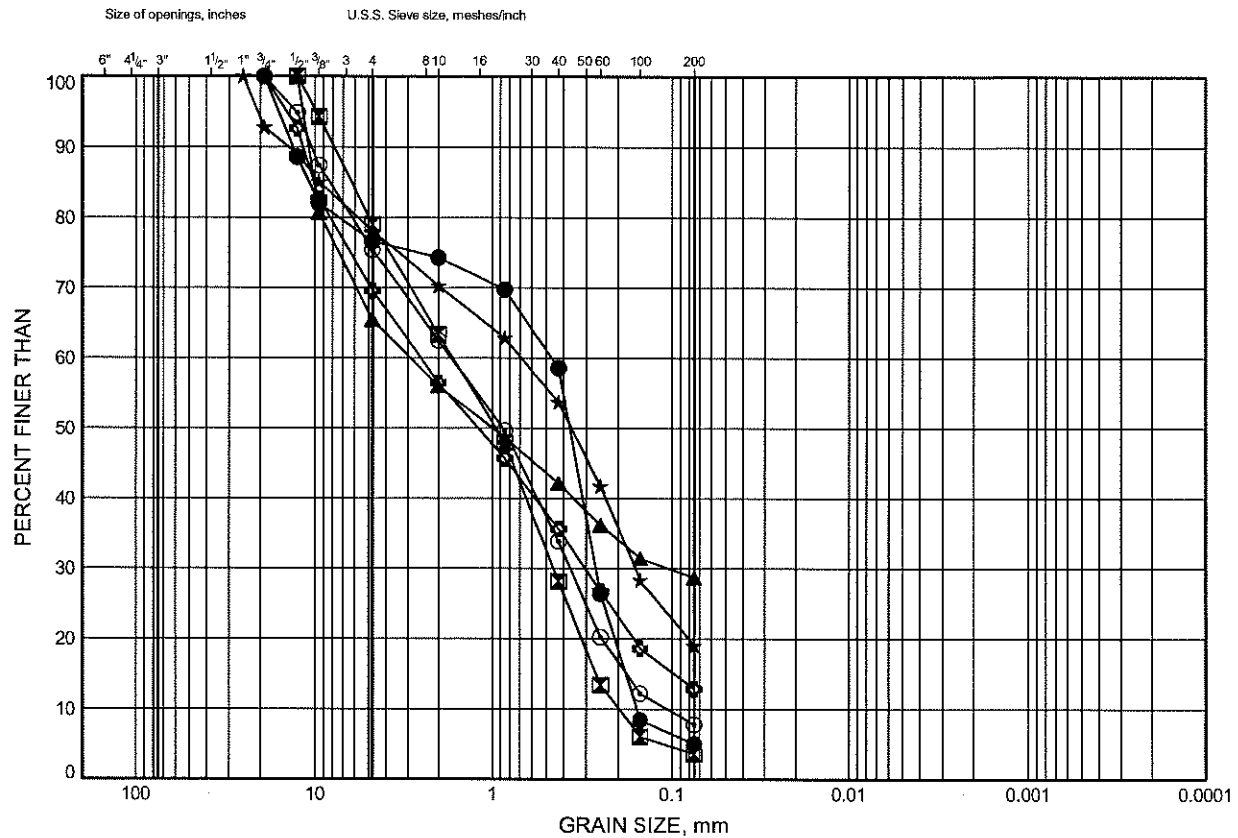


Prep'd MFA
Chkd. AEG

Rapid River GRAIN SIZE DISTRIBUTION

FIGURE B3

SAND AND GRAVEL



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	07-RR04	7.92	312.82
⊠	07-RR04	12.31	308.43
▲	07-RR05	2.43	318.17
★	07-RR05	9.37	311.23
⊙	07-RR06	2.59	317.70
⊕	07-RR11	2.59	318.91

Date November 2007

Project 5321-04-00



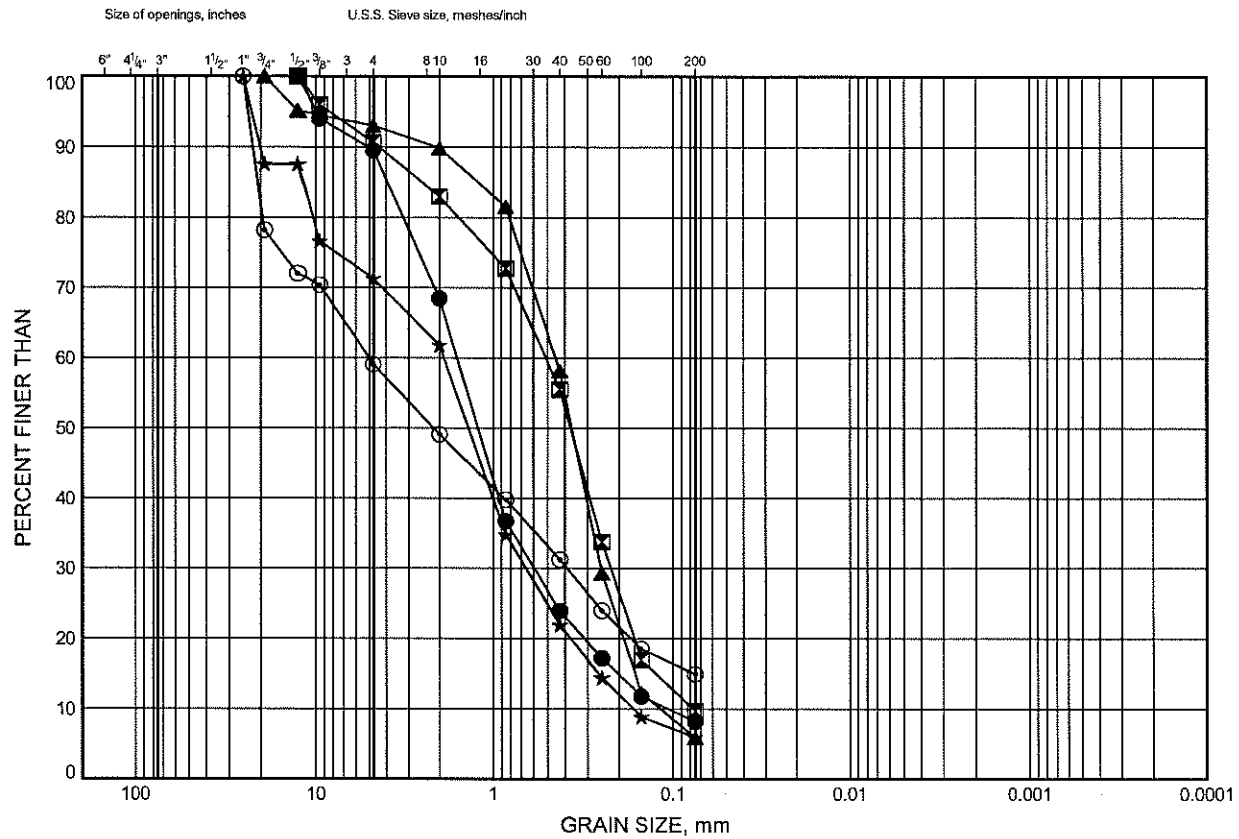
Prep'd MFA

Chkd. AEG

Rapid River GRAIN SIZE DISTRIBUTION

FIGURE B4

SAND AND GRAVEL



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	07-RR15	4.61	315.25
⊠	07-RR16	3.19	317.93
▲	07-RR16	6.40	314.72
★	07-RR16	9.33	311.79
⊙	07-RR18	2.59	318.53

Date January 2008
Project 5321-04-00

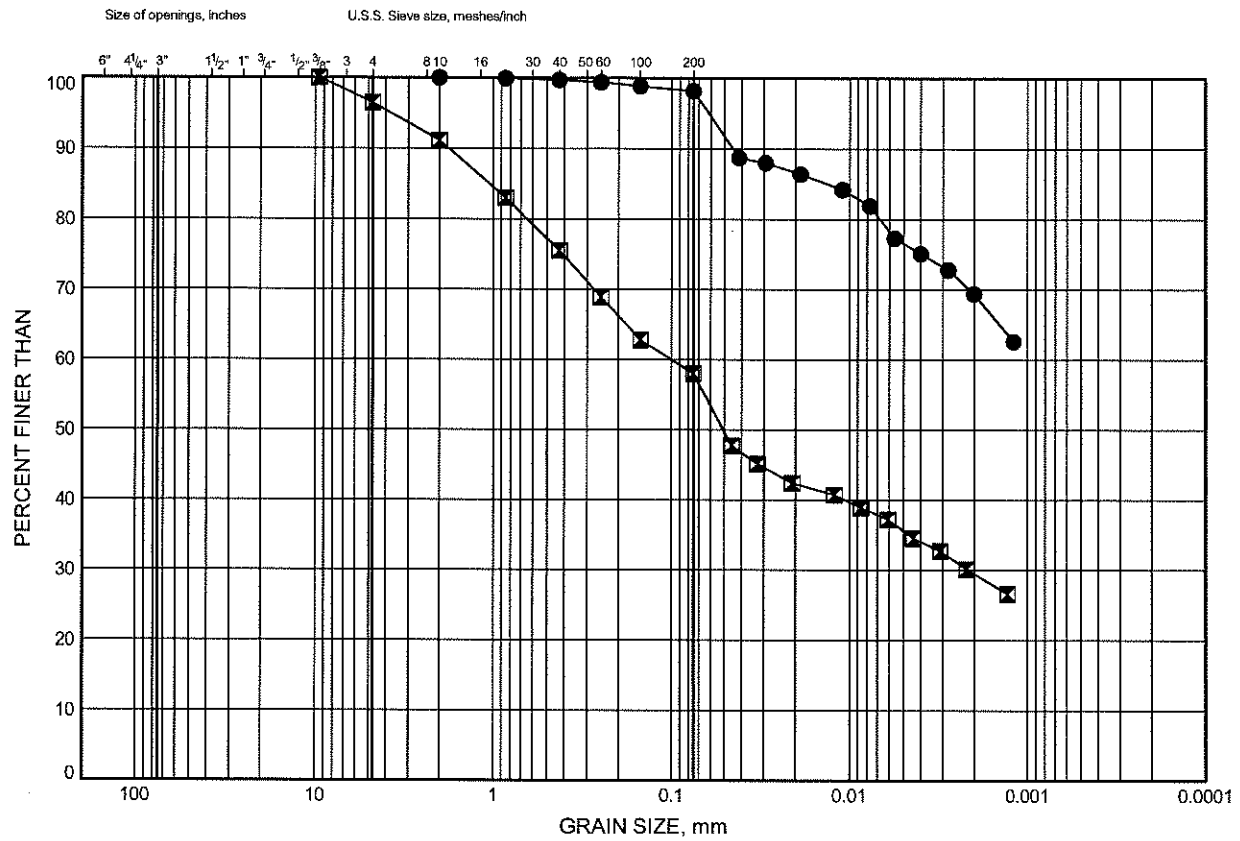


Prep'd MFA
Chkd. AEG

Rapid River GRAIN SIZE DISTRIBUTION

FIGURE B5

CLAY



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	07-RR15	3.19	316.67
◻	07-RR17	3.26	317.08

Date November 2007
Project 5321-04-00

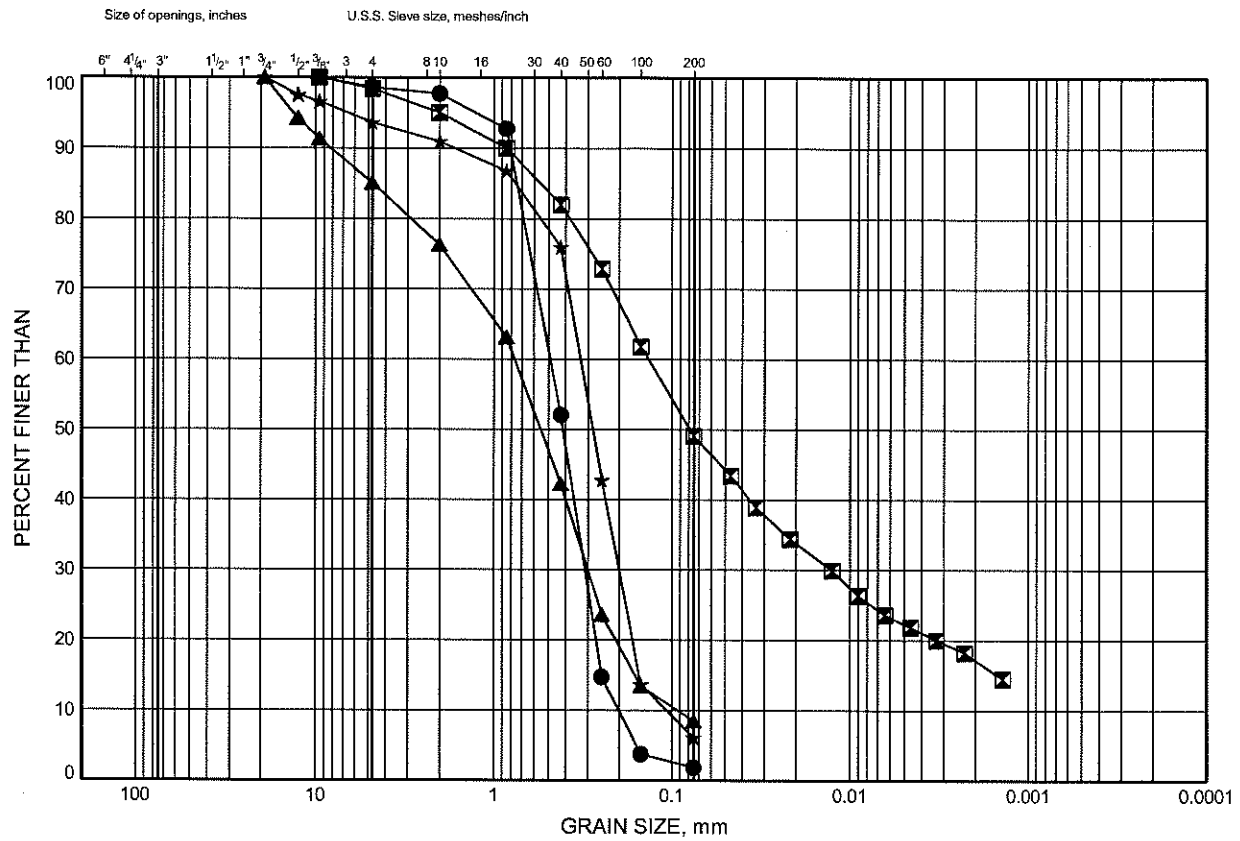


Prep'd MFA
Chkd. AEG

Rapid River GRAIN SIZE DISTRIBUTION

FIGURE B6

SAND



Appendix C

Factual Information from the Dominion Soil Investigation Inc. Report

DOMINION SOIL INVESTIGATION INC. RECORD OF BOREHOLE No 1

WP 14-74-07

DIST 18 HWY 129

DATUM Geodetic

LOCATION Station 259 + 90.5' LT. E Line 'H'

BORING DATE June 5 and 6, 1977

BOREHOLE TYPE Augering and Washboring (N-size)

ORIGINATED BY N. McC.

COMPILED BY I.R.

CHECKED BY I.P.L.

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT — W _L PLASTIC LIMIT — W _P WATER CONTENT — W			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N° VALUES		20	40	60	80	100	W _P	W	W _L		
1049.3	Ground Surface															
0																
1047.3	Loose Boulders with Peat Filler															GR SA SI CL
2.0																Hole Caved- in at El. 1048. after casing withdrawn
	Very Dense Sand and Gravel with numerous Boulders and a trace to some Silt		1	SS	75	9"										
			2	SS	50	3"										
			3	SS	105											
			4	SS	98	1040 9"										12, 23, 5- 40, 42, 18-
			5	SS	100	4"										augering washboring
			6	SS	100	7"										drilling with NX casing & tri-cone
						1030										
	cemented		7	SS	82											45, 43, 12-
			8	SS	165	10"										35, 52, 13-
						1020										
1018.8			9	SS	127	5"										30, 52, 18-
30.5	END OF BOREHOLE															

[illegible]

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

DOMINION SOIL INVESTIGATION LIMITED GRAIN SIZE DISTRIBUTION

OUR REFERENCE NO. 77-5-16

UNIFIED SOIL CLASSIFICATION SYSTEM

SILT & CLAY

FINE

SAND

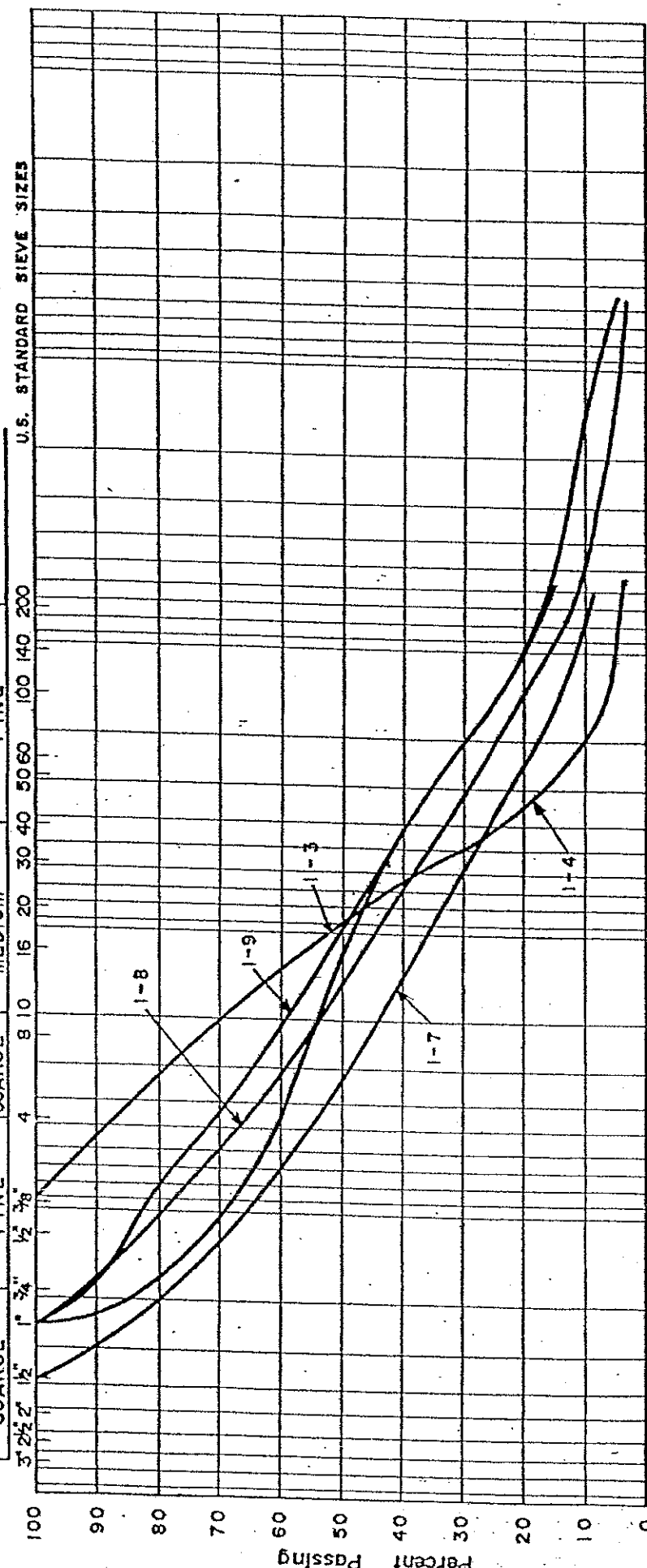
MEDIUM

COARSE

GRAVEL

COARSE

GRAVEL



ENCLOSURE NO. 3

PLASTIC PROPERTIES

LIQUID LIMIT % = N/A

PLASTIC LIMIT % =

PLASTICITY INDEX % =

MOISTURE CONTENT % =

PROJECT: BRIDGE OVER RAPID RIVER.
LOCATION: HWY. 129.
BOREHOLE NO: 1 1 1 1 1 1
SAMPLE NO: 3 4 7 8 9
DEPTH: 8.5' 11' 21' 25' 30'
ELEVATION: 1041' 1038' 1028' 1024' 1019'

Classification of Sample and Group Symbol:

SAND & GRAVEL

with a trace to some silt.

DOMINION SOIL INVESTIGATION LIMITED GRAIN SIZE DISTRIBUTION

OUR REFERENCE NO. 77-5-16

UNIFIED SOIL CLASSIFICATION SYSTEM

SILT & CLAY

FINE

SAND

COARSE

FINE

COARSE

GRAVEL

COARSE

U.S. STANDARD SIEVE SIZES

200

140

100

60

40

30

20

16

10

8

4

2

1

3/4"

1/2"

3/8"

2"

4"

10"

20"

40"

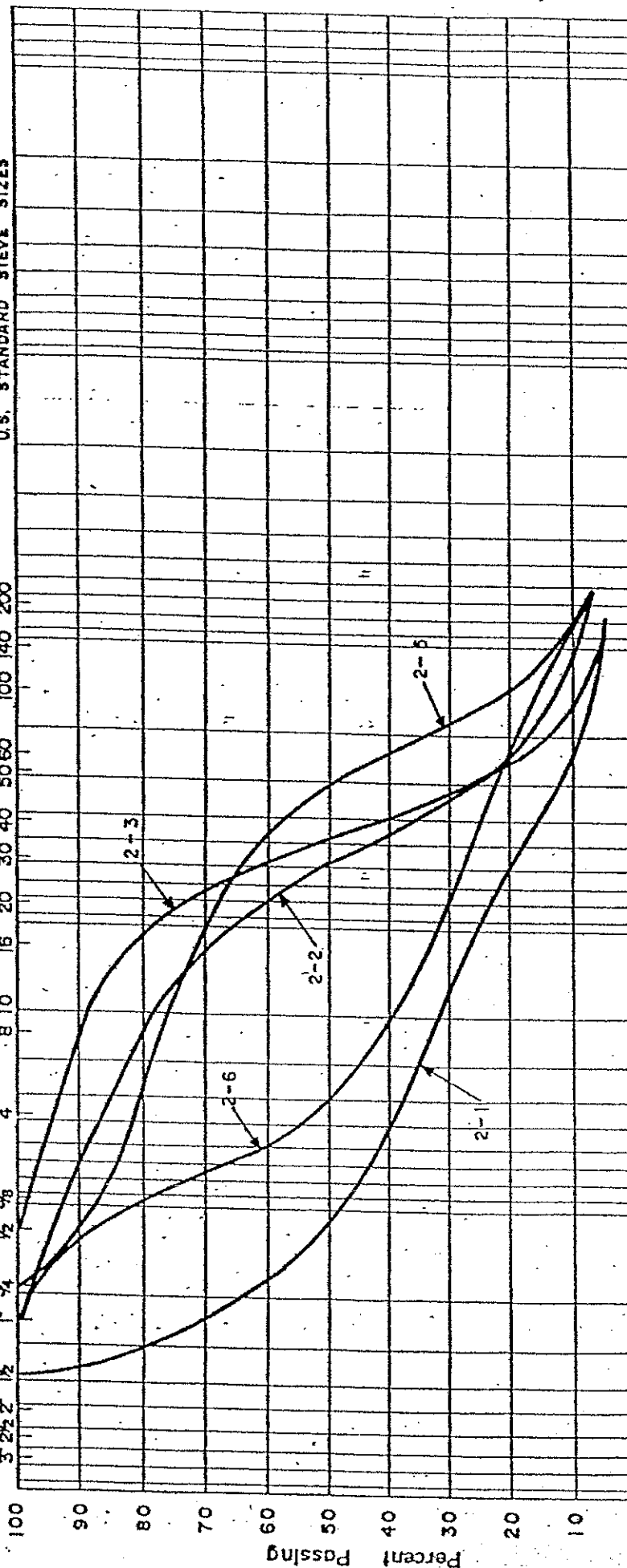
80"

160"

320"

640"

1280"



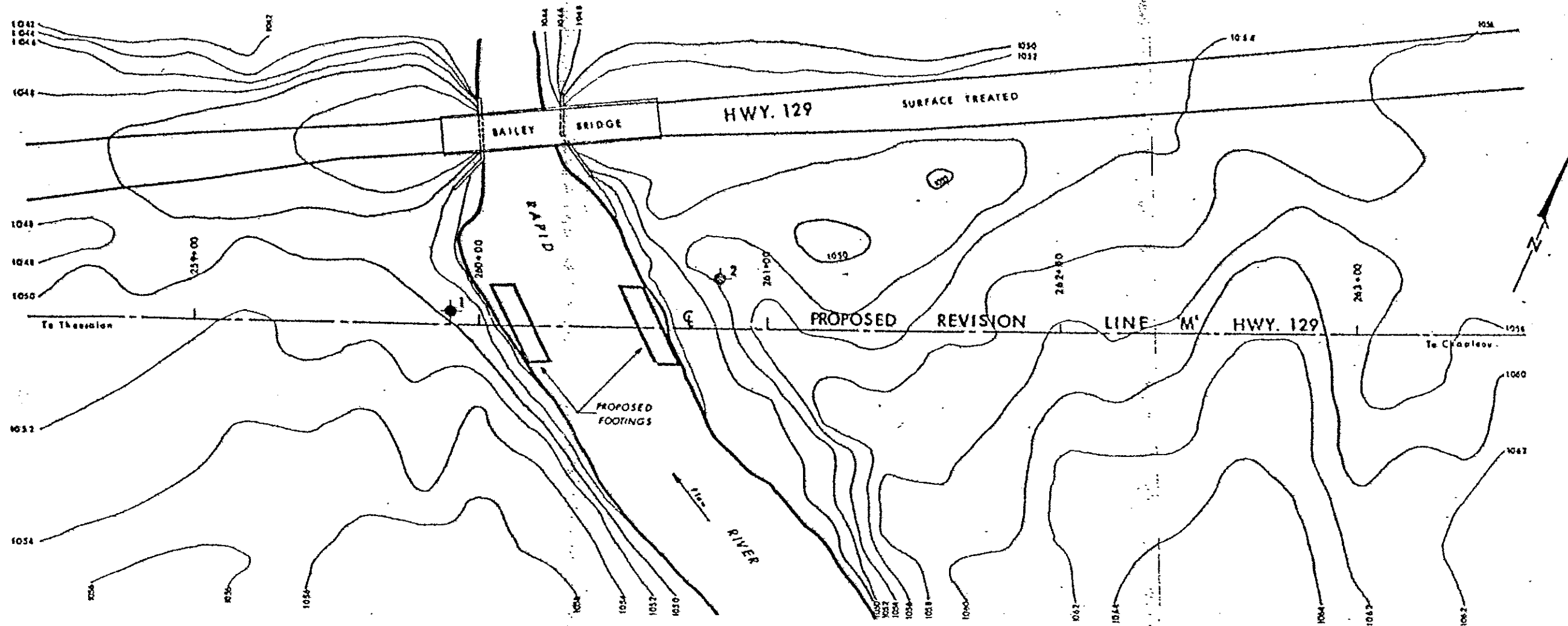
ENCLOSURE No. 4

PLASTIC PROPERTIES
LIQUID LIMIT % N/A
PLASTIC LIMIT %
PLASTICITY INDEX %
MOISTURE CONTENT %

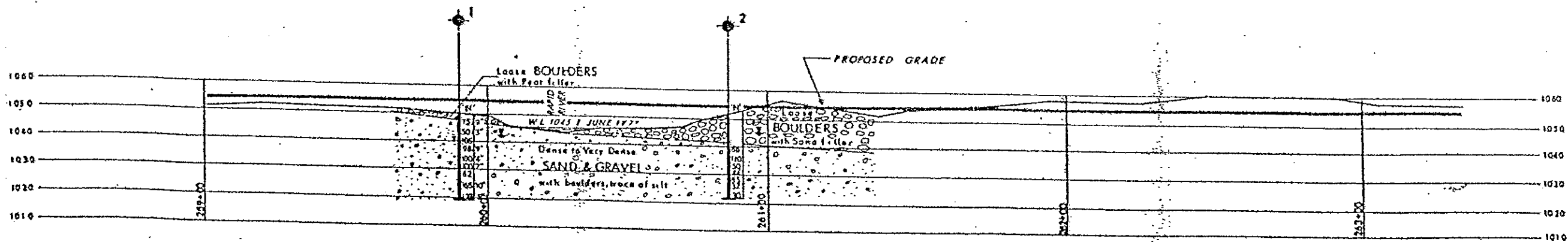
PROJECT: BRIDGE OVER RAPID RIVER.
LOCATION: HWY. 129.
BOREHOLE NO: 2
SAMPLE NO: 1
DEPTH: 125'
ELEVATION: 1040'

COEFFICIENT OF UNIFORMITY: 4-75
COEFFICIENT OF CURVATURE:
DEPTH: 125'
ELEVATION: 1040'

Classification of Sample and Group Symbol:
SAND & GRAVEL
with a trace to some silt.



PLAN
SCALE
20 10 0 20 40 FT.



PROFILE LINE 'M'
SCALE
20 10 0 20 40 FT.

CONT No
WP No 14-74-07

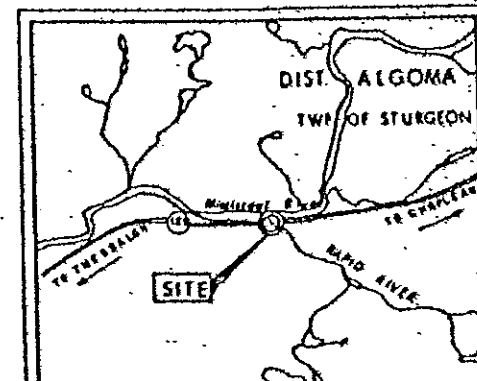
RAPID RIVER

BORE HOLE LOCATIONS & SOIL STRATA



SHEET

DOMINION SOIL INVESTIGATION INC.



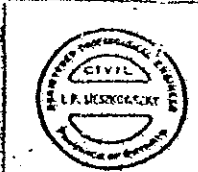
LEGEND

- ◆ Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- W Blows/ft (Std Pen Test 350 ft lb energy)
- CONE Blows/ft (60° Cone, 350 ft lb energy)
- W WL at time of investigation June 1977

No	ELEVATION	STATION	OFFSET
1	1049.3	259+90	5' LT.
2	1052.4	260+84	1' LT.

NOTE

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



REVISIONS	DATE	BY	DESCRIPTION

GEOLOGICAL # 415-58

HWY. No. 129 LINE 'M' REVISION: 1015-18
 SUBORD. EPI. CHECKED: DATE: JUNE 12, 1977 SITE: 385-1
 DRAWN: F.L. CHECKED: DATE: JUNE 12, 1977 SITE: 385-1

Appendix D

Site Photographs

Rapid River Bridge Replacement
Highway 129, Algoma



Photo 1. Looking south from Rapid River Bridge.



Photo 2. Looking north from Rapid River Bridge. Lost Lumber Road on right just below signs at start of guiderail.

Rapid River Bridge Replacement
Highway 129, Algoma



Photo 3. Existing Rapid River Bridge from the northwest. Old south abutment at right.



Photo 4. Old north abutment from earlier bridge west of existing bridge.

Rapid River Bridge Replacement
Highway 129, Algoma

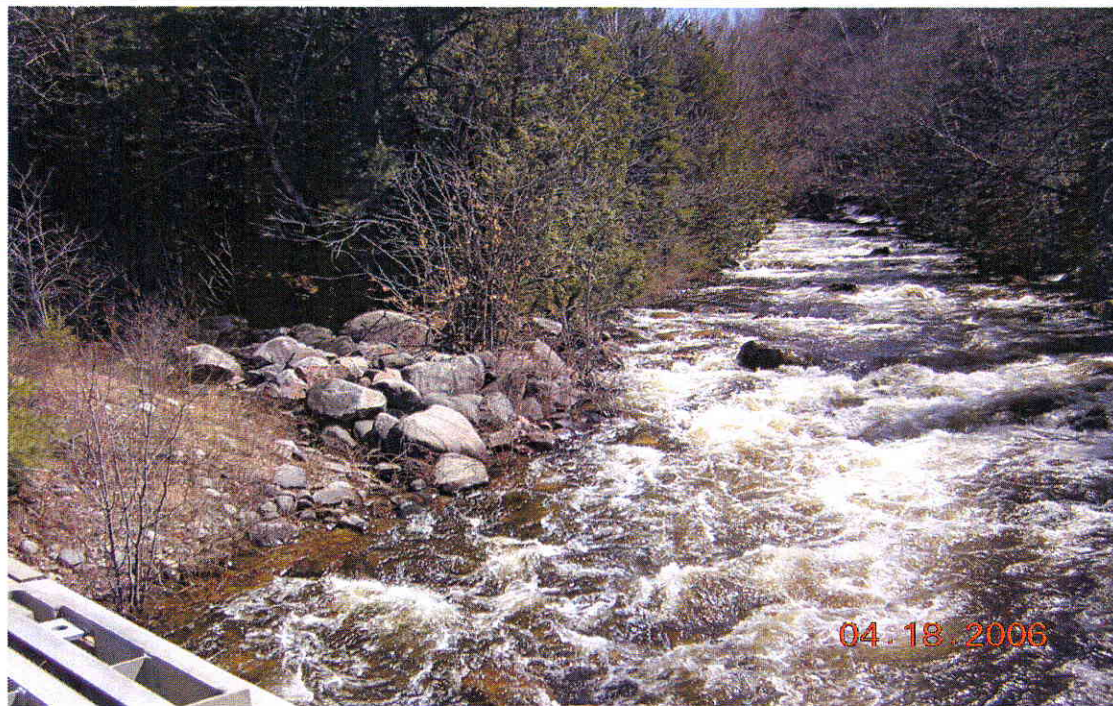


Photo 5. Rapid River upstream, to the east, of the existing bridge.



Photo 6. Soil exposure immediately north of the bridge site, east side of Hwy 129.

Appendix E

Drawings

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

CONT No 512-00-00
GWP No



SHEET

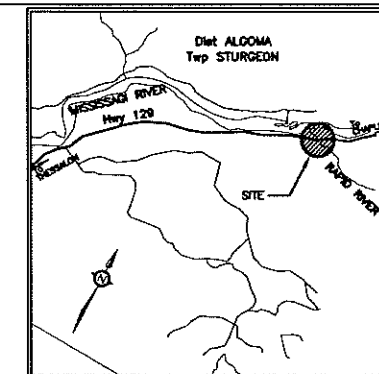
RAPID RIVER
 BRIDGE REPLACEMENT
 BOREHOLE LOCATION PLAN








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KEYPLAN
LEGEND

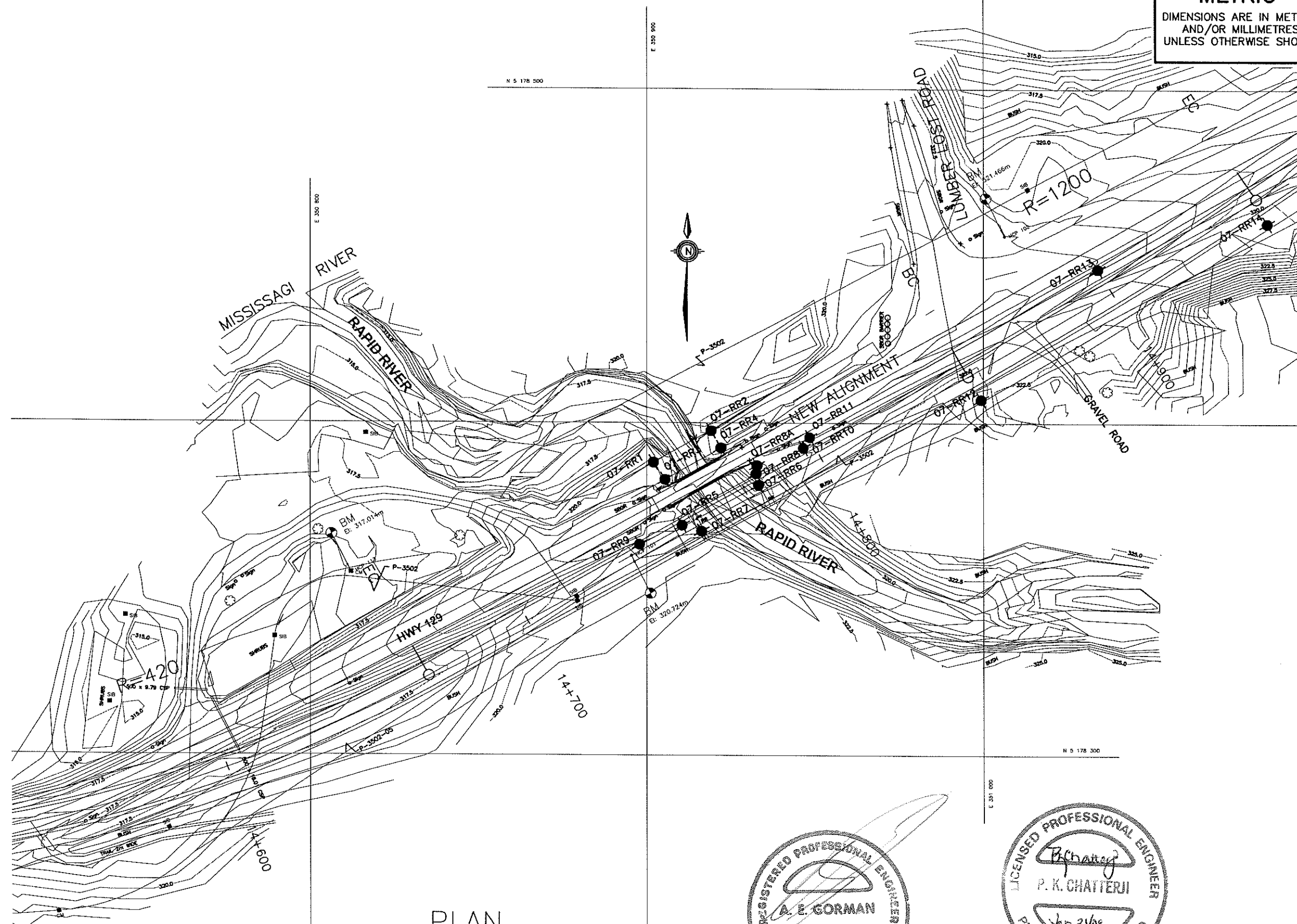
- | | |
|---|---------------------------------------|
|  | Borehole |
|  | Borehole and Cone |
| N | Blows /0.3m (Std Pen Test, 475J/blow) |
| CONE | Blows /0.3m (60° Cone, 475J/blow) |
| PH | Pressure, Hydraulic |
|  | Water Level |
|  | Head Artesian Water |
|  | Piezometer |
| 90% | Rock Quality Designation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

NO	ELEVATION	NORTHING	EASTING
07-RR1	320.51	5 178 388.1	350 902.0
07-RR2	320.36	5 178 397.6	350 919.2
07-RR3	320.44	5 178 383.0	350 905.5
07-RR4	320.74	5 178 392.5	350 922.1
07-RR5	320.60	5 178 369.2	350 910.6
07-RR6	320.30	5 178 381.3	350 933.0
07-RR7	319.86	5 178 367.5	350 916.5
07-RR8	321.12	5 178 387.2	350 932.6
07-RR8A	321.03	5 178 384.8	350 932.3
07-RR9	320.34	5 178 363.5	350 897.8
07-RR10	321.12	5 178 392.5	350 946.4
07-RR11	321.50	5 178 395.7	350 948.3
07-RR12	322.40	5 178 407.1	350 999.3
07-RR13	321.30	5 178 446.3	351 034.2
07-RR14	320.20	5 178 460.1	351 084.9


-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. 41J-74

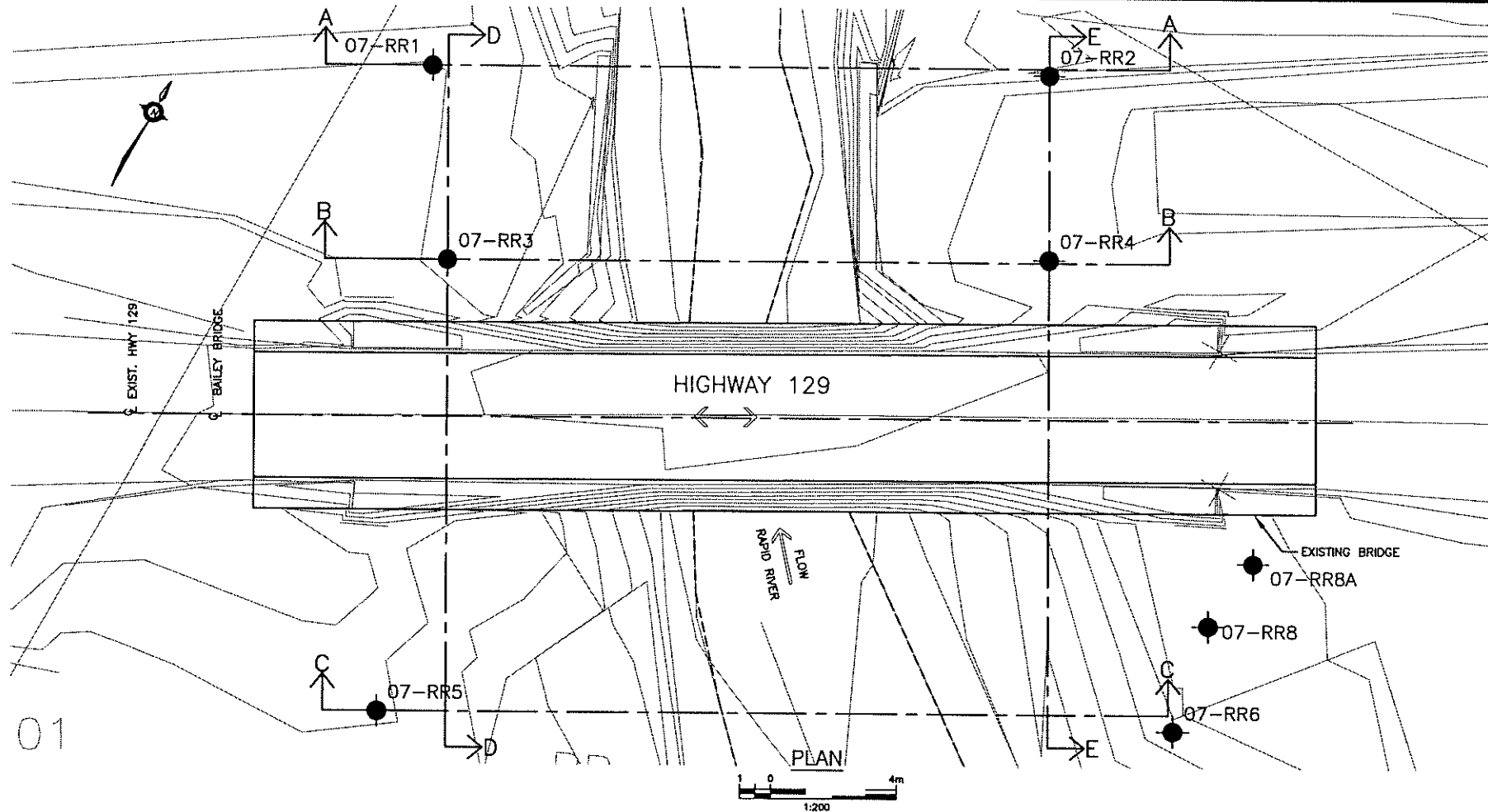


PLAN

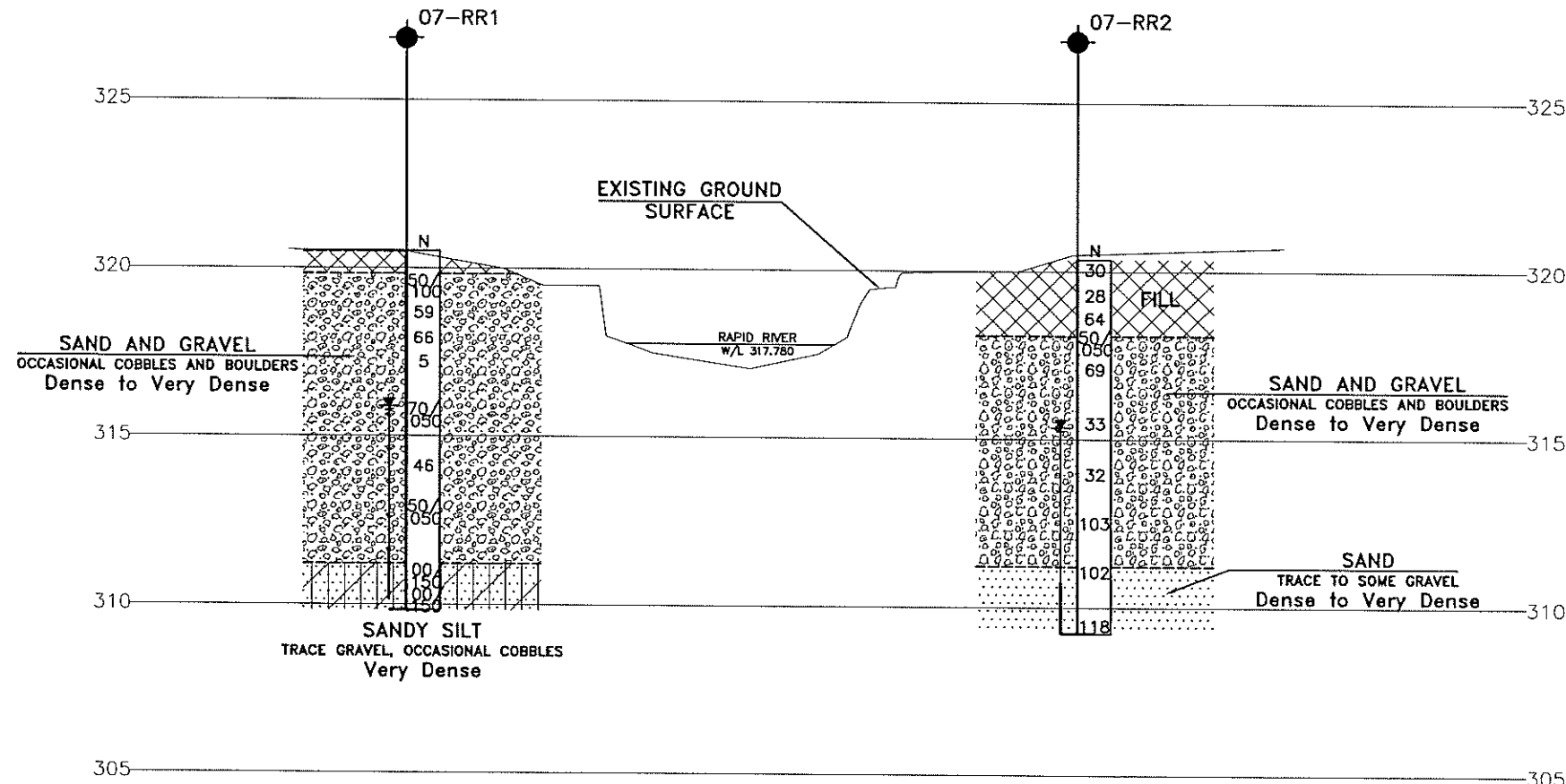


DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS							
	DATE	BY					DESCRIPTION
DESIGN	AEG	CHK	PKC	CODE	LOAD	DATE	APR 2007
DRAWN	MEFA	CHK	PKC	SUE	ISTRUCT	LDWG.	



01



PROFILE A-A
1:200



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

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

CONT No
GWP No.5321-04-00

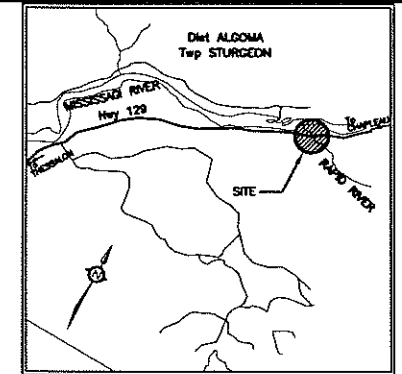
RAPID RIVER
BRIDGE REPLACEMENT
BOREHOLE LOCATION PLAN AND SOIL
STRATA



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

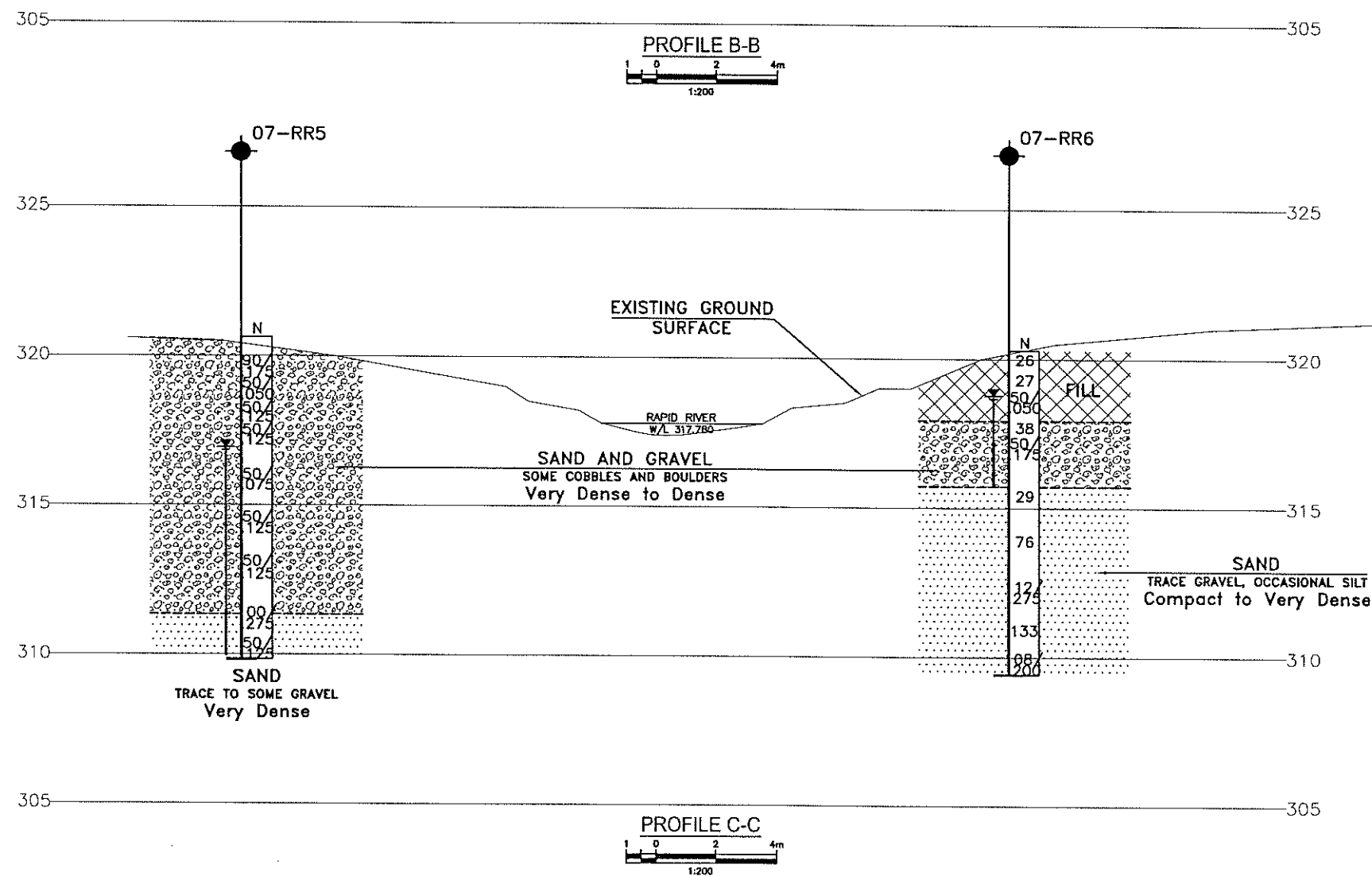
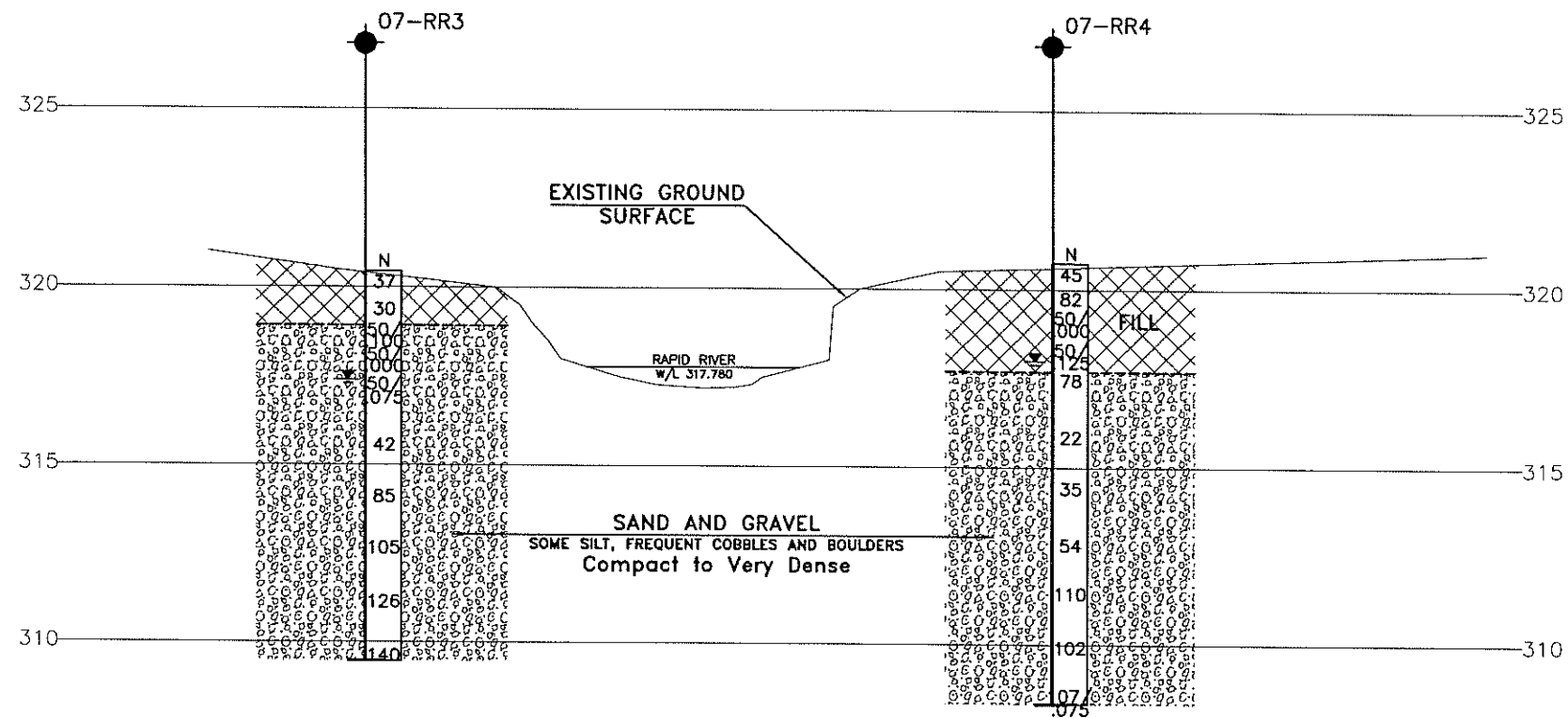
NO	ELEVATION	NORTHING	EASTING
07-RR1	320.51	5 178 388.1	350 902.0
07-RR2	320.36	5 178 397.6	350 919.2
07-RR3	320.44	5 178 383.0	350 905.5
07-RR4	320.74	5 178 392.5	350 922.1
07-RR5	320.60	5 178 369.2	350 910.6
07-RR6	320.30	5 178 381.3	350 933.0
07-RR7	319.86	5 178 367.5	350 916.5
07-RR8	321.12	5 178 387.2	350 932.6
07-RR8A	321.03	5 178 384.8	350 932.3
07-RR9	320.34	5 178 363.5	350 897.8
07-RR10	321.12	5 178 392.5	350 946.4

-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. 41J-74

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	AEG	CHK PKC	CODE
DRAWN	MFA	CHK PKC	SITE 385-013 STRUCT DWG
			LOAD
			DATE MAR 2007



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

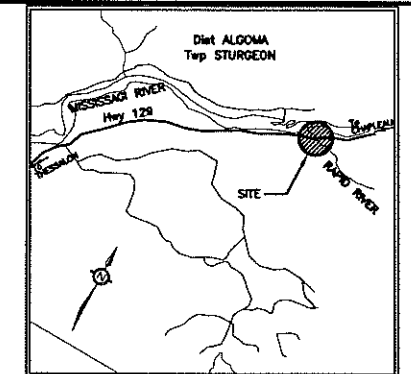
CONT No
 GWP No.5321-04-00

RAPID RIVER
 BRIDGE REPLACEMENT
 BOREHOLE LOCATION PLAN 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
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
07-RR1	320.51	5 178 388.1	350 902.0
07-RR2	320.36	5 178 397.6	350 919.2
07-RR3	320.44	5 178 383.0	350 905.5
07-RR4	320.74	5 178 392.5	350 922.1
07-RR5	320.60	5 178 369.2	350 910.6
07-RR6	320.30	5 178 381.3	350 933.0
07-RR7	319.86	5 178 367.5	350 916.5
07-RR8	321.12	5 178 387.2	350 932.6
07-RR8A	321.03	5 178 384.8	350 932.3
07-RR9	320.34	5 178 363.5	350 897.8
07-RR10	321.12	5 178 392.5	350 946.4

-NOTES-

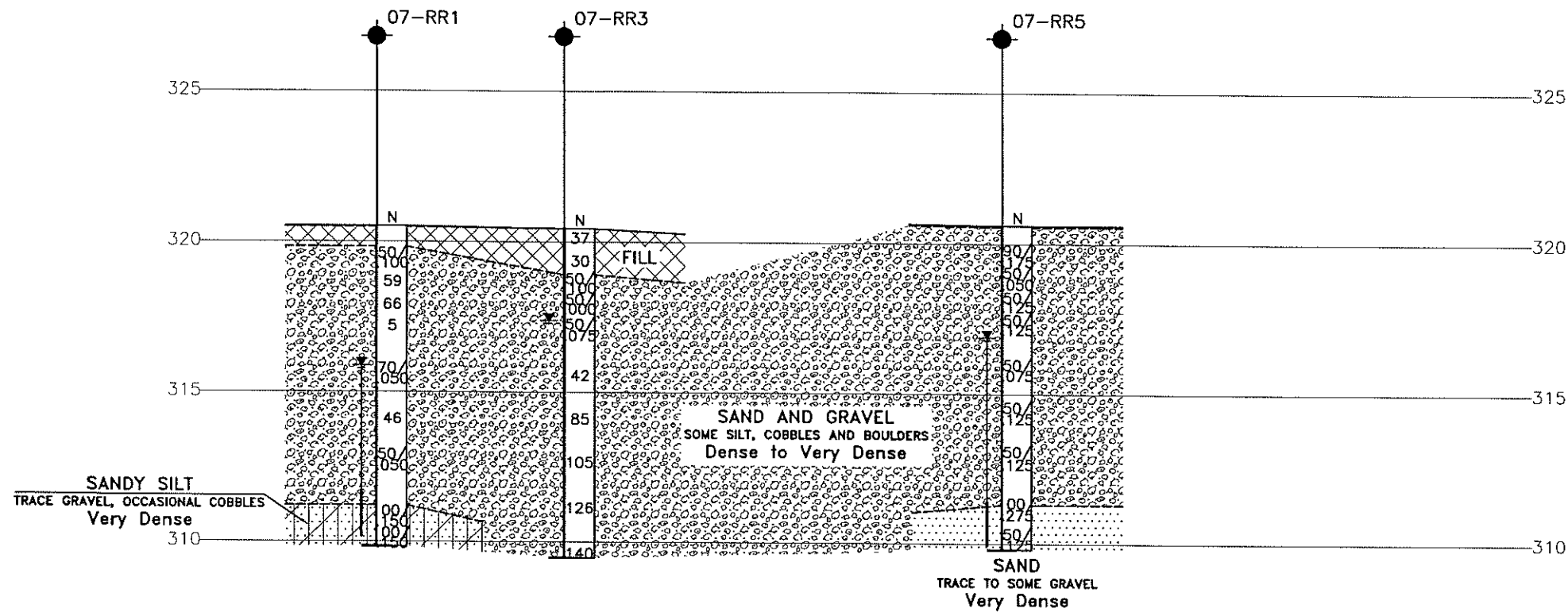
- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCRES No. 41J-74

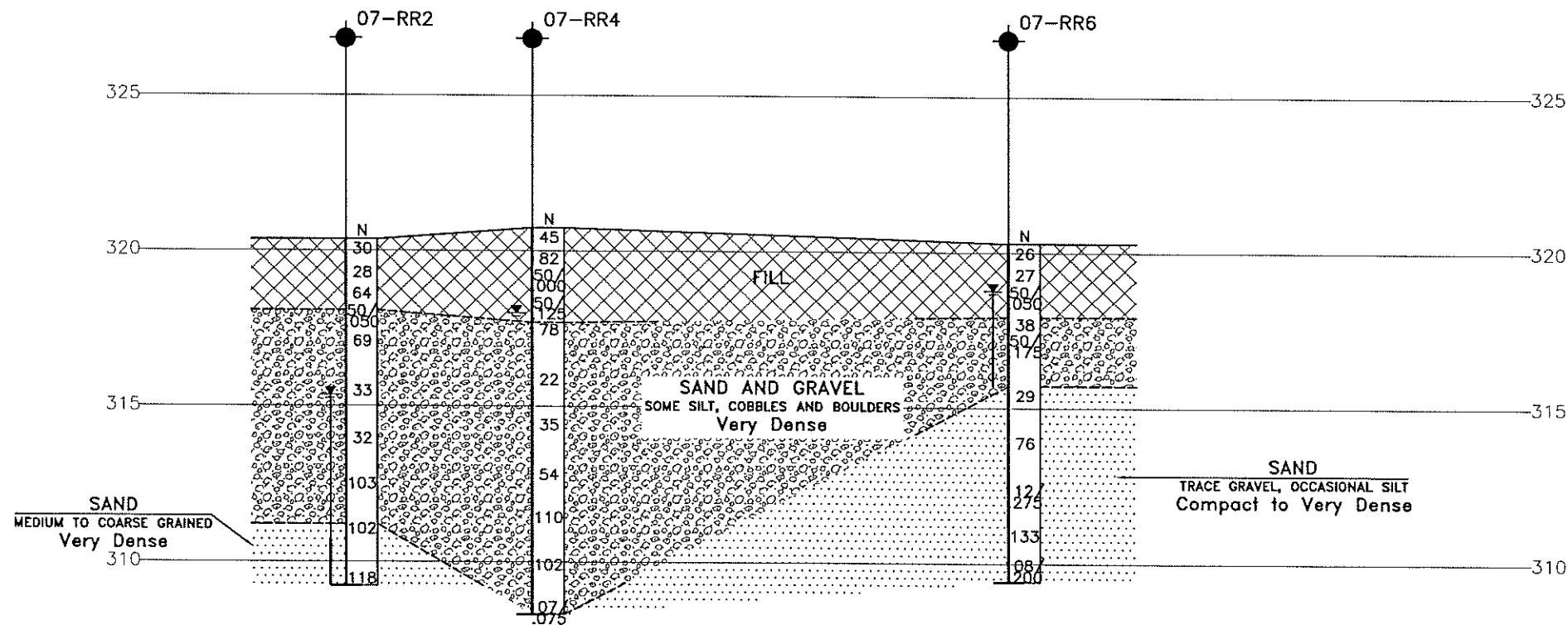


DRAWING NOT TO BE SCALED
 100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION	DATE	MAR 2007
DESIGN	AEG	CHK PKG	CODE	LOAD	
DRAWN	MFA	CHK PKG	SITE 385-013	STRUCT	DWG



SECTION D-D
 1 0 2 4m
 1:200



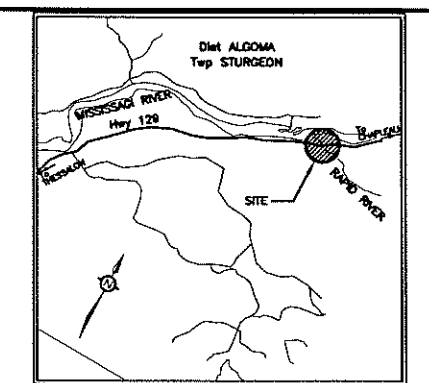
SECTION E-E
 1 0 2 4m
 1:200

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

CONT No
 GWP No.5321-04-00
 RAPID RIVER
 BRIDGE REPLACEMENT
 BOREHOLE LOCATION PLAN AND SOIL
 STRATA
 SHEET

Marshall Macklin Monaghan
 PROJECT MANAGERS • ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.
 GEOTECHNICAL • ENVIRONMENTAL • MATERIALS



KEYPLAN

LEGEND

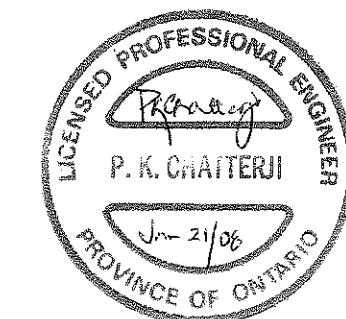
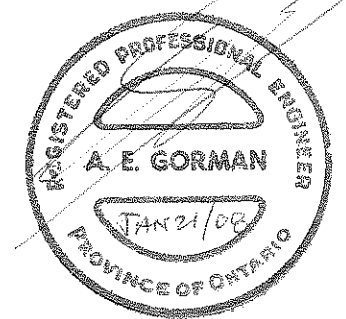
- ◆ Borehole
- ◆ Borehole and Cone
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- Water Level
- Head Artesian Water
- Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
07-RR1	320.51	5 178 388.1	350 902.0
07-RR2	320.36	5 178 397.6	350 919.2
07-RR3	320.44	5 178 383.0	350 905.5
07-RR4	320.74	5 178 392.5	350 922.1
07-RR5	320.60	5 178 369.2	350 910.6
07-RR6	320.30	5 178 381.3	350 933.0
07-RR7	319.86	5 178 367.5	350 916.5
07-RR8	321.12	5 178 387.2	350 932.6
07-RR8A	321.03	5 178 384.8	350 932.3
07-RR9	320.34	5 178 363.5	350 897.8
07-RR10	321.12	5 178 392.5	350 946.4

-NOTES-

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GEOCRES No. 41J-74



DRAWING NOT TO BE SCALED
 100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	AEG	CHK PKC	CODE
DRAWN	MFA	CHK PKC	SITE 385-013
			STRUCT
			DWG
			DATE MAR 2007