

**FOUNDATION INVESTIGATION REPORT
HARRIS RIVER BRIDGE, NBL
HIGHWAY 69 FOUR-LANING
FROM THE SOUTH JUNCTION OF HIGHWAY 529,
NORTHERLY 15 KM**

W.P. 5200-06-01, G.W.P. 5294-08-00, SITE No. 44-162/1

Geocres Number: 41H-86

Report to

MMM Group Limited

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

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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 proposed bridge carrying Highway 69 Northbound lanes (NBL) over Harris River in the Township of Wallbridge, Ontario. The proposed bridge is part of the four-laning of Highway 69 from the south junction of Highway 69 and Highway 529 northerly for 15 km.

The purpose of this investigation was to explore the subsurface conditions at the site and, based on the data obtained, to provide a borehole location plan, records of boreholes, stratigraphic profile and cross-sections, laboratory test results and written descriptions 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 MMM Group Limited (MMM), under the Ministry of Transportation Ontario (MTO) Agreement Number 5006-E-0030.

In the preparation of this report and in addition to the boreholes drilled, general reference has been made to information on subsurface conditions contained in a previous foundation report within the area. The title of this report is listed as follows:

1. Preliminary Foundation Investigation and Design Report for Selected Structures, Highway 69 Route Selection Study, 3.5 km North of Highway 559 to 3.8 km North of Highway 522, GWP 5377-02-00, Highway 69, prepared by Trow Associates Inc., dated September 12, 2005, GEOCREs No: 41H-50.

A record of borehole sheet from the previous report is attached in Appendix C for reference.

2 SITE DESCRIPTION

The site of the proposed structure lies immediately east of the existing concrete arch structure that carries Highway 69 over Harris River in the Township of Wallbridge, Ontario.

At the location of the proposed Harris River Bridge NBL, the river channel width varies between 12.0 m to 20.0 m and water flows westerly. The water level in the river was measured at Elevation 179.25 in September 2008.

The south valley slope is approximately 10.5 m high and the inclination varies from approximately 3H:1V above mid-height to 1.6H:1V below mid-height. The north valley slope is approximately 7.5 m high and the inclination is approximately 3H:1V. The slopes are well treed, with grass and shrubs along the river banks and in the open areas. The river bed and banks are lined with boulders.

The lands surrounding the site are generally undeveloped, forested and contain open swamps. Bedrock outcroppings, ridges and small creeks/water bodies are visible along the existing Highway 69 corridor.

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

The site lies within the physiographic region known as the Georgian Bay Fringe, which covers Parry Sound and Muskoka. The region is characterized by very shallow overburden and bare rock knobs and ridges. Bedrock is exposed in many areas and intermittent swamps were filled in when glacial lake Algonquin inundated the area. The overburden materials consist of sand, silt and clay. Recent organic deposits of peat and muck occur in abundance in the bedrock hollows and valleys.

The area is underlain by strongly foliated and highly to moderately deformed rocks of Precambrian age of the following types:

- Gneisses of metasedimentary origin.
- Migmatitic rocks and gneisses.
- Felsic igneous rocks (tonalite, granodiorite, monzonite, granite, syenite, derived gneisses).
- Tectonite unit (tectonites, various gneisses).

3 SITE INVESTIGATION AND FIELD TESTING

The site investigation and field testing for this project was carried out in two phases. The first phase was carried out from October 20 to 26 and November 16 to 19, 2009 and the second phase was carried out in May, 2010.

Phase 1 consisted of drilling, conducting manual excavation and sampling a total of 34 boreholes (numbered HRB09-01 to HRB09-34) at the proposed foundation elements (abutments and piers) and approaches of the proposed Harris River NBL structure. Phase 2 consisted of drilling and sampling 20 additional boreholes (identified as HRB10-1 to 8, 11, and 12, and BH10-A to J) at the proposed foundation elements. The locations of Boreholes BH10-A to J were selected based on the proposed Option 3 Single Span General Arrangement.

Borehole advancement within the overburden generally ranged from 0.2 m to 7.5 m where the drill rig encountered refusal. The overburden in Boreholes HRB10-07, 08, 11, and 12 was not logged or sampled. Bedrock outcrops and very shallow bedrock (less than 0.1 m depth) were noted at the locations of Boreholes HRB09-25, HRB09-26, and HRB09-28. At these three boreholes, visual assessment and manual excavation were conducted to assess the thickness of the overburden. Thirteen boreholes from Phase 1 and all 20 boreholes from Phase 2 were advanced 3.0 m to 3.9 m into bedrock by NQ size diamond coring. The boreholes drilled during Phase 1 were also supplemented by six dynamic cone penetration tests (DCPT), numbered HRB-D1 to HRB-D6, conducted in close proximity to the boreholes.

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

The Record of Borehole sheet for Borehole HRN-1 drilled during the previous investigation (Reference 1) and the associated laboratory test results are included in Appendix C.

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

Phase 1 drilling was carried out using a track mounted CME 55 drill rig where the locations were accessible. Where a track mounted rig could not be used, portable drilling and coring equipment consisting of a Hilti DD-250 was used. All of the Phase 2 boreholes were drilled using portable drilling and coring equipment. A combination of hollow-stem auger drilling techniques and rotary coring methods were used to advance the boreholes. Overburden samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT).

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

All rock cores were logged, and the Total Core Recovery (TCR), Rock Quality Designation (RQD) and the Fracture Indices (FI) were determined.

Groundwater conditions in the open boreholes were observed throughout the drilling operations. Four standpipe piezometers consisting of 19 mm PVC pipe with slotted screens 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.

Table 3.1 – Borehole Completion Details

Foundation Unit	Borehole	Piezometer Tip Depth/ Elevation (m)	Completion Details
NBL STRUCTURE			
South Approach	HRB09-33	None installed	Borehole backfilled with bentonite holeplug to 2.9 m then auger cuttings to surface.
South Abutment Area	HRB09-01	None installed	Borehole backfilled with holeplug to 2.4 m then auger cuttings to surface.
	HRB09-02	None installed	Borehole backfilled with holeplug to 4.3 m then auger cuttings to surface.
	HRB09-03	None installed	Borehole backfilled with holeplug to 4.1 m then auger cuttings to surface.
	HRB09-04	10.7/179.4	Sand from 10.7 m to 7.3 m, holeplug from 7.3 m to 3.7 m, then auger cuttings to surface.
	HRB09-05	None installed	Borehole backfilled with holeplug to 3.5 m then auger cuttings to surface.
	HRB09-06	None installed	Borehole backfilled with holeplug to 3.9 m then auger cuttings to surface.
	HRB09-07	None installed	Borehole backfilled with holeplug to 4.3 m then auger cuttings to surface.
	HRB09-08	None installed	Borehole backfilled with holeplug to 2.4 m then auger cuttings to surface.
	BH10-A	None installed	Borehole backfilled with holeplug to 3.1 m then drill cuttings to surface.
	BH10-B	None installed	Borehole backfilled with holeplug to surface.
	BH10-C	None installed	Borehole backfilled with holeplug to surface.
	BH10-D	None installed	Borehole backfilled with holeplug to surface.
South River Bank	HRB09-09	None installed	Borehole backfilled with holeplug to surface.
	HRB09-10	None installed	Borehole backfilled with holeplug to 1.5 m then sand to surface.
	HRB09-11	None installed	Borehole backfilled with holeplug to surface.
	HRB09-12	None installed	Borehole backfilled with holeplug to 1.8 m then sand to surface.
	HRB09-13	None installed	Borehole backfilled with holeplug to surface.
	HRB09-14	None installed	Borehole backfilled with holeplug to surface.
	HRB09-15	3.7/180.3	Sand from 3.7 m to 2.0 m, holeplug from 2.0 m to surface.
	HRB09-16	None installed	Borehole backfilled with sand to surface.

Table 3.1 – Borehole Completion Details (Cont'd)

Foundation Unit	Borehole	Piezometer Tip Depth/ Elevation (m)	Completion Details
NBL STRUCTURE			
South River Bank	HRB10-1	None installed	Borehole backfilled with holeplug to surface.
	HRB10-2	None installed	Borehole backfilled with holeplug to surface.
	HRB10-3	None installed	Borehole backfilled with holeplug to surface.
	HRB10-4	None installed	Borehole backfilled with holeplug to surface.
	HRB10-5	None installed	Borehole backfilled with holeplug to surface.
	HRB10-6	None installed	Borehole backfilled with holeplug to surface.
North River Bank	HRB09-17	None installed	Borehole backfilled with holeplug to 1.8 m then auger cuttings to surface.
	HRB09-18	None installed	Borehole backfilled with holeplug to 3.8 m then auger cuttings to surface.
	HRB09-19	None installed	Borehole backfilled with holeplug to 5.5 m then auger cuttings to surface.
	HRB09-20	None installed	Borehole backfilled with holeplug to 2.1 m then auger cuttings to surface.
	HRB09-21	8.1/173.4	Sand from 8.1 m to 4.0 m, holeplug from 4.0 m to 2.4 m, then auger cuttings to surface.
	HRB09-22	None installed	Borehole backfilled with holeplug to 3.0 m then auger cuttings to surface.
	HRB09-23	None installed	Borehole backfilled with holeplug to 1.2 m then auger cuttings to surface.
	HRB09-24	None installed	Borehole backfilled with holeplug to 3.4 m then auger cuttings to surface.
	HRB10-7	None installed	Borehole backfilled with holeplug to surface.
	HRB10-8	None installed	Borehole backfilled with holeplug to surface.
	HRB10-11	None installed	Borehole backfilled with holeplug to surface.
	HRB10-12	None installed	Borehole backfilled with holeplug to 1.8 m then sand to surface.

Table 3.1 – Borehole Completion Details (Cont'd)

Foundation Unit	Borehole	Piezometer Tip Depth/ Elevation (m)	Completion Details
NBL STRUCTURE			
North Abutment Area	HRB09-25	None installed	Manual excavation. Very shallow bedrock.
	HRB09-26	None installed	Manual excavation. Very shallow bedrock.
	HRB09-27	4.0/183.3	Sand from 4.0 m to 0.8 m, then auger cuttings to surface.
	HRB09-28	None installed	Manual excavation. Very shallow bedrock.
	HRB09-29	None installed	Borehole backfilled with holeplug to 2.7 m then auger cuttings to surface.
	HRB09-30	None installed	Borehole backfilled with holeplug to surface.
	HRB09-31	None installed	Borehole backfilled with holeplug to surface.
	HRB09-32	None installed	Borehole backfilled with holeplug to surface.
	BH10-E	None installed	Borehole backfilled with holeplug to surface.
	BH10-F	None installed	Borehole backfilled with holeplug to surface.
	BH10-G	None installed	Borehole backfilled with holeplug to surface.
	BH10-H	None installed	Borehole backfilled with holeplug to 0.6 m then sand to surface.
	BH10-I	None installed	Borehole backfilled with holeplug to surface.
	BH10-J	None installed	Borehole backfilled with holeplug to 0.6 m then sand to surface.
North Approach	HRB09-34	None installed	Borehole backfilled with holeplug to surface.

4 LABORATORY TESTING

All recovered soil samples were subjected to Visual Identification (VI) and rock samples to geological logging. Selected samples were also subjected to grain size distribution analyses (sieve and hydrometer) and Atterberg Limits testing where appropriate. Moisture content determinations were carried out on all soil samples. The results of this testing program are summarized on the Record of Borehole sheets in Appendix A and on the figures presented in Appendix B.

Point load tests were carried out in the laboratory on selected samples of intact bedrock to assist in evaluation of the compressive strength of the bedrock. The results of the point load tests performed on the rock core samples are tabulated in Table 1 immediately following the text of this report and on the Record of Borehole sheets in Appendix A.

5 DESCRIPTION OF SUBSURFACE CONDITIONS

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

In general terms, the overburden encountered at this site consists of topsoil overlying native layers of sand, silty clay, sandy silt and sand and silt. Isolated layers of gravelly sand and sand and gravel were encountered at some borehole locations within the sand layer. Granitic gneiss bedrock was encountered below the overburden and topsoil, generally at depths ranging from 0.05 m to 7.5 m. More detailed descriptions of the individual strata are presented below.

5.1 Topsoil

Dark brown topsoil containing occasional roots, rootlets and wood fibres was contacted in Boreholes HRB09-03 to HRB09-11, HRB09-13 to HRB09-15, HRB09-21 to HRB09-23, HRB09-25, HRB09-26, HRB09-28, HRB09-29, HRB09-33, HRB09-34, HRN-1, BH10-E to BH10-H, HRB10-02, HRB10-04 and HRB10-05. All topsoil was encountered at the surface, with the exception of the topsoil encountered in Borehole BH10-G which was encountered below fill that was placed for drill rig access.

The thickness of the topsoil varied from 25 mm to 500 mm. The topsoil thickness may vary between and beyond the borehole locations and this data is not intended for the purpose of estimating quantities.

The moisture content of samples from the topsoil layer generally varies between 25% and 38%. A moisture content of 130% was measured in Borehole HRB09-21.

5.2 Fill

A layer of brown sand fill containing some gravel, trace silt, occasional bedrock fragments and occasional roots and rootlets was placed surficially at the locations of Boreholes HRB09-18 and HRB09-20 for drill rig access to these borehole locations. A similar sand fill was also placed surficially for drilling access to Borehole BH10-G. The fill was approximately 0.8 m thick at the location of Boreholes HRB09-18 and HRB09-20 and 0.6 m thick at the location of BH10-G.

SPT N-values in the sand fill ranged from 4 to 22 blows per 0.3 m of penetration, indicating a loose to compact relative density. The moisture content of the fill samples ranged from 18 to 35%.

5.3 Sand

Layers of native brown to grey sand containing trace silt to silty, trace gravel, trace clay, occasional roots, rootlets and organics and occasional cobbles, boulders and bedrock fragments were encountered at depths and elevations indicated in Table 5.1. Micaceous sand was encountered at some borehole locations.

Table 5.1 – Depths and Elevations of Sand Layer

Foundation Unit	Borehole	Depth below existing ground surface (m)	Elevation (m)	Thickness (m)
South Abutment Area	HRB09-01	0.0 to 1.7* 2.5 to 3.0	189.4 to 187.7 186.9 to 186.3	1.7 0.5
	HRB09-02	0.0 to 1.8 2.4 to 3.0	189.7 to 187.9 187.3 to 186.7	1.8 0.6
	HRB09-03	0.1 to 1.2 4.1 to 7.4 (Borehole termination depth)	190.0 to 188.9 186.0 to 182.7	1.1 3.3
	HRB09-06	4.1 to 5.6 (Borehole termination depth)	186.0 to 184.4	1.5
	BH10-B	0.0 to 0.6	190.0 to 189.4	0.6
	BH10-C	4.3 to 5.3	185.8 to 184.8	1.0
South River Bank	HRB09-09	0.1 to 5.3 (Borehole termination depth)*	185.6 to 180.4	5.2
	HRB09-10	0.1 to 5.4 (Borehole termination depth)*	184.5 to 179.1	5.3
	HRB09-11	0.1 to 5.1 (Borehole termination depth)*	185.2 to 180.2	5.0
	HRB09-12	0.0 to 4.1 (Borehole termination depth)	183.8 to 179.7	4.1
	HRB09-15	0.2 to 0.6 (Borehole termination depth)*	183.9 to 183.5	0.4
	BH10-01	0.0 to 1.8 2.0 to 7.0	186.7 to 184.9 184.7 to 179.7	1.8 5.0
	BH10-02	0.0 to 4.5*	183.5 to 179.0	4.5
	BH10-03	0.0 to 5.2	186.3 to 181.1	5.2
	BH10-06	0.0 to 0.2	182.4 to 182.2	0.2
North River Bank	HRB09-17	0.0 to 4.0 (Borehole termination depth)	181.7 to 177.7	4.0
	HRB09-19	0.0 to 4.7 (Borehole termination depth)	181.2 to 176.5	4.7
	HRB09-21	0.4 to 4.2 (Borehole termination depth)	181.1 to 177.3	3.8
	HRB09-22	0.5 to 4.5 (Borehole termination depth)	181.2 to 177.2	4.0
	HRB09-23	0.5 to 4.9 (Borehole termination depth)	180.2 to 175.8	4.4
	HRB09-24	0.0 to 4.7 (Borehole termination depth)	181.6 to 176.9	4.7
North Abutment Area	HRB09-27	0.0 to 0.8	187.3 to 186.5	0.8
	HRB09-30	0.0 to 0.5	186.8 to 186.3	0.5
	HRB09-31	0.0 to 0.5	185.7 to 185.2	0.5
	HRB09-32	0.0 to 0.4	186.1 to 185.7	0.4

	BH10-E	0.1 to 0.4	185.8 to 185.5	0.3
	BH10-F	0.1 to 0.6	186.8 to 186.3	0.5
	BH10-G	0.7 to 1.0	185.8 to 185.5	0.3
	BH10-H	0.1 to 0.8	185.9 to 185.2	0.7
	BH10-I	0.0 to 0.4	186.9 to 186.5	0.4
	BH10-J	0.0 to 0.2	186.2 to 186.0	0.2
North Approach	HRB09-34	0.1 to 1.3	191.4 to 190.2	1.2

* Micaceous Sand

Standard Penetration tests in the sand layer gave SPT N-values generally in the range of 1 to 47 blows per 0.3 m of penetration, indicating a very loose to dense relative density.

Isolated higher SPT N-values of 83 blows per 0.25 m of penetration and 73 blows per 0.275 m of penetration, indicating a very dense relative density, were measured in Boreholes HRB09-10 and HRB09-12 near elevation 180.0. An SPT N-value of 69 blows per 0.3 m of penetration was measured in Borehole HRB09-22 near elevation 178.5. Higher SPT N-values were also recorded in Boreholes BH10-E, G, H, I, and J and in Boreholes HRB10-04 and HRB10-06 in the thin layer of sand overlying bedrock.

The moisture contents of samples from the sand layer generally vary between 5% and 55%.

Grain size distribution curves for the sand samples tested are presented in Appendix B, Figures B1 to B5. The results are also summarized on the Record of Borehole sheets in Appendix A. The results of grain size distribution test are summarized as follows:

Soil Particles	Sand (%)
Gravel	0 to 32
Sand	63 to 96
Silt	14 to 34
Clay	2 to 5
Silt & Clay	2 to 26

5.4 Sandy Silt

Native brown to grey sandy silt containing trace clay was encountered at the surface in Boreholes BH10-A and BH10-C and below the silty clay in Boreholes BH10-B and BH10-D. The thickness of the surficial sandy silt layer ranges from 1.8 to 2.7 m (underside elevation 187.2 to 188.3) and the thickness of the lower sandy silt layer ranges from 1.2 to 1.8 m (underside elevation 184.4 to 185.3). Sandy silt containing some clay was also encountered below the topsoil in Borehole HRN-1, drilled at the south abutment

during the previous investigation. The thickness of this layer is 5.5 m (underside elevation 185.1).

SPT 'N' values in the sandy silt ranged from 4 to 29 blows per 0.3 m of penetration, indicating a loose to compact relative density. Moisture contents of the sandy silt range from 8% to 24%.

Grain size distribution curves for four sandy silt samples are presented in Appendix B, Figure B6 and the results are summarized on the Record of Borehole sheets. The results of grain size distribution test are summarized as follows:

Soil Particles	Sandy Silt (%)
Gravel	0
Sand	17 to 34
Silt	55 to 75
Clay	4 to 15

5.5 Silt

An 800-mm thick layer of grey silt containing some sand and some clay was contacted below the sand layer at 1.7 m depth (Elevation 187.7) in Borehole HRB09-01.

The depth to the base of the silt was 2.5 m (Elevation 186.9).

SPT 'N' values in the silt were 2 and 3 blows per 0.3 m of penetration, indicating a very loose relative density. Moisture content was 46 %.

The grain size distribution curve for one silt sample is presented in Figure B7, Appendix B and the results are also included on the Record of Borehole sheets. The results of the grain size distribution test are summarized as follows:

Soil Particles	Silt (%)
Gravel	0
Sand	10
Silt	77
Clay	13

5.6 Sand and Silt

Layers of native brown to grey sand and silt containing, trace gravel, trace to some clay, occasional roots, rootlets, organics and occasional bedrock fragments were encountered at depths and elevations indicated in Table 5.2.

Table 5.2 – Depths and Elevations of Sand and Silt Layer

Foundation Unit	Borehole	Depth below existing ground surface (m)	Elevation (m)	Thickness (m)
South Approach	HRB09-33	0.8 to 4.3 (Borehole termination depth)	189.7 to 186.2	3.5
South Abutment Area	HRB09-01	4.0 to 6.5	185.3 to 182.9	2.5
	HRB09-02	4.1 to 7.0 (Borehole termination depth)	185.6 to 182.7	2.9
	HRB09-03	1.2 to 3.0	188.9 to 187.1	1.8
	HRB09-04	0.1 to 3.1	190.0 to 187.0	3.0
		4.1 to 7.5	186.0 to 182.6	3.4
	HRB09-05	0.1 to 3.3	190.0 to 186.8	3.2
		4.1 to 5.4 (Borehole termination depth)	185.9 to 184.6	1.3
	HRB09-06	0.1 to 3.3	190.0 to 186.8	3.2
	HRB09-07	0.05 to 4.2	190.3 to 186.2	4.1
	HRB09-08	0.05 to 3.9 (Borehole termination depth)	190.3 to 186.5	3.8
	BH10-A	4.0 to 6.2	185.9 to 183.7	2.2
	BH10-B	0.6 to 3.0	189.4 to 187.0	2.4
South River Bank	BH10-C	1.8 to 3.2	188.3 to 186.9	1.4
	BH10-D	0.0 to 2.4	189.1 to 186.7	2.4
	HRB09-13	0.2 to 1.8 (Borehole termination depth)	183.5 to 181.9	1.6
	HRB09-14	0.3 to 1.3	182.1 to 181.1	1.0
	HRB09-16	0.0 to 0.2	183.0 to 182.8	0.2
North Abutment Area	HRB10-04	0.0 to 2.4	182.7 to 180.3	2.4
	HRB10-05	0.0 to 0.6	184.0 to 183.4	0.6
North Abutment Area	HRB09-29	0.5 to 1.4	185.9 to 184.9	1.0

Standard Penetration tests in the sand and silt layer gave SPT N-values generally in the range of 1 to 31 blows per 0.3 m of penetration, indicating a very loose to dense relative density. The layer in general is in a loose to compact condition.

The moisture content of samples from the sand and silt layer generally varies from 5% to 25%.

Grain size distribution curves for the sand and silt samples tested are presented in Figures B8 to B12, Appendix B and the results are summarized on the Record of Borehole sheets in Appendix A. The results of grain size distribution test are summarized as follows:

Soil Particles	Sand (%)
Gravel	0 to 2
Sand	22 to 64
Silt	31 to 70
Clay	2 to 15

5.7 Silty Clay

Native brown to grey silty clay containing trace to some sand and occasional sand seams was contacted below the sandy silt and sand and silt layers at depths ranging from 1.8 m to 3.3 m (Elevations 186.3 to 187.9) in Boreholes HRB09-01 to HRB09-06 and BH10-A to BH10-D drilled at the south abutment. In Borehole HRB09-33, drilled at the south approach, the silty clay was contacted below the topsoil at 0.04 m depth (Elevation 190.3). The thickness of the silty clay layer varies from 0.2 m to 1.3 m.

Layers of silty clay were encountered within the sand and silt near Elevation 188.5 in Borehole HRB09-33 and near Elevation 184.9 and 182.3 in Boreholes HRB10-01 and HRB10-02, respectively. The thickness of these silty clay layers range from 50 to 500 mm.

The depths to the base of the silty clay ranged from 2.6 m to 4.3 m (Elevations 185.3 to 186.5) in Boreholes HRB09-01 to HRB09-06 and BH10-A to BH10-D.

SPT 'N' values in the silty clay ranged from 2 to 9 blows per 0.3 m of penetration, indicating a soft to stiff consistency. Moisture contents ranged from 21% to 55%.

Grain size distribution curves for selected silty clay samples are presented in Appendix B, Figures B13 and B14. The results are also summarized on the Record of Borehole sheets included in Appendix A. Atterberg Limits test results are presented in Figure B17 of Appendix B. The results of the laboratory tests are summarized as follows:

Soil Particle / Index Property	Percentage (%)
Gravel	0
Sand	1 to 20
Silt	42 to 78
Clay	16 to 57
Liquid Limit	23 to 44
Plastic Limit	16 to 22

The above results show that the silty clay is of low to medium plasticity with group symbols of ML-CL to CI.

5.8 Gravelly Sand

In Borehole HRB09-20, a layer of brown gravelly sand containing trace to some silt, trace clay and occasional organics, roots and rootlets was contacted below the fill at 0.8 m depth (Elevation 180.7). Thickness of this gravelly sand layer was 2.7 m. The depth to the base of the gravelly sand in Borehole HRB09-20 was 3.5 m (Elevation 178.0).

Isolated layers of brown gravelly sand were contacted within the sand layer in Boreholes HRB09-17, HRB09-22 and HRB09-24 at elevations ranging from 178.5 to 181.0.

Standard Penetration tests in the gravelly sand layers gave SPT N-values ranging from 5 to 31 blows per 0.3 m of penetration, indicating a loose to dense relative density. An SPT N-value of 62 blows per 0.3 m of penetration, indicating very dense relative density, was measured in Borehole HRB09-20 near borehole termination depth.

The moisture contents of samples from the sand layer generally vary between 8% and 19%.

Grain size distribution curves for the gravelly sand samples tested are presented in Figure B15, Appendix B. The results of grain size distribution tests included on the Record of Borehole Sheets in Appendix A and are summarized as follows:

Soil Particles	Gravelly Sand (%)
Gravel	27 to 28
Sand	58 to 64
Silt & Clay	9 to 14

5.9 Sand and Gravel

A 2.5-m thick layer of sand and gravel containing trace silt, trace clay, occasional organics, roots, rootlets and bedrock fragments was contacted below the fill at 0.8 m depth (Elevation 181.3) in Borehole HRB09-18.

A layer of sand and gravel was also contacted within the sand layer near elevation 179.5 in Borehole HRB09-19.

The base of the sand and gravel layer is at 3.3 m (elev. 178.8) in Borehole HRB09-18.

Standard Penetration tests in the sand and gravel layer gave SPT N-values ranging from 14 to 35 blows per 0.3 m of penetration, indicating a compact to dense relative density. The moisture contents of samples from the sand and gravel layer generally range from 5% to 18%.

Grain size distribution curves for the sand and gravel samples tested are presented in Appendix B, Figure B16. The results of grain size distribution tests are summarized as follows and are included on the Record of Borehole Sheets in Appendix A.

Soil Particles	Sand and Gravel (%)
Gravel	38 to 46
Sand	44 to 53
Silt & Clay	9 to 10

5.10 Bedrock

The overburden soils described above are underlain by granitic gneiss bedrock with feldspathic layers. The bedrock is moderately/slightly weathered to fresh. The bedrock was generally grey with occasional pink and white bands visible in most cores. Occasional mechanical breaks and sub-vertical fractures were observed in the rock cores.

Bedrock was encountered below the topsoil at 25 mm to 100 mm depth in Boreholes HRB09-25, HRB09-26 and HRB09-28.

Bedrock was encountered at various depths and it was proved by coring near the locations of each proposed abutment. Table 5.3 summarizes depths and elevations to the top of bedrock in the boreholes. Where coring was not carried out, bedrock was inferred from auger refusal.

Table 5.3 – Depths and Elevations of Top of Bedrock

Foundation Unit	Borehole	Top of Bedrock	
		Depth (m)	Elevation (m)
South Approach	HRB09-33	4.3**	186.2
South Abutment Area	HRB09-01	6.5*	182.9
	HRB09-02	7.0**	182.7
	HRB09-03	7.4**	182.7
	HRB09-04	7.5*	182.6
	HRB09-05	5.4**	184.6
	HRB09-06	5.6**	184.4

	HRB09-07	4.2*	186.2
	HRB09-08	3.9**	186.5
	HRN-1	5.5*	185.1
	BH10-A	6.2*	183.7
	BH10-B	5.6*	184.4
	BH10-C	5.3*	184.8
	BH10-D	3.8*	185.3
South River Bank	HRB09-09	5.3**	180.4
	HRB09-10	5.4*	179.1
	HRB09-11	5.1*	180.2
	HRB09-12	4.1**	179.7
	HRB09-13	1.8**	181.9
	HRB09-14	1.3*	181.1
	HRB09-15	0.6*	183.5
	HRB09-16	0.2**	182.8
	HRB10-01	7.0*	179.7
	HRB10-02	4.5*	179.0
	HRB10-03	5.2*	181.1
	HRB10-04	2.4*	180.3
	HRB10-05	0.6*	183.4
	HRB10-06	0.2*	182.2
North River Bank	HRB09-17	4.0**	177.7
	HRB09-18	3.3*	178.8
	HRB09-19	4.7*	176.5
	HRB09-20	3.5**	178.0
	HRB09-21	4.2*	177.3
	HRB09-23	4.9**	175.8
	HRB09-24	4.7**	176.9
	HRB10-07	4.6*	177.0
	HRB10-08	2.7*	179.3
	HRB10-11	5.8*	175.3
	HRB10-12	4.9*	176.4
North Abutment Area	HRB09-25	0.040	188.1
	HRB09-26	0.1	188.6
	HRB09-27	0.8*	186.5
	HRB09-28	0.025	187.6
	HRB09-29	1.4*	184.9

	HRB09-30	0.5**	186.3
	HRB09-31	0.5*	185.2
North Abutment Area	HRB09-32	0.4**	185.7
	BH10-E	0.4*	185.5
	BH10-F	0.6*	186.3
	BH10-G	1.0*	185.5
	BH10-H	0.8*	185.2
	BH10-I	0.6*	186.3
	BH10-J	0.2*	186.0
North Approach	HRB09-34	1.3**	190.2

* Bedrock proved by coring

** Refusal on inferred bedrock or boulder

Core recovery in the bedrock generally ranged from 83% to 100%, with the exception of 56% recovery in Borehole HRB09-29 Run 1. The RQD values generally ranged from 50% to 100% indicating fair to excellent rock quality. RQD values of 25% to 49% (indicating a poor rock quality) were noted in 7 of 115 core runs and RQD values of 0% to 24% (indicating a very poor rock quality) were noted in 8 of 115 core runs. RQD values of 0% were noted in Boreholes HRB09-10 Run 1, HRB09-14 Run 1, BH10-I Run 3, HRB10-11 Run 1, HRB10-12 Run 1 and HRB10-12 Run 2.

The Fracture Index (FI) of the rock, expressed as fractures per 0.3 m of core, generally ranged from 0 to greater than 10 in most of the cores. In some cores the FI was greater than 20.

The estimated uniaxial compressive strength of the rock cores generally ranges from 52 MPa to 282 MPa, indicating a strong to extremely strong rock. Lower uniaxial compressive strength values ranging from 5 MPa to 45 MPa were also measured in some cores, indicating the rock to be weak to medium strong. These estimated rock strength values are interpreted from point load tests that were conducted on rock cores recovered from the boreholes. A summary of the Point Load Test Results is presented in Table 1 immediately following the text of this report.

5.11 Water Levels

Water levels were observed in the boreholes during and upon completion of drilling. Four standpipe piezometers were installed during the 2009 investigation to monitor water levels after completion of drilling. The water levels measured in the piezometers and open boreholes are summarized in Table 5.4.

Table 5.4 – Water Level Measurements

Location	Borehole	Date	Water Level (m)		Comment
			Depth	Elevation	
South Abutment	HRB09-04	October 27, 2009	7.2	182.9	In piezometer
		November 20, 2009	7.5	182.6	
	HRN-1	March 24, 2005	6.25	184.3	In piezometer
		April 6, 2005	6.23	184.3	
South River Bank	HRB09-12	November 11, 2009	2.8	181.0	In open borehole
	HRB09-14	November 17, 2009	0.6	181.8	In open borehole
	HRB09-15	November 20, 2009	0.5	183.5	In piezometer
North River Bank	HRB09-17	October 23, 2009	2.3	179.4	In open borehole
	HRB09-20	October 24, 2009	2.6	178.9	In open borehole
	HRB09-21	October 27, 2009	2.5	179.0	In piezometer
		November 20, 2009	2.9	178.6	
	HRB09-22	October 24, 2009	2.9	178.8	In open borehole
	HRB09-23	October 24, 2009	1.5	179.2	In open borehole
North Abutment	HRB09-24	October 24, 2009	2.9	178.7	In open borehole
		October 24, 2009	2.9	178.7	
	HRB09-27	October 27, 2009	0.8	186.5	In piezometer
		November 20, 2009	1.2	186.1	

The piezometric readings taken at the South Abutment, North Abutment and South River Bank indicate that the groundwater levels range from Elevations 182.6 m to 186.5 m. At the North River Bank, the piezometric readings indicate that the groundwater levels range from Elevations 178.6 m to 179.0 m.

The GA drawing shows a water level measured at Harris River at Elevation 179.25 in September 2008.

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

6 MISCELLANEOUS

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

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

Eastern Ontario Diamond Drilling Ltd. from Hawkesbury, Ontario supplied a track mounted CME 55 drill rig and conducted the drilling, sampling and in-situ testing operations.

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

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

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

Thurber Engineering Ltd

Lindsey Blaine, E.I.T.



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



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

Appendix A

Record of Borehole Sheets from Current Investigation

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

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


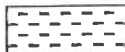



 Water Level
 C_{pen} Shear Strength Determination by Pocket Penetrometer

- (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			

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 BH10-A

1 OF 2

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 254.6 E 231 001.2 ORIGINATED BY JM
HWY 69 BOREHOLE TYPE Tripod/Hand Auger COMPILED BY MFA
DATUM Geodetic DATE 2010.05.15 - 2010.05.15 CHECKED BY TJH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											
								○ UNCONFINED	● QUICK TRIAXIAL	+ FIELD VANE	× LAB VANE								
189.9	GROUND SURFACE						20	40	60	80	100	PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	GR	SA	SI	CL	
0.0	Sandy SILT, trace clay, trace peat Loose to Compact Brown to Grey Moist		1	SS	4														
			2	SS	4														0 24 61 15
			3	SS	29														
			4	SS	12														
187.2			5	SS	5														
2.7	Silly CLAY, trace sand Soft Grey (CL-ML)		6	SS	4														0 4 78 18
185.9			7	SS	14														
4.0	SAND and SILT, trace clay Compact Grey Moist to Wet		8	SS	18														
			9	SS	17														0 39 56 5
			10	SS	12														
183.7	Very Dense at 6.1m		11	SS	100/ 0.225														
6.2	BEDROCK, granitic gneiss, fresh, strong to very strong, thickly bedded, grey with occasional pink and white Sub-vertical breaks at: 100mm at 6.6m 50mm at 9.0m		1	RUN															RUN #1 TCR=100% SCR=100% RQD=100% UCS=219MPa (Average)
			2	RUN															RUN #2 TCR=100% SCR=100% RQD=100% UCS=192MPa (Average)
			3	RUN															RUN #3 TCR=100% SCR=91% RQD=91% UCS=230MPa (Average)
180.6																			
9.3	END OF BOREHOLE AT 9.3m. BOREHOLE OPEN TO 9.3m AND DRY. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 3.1m																		

Continued Next Page

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

RECORD OF BOREHOLE No BH10-A

2 OF 2

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 254.6 E 231 001.2 ORIGINATED BY JM
HWY 69 BOREHOLE TYPE Tripod/Hand Auger COMPILED BY MFA
DATUM Geodetic DATE 2010.05.15 - 2010.05.15 CHECKED BY TJH

SOIL PROFILE			SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	20 40 60 80 100			20 40 60 80 100	20 40 60					
	Continued From Previous Page THEN CUTTINGS TO SURFACE.														

ONTMT4S 6121(HRB).GPJ 5/9/12

RECORD OF BOREHOLE No BH10-B

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 255.8 E 231 004.3 ORIGINATED BY JM
HWY 69 BOREHOLE TYPE Tripod/Hand Auger COMPILED BY MFA
DATUM Geodetic DATE 2010.05.15 - 2010.05.15 CHECKED BY TJH

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				
190.0	GROUND SURFACE						20 40 60 80 100	PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT				
0.0	SAND, some silt Loose Brown Moist		1	SS	6		20 40 60 80 100	W P W W L				GR SA SI CL
189.4												
0.6	SAND and SILT, trace clay Compact Brown to Grey Moist		2	SS	11							
			3	SS	21							0 22 65 13
			4	SS	17							
			5	SS	20							
187.0												
3.0	Silty CLAY, trace sand Soft Grey (CI)		6	SS	3							0 1 57 42
186.2												
3.8	Sandy SILT, trace clay Compact Grey Moist to Wet		7	SS	16							
			8	SS	23							
			9	SS	21							0 26 70 4
184.4											FI	
5.6	BEDROCK, granitic gneiss, fresh, strong to very strong, thickly bedded, grey Sub-vertical breaks at: 100mm at 6.5m 100mm at 7.7m 50mm at 8.0m		1	RUN							1	
											3	RUN #1 TCR=100% SCR=100% RQD=100% UCS=148MPa (Average)
			2	RUN							2	
											>5	
											1	RUN #2 TCR=100% SCR=100% RQD=100% UCS=211MPa (Average)
											1	
											2	
											3	
			3	RUN							>5	RUN #3 TCR=100% SCR=97% RQD=97% UCS=224MPa (Average)
181.4											2	
8.6	END OF BOREHOLE AT 8.6m. BOREHOLE OPEN TO 8.6m AND DRY. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.											

ONTMT4S 6121(HRB).GPJ 5/9/12

+ 3, X 3: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No BH10-C

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 261.2 E 231 009.6 ORIGINATED BY JM
HWY 69 BOREHOLE TYPE Tripod/Hand Auger COMPILED BY MFA
DATUM Geodetic DATE 2010.05.15 - 2010.05.15 CHECKED BY TJH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								20 40 60 80 100							
190.1	GROUND SURFACE														
0.0	SILT, some sand to sandy, trace clay, trace roots Loose to Compact Brown to Grey Moist		1	SS	5		190								
			2	SS	18									0 17 75 8	
			3	SS	11		189								
188.3															
1.8	SAND and SILT Compact Grey Moist		4	SS	18		188								
			5	SS	15										
186.9							187								
3.2	Silty CLAY, trace sand Soft to Firm Grey		6	SS	8										
			7	SS	3									0 7 77 16	
185.8							186								
4.3	SAND, some silt Compact Grey Moist		8	SS	15										
			9	SS	25		185								
184.8															
5.3	BEDROCK, granitic gneiss, fresh, strong to very strong, medium bedded, grey with pink and white bands		1	RUN			184							RUN #1 TCR=100% SCR=84% RQD=84% UCS=187MPa (Average)	
			2	RUN			183							RUN #2 TCR=100% SCR=90% RQD=90% UCS=175MPa (Average)	
	Sub-vertical breaks at: 125mm at 7.7m														
			3	RUN			182							RUN #3 TCR=100% SCR=100% RQD=100% UCS=146MPa (Average)	
181.7															
8.4	END OF BOREHOLE AT 8.4m. BOREHOLE OPEN TO 8.4m AND DRY. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.														

ONTMT4S 6121(HRB) GPJ 5/9/12

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

RECORD OF BOREHOLE No BH10-D

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 262.6 E 231 013.0 ORIGINATED BY JM
 HWY 69 BOREHOLE TYPE Tripod/Hand Auger/Casing COMPILED BY MFA
 DATUM Geodetic DATE 2010.05.16 - 2010.05.17 CHECKED BY TJH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
189.1 0.0	GROUND SURFACE													
	SAND and SILT, trace to some clay, trace topsoil, trace roots Very Loose to Compact Dark Brown to Grey Moist to Wet		1	SS	2		189							0 26 60 14
			2	SS	11									
			3	SS	14		188							
			4	SS	8		187							
186.7 2.6	Silty CLAY, trace sand Firm Grey to Brown		5	SS	17									
	Sandy SILT, trace clay Compact Brown to Grey Moist		6	SS	23		186							0 24 72 4
185.3 3.8	BEDROCK , granitic gneiss, fresh, strong to very strong, medium to thickly bedded, grey Sub-vertical breaks at 4.04 to 4.19m. Sub-horizontal breaks at 4.27, 4.65, and 4.80m. Highly broken zone at 4.19 to 4.27m. Sub-horizontal breaks at 4.93, 5.13, and 5.64m. Sub-vertical breaks at 5.69 to 5.77m.		7	SS	50/									
			1	RUN	150		185							RUN #1 TCR=100% SCR=78% RQD=78% UCS=136MPa (Average)
			2	RUN			184							RUN #2 TCR=100% SCR=91% RQD=91% UCS=65MPa (Average)
			3	RUN			183							RUN #3 TCR=100% SCR=100% RQD=100% UCS=158MPa (Average)
182.1 7.0	END OF BOREHOLE AT 7.0m. BOREHOLE OPEN TO 7.0m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.													

+³, X³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No BH10-E

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 312.1 E 230 977.9 ORIGINATED BY SLL/JM
 HWY 69 BOREHOLE TYPE Split Spoon/Casing COMPILED BY MFA
 DATUM Geodetic DATE 2010.05.13 - 2010.05.14 CHECKED BY TJH

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					
185.9	GROUND SURFACE							20 40 60 80 100					
0.0	TOPSOIL, with roots and rootlets (100mm)		1	SS	28/ 250								
0.1													
185.5	Silly SAND, trace rootlets Compact Brown Moist		1	RUN									
0.4	BEDROCK, granitic gneiss, strong, very thinly to medium bedded, grey to brown Joints at 0.69, 0.89, and 0.99m. Vertical breaks at 0.69, 0.74, 0.86 to 0.89, and 0.99 to 1.12m. Joints at 1.24, 1.40, and 1.98m. Vertical breaks at 1.98 to 2.08m. Joints at 2.23, 2.64, 2.80, and 3.15m.		2	RUN									
			3	RUN									
			4	RUN									
182.4	Vertical breaks at 3.07 to 3.15m. Joint at 3.30m.												
3.5	END OF BOREHOLE AT 3.5m. BOREHOLE OPEN TO 3.5m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.												

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No BH10-F

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 314.8 E 230 976.8 ORIGINATED BY SLUJ/M
HWY 69 BOREHOLE TYPE Split Spoon/Casing COMPILED BY MFA
DATUM Geodetic DATE 2010.05.13 - 2010.05.15 CHECKED BY TJH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	x LAB VANE			
186.9	GROUND SURFACE					20	40	60	80	100	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	
0.0	TOPSOIL, with roots and rootlets (75mm)		1	SS	9						w _P	w	w _L	GR SA SI CL
186.3	Silty SAND Loose Brown Moist													
0.6	BEDROCK, granitic gneiss, strong to very strong, medium bedded, grey		1	RUN										0 73 25 2
	Sub-vertical breaks at: 50mm at 1.4m 50mm at 1.6m													
	150mm vertical breaks at 2.5m		2	RUN										RUN #1 TCR=88% SCR=29% RQD=29% UCS=117MPa (Average)
			3	RUN										RUN #2 TCR=100% SCR=87% RQD=87% UCS=164MPa (Average)
														RUN #3 TCR=100% SCR=100% RQD=100% UCS=168MPa (Average)
183.1	END OF BOREHOLE AT 3.7m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.													
3.8														

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No BH10-G

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 313.3 E 230 981.1 ORIGINATED BY SLL
 HWY 69 BOREHOLE TYPE Split Spoon/Casing COMPILED BY MFA
 DATUM Geodetic DATE 2010.05.13 - 2010.05.14 CHECKED BY TJH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa			WATER CONTENT (%)				
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	x LAB VANE	W _P	W		
186.5	GROUND SURFACE					20	40	60	80	100	20	40	60		GR SA SI CL
0.0	SAND, trace roots and rootlets Loose Brown Moist		1	SS	4							○			
185.9	(FILL PLACED TO PREPARE SITE ACCESS)		2	SS	56/ 225							○			
185.8	TOPSOIL: (50mm)														
0.7	SAND, with roots and rootlets Very Dense Brown Moist		1	RUN											
185.5	BEDROCK, granitic gneiss, strong, with quartz seams and pockets Sub-horizontal joints at 1.55, 1.65, and 1.75m. Vertical joint at 1.85 to 2.26m. Vertical joint at 2.26 to 2.41m.														
1.0	Sub-horizontal joints at 2.97, 3.02, and 3.07m.		2	RUN											
			3	RUN											
182.1	END OF BOREHOLE AT 4.4m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.														
4.4															

RECORD OF BOREHOLE No BH10-H

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 314.6 E 230 984.2 ORIGINATED BY SLL
HWY 69 BOREHOLE TYPE Hammer/Casing COMPILED BY MFA
DATUM Geodetic DATE 2010.05.13 - 2010.05.13 CHECKED BY TJH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
186.0	GROUND SURFACE													
0.0	TOPSOIL, with roots and rootlets (100mm)		1	SS	9		186							0 70 28 2
0.1	Silty SAND, trace clay Loose to Very Dense		2	SS	50/									
185.2	Brown Mciist				0.050									
0.8	BEDROCK, granitic gneiss, strong, with quartz and pink quartzite		1	RUN			185							RUN #1 TCR=100% SCR=100% RQD=78% UCS=140MPa (Average)
			2	RUN			184							RUN #2 TCR=100% SCR=100% RQD=52% UCS=124MPa (Average)
			3	RUN			183							RUN #3 TCR=100% SCR=100% RQD=100% UCS=144MPa (Average)
182.2	Sub-vertical joints at: 125mm at 3.3m 75mm at 3.6m		4	RUN										RUN #4 TCR=100% SCR=100% RQD=100% UCS=158MPa (Average)
3.8	END OF BOREHOLE AT 3.8m. BOREHOLE BACKFILLED WITH BENTONITE TO 0.6m, THEN SAND TO SURFACE.													

+³, X³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No BH10-I

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 317.4 E 230 983.0 ORIGINATED BY SLL
 HWY 69 BOREHOLE TYPE Split Spoon/Casing COMPILED BY MFA
 DATUM Geodetic DATE 2010.05.13 - 2010.05.14 CHECKED BY TJH

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												
186.9	GROUND SURFACE							20	40	60	80	100								
0.0	SAND, trace gravel Very Dense		1	SS	56/															
186.5	Brown				200															
0.4	Moist		1	RUN																
186.3																				
0.6	BOULDER with quartz seam																			
	BEDROCK, granitic gneiss, strong, dark grey, with quartz seams		2	RUN			186													
	Vertical joint at 1.75 to 1.91m. Vertical joint at 1.91 to 2.06m. Sub-vertical joint at 2.11 to 2.31m.		3	RUN			185													
			4	RUN																
	Sub-vertical joint at 3.38 to 3.43m.																			
			5	RUN			184													
183.3																				
3.6	END OF BOREHOLE AT 3.6m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.																			

+³, X³: Numbers refer to Sensitivity 20 15 10 5 0 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No BH10-J

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 320.1 E 230 989.7 ORIGINATED BY SLL
 HWY 69 BOREHOLE TYPE Hammer/Casing COMPILED BY MFA
 DATUM Geodetic DATE 2010 05 13 - 2010 05 13 CHECKED BY TJH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%) w _p w w _L				
186.2	GROUND SURFACE						20	40	60	80	100		GR	SA	SI	CL	
0.0	SAND, trace gravel, occasional cobbles		1	SS	50/ 100												
0.2	Very Dense Brown Moist		1	RUN													
	BEDROCK, granitic gneiss, weathered, strong, with quartz and quartzite seams		2	RUN													
	Vertical joint at 0.58 to 0.84m. Vertical joint at 0.84 to 0.89m. Rubble zone at 1.07 to 1.14m.		3	RUN													
	Vertical joint at 2.03 to 2.13m.		4	RUN													
182.8																	
3.4	END OF BOREHOLE AT 3.4m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 0.61m, THEN SAND TO SURFACE.																

RECORD OF BOREHOLE No HRB09-01

1 OF 2

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 257.6 E 230 999.8 ORIGINATED BY ES
HWY 69 BOREHOLE TYPE Hollow Stem Augers / NQ Coring COMPILED BY AN
DATUM Geodetic DATE 2009.10.20 - 2009.10.20 CHECKED BY RPR

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					
								20 40 60 80 100					
189.4	GROUND SURFACE												
0.0	SAND, micaceous, fine grained, trace to some silt Very Loose to Loose Brown Damp		1	SS	3								
			2	SS	6								
187.7													
1.7	SILT, some sand, some clay, occasional oxide staining Very Loose Grey Moist		3	SS	2								
186.9													
2.5	SAND, fine grained, trace silt Very Loose Brown Moist		4	SS	3								
186.3													
3.0	Silty CLAY, trace sand, occasional sand seams, occasional oxide staining Soft to Stiff Grey		5	SS	3								
185.3													
4.0	SAND and SILT, trace clay, occasional oxide staining Compact Brown to Grey Moist		6	SS	13								
			7	SS	14								
182.9			8	SS	63/ 0.225								
6.5	BEDROCK, granitic gneiss, containing feldspathic layers, moderately weathered to fresh, grey, pink and white bands, occasional mechanical breaks Coring started at 6.5m Sub-vertical fractures at: 75mm at 6.7m 25mm at 6.9m Sub-horizontal fractures at 7.1m		1	RUN									
			2	RUN									
							</						

Continued Next Page

+³ . X³ : Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HRB09-01

2 OF 2

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 257.6 E 230 999.8 ORIGINATED BY ES
 HWY 69 BOREHOLE TYPE Hollow Stem Augers / NQ Coring COMPILED BY AN
 DATUM Geodetic DATE 2009.10.20 - 2009.10.20 CHECKED BY RPR

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 (%)					
	Continued From Previous Page													
	BOREHOLE BACKFILLED WITH HOLEPLUG TO 2.4m, THEN AUGER CUTTINGS TO SURFACE.													

ONTMT4S 6121(HRB).GPJ 5/9/12

RECORD OF BOREHOLE No HRB09-02

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 258.9 E 230 999.8 ORIGINATED BY ES
HWY 69 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2009.10.20 - 2009.10.20 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
189.7 0.0	GROUND SURFACE													
	SAND, fine grained, trace to some silt Very Loose Brown Damp		1	SS	3									
			2	SS	4									
187.9 1.8	Silty CLAY, sandy, occasional rootlets Soft Greyish Brown		3	SS	2									0 20 57 23
187.3 2.4	SAND, some silt Very Loose Brown Moist		4	SS	2									
186.7 3.0	Silty CLAY, trace sand, occasional sand pockets, occasional oxide staining Soft Brown to Grey		5	SS	3									0 2 54 44
185.6 4.1	SAND and SILT, trace clay, occasional oxide staining Compact Brown to Grey Damp		6	SS	14									0 42 55 3
			7	SS	29									
182.7 7.0	END OF BOREHOLE AT 7.0m UPON AUGER REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO 4.3m, THEN AUGER CUTTINGS TO SURFACE.													

+ 3 . X 3 : Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HRB09-03

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 257.8 E 231 003.8 ORIGINATED BY ES
HWY 69 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2009.10.20 - 2009.10.20 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE LIQUID CONTENT LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)			
								○ UNCONFINED + FIELD VANE							w _p w w _L			GR SA SI CL
							● QUICK TRIAXIAL x LAB VANE											
190.1	GROUND SURFACE							20	40	60	80	100						
0.0 0.1	TOPSOIL: (60mm)						190											
	SAND, fine grained, trace to some silt, trace clay, occasional roots Loose Brown Damp		1	SS	4								○					
188.9			2	SS	6		189						○					
1.2	SAND and SILT, some clay, occasional oxide staining Loose to Compact Brown to Grey Damp		3	SS	20								○				0	31 58 11
			4	SS	11		188						○					
187.1	Silty CLAY, trace sand Firm Brown to Grey		5	SS	6		187						┌──┐ ○				0	1 42 57
186.0							186						○					
4.1	SAND, fine grained, some silt, trace clay, occasional oxide staining Compact Brown Damp		6	SS	16		185											
							184						○				0	84 14 2
			7	SS	26		183											
182.7																		
7.4	END OF BOREHOLE AT 7.4m UPON AUGER REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO 4.1m, THEN AUGER CUTTINGS TO SURFACE.																	

ONTMT4S 6121(HRB).GPJ 5/9/12

RECORD OF BOREHOLE No HRB09-04

1 OF 2

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 258.9 E 231 003.7 ORIGINATED BY ES
 HWY 69 BOREHOLE TYPE Hollow Stem Augers / NQ Coring COMPILED BY AN
 DATUM Geodetic DATE 2009.10.21 - 2009.10.21 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W P W L	W P W L	W P W L		
190.1	GROUND SURFACE													
0.0	TOPSOIL: (75mm)													
0.1	SAND and SILT Loose to Compact Brown Damp to Moist		1	SS	4									
			2	SS	6									0 25 60 15
	Occasional oxide staining		3	SS	18									
	Moist to Wet		4	SS	10									
187.0	Silty CLAY, trace sand Firm Grey		5	SS	5									
186.0	SAND and SILT, fine grained, trace clay, occasional oxide staining Compact Brown to Grey Damp		6	SS	12									0 29 68 3
			7	SS	25									
			8	SS	23									
182.6	BEDROCK, granitic gneiss, containing feldspathic layers, fresh, grey, pink and white bands, occasional mechanical breaks Coring started at 7.5m		9	SS	50									
7.5			1	RUN										RUN #1 TCR=100% SCR=82% RQD=82% UCS=195MPa (Average)
	Sub-vertical fractures: 100mm at 7.8m 50mm at 9.1m		2	RUN										RUN #2 TCR=100% SCR=97% RQD=97% UCS=141MPa (Average)
	Highly broken zone (125mm) at 8.6m													

Continued Next Page

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

RECORD OF BOREHOLE No HRB09-04

2 OF 2

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 258.9 E 231 003.7 ORIGINATED BY ES
HWY 69 BOREHOLE TYPE Hollow Stem Augers / NQ Coring COMPILED BY AN
DATUM Geodetic DATE 2009.10.21 - 2009.10.21 CHECKED BY RPR

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 (%)			
							20	40	60	80	100	W _P	W	W _L		
	Continued From Previous Page															
179.4	BEDROCK, granitic gneiss, containing feldspathic layers, fresh, grey, pink and white bands, occasional mechanical breaks		3	RUN		180										RUN #3 TCR=100% SCR=100%
10.7	END OF BOREHOLE AT 10.7m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Oct 27/09 7.2 182.9 Nov 20/09 7.5 182.6															RQD=100% UCS=125MPa (Average)

+ 3, x 3 Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HRB09-05

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 257 9 E 231 009 6 ORIGINATED BY ES
 HWY 69 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2009.10.21 - 2009.10.21 CHECKED BY RPR

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				
190.1	GROUND SURFACE							20 40 60 80 100				
0.0 0.1	TOPSOIL: (75mm)							20 40 60 80 100				
	SAND and SILT, some clay, occasional oxide staining Loose to Compact Brown Moist Occasional oxide staining		1	SS	4		190					
			2	SS	16		189					
	Occasional sand pockets		3	SS	15							0 26 63 11
	Wet		4	SS	13		188					
186.8							187					
3.3	Silty CLAY, trace sand Firm Grey		5	SS	6							0 1 45 54
185.9							186					
4.1	SAND and SILT, trace clay, occasional sand seams Compact Grey Damp		6	SS	14							0 26 70 4
184.6							185					
5.4	END OF BOREHOLE AT 5.4m UPON AUGER REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO 3.5m THEN AUGER CUTTINGS TO SURFACE.											

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

RECORD OF BOREHOLE No HRB09-06

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 259.2 E 231 009.6 ORIGINATED BY ES
 HWY 69 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2009.10.21 - 2009.10.21 CHECKED BY RPR

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20	40	60	80	100		
190.1	GROUND SURFACE												
0.0 0.1	TOPSOIL: (75mm)												
	SAND and SILT, trace to some clay, occasional roots and rootlets, occasional oxide staining Loose to Compact Brown Damp		1	SS	12	190							
			2	SS	19	189							0 34 53 13
			3	SS	9	188							0 36 59 5
			4	SS	13	187							
186.8			5	SS	9	186							
3.3	Silty CLAY, trace sand Stiff Grey					185							
186.0													
4.1	SAND, fine grained, trace silt Compact Grey Damp		6	SS	14								
184.4													
5.6	END OF BOREHOLE AT 5.6m UPON AUGER REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO 3.9m, THEN AUGER CUTTINGS TO SURFACE.												

+ 3, x 3: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HRB09-07

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 258.1 E 231 014.3 ORIGINATED BY ES
 HWY 69 BOREHOLE TYPE Hollow Stem Augers / NQ Coring COMPILED BY AN
 DATUM Geodetic DATE 2009.10.22 - 2009.10.22 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)				
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE	w _P	w	w _L		
190.4	GROUND SURFACE					20	40	60	80	100	20	40	60			
0.0	TOPSOIL: (50mm)															
	SAN and SILT, trace clay Loose to Compact Brown Damp		1	SS	4						○					
			2	SS	14						○					
	Occasional oxide staining		3	SS	14						○				0 30 62 8	
			4	SS	15						○					
	Layer of silty clay (100mm) Dense Grey		5	SS	31						○				0 46 51 3	
186.2														FI		
4.2	BEDROCK, granitic gneiss, feldsphtic layers, fresh, grey, pink and white bands, occasional mechanical breaks Coring started at 4.2m		1	RUN										2	RUN #1 TCR=100% SCR=100% RQD=100% UCS=207MPa (Average)	
			2	RUN										0		
	Sub-vertical fractures at 5.5m													0		
			3	RUN										1	RUN #2 TCR=100% SCR=100% RQD=100% UCS=154MPa (Average)	
														1		
	Sub-vertical fractures: 50mm at 6.9m													1		
183.0														0	RUN #3 TCR=100% SCR=100% RQD=100% UCS=123MPa (Average)	
7.4	END OF BOREHOLE AT 7.4m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO 4.3m, THEN AUGER CUTTINGS TO SURFACE.													0		
														2		
														1		

ONTMT4S 6121(HRB).GPJ 5/9/12

METRIC

[illegible]

+ 3, × 3 Numbers refer to Sensitivity

RECORD OF BOREHOLE No HRB09-09

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 273.2 E 230 993.5 ORIGINATED BY ES
 HWY 69 BOREHOLE TYPE Portable Auger/Coring Equipment / 3rd Weight Hammer COMPILED BY AN
 DATUM Geodetic DATE 2009.11.18 - 2009.11.18 CHECKED BY RPR

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							
185.7	GROUND SURFACE							20 40 60 80 100							
0.0	TOPSOIL: (125mm)							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							
0.1	SAND, micaceous, fine grained, trace silt, trace clay, occasional roots and rootlets, occasional wood fibers, occasional black staining Very Loose to Compact Brown Damp Layer of sand and silt at 0.9m Occasional cobbles Grey		1	SS	2		185								0 63 34 3
			2	SS	2										
			3	SS	4		184								0 90 10 (SI+CL)
			4	SS	11										
			5	SS	14		183								
			6	SS	18										
			7	SS	15		182								
			8	SS	28										0 86 14 (SI+CL)
			9	SS	79 / 0.250		181								
180.4															
5.3	END OF BOREHOLE AT 5.3m UPON REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO SURFACE														

RECORD OF BOREHOLE No HRB09-10

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 274.8 E 230 993.4 ORIGINATED BY ES
 HWY 69 BOREHOLE TYPE Portable Auger/Coring Equipment / 3rd Weight Hammer COMPILED BY AN
 DATUM Geodetic DATE 2009.11.18 - 2009.11.18 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
184.6	GROUND SURFACE													
0.0	TOPSOIL: (100mm)													
0.1	SAND, micaceous, fine grained, trace to some silt, trace clay, occasional rootlets, occasional staining Very Loose to Loose Brown Damp Possible boulders at 0.9m (100mm)		1	SS	1		184							
			2	SS	56/ 0.200									
			3	SS	4		183							0 87 13 (SI+CL)
			4	SS	6									
	Compact Brown to Grey		5	SS	12		182							
			6	SS	12									0 83 17 (SI+CL)
	Grey Wet		7	SS	18		181							
			8	SS	36									
	Dense to Very Dense		9	SS	83/ 0.250		180							0 89 11 (SI+CL)
179.1														
5.4	BEDROCK, granitic gneiss, feldspathic layers, moderately weathered to fresh, pink and white bands, occasional mechanical breaks Coring started at 5.4m Sub-vertical fractures: 25mm at 5.8m 50mm at 6.1m 25mm at 6.3m 50mm at 6.5m 50mm at 7.5m 25mm at 7.6m Horizontal fractures at 6.8m, 9.6m, 7.2m and 7.5m Highly broken zone at 6.4m (100mm)		1	RUN			179							FI RUN #1 TCR=100% SCR=0% RQD=0%
			2	RUN										RUN #2 TCR=100% SCR=46% RQD=46% UCS=143MPa (Average)
			3	RUN			178							RUN #3 TCR=100% SCR=71% RQD=60% UCS=116MPa (Average)
			4	RUN			177							RUN #4 TCR=100% SCR=100% RQD=100% UCS=206MPa (Average)
175.9														
8.7	END OF BOREHOLE AT 8.7m. BOREHOLE OPEN AND DRY UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH HOLEPLUG TO 1.5m, THEN SAND TO SURFACE.						176							

ONTMT4S 6121(HRB).GPJ 5/9/12

RECORD OF BOREHOLE No HRB09-11

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 273.4 E 230 997.4 ORIGINATED BY ES
 HWY 69 BOREHOLE TYPE Portable Auger/Coring Equipment / 3rd Weight Hammer COMPILED BY AN
 DATUM Geodetic DATE 2009.11.17 - 2009.11.18 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
185.3	GROUND SURFACE													
0.0	TOPSOIL: (125mm)													
0.1	SAND, micaceous, fine grained, trace to some silt, trace clay, occasional organics Very Loose to Loose Brown Damp		1	SS	1		185							0 77 23 (SI+CL)
			2	SS	2									
			3	SS	2		184							
			4	SS	4									
	Grey Occasional cobbles		5	SS	9		183							0 80 20 (SI+CL)
			6	SS	16		182							
	Compact to Dense		7	SS	22									0 96 4 (SI+CL)
			8	SS	47		181							
180.2														
5.1	BEDROCK, granitic gneiss, feldspathic layers, slightly weathered to fresh, pink and white bands, occasional mechanical breaks Coring started at 5.1m Sub-vertical fractures: 25mm at 5.3m 25mm at 5.6m 75mm at 5.9m 200mm at 6.7m 50mm at 7.9m Sub-horizontal fractures at 5.1m (25mm), 5.0m, 5.6m, 6.7m, 7.2m and 7.4m		1	RUN			180							RUN #1 TCR=100% SCR=92% RQD=69% UCS=157MPa (Average)
			2	RUN			179							RUN #2 TCR=100% SCR=76% RQD=76% UCS=151MPa (Average)
			3	RUN			178							RUN #3 TCR=100% SCR=96% RQD=96% UCS=189MPa (Average)
177.1														
8.2	END OF BOREHOLE AT 8.2m BOREHOLE OPEN AND DRY UPON COMPLETION OF DRILLING BOREHOLE BACKFILLED WITH HOLEPLUG TO SURFACE.													

ONTMT4S 6121(HRB).GPJ 5/9/12

RECORD OF BOREHOLE No HRB09-12

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 274.9 E 230 997.4 ORIGINATED BY ES
 HWY 69 BOREHOLE TYPE Portable Auger/Coring Equipment / 3rd Weight Hammer COMPILED BY AN
 DATUM Geodetic DATE 2009.11.19 - 2009.11.19 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
183.8	GROUND SURFACE													
0.0	SAND, trace to some silt, trace clay, occasional roots and organics Very Loose to Compact Brown to Grey Damp to Moist		1	SS	2									
			2	SS	2		183							
	Layer of sand and silt, some clay at 1.5m		3	SS	4									0 36 49 15
	Occasional cobbles		4	SS	12		182							
			5	SS	16									0 87 13 (SI+CL)
	Occasional bedrock fragments		6	SS	25		181							
	Very Dense		7	SS	73/ 0.275		180							
179.7														
4.1	END OF BOREHOLE AT 4.1m UPON REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 3.6m AND WATER LEVEL AT 2.9m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO 1.8m, THEN SAND TO SURFACE.													

RECORD OF BOREHOLE No HRB09-13

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 273.6 E 231 003.3 ORIGINATED BY ES
HWY 69 BOREHOLE TYPE Portable Auger/Coring Equipment / 3rd Weight Hammer COMPILED BY AN
DATUM Geodetic DATE 2009.11.17 - 2009.11.17 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
183.7	GROUND SURFACE													
0.0	TOPSOIL: (225mm)													
0.2	SAND and SILT, some clay, occasional organics and roots Very Loose to Loose Brown to Grey Moist		1	SS	1		183							0 51 36 13
			2	SS	4									
			3	SS	9									
181.9							182							
1.8	END OF BOREHOLE AT 1.8m UPON REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO SURFACE.													

+ 3 X 3 Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HRB09-14

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 275.1 E 231 003.2 ORIGINATED BY ES
 HWY 69 BOREHOLE TYPE Portable Auger/Coring Equipment / 3rd Weight Hammer COMPILED BY AN
 DATUM Geodetic DATE 2009 11 17 - 2009 11 17 CHECKED BY RPR

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									
182.4	GROUND SURFACE						20	40	60	80	100						
0.0	TOPSOIL, occasional roots and wood fibers		1	SS	1	▽											
182.1	Dark Brown (300mm)		2	SS	3												
0.3	SAND and SILT, some sand, trace gravel, micaceous Very Loose Brown Wet		3	SS	50/												
181.1	BEDROCK, granitic gneiss, feldsphatic layers, slightly weathered to fresh, pink and white bands, occasional mechanical breaks Coring started at 1.3m		1	RUN	0.125												
1.3	Horizontal fractures at 1.4m		2	RUN													
	Sub-horizontal fractures at 1.5m		3	RUN													
	Sub-vertical fractures at: 50mm at 1.5m 50mm at 2.4m 75mm at 2.6m 50mm at 4.8m		4	RUN													
177.3	END OF BOREHOLE AT 5.1m. BOREHOLE OPEN AND WATER LEVEL AT 0.6m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO SURFACE.																
5.1																	

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

RECORD OF BOREHOLE No HRB09-15

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 273.8 E 231 009.9 ORIGINATED BY ES
HWY 69 BOREHOLE TYPE Portable Auger/Coring Equipment / 3rd Weight Hammer COMPILED BY AN
DATUM Geodetic DATE 2009 11 16 - 2009 11 16 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		WATER CONTENT (%)				
184.0	GROUND SURFACE							20 40 60 80 100		20 40 60				GR SA SI CL
0.0	TOPSOIL: (200mm)							20 40 60 80 100		20 40 60				
0.2	SAND, trace silt, trace clay, micaceous		1	SS	2									
183.5	Very Loose													
0.6	Brown Moist		1	RUN										
	BEDROCK, granitic gneiss, feldspathic layers, fresh, pink and white bands, occasional mechanical breaks Coring started at 0.6m Sub-vertical fractures at: 50mm at 0.5m 25mm at 1.8m 75mm at 1.9m 50mm at 2.8m		2	RUN										
	Horizontal fractures at 0.6m and 1.5m		3	RUN										
	Sub-horizontal fractures at 2.8m													
		</												

RECORD OF BOREHOLE No HRB09-16

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 275.3 E 231 007.8 ORIGINATED BY ES
HWY 69 BOREHOLE TYPE Portable Auger/Coring Equipment / 3rd Weight Hammer COMPILED BY AN
DATUM Geodetic DATE 2009.11.17 - 2009.11.17 CHECKED BY RPR

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 (%)					
183.0														
0.0	SAND and SILT, mixed with organics		1	SS	50/		183							
0.2	Very Loose Dark Brown Wet END OF BOREHOLE AT 0.2m UPON REFUSAL ON PROBABLE BEDROCK OR BOULDER BOREHOLE BACKFILLED WITH SAND TO SURFACE.				0.075									

RECORD OF BOREHOLE No HRB09-17

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 301.1 E 230 982.2 ORIGINATED BY ES
HWY 69 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2009.10.23 - 2009.10.23 CHECKED BY RPR

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									
○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE																	
181.7	GROUND SURFACE						20	40	60	80	100						
0.0	SAND, occasional organics, topsoil, roots and rootlets Very Loose to Loose Brown Damp		1	SS	2												
			2	SS	5												
	Some gravel, some silt, trace clay Compact		3	SS	16												
			4	SS	12												
	Gravelly		5	SS	28												
177.7			6	SS	50/												
4.0	END OF BOREHOLE AT 4.0m UPON REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN AND WATER LEVEL AT 2.3m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO 1.8m, THEN AUGER CUTTINGS TO SURFACE.				0.075												

RECORD OF BOREHOLE No HRB09-18

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 302.6 E 230 982.2 ORIGINATED BY ES
HWY 69 BOREHOLE TYPE Hollow Stem Augers / NQ Coring COMPILED BY AN
DATUM Geodetic DATE 2009.10.23 - 2009.10.23 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	x LAB VANE				
182.9	GROUND SURFACE						20	40	60	80	100	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	
0.0	SAND, fine grained, some gravel, trace silt, occasional roots and rootlets, occasional bedrock fragments Compact Brown Damp (FILL PLACED TO PREPARE SITE ACCESS)		1	SS	22										
182.1															
0.8			2	SS	14										38 53 9 (SI+CL)
	SAND and GRAVEL, trace silt, trace clay, occasional organics, roots and rootlets, occasional bedrock fragments, occasional oxide staining Compact Brown Damp														
			3	SS	18										
	Dense		4	SS	35										46 44 10 (SI+CL)
179.6			5	SS	50/										
3.3	BEDROCK, granitic gneiss, feldspathic layers, slightly weathered to fresh, grey, pink and white bands, occasional mechanical breaks Coring started at 3.3m Sub-vertical fractures: 50mm at 3.5m 25mm at 3.9m 50mm at 4.1m 25mm at 4.3m 50mm at 4.7m Sub-horizontal fractures: 25mm at 4.1m Horizontal fractures at 3.4m and 3.5m				0.050										
			1	RUN											RUN #1 TCR=100% SCR=69% RQD=69% UCS=182MPa (Average)
			2	RUN											RUN #2 TCR=100% SCR=97% RQD=97% UCS=148MPa (Average)
				</											

+ 3 . X 3 : Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HRB09-19

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 301.2 E 230 986.2 ORIGINATED BY ES
 HWY 69 BOREHOLE TYPE Hollow Stem Augers / NQ Coring COMPILED BY AN
 DATUM Geodetic DATE 2009.10.23 - 2009.10.23 CHECKED BY RPR

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20	40	60	80	100		
181.2 0.0	GROUND SURFACE SAND, fine grained, trace silt, trace clay, occasional roots and rootlets Very Loose to Loose Brown Damp Layer of sand and gravel Occasional bedrock fragments Compact Dense Grey Wet		1	SS	1	181							44 47 9 (SI+CL)
			2	SS	5	180							
			3	SS	29	179							
			4	SS	29	178							
			5	SS	37	177							
176.5 4.7	BEDROCK , granitic gneiss, feldspathic layers, moderately weathered to fresh, grey, pink and white bands, occasional mechanical breaks Coring started at 4.7m Sub-vertical fractures at 5.4m (50mm) Sub-horizontal fractures at 5.8m (25mm) Sub-vertical fractures at 6.9m (25mm)		6	SS	50/	176							RUN #1 TCR=95% SCR=88% RQD=88% UCS=124MPa (Average)
			1	RUN	.150	175							
			2	RUN		174							
173.5 7.7	END OF BOREHOLE AT 7.7m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO 5.5m, THEN AUGER CUTTINGS TO SURFACE.		3	RUN									RUN #3 TCR=100% SCR=71% RQD=71% UCS=122MPa (Average)

ONTMT4S 6121(HRB).GPJ 5/9/12

RECORD OF BOREHOLE No HRB09-20

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 302.7 E 230 986.1 ORIGINATED BY ES
 HWY 69 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2009.10.24 - 2009.10.24 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)					
182.3	GROUND SURFACE							20	40	60	80	100	w _p	w	w _L	GR	SA	SI	CL	
0.0	SAND, fine grained, occasional roots Loose Brown Moist (FILL PLACED TO PREPARE SITE ACCESS)		1	SS	5	▽	182													
181.5																				
0.8	Gravelly SAND, trace to some silt, trace clay, occasional organics, roots and rootlets Loose to Compact Brown Damp		2	SS	5		181													
			3	SS	24		180													
	Dense		4	SS	31		179													
	Very Dense Grey Wet		5	SS	62															
178.8																				
3.5	END OF BOREHOLE AT 3.5m UPON REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN AND WATER LEVEL AT 2.6m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO 2.1m, THEN AUGER CUTTINGS TO SURFACE.																			

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

RECORD OF BOREHOLE No HRB09-21

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 301.4 E 230 992.0 ORIGINATED BY ES
 HWY 69 BOREHOLE TYPE Hollow Stem Augers / NQ Coring COMPILED BY AN
 DATUM Geodetic DATE 2009.10.25 - 2009.10.25 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)					
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE									
181.5	GROUND SURFACE						20	40	60	80	100	PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	GR	SA	SI	CL
0.0	TOPSOIL, occasional roots and rootlets, wood fibres		1	SS	6													
181.1	Loose																	
0.4	Dark Brown Damp (400mm)																	
	SAND, fine grained, trace to some silt, trace clay, trace gravel, occasional cobbles		2	SS	7													
	Loose to Compact																	
	Brown																	
	Damp																	






ONTMT4S 6121(HRB).GPJ 5/9/12

RECORD OF BOREHOLE No HRB09-22

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 302 9 E 230 991.9 ORIGINATED BY ES
HWY 69 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2009.10.24 - 2009.10.24 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		WATER CONTENT (%)					
181.7	GROUND SURFACE							20 40 60 80 100		20 40 60					
0.0	TOPSOIL, some sand, occasional roots and rootlets Very Loose Dark Brown Damp (500mm)		1	SS	1										
181.2															
0.5	SAND, fine grained, trace silt, trace clay Loose to Compact Brown Damp Cobbles at 1.3m Layer of gravelly sand with occasional bedrock fragments		2	SS	4										
	Some gravel Brown to Grey Wet		4	SS	21										
	Occasional cobbles, occasional bedrock fragments Very dense		5	SS	69										
177.2															
4.5	END OF BOREHOLE AT 4.5m. BOREHOLE OPEN AND WATER LEVEL AT 2.9m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO 3.0m, THEN AUGER CUTTINGS TO SURFACE.														

RECORD OF BOREHOLE No HRB09-23

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 301 6 E 230 996.7 ORIGINATED BY ES
HWY 69 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2009.10.24 - 2009.10.24 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
180.7	GROUND SURFACE							20 40 60 80 100					
0.0	TOPSOIL, some sand, occasional roots and rootlets		1	SS	1								
180.2	Very Loose												
0.5	Dark Brown												
	Damp (500mm)												
	SAND, fine grained, trace to some gravel, trace silt, trace clay, occasional cobbles, occasional oxide staining		2	SS	36								
	Compact to Dense												
	Brown		3	SS	11								
	Damp to Wet												
			4	SS	11								
			5	SS	12								
175.8			6	SS	38/ 0.200								
4.9	END OF BOREHOLE AT 4.9m UPON REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN AND WATER LEVEL AT 1.5m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO 1.2m, THEN AUGER CUTTINGS TO SURFACE.												

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

RECORD OF BOREHOLE No HRB09-24

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 303 1 E 230 996.6 ORIGINATED BY ES
HWY 69 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2009.10.24 - 2009.10.24 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											
○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE																			
181.6	GROUND SURFACE						20	40	60	80	100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	GR	SA	SI	CL	
0.0	SAND, fine grained, trace silt, trace clay, occasional roots Very Loose to Compact Brown Damp Layer of gravelly sand with occasional cobbles Occasional oxide staining Medium grained, some gravel Dense Wet		1	SS	1	▽													
			2	SS	17														32 63 5 (SI+CL)
			3	SS	16														
			4	SS	19														
			5	SS	40														16 74 10 (SI+CL)
176.9			6	SS	50/		177												
4.7	END OF BOREHOLE AT 4.7m UPON REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN AND WATER LEVEL AT 2.9m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO 3.4m, THEN AUGER CUTTINGS TO SURFACE.				0.100														

RECORD OF BOREHOLE No HRB09-25

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 317.0 E 230 975.9 ORIGINATED BY ES
 HWY 69 BOREHOLE TYPE Visual Assessment and Manual Excavation COMPILED BY AN
 DATUM Geodetic DATE 2009.10.24 - 2009.10.24 CHECKED BY RPR

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 (%)			
							20	40	60	80	100	20	40	60		
188.1	GROUND SURFACE															
8.8	TOPSOIL: (35mm) BEDROCK BELOW TOPSOIL.															

ONTMT4S 6121(HRB), GPJ 5/9/12

+ 3 . X 3 : Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HRB09-26

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 318.2 E 230 975.8 ORIGINATED BY ES
 HWY 69 BOREHOLE TYPE Visual Assessment and Manual Excavation COMPILED BY AN
 DATUM Geodetic DATE 2009.10.24 - 2009.10.24 CHECKED BY RPR

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 (%)			
							20	40	60	80	100	20	40	60		
188.7	GROUND SURFACE															
0.0	TOPSOIL, occasional roots, occasional cobbles (100mm)															
0.1	BEDROCK BELOW TOPSOIL															

RECORD OF BOREHOLE No HRB09-27

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 317, 1 E 230 979.8 ORIGINATED BY ES
HWY 69 BOREHOLE TYPE Hollow Stem Augers / NQ Coring COMPILED BY AN
DATUM Geodetic DATE 2009.10.25 - 2009.10.25 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		WATER CONTENT (%)				
187.3	GROUND SURFACE						20 40 60 80 100	20 40 60				GR SA SI CL		
0.0	SAND, some silt, trace gravel, trace clay, occasional roots and rootlets Very Loose Brown Damp		1	SS	1							FI		
186.5			2	SS	50/							3	5 75 18 2	
0.8	BEDROCK, granitic gneiss, feldspathic layers, moderately weathered to fresh, grey, pink and white bands, occasional mechanical breaks Coring started at 0.7m Horizontal fractures at 1.0m, 1.1m, 1.2m, 1.3m Sub-vertical fractures at 1.7m, 1.9m 50mm at 2.0m 50mm at 2.4m 100mm at 2.8m 125mm at 2.9m Sub-horizontal fractures at 1.4m, 2.5m 100mm at 2.8m 175mm at 2.9m		1	RUN	0.025							3	RUN #1 TCR=83% SCR=57% RQD=57% UCS=109MPa (Average)	
			2	RUN								2	RUN #2 TCR=100% SCR=92% RQD=83% UCS=145MPa (Average)	
			3	RUN								3		
												>5		
												>10		
												0	RUN #3 TCR=100% SCR=83% RQD=83% UCS=146MPa (Average)	
183.3												1		
												0		
4.0	END OF BOREHOLE AT 4.0m UPON AUGER REFUSAL Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Oct 27/09 0.8 186.5 Nov 20/09 1.2 186.1													

+ 3 . x 3 Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

METRIC

[illegible]

RECORD OF BOREHOLE No HRB09-29

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 317.3 E 230 985.6 ORIGINATED BY ES
HWY 69 BOREHOLE TYPE Hollow Stem Augers / NQ Coring COMPILED BY AN
DATUM Geodetic DATE 2009 10.25 - 2009 10.25 CHECKED BY RPR

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			SHEAR STRENGTH kPa					W _p	W	W _L		
186.3	GROUND SURFACE						20	40	60	80	100	20	40	60		GR SA SI CL
0.0	TOPSOIL, mixed with sand and organics, trace silt, occasional roots and rootlets		1	SS	1	186										
0.5	Very Loose Brown Damp (500mm)		2	SS	4											
184.9	SAND and SILT, trace gravel, trace clay, occasional bedrock fragments		3	SS	50/	185										
1.4	Loose Brown Damp to Wet Layer of cobbles at 1.3m				0.050											
	BEDROCK, granitic gneiss, feldspathic layers, moderately weathered, grey, pink and white bands, occasional quartz interbeds		1	RUN		184										
	Coring started at 1.4m Becoming slightly weathered to fresh															
	Sub-vertical fractures at 5.0m, 5.1m and 5.2m															
	125mm at 2.4m															
	50mm at 4.1m															
	75mm at 4.2m															
	25mm at 4.7m															
	Sub-horizontal fractures at 2.4m, 2.5m and 3.1m															
	25mm at 4.7m															
181.0						182										
5.3	END OF BOREHOLE AT 5.3m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO 2.7m, THEN AUGER CUTTINGS TO SURFACE.															

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

RECORD OF BOREHOLE No HRB09-30

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 318.5 E 230 985.6 ORIGINATED BY ES
 HWY 69 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2009.10.26 - 2009.10.26 CHECKED BY RPR

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20	40	60	80	100		
186.8	GROUND SURFACE												
0.0	SAND, fine to medium grained, trace gravel Compact Brown Damp		1	SS	30								
186.3													
0.5	END OF BOREHOLE AT 0.5m UPON REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN AND DRY UPON COMPLETION BOREHOLE BACKFILLED WITH HOLEPLUG TO SURFACE.												

RECORD OF BOREHOLE No HRB09-31

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 317.5 E 230 990.3 ORIGINATED BY ES
 HWY 69 BOREHOLE TYPE Hollow Stem Augers / NQ Coring COMPILED BY AN
 DATUM Geodetic DATE 2009.10.26 - 2009.10.26 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			FLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa			WATER CONTENT (%)					
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	x LAB VANE	w _p	w			w _L
185.7	GROUND SURFACE						20	40	60	80	100	20	40	60	GR SA SI CL	
0.0	SAND, mixed with organics, trace silt, occasional roots and rootlets Very Loose Brown Damp		1	SS	2											
185.2	BEDROCK, granitic gneiss, feldsphatic layers, moderately weathered to fresh, grey, pink and white bands, occasional mechanical breaks Coring started at 0.5m Sub-vertical fractures at: 50mm at 0.9m 100mm at 2.3m 25mm at 2.5m 200mm at 2.9m Sub-horizontal fractures at: 25mm at 2.3m 25mm at 2.5m 25mm at 3.1m		1	RUN												
0.5																
				2	RUN											

+ 3 × 3 : Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HRB09-32

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 318.7 E 230 990.3 ORIGINATED BY ES
HWY 69 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2009 10 26 - 2009 10 26 CHECKED BY RPR



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		W _P W W _L				
186.1	GROUND SURFACE							20 40 60 80 100						
0.0	SAND, mixed with organics, trace gravel, occasional roots and rootlets		1	SS	56/		186							
185.7	Loose				0.275									
0.4	Brown Damp													
	END OF BOREHOLE AT 0.4m UPON REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO SURFACE.													

RECORD OF BOREHOLE No HRB09-33

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 249.2 E 230 010.6 ORIGINATED BY ES
HWY 69 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2009.10.22 - 2009.10.22 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						WATER CONTENT (%) w _p w w _L					
190.4	GROUND SURFACE							20	40	60	80	100							
0.0	TOPSOIL: (35mm) Silty CLAY, some sand Firm Brown		1	SS	5		190												
189.7																			
0.8	SAND and SILT, occasional oxide staining Loose to Compact Brown Damp Layers of silty clay (500mm) Brown to Grey Wet		2	SS	13		189												0 31 60 9
			3	SS	12														
			4	SS	9		188												
			5	SS	11		187												0 33 61 6
186.2																			
4.3	END OF BOREHOLE AT 4.3m UPON AUGER REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO 2.9m THEN AUGER CUTTINGS TO SURFACE.																		

+ 3 x 3 Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HRB09-34

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 327.1 E 230 979.1 ORIGINATED BY ES
 HWY 69 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2009.10.23 - 2009.10.23 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
191.5	GROUND SURFACE													
0.0	TOPSOIL, some sand, trace roots and rootlets (125mm)		1	SS	2		191							
0.1	SAND, some silt, mixed with organics, trace gravel, trace clay, occasional roots and rootlets Very Loose to Compact Dark Brown Damp		2	SS	22									3 77 18 2
190.2														
1.3	END OF BOREHOLE AT 1.3m UPON REFUSAL ON PROBABLE BEDROCK OR BOULDER BOREHOLE OPEN AND DRY UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH HOLEPLUG TO SURFACE.													

+³, ×³ Numbers refer to
Sensitivity


20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HRB10-01

1 OF 2

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 272.2 E 230 993.5 ORIGINATED BY ES
HWY 69 BOREHOLE TYPE 3rd Weight Hammer/NQ Coring COMPILED BY AN
DATUM Geodetic DATE 2010.05.05 - 2010.05.05 CHECKED BY TH

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							
186.7	GROUND SURFACE														
0.0	SAND, fine grained, some silt, trace gravel, mixed with topsoil Very Loose to Loose Brown Moist		1	SS	1										
			2	SS	2										
			3	SS	4										
184.9	CLAY, trace silt, trace sand Firm Brown		4	SS	6										
184.7															
2.0	SAND, fine grained, trace gravel Compact Brown Moist		5	SS	21										

Continued Next Page

+ 3 x 3 Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HRB10-01

2 OF 2

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 272.2 E 230 993.5 ORIGINATED BY ES
HWY 69 BOREHOLE TYPE 3rd Weight Hammer/INQ Coring COMPILED BY AN
DATUM Geodetic DATE 2010.05.05 - 2010.05.05 CHECKED BY TH

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																	
176.1																3		
10.6	END OF BOREHOLE AT 10.6m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.															4		

+³, X³: Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HRB10-02

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 275.8 E 230 993.4 ORIGINATED BY ES
 HWY 69 BOREHOLE TYPE 3rd Weight Hammer/NQ Coring COMPILED BY AN
 DATUM Geodetic DATE 2010.05.04 - 2010.05.04 CHECKED BY TH

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											
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE											
183.5	GROUND SURFACE						20	40	60	80	100	20	40	60		GR	SA	SI	CL
0.0	TOPSOIL: (50mm)		1	SS	1														
	Silly SAND, fine grained, micacious, trace gravel, trace clay, trace rootlets Very Loose to Dense Brown Moist		2	SS	3														1 63 31 5
	50mm silty clay layer at 1.2m		3	SS	4														
			4	SS	7														
			5	SS	18														
	Becomes coarse grained		6	SS	25														4 70 26 (SI+CL)
			7	SS	38														
179.0																			
4.5	BEDROCK, granitic gneiss, occasional quartz interbeds, strong, reddish grey Coring started at 4.5m 50mm sub-vertical fractures at 5.2m 250mm highly broken zone at 6.1m		1	RUN															
			2	RUN															RUN #1 TCR=100% SCR=100% RQD=100% RUN #2 TCR=100% SCR=69% RQD=64% UCS=174MPa (Average)
	Horizontal fractures at: 500mm at 6.0m 25mm at 7.0m 625mm vertical fractures at 6.0m		3	RUN															RUN #3 TCR=100% SCR=38% RQD=38% UCS=192MPa (Average)
	25mm sub-horizontal fractures at 7.2m		4	RUN															RUN #4 TCR=100% SCR=100% RQD=100% UCS=175MPa (Average)
175.5																			
8.0	END OF BOREHOLE AT 8.0m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.																		

ONTMT4S 6121(HRB).GPJ 5/9/12

+ 3, X 3: Numbers refer to
Sensitivity

20
15-0.5
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HRB10-03

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 272.5 E 231 000.5 ORIGINATED BY ES
 HWY 69 BOREHOLE TYPE 3rd Weight Hammer/NQ Coring COMPILED BY AN
 DATUM Geodetic DATE 2010 05 06 - 2010 05 06 CHECKED BY TH

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			SHEAR STRENGTH kPa					w _p	w	w _L	WATER CONTENT (%)								
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE																
186.3	GROUND SURFACE						20	40	60	80	100									GR	SA	SI	CL	
0.0	Silty SAND, fine grained, trace clay, trace roots Very Loose to Loose Brown Moist to Wet Occasional oxide staining		1	SS	1																			
			2	SS	5																			
			3	SS	2																			
			4	SS	4																			
			5	SS	4																			
			6	SS	3																			
			7	SS	6																			
	Trace roots and organics from 3.6m to 3.7m																							
181.1																								
5.2	BEDROCK, granitic gneiss, strong, reddish grey Coring started at 5.2m Sub-vertical fractures at: 50mm at 6.7m 75mm at 7.2m 50mm at 7.4m 100mm at 7.5m 50mm at 7.6m 50mm at 7.7m 125mm at 8.4m		1	RUN																				
			2	RUN																				
			3	RUN																				
177.7																								
8.6	END OF BOREHOLE AT 8.5m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.																							

+ 3, X 3 Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

METRIC

SOIL PROFILE						DYNAMIC CONE PENETRATION RESISTANCE PLOT							UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER TYPE "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa								
						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT w _p w w _L	
182.7	GROUND SURFACE													
0.0	TOPSOIL: (40mm)													
	SAND and SILT, trace clay, trace gravel, trace rootlets Very Loose Brown Moist to Wet		1 SS 1											
			2 SS 1		182									
			3 SS 2		181									
			4 SS 54/ 0.275											
180.3	BEDROCK, granitic gneiss, strong, reddish grey Coring started at 2.4m		1 RUN		180								FI	RUN #1 TCR=100% SCR=100% RQD=100% UCS=172MPa (Average)
2.4			2 RUN		179								2	RUN #2 TCR=100% SCR=93% RQD=93% UCS=184MPa (Average)
	75mm sub-vertical fractures at 4.5m		3 RUN		178								0	RUN #3 TCR=100% SCR=58% RQD=58% UCS=177MPa (Average)
	425mm highly broken zone at 5.0m												0	
177.2	END OF BOREHOLE AT 5.5m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.												>20	
5.5														

+ 3, X 3: Numbers refer to Sensitivity

METRIC

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No HRB10-06

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 276.3 E 231 007.9 ORIGINATED BY ES
HWY 69 BOREHOLE TYPE 3rd Weight Hammer/NQ Coring COMPILED BY AN
DATUM Geodetic DATE 2010.05.03 - 2010.05.03 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p	W	W _L		
182.4	GROUND SURFACE							20	40	60	80	100					GR SA SI CL
0.0	SAND, trace silt, trace organics		1	SS	50/												RUN #1 TCR=100% SCR=88% RQD=88% UCS=195MPa (Average) RUN #2 TCR=100% SCR=100% RQD=100% UCS=187MPa (Average) RUN #3 TCR=100% SCR=77% RQD=81% UCS=187MPa (Average)
0.2	Very Loose Light Brown Moist		1	RUN	0.150		182									FI	
	BEDROCK, granitic gneiss, strong, reddish grey Coring started at 0.2m															1	
																1	
																0	
			2	RUN			181									1	
																0	
																0	
																0	
																1	
	Sub-vertical fractures at: 125mm at 2.8m 75mm at 3.0m 75mm at 3.2m		3	RUN			180									2	
179.1																>5	
3.3	END OF BOREHOLE AT 3.3m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.																

ONTMT4S 6121(HRB).GPJ 5/9/12

RECORD OF BOREHOLE No HRB10-07

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 300.1 E 230 982.2 ORIGINATED BY SLL
 HWY 69 BOREHOLE TYPE EW Casing COMPILED BY MFA
 DATUM Geodetic DATE 2010.05.14 - 2010.05.14 CHECKED BY TJH

SOIL PROFILE				SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		FLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa			WATER CONTENT (%)						
181.6 0.0	GROUND SURFACE						20 40 60 80 100	20 40 60	W _P W W _L				GR SA SI CL		
177.0 4.6	BEDROCK , granitic gneiss, strong, grey, with quartz seams Coring started at 4.6m Sub-vertical joints at 6.02, 6.04, 6.10, 6.17, 6.21, and 6.22m. Sub-vertical joints at 6.25, 6.30, 6.38, 6.40, 6.45, 6.53, 6.55, 6.59, 6.61, 6.63, 6.65, and 6.68m.		1	RUN									FI	RUN #1 TCR=100% SCR=100% RQD=100% UCS=153MPa (Average)	
			2	RUN										1	RUN #2 TCR=100% SCR=100% RQD=56% UCS=126MPa (Average)
			3	RUN										7	RUN #3 TCR=100% SCR=100% RQD=32% UCS=82MPa (Average)
			4	RUN										5	RUN #4 TCR=100% SCR=100% RQD=71% UCS=74MPa (Average)
174.0 7.6	END OF BOREHOLE AT 7.6m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.												2		

ONTMT4S 6121(HRB).GPJ 5/9/12

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

RECORD OF BOREHOLE No HRB10-08

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 303.5 E 230 982.2 ORIGINATED BY SLL
 HWY 69 BOREHOLE TYPE EW Casing COMPILED BY MFA
 DATUM Geodetic DATE 2010.05.10 - 2010.05.11 CHECKED BY TJH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
182.0	GROUND SURFACE													
0.0														
	No sampling													
179.3														
2.7	BEDROCK , granitic gneiss, fresh, strong, dark grey Coring started at 2.7m Vertical joints at 2.87, 3.10, 3.12, 3.18, 3.24, and 3.28m. Horizontal joints at 3.00, and 3.38m. Sub-vertical joints at 3.66, 3.81, 3.83, and 3.89m. With quartz seams Sub-vertical joints at 4.42, 4.44, 4.57, 4.80, and 4.82m. Sub-horizontal joint at 4.88 to 5.03m. Vertical joint at 5.28m.		1	RUN			182							RUN #1 TCR=100% SCR=100% RQD=88% UCS=110MPa (Average) RUN #2 TCR=100% SCR=100% RQD=72% UCS=168MPa (Average) RUN #3 TCR=100% SCR=100% RQD=83% UCS=205MPa (Average)
			2	RUN			179							
							178							
			3	RUN			177							
176.3														
5.7	END OF BOREHOLE AT 5.7m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.													

RECORD OF BOREHOLE No HRB10-11

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Harris River Bridge, N 5 061 300.6 E 230 996.8 ORIGINATED BY SLL
 HWY 69 BOREHOLE TYPE EW Casing COMPILED BY MFA
 DATUM Geodetic DATE 2010.05.11 - 2010.05.12 CHECKED BY TJH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
181.1 0.0	GROUND SURFACE													
	No sampling													
175.3 5.8	BEDROCK, granitic gneiss, fresh, grey, with quartz and micaceous lenses Horizontal joint at 5.84 to 6.00m. Horizontal joint at 6.00 to 6.20m. Horizontal joint at 6.20 to 6.35m.		1	RUN										
			2	RUN										
			3	RUN										
	Horizontal joint at 7.75 to 8.10m.		4	RUN										
			5	RUN										
172.0 9.1	Horizontal joint at 8.99 to 9.07m.													
	END OF BOREHOLE AT 9.1m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE													

ONTMT4S 6121(HRB), GPJ 5/9/12

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HRB10-12

1 OF 1

METRIC

W.P. 5076-06-00 LOCATION Hams River Bridge, N 5 061 304.1 E 230 996.7 ORIGINATED BY SLL
 HWY 69 BOREHOLE TYPE EW Casing COMPILED BY MFA
 DATUM Geodetic DATE 2010.05.12 - 2010.05.13 CHECKED BY TJH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
181.3 0.0	GROUND SURFACE													
	No sampling													
176.4 4.9	BEDROCK, granitic gneiss, fresh, strong, with quartz lenses		1	RUN										
			2	RUN										
	Horizontal joint at 6.07 to 6.63m.		3	RUN										
	With pink quartzite Hidden joint at 6.63 to 6.91m.		4	RUN										
			5	RUN										
173.3 8.0	END OF BOREHOLE AT 8.0m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 1.5m, THEN SAND TO SURFACE.													

ONTMT4S 6121(HRB), GPJ 5/9/12

Appendix B

Laboratory Test Results

TABLE 1 - Point Load Test Results
HARRIS RIVER BRIDGE
HWY 69 FOUR-LANING
FROM THE SOUTH JUNCTION OF HIGHWAY 69 AND HIGHWAY 529, NORTHERLY 15 KM

19-5161-21

HRB09-01	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS			
	FT.	IN.	METERS										
RUN #1	22	1	6.73	21.5	D	47.60	135.10	ok	222.75				
	23	6	7.16	20.5	A	47.60	89.00	ok	212.39				
	23	7	7.19	20.5	A	47.60	45.80	ok	261.14				
RUN #2	23	9	7.24	14.5	D	47.60	88.40	ok	150.23				
	23	8	7.21	21.0	A	47.60	45.30	ok	187.49				
	25	1	7.65	22.0	D	47.60	144.30	ok	227.83				
	25	0	7.62	28.0	A	47.60	43.50	ok	257.96				
	26	2	7.98	25.0	D	47.60	89.10	ok	259.01				
	26	3	8.00	28.0	A	47.60	44.70	ok	252.58				
	27	5	8.36	23.0	D	47.60	107.10	ok	238.29				
RUN #3	29	7	9.02	25.5	D	47.60	85.20	ok	264.19				
	28	11	8.81	31.0	A	47.60	48.60	ok	262.09	RUN #1:	AVERAGE	MAX	MIN
	30	0	9.14	24.0	D	47.60	103.50	ok	248.65	RUN #2:	232	261	212
	32	0	9.75	18.0	D	47.60	90.50	ok	186.49	RUN #3:	240	264	186

HRB09-04	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS			
	FT.	IN.	METERS										
RUN #1	24	10	7.57	20.5	D	47.40	121.40	ok	213.78				
	25	1.5	7.66	29.0	A	47.40	50.60	ok	238.41				
	26	1	7.85	15.0	D	47.40	130.70	ok	156.43				
	27	5.5	8.37	14.5	D	47.40	115.40	ok	151.21				
	27	7	8.41	24.0	A	47.40	45.30	ok	214.97				
RUN #2	29	0	8.84	7.0	D	47.40	106.10	ok	73.00				
	29	1	8.86	15.0	A	47.40	42.50	ok	141.17				
	30	6	9.30	12.5	D	47.40	87.00	ok	130.36				
	30	7	9.32	24.0	A	47.50	49.70	ok	169.74				
	31	6	9.60	15.5	D	47.50	98.90	ok	161.11				
	31	3	9.53	26.0	A	47.50	55.80	ok	197.82				
	32	5	9.88	16.5	D	47.50	137.60	ok	171.51				
	33	8	10.26	12.5	A	47.50	53.10	ok	98.83	RUN #1:	AVERAGE	MAX	MIN
										RUN #2:	195	238	151
										RUN #3:	147	200	73
RUN #3	34	0	10.36	12.0	D	47.50	130.00	ok	124.73	RUN #3:	125	125	125

HRB09-07	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS			
	FT.	IN.	METERS										
RUN #1	13	10	4.22	18.0	D	47.60	75.70	ok	186.49				
	14	2	4.32	15.5	D	47.60	108.00	ok	160.59				
	14	0.5	4.28	32.5	A	47.60	49.00	ok	273.03				
RUN #2	14	6	4.42	21.0	D	47.60	78.00	ok	217.57				
	14	5	4.39	31.0	A	47.60	44.30	ok	281.59				
	15	8	4.78	11.5	D	47.60	76.70	ok	119.15				
	15	7.5	4.76	18.5	A	47.60	60.00	ok	132.84				
	16	9	5.11	16.0	D	47.50	98.30	ok	166.31				
	16	11	5.16	16.0	A	47.50	53.20	ok	126.32				
	18	0	5.49	9.0	D	47.50	96.00	ok	93.55				
	17	9	5.41	15.5	A	47.50	42.70	ok	145.10				
	19	1	5.82	10.0	D	47.50	77.00	ok	103.94				
	19	1.5	5.83	17.5	A	47.50	47.60	ok	150.60				
RUN #3	19	6	5.94	14.5	D	47.50	105.00	ok	150.72				
	19	7	5.97	22.0	A	47.50	51.60	ok	177.85				
	20	8	6.30	12.0	D	47.50	139.50	ok	124.73				
	20	9	6.32	13.0	A	47.50	38.20	ok	132.67				
	21	5	6.53	13.0	D	47.50	152.80	ok	135.13				
	21	9	6.63	16.0	A	47.50	48.10	ok	136.58				
	23	2	7.06	10.0	D	47.50	91.60	ok	103.94	RUN #1:	AVERAGE	MAX	MIN
	23	2.5	7.07	2.5	A	47.50	40.50	ok	24.38	RUN #2:	207	273	161
										RUN #3:	154	282	94
											123	178	24

HRB09-10	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS			
	FT.	IN.	METERS										
RUN #1	18	3	5.56	1.0	D	47.70	75.10	ok	10.33				
RUN #2	19	2	5.84	21.0	D	50.60	151.50	ok	197.91				
	20	0	6.10	15.0	D	50.40	108.00	ok	142.23				
	19	11.5	6.08	8.0	A	50.40	57.60	ok	56.72				
	20	10	6.35	13.0	D	40.30	94.50	ok	174.34				
RUN #3	22	2	6.76	20.0	D	50.40	49.70	ok	189.64				
	22	5	6.83	5.0	A	50.40	49.70	ok	39.74				
	23	7	7.19	16.0	D	50.40	105.20	ok	151.71				
	23	11	7.29	15.0	A	50.40	66.10	ok	95.59				
	24	11	7.59	11.0	D	50.40	84.40	ok	104.30				
RUN #4	25	11	7.90	23.5	D	50.60	102.20	ok	221.47				
	26	0	7.92	26.0	A	50.60	49.30	ok	207.33	RUN #1:	AVERAGE	MAX	MIN
	27	2	8.28	19.5	D	50.50	77.70	ok	184.33	RUN #2:	10	10	10
	27	2.5	8.29	32.5	A	50.50	44.20	ok	262.49	RUN #3:	143	196	57
	28	4	8.64	14.0	D	50.40	66.70	ok	132.75	RUN #4:	116	190	40
											206	282	133

TABLE 1 - Point Load Test Results
HARRIS RIVER BRIDGE
HWY 69 FOUR-LANING
FROM THE SOUTH JUNCTION OF HIGHWAY 69 AND HIGHWAY 529, NORTHERLY 15 KM

19-5161-21

HRB09-11	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS			
	FT.	IN.	METERS										
RUN #1	17	5	5.31	15.0	D	50.50	95.70	ok	141.80				
	17	4	5.28	25.0	A	50.50	40.10	ok	234.33				
	18	4	5.59	15.0	D	50.30	109.80	ok	142.67				
	19	3	5.87	11.5	D	50.20	50.20	ok	109.72				
RUN #2	20	3	6.17	17.0	D	50.40	107.20	ok	161.20				
	20	4	6.20	29.5	A	50.40	55.50	ok	215.27				
	21	7.5	6.59	8.0	D	50.20	69.80	ok	76.33				
RUN #3	23	1	7.04	22.0	D	50.50	91.70	ok	207.97				
	23	2	7.06	33.0	A	50.50	48.90	ok	265.23				
	24	5	7.44	14.0	D	50.50	114.50	ok	132.34				
	24	6	7.47	11.0	A	50.50	51.30	ok	85.19				
	25	9	7.85	24.5	D	50.50	89.70	ok	231.60				
	25	8	7.82	27.5	A	50.50	49.50	ok	218.94	RUN #1:	AVERAGE	MAX	MIN
	26	9	8.15	24.0	D	50.50	120.60	ok	226.87	RUN #2:	157	234	110
	26	8	8.13	19.0	A	50.50	53.60	ok	142.22	RUN #3:	151	215	76
										RUN #3:	189	265	85

HRB09-14	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS			
	FT.	IN.	METERS										
RUN #1	4	10	1.47	19.5	D	47.70	83.00	ok	201.38				
	4	11	1.50	17.5	A	47.70	41.90	ok	165.71				
RUN #2	5	8	1.73	24.0	D	47.70	102.70	ok	247.85				
	5	9	1.75	23.0	A	47.70	48.30	ok	195.07				
	7	2	2.18	15.0	D	47.70	71.31	ok	154.80				
	8	9	2.67	14.0	D	50.50	79.50	ok	132.34				
RUN #3	9	5	2.67	18.5	D	50.60	133.30	ok	174.35				
	9	5.5	2.88	22.0	A	50.60	47.90	ok	179.40				
	10	6	3.20	20.5	D	50.60	149.70	ok	193.19				
	11	2	3.40	19.5	D	50.60	180.00	ok	183.77				
	12	6	3.81	23.0	D	50.60	133.50	ok	216.76				
RUN #4	13	6	4.11	15.5	D	50.50	105.70	ok	148.52				
	14	6	4.42	20.5	D	50.50	117.10	ok	193.79				
	14	7	4.45	10.0	A	50.50	45.90	ok	84.41	RUN #1:	AVERAGE	MAX	MIN
	15	2	4.62	25.0	D	50.50	111.60	ok	236.33	RUN #2:	184	201	166
	15	3	4.65	20.0	A	50.50	57.10	ok	142.55	RUN #3:	183	248	132
	16	4	4.98	26.0	D	50.50	137.40	ok	245.78	RUN #4:	189	217	174
										RUN #4:	175	246	84

HRB09-15	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS			
	FT.	IN.	METERS										
RUN #1	2	0	0.61	16.0	D	47.80	117.10	ok	164.70				
	2	1	0.64	23.0	A	47.80	53.10	ok	180.96				
RUN #2	3	0	0.91	21.0	D	50.20	76.50	ok	200.36				
	4	0	1.22	14.0	D	49.60	110.00	ok	136.08				
	4	1	1.24	17.0	A	49.60	47.80	ok	141.01				
	5	3	1.60	23.0	D	50.50	93.40	ok	217.42				
	7	0	2.13	18.5	D	50.50	96.00	ok	174.88				
	6	11	2.11	22.5	A	50.50	44.10	ok	195.91				
RUN #3	8	1	2.46	23.0	D	50.50	152.50	ok	217.42				
	9	7	2.92	21.5	D	50.50	93.00	ok	203.24				
	9	7	2.92	23.0	D	50.50	69.80	ok	217.42	RUN #1:	AVERAGE	MAX	MIN
RUN #4	11	2	3.40	19.0	D	50.50	105.00	ok	179.61	RUN #2:	173	181	165
	11	3	3.43	15.5	A	50.50	47.80	ok	126.79	RUN #3:	178	217	136
										RUN #4:	213	217	203
										RUN #4:	153	180	127

HRB09-18	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS			
	FT.	IN.	METERS										
RUN #1	11	0	3.35	22.0	D	47.50	152.00	ok	226.68				
	11	3	3.43	18.5	A	47.50	36.40	ok	196.00				
	12	2	3.71	12.0	D	47.50	92.20	ok	124.73				
	12	3.5	3.75	17.5	A	47.50	36.00	ok	187.00				
	13	2	4.01	16.5	D	47.50	150.40	ok	171.51				
RUN #2	13	10	4.22	15.0	D	47.50	147.00	ok	155.92				
	14	11	4.55	13.0	D	47.50	153.00	ok	135.13				
	15	2.5	4.64	19.0	A	47.50	43.70	ok	174.71				
	16	2	4.93	15.0	D	47.50	91.60	ok	155.92				
	16	1.5	4.91	18.5	A	47.50	51.80	ok	149.11				
	17	5	5.31	11.5	D	47.50	153.00	ok	119.54				
RUN #3	18	9	5.72	12.0	D	47.50	123.40	ok	124.73				
	18	8	5.69	21.5	A	47.50	47.90	ok	184.12	RUN #1:	AVERAGE	MAX	MIN
	20	6	6.25	14.0	D	47.50	91.80	ok	145.52	RUN #2:	182	229	125
	20	5.5	6.24	21.0	A	47.50	45.60	ok	186.83	RUN #3:	148	175	120
										RUN #3:	160	187	125

TABLE 1 - Point Load Test Results
HARRIS RIVER BRIDGE
HWY 89 FOUR-LANING
FROM THE SOUTH JUNCTION OF HIGHWAY 89 AND HIGHWAY 529, NORTHERLY 15 KM

19-5161-21

HRB09-19	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS			
	FT.	IN.	METERS										
RUN #1	16	0	4.88	14.0	D	47.50	131.00	ok	145.52				
	15	11.5	4.86	11.5	A	47.50	48.10	ok	98.17				
	17	0	5.18	8.5	D	47.50	120.00	ok	88.35				
	16	11	5.16	18.0	A	47.50	51.70	ok	145.29				
	18	6	5.64	9.5	D	47.50	95.60	ok	98.75				
	18	5.5	5.63	19.5	A	47.50	48.90	ok	169.75				
RUN #2	19	3	5.87	14.0	D	47.50	89.20	ok	145.52				
	19	2	5.84	25.5	A	47.50	52.00	ok	204.91				
	20	5	6.22	7.5	D	47.50	133.50	ok	77.96				
	20	7	6.27	19.0	A	47.50	57.10	ok	142.00				
	21	8	6.60	13.0	D	47.50	71.60	ok	135.13				
	21	8.5	6.62	21.5	A	47.50	47.10	ok	186.54				
	22	8	6.91	14.0	D	47.50	90.10	ok	145.52				
	22	7	6.88	23.0	A	47.50	55.00	ok	176.06				
	24	0	7.32	5.0	D	47.50	67.70	ok	51.97				
										AVERAGE	MAX	MIN	
RUN #3	24	3	7.39	7.5	D	47.50	108.00	ok	77.96	RUN #1:	124	170	88
	24	7	7.49	19.5	A	47.50	47.90	ok	167.00	RUN #2:	141	205	52
										RUN #3:	122	167	78

HRB09-21	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS			
	FT.	IN.	METERS										
RUN #1	16	3	4.95	12.0	D	47.50	105.50	ok	124.73				
	16	4	4.98	19.0	A	47.50	46.80	ok	165.67				
	17	2	5.23	14.0	D	47.50	108.60	ok	145.52				
	17	3.5	5.27	21.0	A	47.50	47.80	ok	180.13				
	18	3	5.56	13.0	D	47.50	73.40	ok	135.13				
RUN #2	18	7	5.66	8.5	D	47.50	104.20	ok	88.35				
	19	4.5	5.91	4.0	A	47.50	45.50	ok	35.65				
	20	10	6.35	0.5	D	47.50	85.50	ok	5.20				
	21	1	6.43	0.0	D	47.50	70.60	ok	0.00				
	21	6	6.55	5.0	A	47.50	44.70	ok	45.18				
	21	9	6.63	11.0	D	47.50	74.90	ok	114.34				
	23	1	7.04	15.5	A	47.50	58.80	ok	113.24				
RUN #3	23	4	7.11	7.5	D	47.50	102.20	ok	77.96				
	23	5	7.14	18.5	A	47.50	49.00	ok	155.67				
	24	11.5	7.61	13.5	D	47.50	90.90	ok	140.32				
	24	10	7.57	27.0	A	47.50	55.40	ok	206.57				
	25	3	7.70	12.5	D	47.50	93.70	ok	129.93				
	25	3.5	7.71	19.0	A	47.50	49.50	ok	158.62	RUN #1:	150	180	125
	26	7	8.10	12.5	D	47.50	49.50	ok	129.93	RUN #2:	57	114	0
										RUN #3:	143	207	78

HRB09-27	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS			
	FT.	IN.	METERS										
RUN #1	2	11	0.89	12.0	D	47.50	67.50	ok	124.73				
	3	5	1.04	6.0	A	47.50	56.50	ok	45.21				
	3	11	1.19	7.5	D	47.50	114.90	ok	77.96				
	4	2	1.27	24.0	A	47.50	54.30	ok	186.50				
RUN #2	5	0	1.52	14.0	D	47.50	97.00	ok	145.52				
	5	10	1.78	15.0	D	47.50	140.00	ok	155.92				
	7	0	2.13	15.5	D	47.50	79.90	ok	161.11				
	6	11	2.11	26.0	A	47.50	46.80	ok	226.71				
	7	11	2.41	3.5	D	47.50	83.30	ok	36.38				
RUN #3	10	6	3.20	9.0	D	47.50	124.80	ok	93.55				
	11	3	3.43	14.0	D	47.50	109.00	ok	145.52				
	11	2	3.40	20.0	A	47.50	91.60	ok	103.63				
	11	11	3.63	20.0	D	47.50	83.50	ok	207.89				
	12	11	3.94	8.5	D	47.50	80.80	ok	88.35	RUN #1:	109	186	45
	12	11.5	3.95	27.5	A	47.50	47.10	ok	238.60	RUN #2:	145	227	36
										RUN #3:	146	239	88

HRB09-29	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS			
	FT.	IN.	METERS										
RUN #1	6	10.5	2.10	16.0	D	47.00	67.50	ok	169.06				
	7	1	2.16	29.0	A	47.10	64.70	ok	198.03				
	8	9	2.67	4.0	D	47.10	85.30	ok	42.13				
	8	8.5	2.65	21.0	A	47.10	43.80	ok	194.02				
RUN #2	10	0	3.05	14.5	D	47.20	106.20	ok	152.21				
	10	1	3.07	9.0	A	47.20	45.70	ok	80.33				
	11	4	3.45	12.0	D	47.20	117.80	ok	125.96				
	11	9.5	3.59	29.0	A	47.20	44.70	ok	263.31				
	12	8	3.86	11.0	D	47.20	73.90	ok	115.47				
	12	5	3.78	16.5	A	47.20	50.00	ok	137.36				
RUN #3	15	2	4.62	15.0	D	47.20	150.00	ok	157.45				
	15	4.5	4.69	25.5	A	47.20	57.10	ok	191.52				
	15	11	4.85	19.0	D	47.20	91.50	ok	199.44				
	15	10	4.83	19.0	A	47.20	49.00	ok	160.66				
	17	1	5.21	10.5	D	47.20	94.50	ok	110.22	RUN #1:	151	198	42
	17	1.5	5.22	27.0	A	47.20	42.80	ok	253.55	RUN #2:	146	263	80
										RUN #3:	179	254	110

TABLE 1 - Point Load Test Results
HARRIS RIVER BRIDGE
HWY 69 FOUR-LANING
FROM THE SOUTH JUNCTION OF HIGHWAY 69 AND HIGHWAY 529, NORTHERLY 15 KM

19-5161-21

HRB09-31	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS			
	FT.	IN.	METERS										
RUN #1	2	2	0.66	16.0	D	47.20	104.00	ok	188.95				
RUN #2	4	4	1.32	0.5	D	47.20	98.20	ok	5.25				
	4	4.5	1.33	19.5	A	47.20	46.20	ok	172.58				
	4	7	1.40	15.5	D	47.20	77.90	ok	162.70				
	5	8	1.73	20.0	D	47.20	107.60	ok	209.94				
	6	8	2.03	16.5	D	47.20	101.00	ok	173.20				
	6	7	2.01	19.0	A	47.20	51.90	ok	153.66				
	8	2	2.49	16.5	D	47.20	97.40	ok	173.20				
	8	1.5	2.48	18.5	A	47.20	51.10	ok	151.43				
RUN #3	9	0	2.74	11.0	D	47.60	98.40	ok	113.87		AVERAGE	MAX	MIN
	9	0.5	2.76	15.0	A	47.60	48.80	ok	126.41	RUN #1:	189	189	189
	10	8	3.25	3.5	D	47.60	108.70	ok	36.26	RUN #2:	150	210	5
	11	9	3.58	18.5	A	47.60	45.20	ok	165.45	RUN #3:	111	165	36

BH10-A	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS			
	FT.	IN.	METERS										
RUN #1	23	0	7.01	26.5	D	50.64	183.21	ok	249.43				
	23	2	7.06	25.0	A	50.52	53.20	ok	188.17				
RUN #2	25	9	7.85	20.5	D	50.87	156.69	ok	191.61				
RUN #3	28	1	8.56	24.5	D	50.68	190.18	ok	230.33				
											AVERAGE	MAX	MIN
										RUN #1:	219	249	188
										RUN #2:	192	192	192
										RUN #3:	230	230	230

BH10-B	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS			
	FT.	IN.	METERS										
RUN #1	20	3	6.17	15.5	D	50.15	263.45	ok	148.11				
RUN #2	23	1	7.04	25.5	D	50.28	180.32	ok	242.69				
	23	2	7.06	22.5	A	50.17	49.66	ok	179.60				
RUN #3	27	3	8.31	23.5	D	50.21	120.13	ok	224.14				
											AVERAGE	MAX	MIN
										RUN #1:	148	148	148
										RUN #2:	211	243	180
										RUN #3:	224	224	224

BH10-C	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS			
	FT.	IN.	METERS										
RUN #1	19	6	5.94	20.0	D	50.86	143.30	ok	186.99				
RUN #2	23	5	7.14	19.0	D	51.34	207.28	ok	175.07				
RUN #3	27	2	8.28	17.5	D	51.61	132.04	ok	159.95				
	27	3	8.31	16.0	A	51.46	46.77	ok	131.18				
											AVERAGE	MAX	MIN
										RUN #1:	187	187	187
										RUN #2:	175	175	175
										RUN #3:	146	160	131

BH10-D	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS			
	FT.	IN.	METERS										
RUN #1	14	6	4.42	14.5	D	50.78	38.78	ok	135.90				
RUN #2	16	6	5.03	7.0	D	51.03	212.00	ok	65.11				
RUN #3	20	1	6.12	17.0	D	51.01	381.00	ok	158.22				
											AVERAGE	MAX	MIN
										RUN #1:	136	136	136
										RUN #2:	65	65	65
										RUN #3:	158	158	158

BH10-E	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS			
	FT.	IN.	METERS										
RUN #1	2	6	0.76	21.0	D	50.62	183.42	ok	197.79				
RUN #2	3	9	1.14	16.5	A	50.51	50.88	ok	128.58				
RUN #3	8	10	2.69	14.0	D	50.55	132.46	ok	132.14				
RUN #4	10	11	3.33	18.5	D	50.64	170.22	ok	174.13				
											AVERAGE	MAX	MIN
										RUN #1:	198	198	198
										RUN #2:	129	129	129
										RUN #3:	132	132	132
										RUN #4:	174	174	174

TABLE 1 - Point Load Test Results
HARRIS RIVER BRIDGE
HWY 69 FOUR-LANING
FROM THE SOUTH JUNCTION OF HIGHWAY 69 AND HIGHWAY 529, NORTHERLY 15 KM

19-5161-21

BH10-F	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS		
	FT.	IN.	METERS									
RUN #1	2	11	0.89	12.5	D	50.71	245.21	ok	117.41			
RUN #2	7	6	2.29	17.5	D	50.72	139.66	ok	164.32			
RUN #3	10	9	3.28	18.5	D	50.82	154.95	ok	172.65			
	10	10	3.30	21.5	A	50.88	52.10	ok	163.56			
										AVERAGE	MAX	MIN
										RUN #1:	117	117
										RUN #2:	164	164
										RUN #3:	168	173

Tested: June 2, 1010

BH 10-G	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS		
	FT.	IN.	METERS									
RUN #1	4	0	1.22	15.5	D	50.06	97.56	ok	148.52	NO HCL REACTION		
	4	11	1.50	18.8	A	50.31	50.96	ok	146.77			
	5	8	1.73	14.0	D	50.12	89.71	ok	133.90			
RUN #2	8	9	2.67	11.8	D	50.18	133.48	ok	112.65			
	9	7	2.92	10.6	D	49.88	117.52	ok	102.14			
	10	6	3.20	16.8	D	50.08	114.57	ok	160.88			
	11	3	3.43	14.0	A	50.04	50.11	ok	111.19			
RUN #3	12	1	3.68	10.3	D	50.27	109.83	ok	98.06			
	13	0	3.96	18.7	D	50.10	155.00	ok	178.96			
	13	10	4.22	9.6	D	50.17	83.74	ok	91.68			
										AVERAGE	MAX	MIN
										RUN #1:	143	149
										RUN #2:	122	161
										RUN #3:	123	179

Tested: June 2, 1010

BH 10-H	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS		
	FT.	IN.	METERS									
RUN #1	4	0	1.22	15.3	D	50.13	320.00	ok	146.29	NO HCL REACTION		
	5	4	1.63	18.1	D	50.51	332.00	ok	171.05			
	6	5	1.96	10.8	D	50.39	93.54	ok	102.44			
RUN #2	7	5	2.26	18.2	D	50.32	73.25	ok	173.00			
	8	2	2.49	8.1	D	50.08	93.81	ok	77.57			
	9	5	2.87	13.0	D	50.49	105.43	ok	122.93			
RUN #3	10	5	3.18	15.0	D	50.06	235.00	ok	143.73			
RUN #4	12	2	3.71	16.5	D	50.13	147.37	ok	157.76			
										AVERAGE	MAX	MIN
										RUN #1:	140	171
										RUN #2:	124	173
										RUN #3:	144	144
										RUN #4:	158	158

Tested: June 2, 1010

BH 10-I	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS		
	FT.	IN.	METERS									
RUN #2	2	8	0.81	10.5	D	50.14	193.00	ok	100.36	NO HCL REACTION		
	4	0	1.22	9.1	D	50.17	97.58	ok	86.90			
	5	0	1.52	16.3	D	50.15	124.88	ok	155.76			
	5	7	1.70	15.2	D	50.15	123.71	ok	145.24			
RUN #4	8	0	2.44	20.3	D	50.66	113.24	ok	190.96			
RUN #5	9	7	2.92	19.0	D	50.11	116.54	ok	181.78			
	10	8	3.25	16.2	D	50.00	225.00	ok	155.52			
										AVERAGE	MAX	MIN
										RUN #2:	122	156
										RUN #4:	191	191
										RUN #5:	169	182

BH10-J	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS		
	FT.	IN.	METERS									
RUN #1	1	9	0.53	16.5	D	50.61	107.36	ok	155.45			
RUN #2	4	1	1.24	18.5	D	50.77	671.02	ok	173.44			
	4	4	1.32	20.5	A	50.65	52.44	ok	155.72			
RUN #3	8	9	2.67	12.5	D	50.53	156.93	ok	118.05			
										AVERAGE	MAX	MIN
										RUN #1:	155	155
										RUN #2:	165	173
										RUN #3:	118	118

Tested: June 3, 1010

HRB10-1	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS		
	FT.	IN.	METERS									
RUN #1	23	10	7.26	12.5	D	50.51	135.18	ok	118.13			
RUN #2	29	7	9.02	17.0	D	50.72	152.68	ok	150.62			
RUN #3	30	2	9.19	18.5	D	50.84	256.71	ok	173.07			
	30	4	9.25	21.5	A	50.65	49.82	ok	169.93			
										AVERAGE	MAX	MIN
										RUN #1:	118	118
										RUN #2:	160	160
										RUN #3:	172	173

TABLE 1 - Point Load Test Results
HARRIS RIVER BRIDGE
HWY 69 FOUR-LANING
FROM THE SOUTH JUNCTION OF HIGHWAY 69 AND HIGHWAY 529, NORTHERLY 15 KM

19-5161-21

HRB10-2	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS		
	FT.	IN.	METERS									
RUN #2	15	11	4.65	18.5	D	50.71	221.63	ok	173.76			
RUN #3	19	2	5.84	20.5	D	50.82	138.74	ok	191.90			
RUN #4	23	1	7.04	22.5	D	50.69	72.16	ok	211.46			
	23	2	7.06	18.0	A	50.70	51.69	ok	138.16			
										AVERAGE	MAX	MIN
										RUN #2:	174	174
										RUN #3:	192	192
										RUN #4:	175	211
											138	

Tested: June 3, 1010

HRB10-3	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS		
	FT.	IN.	METERS									
RUN #1	17	5	5.31	11.5	D	47.44	138.32	ok	119.77	NO HCL REACTION		
	18	1	5.51	14.1	D	49.94	152.00	ok	135.61			
RUN #2	21	7	6.58	9.5	D	48.89	275.00	ok	94.43			
	22	5	6.83	19.8	D	50.07	217.00	ok	189.67			
	23	2	7.06	22.2	D	50.09	234.00	ok	212.53			
	24	7	7.49	2.5	D	49.85	124.59	ok	24.11			
RUN #3	25	0	7.62	8.5	D	50.13	134.83	ok	81.27			
	25	10	7.67	14.2	D	50.15	114.52	ok	135.69			
	26	5	8.05	20.7	D	49.91	219.90	ok	199.28			
										AVERAGE	MAX	MIN
										RUN #1:	128	136
										RUN #2:	130	213
										RUN #3:	139	199
											81	

Tested: June 3, 1010

HRB10-4	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS		
	FT.	IN.	METERS									
RUN #1	8	5	2.57	14.1	D	47.74	112.93	ok	145.42	HCL REACTION @ 9' 1"		
	9	1	2.77	18.5	D	50.47	273.00	ok	175.04			
	10	3	3.12	20.3	D	50.48	126.81	ok	192.02			
	10	11	3.33	18.4	D	50.48	125.13	ok	174.04			
RUN #2	11	11	3.83	12.7	D	50.72	216.00	ok	119.25			
	13	1	3.99	22.9	D	50.95	165.00	ok	213.52			
	14	3	4.34	23.5	D	50.90	120.89	ok	219.45			
RUN #3	15	8	4.78	20.5	D	51.13	237.00	ok	190.10			
	16	4	4.98	17.8	D	51.25	177.00	ok	164.46			
										AVERAGE	MAX	MIN
										RUN #1:	172	192
										RUN #2:	184	219
										RUN #3:	177	190
											145	
											119	
											164	

Tested: June 3, 1010

HRB10-05	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS		
	FT.	IN.	METERS									
RUN #1	2	5	0.74	22.8	D	50.16	255.00	ok	217.80	NO HCL REACTION		
	3	1	0.94	23.9	D	49.71	213.00	ok	231.52			
	4	5	1.35	19.0	D	50.08	187.00	ok	181.95			
	5	7	1.70	16.2	D	50.10	186.00	ok	155.04			
RUN #2	6	2	1.88	18.7	D	50.40	156.00	ok	177.32			
	7	2	2.18	18.0	D	50.37	162.00	ok	170.84			
	8	1	2.46	20.3	D	50.17	150.00	ok	193.86			
	9	8	2.95	22.7	D	50.25	161.00	ok	216.24			
RUN #3	10	2	3.10	17.2	D	50.15	142.00	ok	164.36			
	11	4	3.45	23.2	D	50.17	153.00	ok	221.55			
	12	4	3.76	22.0	D	50.20	161.00	ok	209.90			
										AVERAGE	MAX	MIN
										RUN #1:	197	232
										RUN #2:	190	216
										RUN #3:	199	222
											155	
											171	
											164	

Tested: June 3, 1010

HRB10-06	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS		
	FT.	IN.	METERS									
RUN #1	1	4	0.41	20.9	D	50.45	256.00	ok	197.87	NO HCL REACTION		
	2	2	0.66	20.2	D	50.37	261.00	ok	191.72			
RUN #2	2	11	0.89	19.4	D	50.27	158.00	ok	184.69			
	3	11	1.19	17.4	D	50.27	197.00	ok	165.65			
	5	0	1.52	18.5	D	50.32	201.00	ok	175.85			
	6	2	1.88	23.5	D	50.29	210.00	ok	223.59			
RUN #3	6	11	2.11	16.1	D	50.38	164.00	ok	152.76			
	7	10	2.39	20.8	D	50.47	88.76	ok	196.81			
	9	2	2.79	20.5	D	50.49	162.00	ok	193.85			
	10	3	3.12	21.7	D	50.37	131.39	ok	205.95			
										AVERAGE	MAX	MIN
										RUN #1:	195	198
										RUN #2:	187	224
										RUN #3:	187	206
											192	
											166	
											153	

TABLE 1 - Point Load Test Results
HARRIS RIVER BRIDGE
HWY 69 FOUR-LANING
FROM THE SOUTH JUNCTION OF HIGHWAY 69 AND HIGHWAY 529, NORTHERLY 15 KM

19-5161-21

HRB10-7	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS			
	FT.	IN.	METERS										
RUN #1	15	3	4.65	16.5	D	51.06	98.20	ok	153.33				
RUN #2	19	3	5.87	13.5	D	50.98	232.20	ok	125.76				
RUN #3	22	4	6.81	12.5	A	51.07	62.50	ok	82.35				
RUN #4	24	2	7.37	8.0	D	51.08	118.20	ok	74.30				
											AVERAGE	MAX	MIN
										RUN #1:	153	153	153
										RUN #2:	126	126	126
										RUN #3:	82	82	82
										RUN #4:	74	74	74

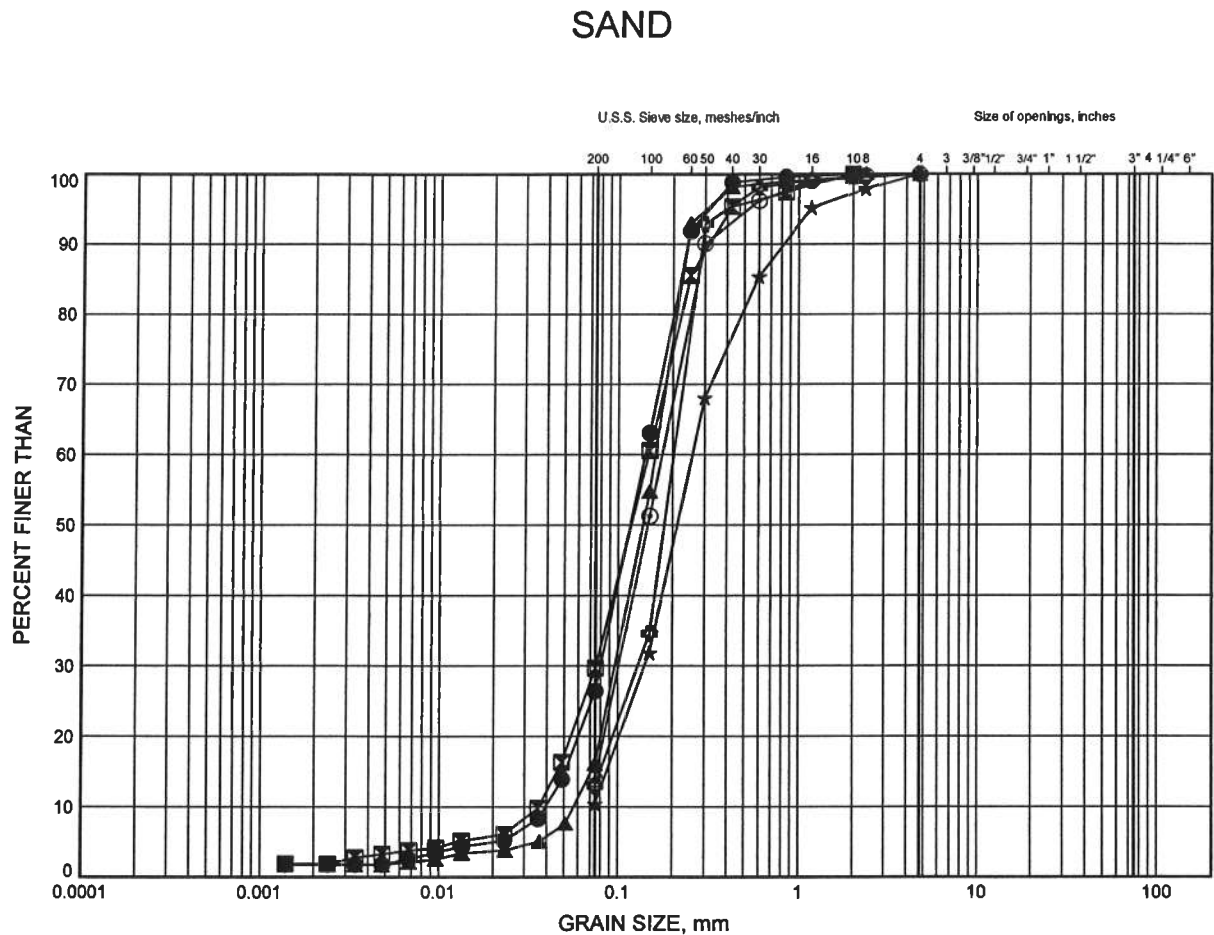
HRB10-8	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS			
	FT.	IN.	METERS										
RUN #1	9	8	2.95	12.0	D	51.46	123.56	ok	110.17				
RUN #2	13	6	4.11	19.0	D	51.84	92.01	ok	172.46				
	13	8	4.17	20.5	A	50.79	49.21	ok	163.23				
RUN #3	15	8	4.78	21.5	D	50.19	215.00	ok	205.19				
											AVERAGE	MAX	MIN
										RUN #1:	110	110	110
										RUN #2:	168	172	163
										RUN #3:	205	205	205

HRB10-11	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS			
	FT.	IN.	METERS										
RUN #3	21	4	6.50	16.5	D	50.43	205.40	ok	156.31				
RUN #4	24	2	7.37	21.0	D	51.08	162.20	ok	195.03				
RUN #5	28	4	8.64	14.0	D	51.05	132.00	ok	130.14				
	28	6	8.69	15.5	A	50.98	32.50	ok	169.73				
											AVERAGE	MAX	MIN
										RUN #3:	156	156	156
										RUN #4:	195	195	195
										RUN #5:	150	170	130

HRB10-12	DEPTH			FORCE (kN)	AXIAL / DIAMETRIC	DIAMETER (mm)	LENGTH (mm)	BREAK	UCS (Mpa)	CONCLUSIONS			
	FT.	IN.	METERS										
RUN #2	18	7	5.66	8.5	D	37.24	75.85	ok	128.83				
RUN #3	22	3	6.78	17.5	D	50.43	231.45	ok	165.78				
RUN #4	25	9	7.85	13.0	D	50.54	155.98	ok	122.74				
	25	7	7.80	15.5	A	50.62	52.86	ok	117.07				
											AVERAGE	MAX	MIN
										RUN #2:	129	129	129
										RUN #3:	166	166	166
										RUN #4:	120	123	117

Hwy 69 Four-Laning North of Hwy 529 GRAIN SIZE DISTRIBUTION

FIGURE B1



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

LEGEND

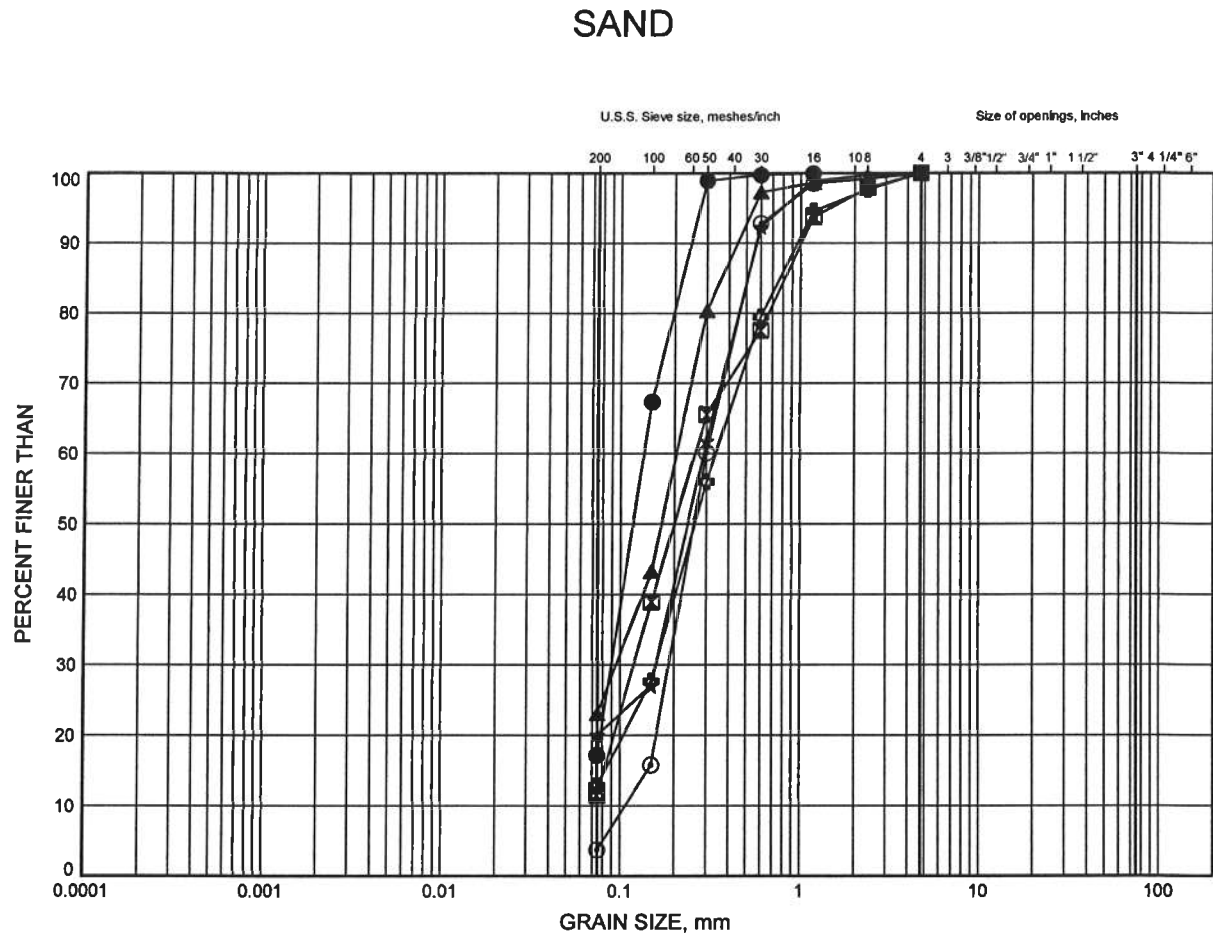
SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH10-F	0.30	186.60
⊠	BH10-H	0.30	185.70
▲	HRB09-03	6.40	183.73
★	HRB09-09	2.13	183.55
⊙	HRB09-09	4.57	181.11
⊕	HRB09-10	1.37	183.21



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Hwy 69 Four-Laning North of Hwy 529 GRAIN SIZE DISTRIBUTION

FIGURE B2



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HRB09-10	3.20	181.38
⊠	HRB09-10	4.42	180.16
▲	HRB09-11	0.91	184.41
★	HRB09-11	2.74	182.58
⊙	HRB09-11	3.96	181.36
⊕	HRB09-12	2.74	181.10

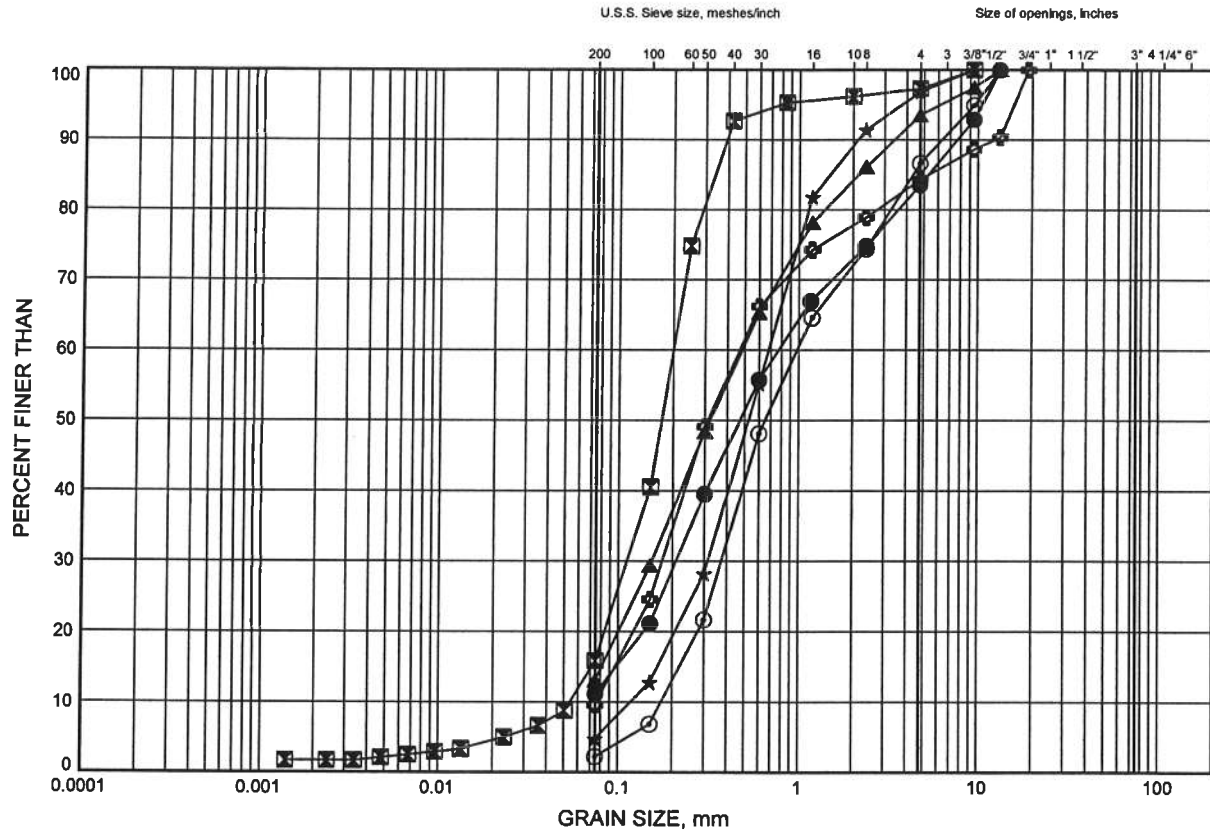


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Hwy 69 Four-Laning North of Hwy 529 GRAIN SIZE DISTRIBUTION

FIGURE B3

SAND



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

LEGEND

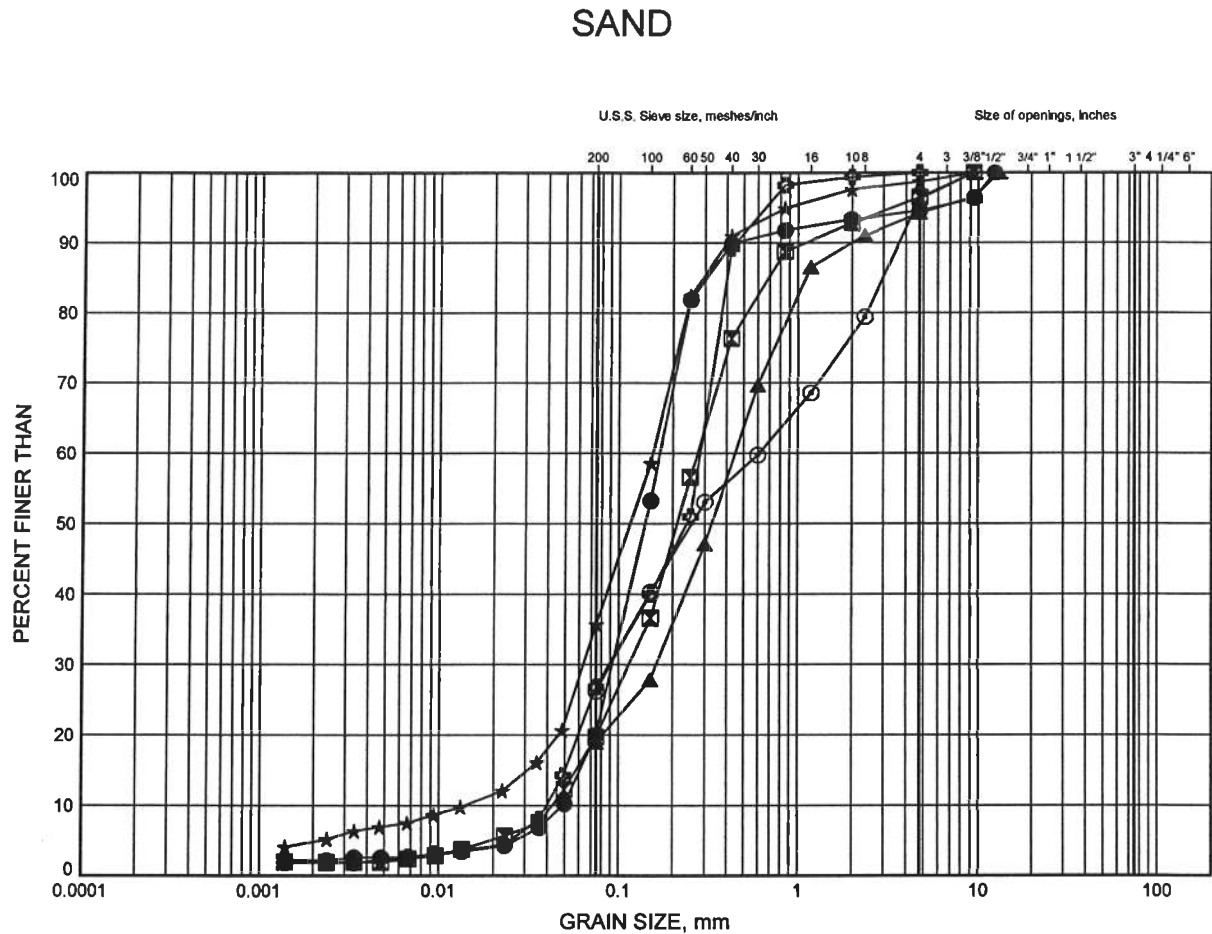
SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HRB09-17	1.83	179.91
⊠	HRB09-21	1.07	180.43
▲	HRB09-21	2.59	178.90
★	HRB09-23	2.59	178.15
⊙	HRB09-23	4.75	175.99
⊕	HRB09-24	3.35	178.24



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Hwy 69 Four-Laning North of Hwy 529 GRAIN SIZE DISTRIBUTION

FIGURE B4



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

LEGEND

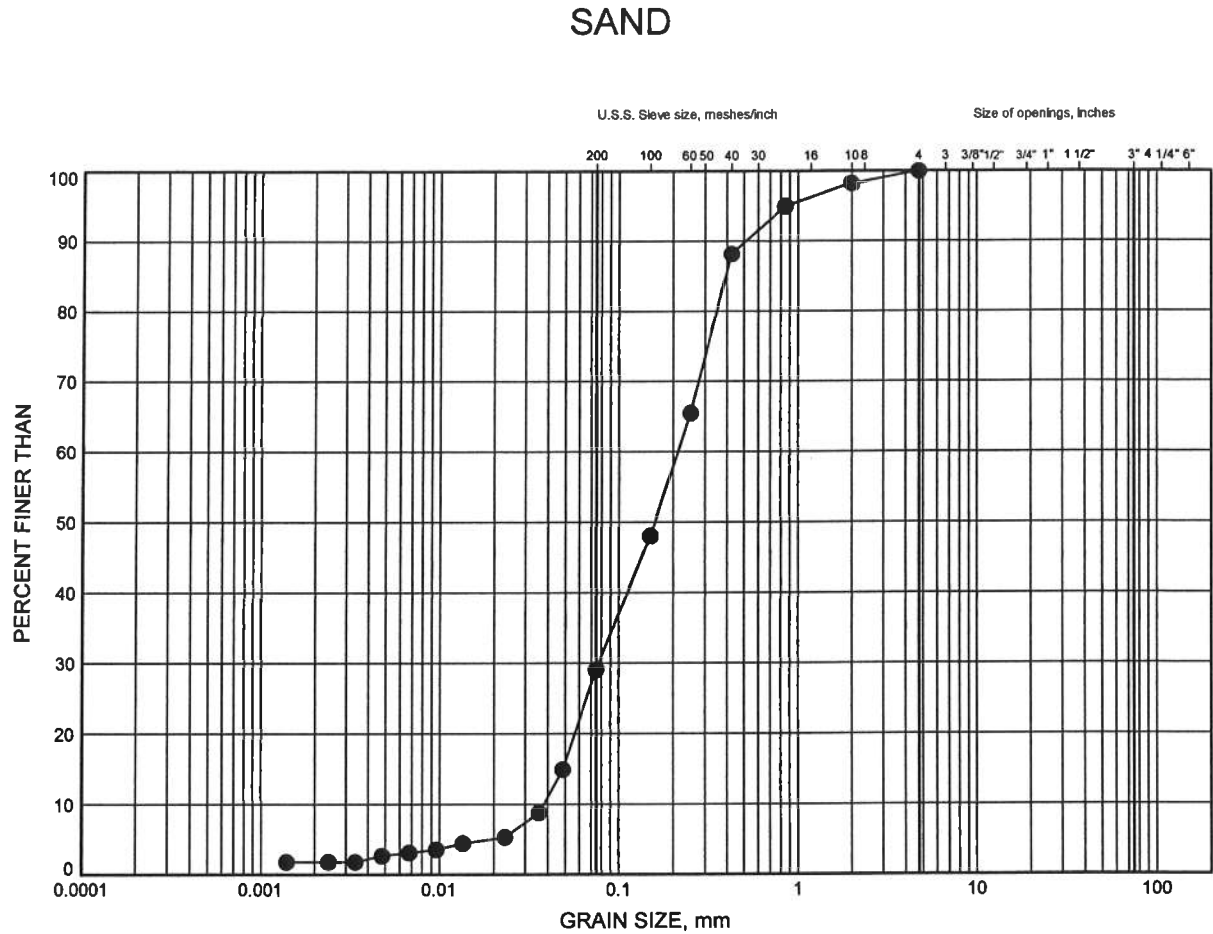
SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HRB09-27	0.70	186.60
⊠	HRB09-34	1.04	190.44
▲	HRB10-01	1.50	185.20
★	HRB10-02	0.90	182.60
⊙	HRB10-02	3.35	180.15
⊕	HRB10-03	0.30	186.00



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Hwy 69 Four-Laning North of Hwy 529 GRAIN SIZE DISTRIBUTION

FIGURE B5



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HRB10-03	2.74	183.56

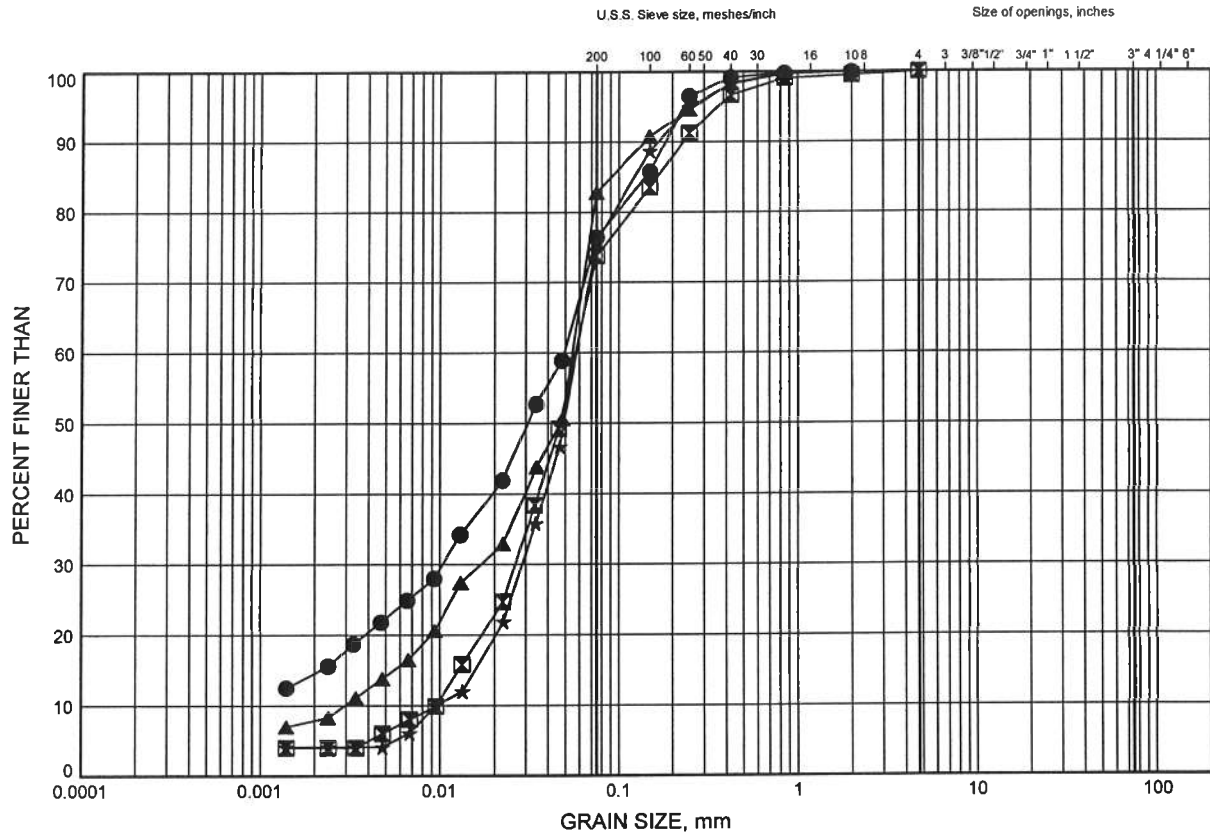


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Hwy 69 Four-Laning North of Hwy 529 GRAIN SIZE DISTRIBUTION

FIGURE B6

SANDY SILT



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH10-A	0.91	188.99
☒	BH10-B	5.18	184.82
▲	BH10-C	0.91	189.19
★	BH10-D	3.35	185.75

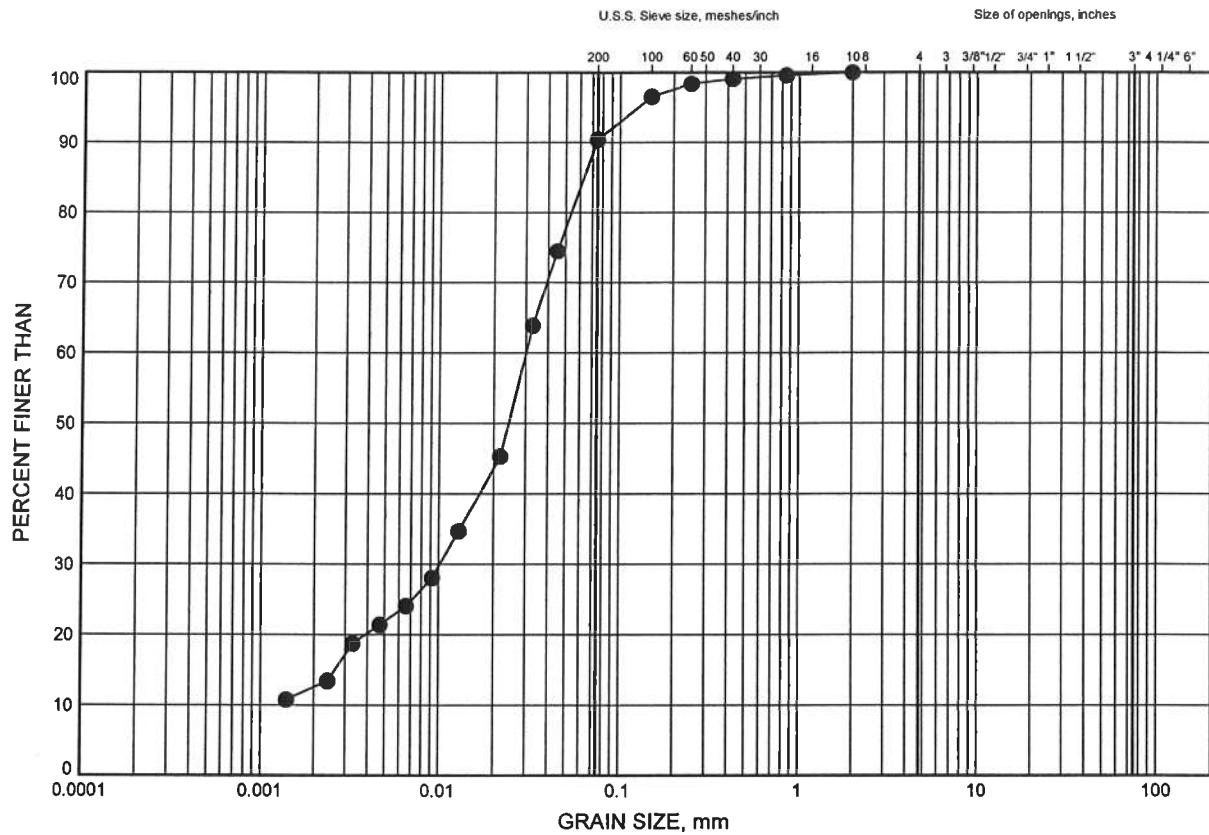


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Hwy 69 Four-Laning North of Hwy 529 GRAIN SIZE DISTRIBUTION

FIGURE B7

SILT



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HRB09-01	1.83	187.55

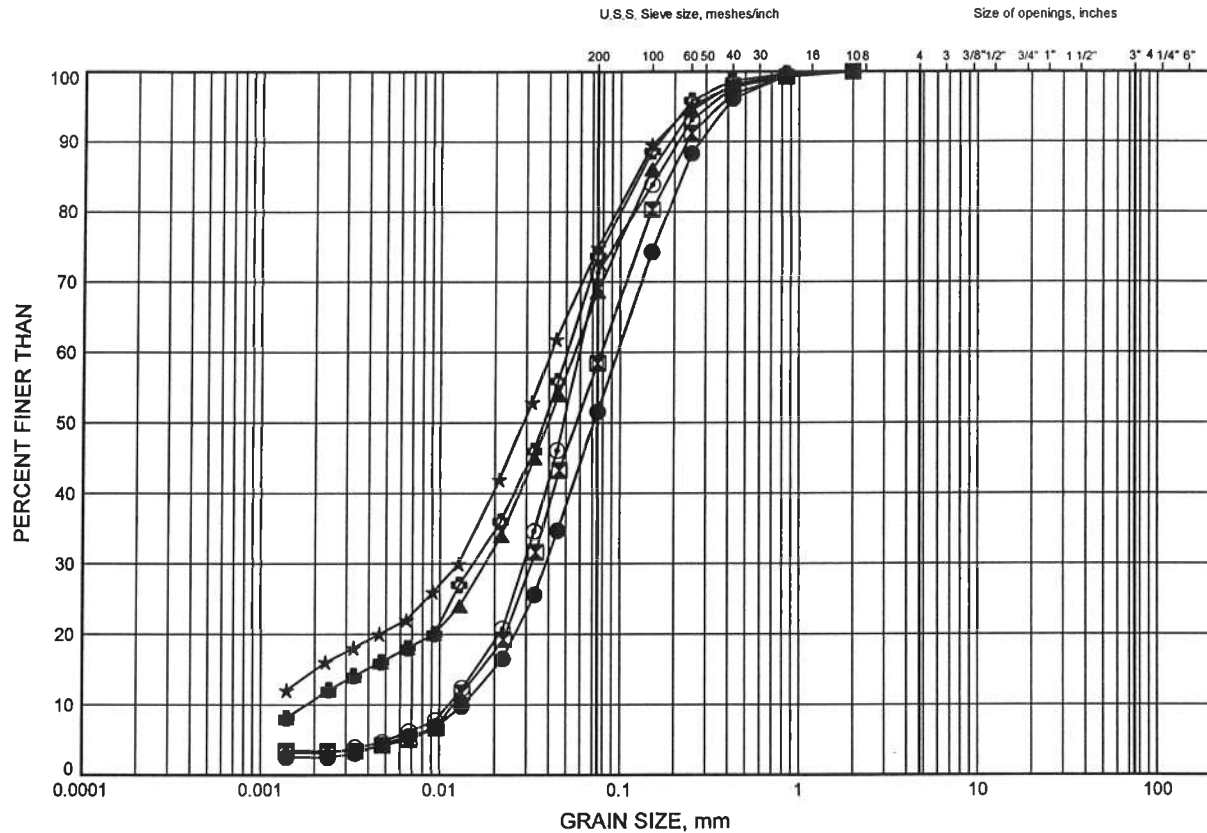


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Hwy 69 Four-Laning North of Hwy 529 GRAIN SIZE DISTRIBUTION

FIGURE B8

SAND & SILT



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

LEGEND

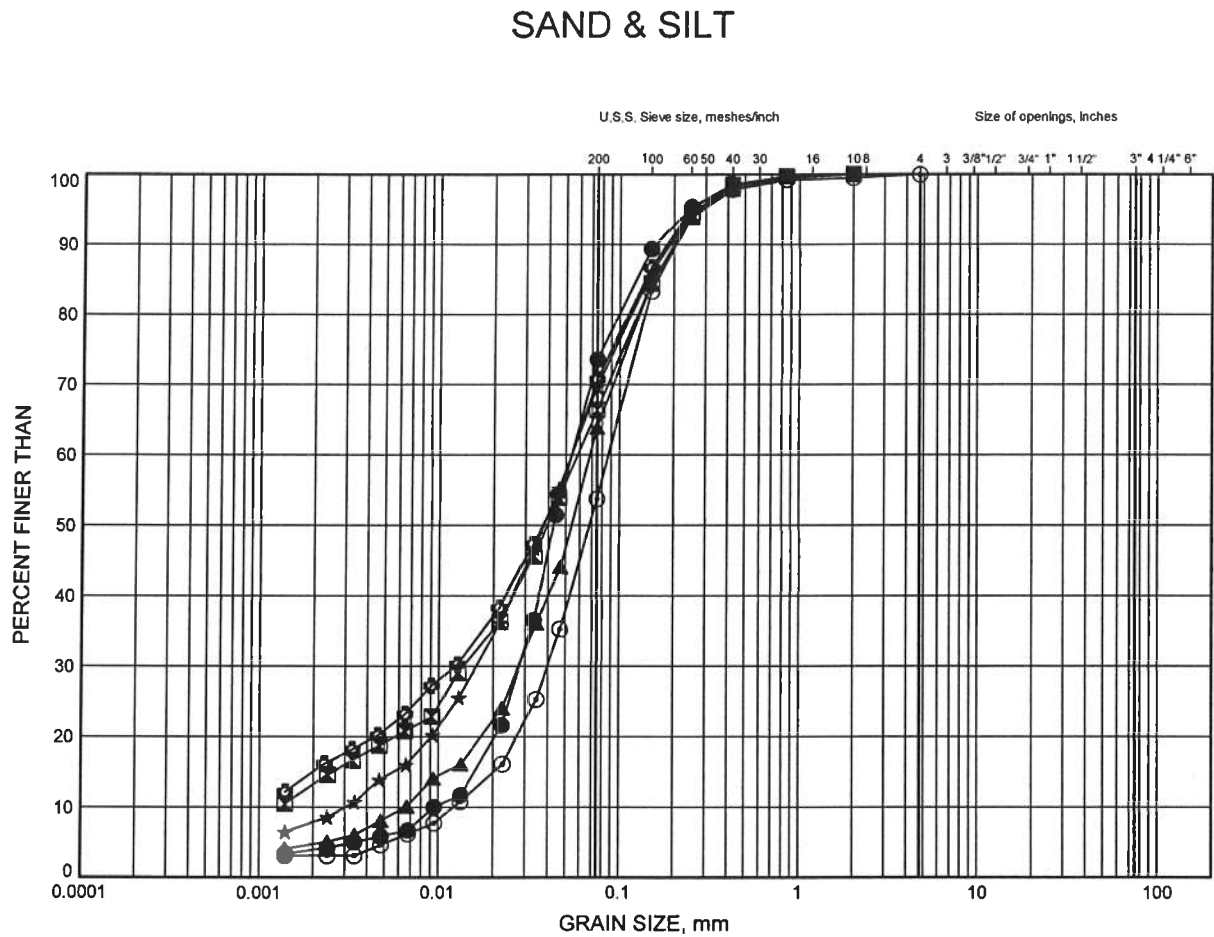
SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HRB09-01	4.88	184.50
⊠	HRB09-02	4.88	184.82
▲	HRB09-03	1.83	188.30
★	HRB09-04	1.07	189.00
⊙	HRB09-04	4.88	185.19
⊕	HRB09-05	1.83	188.23



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Hwy 69 Four-Laning North of Hwy 529 GRAIN SIZE DISTRIBUTION

FIGURE B9



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HRB09-05	4.88	185.19
⊠	HRB09-06	1.07	189.00
▲	HRB09-06	2.29	187.78
★	HRB09-07	1.83	188.57
⊙	HRB09-07	3.35	187.04
⊕	HRB09-08	1.07	189.29

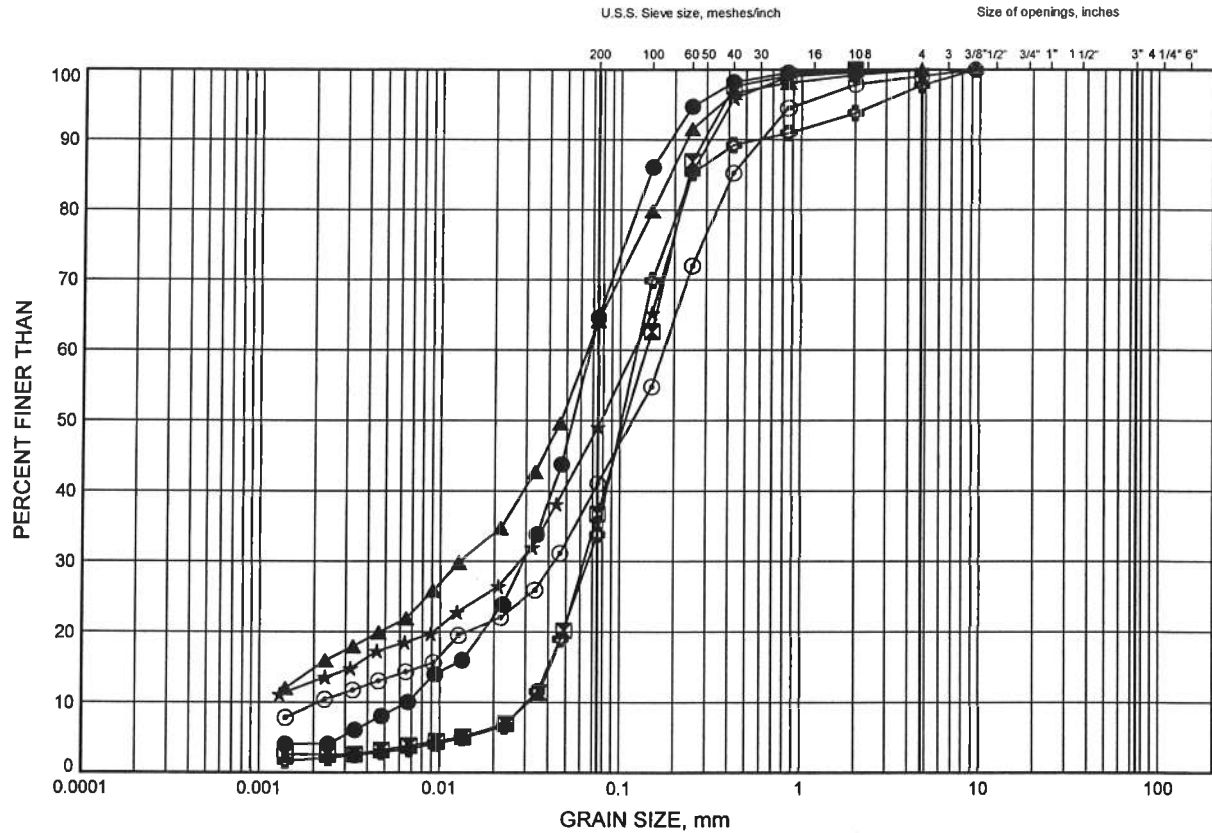


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Hwy 69 Four-Laning North of Hwy 529 GRAIN SIZE DISTRIBUTION

FIGURE B10

SAND & SILT



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HRB09-08	2.59	187.77
⊠	HRB09-09	0.91	184.77
▲	HRB09-12	1.52	182.32
★	HRB09-13	0.91	182.79
⊙	HRB09-14	0.91	181.52
⊕	HRB09-29	0.99	185.32

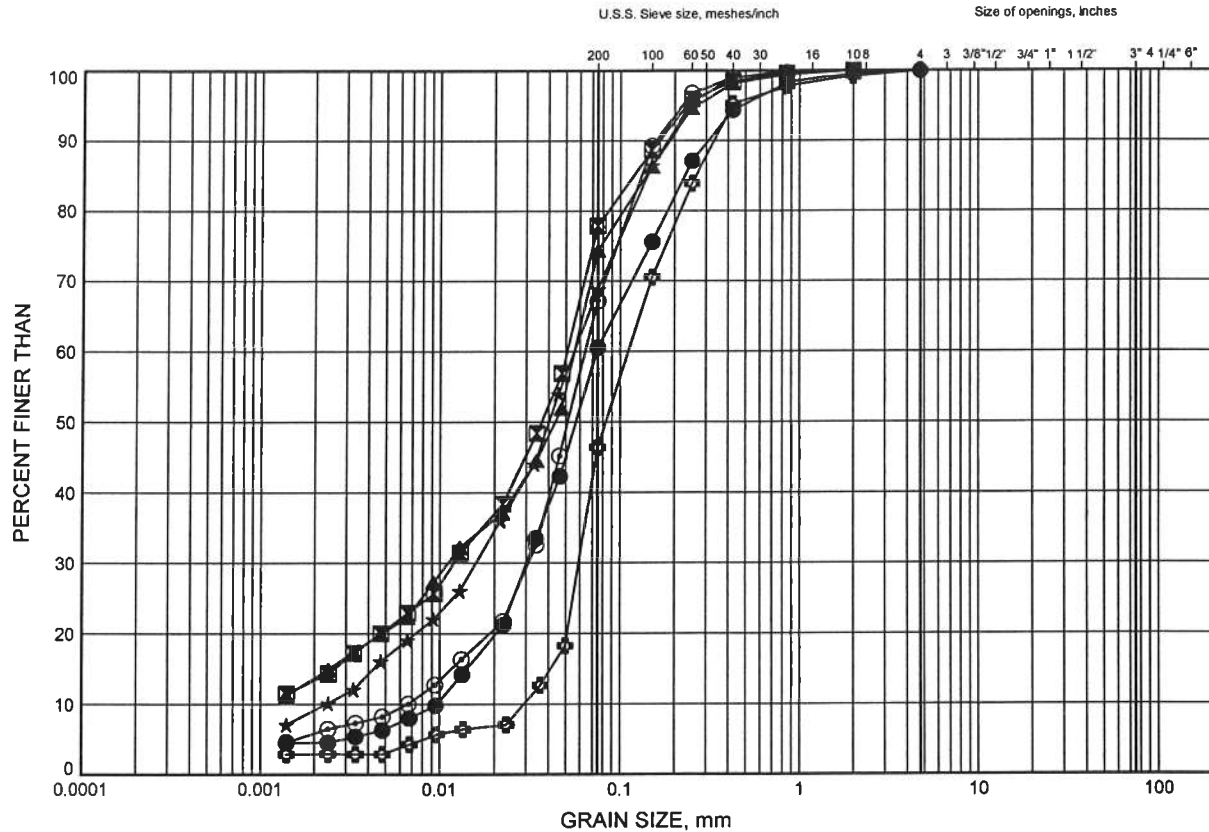


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Hwy 69 Four-Laning North of Hwy 529 GRAIN SIZE DISTRIBUTION

FIGURE B11

SAND & SILT



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH10-A	5.18	184.72
■	BH10-B	1.52	188.48
▲	BH10-D	0.30	188.80
★	HRB09-33	1.07	189.37
⊙	HRB09-33	3.35	187.08
⊕	HRB10-04	0.91	181.79

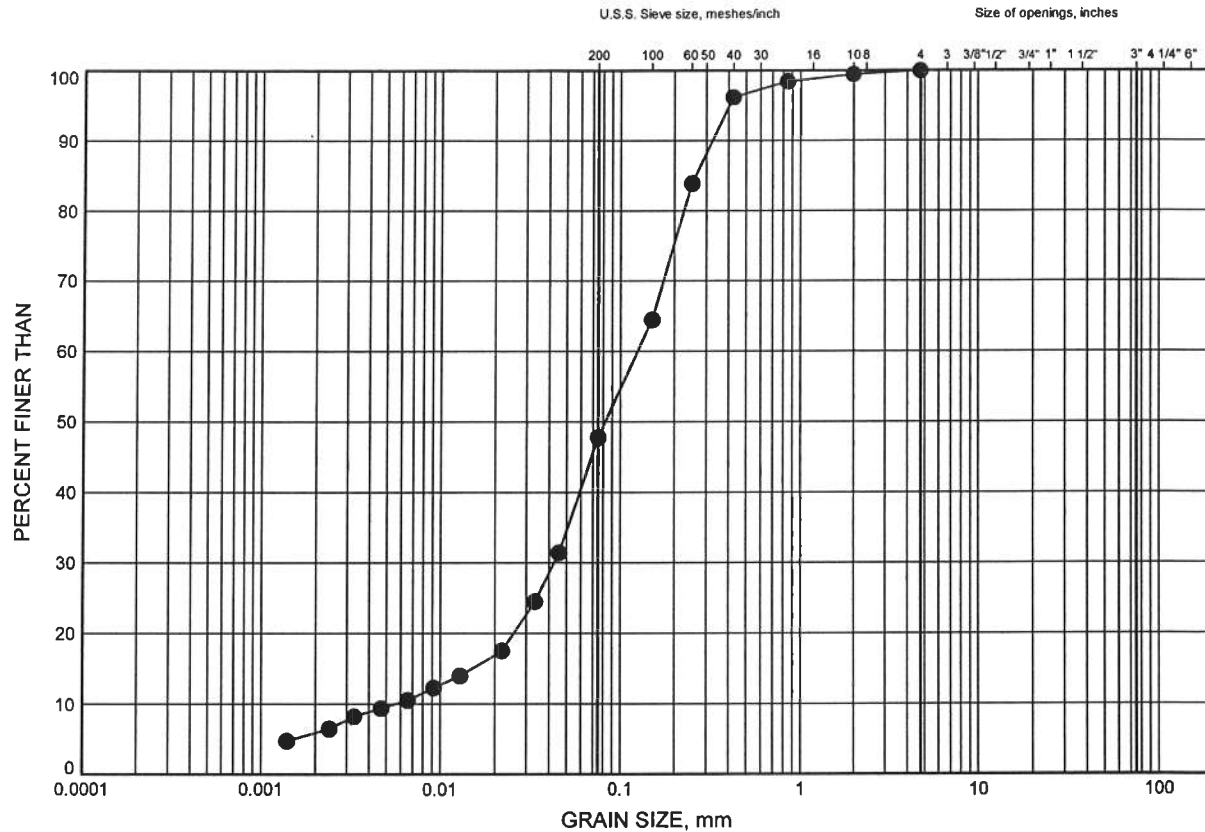


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Hwy 69 Four-Laning North of Hwy 529 GRAIN SIZE DISTRIBUTION

FIGURE B12

SAND & SILT



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

LEGEND

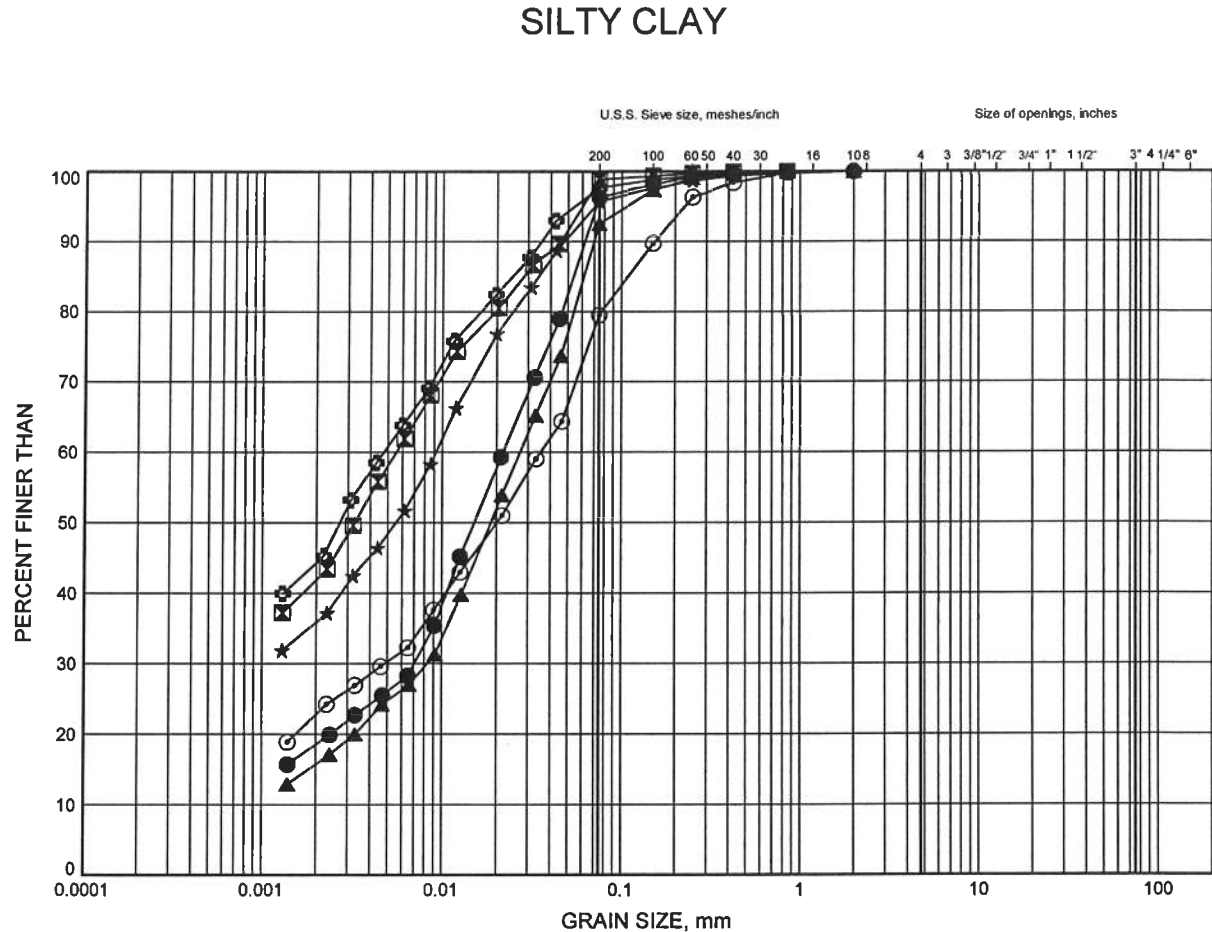
SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HRB10-05	0.28	183.72



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Hwy 69 Four-Laning North of Hwy 529 GRAIN SIZE DISTRIBUTION

FIGURE B13



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

LEGEND

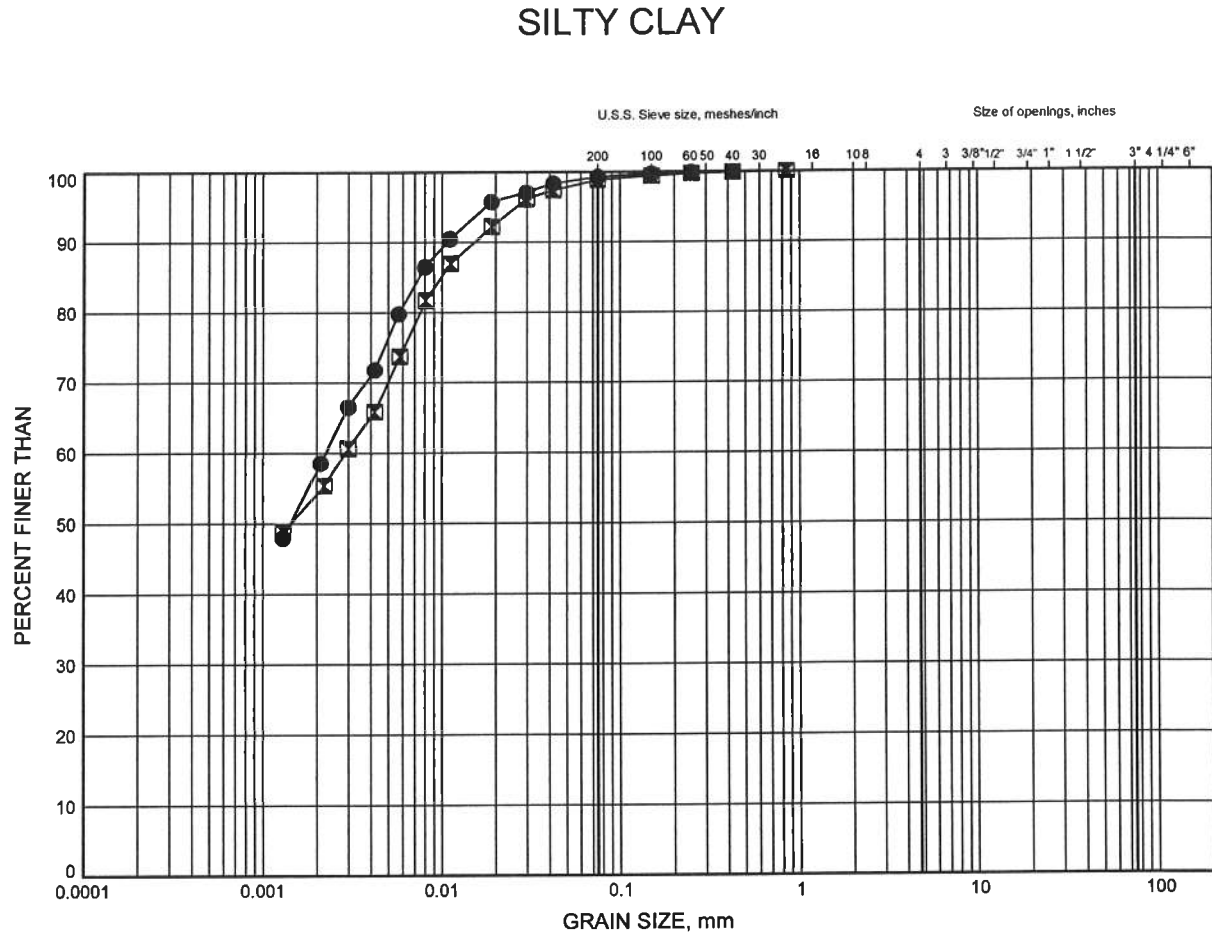
SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BH10-A	3.35	186.55
⊠	BH10-B	3.35	186.65
▲	BH10-C	3.96	186.14
★	HRB09-01	3.35	186.03
⊙	HRB09-02	1.83	187.87
⊕	HRB09-02	3.35	186.35



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Hwy 69 Four-Laning North of Hwy 529 GRAIN SIZE DISTRIBUTION

FIGURE B14



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

LEGEND

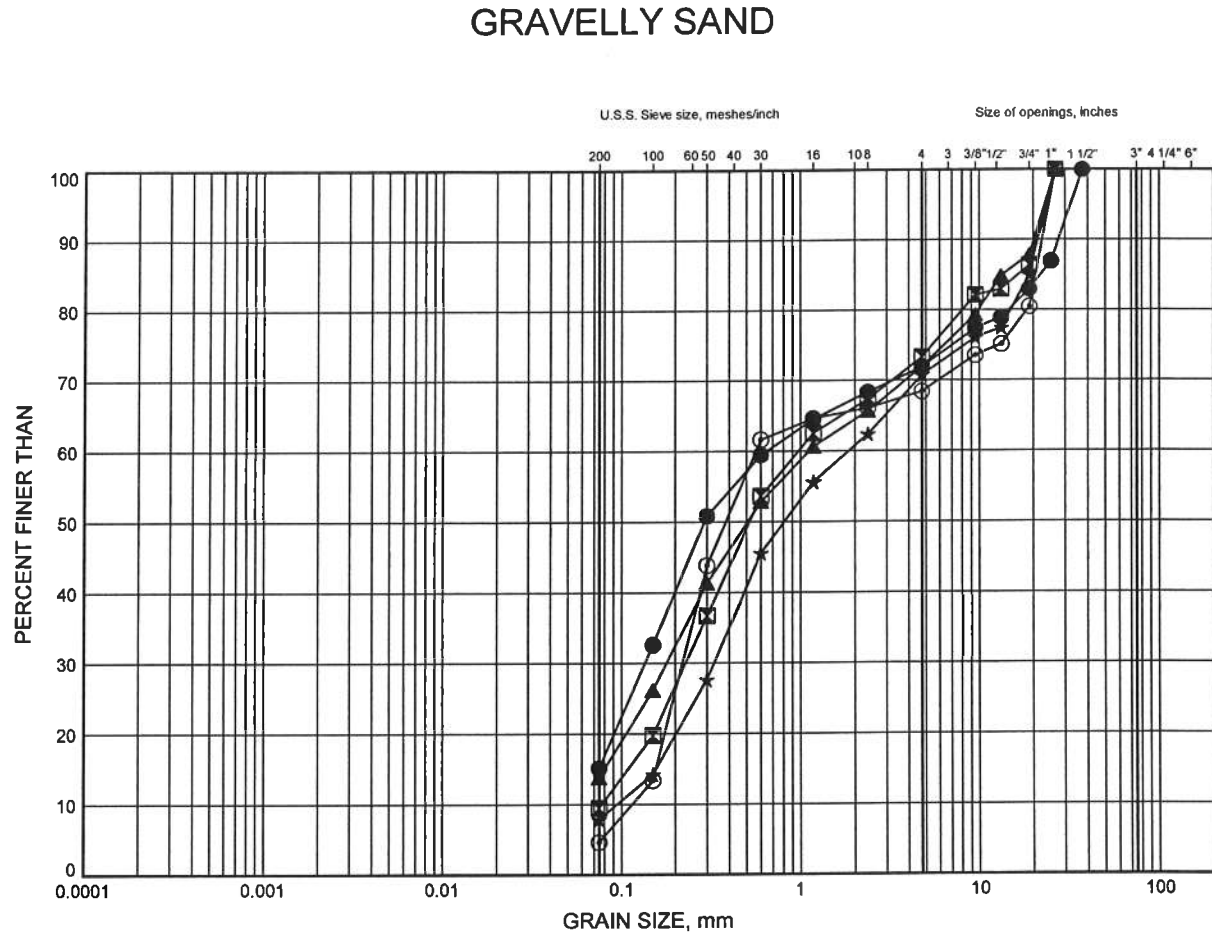
SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HRB09-03	3.35	186.78
□	HRB09-05	3.35	186.71



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Hwy 69 Four-Laning North of Hwy 529 GRAIN SIZE DISTRIBUTION

FIGURE B15



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

LEGEND

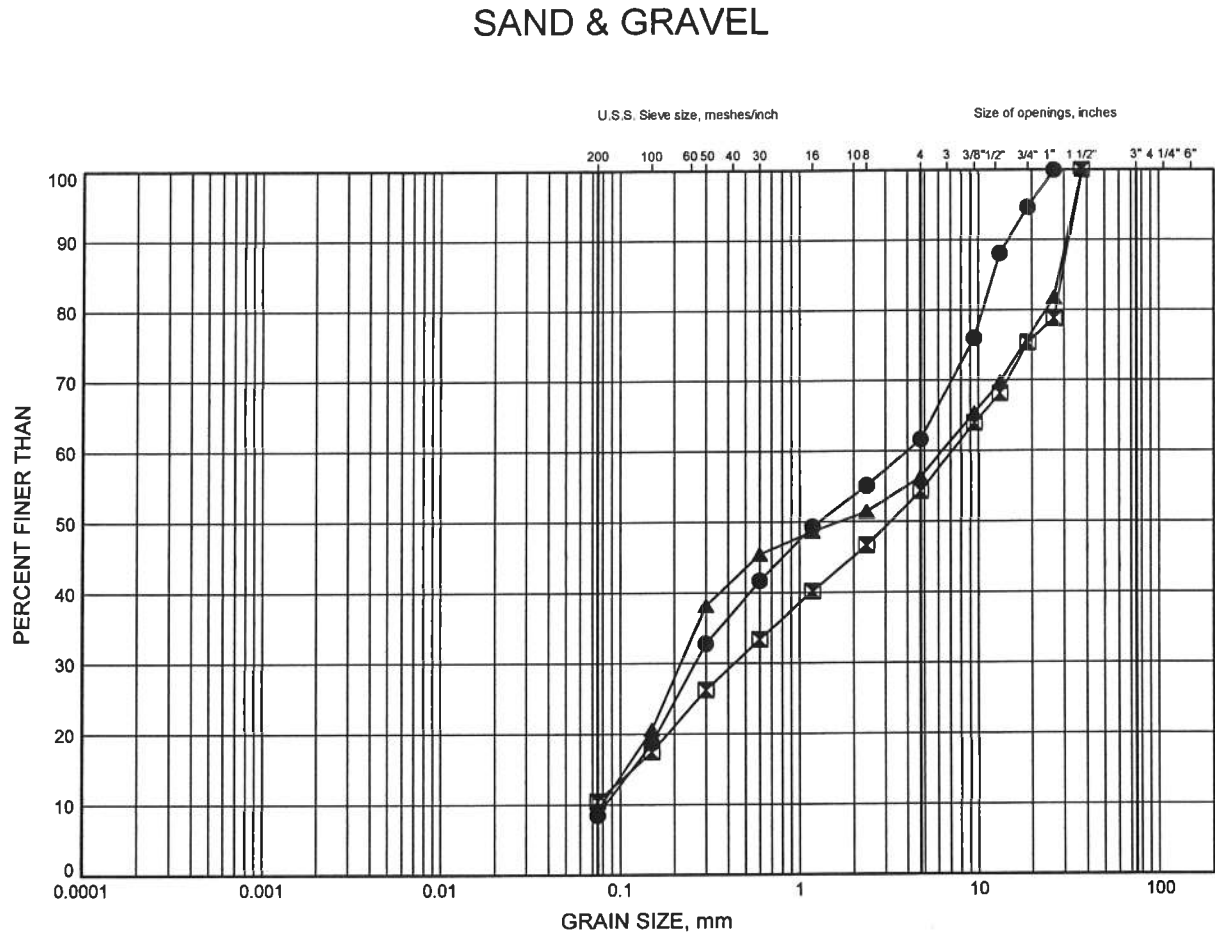
SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HRB09-17	3.35	178.39
⊠	HRB09-20	1.83	180.47
▲	HRB09-20	3.29	179.01
★	HRB09-22	1.83	179.89
⊙	HRB09-24	1.07	180.52



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Prepared By .AN.....
Checked By .LRB.....

Hwy 69 Four-Laning North of Hwy 529 GRAIN SIZE DISTRIBUTION

FIGURE B16



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	HRB09-18	1.07	181.83
⊠	HRB09-18	2.59	180.31
▲	HRB09-19	1.83	179.38

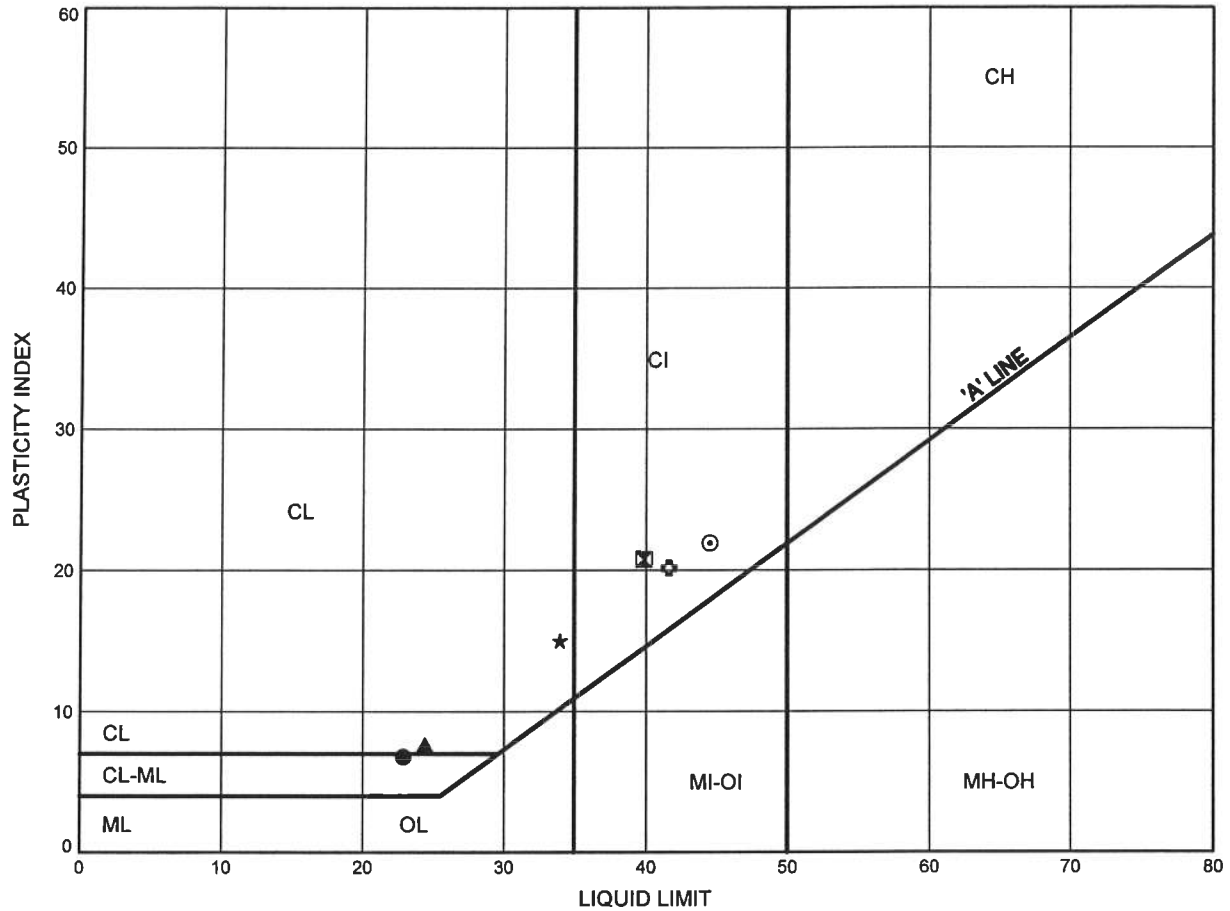


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Checked By LRB.....

Hwy 69 Four-Laning North of Hwy 529
ATTERBERG LIMITS TEST RESULTS

FIGURE B17

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	BH10-A	3.35	186.55
⊠	BH10-B	3.35	186.65
▲	HRB09-01	3.35	186.03
★	HRB09-02	3.35	186.35
⊙	HRB09-03	3.35	186.78
⊕	HRB09-05	3.35	186.71



Date June 2010
 Project 5076-06-00

Prep'd AN
 Chkd. LRB

Appendix C

Record of Borehole Sheets from Previous Investigation

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

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


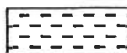



 Water Level
 Shear Strength Determination by Pocket Penetrometer

- (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)

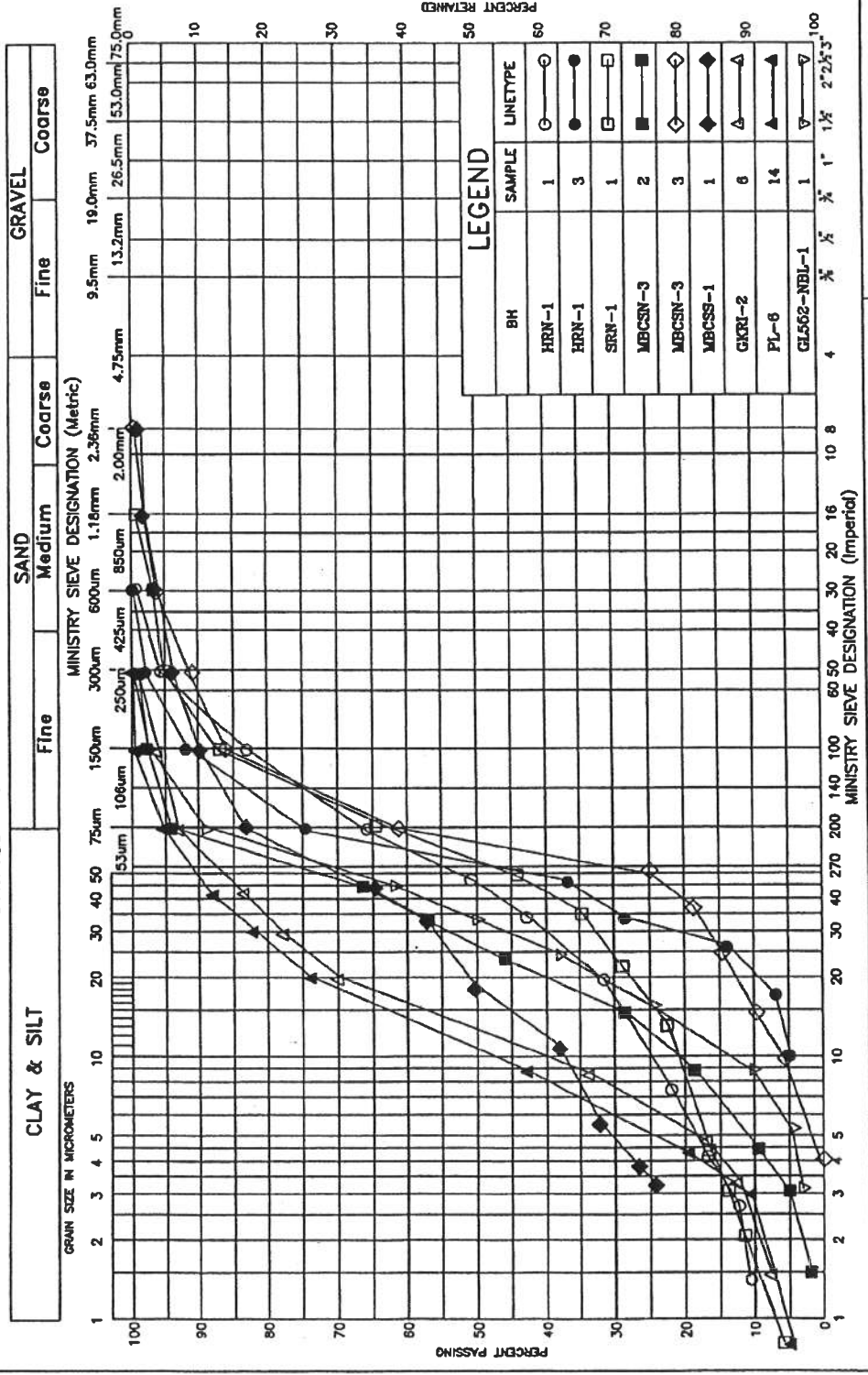
DISCONTINUITY SPACING		STRENGTH CLASSIFICATION			
Bedding	Bedding Plane Spacing	Rock Strength	Approximate Uniaxial Compressive Strength		Field Estimation of Hardness*
			(MPa)	(psi)	
Very thickly bedded	Greater than 2m	Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped 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 HRN-1												1 OF 1		METRIC			
G.W.P. 6377-02-00			LOCATION Hwy 69, Harris River NBL, Co-ords: 5061257 N, 231006 E			ORIGINATED BY SM											
DIST 54 HWY 69			BOREHOLE TYPE Continuous Hollow Stem Auger and HQ Rock Coring			COMPILED BY H.G.											
DATUM Geodetic			DATE 2005.02.12 - 2005.02.12			CHECKED BY H.G.											
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC NATURAL LIQUID			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	T _N VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100	20 40 60 80 100	W _p	W	W _L	γ	GR	SA	SI	CL
190.0	Ground Surface																
190.0 0.2	150 mm topsoil Sandy Silt, brown, moist to wet, compact, some clay		1	SS	13												
			2	SS	14												
			3	SS	22												
185.1	Auger refusal. Coring started.																
5.5	Granitic GNEISS Slightly weathered, pinkish gray, coarse grained, strong Good to excellent quality Some fractures: Planar, wide spaced, at 70 degrees to vertical, smooth, no filling		4	NQRC	Rec 100%												
			5	NQRC	Rec 100%												
182.1	End of Borehole																
6.5	Groundwater not encountered at time of drilling. Groundwater encountered at 6.25 m on March 24, 2005. Groundwater measured at 6.23 m on April 6, 2005.																

ONTARIO MOT 07 HARRIS RIVER NBL.GPJ ONTARIO MOT.GDT 05/06/28

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation
Ontario

GRAIN SIZE DISTRIBUTION

SILT, SANDY SILT, ORGANIC SILT

FIG No. 2

GWP 5377-02-00

Appendix D

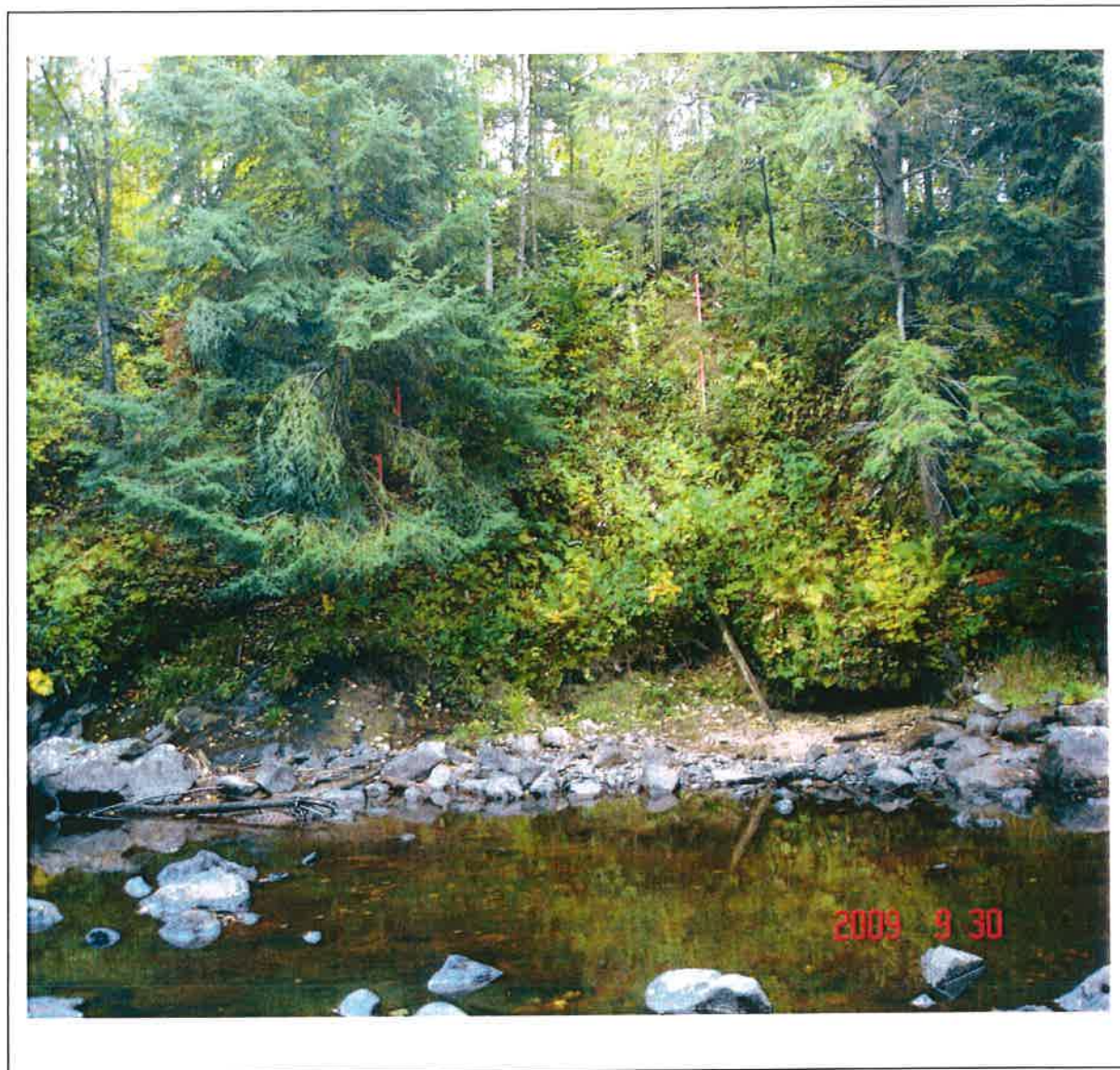
Site Photographs



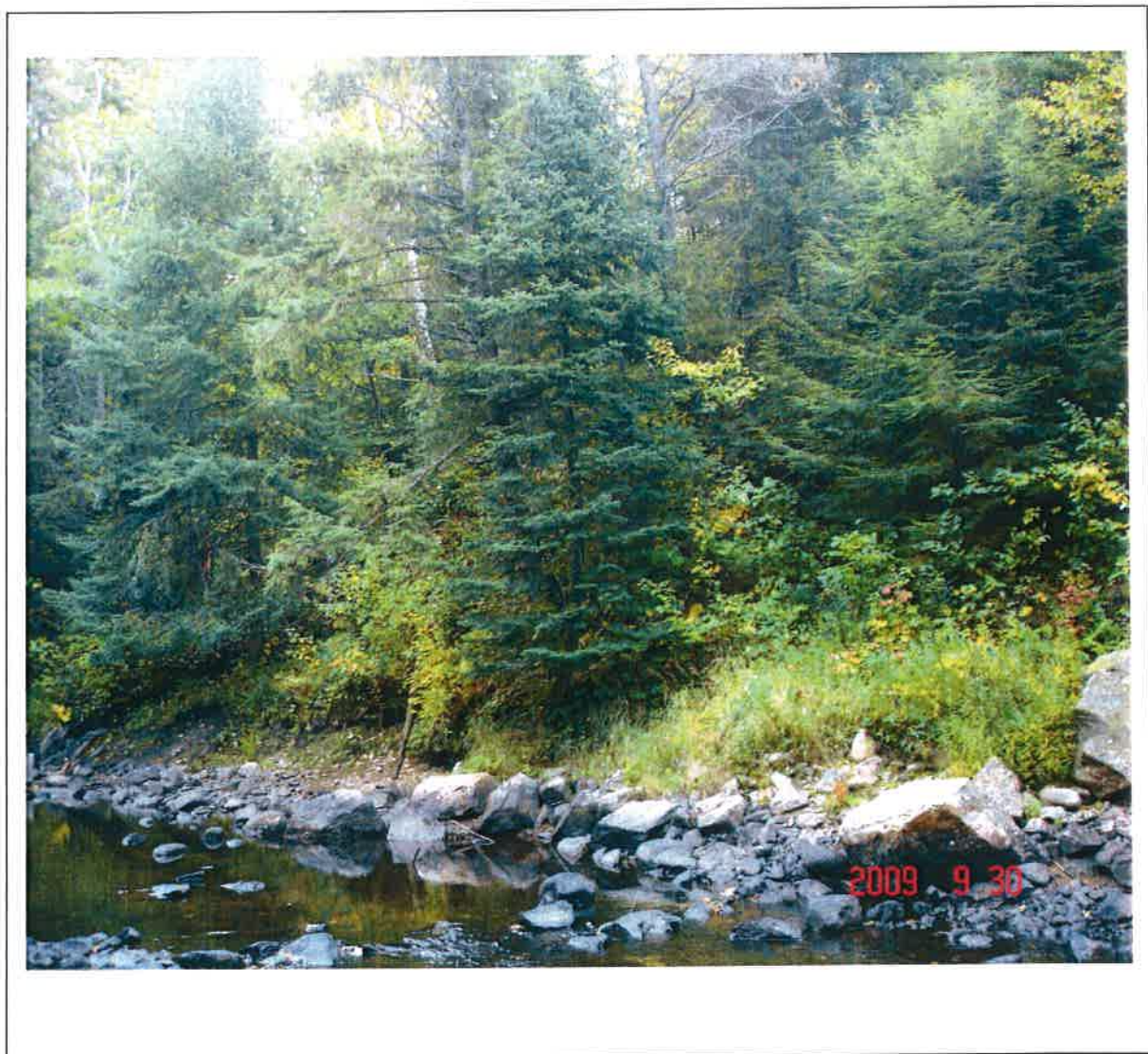
Photograph 1 – Existing conditions of Harris River looking east at site



Photograph 2 – Existing structure at Highway 69 and Harris River crossing looking west



Photograph 3 – South river bank at location of proposed structure.



Photograph 4 – Looking southeast at south river bank at location of proposed structure.

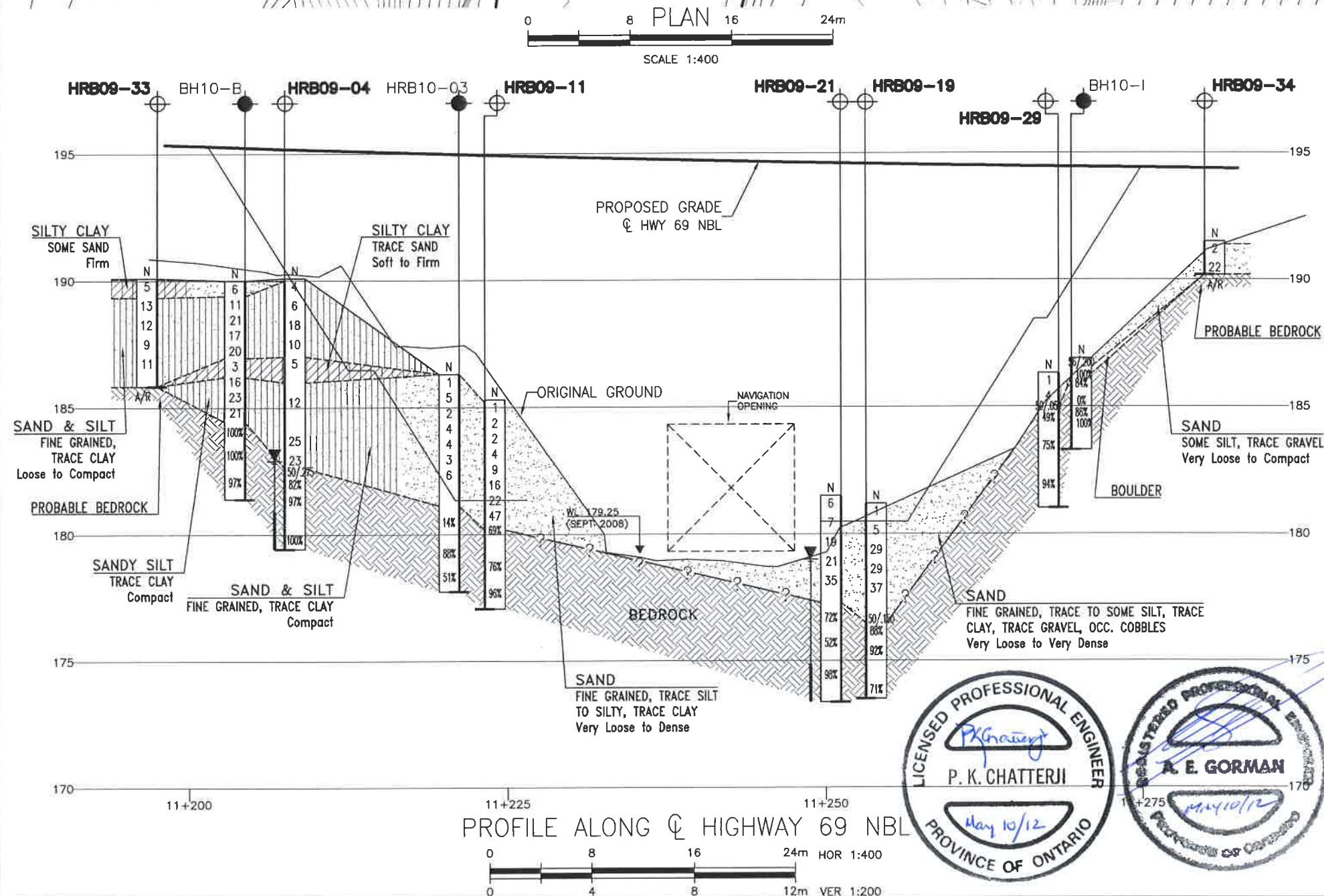


Photograph 5 – Looking northeast at north river bank at location of proposed structure.

Appendix E

Drawing

Borehole Locations and Soil Strata



METRIC

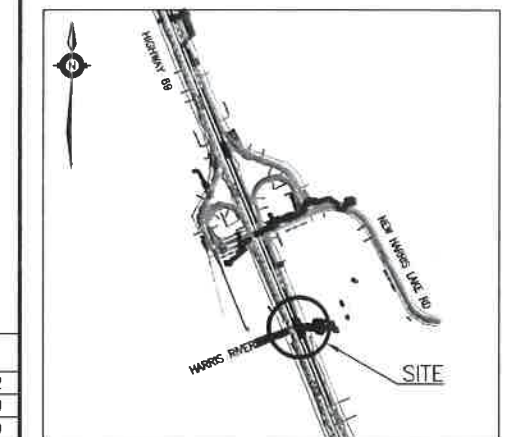
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

HWY 69
CONT No
WP No 5200-06-01

HIGHWAY 69 FOUR-LANING
HARRIS RIVER BRIDGE
NORTHBOUND LANES
BOREHOLE LOCATIONS AND SOIL STRATA



SHEET



LEGEND

- Borehole (2010 Investigation)
- Borehole (2009 Investigation)
- Cone
- Borehole By Others
- Blows /0.3m (Std Pen Test, 475J/blow)
- Blows /0.3m (60' Cone, 475J/blow)
- Pressure, Hydraulic
- Water Level
- Head Artesian Water
- Piezometer
- Rock Quality Designation (RQD)
- Auger Refusal

NO	ELEVATION	NORTHING	EASTING
HRB09-01	189.4	5 061 257.6	230 999.8
HRB09-02	189.7	5 061 258.9	230 999.8
HRB09-03	190.1	5 061 257.8	231 003.8
HRB09-04	190.1	5 061 259.0	231 003.7
HRB09-05	190.1	5 061 258.0	231 009.6
HRB09-06	190.1	5 061 259.2	231 009.6
HRB09-07	190.4	5 061 258.1	231 014.3
HRB09-08	190.4	5 061 259.3	231 014.2
HRB09-09	185.7	5 061 273.2	230 993.5
HRB09-10	184.6	5 061 274.8	230 993.4
HRB09-11	185.3	5 061 273.4	230 997.4
HRB09-12	183.8	5 061 274.9	230 997.4
HRB09-13	183.7	5 061 273.6	231 003.3

-NOTES-

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

GEOCREs No. 41H-86

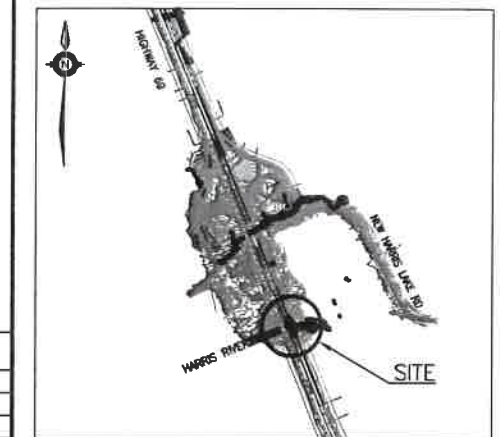
DATE	BY	DESCRIPTION
DESIGN	RPR	CHK AEG
DRAWN	MFA	CHK PKC
LOAD	DATE	MAY 2012
STRUCT	DWG	2



METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWNHWY 69
CONT No
WP No 5200-06-01HIGHWAY 69 FOUR-LANING
HARRIS RIVER BRIDGE
NORTHBOUND LANES
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET



KEYPLAN

LEGEND

- Borehole (2010 Investigation)
- Borehole (2009 Investigation)
- Cone
- Borehole By Others
- Blows /0.3m (Std Pen Test, 475J/blow)
- Blows /0.3m (60' Cone, 475J/blow)
- Pressure, Hydraulic
- Water Level
- Head Artesian Water
- Piezometer
- Rock Quality Designation (RQD)
- Auger Refusal

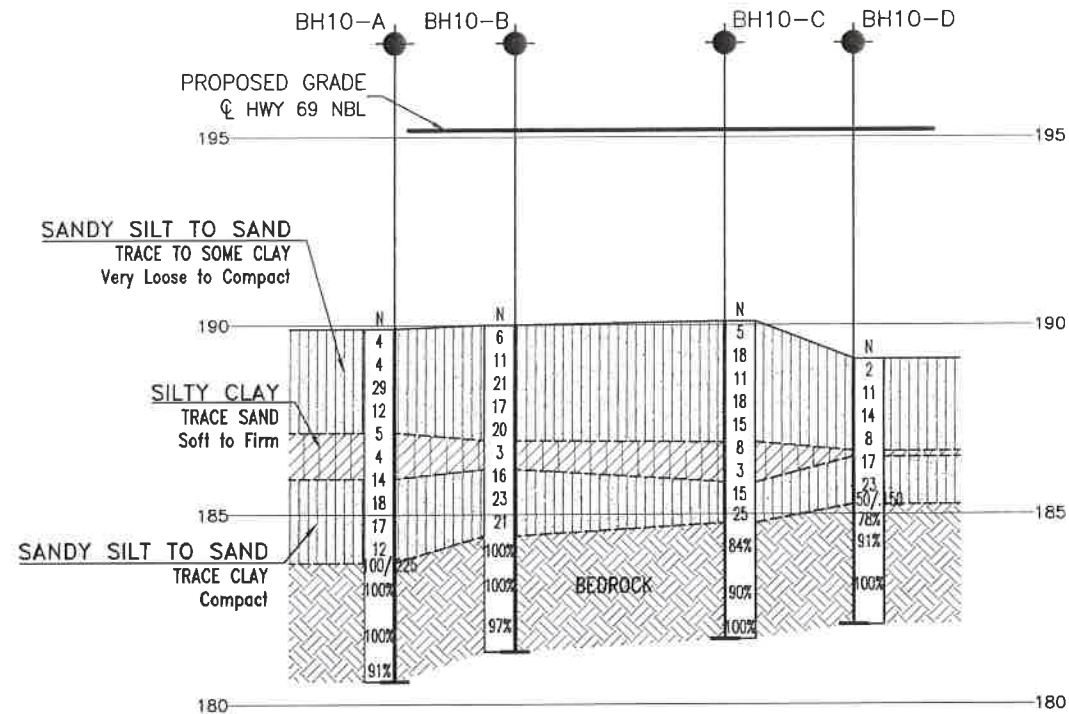
NO	ELEVATION	NORTHING	EASTING
HRB09-14	182.4	5 061 275.1	231 003.2
HRB09-15	184.0	5 061 273.8	231 007.9
HRB09-16	183.0	5 061 275.3	231 007.9
HRB09-17	181.7	5 061 301.1	230 982.2
HRB09-18	182.9	5 061 302.6	230 982.2
HRB09-19	181.2	5 061 301.2	230 986.2
HRB09-20	182.3	5 061 302.7	230 986.1
HRB09-21	181.5	5 061 301.4	230 992.0
HRB09-22	181.7	5 061 302.9	230 992.0
HRB09-23	180.7	5 061 301.6	230 996.7
HRB09-24	181.6	5 061 303.1	230 996.6
HRB09-25	188.1	5 061 317.0	230 975.9
HRB09-26	188.7	5 061 318.2	230 975.8
HRB09-27	187.3	5 061 317.1	230 979.8
HRB09-28	187.7	5 061 318.3	230 979.8
HRB09-29	186.3	5 061 317.3	230 985.6
HRB09-30	186.8	5 061 318.5	230 985.6
HRB09-31	185.7	5 061 317.5	230 990.3
HRB09-32	186.1	5 061 318.7	230 990.3
HRB09-33	190.4	5 061 249.2	231 010.6
HRB09-34	191.5	5 061 327.1	230 979.1
HRN-1	190.6	5 061 257.0	231 006.0
HRB10-01	186.7	5 061 272.2	230 993.5
HRB10-02	183.5	5 061 275.8	230 993.4
HRB10-03	186.3	5 061 272.5	231 000.5
HRB10-04	182.7	5 061 276.0	231 000.4
HRB10-05	183.9	5 061 272.8	231 008.1
HRB10-06	182.4	5 061 276.3	231 007.9
HRB10-07	181.6	5 061 300.1	230 982.2
HRB10-08	182.0	5 061 303.5	230 982.2
HRB10-11	181.1	5 061 300.6	230 996.8
HRB10-12	181.3	5 061 304.1	230 996.7
BH10-A	189.9	5 061 254.6	231 001.2
BH10-B	190.0	5 061 255.8	231 004.3
BH10-C	190.1	5 061 261.2	231 009.6
BH10-D	189.1	5 061 262.6	231 012.9
BH10-E	185.9	5 061 312.1	230 977.9
BH10-F	186.9	5 061 314.8	230 976.8
BH10-G	186.5	5 061 313.3	230 981.0
BH10-H	186.0	5 061 314.6	230 984.1
BH10-I	186.9	5 061 317.4	230 983.0
BH10-J	186.2	5 061 320.1	230 989.7

NO	ELEVATION	NORTHING	EASTING
HRB09-01	189.4	5 061 257.6	230 999.8
HRB09-02	189.7	5 061 258.9	230 999.8
HRB09-03	190.1	5 061 257.8	231 003.8
HRB09-04	190.1	5 061 259.0	231 003.7
HRB09-05	190.1	5 061 258.0	231 009.6
HRB09-06	190.1	5 061 259.2	231 009.6
HRB09-07	190.4	5 061 258.1	231 014.3
HRB09-08	190.4	5 061 259.3	231 014.2
HRB09-09	185.7	5 061 273.2	230 993.5
HRB09-10	184.6	5 061 274.8	230 993.4
HRB09-11	185.3	5 061 273.4	230 997.4
HRB09-12	183.8	5 061 274.9	230 997.4
HRB09-13	183.7	5 061 273.6	231 003.3

-NOTES-

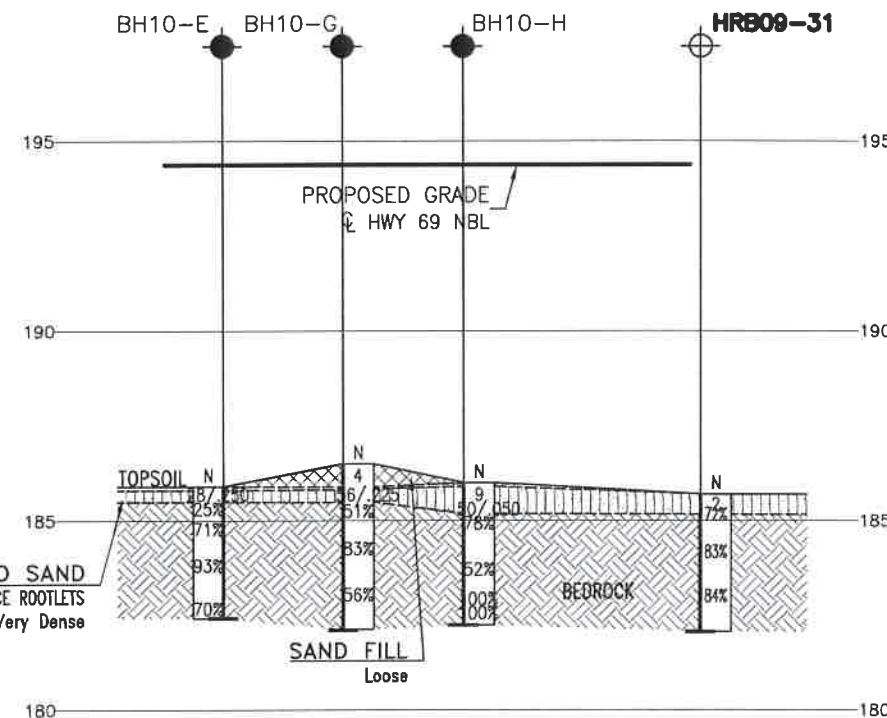
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- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCREs No. 41H-86



SECTION A-A (SOUTH ABUTMENT)

SCALE 1:200



SECTION B-B (NORTH ABUTMENT)

SCALE 1:200



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	RPR	CHK AEG	CODE
DRAWN	MFA	CHK PKC	SITE
			STRUCT
			DWG 3
			DATE MAY 2012