

**FOUNDATION INVESTIGATION REPORT  
DETAIL DESIGN  
BEATTY CREEK BRIDGE REPLACEMENT  
HIGHWAY 534  
G.W.P. 5200-03-00, SITE 44-016**

**Geocres Number: 31L-120**

**Report to**

**McCormick Rankin Corporation**

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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## **1 INTRODUCTION**

This report presents the factual findings obtained from a foundation investigation conducted for the proposed replacement of the Beatty Creek bridge located on Highway 534 approximately 100 m west of the Highway 654 junction.

A preliminary foundation investigation was carried out for this project by Thurber in August to September 2006, and the factual data from that investigation has been incorporated into the current assignment.

The purpose of the investigation was to explore the subsurface conditions at the site and, based on the data obtained, to provide a borehole location plan, borehole logs, stratigraphic profile and a written description of the subsurface conditions. A model of the subsurface conditions was developed to describe the geotechnical conditions influencing structure foundation design, embankment stability and settlement, and construction concerns.

Thurber carried out the investigation as a sub-consultant to McCormick Rankin Corporation, under the Ministry of Transportation Ontario (MTO) Agreement Number 5004-E-0056.

## **2 SITE DESCRIPTION**

The bridge site lies on Highway 534 approximately 100 m west of Highway 654 and 1 km south of the Village of Nipissing. It lies in the Township of Nipissing, District of Parry Sound.

The general site area is located within the physiographic region known as the Canadian Shield, characterized by Pre-Cambrian bedrock typically occurring as rounded knobs and ridges where exposed. The bedrock is locally overlain by deposits of glacio-fluvial sands and gravels, and glacio-lacustrine soils. More recent organic deposits are present in poorly drained swamp environments.

The immediate area of the bridge is generally wooded, low-lying and wet. Photographs of the site are provided in Appendix C. At the site, Beatty Creek is a slow moving watercourse within a meandering channel typically ranging from 6 to 8 m wide. An abandoned meander with ponded

water exists in the southwest quadrant of the creek crossing. The site is prone to flooding during heavy rainfall events and spring snowmelt.

The existing bridge is a three span timber beam and deck structure supported on timber pile bents. The bridge has a total length of 13 m.

An abandoned road alignment, now a snowmobile trail, runs south of the current road alignment. A general store is present at the junction of Highway 654.

### 3 SITE INVESTIGATION AND FIELD TESTING

Thurber carried out site investigation and field testing for the detailed design phase of this project during the period July 23 to August 2, 2007. The fieldwork for the preliminary investigation was carried out from August 28 to September 8, 2006. In total, 18 boreholes were drilled and sampled at the locations of the proposed bridge, approaches and embankments.

The approximate locations of the boreholes are shown on the attached Borehole Locations and Soil Strata Drawings in Appendix D. The locations and depths of the boreholes were as follows:

**Table 3.1 – Borehole Details**

Location	Study Phase	Number of Boreholes	Borehole Numbers	Depth of Boreholes (m)
Proposed Bridge Abutments	Preliminary	4	06-B1 to 06-B4	41.8 to 47.8
	Detail	4	07-B1, 07-B2, 07-B4, 07-B5	15.8 to 45.5
Structure Approaches	Detail	2	07-B3, 07-B6	40.4 to 44.0
Existing and Proposed Embankments	Preliminary	2	06-B8, 06-B10	17.7 to 20.1
	Detail	3	07-B7 to 07-B9	38.7 to 44.5
Alternate Alignments	Preliminary	3	06-B6, 06-B7, 06-B9	12.6 to 42.5

The borehole depths in Table 3.1 include recovery of an approximate 3 m length of rock core at four locations.

Thurber positioned the boreholes in the field relative to the centreline of Highway 534 and the existing bridge structure. Several boreholes were repositioned from the programmed locations due to overhead wires, embankment slopes, and the creek channel. The coordinates and ground surface elevations at the boreholes were subsequently established by MRC. The coordinates and elevations of the boreholes are given on the Borehole Locations and Soil Strata Drawing and on the individual Record of Borehole Sheets in Appendix A.

A combination of hollow stem auger and rotary drilling techniques was used to advance the boreholes and samples were obtained using a split spoon sampler in conjunction with Standard Penetration Tests (SPT). The in situ strength of the cohesive soils was assessed using the MTO shear vane, and thin wall tube samples were recovered from the soft cohesive deposits. The boreholes were supplemented by dynamic cone penetration testing. Bedrock cores were recovered using NQ coring equipment.

A member of Thurber's engineering staff supervised the drilling and sampling operations on a full time basis. The inspector logged the soil and groundwater conditions encountered in the boreholes, and collected, labelled and arranged for transport of the samples to Thurber's laboratory.

Standpipe piezometers were installed in selected boreholes to monitor groundwater levels. The completion details of the piezometers are presented in Table C1 of Appendix C.

The boreholes without piezometers were grouted upon completion. Following water level measurements, the piezometers were decommissioned in accordance with the abandonment requirements of MOE Reg. 903.

#### **4 LABORATORY TESTING**

All recovered soil samples were subjected to visual identification and to natural moisture content determination. The results of this testing are shown on the Record of Borehole sheets in Appendix A.

Selected samples were subjected to gradation analysis (sieve and hydrometer) and Atterberg Limits testing. Thin wall tube samples were also selected for consolidation testing and unconfined compression tests. The results are shown on the Record of Borehole sheets in Appendix A and on the charts in Appendix B.

The rock core descriptions were confirmed in the laboratory and Point Load Tests were conducted to assess the compressive strength of the rock.

#### **5 DESCRIPTION OF SUBSURFACE CONDITIONS**

##### **5.1 General**

Reference is made to the Record of Borehole sheets in Appendix A and to the Borehole Locations and Soil Strata Drawings in Appendix D. An overall description of the stratigraphy based on the conditions encountered in the boreholes is given in the following paragraphs. However, the factual data presented in the borehole logs takes precedence over this general description and interpretation of the site conditions.

The soil stratigraphy encountered at this site generally consists of existing road embankment fill and/or relatively thin layers of sand, silty sand, sandy silt and silt, underlain by a deposit of very soft to stiff silty clay to clayey silt. The upper clay deposit is underlain by a unit of sands and silts, and a deeper, thick layer of soft to very stiff silty clay to clayey silt. The lower clay deposit typically overlies sands and silts which mantle bedrock.

The thickness and gradation of the particular deposits vary with location. Further, the deposits have a layered structure and often contain discontinuous seams and layers of coarser or finer material within each generalized unit.

More detailed descriptions of the individual strata are presented below.

Three boreholes (BH06-B6, 06-B7 and 06-B9) were drilled on alternate alignments during the preliminary investigation. The Record of Borehole sheets for these boreholes are included in Appendix A for information purposes, however the data is not included in the discussion below.

## **5.2 Roadway Pavement and Embankment Fill**

A 40 to 90 mm thick layer of asphalt, appearing to consist of chip seal surface treatment, was encountered in seven boreholes drilled on Highway 534.

The asphalt was underlain by granular fill (sand and gravel to sand, some gravel). Based on recorded SPT N-values ranging from 7 to 28 blows/0.3 m, the fill is typically loose to compact. One N-value of 49 blows/0.3 m (dense) was obtained east of the bridge (BH06-B10). Moisture contents varied from 2 to 22% dependent upon the relative silt content and position with respect to the water table. The depth of the granular fill ranged from 1.4 to 2.4 m (elevation 196.6 to 198.1 m).

A 0.6 m thick layer of sand and gravel fill was placed at the location of borehole 06-B02 as a levelling and support pad for drilling equipment.

## **5.3 Topsoil and Peat**

A 150 to 200 mm thick layer of topsoil was encountered surficially in four boreholes drilled off of the road embankment. A 300 mm thick layer of peat was encountered at one other location (BH07-B8). The topsoil/peat thickness may vary between and beyond the borehole locations and the data is not intended for the purpose of estimating quantities.

## **5.4 Surficial Layers of Sand and Silt**

Discontinuous layers of cohesionless sand, silty sand, sandy silt and silt were encountered at the ground surface or below fill, topsoil or a clay layer in all but two boreholes. The sand and silt layers were typically described as wet and grey, locally dry to moist and brown to dark brown.

SPT values of 1 to 16 blows/0.3 m were obtained in the sand/silt layers, indicating a very loose to compact condition. Natural moisture contents ranged from 5 to 43%,

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

Gravel %	0
Sand %	2 to 94
Silt & Clay %	6 to 98

The grain size distribution curves for the samples tested are presented in Figures B1 and 07-B1 in Appendix B.

The sand and silt layers typically ranged in thickness from 0.3 to 3.2 m, locally 5.9 m in one borehole (BH07-B9) located near Highway 654. The depth to the base of these strata ranged from 0.5 to 6.1 m (elevation 194.2 to 196.6 m).

### 5.5 Upper Silty Clay to Clayey Silt

A thick deposit of silty clay, grading to clayey silt at the upper and lower boundaries of this unit at many locations, was encountered below the embankment fill and sand/silt strata at all locations. The clay was typically described as grey and wet.

SPT values obtained in the silty clay/clayey silt ranged from 0 to 14 blows/0.3 m. The undrained shear strength, assessed by in situ vane testing, ranged from 8 to 72 kPa, typically about 16 to 34 kPa. Undrained shear strengths of 10.8 and 8.5 kPa were determined by laboratory unconfined compression testing of two samples. Based on this data, the clay has a very soft to stiff consistency.

Natural moisture contents of 19 to 120% were measured in this unit. Values of less than about 30% probably reflect the presence of silt lenses within the cohesive deposit.

The results of laboratory tests carried out on 23 samples were as follows:

Gravel %	0
Sand %	0 to 4
Silt %	28 to 84
Clay %	15 to 71
Liquid Limit	30 to 87
Plastic Limit	16 to 42

The results of these tests indicate that the silty clay is a CL to CH soil (low to high plasticity).

The grain size distribution curves for the samples tested are shown in Figures B2 to B5 and 07-B2 to 07-B4, Appendix B. The Atterberg Limits are plotted on Figures B11 to B13, 07-B11 and 07-B12.

The results of consolidation testing conducted on samples of the silty clay to clayey silt are included in Appendix B and summarized in Table 5.1.

**Table 5.1 – Consolidation Test Parameters**

Borehole	Sample Depth (m)	Soil Type	w <sub>o</sub> (%)	γ (kN/m <sup>3</sup> )	e <sub>o</sub>	p <sub>o</sub> ' (kPa)	p <sub>c</sub> ' (kPa)	OCR	C <sub>c</sub>	C <sub>r</sub>
06-B04	6.1-6.7	CH	93	14.6	2.61	85	90	1.1	2.49	0.18
06-B06	4.8-5.0	CH	97	14.5	2.67	40	80	2.0	1.89	0.16
07-B2	3.0-3.7	CL-ML	47	17.2	1.31	35	45	1.3	0.40	0.05
07-B4	9.1-9.8	CL-ML	28	19.3	0.79	100	120	1.2	0.16	0.01

Comparison of the existing and preconsolidation pressures (p<sub>o</sub>' and p<sub>c</sub>') derived from the test results indicate that the natural silty clay is lightly preconsolidated. The coefficient of consolidation, c<sub>v</sub>, recorded during the test generally varied from 10<sup>-2</sup> to 10<sup>-4</sup> cm<sup>2</sup>/s for the typical pressure range anticipated in the field. The compressibility characteristics will vary with depth in accordance with the moisture content and shear strength profiles.

The total thickness of the upper clay deposit, excluding the discontinuous layers of non-cohesive sand and silt contained within this unit, ranged from 5.9 to 11.9 m. The interpreted depth to the base of the clay layer ranged from 7.5 to 14.9 m (elevation 184.1 to 189.8 m).

### 5.6 Intermediate Sands and Silts

Various deposits of non-cohesive sand, silty sand, sandy silt and silt were encountered between the upper and lower cohesive units.

SPT N-values obtained in the sands and silts ranged from 1 to 25 blows/0.3 m, indicating a very loose to compact condition. A value of 36 blows/0.3 m was obtained at one location (BH07-9), indicating a localized dense zone.

The natural moisture content of recovered samples ranged from 11 to 31%, typically 16 to 25%.

The results of laboratory tests carried out on 20 samples were as follows:

Gravel %	0 to 7
Sand %	1 to 94
Silt %	4 to 96
Clay %	3 to 17

The grain size distribution curves for the samples tested are shown in Figures B6, B7 and 07-B5 to 07-B7, Appendix B.

The sands and silts deposits ranged in thickness from 1.5 to 13.9 m. The depth to the base of this unit was interpreted to range from 13.7 to 23.5 m (elevation 175.5 to 185.1 m).

### 5.7 Lower Clayey Silt to Silty Clay

A thick deposit of silty clay, grading to clayey silt at several locations, was encountered below the intermediate sand/silt strata. The clay was typically described as grey and wet.

SPT values obtained in the lower silty clay/clayey silt ranged from 1 to 30 blows/0.3 m. One value of 40 blows/0.3 m (hard) was obtained. The undrained shear strength, assessed by in situ vane testing, ranged from 20 to 96 kPa. Based on this data, the clay has a soft to stiff consistency.

Natural moisture contents of 23 to 61% were measured in this unit.

The results of laboratory tests carried out on 20 samples were as follows:

Gravel %	0
Sand %	0 to 9
Silt %	36 to 84
Clay %	15 to 62
Liquid Limit	25 to 48
Plastic Limit	14 to 26



The results of these tests indicate that the silty clay is a CL to CI soil (low to intermediate plasticity).

The grain size distribution curves for the samples tested are shown in Figures B8 to B10, 07-B8 and 07-B9, Appendix B. The Atterberg Limits are plotted on Figures B14, B15, 07-B13 and 07-B14.

The results of consolidation testing conducted on one sample of the silty clay are included in Appendix B and summarized in Table 5.2.

**Table 5.2 – Consolidation Test Parameters**

Borehole	Sample Depth (m)	Soil Type	w <sub>o</sub> (%)	γ (kN/m <sup>3</sup> )	e <sub>o</sub>	p <sub>o</sub> ' (kPa)	p <sub>c</sub> ' (kPa)	OCR	C <sub>c</sub>	C <sub>γ</sub>
07-B5	27.4-28.0	CL	47	17.2	1.30	240	240	1.0	0.60	0.09

Comparison of the existing and preconsolidation pressures (p<sub>o</sub>' and p<sub>c</sub>') derived from the test results indicate that the natural silty clay is normally consolidated. The coefficient of consolidation, c<sub>v</sub>, recorded during the test generally varied from 10<sup>-2</sup> to 10<sup>-3</sup> cm<sup>2</sup>/s for the typical pressure range anticipated in the field. The compressibility characteristics will vary with depth in accordance with the moisture content and shear strength profiles.

The total thickness of the lower cohesive deposit, excluding the discontinuous layers of non-cohesive sand and silt contained within this unit, ranged from 11.9 to 24.4 m. The interpreted depth to the base of the clay layer ranged from 21.3 to 39.6 m (elevation 157.8 to 164.3 m). Locally in one borehole located west of the bridge site (BH06-B8), the thickness was 3.1 m with a base at 16.8 m depth (elevation 181.2 m).

## 5.8 Basal Sands and Silts

Various deposits of non-cohesive sand, silty sand, sandy silt and silt were encountered below the lower silty clay to clayey silt unit. These deposits were described as grey and wet.

SPT N-values obtained in the basal sands and silts ranged from 6 blows/0.3 m to 100 blows/0.15 m, indicating a loose to very dense condition.

The natural moisture content of recovered samples ranged from 16 to 30%.

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

Gravel %	0
Sand %	13 to 39
Silt %	54 to 78
Clay %	3 to 13

The grain size distribution curves for the samples tested are shown in Figures B10 and 07-B10, Appendix B.

The sand and silt deposits ranged in thickness from 0.9 to 9.9 m. The depth to the base of this unit ranged from 38.3 to 45.3 m (elevation 153.5 to 159.5 m). Locally in one borehole located west of the bridge site (BH06-B8), auger refusal was encountered in this unit at 17.7 m depth (elevation 180.3 m).

### 5.9 Bedrock and/or Refusal

Bedrock or refusal was encountered at the depths and elevations listed in Table 5.3.

**Table 5.3 – Depth to Bedrock and/or Refusal**

Location	Borehole	Bedrock and/or Refusal		Comment
		Depth (m)	Elevation (m)	
West Approach	07-B3	44.0	155.1	Probable bedrock
West Abutment				
8 m North of North End	06-B1	43.6	153.5	Probable bedrock
2 m South of Centreline	07-B4	45.3	153.7	Probable bedrock
2 m South of South End	06-B3	44.6	154.4	Bedrock proven by coring
East Abutment				
3 m North of Centreline	06-B2	41.9	155.5	Bedrock proven by coring
2 m South of Centreline	07-B5	42.6	156.4	Bedrock proven by coring
2 m South of South End	06-B4	41.8	157.2	Probable bedrock
East Approach	07-B6	40.4	158.7	Probable bedrock
West of Beatty Creek				
	06-B8	17.7	180.3	Auger refusal
	07-B7	38.7	159.5	Probable bedrock
East of Beatty Creek				
	07-B8	41.1	157.1	Probable bedrock
	07-B9	44.5	155.8	Probable bedrock

The bedrock was proved in boreholes 06-B2, 06-B3 and 07-B5 by coring approximately 3.0 m. The bedrock consists of salmon and black granite of the Pre-Cambrian Canadian Shield. The rock is described as fresh, with black banding and occasional horizontal to vertical joints.

The total core recovery was 93 to 100%. With the exception of the second core run in borehole 06-B6, RQD values ranged from 80 to 100%, indicating an excellent rock quality. A lower RQD value of 60% was obtained in the second run from borehole 06-B6 where a vertical joint was encountered. The Fracture Index was generally 0 to 1, with isolated values of 2 to 5 fractures/0.3 m.

Based on Point Load Testing, the unconfined compressive strength of the bedrock was estimated to range from about 120 to 160 MPa. Based on these strength values and the classification system given in the Canadian Foundation Engineering Manual, the rock is classified as very strong.

### 5.10 Groundwater

The initial and final groundwater depths and elevations measured in the piezometers are shown in Table 5.4.

**Table 5.4 – Groundwater Depths and Elevations**

Location	Borehole	Tip Depth (m)	Date	Water Level (m)	
				Depth *	Elevation
West Abutment	06-B1	42.7	31-Aug-2006	1.5 ags	198.6
			08-Sep-2006	1.5 ags	198.6
			25-Sept-2006	1.5 ags	198.6
			29-Aug-2007	1.6 ags	198.7
			01-Oct-2007	1.6 ags	198.7
	07-B1	4.6	15-Aug-2007	0.6 ags	197.8
			29-Aug-2007	0.5 ags	197.7
			01-Oct-2007	0.3 ags	197.5
	07-B4	23.8	15-Aug-2007	0.3	198.7
			29-Aug-2007	0.4	198.6
			01-Oct-2007	0.7	198.3
East Abutment	06-B2	40.5	08-Sept-2006	0.4 ags	197.8
			25-Sept-2006	1.1 ags	198.5
			29-Aug-2007	1.2 ags	198.6
			01-Oct-2007	1.0 ags	198.4
	07-B5	9.0	15-Aug-2007	0.4	198.6
			29-Aug-2007	1.2	198.8
			01-Oct-2007	1.1	197.9
West of Beatty Creek	06-B8	16.8	06-Sept-2006	0.3 ags	198.3
			11-Sept-2006	0.3 ags	198.3
			25-Sept-2006	0.4 ags	198.4
	07-B7	7.6	15-Aug-2007	0.1 ags	198.3
			29-Aug-2007	0.3 ags	198.5
			01-Oct-2007	0.3 ags	198.5
East of Beatty Creek	07-B2	10.7	15-Aug-2007	1.0 ags	198.0
			29-Aug-2007	1.0 ags	198.0
			01-Oct-2007	1.1 ags	198.1
	07-B8	9.1	15-Aug-2007	0.2 ags	198.4
			29-Aug-2007	0.3 ags	198.5
			01-Oct-2007	0.2 ags	198.4
	06-B10	20.1	09-Sept-2006	1.1	198.4
			25-Sept-2006	1.1	198.4
			29-Aug-2007	0.9	198.6
			01-Oct-2007	1.0	198.5

\* ags = above ground surface (artesian condition)

The above water levels reflect the piezometric head at the level of the piezometer tips at the time of the investigation. The measurements are short-term observations and seasonal fluctuations of the groundwater level are to be expected.

Shallow groundwater levels in the upper deposits will fluctuate with the water level in Beatty Creek. Higher levels should be expected after the spring snowmelt or after periods of heavy rainfall, and lower levels may be anticipated after dry periods. The water level in Beatty Creek was near elevation 197 m at the time of the investigation.

## 6 MISCELLANEOUS

McCormick Rankin Corporation determined the co-ordinates and ground elevations at the boreholes following completion of the site investigation.

George Downing Estate Drilling Ltd. supplied and operated the drilling and sampling equipment. Full time supervision of the field activities, including obtaining utility clearances, was carried out by Mr. George Azzopardi and Mr. Stephane Loranger of Thurber.

Supervision of the field program, interpretation of the field data, and preparation of the report was performed by Mr. Murray Anderson, P.Eng. The report was reviewed by Mr. Alastair Gorman, P.Eng., and by Dr. P.K. Chatterji, Ph.D., a Designated Principal Contact for MTO Foundations Projects.

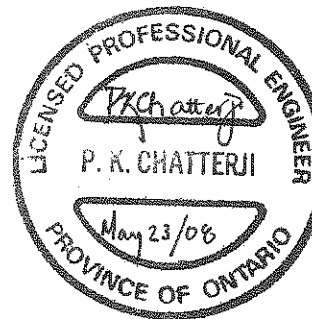
Thurber Engineering Ltd.  
Murray R. Anderson, P.Eng., M.Eng.  
Senior Geotechnical Engineer



Alastair E. Gorman, P.Eng., M.Sc.  
Project Manager



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



**Appendix A**

**Record of Borehole Sheets**

## SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

### 1. TEXTURAL CLASSIFICATION OF SOILS

CLASSIFICATION	PARTICLE SIZE	VISUAL IDENTIFICATION
Boulders	Greater than 200mm	same
Cobbles	75 to 200mm	same
Gravel	4.75 to 75mm	5 to 75mm
Sand	0.075 to 4.75mm	Not visible particles to 5mm
Silt	0.002 to 0.075mm	Non-plastic particles, not visible to the naked eye
Clay	Less than 0.002mm	Plastic particles, not visible to the naked eye

### 2. COARSE GRAIN SOIL DESCRIPTION (50% greater than 0.075mm)

TERMINOLOGY	PROPORTION
Trace or Occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

### 3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH (kPa)	APPROXIMATE SPT <sup>(1)</sup> 'N' VALUE
Very Soft	12 or less	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	Greater than 200	Greater than 30

NOTE: Hierarchy of Soil Strength Prediction

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

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

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

### 5. LEGEND FOR RECORDS OF BOREHOLES

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

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



Water Level






C<sub>pen</sub> Shear Strength Determination by Pocket Penetrometer

- (1) SPT 'N' Value Standard Penetration Test 'N' Value – refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.
- (2) DCPT Dynamic Cone Penetration Test – Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone penetration is the number of hammer blows required for each 0.3 m advance of the conical point into undisturbed ground.

# UNIFIED SOILS CLASSIFICATION

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

## EXPLANATION OF ROCK LOGGING TERMS

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

DISCONTINUITY SPACING		STRENGTH CLASSIFICATION			
Bedding	Bedding Plane Spacing	Rock Strength	Approximate Uniaxial Compressive Strength (MPa) (psi)	Field Estimation of Hardness*	
Very thickly bedded	Greater than 2m	Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Thickly bedded	0.6 to 2m				
Medium bedded	0.2 to 0.6m	Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Thinly bedded	60mm to 0.2m				
Very thinly bedded	20 to 60mm	Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
Laminated	6 to 20mm				
Thinly Laminated	Less than 6mm	Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.
		Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
		Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
		Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail

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



# RECORD OF BOREHOLE No 07-B01

1 OF 2

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 307.8 E 303 697.8 ORIGINATED BY GA  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2007-01-08 - 2007-01-08 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT  Y kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
197.2	Ground Surface													
0.0	TOPSOIL: (200mm)						+0.3*							*Artesian
0.2	SAND, some silt, trace clay Loose Grey Wet		1	SS	5		197							
196.4														
0.8	SILT, some clay to clayey, trace sand Soft to Firm Grey Wet		2	SS	4		196							
			3	SS	3									
194.9							195							
2.3	Silty CLAY Very Soft to Soft Grey Wet		4	SS	1									0 0 76 24
			1	TW			194							
							2.0 +							
			2	TW			193							
							3.0 +							
			3	TW			191							
							2.3 +							
							190							
189.3			5	SS	7									
7.9	SAND, fine grained, some silt Loose Grey Wet						189							
			6	SS	9		188							

Continued Next Page

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

# RECORD OF BOREHOLE No 07-B01

2 OF 2

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 307.8 E 303 697.8 ORIGINATED BY GA  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2007-01-08 - 2007-01-08 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
								20 40 60 80 100							
								20 40 60 80 100							
Continued From Previous Page							UNCONFINED + FIELD VANE QUICK TRIAXIAL X LAB VANE			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT W <sub>p</sub> W W <sub>L</sub> WATER CONTENT (%)					
185.5			7	SS	7		187								
11.7	Sandy SILT, trace clay Compact to Very Loose Grey Wet		8	SS	12		186								
			9	SS	3		185								0 33 64 3
							184								
							183								
181.4			10	SS	7		182								0 38 59 3
15.8	END OF BOREHOLE AT 15.8m. BOREHOLE OPEN TO 15.8m AND WATER LEVEL AT 0.3m UPON COMPLETION.  Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.  WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 2007-08-15 0.62 above G.S. 197.8 2007-08-29 0.50 above G.S. 197.7 2007-10-01 0.32 above G.S. 197.5														

## METRIC

[illegible]

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

ONTMT4S 5198-BEATTY.GPJ 15/11/07

# RECORD OF BOREHOLE No 07-B02

2 OF 2

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 349.2 E 303 706.4 ORIGINATED BY GA  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2007-02-08 - 2007-02-08 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED    + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE					
	Continued From Previous Page							20 40 60 80 100					
	Loose to Compact Grey Wet		7	SS	9								7 89 4 (SI+CL)
			8	SS	14								
183.7													
13.3	SILT, trace sand, trace clay Loose Grey Wet		9	SS	7								0 5 86 9
			10	SS	7								
181.2													
15.8	END OF BOREHOLE AT 15.8m. BOREHOLE OPEN TO 15.8m AND WATER LEVEL AT 1.4m UPON COMPLETION.  Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.   WATER LEVEL READINGS: DATE    DEPTH(m)    ELEV.(m) 2007-08-15    1.02 above G.S.    198.0 2007-08-29    1.00 above G.S.    198.0 2007-10-01    1.06 above G.S.    198.1												

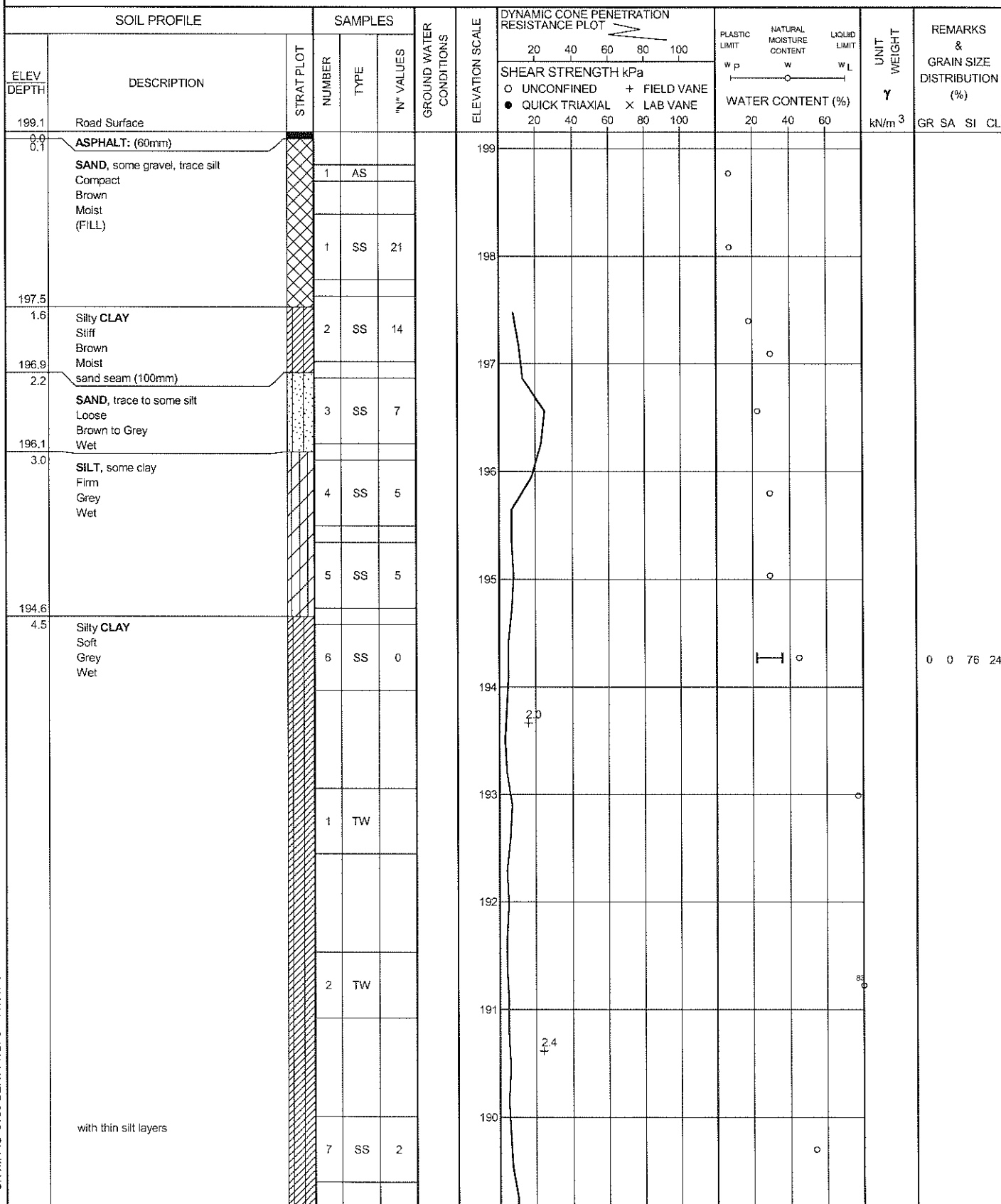
ONTM14S 5198-BEATTY.GPJ 15/11/07

# RECORD OF BOREHOLE No 07-B03

1 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 285.1 E 303 705.0 ORIGINATED BY SLL  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2007-07-28 - 2007-07-29 CHECKED BY MRA



Continued Next Page

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

# RECORD OF BOREHOLE No 07-B03

2 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 285.1 E 303 705.0 ORIGINATED BY SLL  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2007-07-28 - 2007-07-29 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	
	Continued From Previous Page							SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE	WATER CONTENT (%)			GR SA SI CL
188.9							189					
10.2	SAND, some silt, trace clay Compact Grey Wet		8	SS	12		188					0 76 16 8
							187					
			9	SS	21		186					
185.7							185					
13.4	Clayey SILT, trace sand Soft Grey Wet		10	SS	3		184					0 14 81 5
185.1							183					
14.0	SILT, some sand, trace clay Loose Grey Wet		11	SS	8		182					
			12	SS	9		181					
181.3							180					
17.8	Silty CLAY, with silty sand seams Soft Grey Wet		13	SS	4							
180.5												
18.6	SILT, some sand, trace clay Loose Grey Wet											

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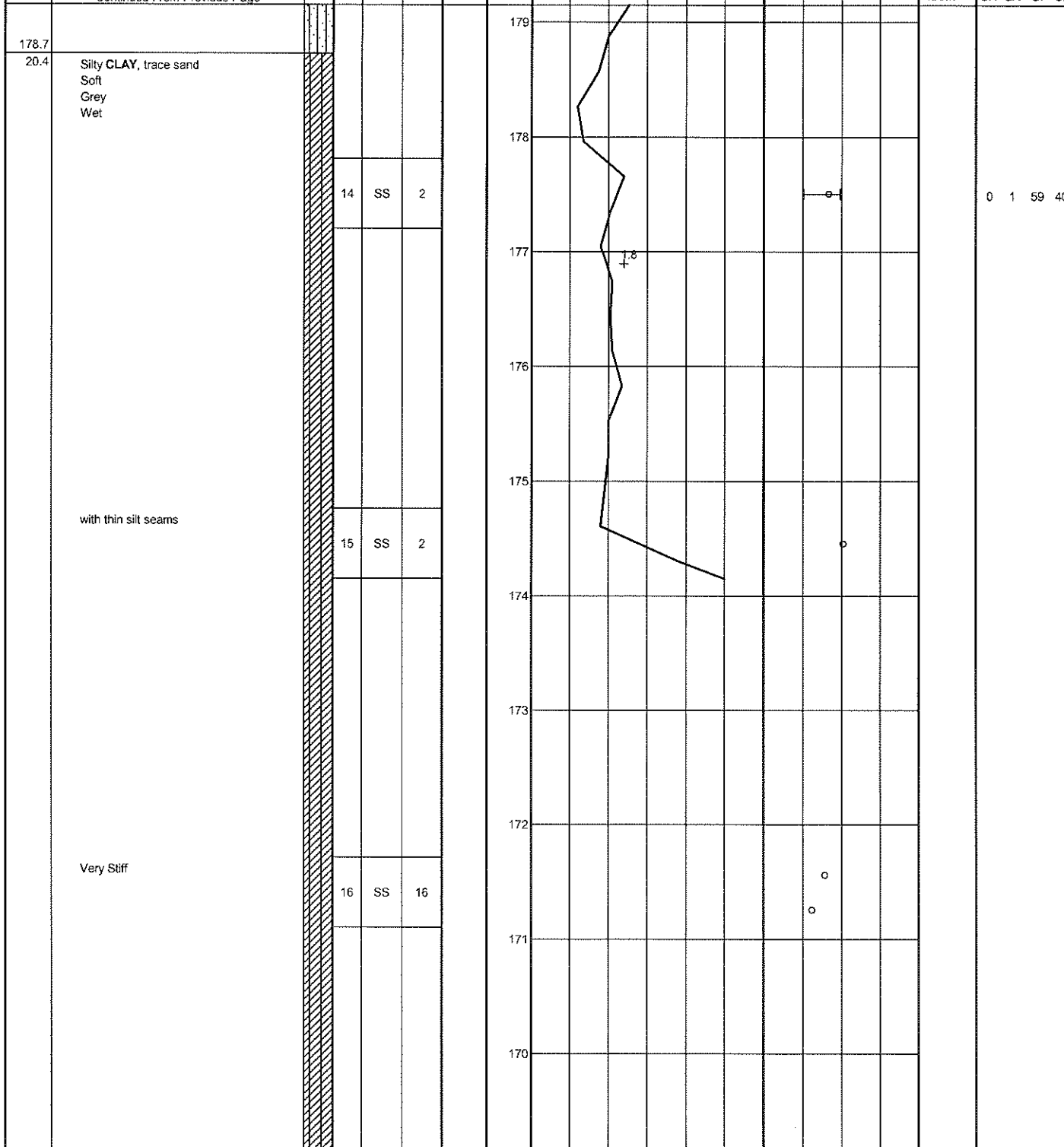
+<sup>3</sup>, X<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

**METRIC**

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20 40 60 80 100			
	Continued From Previous Page						SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100				



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

# RECORD OF BOREHOLE No 07-B03

4 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 285.1 E 303 705.0 ORIGINATED BY SLL  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2007-07-28 - 2007-07-29 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	
	Continued From Previous Page							SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	WATER CONTENT (%) 20 40 60			GR SA SI CL
	with thin silty sand seams		17	SS	15		169					
							168					
							167					
	Hard		18	SS	40		166					
							165					0 3 59 38
163.9							164					
35.2	SILT, some sand, trace clay, with sand seams Very Dense to Compact Grey Wet		19	SS	59		163					
							162					
							161					
							160					
			20	SS	18							0 18 78 4

Continued Next Page

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



## METRIC

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT  W <sub>p</sub> W                      W <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI C		
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE			"N" VALUES	20				40	60
	Continued From Previous Page						SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100						
							WATER CONTENT (%)						
							20	40	60	80	100		



[illegible]

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

(%) STRAIN AT FAILURE

**METRIC**

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 	PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT 	UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES						
199.0	Road Surface										

[illegible]

+ 3, X 3: Numbers refer to Sensitivity

# RECORD OF BOREHOLE No 07-B04

2 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 302.1 E 303 712.4 ORIGINATED BY SLI  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2007-01-08 - 2007-02-08 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
								WATER CONTENT (%)				
	Continued From Previous Page											
	Grey Wet  with thin clay seams		7	SS	6		189					
							188					
187.0							187					
12.0	Silty <b>SAND</b> Compact Brown Wet		8	SS	14		186					
185.6							185					
13.4	<b>SILT</b> , some clay, trace to some sand Soft Grey Wet		9	SS	1		184					
184.1							183					
14.9	<b>SILT</b> , some sand, trace clay Loose Brown Wet		10	SS	4		182					
							181					
	Grey		11	SS	5		180					
180.6												
18.4	Clayey <b>SILT</b>		12	SS	19							
180.3	Very Stiff											
18.7	Grey Wet											
	<b>SILT</b> , some sand, trace clay Compact Grey Wet											

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Continued Next Page

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

# RECORD OF BOREHOLE No 07-B04

3 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 302.1 E 303 712.4 ORIGINATED BY SLL  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2007-01-08 - 2007-02-08 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								20 40 60 80 100					
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					
Continued From Previous Page								PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT w <sub>P</sub> w w <sub>L</sub> WATER CONTENT (%)					
							179						
							178						
			13	SS	12								
							177						
							176						
175.5							175						
23.5	Silty <b>CLAY</b> , with silty sand seams Soft Grey Wet		14	SS	3		174						
							173						
							172						
	Very Stiff		15	SS	22		171						
							170						

Continued Next Page

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

# RECORD OF BOREHOLE No 07-B04

4 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 302.1 E 303 712.4 ORIGINATED BY SLL  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2007-01-08 - 2007-02-08 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				
	Continued From Previous Page						20 40 60 80 100					
			16	SS	30							0 1 67 32
			17	SS	19							
163.6												
35.4	SILT and SAND, trace clay Compact to Dense Grey Wet											
			18	SS	23							
			19	SS	36							0 39 58 3

Continued Next Page

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

METRIC

G.W.P.	5200-03-00	LOCATION	Beatty Creek Bridge N 5 105 302.1 E 303 712.4	ORIGINATED BY	SLI
HWY	534	BOREHOLE TYPE	Hollow Stem Augers	COMPILED BY	WM
DATUM	Geodetic	DATE	2007-01-08 - 2007-02-08	CHECKED BY	MRA

[illegible]

ONTMT4\$ 5198-BEATTY.GPJ 15/11/07

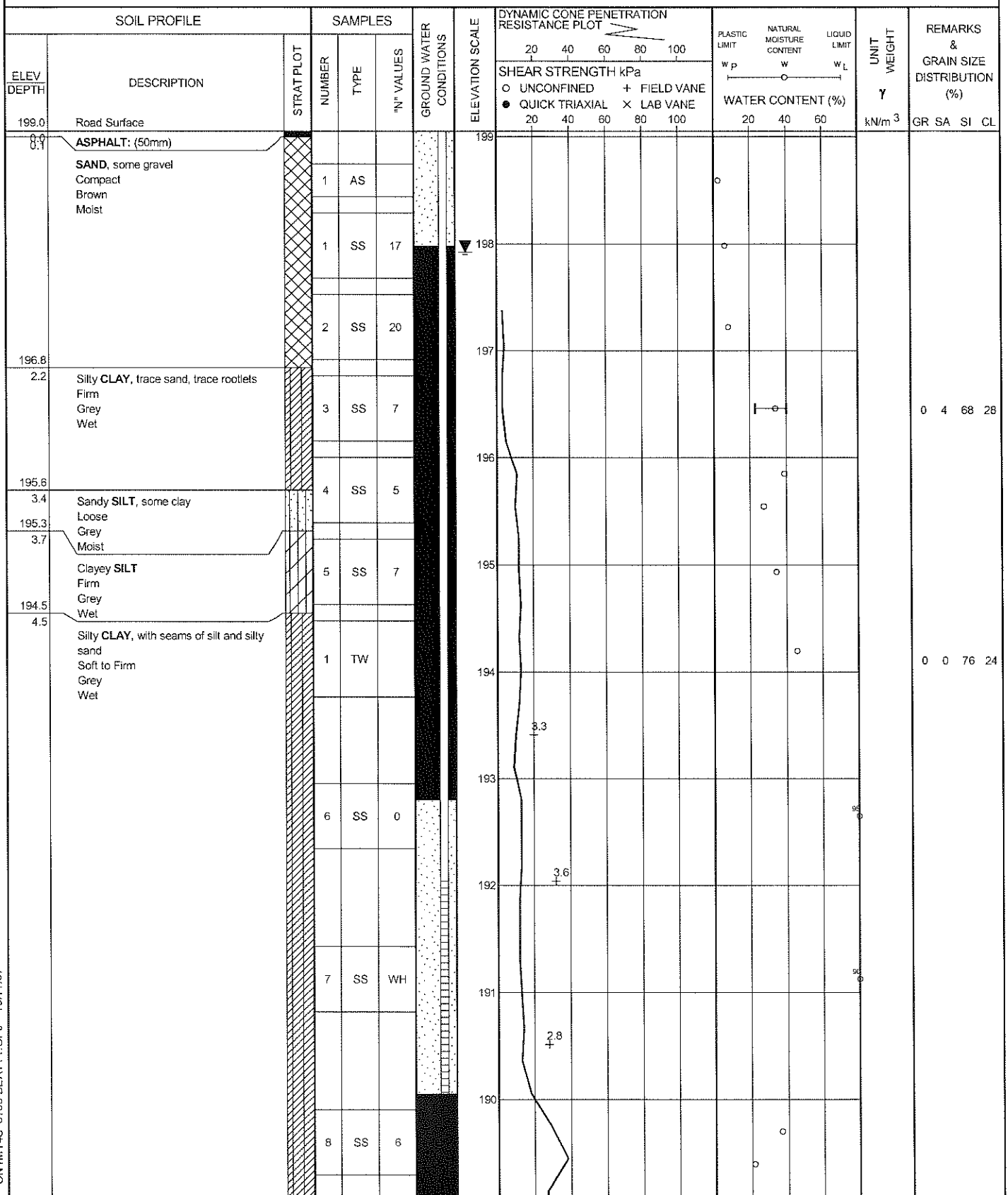
+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity

# RECORD OF BOREHOLE No 07-B05

1 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 318.1 E 303 719.1 ORIGINATED BY SLL  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2007-07-25 - 2007-07-26 CHECKED BY MRA



Continued Next Page

+ 3, x 3: Numbers refer to  
Sensitivity

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

# RECORD OF BOREHOLE No 07-B05

2 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 318.1 E 303 719.1 ORIGINATED BY SLL  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2007-07-25 - 2007-07-26 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
	Continued From Previous Page							○ UNCONFINED    + FIELD VANE ● QUICK TRIAXIAL    x LAB VANE	WATER CONTENT (%)			
									PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w		
							20 40 60 80 100	20 40 60				
187.1			9	SS	9		189					0 2 75 23
11.9	SAND, trace gravel, trace silt Compact Grey Wet		10	SS	12		188					
185.4							187					0 27 70 3
13.6	Silty CLAY, with silt seams						186					
185.1							185					
13.9	Sandy SILT, trace to some clay Loose to Compact Grey Wet		11	SS	7		184					
			12	SS	25		183					
							182					
			13	SS	4		181					
180.7							180					
18.3	Silty CLAY, with silty sand seams Firm to Stiff Grey Wet		14	SS	4							

Continued Next Page

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



# RECORD OF BOREHOLE No 07-B05

3 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 318.1 E 303 719.1 ORIGINATED BY SLL  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2007-07-25 - 2007-07-26 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE							
Continued From Previous Page															
							179								
							178								
			15	SS	3		177		2.9						
							176								
							175								
			16	SS	4		174		3.2					0 0 57 43	
							173								
							172								
			2	TW			171		3.1					0 0 70 30	
							170								

Continued Next Page

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

20  
15  
10

(%) STRAIN AT FAILURE

## METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		NATURAL MOISTURE CONTENT	LQUID LIMIT	UNIT WEIGHT  γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI C
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	WATER CONTENT (%)				
Continued From Previous Page							20 40 60 80 100	PLASTIC LIMIT	W.P.	W	LIQUID LIMIT W.L.	kN/m³	
							169						
							168						
							167						
							166						
							165						
							164						
							163						
							162						
							161						
							160						
163.8 35.2	with sand layers		17	SS	12								
	SILT and SAND, trace clay Loose to Compact Grey Wet		18	SS	6								
160.7 38.3	Clayey SILT, with silt layers Stiff Grey Wet		19	SS	11								
159.1													

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

ONTMT4S 5198-BEATTY.GPJ 15/11/07

RECORD OF BOREHOLE No 07-B05

5 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 318.1 E 303 719.1 ORIGINATED BY SLL  
HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
DATUM Geodetic DATE 2007-07-25 - 2007-07-26 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)	
								○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    x LAB VANE										
	Continued From Previous Page						20	40	60	80	100	20	40	60				
39.9	<b>SAND</b> , trace silt Very Dense Grey Wet																	
			20	SS	100/ .150								○					
156.4																		
42.6	Salmon and black, fresh, coarse grained, very strong <b>GRANITE</b> Horizontal joint at 43.2m Sub-vertical joints at 43.5m, 43.8m, 44.6m, 44.8m, 45.3m and 45.4m		1	RUN														
			2	RUN														
	with pink quartzite at 45.49m																	
153.5																		
45.5	END OF BOREHOLE AT 45.5m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.  WATER LEVEL READINGS: DATE    DEPTH(m)    ELEV.(m) 2007-08-15    0.43       198.57 2007-08-29    1.22       197.78 2007-10-01    1.14       197.86																	

## METRIC

[illegible]

(%) STRAIN AT FAILURE

ONTM4S 5198-BEATTY.GPJ 15/11/07

# RECORD OF BOREHOLE No 07-B06

2 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 335.9 E 303 727.4 ORIGINATED BY SLL  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2007-07-27 - 2007-07-28 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
								20 40 60 80 100				
								20 40 60 80 100				
Continued From Previous Page												
188.3	SAND and SILT, with thin silt seams Compact Grey Wet		8	SS	25							
10.8												
			9	SS	17							
184.9			10	SS	18							
14.2	Clayey SILT Stiff to Soft Grey Wet											
183.7												
15.4	SILT, some sand, trace clay Loose Grey Wet		11	SS	3							
			12	SS	10							
181.3												
17.8	SILT, some clay to clayey, with intermittent soft clay seams Firm to Stiff Grey Wet		13	SS	1							

ONTMT4S 5198-BEATTY.GPJ 15/11/07

Continued Next Page

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

20  
15  
10


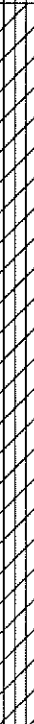
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 07-B06

3 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 335.9 E 303 727.4 ORIGINATED BY SLL  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2007-07-27 - 2007-07-28 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100						
								20 40 60 80 100						
Continued From Previous Page							20 40 60 80 100			20 40 60				
177.4	SILT, some sand Loose Grey Wet		14	SS	4		179						0 6 52 42	
21.7							178							
175.8 23.3	Silty CLAY, trace sand, with thin silty sand and sand seams Firm to Stiff Grey Wet						177							
							176							
							175							
			15	SS	6		174							
							173							
							172							
			16	SS	10		171							
							170							

Continued Next Page

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

20  
15 5  
10 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 07-B06

4 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 335.9 E 303 727.4 ORIGINATED BY SLL  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2007-07-27 - 2007-07-28 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
								20 40 60 80 100	PLASTIC LIMIT	NATURAL MOISTURE CONTENT		
Continued From Previous Page								W <sub>P</sub> W W <sub>L</sub>				
								WATER CONTENT (%)				
								20 40 60 80 100	20 40 60			
							169					
			17	SS	3							
							168					
							167					
							166					
			18	SS	2							
							165					
								2.6				
							164					
							163					
	Very Stiff		19	SS	22							
							162					
							161					
160.5							160					
38.6	SAND, trace silt, trace gravel Compact Grey Wet											
			20	SS	25							

Continued Next Page

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

20  
15  
10  
(%) STRAIN AT FAILURE

ONTM14S 5198-BEATTY.GPJ 13/11/07

# RECORD OF BOREHOLE No 07-B06

5 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 335.9 E 303 727.4 ORIGINATED BY SLL  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2007-07-27 - 2007-07-28 CHECKED BY MRA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
							20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		
	Continued From Previous Page															
158.7						159										
40.4	END OF BOREHOLE AT 40.4m. AUGER REFUSAL ON PROBABLE BEDROCK AT 40.4m. BOREHOLE GROUTED WITH BENTONITE TO 0.5m, SAND TO 0.15m, AND ASPHALT PATCH TO SURFACE.															

ONTMT4S 5198-BEATTY.GPJ 15/11/07



# RECORD OF BOREHOLE No 07-B07

1 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 271.9 E 303 683.2 ORIGINATED BY SLL  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2007-07-27 - 2007-01-08 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								20 40 60 80 100					
198.2	Ground Surface												
0.0	TOPSOIL: (200mm)						+0.3*						*Artesian
0.2	Silty CLAY, occasional rootlets Stiff Brown Damp		1	SS	9		198						
			2	SS	8		197						
196.8	Sandy SILT Loose Grey Wet		3	SS	6		196						0 28 69 3
196.0	SILT, trace clay, trace to some sand Very Loose Grey Wet		4	SS	3		195						
195.2	Silty CLAY, trace sand Very Soft Grey Wet		5	SS	4		194						
			6	SS	1		193						
			1	TW			192						
			7	SS	2		191						0 1 28 71
189.1	SAND, fine to medium grained Compact Grey Wet		2	TW			189						

Continued Next Page

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

ONTMT4S 5198-BEATTY.GPJ 15/11/07

# RECORD OF BOREHOLE No 07-B07

2 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge, N 5 105 271.9 E 303 683.2 ORIGINATED BY SLL  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2007-07-27 - 2007-01-08 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	
	Continued From Previous Page							SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE	WATER CONTENT (%)			GR SA SI CL
184.5			8	SS	17		188					
							187					
			9	SS	13		186					
							185					
13.7	Sandy SILT Loose to Compact Grey Wet		10	SS	10		184					
							183					
			11	SS	9		182					
							181					
			12	SS	14		180					
							179					
179.9												
18.3	Silty CLAY, trace sand Firm to Very Stiff Grey Wet		13	SS	5							

Continued Next Page

+<sup>3</sup> X<sup>3</sup> Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

## METRIC

[illegible]

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

# RECORD OF BOREHOLE No 07-B07

4 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 271.9 E 303 683.2 ORIGINATED BY SLL  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2007-07-27 - 2007-01-08 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
							20 40 60 80 100	20 40 60 80 100	20 40 60					
	Continued From Previous Page													
			17	SS	16		168							
							167							
							166							
							165							
			18	SS	14		164							
							163							
163.1							162							
35.1	Silty SAND, trace clay Dense Grey Wet						161							
			19	SS	31		160							
159.5														
38.7	END OF BOREHOLE AT 38.7m. AUGER REFUSAL ON PROBABLE BEDROCK AT 38.7m. BOREHOLE OPEN TO 38.7m AND WATER LEVEL AT 1.5m UPON COMPLETION. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.													

Continued Next Page

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

20  
15  
10

(%) STRAIN AT FAILURE

## METRIC

[illegible]

## METRIC

SOIL PROFILE			SAMPLES				ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT  0 20 40 60 80 100	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT w <sub>p</sub> w w <sub>L</sub>	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"U" VALUES		+0.15*	20 40 60 80 100	WATER CONTENT (%) 20 40 60		GR SA SI C	
198.2	Ground Surface											*Artesian
0.0	PEAT		1	SS	5							
197.9			2	SS	6							
0.3	Silty SAND, occasional rootlets Loose Grey Damp		3	SS	5							
196.0			4	SS	5						0 6 87	
2.2	SILT, trace sand, trace clay Loose Grey Wet		5	SS	3							
195.2			1	TW								
3.0	Silty CLAY Soft to Firm Grey Wet		6	SS	2							
			7	SS	2						0 0 36	
			8	SS	2							
	occasional sand seams		9	SS	2							

+ 3, × 3; Numbers refer to Sensitivity

ONTMT4S 5198-BEATTY.GPJ 15/11/07

# RECORD OF BOREHOLE No 07-B08

2 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 376.1 E 303 735.3 ORIGINATED BY SLL  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2007-07-25 - 2007-07-26 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
Continued From Previous Page								○ UNCONFINED    + FIELD VANE ● QUICK TRIAXIAL    x LAB VANE	WATER CONTENT (%) W <sub>P</sub> W                  W <sub>L</sub>			
							20   40   60   80   100	20   40   60				GR   SA   SI   CL
186.0	SAND, fine to medium grained, trace silt Compact Grey Wet		2	TW								0   93   7 (SI+CL)
12.2			10	SS	12							
			11	SS	11							
183.0	Silty CLAY Soft to Firm Grey Wet		12	SS	3							
15.2			3	TW								
			12	SS	3							
			14	SS	3							

Continued Next Page

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

# RECORD OF BOREHOLE No 07-B08

3 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 376.1 E 303 735.3 ORIGINATED BY SLL  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2007-07-25 - 2007-07-26 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w		
	Continued From Previous Page							SHEAR STRENGTH kPa ○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    x LAB VANE				
								WATER CONTENT (%)				
176.9							178					
21.3	Clayey SILT Soft Grey Wet		15	SS	3		177					
							176					
174.7							175					
23.5	SAND, fine to medium grained Compact Grey Wet		16	SS	11		174					
							173					
							172					
170.8							171					
27.4	Silty CLAY, trace sand Soft to Firm Grey Wet		17	SS	3		170					
							169					

Continued Next Page

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

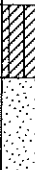




# RECORD OF BOREHOLE No 07-B08

4 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 376.1 E 303 735.3 ORIGINATED BY SLL  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2007-07-25 - 2007-07-26 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										
								20 40 60 80 100										
Continued From Previous Page							UNCONFINED + FIELD VANE QUICK TRIAXIAL X LAB VANE					WATER CONTENT (%) w <sub>p</sub> w w <sub>L</sub>						
167.7	SAND, fine to medium grained Compact Grey Wet		18	SS	14		168									0 2 76 22		
30.5																		
165.3	Silty CLAY, trace sand Stiff Grey Wet		19	SS	9		165											
32.9																		
										</								

Continued Next Page

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

RECORD OF BOREHOLE No 07-B08

5 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 376.1 E 303 735.3 ORIGINATED BY SLL  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2007-07-25 - 2007-07-26 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		WATER CONTENT (%)				
							20 40 60 80 100		20 40 60					
	Continued From Previous Page													
157.1	Very Dense Grey Wet						158							
41.1	END OF BOREHOLE AT 41.1m. AUGER REFUSAL ON PROBABLE BEDROCK AT 41.1m. BOREHOLE OPEN TO 41.1m AND WATER LEVEL AT 1.1m ABOVE GROUND SURFACE UPON COMPLETION. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.  WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 2007-08-15 0.16 above G.S. 198.36 2007-08-29 0.30 above G.S. 198.50 2007-10-01 0.15 above G.S. 198.35													

# RECORD OF BOREHOLE No 07-B09

1 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 413.5 E 303 761.1 ORIGINATED BY SLL  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2007-07-23 - 2007-07-25 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	
200.3	Ground Surface											
0.0	TOPSOIL: (200mm)											
0.2	SAND, fine grained, some silt Loose Brown Wet		1	SS	8		200					
			2	SS	10		199					
	Grey		3	SS	6		198					0 85 15 (SI+CL)
			4	SS	7		197					
			5	SS	8		196					
196.6												
3.7	SILT, some clay Compact Grey Wet		6	SS	11		195					0 2 88 10
195.8												
4.5	Silty SAND Loose Grey Wet		7	SS	9		194					
							193					
194.2												
6.1	Silty CLAY, trace sand Firm to Stiff Grey Wet		8	SS	3		192					
							191					
			9	SS	3							
			10	SS	2							0 4 60 36

Continued Next Page




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

# RECORD OF BOREHOLE No 07-B09

2 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 413.5 E 303 761.1 ORIGINATED BY SLL  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2007-07-23 - 2007-07-25 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)	
								20 40 60 80 100	PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W			LIQUID LIMIT W <sub>L</sub>	
Continued From Previous Page								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE						
	with sand seams		11	SS	5		190							
								189						
								188						
			12	SS	8									
186.6							187							
13.7	SAND, fine grained, trace silt Dense Grey Wet		13	SS	36									
								186						
185.1							185							
15.2	Silty CLAY, occasional silt seams Firm to Stiff Grey Wet		14	SS	3									
								184						
					15	SS	4							
							183							
			16	SS	3		182							
							181							

Continued Next Page

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

RECORD OF BOREHOLE No 07-B09

3 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 413.5 E 303 761.1 ORIGINATED BY SLL  
HWY 534 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
DATUM Geodetic DATE 2007-07-23 - 2007-07-25 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED    + FIELD VANE ● QUICK TRIAXIAL    x LAB VANE					
	Continued From Previous Page						20 40 60 80 100	WATER CONTENT (%) 20 40 60					
179.0	SILT, some clay, trace sand Firm Grey Wet						180						
21.3			17	SS	7		179				○		0 4 79 17
							178						
							177						
							176						
							175						
							174						
173.5	Silty CLAY, occasional silt and sand seams Stiff Grey Wet						173						
26.8			19	SS	5						○		0 0 73 27
							172						
							171						

Continued Next Page

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

20  
15  
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 07-B09

4 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 413.5 E 303 761.1 ORIGINATED BY SLL  
HWY 534 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
DATUM Geodetic DATE 2007-07-23 - 2007-07-25 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT      NATURAL LIMIT      MOISTURE      LIQUID CONTENT      LIMIT			UNIT WEIGHT  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		WATER CONTENT (%)				
								○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL      x LAB VANE						
	Continued From Previous Page						20 40 60 80 100	20 40 60						
			20	SS	16									
			21	SS	14									
			22	SS	12									

Continued Next Page

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

# RECORD OF BOREHOLE No 07-B09

5 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 413.5 E 303 761.1 ORIGINATED BY SLL  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM  
 DATUM Geodetic DATE 2007-07-23 - 2007-07-25 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
								20 40 60 80 100				
	Continued From Previous Page											
	Grey Wet						160					
							159					
							158					
			24	SS	35		157					
155.8							156					
44.5	END OF BOREHOLE AT 44.5m. AUGER REFUSAL ON PROBABLE BEDROCK AT 44.5m. BOREHOLE OPEN TO 44.5m AND WATER LEVEL AT 3.7m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE TO SURFACE.											

ONTM14S 5198-BEATTY.GPJ 15/1/07

**Record of Borehole Sheets  
from Preliminary Investigation**



# RECORD OF BOREHOLE No 06-B01

1 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 308.55 E 303 697.02 ORIGINATED BY GA  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2006.08.29 - 2006.08.30 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	
197.1	Ground Surface											
0.0	<b>SAND</b> , some silt, occasional rootlets Very Loose Dark Brown Dry		1	SS	2		+1.6*					*Artesian
196.6							197					
0.5	<b>SILT</b> , some clay to clayey, trace sand Very Soft Grey Wet		2	SS	2		196					
			3	SS	1		195					0 1 84 15
			4	SS	1		194					
194.1												
3.0	<b>Silty CLAY</b> , occasional black staining Very Soft Grey Wet (CL)		5	SS	1		193					
			6	SS	1		192					0 1 54 45
			1	TW			191	4.0				
							190					
189.6												
7.5	<b>SAND</b> , fine grained, some silt Loose Grey Wet		7	SS	6		189					
							188					
188.0												
9.1	<b>SILT</b> , some clay, trace sand Very Soft Grey Wet		8	SS	1							

Continued Next Page

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

# RECORD OF BOREHOLE No 06-B01

2 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 308.55 E 303 697.02 ORIGINATED BY GA  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2006.08.29 - 2006.08.30 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
								○ UNCONFINED    + FIELD VANE	PLASTIC LIMIT	NATURAL MOISTURE CONTENT		
Continued From Previous Page							● QUICK TRIAXIAL    x LAB VANE <td colspan="3">WATER CONTENT (%)</td> <td></td> <td></td>	WATER CONTENT (%)				
							20 40 60 80 100	20 40 60				
186.4												
10.7	SAND, trace silt, trace gravel Loose Grey Wet		9	SS	8							6 91 3 (SI+CL)
184.9												
12.2	Sandy SILT, trace clay Compact to Loose Grey Wet		10	SS	15							
			11	SS	5							
			12	SS	6							0 35 60 5
	Occasional clay seams											
			13	SS	4							

Continued Next Page

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

# RECORD OF BOREHOLE No 06-B01

3 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 308.55 E 303 697.02 ORIGINATED BY GA  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2006.08.29 - 2006.08.30 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	
	Continued From Previous Page							SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE	WATER CONTENT (%)			
175.8	21.3 Clayey SILT Firm Grey Wet (CL)  with clay seams and silty sand layers		14	SS	6		177					
172.7	24.4 SAND, fine grained, some silt Compact Grey Wet		15	SS	13		176					
169.8	27.3 Clayey SILT, trace to some sand Soft Grey Wet		16	SS	3		175					
							174					
							173					
							172					
							171					
							170					
							169					
							168					

Continued Next Page

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

## METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>
Continued From Previous Page							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE <td colspan="3">WATER CONTENT (%)</td> <td></td>			WATER CONTENT (%)					
166.6 30.5	Silty <b>CLAY</b> , trace sand Very Soft to Firm Grey Wet (CL)		17	SS	3		20	40	60	80	100	20	40	60	0 3 57 40 Artesian Flow
			18	SS	5										
160.5 36.6	Sandy <b>SILT</b> Loose Grey Wet		19	SS	8										
157.5 39.6	<b>SAND</b> , fine grained, some silt Compact		20	SS	14										

Continued Next Page

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

# RECORD OF BOREHOLE No 06-B01

5 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 308.55 E 303 697.02 ORIGINATED BY GA  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2006.08.29 - 2006.08.30 CHECKED BY MA

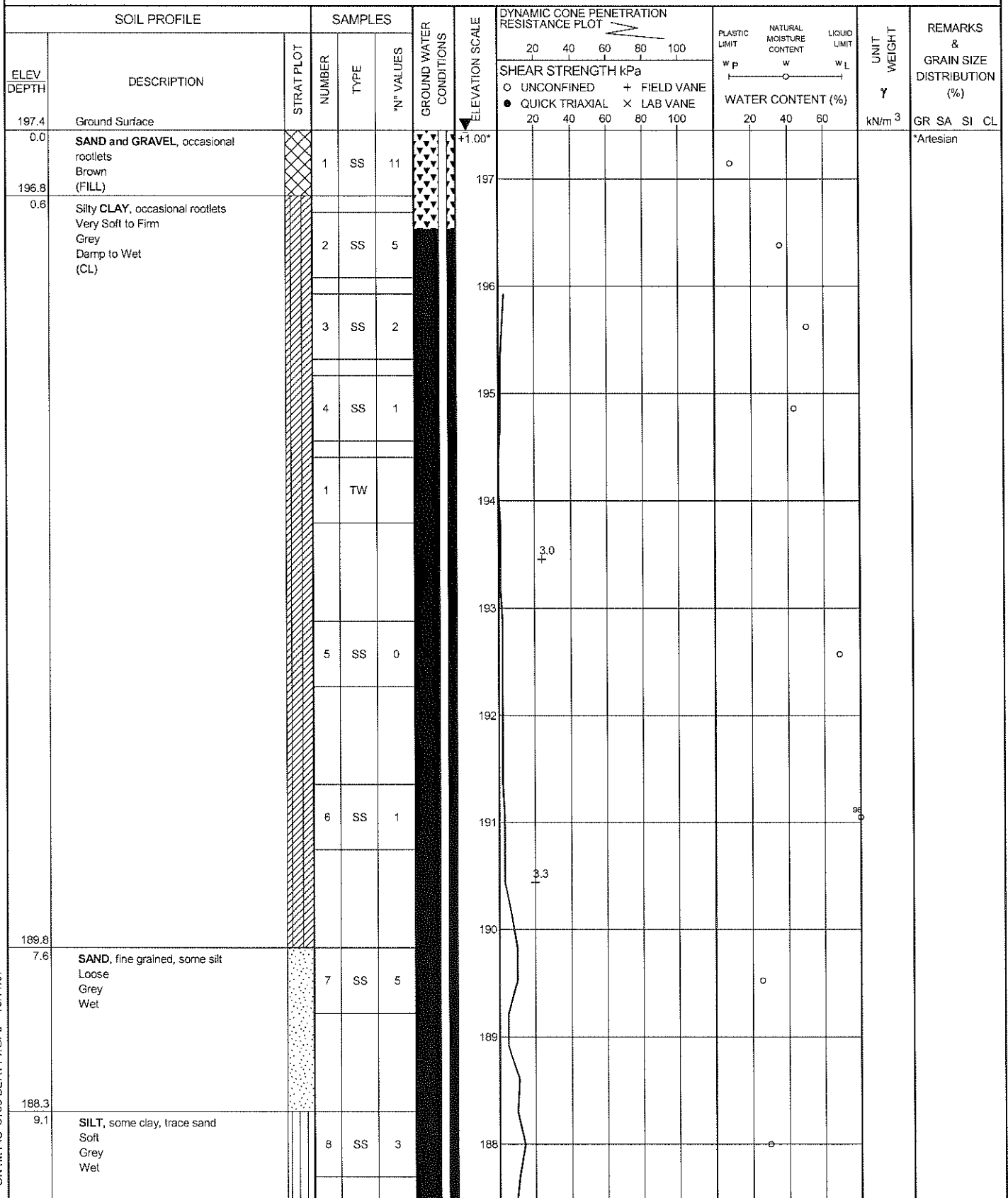
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
	Continued From Previous Page													
	Grey Wet (SW)						157							
							156							
							155							
			21	SS	24		154							
153.5														
43.6	END OF BOREHOLE AT 43.59 m. AUGER REFUSAL AT 43.59 m ON PROBABLE BEDROCK OR BOULDERS. BOREHOLE OPEN AND ARTESIAN FLOW TO 0.3 m ABOVE GROUND SURFACE. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.  WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 2006-08-30 1.2 above G.S. 198.3 2006-08-31 1.5 above G.S. 198.6 2006-09-06 1.5 above G.S. 198.6 2006-09-08 1.5 above G.S. 198.6 2006-09-11 1.5 above G.S. 198.6 2006-09-25 1.5 above G.S. 198.6 2007-08-29 1.6 above G.S. 198.7 2007-10-01 1.6 above G.S. 198.7													

# RECORD OF BOREHOLE No 06-B02

1 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 320.69 E 303 714.37 ORIGINATED BY GA  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2006.09.06 - 2006.09.07 CHECKED BY MA



Continued Next Page

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

ONTMT4S 5198-BEATTY.GPJ 15/11/07

## METRIC

SOIL PROFILE			SAMPLES		GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI C
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	"N" VALUES		SHEAR STRENGTH kPa	PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w		
Continued From Previous Page										
186.7 10.7	SAND, fine to medium grained, trace silt Loose Grey Wet	[Pattern]	9	SS 7						
185.2 12.2	Silty CLAY, trace sand Very Soft Grey to Reddish Brown Wet	[Pattern]	10	SS 2						0 1 30 6
184.0 13.4	SILT and SAND Loose Grey Wet	[Pattern]	11	SS 8						0 41 55
179.1 18.3	SILT, some clay to clayey, trace sand Very Soft Grey Wet	[Pattern]	13	SS 3						0 1 84 1

+ 3, X 3: Numbers refer to Sensitivity

ONTMT4S 5198-BEATTY.GPJ 15/11/07

**METRIC**

CHECKED BY \_\_\_\_\_ MA

Continued Next Page

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



# RECORD OF BOREHOLE No 06-B02

4 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 320.69 E 303 714.37 ORIGINATED BY GA  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2006.09.06 - 2006.09.07 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	W <sub>p</sub>	W	W <sub>L</sub>			
Continued From Previous Page														
			17	SS	6									
			18	SS	1									
			19	SS	6									
157.8														
39.6	SAND, fine grained, trace silt Compact		20	SS	14									

Continued Next Page

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

# RECORD OF BOREHOLE No 06-B02

5 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 320.69 E 303 714.37 ORIGINATED BY GA  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2006.09.06 - 2006.09.07 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
	Continued From Previous Page							20 40 60 80 100						
	Grey Wet							20 40 60 80 100						
155.5								20 40 60 80 100						
41.9	Salmon and black, fresh, coarse grained, very strong, <b>GRANITE</b> , with black banding							20 40 60 80 100						
	Horizontal joint at 42.62 m		1	RUN				20 40 60 80 100						
								20 40 60 80 100						
	Horizontal joints at 43.87, 44.12 and 44.42 m		2	RUN				20 40 60 80 100						
152.4								20 40 60 80 100						
45.0	END OF BOREHOLE AT 44.98 m. BOREHOLE OPEN AND WATER LEVEL AT SURFACE ON COMPLETION. ARTESIAN CONDITION DISSIPATED. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.  WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 2006-09-08 0.39 above G.S. 197.79 2006-09-11 0.41 above G.S. 197.81 2006-09-25 1.12 above G.S. 198.52 2007-08-29 1.16 above G.S. 198.56 2007-10-01 1.00 above G.S. 198.40													

ONTMT4S 5198-BEATTY.GPJ 15/11/07

# RECORD OF BOREHOLE No 06-B03

1 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 301.00 E 303 716.81 ORIGINATED BY KH  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2006.08.29 - 2006.08.29 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	
199.0	Road Surface											
0.0	ASPHALT: (40 mm)		1	SS	23		199					
	SAND and GRAVEL, trace silt Compact to Loose Brown Moist (FILL)		2	SS	8		198					
	Silty		3	SS	20		197					
196.9												
2.1	Sandy SILT, occasional wood fiber Very Loose Grey Wet sand pocket at 2.69 m		4	SS	2		196					
196.0												
3.0	Clayey SILT, trace sand, trace organics Very Soft Grey Wet		5	SS	2		195					
194.7												
4.3	Silty CLAY Very Soft to Soft Grey to Greenish Grey Wet		6	SS	1		194					
			7	SS	1		193					
			8	SS	1		192					
							191					
189.8			9	SS	1		190					
9.2	Clayey SILT, trace sand Very Soft Grey Wet											

Continued Next Page

+ 3, x 3: Numbers refer to  
Sensitivity

20  
15 5  
10 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 06-B03

2 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 301.00 E 303 716.81 ORIGINATED BY KH  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2006.08.29 - 2006.08.29 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	
	Continued From Previous Page							SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE	WATER CONTENT (%)			GR SA SI CL
187.4			10	SS	1		189					0 3 77 20
11.6	SAND, fine to medium grained, trace silt Very Loose Grey Wet		11	SS	3		188					
185.9							187					
13.1	Silty SAND, trace clay Very Loose Grey Wet		12	SS	1		186					
							185					
			13	SS	1		184					0 68 28 4
							183					
182.2							182					
16.8	Silty CLAY, trace sand Very Soft Grey Wet		14	SS	1		181					
							180					

Continued Next Page

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

RECORD OF BOREHOLE No 06-B03

3 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 301.00 E 303 716.81 ORIGINATED BY KH  
HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
DATUM Geodetic DATE 2006.08.29 - 2006.08.29 CHECKED BY MA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa	WATER CONTENT (%)	W <sub>p</sub>	W		
	Continued From Previous Page						20 40 60 80 100	20 40 60					
			15	SS	1		179						
							178						0 1 69 30
							177						
							176						
			16	SS	1		175						
							174						
							173						
							172						
			17	SS	1		171						
							170						

Continued Next Page

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

# RECORD OF BOREHOLE No 06-B03

4 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 301.00 E 303 716.81 ORIGINATED BY KH  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2006.08.29 - 2006.08.29 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL    × LAB VANE		
Continued From Previous Page							20 40 60 80 100	PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>		
			18	SS	1		169					0 1 58 41
							168					
							167					
							166					
			19	SS	1		165					
164.3							164					
34.7	SILT, some sand, some clay, occasional fine sand layers Compact Grey Wet						163					
			20	SS	22		162					0 13 74 13
							161					
161.2							160					
37.8	SAND, fine grained, some silt Compact Grey Wet											
			21	SS	17							

Continued Next Page

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

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 06-B03

5 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 301.00 E 303 716.81 ORIGINATED BY KH  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2006.08.29 - 2006.08.29 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								20 40 60 80 100					
								20 40 60 80 100					
	Continued From Previous Page												
157.5	SILT, some sand Loose Grey Wet						159						
41.5							158						
							157						
			22	SS	9		156						
							155						
154.4	Salmon and black, fresh, coarse grained, very strong. <b>GRANITE</b>		1	RUN			154						
44.6			2	RUN			153						
			3	RUN			152						
151.2	END OF BOREHOLE AT 47.80 m. BOREHOLE BACKFILLED WITH BENTONITE AND SAND, WITH COLD PATCH AT SURFACE.												
47.8													

ONTM14S 5198-BEATTY.GPJ 15/11/07

# RECORD OF BOREHOLE No 06-B04

1 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 316.00 E 303 723.57 ORIGINATED BY KH  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2006.08.30 - 2006.08.30 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
199.0	Road Surface											
0.0	ASPHALT: (90 mm)											
0.1	Gravelly SAND Compact to Loose Brown Moist (FILL)		1	SS	26		199					
			2	SS	7		198					
			3	SS	28		197					
196.6												
2.4	Sandy SILT, trace clay, trace gravel, occasional wood fragments Very Loose		4	SS	2		196					
196.0	Grey Wet											
3.0	Silty CLAY, trace gravel and organics to 4.11 m Very Soft to Soft Grey Wet		5	SS	2		195					
			6	SS	1		194					
			1	TW			193					0 0 33 67
			7	SS	1		192					0 0 37 63
							191					
			8	SS	1		190					

Continued Next Page

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



# RECORD OF BOREHOLE No 06-B04

2 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 316.00 E 303 723.57 ORIGINATED BY KH  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2006.08.30 - 2006.08.30 CHECKED BY MA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa		
	Continued From Previous Page						<div><div>20406080100</div><div>UNCONFINED + FIELD VANE</div><div>QUICK TRIAXIAL X LAB VANE</div></div> <div><div>204060</div><div>WATER CONTENT (%)</div></div>			
			9	SS	2					
			10	SS	3					
			11	SS	1					
184.1										
14.9	SILT, trace sand, trace clay Very Loose Grey Wet		12	SS	2					
</										

Continued Next Page

+<sup>3</sup>, x<sup>3</sup>: Numbers refer to Sensitivity 20 15 10 5 0 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 06-B04

3 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 316.00 E 303 723.57 ORIGINATED BY KH  
HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
DATUM Geodetic DATE 2006.08.30 - 2006.08.30 CHECKED BY MA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT	WATER CONTENT (%)	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE							
	Continued From Previous Page										
			14	SS	1						
			15	SS	1						
172.2	Silty CLAY, trace sand Very Soft Grey Wet		16	SS	1						

Continued Next Page

+<sup>3</sup>, X<sup>3</sup> Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 06-B04

4 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 316.00 E 303 723.57 ORIGINATED BY KH  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2006.08.30 - 2006.08.30 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE							
								● QUICK TRIAXIAL	× LAB VANE							
	Continued From Previous Page		17	SS	1		169								0 8 61 31	
			18	SS	3		168								0 8 60 32	
			19	SS	22		167									
162.4	SAND, fine grained, some silt Compact to Dense Grey Wet						166									
36.6							165									
							164									
							163									
							162									
							161									
			20	SS	36		160									

Continued Next Page

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

# RECORD OF BOREHOLE No 06-B04

5 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 316.00 E 303 723.57 ORIGINATED BY KH  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2006.08.30 - 2006.08.30 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED    + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE							
	Continued From Previous Page							20 40 60 80 100							
							159								
							158								
157.2															
41.8	END OF BOREHOLE AT 41.76 m. CASING REFUSAL AT 41.76 m ON PROBABLE BEDROCK OR BOULDERS. BOREHOLE BACKFILLED WITH BENTONITE AND SAND, WITH COLD PATCH AT SURFACE.														

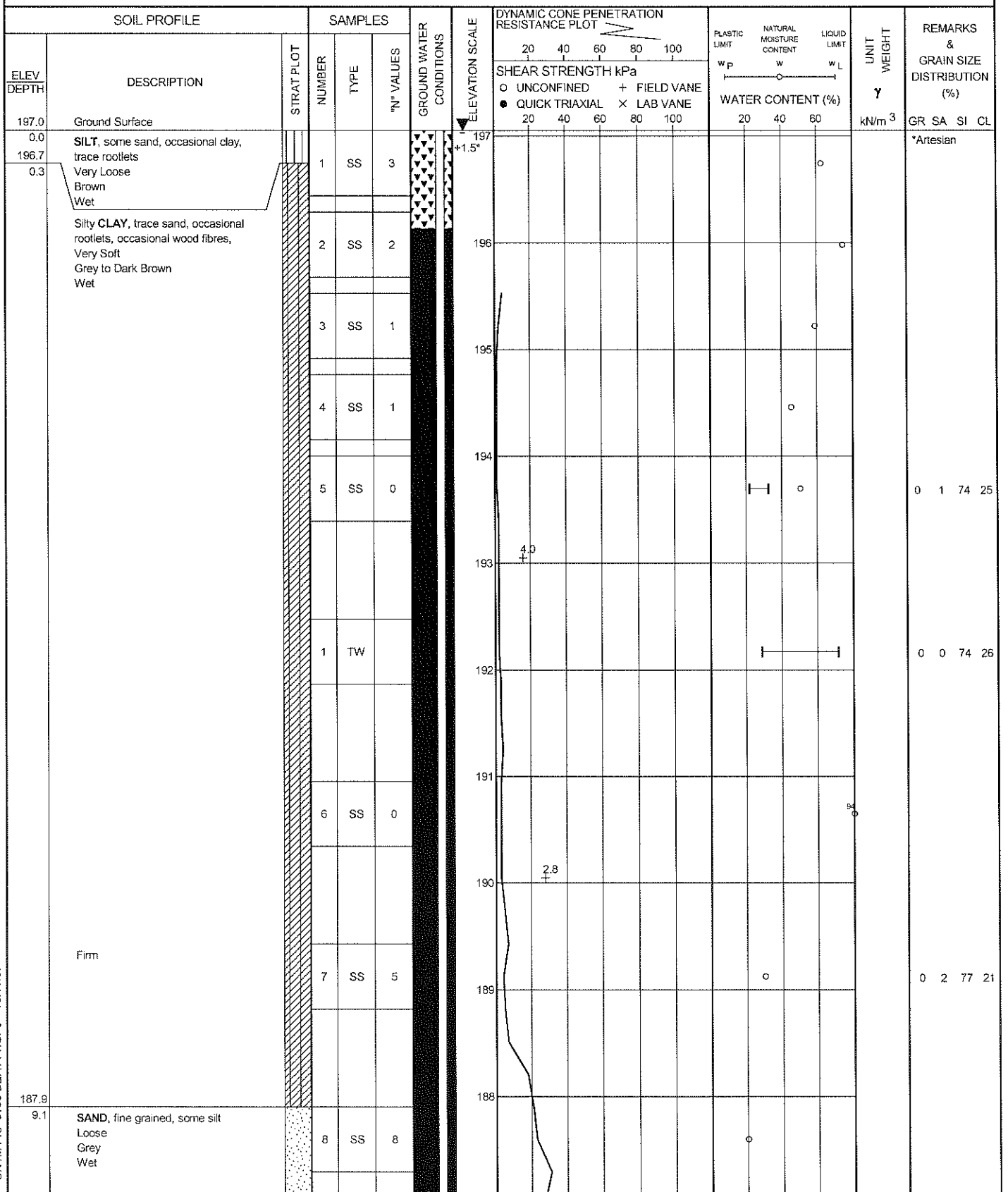
+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 06-B06

1 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 311.29 E 303 735.18 ORIGINATED BY GA  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2006.09.07 - 2006.09.08 CHECKED BY MA



Continued Next Page

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

# RECORD OF BOREHOLE No 06-B06

2 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 311.29 E 303 735.18 ORIGINATED BY GA  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2006.09.07 - 2006.09.08 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				
								WATER CONTENT (%)				
	Continued From Previous Page						20 40 60 80 100	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT		
								w <sub>p</sub>	w	w <sub>L</sub>		
186.3												
10.7	Silty CLAY Very Soft Grey to Reddish Brown Wet		9	SS	2		187					
							186					
							185					
			10	SS	1		184					
							183					
183.3							182					
13.7	SILT, some sand, trace clay Loose to Very Loose Grey Wet		11	SS	8		181					
							180					
			12	SS	5		179					
							178					
			13	SS	3							

Continued Next Page

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

**METRIC**

G.W.P.	5200-03-00	LOCATION	Beatty Creek Bridge N 5 105 311.29 E 303 735.18	ORIGINATED BY	GA
HWY	534	BOREHOLE TYPE	Hollow Stem Augers/NW Casing	COMPILED BY	WM
DATUM	Geodetic	DATE	2006.09.07 - 2006.09.08	CHECKED BY	MA

[illegible]

+  $^3 X^3$ : Numbers refer to Sensitivity

ONTMT4\$ 5198-BEATTY.GPJ 15/11/07

## METRIC

ORIGINATED BY GA  
COMPILED BY WM  
CHECKED BY MA

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



RECORD OF BOREHOLE No 06-B06

5 OF 5

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 311.29 E 303 735.18 ORIGINATED BY GA  
HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
DATUM Geodetic DATE 2006.09.07 - 2006.09.08 CHECKED BY MA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT						UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa						
	Continued From Previous Page						20 40 60 80 100							
							○ UNCONFINED + FIELD VANE							
							● QUICK TRIAXIAL X LAB VANE							
							WATER CONTENT (%)							
							20 40 60							
					</									

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

20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 06-B07

1 OF 2

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 093.68 E 303 642.56 ORIGINATED BY GA  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2006.08.28 - 2006.08.28 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	
197.9 0.0	Ground Surface  <b>SAND</b> , some silt, trace organics Loose to Very Loose Brown Dry (SP)  Grey Wet		1	SS	4							
			2	SS	3		197					
196.4 1.5	<b>SILT</b> , some clay to clayey Very Soft Grey Wet (ML-NP)		3	SS	2		196					
			4	SS	1							0 0 82 18
194.9 3.0	Silty <b>CLAY</b> , trace sand Very Soft Grey Wet (CL)		5	SS	2		195					
			6	SS	1		194	4.0 +				
			7	SS	1		193					
			8	SS	4		192					
							191	3.0 +				
189.7 8.2	<b>SAND</b> , fine grained, trace to some silt Dense Grey Wet (SW)		9	SS	31		190				80	0 1 31 68
							189					
							188					

Continued Next Page

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

RECORD OF BOREHOLE No 06-B07

2 OF 2

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 093.68 E 303 642.56 ORIGINATED BY GA  
HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
DATUM Geodetic DATE 2006.08.28 - 2006.08.28 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT  γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
	Continued From Previous Page							20 40 60 80 100								
			10	SS	31		187									
186.3																
11.6	GRAVEL, some sand, occasional granite fragments Very Dense Wet						186									
185.3			11	SS	130											
12.6	END OF BOREHOLE AT 12.65 m. AUGER REFUSAL AT 12.65 m ON PROBABLE BEDROCK OR BOULDERS. BOREHOLE OPEN AND ARTESIAN FLOW TO 0.3 m ABOVE GROUND SURFACE UPON COMPLETION. ARTESIAN CONDITION DISSIPATED AFTER 20 MIN. BOREHOLE BACKFILLED WITH HOLEPLUG AND CONCRETE AT SURFACE.															

+ <sup>3</sup> . X <sup>3</sup> ; Numbers refer to  
Sensitivity 20 15 10 5 0 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 06-B08

1 OF 2

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 196.21 E 303 667.23 ORIGINATED BY GA  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2006.09.05 - 2006.09.05 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		UNIT WEIGHT  γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		WATER CONTENT (%)			
198.0	Ground Surface							20 40 60 80 100		W P W W L			GR SA SI CL
0.0	SAND, some silt, with rootlets and organics		1	SS	6		198 +1.5'						*Artesian
0.3	SAND, fine to medium grained, trace silt, occasional iron oxide staining Loose Brown Dry to Wet		2	SS	5		197						
			3	SS	4		196						0 94 6 (SI+CL)
195.7	Silty CLAY Very Soft to Soft Grey Wet		4	SS	2		195						
2.3			5	SS	1		194	3.0					
			6	SS	1		193						
			7	SS	1		192						0 0 33 67
			8	SS	0		191	3.3					
							190						
188.9	SAND, fine to medium grained, trace silt Loose to Compact Grey Wet		9	SS	9		189						

Continued Next Page

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

RECORD OF BOREHOLE No 06-B08

2 OF 2

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 196.21 E 303 667.23 ORIGINATED BY GA  
HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
DATUM Geodetic DATE 2006.09.05 - 2006.09.05 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
								WATER CONTENT (%)				
	Continued From Previous Page											
			10	SS	18							
			11	SS	7							
184.3												
13.7	Silty <b>CLAY</b> , trace sand, occasional silt seams Soft Grey Wet		12	SS	3							
			13	SS	3							
181.2												
16.8	<b>SILT</b> , trace sand, occasional sand seams Compact Grey Wet		14	SS	21							
180.3			15	SS	100							
17.7	END OF BOREHOLE AT 17.68 m. AUGER REFUSAL AT 17.68 m ON PROBABLE BEDROCK OR BOULDERS. BOREHOLE OPEN AND WATER LEVEL AT 1.52 m ON COMPLETION. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.  WATER LEVEL READINGS: DATE   DEPTH(m)   ELEV.(m) 2006-09-06   0.30   above G.S. 2006-09-08   0.30   above G.S. 2006-09-11   0.31   above G.S. 2006-09-25   0.35   above G.S.											

ONTMT4S 5198-BEATTY.GPJ 15/11/07

+<sup>3</sup>. X<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 06-B09

1 OF 3

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 202.30 E 303 701.05 ORIGINATED BY GA  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2006.08.31 - 2006.08.31 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w		
								SHEAR STRENGTH kPa ○ UNCONFINED    + FIELD VANE ● QUICK TRIAXIAL    x LAB VANE			WATER CONTENT (%)	
198.1	Ground Surface						20 40 60 80 100	20 40 60				GR SA SI CL
0.0	Silty <b>SAND</b> , occasional rootlets		1	SS	5							
197.6	Dry											
0.5	Silty <b>CLAY</b> , trace sand, occasional iron oxide staining		2	SS	8							
	Stiff Grey Damp											
196.7												
1.4	Sandy <b>SILT</b> Compact Grey Wet		3	SS	12							
195.7												
2.4	Clayey <b>SILT</b> Soft to Very Soft Grey Wet		4	SS	5							0 0 86 14
			5	SS	3							
194.0												
4.1	Silty <b>CLAY</b> Very Soft Grey Wet		6	SS	2							
			7	SS	1							0 0 37 63
			8	SS	0							
189.0												
9.1	Sandy <b>SILT</b> , trace clay Loose Grey Wet		9	SS	8							
												0 38 53 9

Continued Next Page

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

RECORD OF BOREHOLE No 06-B09

2 OF 3

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 202.30 E 303 701.05 ORIGINATED BY GA  
HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
DATUM Geodetic DATE 2006.08.31 - 2006.08.31 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)		
								○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    x LAB VANE					PLASTIC LIMIT      NATURAL MOISTURE CONTENT      LIQUID LIMIT w <sub>p</sub> w                      w <sub>L</sub>		
	Continued From Previous Page						20 40 60 80 100	20 40 60							
187.4															
10.7	SAND, fine to coarse grained, trace silt Compact Grey Wet		10	SS	15										
185.9															
12.2	GRAVEL, some sand, trace silt, with granite fragments Compact Grey Wet		11	SS	17										
185.0															
13.1	SAND, fine to coarse grained, trace silt, trace gravel Loose Grey Wet		12	SS	8										
182.9															
15.2	SILT, some sand Compact Grey Wet		13	SS	12										
181.3															
16.8	SAND, fine to coarse grained, trace silt, trace gravel Compact Grey Wet		14	SS	14										
178.9															
19.2	SAND and GRAVEL Compact Grey Wet														

Continued Next Page

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

20  
15  
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 06-B09

3 OF 3

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 202.30 E 303 701.05 ORIGINATED BY GA  
HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
DATUM Geodetic DATE 2006.08.31 - 2006.08.31 CHECKED BY MA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa		WATER CONTENT (%)			
	Continued From Previous Page		15	SS	22								
177.7													
20.4	END OF BOREHOLE AT 20.42 m. BOREHOLE OPEN TO 19.81 m AND WATER LEVEL AT 1.52 m ON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE.												



# RECORD OF BOREHOLE No 06-B10

1 OF 3

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 376.19 E 303 758.13 ORIGINATED BY KH  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2006.08.31 - 2006.08.31 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100						
								SHEAR STRENGTH kPa						
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE		WATER CONTENT (%)	
199.5	Road Surface											GR SA SI CL		
0.0	ASPHALT: (50 mm)													
	Gravelly SAND, trace silt Very Dense to Compact Brown Moist (FILL)		1	SS	49		199							
			2	SS	15									
198.1														
1.4	Silty SAND, fine grained, trace clay, trace rootlets Compact to Loose Grey Wet		3	SS	16		198					0 60 40 (SI+CL)		
			4	SS	7		197							
196.5														
3.0	SILT, trace to some sand, trace clay Very Loose Grey Wet		5	SS	1		196							
194.9							195					0 2 82 16		
4.6	Clayey SILT, fine grained, some sand Very Soft Grey Wet (CL-ML)		6	SS	1									
194.0							194							
5.5	Silty CLAY Very Soft Grey Wet		7	SS	1									
							193							
			8	SS	1		192					0 0 38 62		
							191							
			9	SS	1									
							190							

Continued Next Page

+ 3, × 3: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 06-B10

2 OF 3

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 376.19 E 303 758.13 ORIGINATED BY KH  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2006.08.31 - 2006.08.31 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
								WATER CONTENT (%)				
	Continued From Previous Page											
187.9			10	SS	1		189					
11.6	Silty SAND Compact Grey Wet		11	SS	10		188					0 66 34 (SI+CL)
186.4							187					
13.1	Clayey SILT Very Soft Grey Wet		12	SS	1		186					
184.6							185					
14.9	SILT, some sand to sandy, trace clay Very Loose Grey Wet		13	SS	1		184					
							183					0 4 96 (SI+CL)
			14	SS	1		182					
181.8							181					
17.7	SAND, fine grained, trace silt Very Loose Grey Wet		15	SS	3		180					

Continued Next Page

+ 3, X 3: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 06-B10

3 OF 3

METRIC

G.W.P. 5200-03-00 LOCATION Beatty Creek Bridge N 5 105 376.19 E 303 758.13 ORIGINATED BY KH  
 HWY 534 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY WM  
 DATUM Geodetic DATE 2006.08.31 - 2006.08.31 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								20	40	60	80	100					

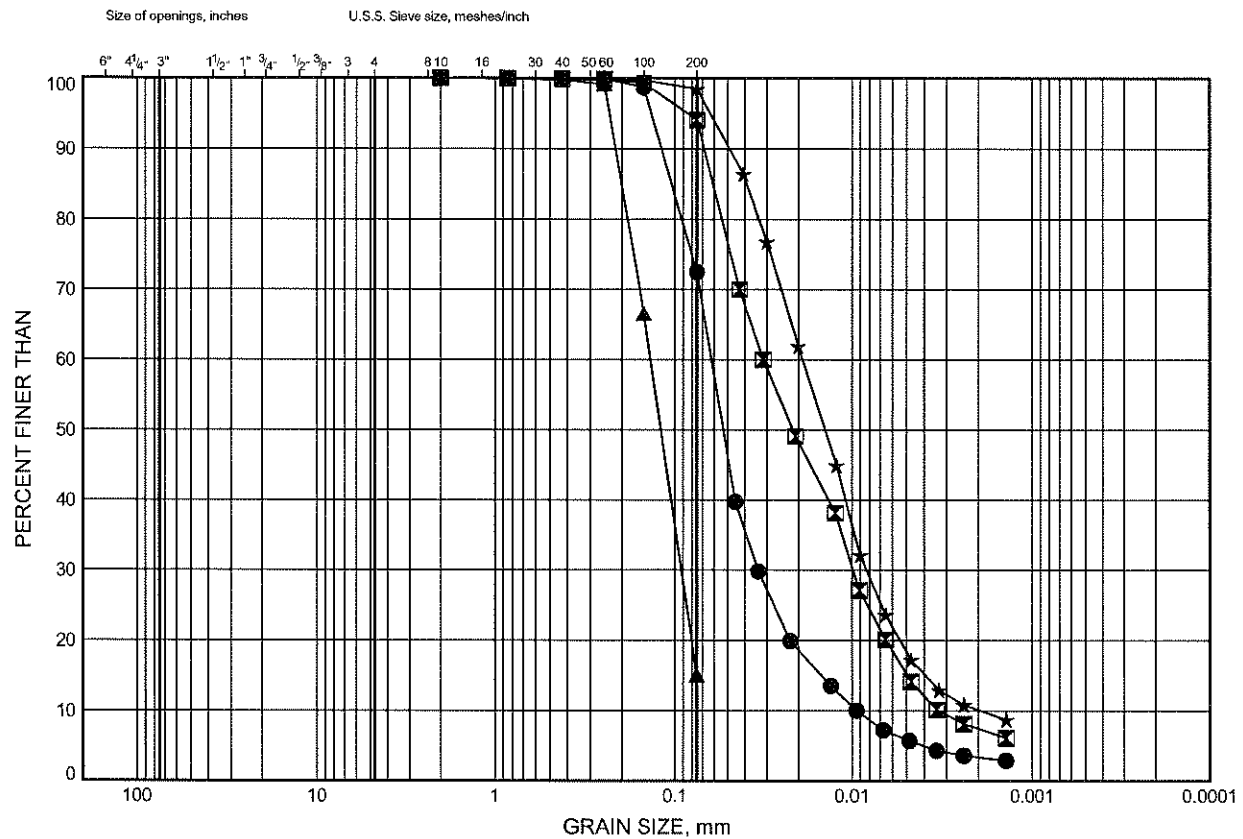
## **Appendix B**

### **Laboratory Test Results**

# Beatty Creek Bridge Replacement GRAIN SIZE DISTRIBUTION

FIGURE 07-B1

## SURFICIAL SANDS AND SILTS



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	07-B07	1.83	196.37
☒	07-B08	2.59	195.61
▲	07-B09	1.83	198.47
★	07-B09	4.11	196.19

Date November 2007  
Project 5200-03-00

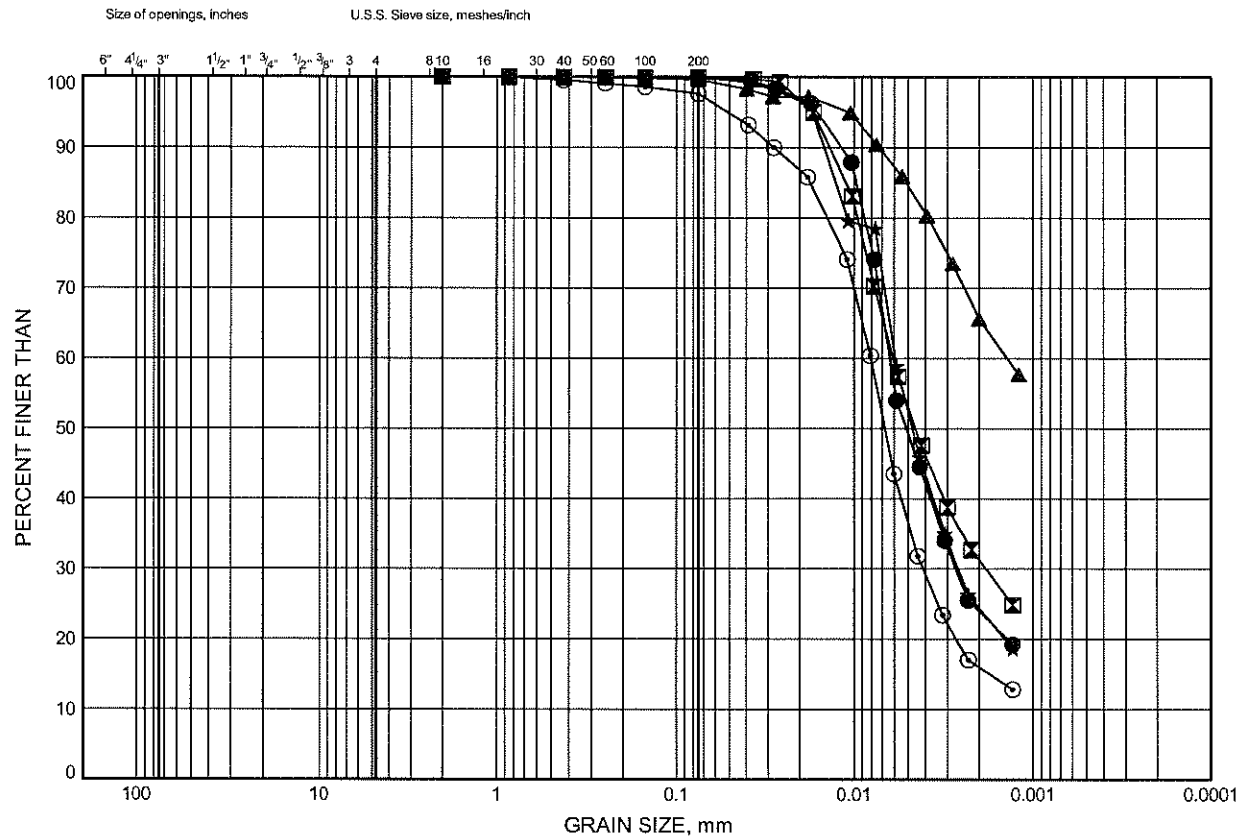


Prep'd MFA  
Chkd. MRA

# Beatty Creek Bridge Replacement GRAIN SIZE DISTRIBUTION

FIGURE 07-B2

## UPPER SILTY CLAY TO CLAYEY SILT



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	07-B01	2.59	194.61
⊠	07-B02	3.39	193.61
▲	07-B02	6.40	190.60
★	07-B03	4.88	194.22
⊙	07-B04	4.11	194.89

Date November 2007  
Project 5200-03-00



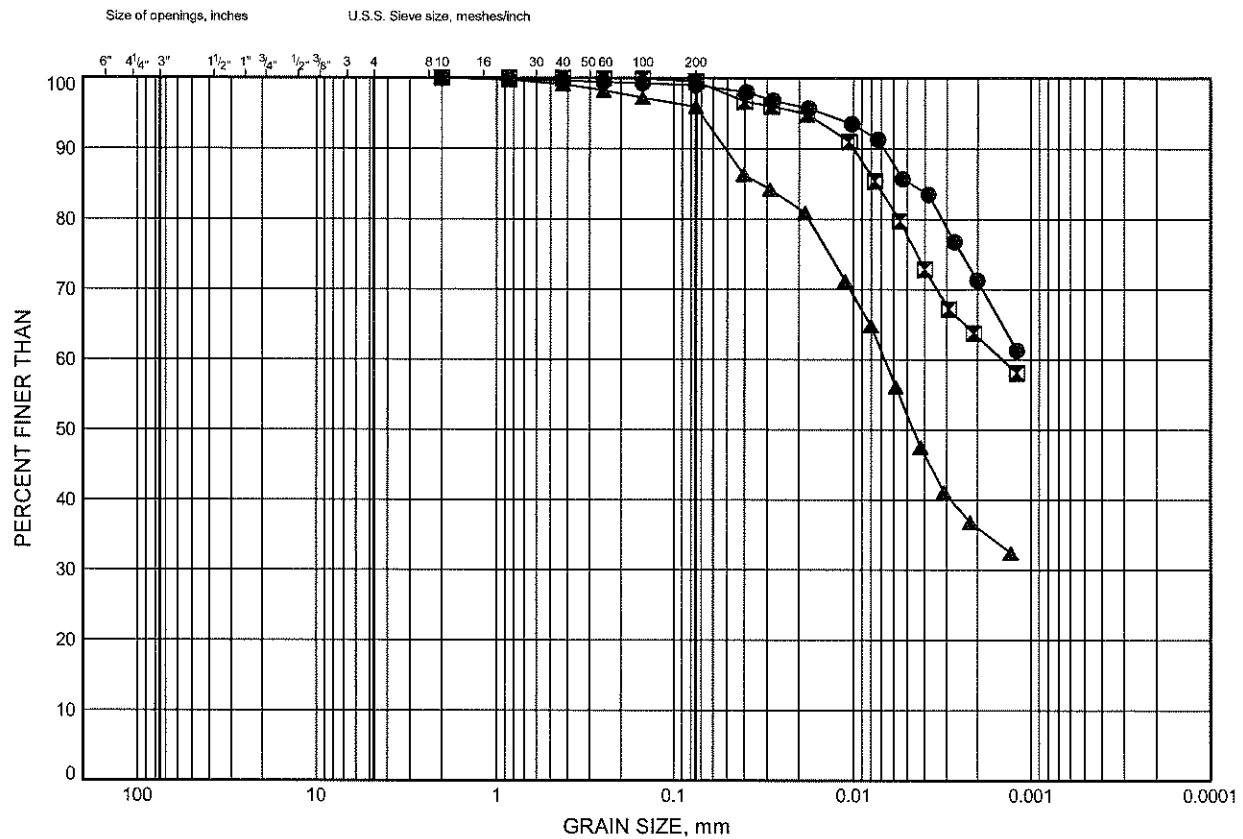
Prep'd MFA  
Chkd. MRA



# Beatty Creek Bridge Replacement GRAIN SIZE DISTRIBUTION

FIGURE 07-B4

## UPPER SILTY CLAY TO CLAYEY SILT



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	07-B07	7.92	190.28
⊠	07-B08	6.40	191.80
▲	07-B09	9.45	190.85

Date November 2007  
Project 5200-03-00



Prep'd MFA  
Chkd. MRA

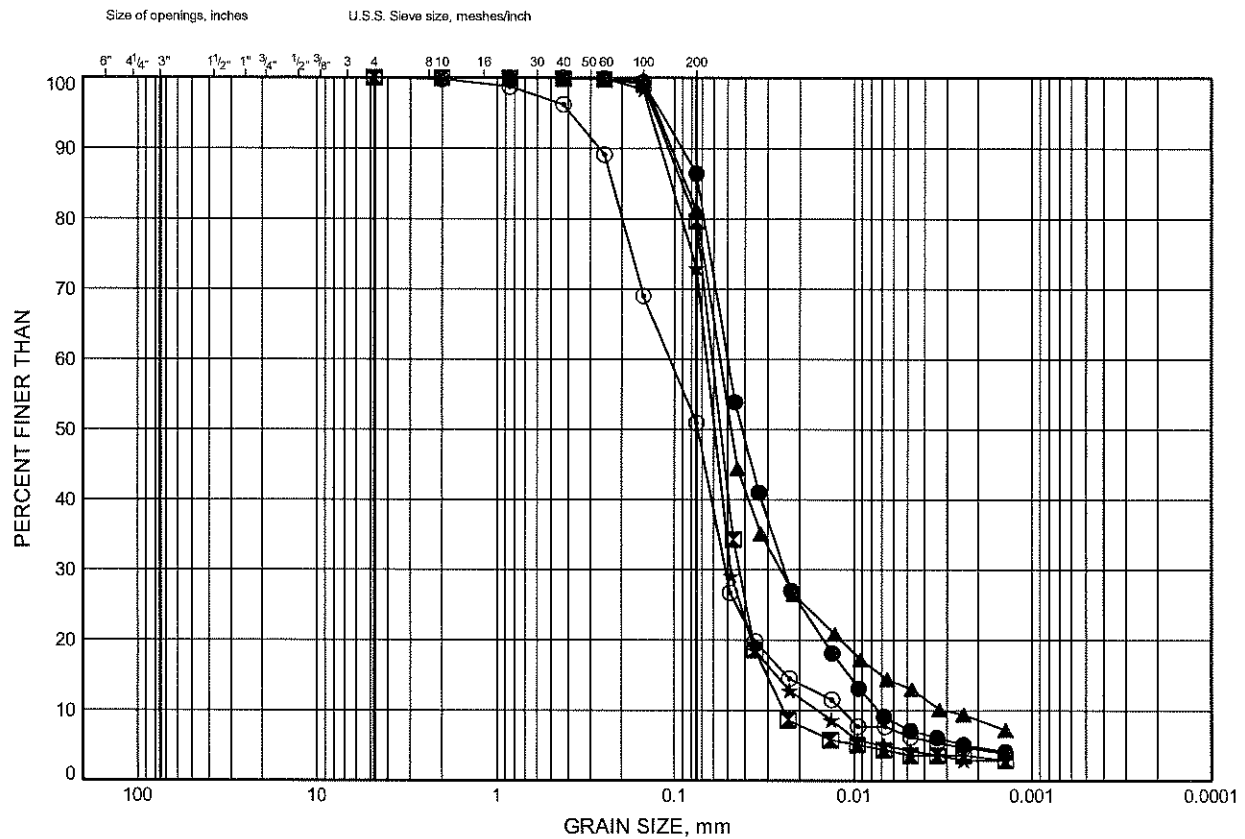




# Beatty Creek Bridge Replacement GRAIN SIZE DISTRIBUTION

FIGURE 07-B6

## INTERMEDIATE SAND TO SILT



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	07-B03	14.17	184.93
⊠	07-B04	17.07	181.93
▲	07-B04	18.82	180.18
★	07-B05	15.54	183.46
⊙	07-B06	10.97	188.13

Date November 2007  
Project 5200-03-00

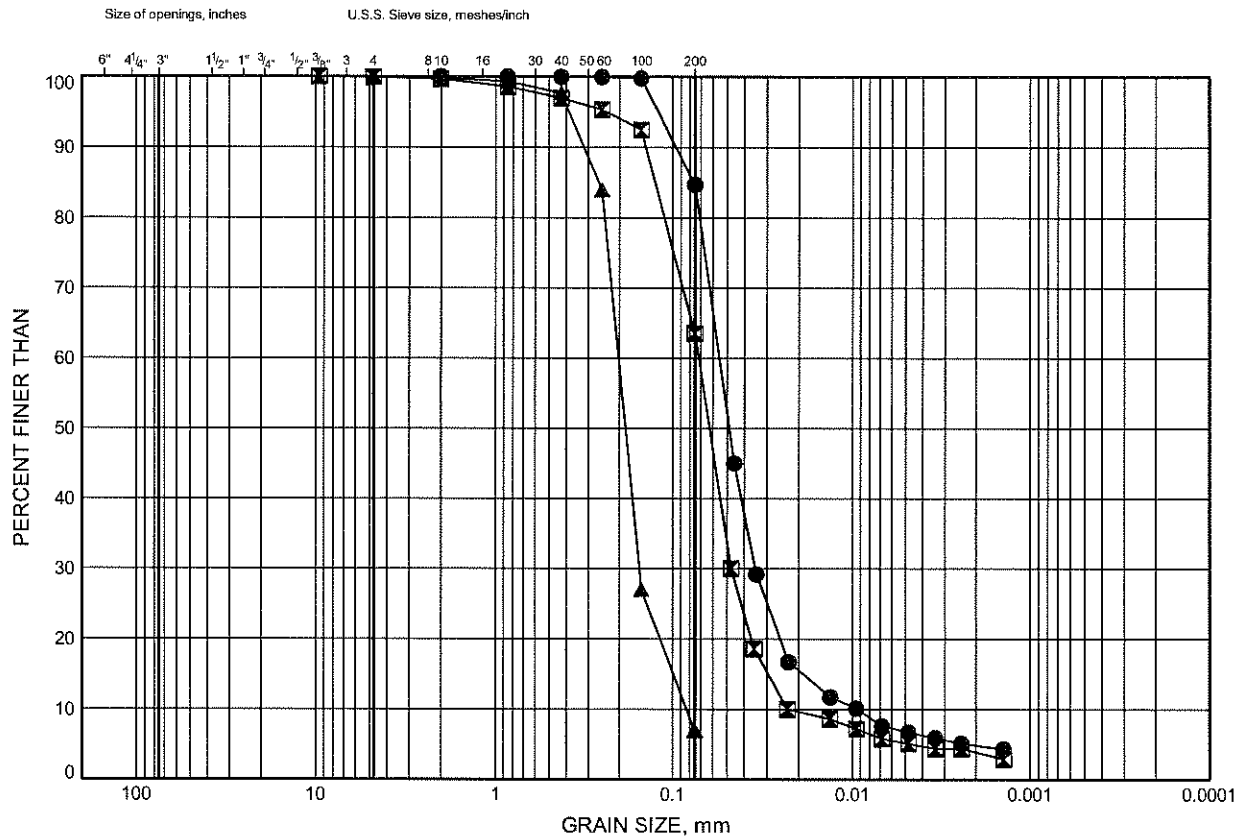


Prep'd MFA  
Chkd. MRA

# Beatty Creek Bridge Replacement GRAIN SIZE DISTRIBUTION

FIGURE 07-B7

## INTERMEDIATE SAND TO SILT



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	07-B06	17.07	182.03
⊠	07-B07	15.54	182.66
▲	07-B08	12.50	185.70

Date November 2007  
Project 5200-03-00



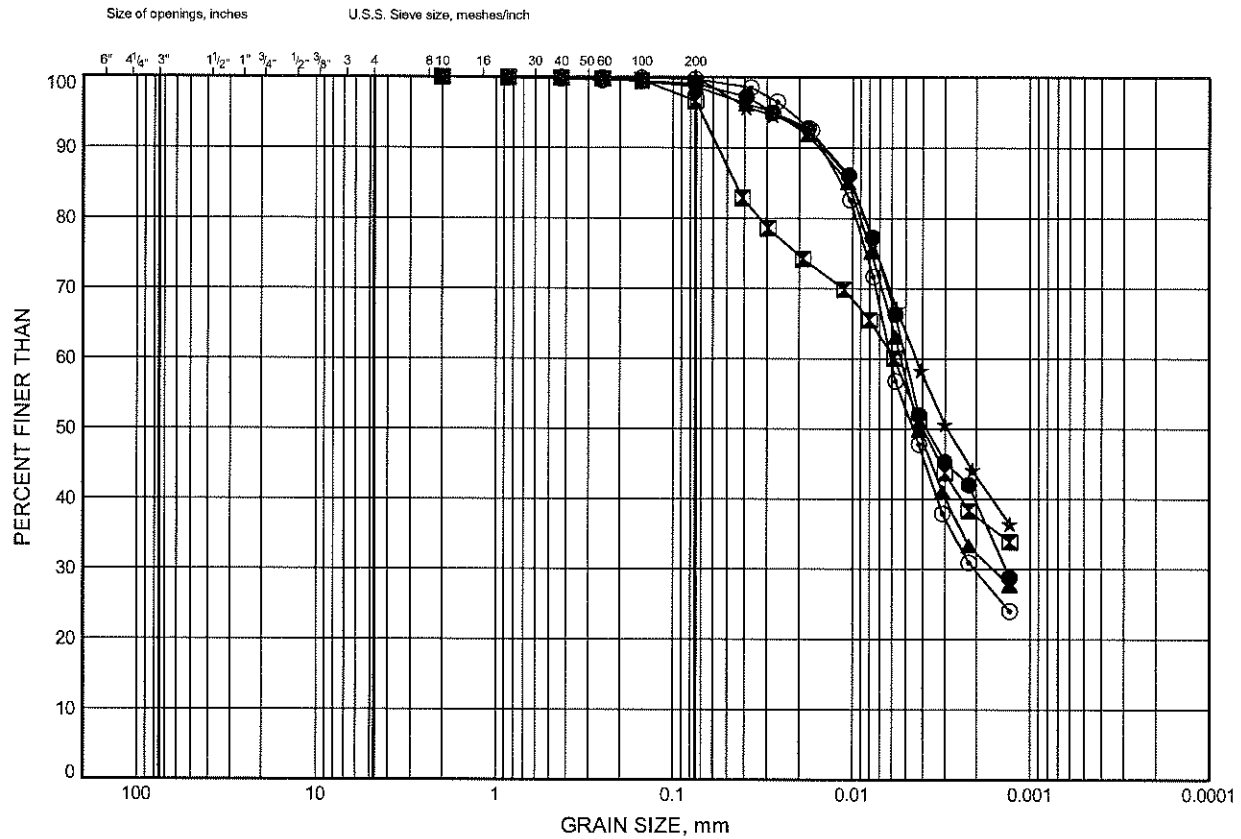
Prep'd MFA  
Chkd. MRA

# Beatty Creek Bridge Replacement

## GRAIN SIZE DISTRIBUTION

FIGURE 07-B8

### LOWER SILTY CLAY TO CLAYEY SILT



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	07-B03	21.64	177.46
⊠	07-B03	33.83	165.27
▲	07-B04	30.78	168.22
★	07-B05	24.69	174.31
⊙	07-B05	27.74	171.26

Date November 2007  
Project 5200-03-00



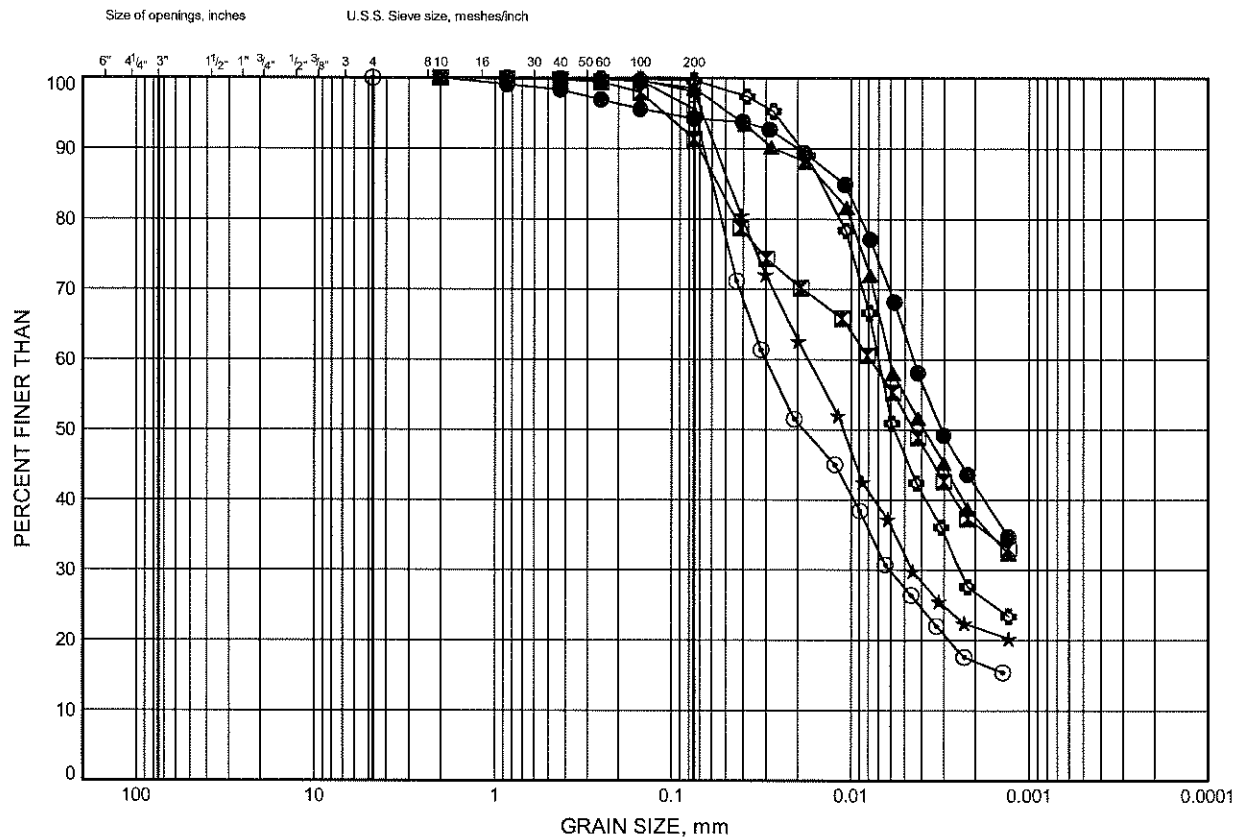
Prep'd MFA  
Chkd. MRA

# Beatty Creek Bridge Replacement

## GRAIN SIZE DISTRIBUTION

FIGURE 07-B9

### LOWER SILTY CLAY TO CLAYEY SILT



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	07-B06	24.69	174.41
⊠	07-B06	36.88	162.22
▲	07-B07	27.74	170.46
★	07-B08	33.83	164.37
⊙	07-B09	21.64	178.66
⊕	07-B09	27.74	172.56

Date November 2007  
Project 5200-03-00

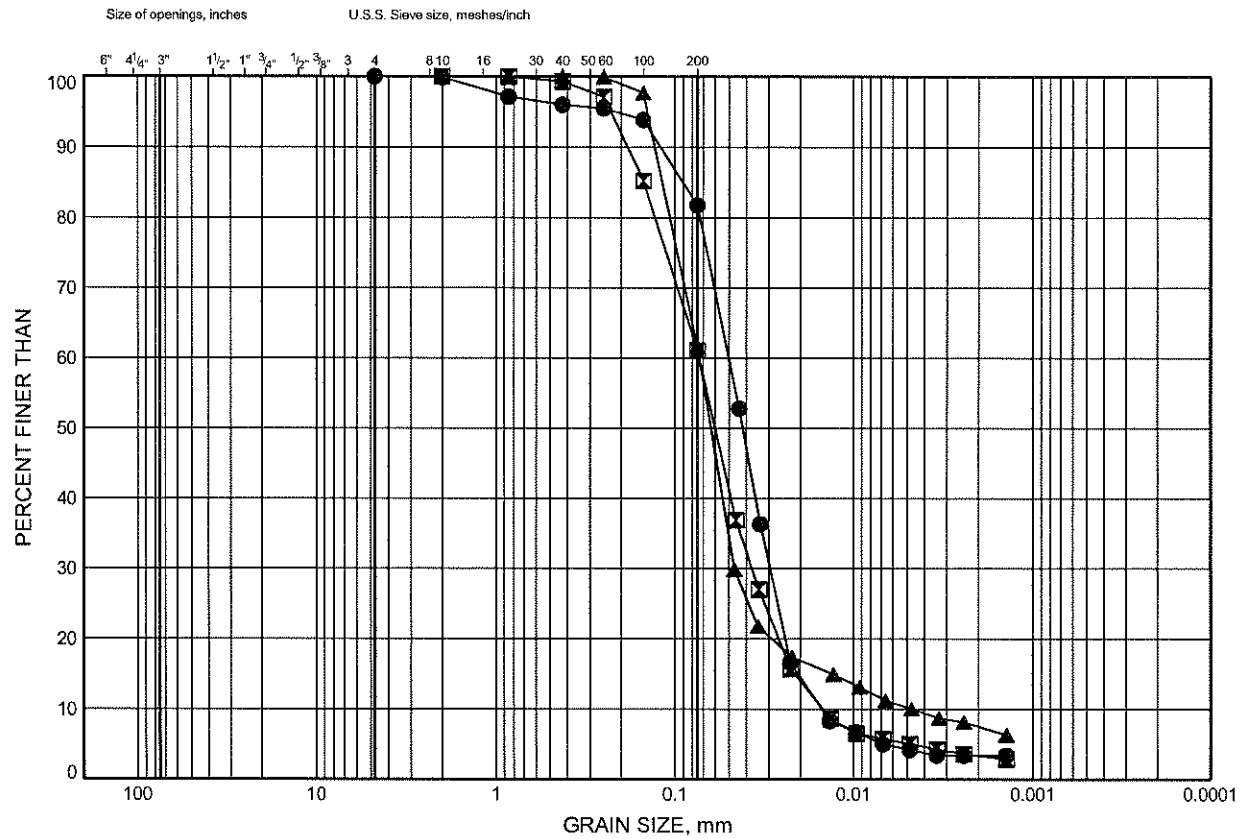


Prep'd MFA  
Chkd. MRA

# Beatty Creek Bridge Replacement GRAIN SIZE DISTRIBUTION

FIGURE 07-B10

## LOWER SILT AND SAND



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	07-B03	39.93	159.17
■	07-B04	39.93	159.07
▲	07-B05	35.51	163.49

Date November 2007  
Project 5200-03-00

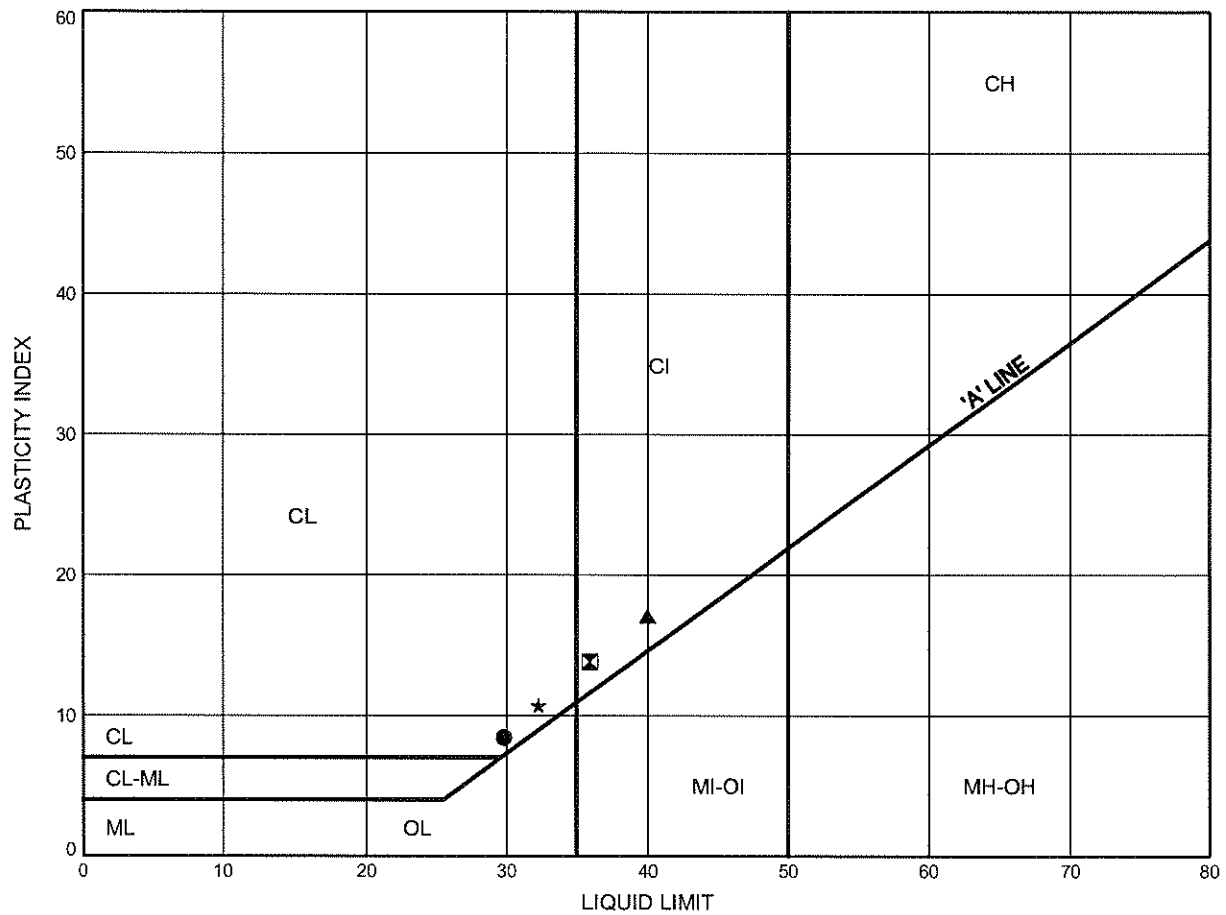


Prep'd MFA  
Chkd. MRA

Beatty Creek Bridge Replacement  
**ATTERBERG LIMITS TEST RESULTS**

FIGURE 07-B11

**UPPER SILTY CLAY**



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	07-B02	3.39	193.61
⊠	07-B03	4.88	194.22
▲	07-B05	2.59	196.41
★	07-B06	4.88	194.22

Date November 2007  
 Project 5200-03-00

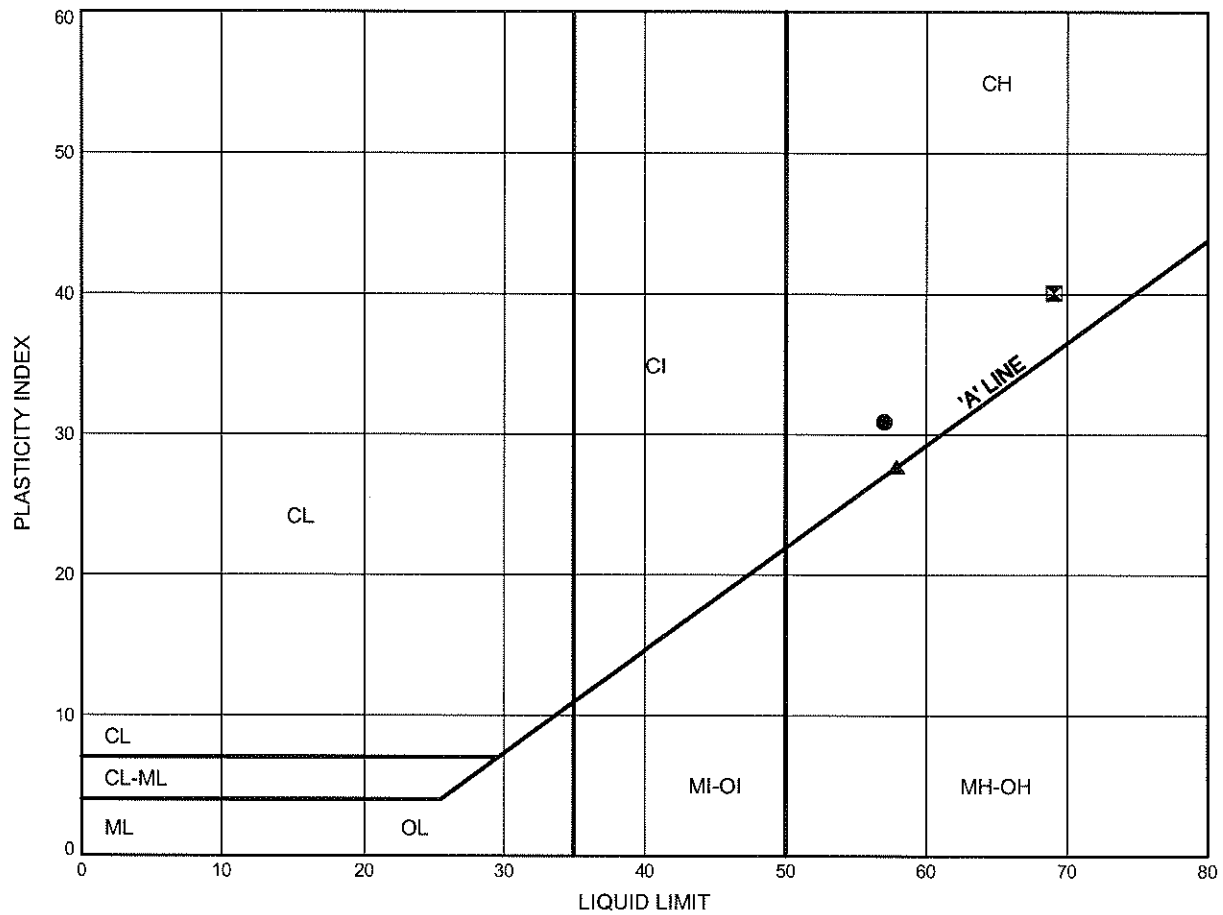


Prep'd MFA  
 Chkd. MRA

Beatty Creek Bridge Replacement  
**ATTERBERG LIMITS TEST RESULTS**

FIGURE 07-B12

**UPPER SILTY CLAY**



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	07-B07	7.92	190.28
⊠	07-B08	6.40	191.80
▲	07-B09	9.45	190.85

Date November 2007  
 Project 5200-03-00



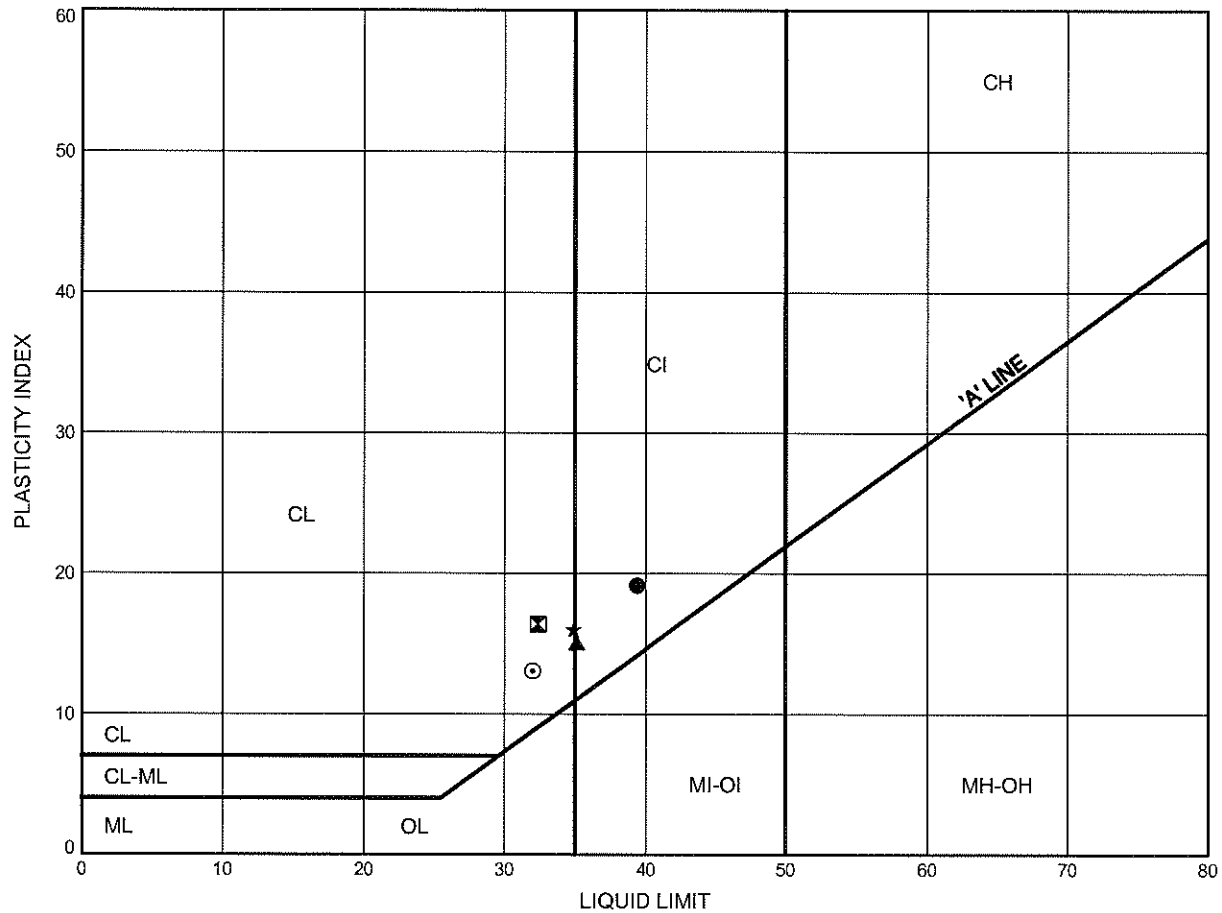
Prep'd MFA  
 Chkd. MRA



Beatty Creek Bridge Replacement  
**ATTERBERG LIMITS TEST RESULTS**

FIGURE 07-B13

**LOWER SILTY CLAY**



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	07-B03	21.64	177.46
⊠	07-B03	33.83	165.27
▲	07-B04	30.78	168.22
★	07-B05	24.69	174.31
⊙	07-B05	27.74	171.26

Date November 2007  
 Project 5200-03-00

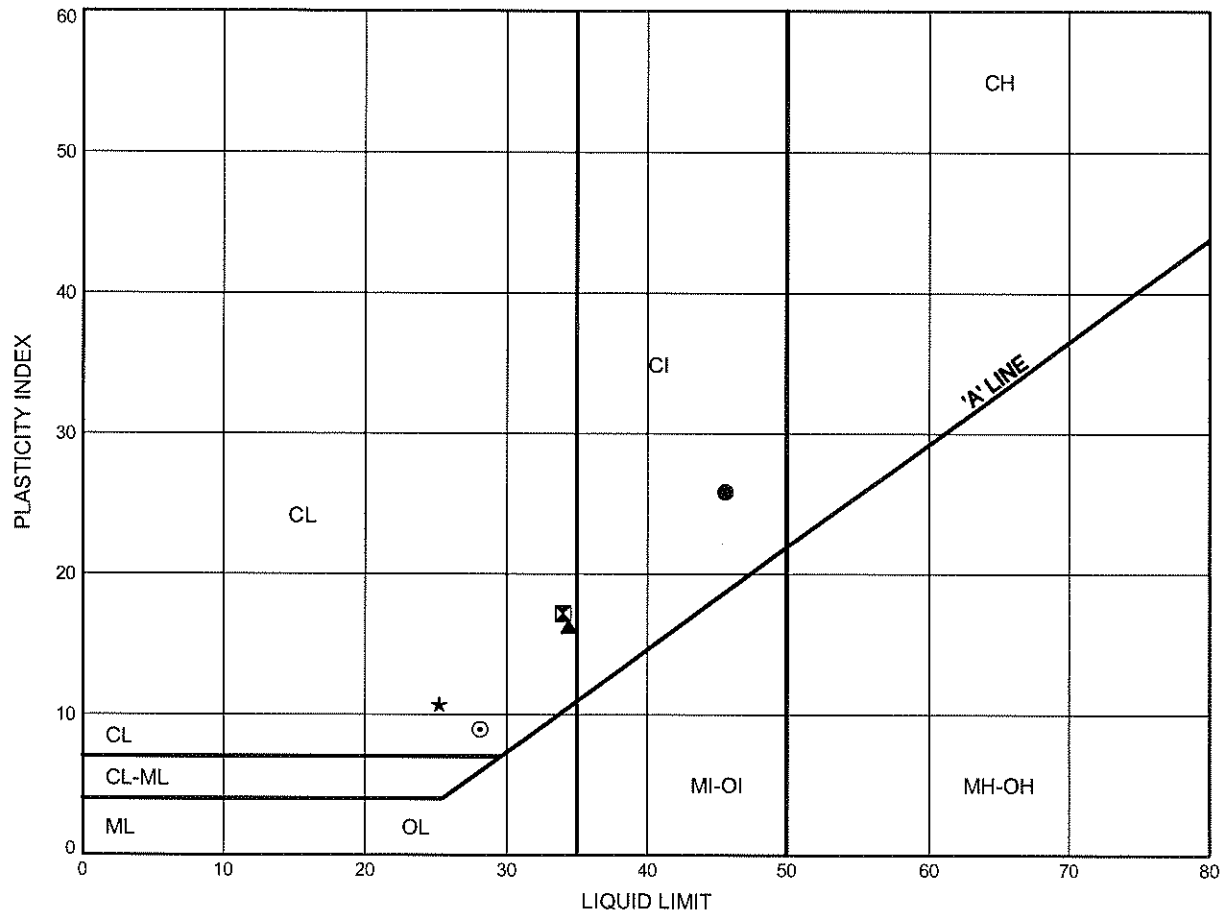


Prep'd MFA  
 Chkd. MRA

Beatty Creek Bridge Replacement  
**ATTERBERG LIMITS TEST RESULTS**

FIGURE 07-B14

**LOWER SILTY CLAY**



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	07-B06	24.69	174.41
⊠	07-B06	36.88	162.22
▲	07-B07	27.74	170.46
★	07-B08	33.83	164.37
⊙	07-B09	27.74	172.56

Date November 2007  
 Project 5200-03-00



Prep'd MFA  
 Chkd. MRA

## Consolidation Test Report

CLIENT: **McCormick Rankin Corporation**

FILE NUMBER: 18-45-1 / 19-1351-98

PROJECT: Mindemoya and Beatty Creek

REPORT DATE: 15-Nov-07

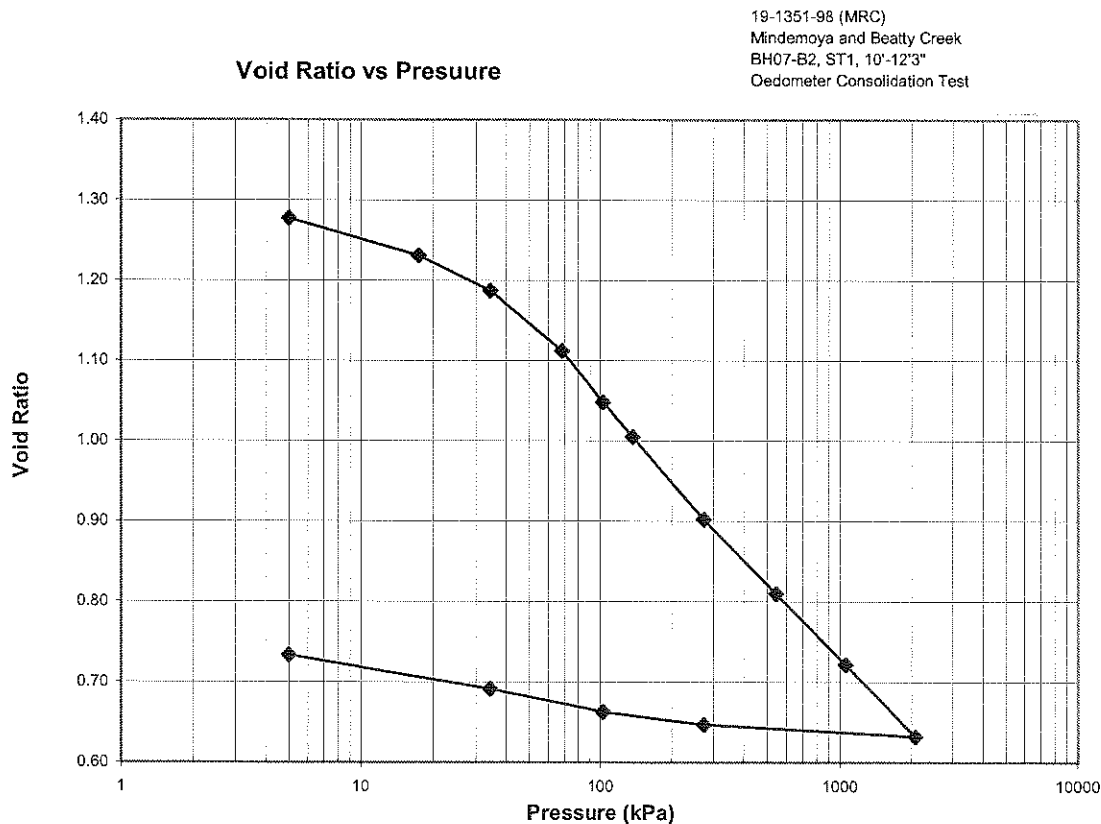
TEST DATES: September 5, 2007 - September 18, 2007

SAMPLE: BH07-B2, ST1, 10'-12'3"  
 Silty Clay, grey, low plastic, (CL-ML), Lab Vane: 10 - 17 kPa (Soft)  
 Grain Size: 32 % Clay & 68 % Silt

PROCEDURE: Tested in accordance with Standard Test Method for One-Dimensional Consolidation  
 Properties of Soils, ASTM D 2435-04, method B

	<u>Start of Test</u>	<u>End of Test</u>
Wet Dens. (kg/m <sup>3</sup> )	1754.3	2041.0
Dry Dens. (kg/m <sup>3</sup> )	1192.0	1572.0
Moisture Cont. (%)	47.2	29.9
Void Ratio	1.307	0.749
Saturation (%)	99.2	

Note: A Specific Gravity of 2.75 was assumed for the void ratio and saturation calculations



TEST DONE BY: WM/EA  
 REVIEWED BY: JPL

## Consolidation Test Report

Mindemoya and Beatty Creek  
18-45-1 / 19-1351-98

BH07-B2, ST1, 10'-12'3"

**TRIMMING:** The Specimen was manually trimmed to the size of consolidation ring, then mounted in a fixed ring consolidometer

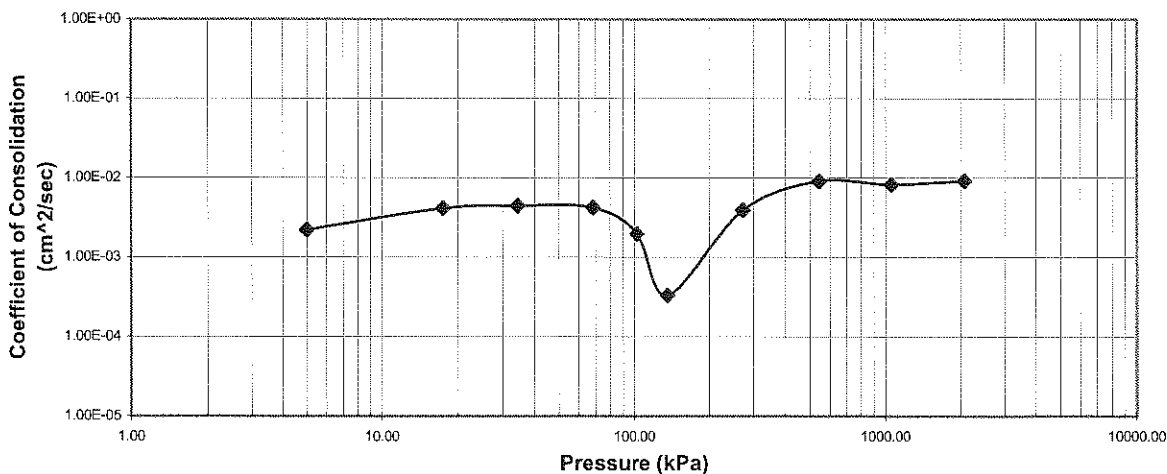
**LOADING:** A seating load of 5 kPa was applied and the consolidometer was flooded with distilled water. Sample was monitored to ensure no swelling effect occurred before the start of the test. Subsequent loads were applied and the duration of each load step was 24 hrs.

**CALCULATIONS:** Coefficients of Consolidation were calculated by the square root time method.

Pressure (kPa)	Corr. Hgt (mm)	Avg. Hgt. (mm)	T90 (min)	Cv (cm <sup>2</sup> /sec)	Void Ratio	mv (m <sup>2</sup> /kN)	k (cm/s)
0.00	19.850	19.850			1.307		
5.00	19.596	19.723	6.25	2.20E-03	1.278	1.61E-03	3.47E-07
17.50	19.197	19.396	3.24	4.10E-03	1.231	1.13E-03	4.52E-07
34.46	18.818	19.007	2.89	4.42E-03	1.187	9.59E-04	4.15E-07
68.42	18.171	18.494	2.89	4.18E-03	1.112	8.07E-04	3.31E-07
102.82	17.620	17.896	5.76	1.96E-03	1.048	5.51E-04	1.06E-07
136.78	17.249	17.434	32.49	3.31E-04	1.005	3.26E-04	1.06E-08
273.12	16.366	16.807	2.56	3.90E-03	0.902	1.47E-04	5.64E-08
545.39	15.569	15.968	1.00	9.01E-03	0.809	7.45E-05	6.57E-08
1057.63	14.812	15.191	1.00	8.15E-03	0.721	3.79E-05	3.03E-08
2080.12	14.043	14.428	0.81	9.08E-03	0.632	3.57E-06	3.18E-09
273.12	14.171	14.492			0.647		
102.82	14.308	14.240			0.663		
34.46	14.554	14.431			0.691		
5.00	14.916	14.735			0.734		

Coefficient of Consolidation vs Pressure

19-1351-98 (MRC)  
Mindemoya and Beatty Creek  
BH07-B2, ST1, 10'-12'3"  
Oedometer Consolidation Test



Notes: Cv and k calculated using  $t_{90}$  values

TEST DONE BY: WM/EA  
REVIEWED BY: JPL

## Consolidation Test Report

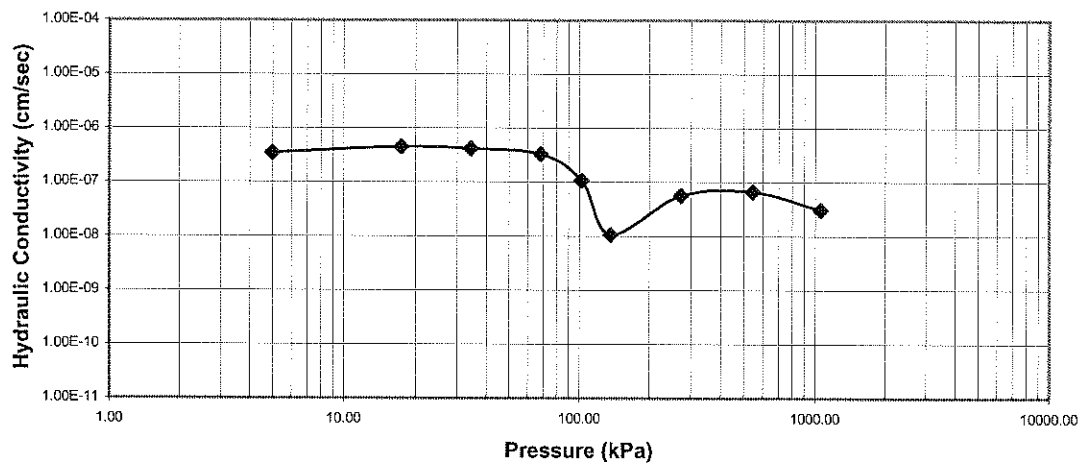
Mindemoya and Beatty Creek

18-45-1 / 19-1351-98

BH07-B2, ST1, 10'-12'3"

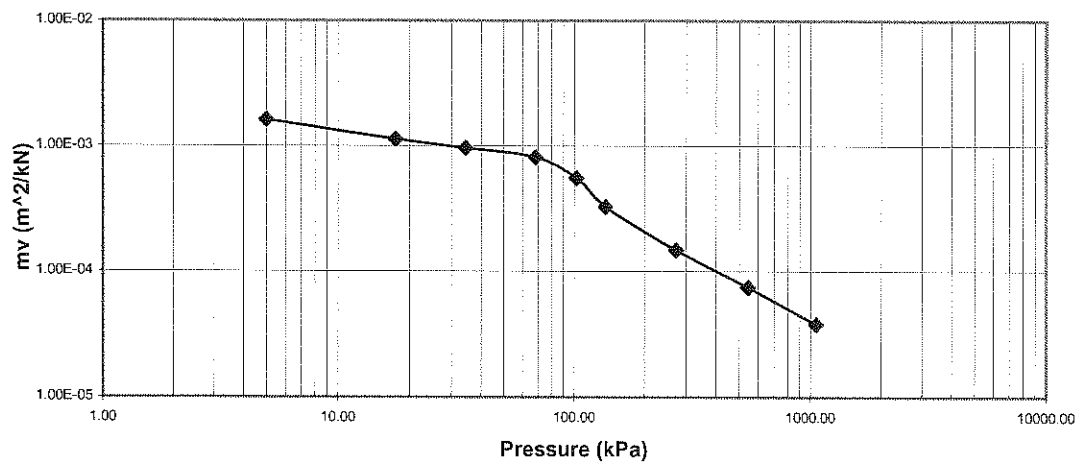
### Hydraulic Conductivity vs Pressure

19-1351-98 (MRC)  
Mindemoya and Beatty Creek  
BH07-B2, ST1, 10'-12'3"  
Oedometer Consolidation Test



### mv vs Pressure

19-1351-98 (MRC)  
Mindemoya and Beatty Creek  
BH07-B2, ST1, 10'-12'3"  
Oedometer Consolidation Test



TEST DONE BY: WM/EA

REVIEWED BY: JPL

## Consolidation Test Report

CLIENT: **McCormick Rankin Corporation**

FILE NUMBER: 18-45-1 / 19-1351-98

PROJECT: Mindemoya and Beatty Creek

REPORT DATE: 9-Oct-07

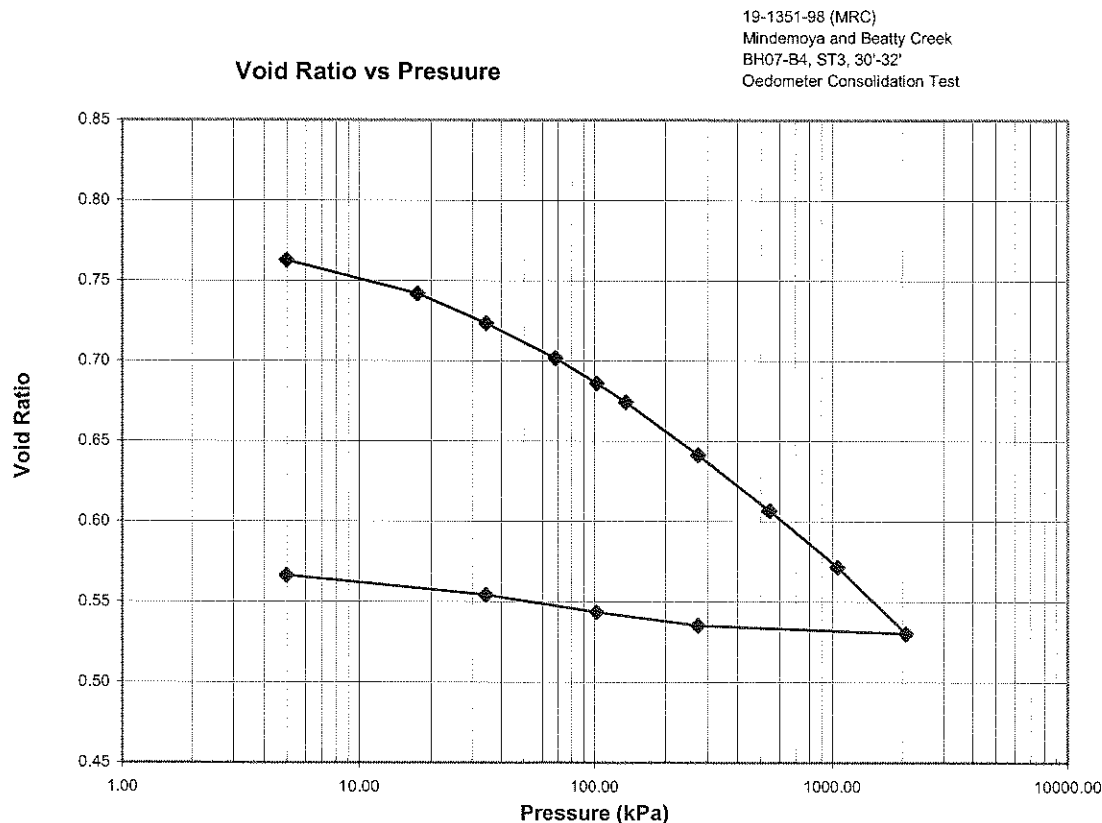
TEST DATES: August 21, 2007 - September 3, 2007

SAMPLE: BH07-B4, ST3, 30'-32'  
 Silty Clay, dark grey, low plastic, (CL-ML), Lab Vane: 15 kPa (Soft)  
 Grain Size: 20 % Clay & 80 % Silt

PROCEDURE: Tested in accordance with Standard Test Method for One-Dimensional Consolidation Properties of Soils, ASTM D 2435-04, method B

	<u>Start of Test</u>	<u>End of Test</u>
Wet Dens. (kg/m <sup>3</sup> )	1964.0	2135.2
Dry Dens. (kg/m <sup>3</sup> )	1536.0	1742.0
Moisture Cont. (%)	27.9	22.6
Void Ratio	0.790	0.579
Saturation (%)	97.0	

Note: A Specific Gravity of 2.75 was assumed for the void ratio and saturation calculations



TEST DONE BY: WM/EA  
 REVIEWED BY: JPL

## Consolidation Test Report

Mindemoya and Beatty Creek  
18-45-1 / 19-1351-98

BH07-B4, ST3, 30'-32'

**TRIMMING:** The Specimen was manually trimmed to the size of consolidation ring, then mounted in a fixed ring consolidometer

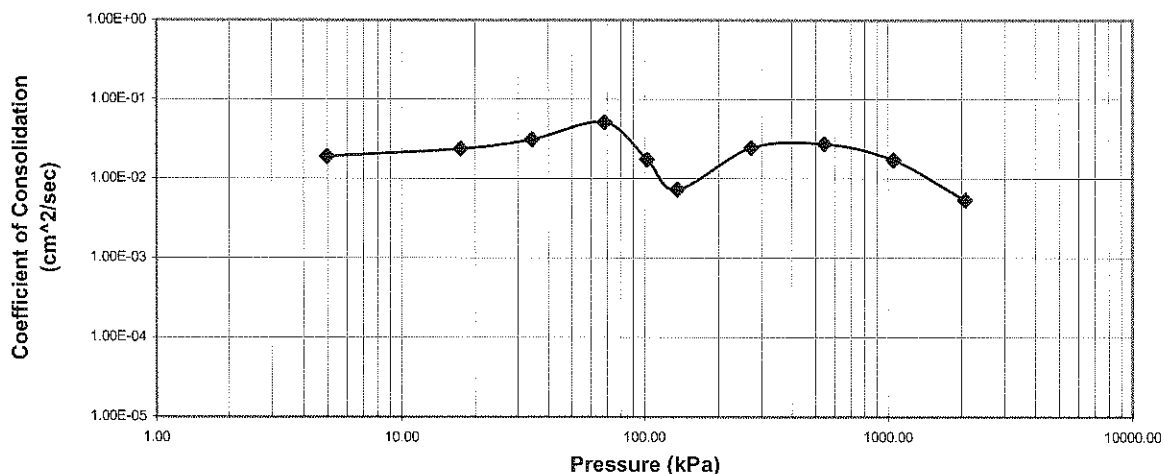
**LOADING:** A seating load of 5 kPa was applied and the consolidometer was flooded with distilled water. Sample was monitored to ensure no swelling effect occurred before the start of the test. Subsequent loads were applied and the duration of each load step was 24 hrs.

**CALCULATIONS:** Coefficients of Consolidation were calculated by the square root time method.

Pressure (kPa)	Corr. Hgt (mm)	Avg. Hgt. (mm)	T90 (min)	Cv (cm <sup>2</sup> /sec)	Void Ratio	mv (m <sup>2</sup> /kN)	k (cm/s)
0.00	19.850	19.850			0.790		
5.00	19.542	19.696	0.72	1.90E-02	0.763	9.25E-04	1.72E-06
17.50	19.313	19.427	0.56	2.37E-02	0.742	6.12E-04	1.42E-06
34.46	19.107	19.210	0.42	3.09E-02	0.723	3.57E-04	1.08E-06
68.42	18.866	18.986	0.25	5.09E-02	0.702	2.56E-04	1.28E-06
102.82	18.691	18.779	0.72	1.72E-02	0.686	1.91E-04	3.22E-07
136.78	18.563	18.627	1.69	7.25E-03	0.674	1.35E-04	9.58E-08
273.12	18.198	18.380	0.49	2.44E-02	0.641	7.14E-05	1.71E-07
545.39	17.812	18.005	0.42	2.71E-02	0.607	3.84E-05	1.02E-07
1057.63	17.422	17.617	0.64	1.71E-02	0.571	2.25E-05	3.77E-08
2080.12	16.966	17.194	1.96	5.33E-03	0.530	1.53E-06	8.01E-10
273.12	17.021	16.994			0.535		
102.82	17.113	17.067			0.543		
34.46	17.232	17.173			0.554		
5.00	17.366	17.299			0.566		

**Coefficient of Consolidation vs Pressure**

19-1351-98 (MRC)  
Mindemoya and Beatty Creek  
BH07-B4, ST3, 30'-32'  
Oedometer Consolidation Test



Notes: Cv and k calculated using  $t_{90}$  values

TEST DONE BY: WM/EA  
REVIEWED BY: JPL

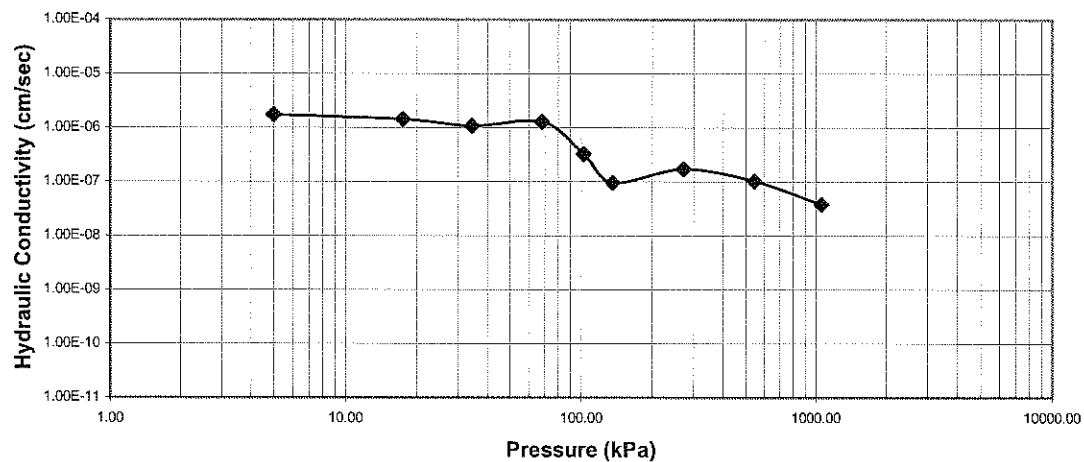
## Consolidation Test Report

Mindemoya and Beatty Creek  
18-45-1 / 19-1351-98

BH07-B4, ST3, 30'-32'

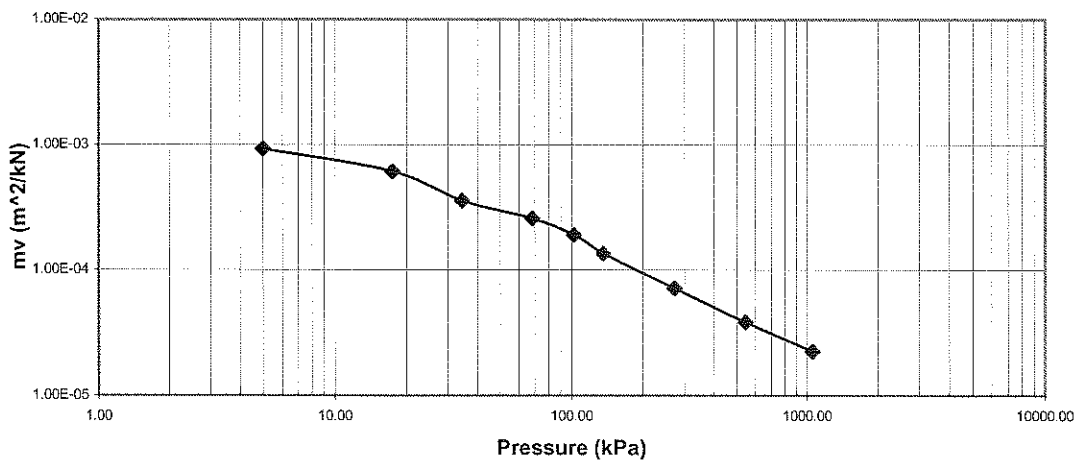
### Hydraulic Conductivity vs Pressure

19-1351-98 (MRC)  
Mindemoya and Beatty Creek  
BH07-B4, ST3, 30'-32'  
Oedometer Consolidation Test



### mv vs Pressure

19-1351-98 (MRC)  
Mindemoya and Beatty Creek  
BH07-B4, ST3, 30'-32'  
Oedometer Consolidation Test



TEST DONE BY: WM/EA  
REVIEWED BY: JPL



## Consolidation Test Report

CLIENT: **McCormick Rankin Corporation**

FILE NUMBER: 18-45-1 /19-1351-98

PROJECT: Mindemoya and Beatty Creek

REPORT DATE: 5-Oct-07

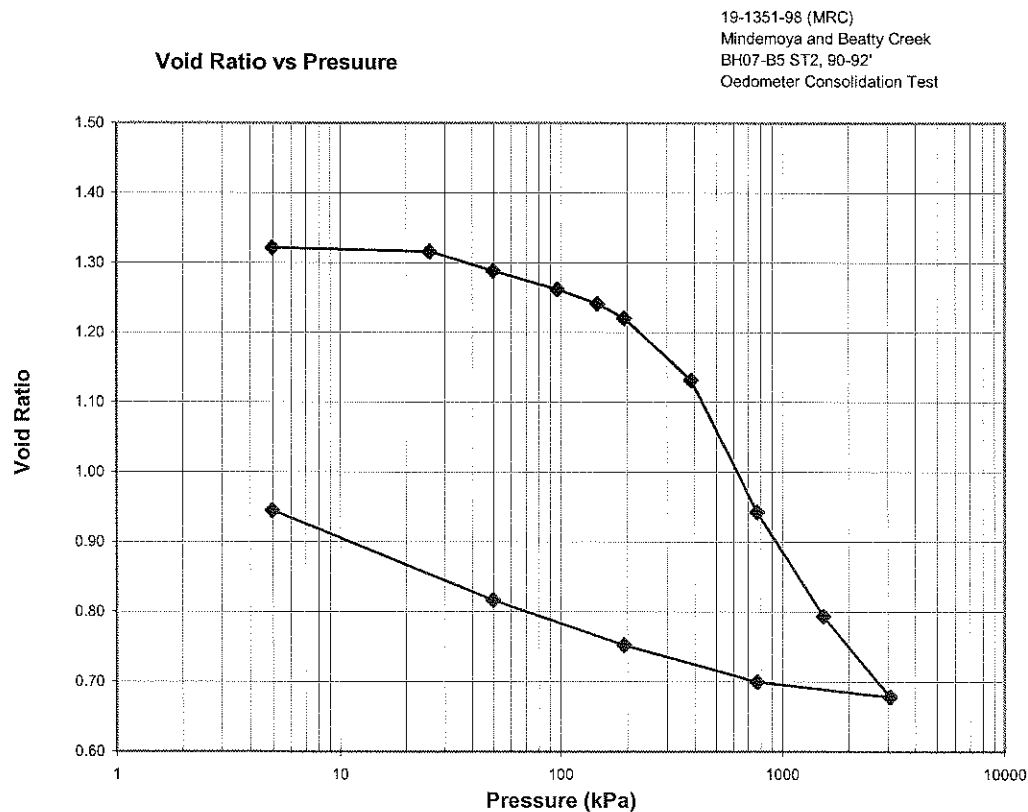
TEST DATES: September 17, 2007 - September 30, 2007

SAMPLE: BH07-B5 ST2, 90'-92'  
 Silty Clay, grey, plastic, (CL), Lab Vane: 16 - 27 kPa (soft to firm)  
 Grain Size: 30 % Clay & 70 % Silt

PROCEDURE: Tested in accordance with Standard Test Method for One-Dimensional Consolidation Properties of Soils, ASTM D 2435-04, method B

	<u>Start of Test</u>	<u>End of Test</u>
Wet Dens. (kg/m <sup>3</sup> )	1749.5	1910.6
Dry Dens. (kg/m <sup>3</sup> )	1193.8	1409.1
Moisture Cont. (%)	46.5	35.6
Void Ratio	1.304	0.952
Saturation (%)	98.2	

Note: A Specific Gravity of 2.75 was assumed for the void ratio and saturation calculations



TEST DONE BY: EA  
 REVIEWED BY: JPL

## Consolidation Test Report

Mindemoya and Beatty Creek  
18-45-1 /19-1351-98

BH07-B5 ST2, 90'-92'

**TRIMMING:** The Specimen was manually trimmed to the size of consolidation ring, then mounted in a fixed ring consolidometer

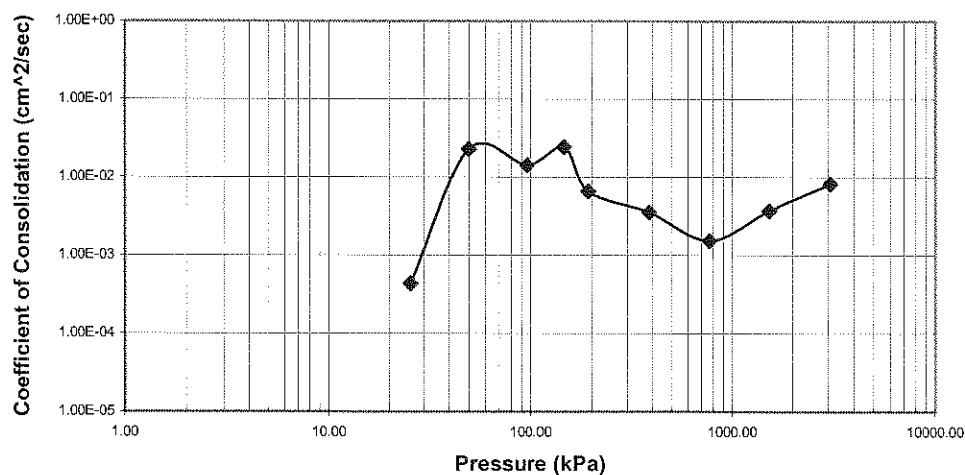
**LOADING:** A seating load of 4.97 kPa was applied and the consolidometer was flooded with distilled water. Sample was monitored to ensure no swelling effect occurred before the start of the test. Subsequent loads were applied and the duration of each load step was 24 hours.

**CALCULATIONS:** Coefficients of Consolidation were calculated by the square root time method.

Pressure (kPa)	Corr. Hgt (mm)	Avg. Hgt. (mm)	T90 (min)	Cv (cm <sup>2</sup> /sec)	Void Ratio	mv (m <sup>2</sup> /kN)	k (cm/s)
0.00	25.350	25.350			1.304		
4.97	25.550	25.450			1.321	1.09E-04	
25.67	25.492	25.521	53.30	4.32E-04	1.316	5.02E-04	2.12E-08
49.86	25.180	25.336	1.00	2.27E-02	1.288	2.46E-04	5.46E-07
96.65	24.884	25.032	1.56	1.42E-02	1.262	1.80E-04	2.50E-07
146.46	24.653	24.768	0.90	2.41E-02	1.241	1.88E-04	4.45E-07
193.24	24.426	24.540	3.24	6.57E-03	1.221	2.02E-04	1.30E-07
385.77	23.426	23.926	5.76	3.51E-03	1.131	2.13E-04	7.35E-08
770.72	21.310	22.368	11.56	1.53E-03	0.942	8.37E-05	1.25E-08
1540.91	19.650	20.480	4.00	3.70E-03	0.794	3.26E-05	1.18E-08
3081.80	18.356	19.003	1.56	8.18E-03	0.678	4.07E-06	3.26E-09
770.72	18.598	18.477			0.700		
193.24	19.184	18.891			0.752		
49.86	19.905	19.544			0.816		
4.97	21.338	20.622			0.945		

Coefficient of Consolidation vs Pressure

19-1351-98 (MRC)  
Mindemoya and Beatty Creek  
BH07-B5 ST2, 90'-92'  
Oedometer Consolidation Test



Notes: Cv and k calculated using  $t_{90}$  values

TEST DONE BY: EA  
REVIEWED BY: JPL

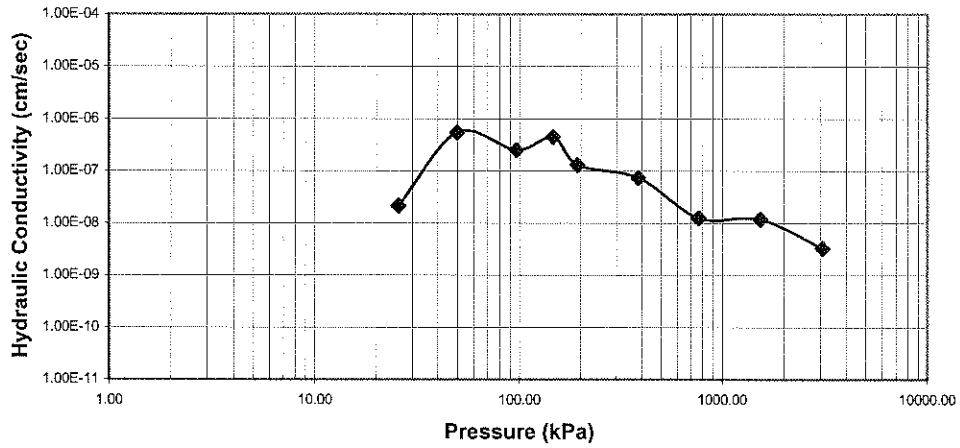
# Consolidation Test Report

Mindemoya and Beatty Creek  
18-45-1 /19-1351-98

BH07-B5 ST2, 90'-92'

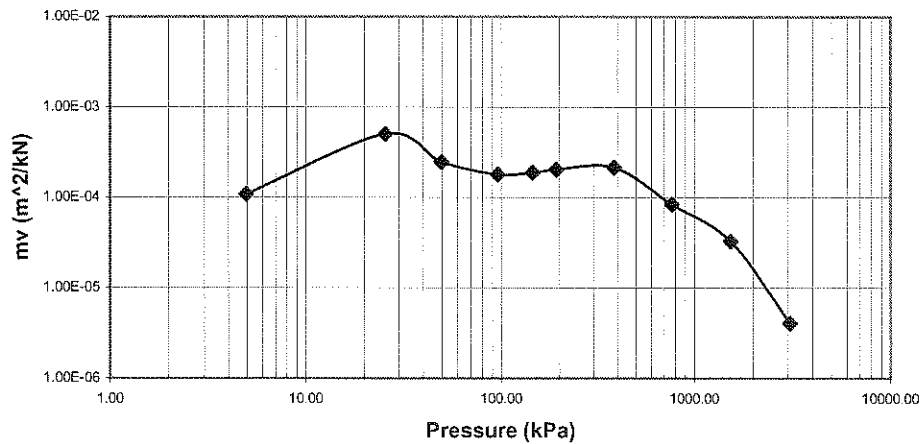
## Hydraulic Conductivity vs Pressure

19-1351-98 (MRC)  
Mindemoya and Beatty Creek  
BH07-B5 ST2, 90'-92'  
Oedometer Consolidation Test



## mv vs Pressure

19-1351-98 (MRC)  
Mindemoya and Beatty Creek  
BH07-B5 ST2, 90'-92'  
Oedometer Consolidation Test



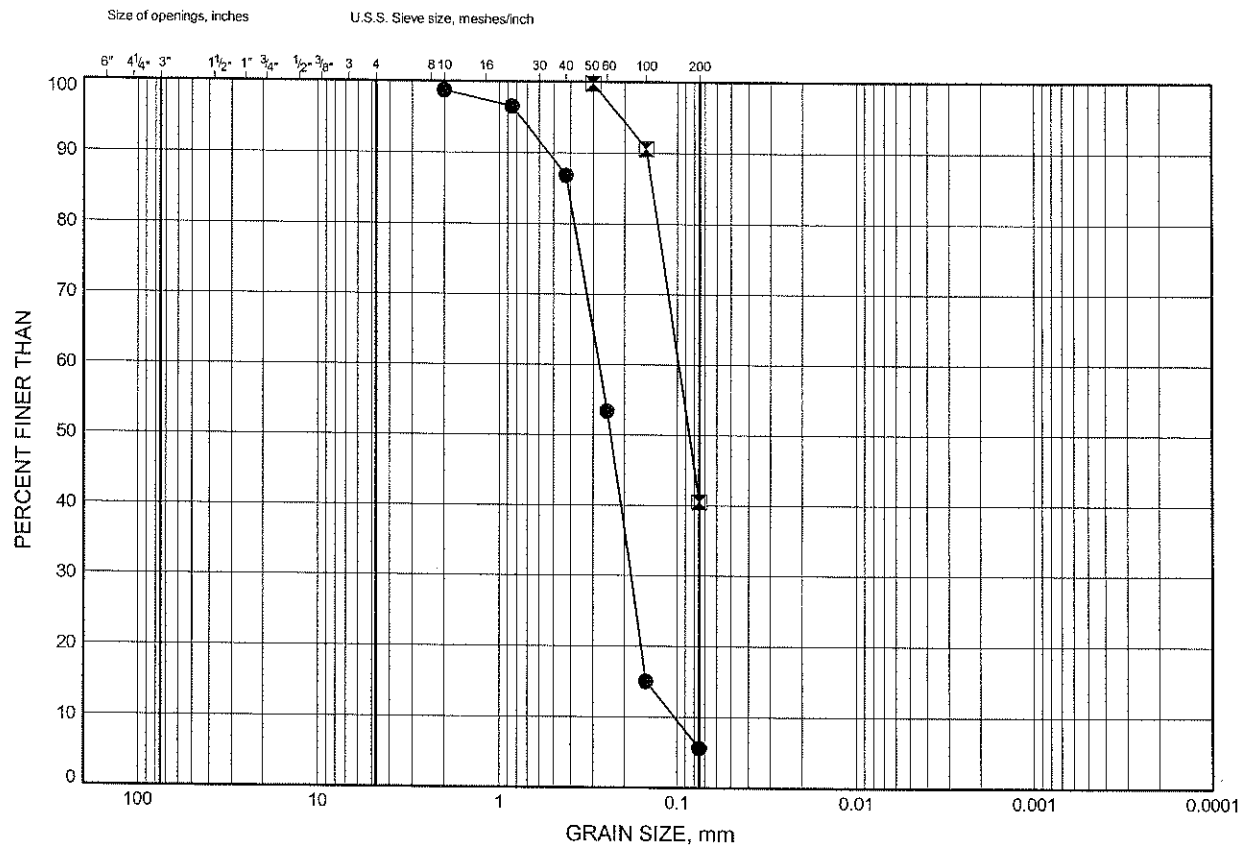
TEST DONE BY: EA  
REVIEWED BY: JPL

**Laboratory Test Results  
from Preliminary Investigation**

# Beatty Creek Bridge Replacement GRAIN SIZE DISTRIBUTION

FIGURE B1

## Surficial Sand to Silty Sand

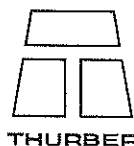


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-B08	1.83	196.17
☒	06-B10	1.83	197.67

Date December 2006

Project 5200-03-00



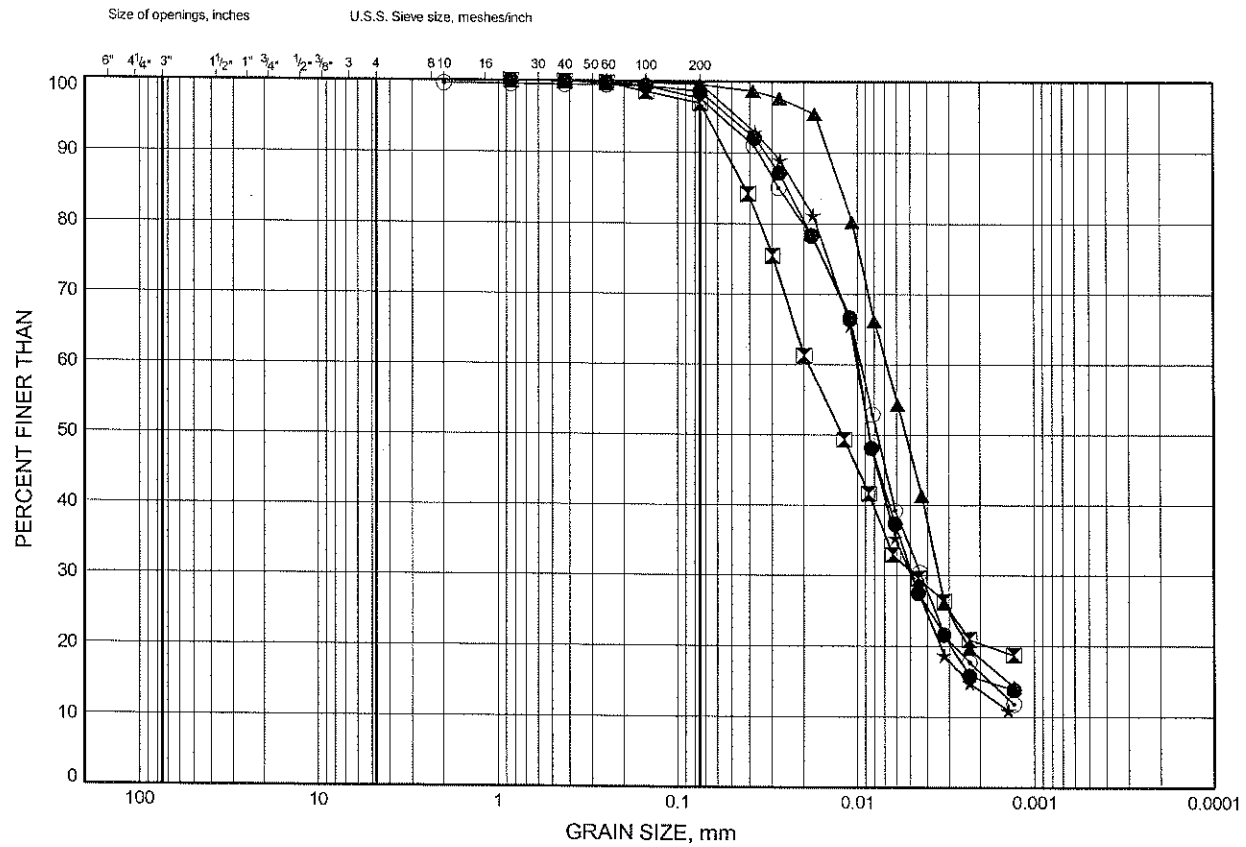
Prep'd JHL

Chkd. MRA

# Beatty Creek Bridge Replacement GRAIN SIZE DISTRIBUTION

FIGURE B2

## Upper Clayey Silt

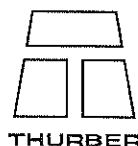


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-B01	1.83	195.27
⊠	06-B03	10.67	188.33
▲	06-B07	2.59	195.31
★	06-B09	2.59	195.51
⊙	06-B10	4.88	194.62

Date December 2006

Project 5200-03-00



Prep'd JHL

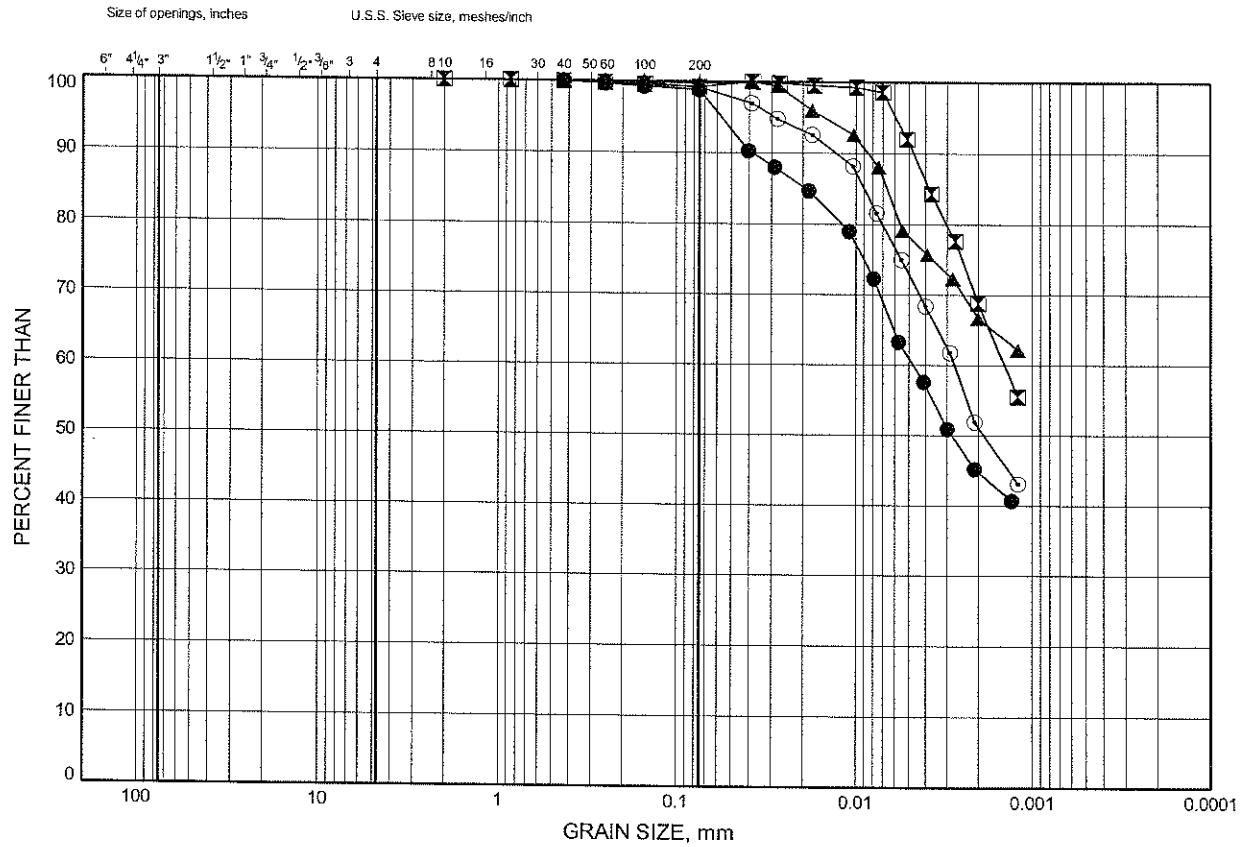
Chkd. MRA

# Beatty Creek Bridge Replacement

## GRAIN SIZE DISTRIBUTION

FIGURE B3

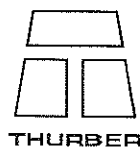
### Upper Silty Clay



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-B01	4.88	192.22
⊠	06-B02	12.50	184.90
▲	06-B04	6.40	192.60
★	06-B04	7.62	191.38
⊙	06-B04	13.72	185.28

Date December 2006  
Project 5200-03-00



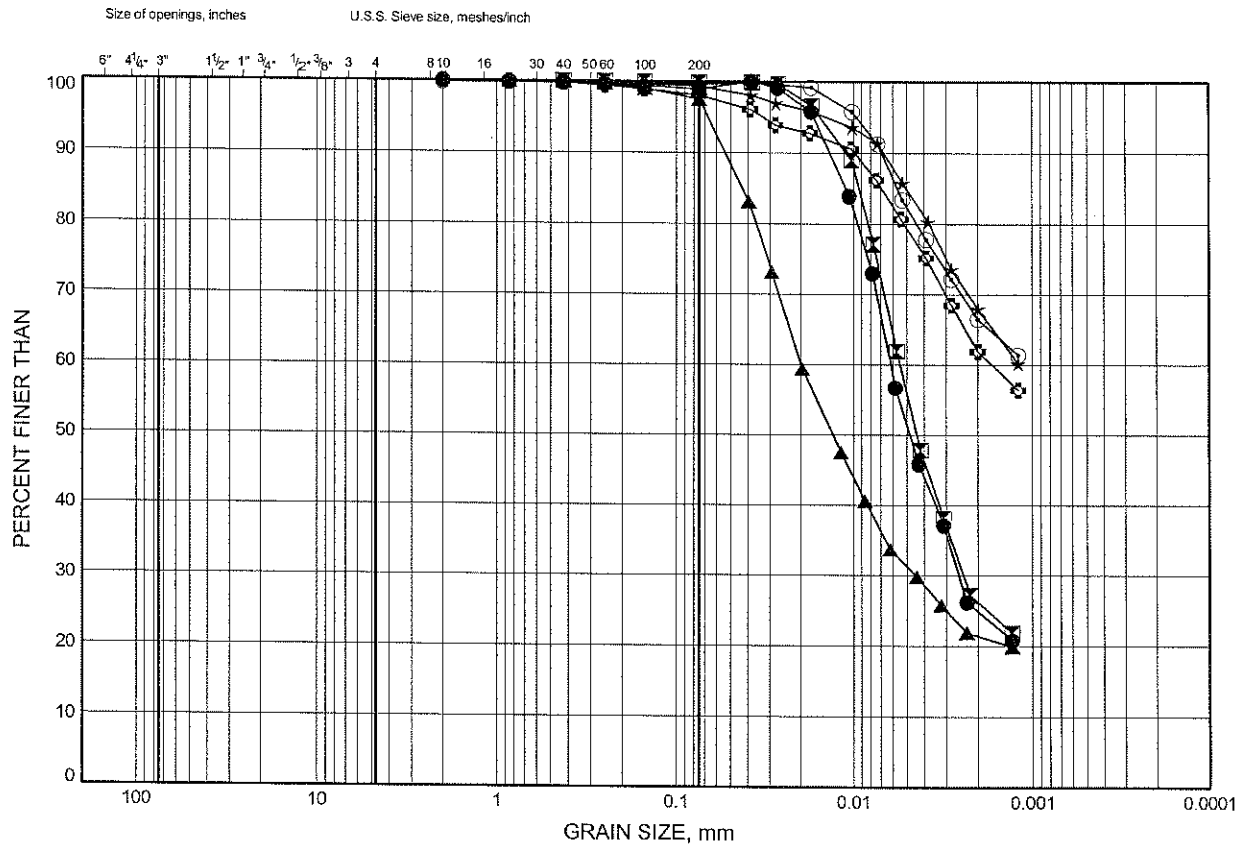
Prep'd JHL  
Chkd. MRA

# Beatty Creek Bridge Replacement

## GRAIN SIZE DISTRIBUTION

FIGURE B4

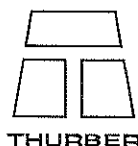
### Upper Silty Clay



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-B06	3.35	193.65
⊠	06-B06	4.88	192.12
▲	06-B06	7.92	189.08
★	06-B07	7.92	189.98
⊙	06-B08	6.40	191.60
⊛	06-B08	15.54	182.46

Date December 2006  
Project 5200-03-00



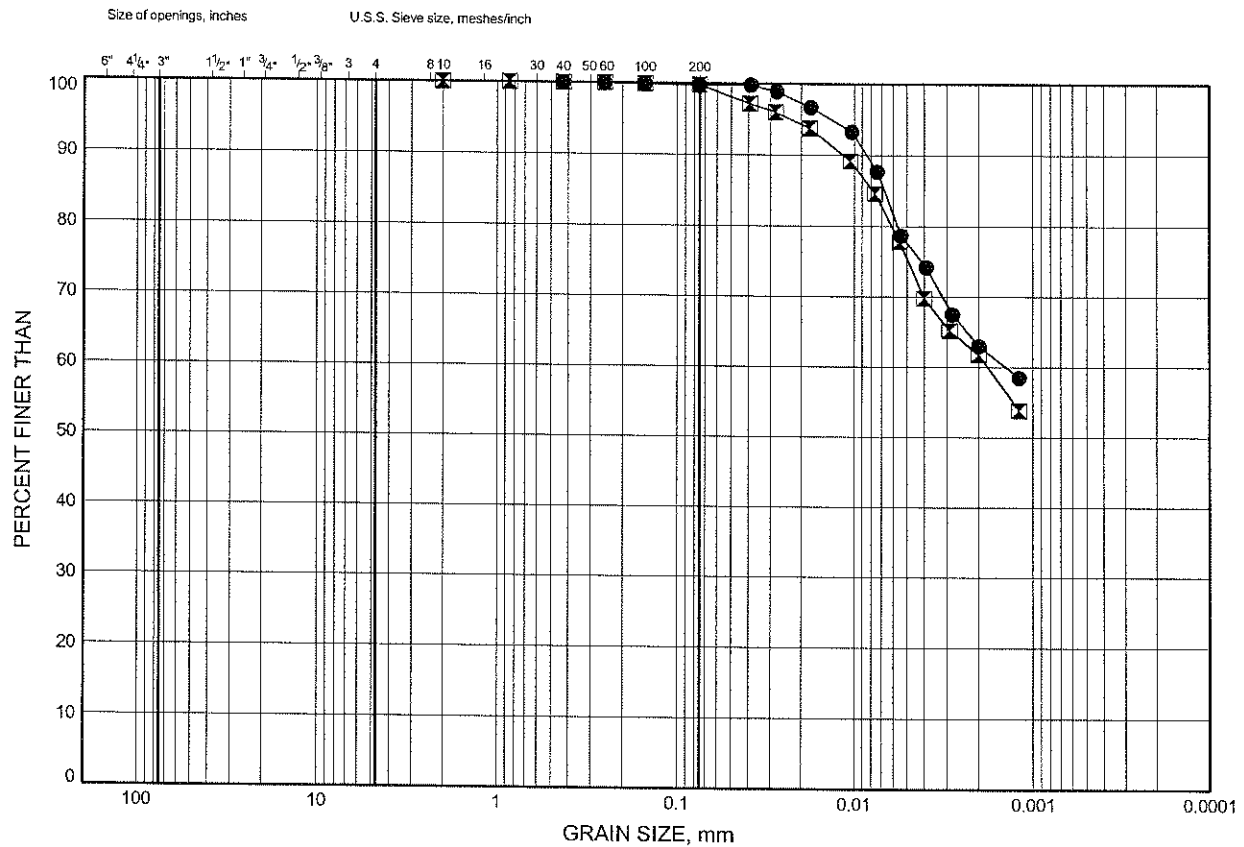
Prep'd JHL  
Chkd. MRA



# Beatty Creek Bridge Replacement GRAIN SIZE DISTRIBUTION

FIGURE B5

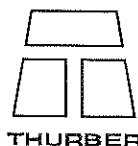
## Upper Silty Clay



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-B09	6.40	191.70
⊠	06-B10	7.62	191.88

Date December 2006  
Project 5200-03-00



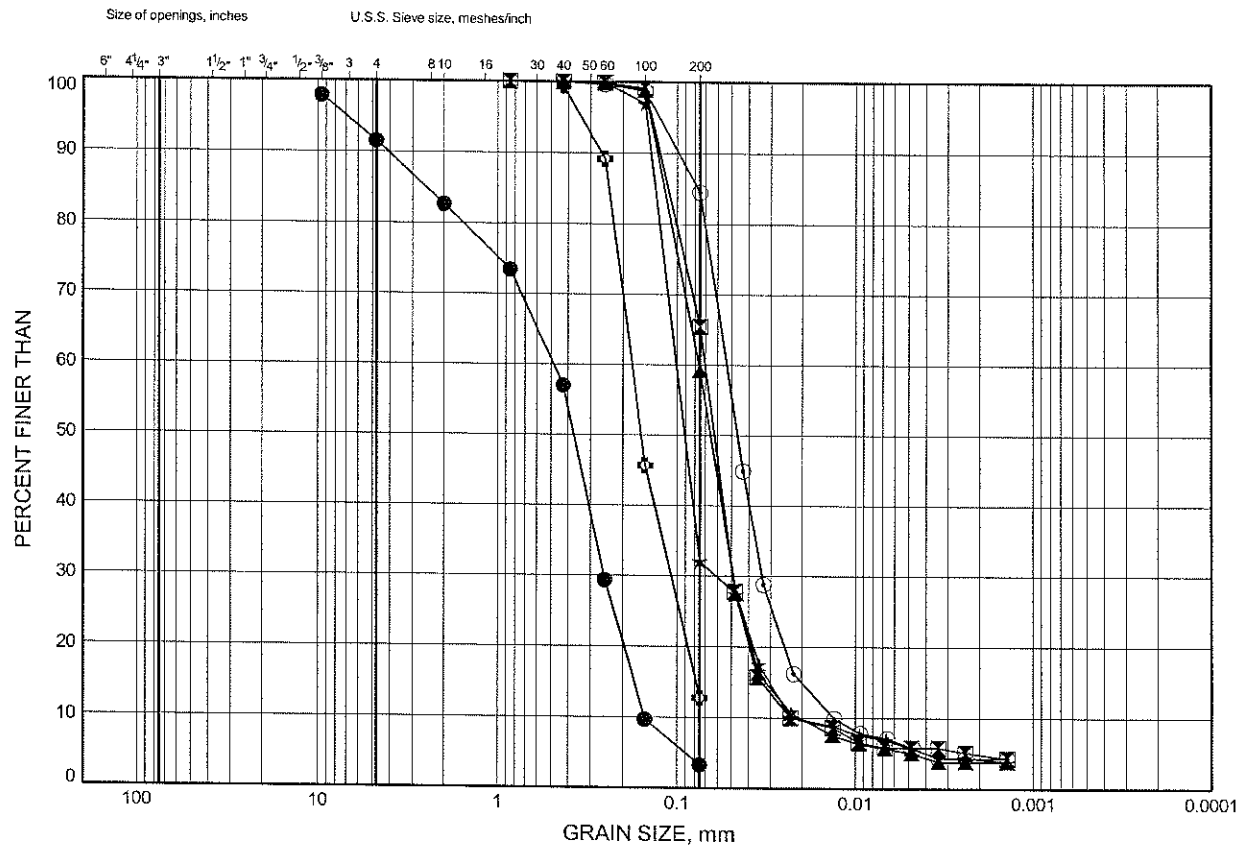
Prep'd JHL  
Chkd. MRA

# Beatty Creek Bridge Replacement

## GRAIN SIZE DISTRIBUTION

FIGURE B6

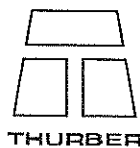
### Intermediate Sand to Silt



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-B01	10.97	186.13
⊠	06-B01	15.54	181.56
▲	06-B02	15.54	181.86
★	06-B03	15.24	183.76
⊙	06-B06	14.02	182.98
⊕	06-B06	27.74	169.26

Date December 2006

Project 5200-03-00



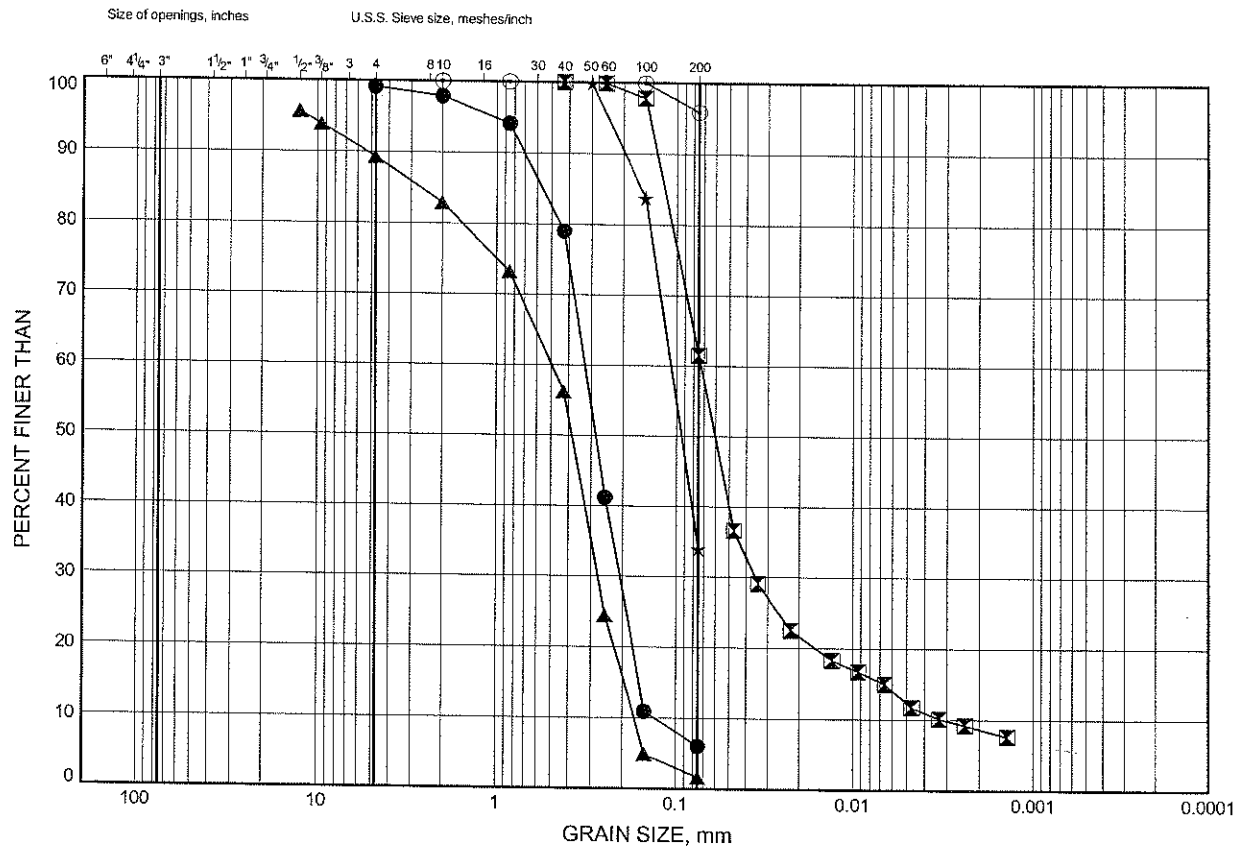
Prep'd JHL

Chkd. MRA

# Beatty Creek Bridge Replacement GRAIN SIZE DISTRIBUTION

FIGURE B7

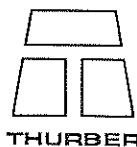
## Intermediate Sand to Silt



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-B08	10.97	187.03
⊠	06-B09	9.45	188.65
▲	06-B09	14.02	184.08
★	06-B10	12.19	187.31
⊙	06-B10	16.76	182.74

Date December 2006

Project 5200-03-00



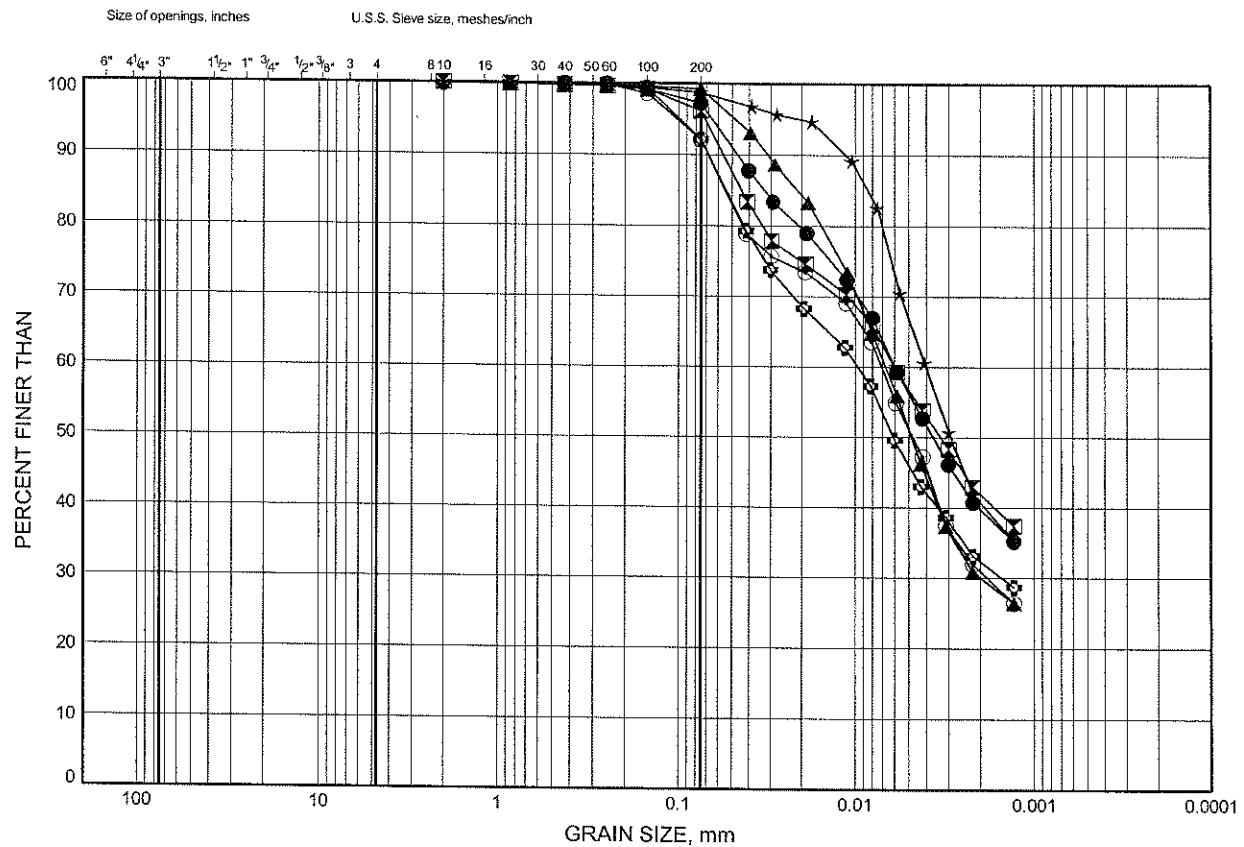
Prep'd JHL

Chkd. MRA

# Beatty Creek Bridge Replacement GRAIN SIZE DISTRIBUTION

FIGURE B8

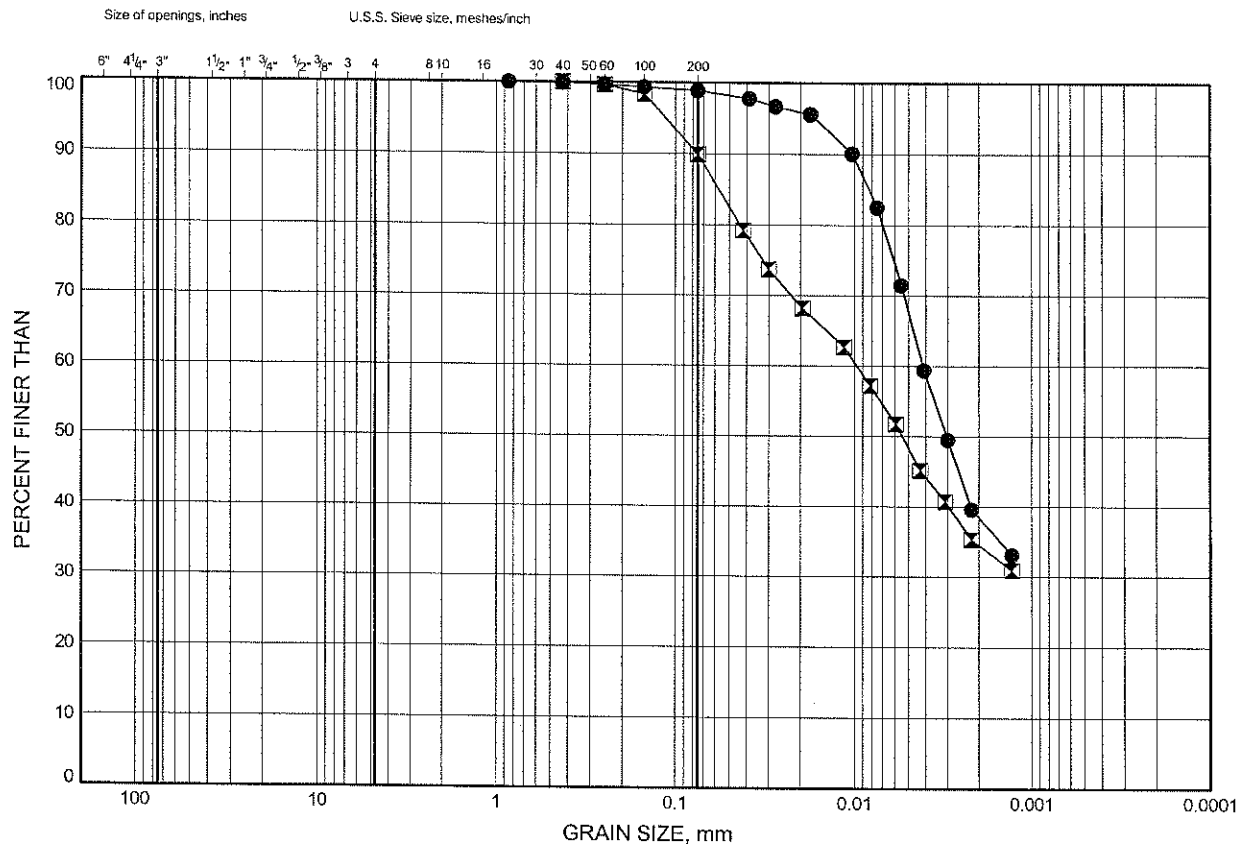
## Lower Silty Clay



# Beatty Creek Bridge Replacement GRAIN SIZE DISTRIBUTION

FIGURE B9

## Lower Silty Clay

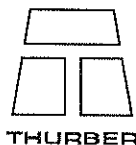


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-B06	30.78	166.22
⊠	06-B06	33.83	163.17

Date December 2006

Project 5200-03-00



THURBER

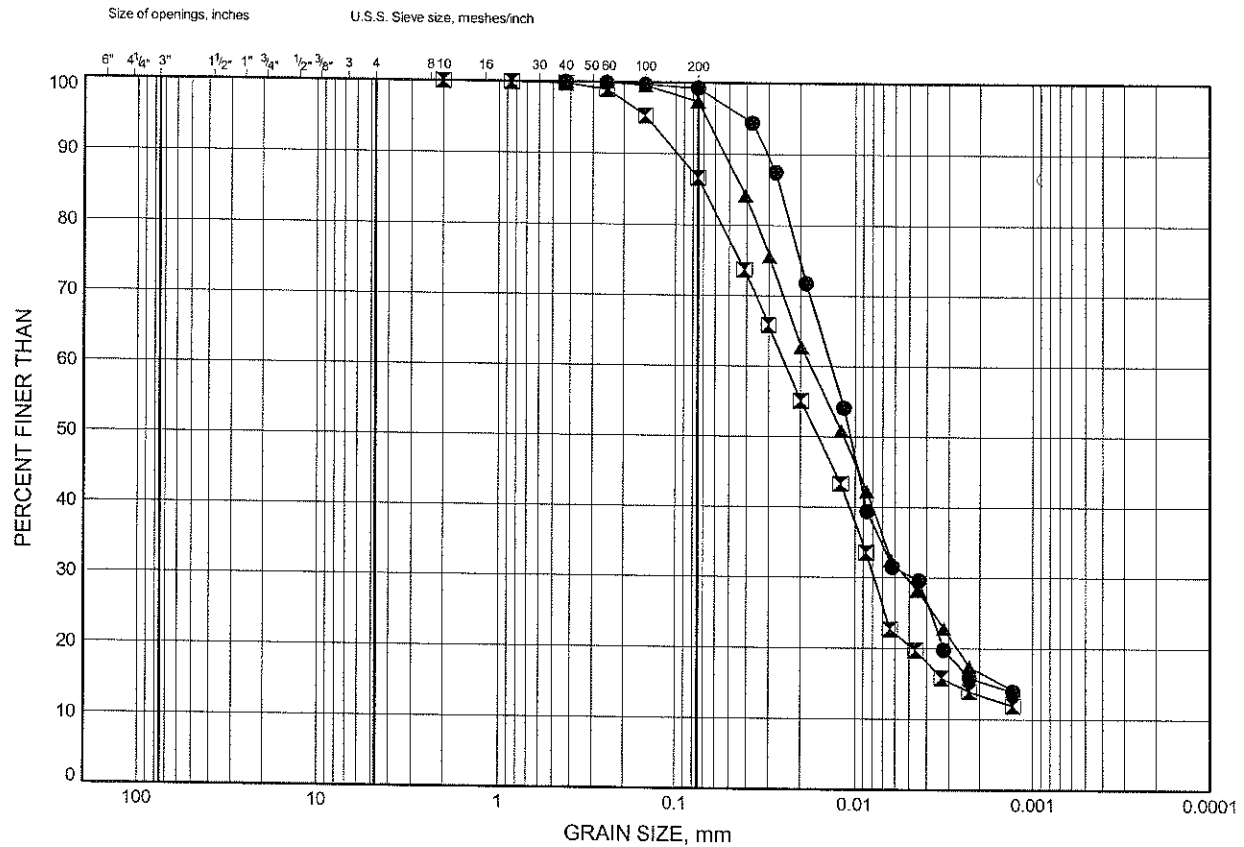
Prep'd JHL

Chkd. MRA

# Beatty Creek Bridge Replacement GRAIN SIZE DISTRIBUTION

FIGURE B10

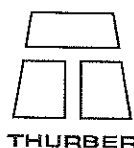
## Lower Clayey Silt



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-B02	18.59	178.81
⊠	06-B03	36.58	162.42
▲	06-B04	18.29	180.71

Date December 2006  
Project 5200-03-00

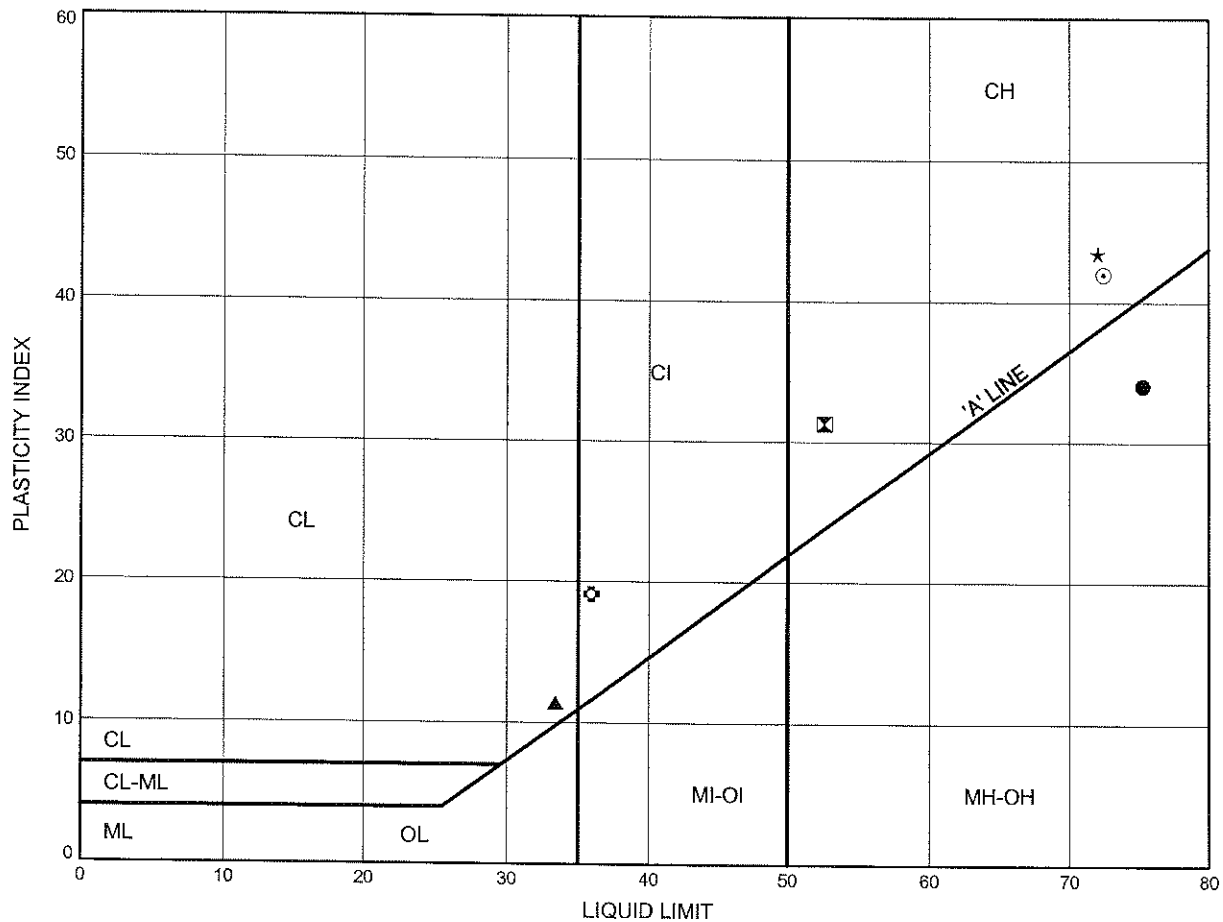


Prep'd JHL  
Chkd. MRA

# Beatty Creek Bridge Replacement ATTERBERG LIMITS TEST RESULTS

FIGURE B11

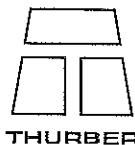
## Upper Silty Clay



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-B01	4.88	192.22
⊠	06-B02	12.50	184.90
▲	06-B03	4.88	194.12
★	06-B04	6.40	192.60
⊙	06-B04	7.62	191.38
⊛	06-B04	13.72	185.28

Date December 2006

Project 5200-03-00



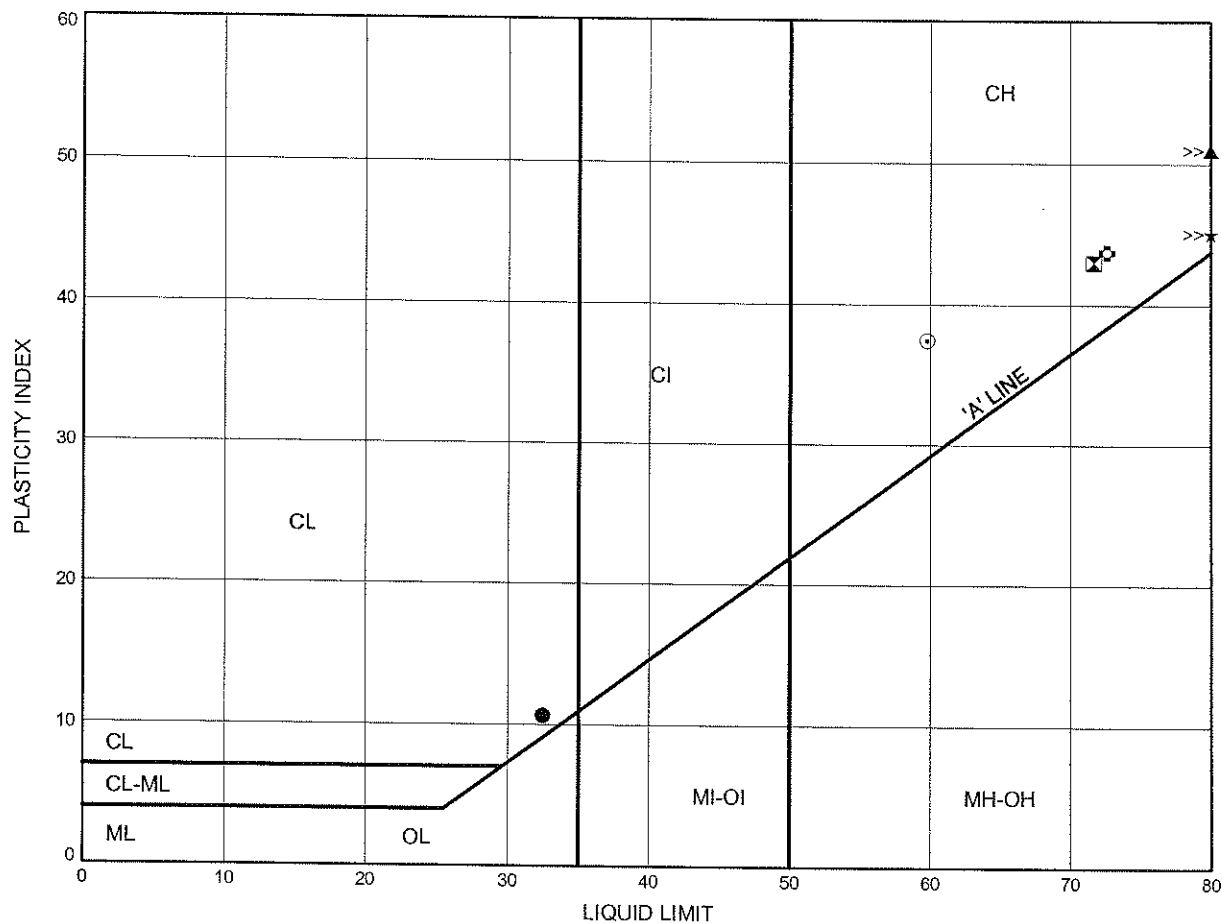
Prep'd JHL

Chkd. MRA

# Beatty Creek Bridge Replacement ATTERBERG LIMITS TEST RESULTS

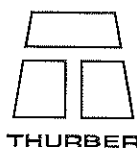
FIGURE B12

## Upper Silty Clay



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-B06	3.35	193.65
⊠	06-B06	4.88	192.12
▲	06-B07	7.92	189.98
★	06-B08	6.40	191.60
⊙	06-B08	15.54	182.46
⊛	06-B09	6.40	191.70

Date December 2006  
Project 5200-03-00



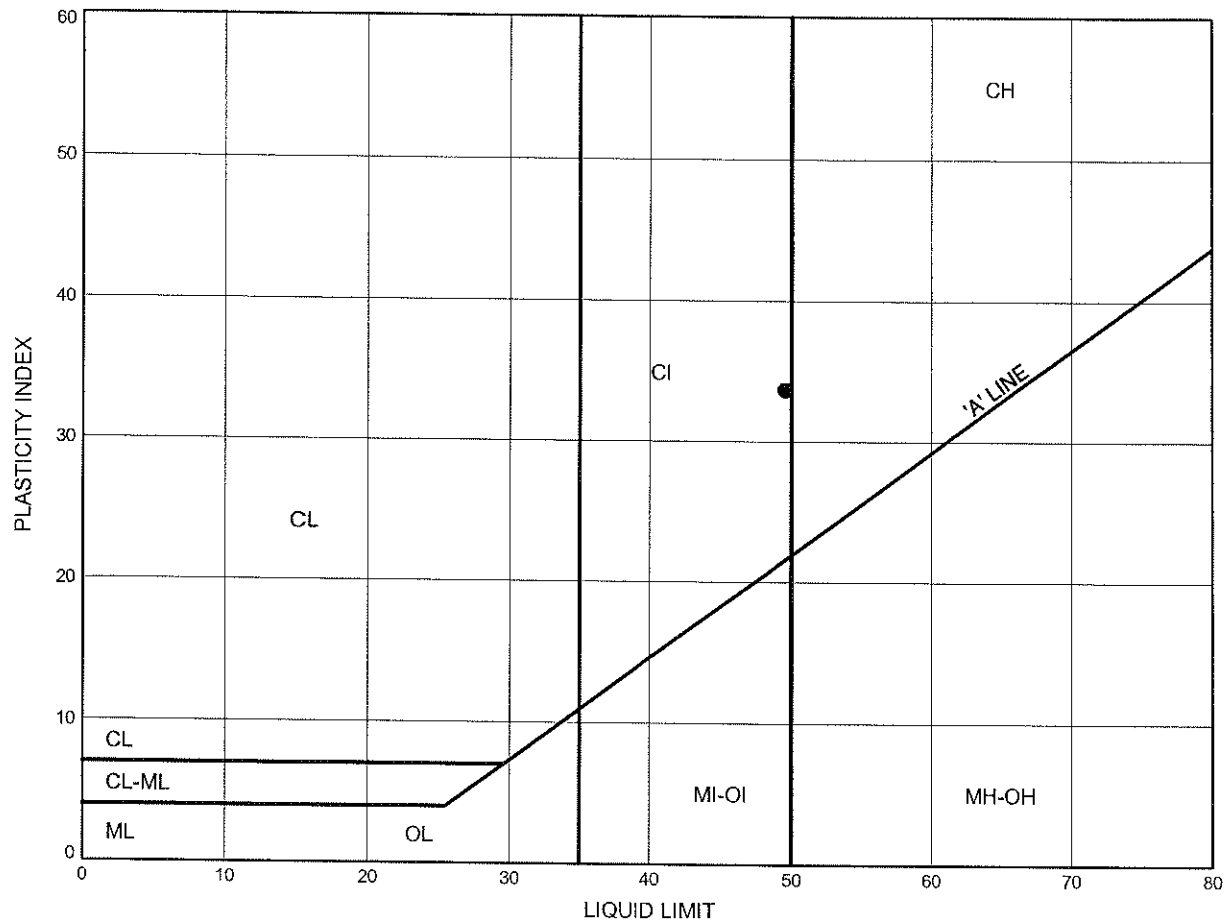
Prep'd JHL  
Chkd. MRA



# Beatty Creek Bridge Replacement ATTERBERG LIMITS TEST RESULTS

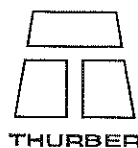
FIGURE B13

Upper Silty Clay



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-B10	7.62	191.88

Date December 2006  
Project 5200-03-00

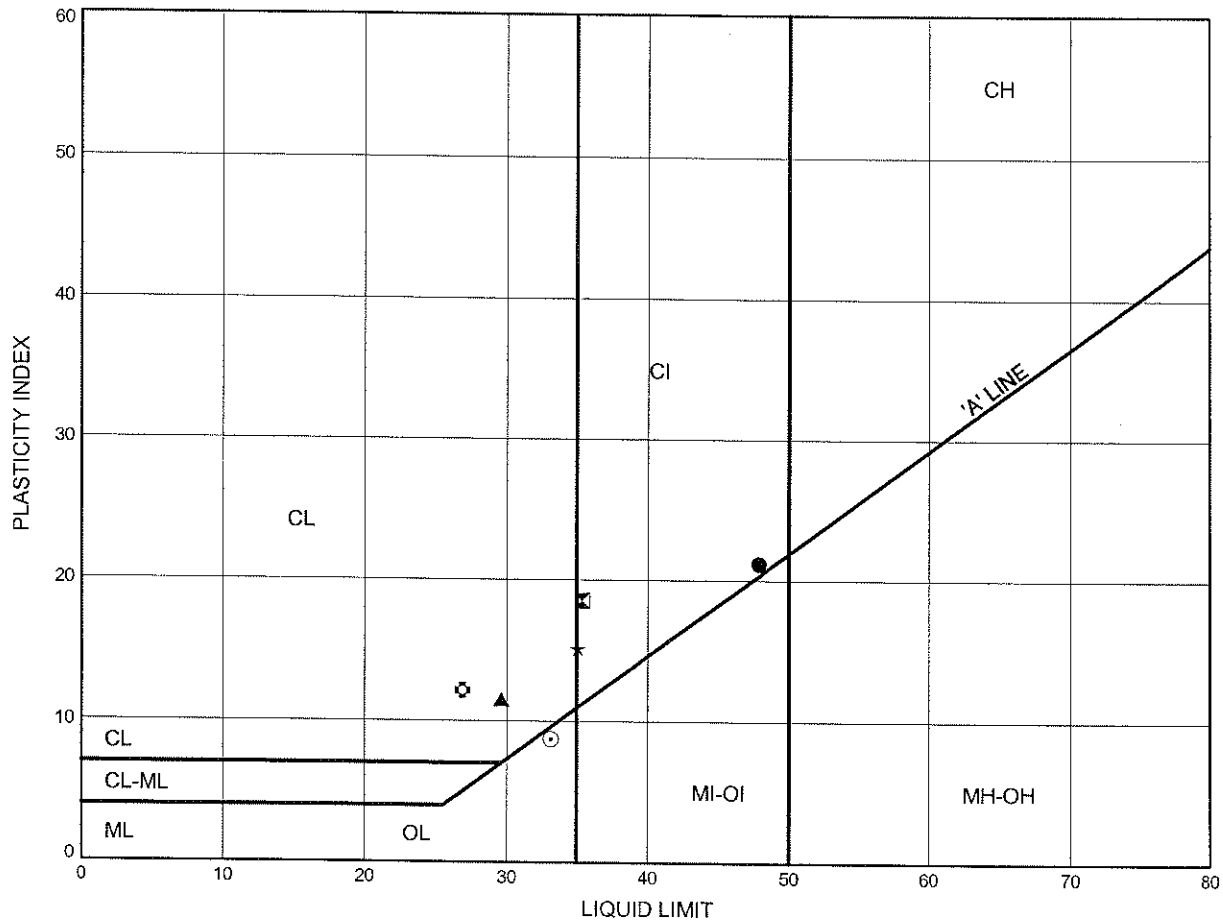


Prep'd JHL  
Chkd. MRA

Beatty Creek Bridge Replacement  
**ATTERBERG LIMITS TEST RESULTS**

FIGURE B14

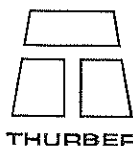
Lower Silty Clay



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-B01	30.78	166.32
⊠	06-B02	30.78	166.62
▲	06-B03	21.34	177.66
★	06-B03	30.48	168.52
⊙	06-B04	30.48	168.52
⊛	06-B04	33.53	165.47

Date December 2006

Project 5200-03-00



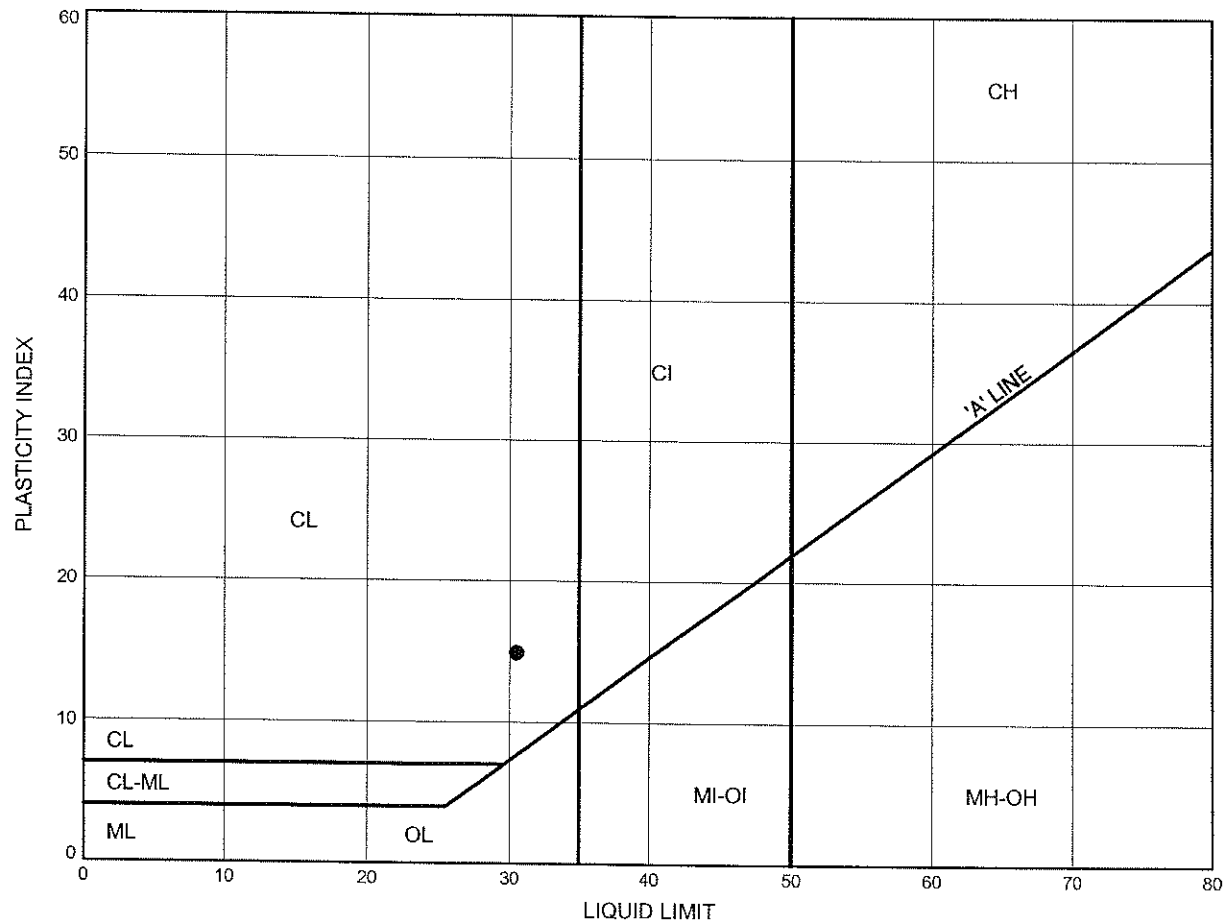
Prep'd JHL

Chkd. MRA

# Beatty Creek Bridge Replacement ATTERBERG LIMITS TEST RESULTS

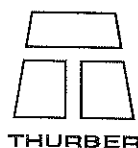
FIGURE B15

## Lower Silty Clay



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	06-B06	33.83	163.17

Date December 2006  
Project 5200-03-00



Prep'd JHL  
Chkd. MRA



## Consolidation Test Report

CLIENT: McCormick Rankin Corporation

FILE NUMBER: 18-45-1 / 19-1351-98

PROJECT: Mindemoya and Beatty Creek

REPORT DATE: 24-Oct-06

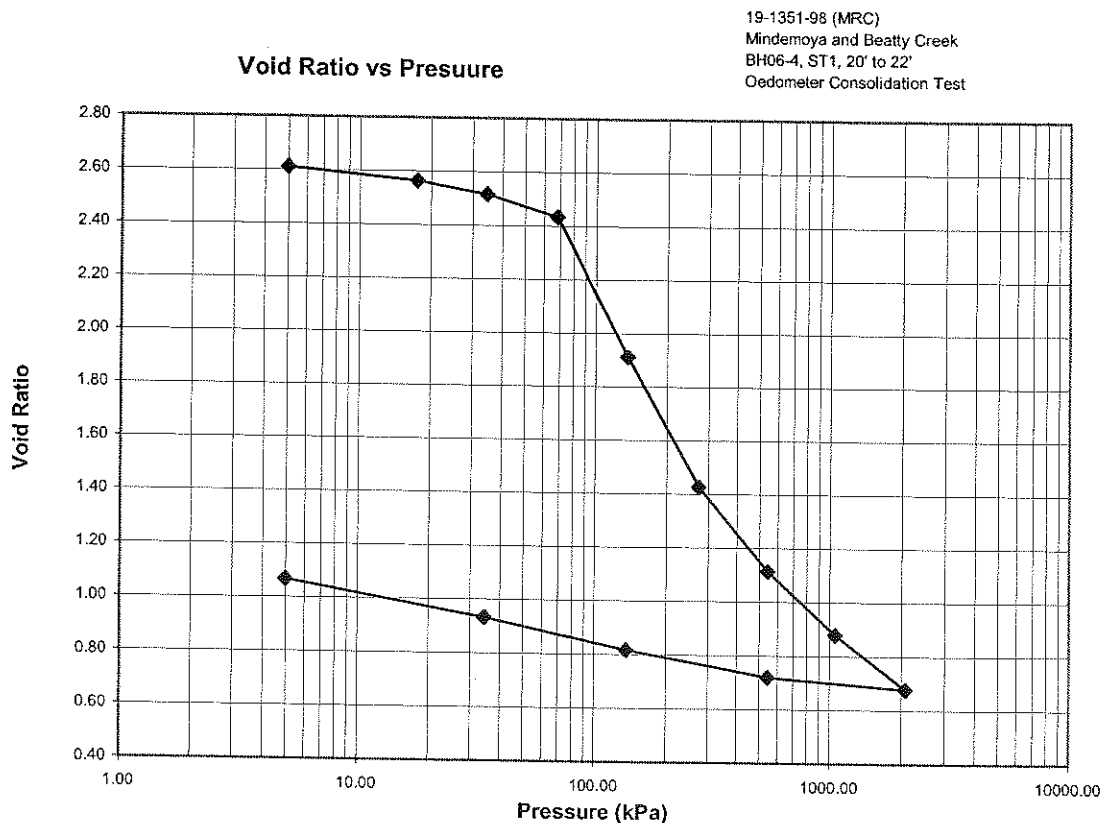
TEST DATES: September 13, 2006 - September 27, 2006

SAMPLE: BH06-4, ST1, 20'-22'  
Silty Clay, dark grey, plastic, (CH), Lab Vane: 20 - 23 kPa (Soft)  
Grain Size: 67 % Clay & 33 % Silt

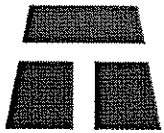
PROCEDURE: Tested in accordance with Standard Test Method for One-Dimensional Consolidation Properties of Soils, ASTM D 2435-04, method B

	<u>Start of Test</u>	<u>End of Test</u>
Wet Dens. (kg/m <sup>3</sup> )	1488.5	2095.2
Dry Dens. (kg/m <sup>3</sup> )	770.7	1349.1
Moisture Cont. (%)	93.1	55.3
Void Ratio	2.612	1.064
Saturation (%)	99.3	

Note: A Specific Gravity of 2.78 was measured for the void ratio and saturation calculations



TEST DONE BY: EA  
REVIEWED BY: JPL



## Consolidation Test Report

Mindemoya and Beatty Creek  
18-45-1 / 19-1351-98

BH06-4, ST1, 20'-22'

**TRIMMING:** The Specimen was manually trimmed to the size of consolidation ring, then mounted in a fixed ring consolidometer

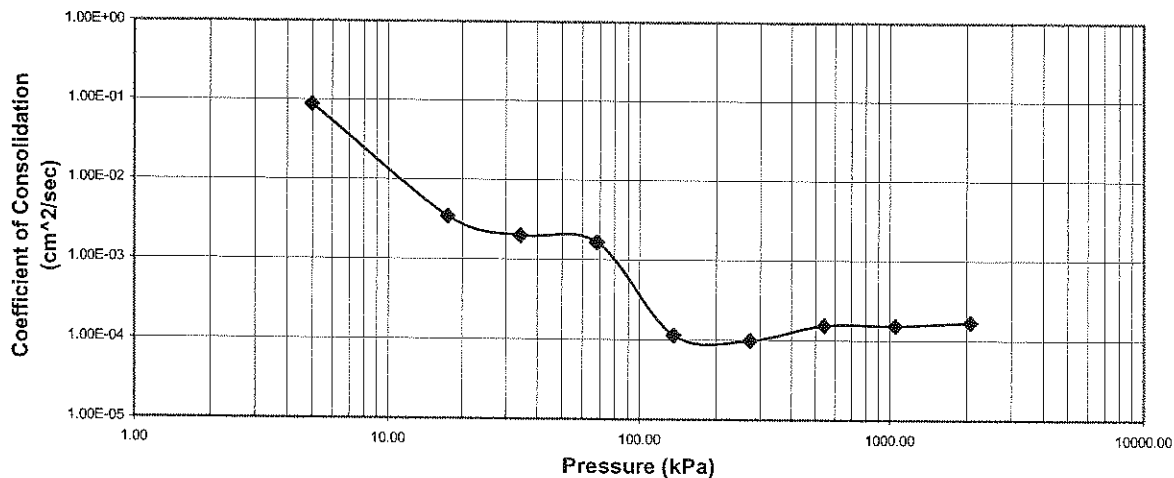
**LOADING:** A seating load of 5 kPa was applied and the consolidometer was flooded with distilled water. Sample was monitored to ensure no swelling effect occurred before the start of the test. Subsequent loads were applied and the duration of each load step was 24 hrs.

**CALCULATIONS:** Coefficients of Consolidation were calculated by the square root time method.

Pressure (kPa)	Corr. Hgt (mm)	Avg. Hgt. (mm)	T90 (min)	Cv (cm <sup>2</sup> /sec)	Void Ratio	mv (m <sup>2</sup> /kN)	k (cm/s)
0.00	19.850	19.850			2.612		
5.00	19.844	19.847	0.16	8.70E-02	2.611	1.06E-03	9.05E-06
17.50	19.581	19.712	4.00	3.43E-03	2.563	7.75E-04	2.61E-07
34.46	19.320	19.450	6.76	1.98E-03	2.516	6.68E-04	1.29E-07
68.42	18.869	19.094	7.84	1.64E-03	2.434	2.11E-03	3.40E-07
136.78	16.003	17.436	94.09	1.14E-04	1.912	9.87E-04	1.10E-08
273.12	13.331	14.667	77.40	9.82E-05	1.426	3.18E-04	3.06E-09
545.39	11.612	12.472	36.00	1.53E-04	1.114	1.27E-04	1.90E-09
1057.63	10.320	10.966	28.09	1.51E-04	0.878	5.46E-05	8.09E-10
2080.12	9.212	9.766	20.05	1.68E-04	0.677	7.58E-06	1.25E-10
545.39	9.443	9.328			0.719		
136.78	9.982	9.713			0.817		
34.46	10.618	10.300			0.933		
5.00	11.352	10.985			1.066		

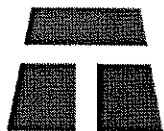
Coefficient of Consolidation vs Pressure

19-1351-98 (MRC)  
Mindemoya and Beatty Creek  
BH06-4, ST1, 20' to 22'  
Oedometer Consolidation Test



Notes: Cv and k calculated using  $t_{90}$  values

TEST DONE BY: EA  
REVIEWED BY: JPL



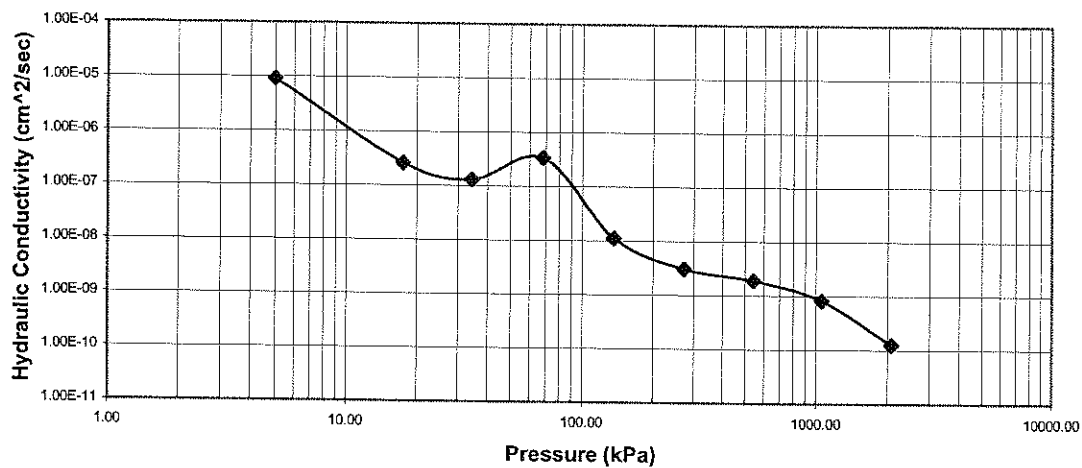
## Consolidation Test Report

Mindemoya and Beatty Creek  
18-45-1 / 19-1351-98

BH06-4, ST1, 20'-22'

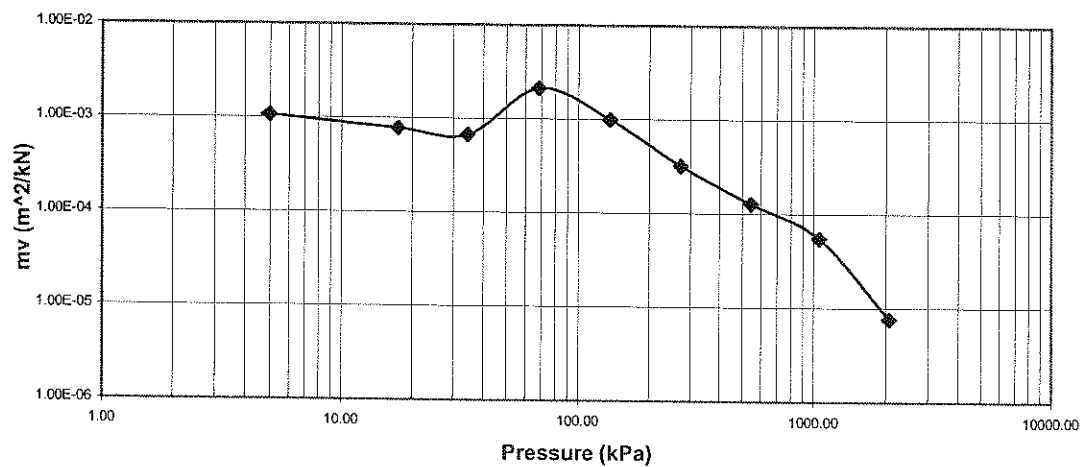
**Hydraulic Conductivity vs Pressure**

19-1351-98 (MRC)  
Mindemoya and Beatty Creek  
BH06-4, ST1, 20' to 22'  
Oedometer Consolidation Test



**mv vs Pressure**

19-1351-98 (MRC)  
Mindemoya and Beatty Creek  
BH06-4, ST1, 20' to 22'  
Oedometer Consolidation Test



TEST DONE BY: EA  
REVIEWED BY: JPL



## Consolidation Test Report

CLIENT: McCormick Rankin Corporation

FILE NUMBER: 18-45-1 /19-1351-98

PROJECT: Mindemoya and Beatty Creek

REPORT DATE: 24-Oct-06

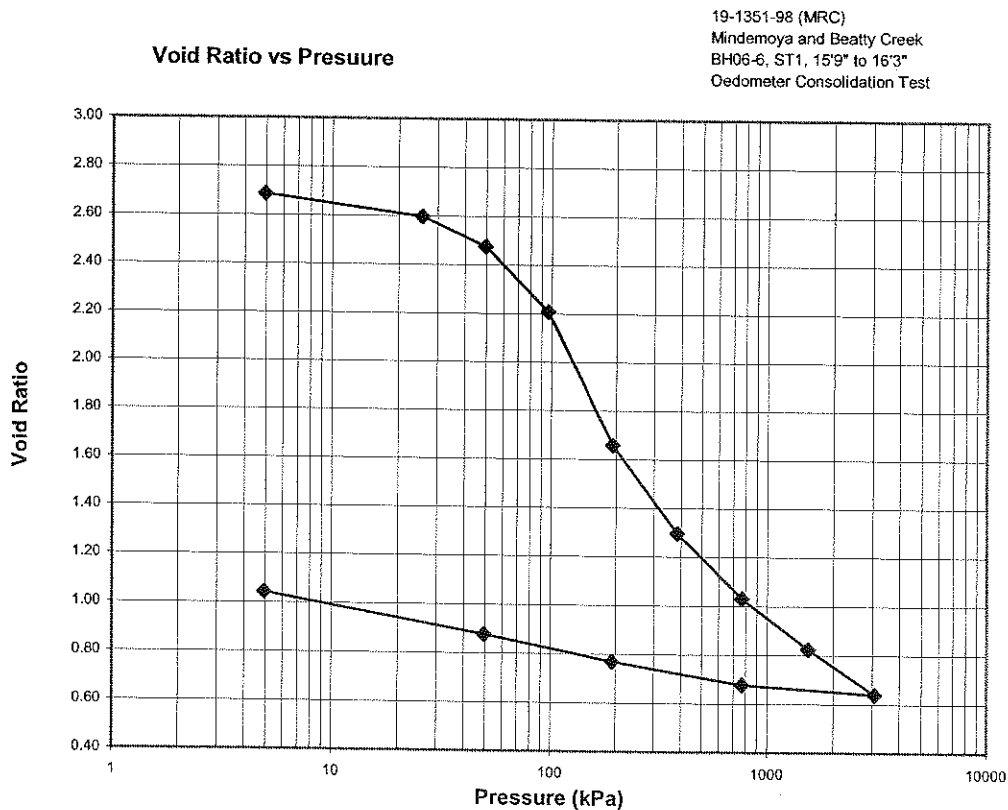
TEST DATES: September 13, 2006 - September 27, 2006

SAMPLE: BH06-6-ST1, 15'9" -16'3"  
Silty Clay, dark grey, plastic, (CH)  
Lab Vane: 16-20 kPa (Soft), Grain Size: 26 % Clay & 74 % Silt

PROCEDURE: Tested in accordance with Standard Test Method for One-Dimensional Consolidation Properties of Soils, ASTM D 2435-04, method B

	<u>Start of Test</u>	<u>End of Test</u>
Wet Dens. (kg/m <sup>3</sup> )	1478.8	2005.6
Dry Dens. (kg/m <sup>3</sup> )	752.7	1358.0
Moisture Cont. (%)	96.5	43.8
Void Ratio	2.680	1.040
Saturation (%)	99.7	

Note: A Specific Gravity of 2.77 was measured for the void ratio and saturation calculations



TEST DONE BY: EA  
REVIEWED BY: JPL



## Consolidation Test Report

Mindemoya and Beatty Creek  
18-45-1 /19-1351-98

BH06-6-ST1, 15'9" -16'3"

**TRIMMING:** The Specimen was manually trimmed to the size of consolidation ring, then mounted in a fixed ring consolidometer

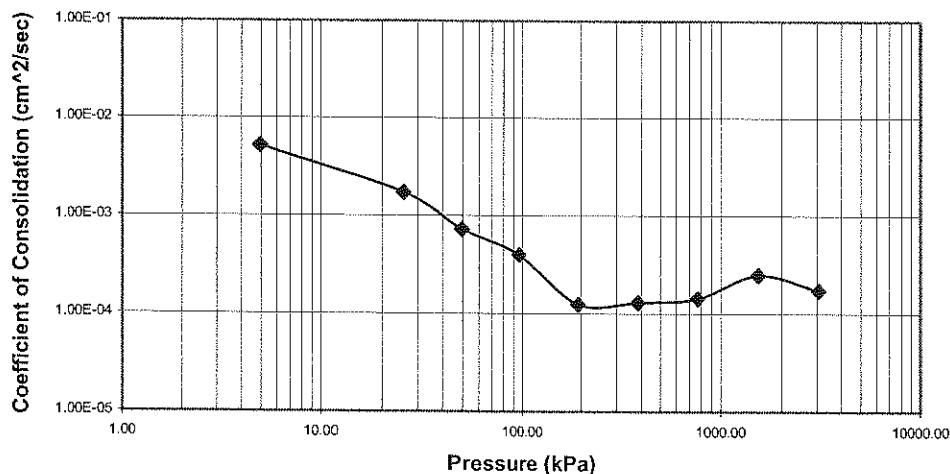
**LOADING:** A seating load of 4.97 kPa was applied and the consolidometer was flooded with distilled water. Sample was monitored to ensure no swelling effect occurred before the start of the test. Subsequent loads were applied and the duration of each load step was 24 hours.

**CALCULATIONS:** Coefficients of Consolidation were calculated by the square root time method.

Pressure (kPa)	Corr. Hgt (mm)	Avg. Hgt. (mm)	T90 (min)	Cv (cm <sup>2</sup> /sec)	Void Ratio	mv (m <sup>2</sup> /kN)	k (cm/s)
0.00	25.350	25.350			2.680		
4.97	25.395	25.372	4.41	5.16E-03	2.687	1.18E-03	5.97E-07
25.67	24.783	25.089	12.96	1.72E-03	2.597	1.37E-03	2.30E-07
49.86	23.957	24.370	29.16	7.20E-04	2.475	1.55E-03	1.10E-07
96.65	22.139	23.048	47.61	3.94E-04	2.208	1.55E-03	5.98E-08
193.24	18.396	20.267	116.64	1.24E-04	1.657	5.08E-04	6.20E-09
385.77	15.948	17.172	81.00	1.29E-04	1.297	1.88E-04	2.37E-09
770.72	14.140	15.044	56.25	1.42E-04	1.031	7.30E-05	1.02E-09
1540.91	12.733	13.436	26.01	2.45E-04	0.824	3.25E-05	7.81E-10
3081.80	11.482	12.107	30.25	1.71E-04	0.639	4.42E-06	7.42E-11
770.72	11.737	11.609			0.677		
193.24	12.361	12.049			0.769		
49.86	13.096	12.728			0.877		
4.97	14.213	13.655			1.041		

Coefficient of Consolidation vs Pressure

19-1351-98 (MRC)  
Mindemoya and Beatty Creek  
BH06-6, ST1, 15'9" to 16'3"  
Oedometer Consolidation Test



Notes: Cv and k calculated using  $t_{90}$  values

TEST DONE BY: EA  
REVIEWED BY: JPL





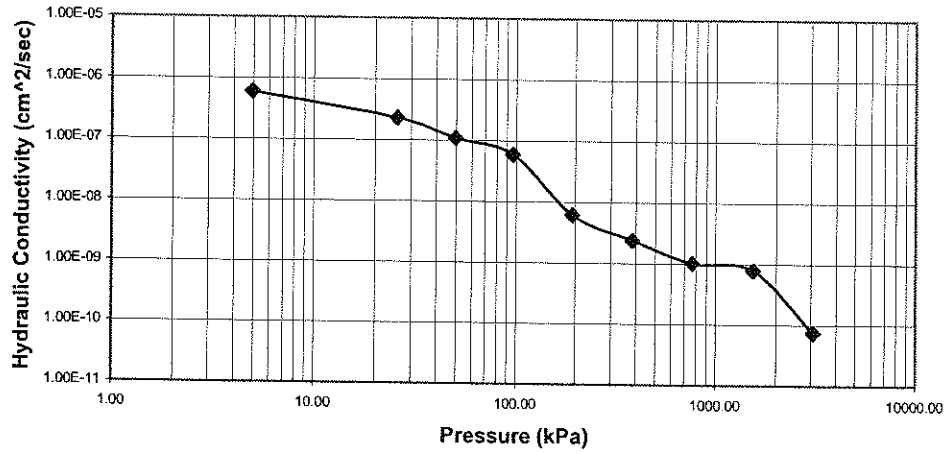
## Consolidation Test Report

Mindemoya and Beatty Creek  
18-45-1 /19-1351-98

BH06-6-ST1, 15'9" -16'3"

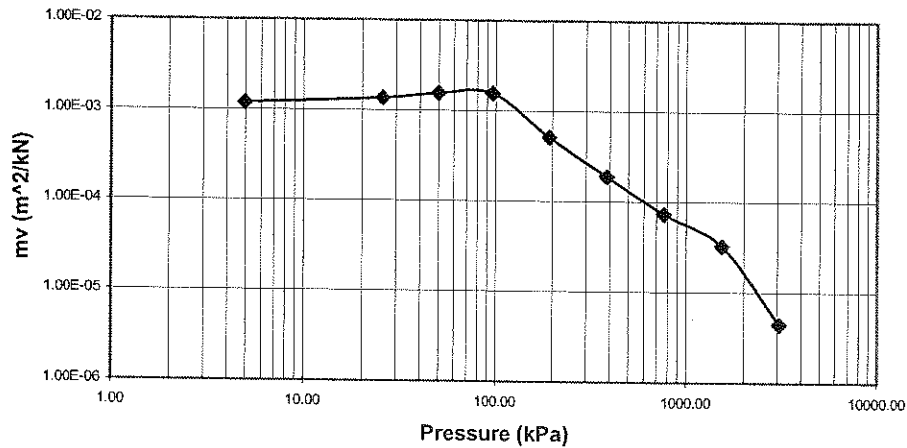
Hydraulic Conductivity vs Pressure

19-1351-98 (MRC)  
Mindemoya and Beatty Creek  
BH06-6, ST1, 15'9" to 16'3"  
Oedometer Consolidation Test



mv vs Pressure

19-1351-98 (MRC)  
Mindemoya and Beatty Creek  
BH06-6, ST1, 15'9" to 16'3"  
Oedometer Consolidation Test



TEST DONE BY: EA  
REVIEWED BY: JPL



**THURBER ENGINEERING LTD.**  
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

## UNCONFINED COMPRESSION TEST REPORT

CLIENT: McCormick Rankin Corporation

FILE NUMBER: 19-1351-98

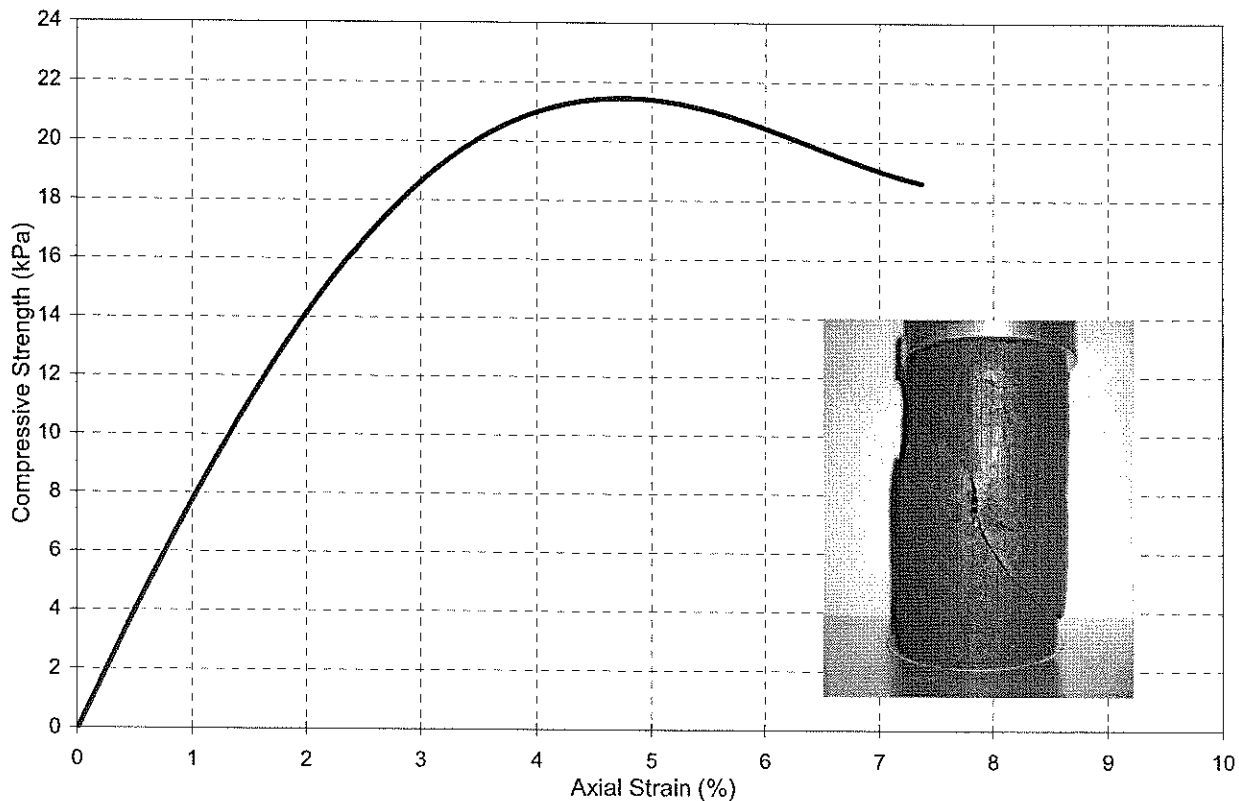
PROJECT: Mindemoya and Beatty Creek

REPORT DATE: 31-Oct-06

BOREHOLE No.: BH06-4 TEST DATE: 31-Oct-06  
SAMPLE: ST-1, 6.1 - 6.4 m  
DESCRIPTION: Silty CLAY (CH), dark grey, soft, plastic, undisturbed, Lab Vane: 20 kPa

Avg. Height (cm):	13.99	Wet Density (kg/cu.m.):	1,535
Avg. Diameter (cm):	6.94	Dry Density (kg/cu.m.):	863
Height to Dia. Ratio	2:1	Moisture Content* (%):	77.8
Weight (g):	812.2	Void Ratio:	2.221
Measured Sp. Gr.:	2.78	Saturation (%):	97

AVG. RATE OF STRAIN TO FAILURE: 1%  
UNCONFINED COMPRESSIVE STRENGTH: 21.5 kPa @ 4.85 % strain  
UNDRAINED SHEAR STRENGTH: 10.8 kPa



Note: \* The water content was obtained after shear from the entire specimen  
\*\* Type of Failure: Diagonal shear approximately 58° from horizontal

TEST DONE BY: WM  
REVIEWED BY: JPL

BH06-4-ST1(UCS).xls



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## UNCONFINED COMPRESSION TEST REPORT

CLIENT: McCormick Rankin Corporation

FILE NUMBER: 19-1351-98

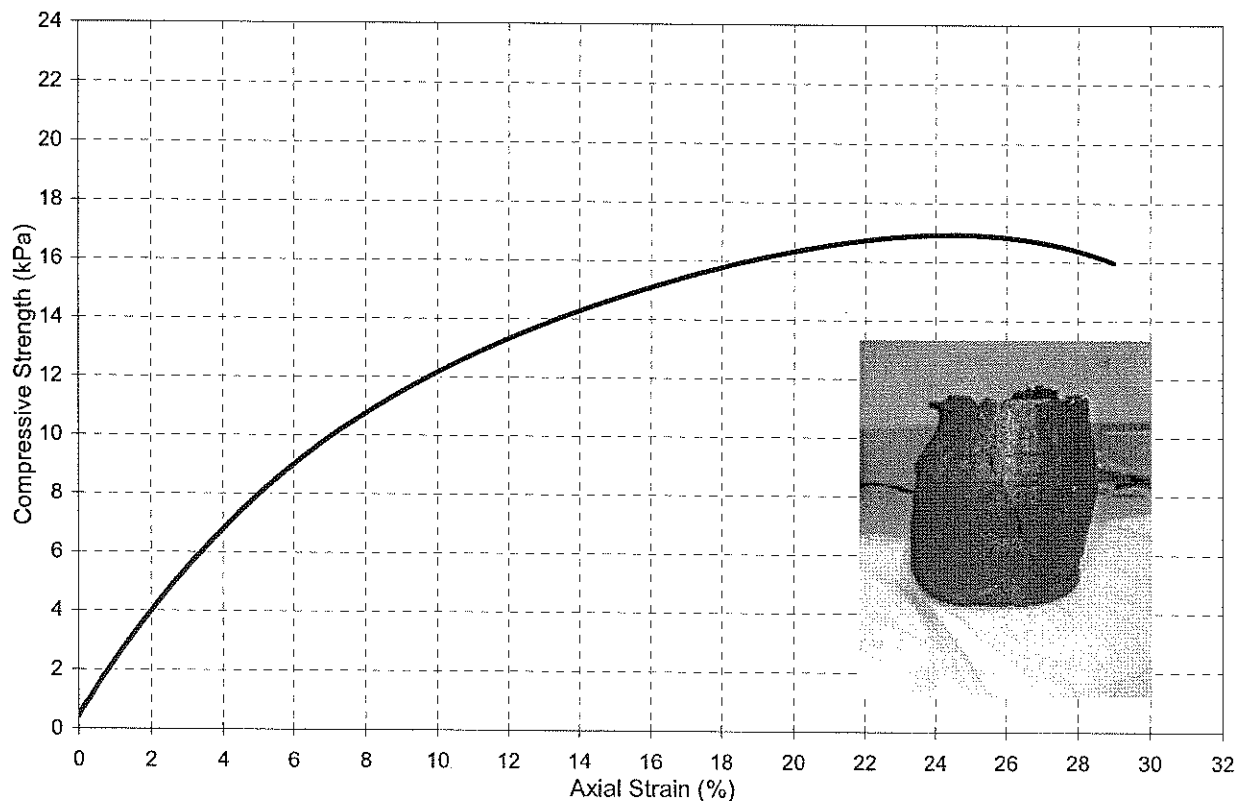
PROJECT: Mindemoya and Beatty Creek

REPORT DATE: 31-Oct-06

BOREHOLE No.: BH06-6  
SAMPLE: ST-1, 4.6 - 4.8 m  
DESCRIPTION: Silty CLAY (CH), dark grey, very soft to soft, plastic, undisturbed

Avg. Height (cm):	13.30	Wet Density (kg/cu.m.):	1,554
Avg. Diameter (cm):	6.86	Dry Density (kg/cu.m.):	875
Height to Dia. Ratio	2:1	Moisture Content* (%):	77.5
Weight (g):	763.8	Void Ratio:	2.164
Measured Sp. Gr.:	2.77	Saturation (%):	99

AVG. RATE OF STRAIN TO FAILURE: 1%  
UNCONFINED COMPRESSIVE STRENGTH: 17.0 kPa @ 24.2 % strain  
UNDRAINED SHEAR STRENGTH: 8.5 kPa



Note \* The water content was obtained after shear from the entire specimen  
\*\* Type of Failure: Bulged and diagonal shear approximately 60° from horizontal

TEST DONE BY: WM  
REVIEWED BY: JPL

BH06-6-ST1(UCS).xls

## **Appendix C**

### **Photographs, Figures and Tables**

## Beatty Creek Bridge Replacement



Photograph 1: North side of existing bridge looking east (May 2006).



Photograph 2: North side of existing bridge looking northeast (March 2006).



## Beatty Creek Bridge Replacement



Photograph 3: North side of existing bridge looking west (May 2006).



Photograph 4: Looking west toward Beatty Creek bridge from Hwy 654 (September 2007).

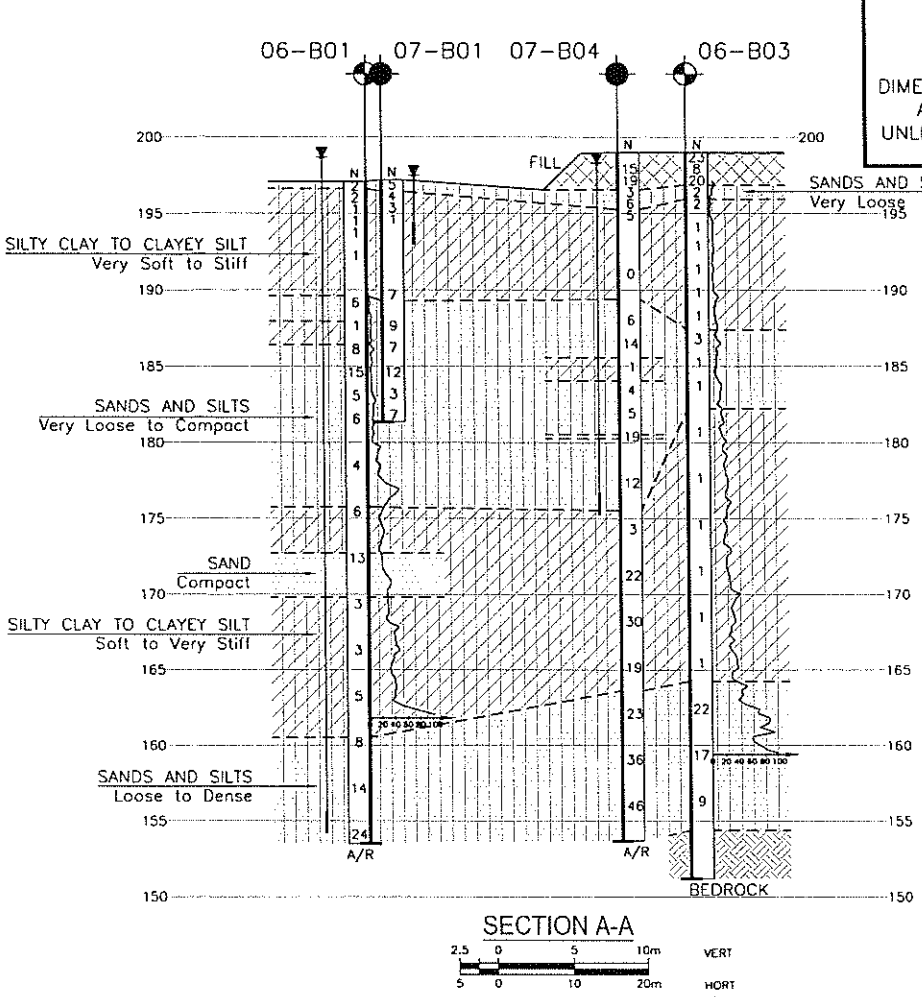
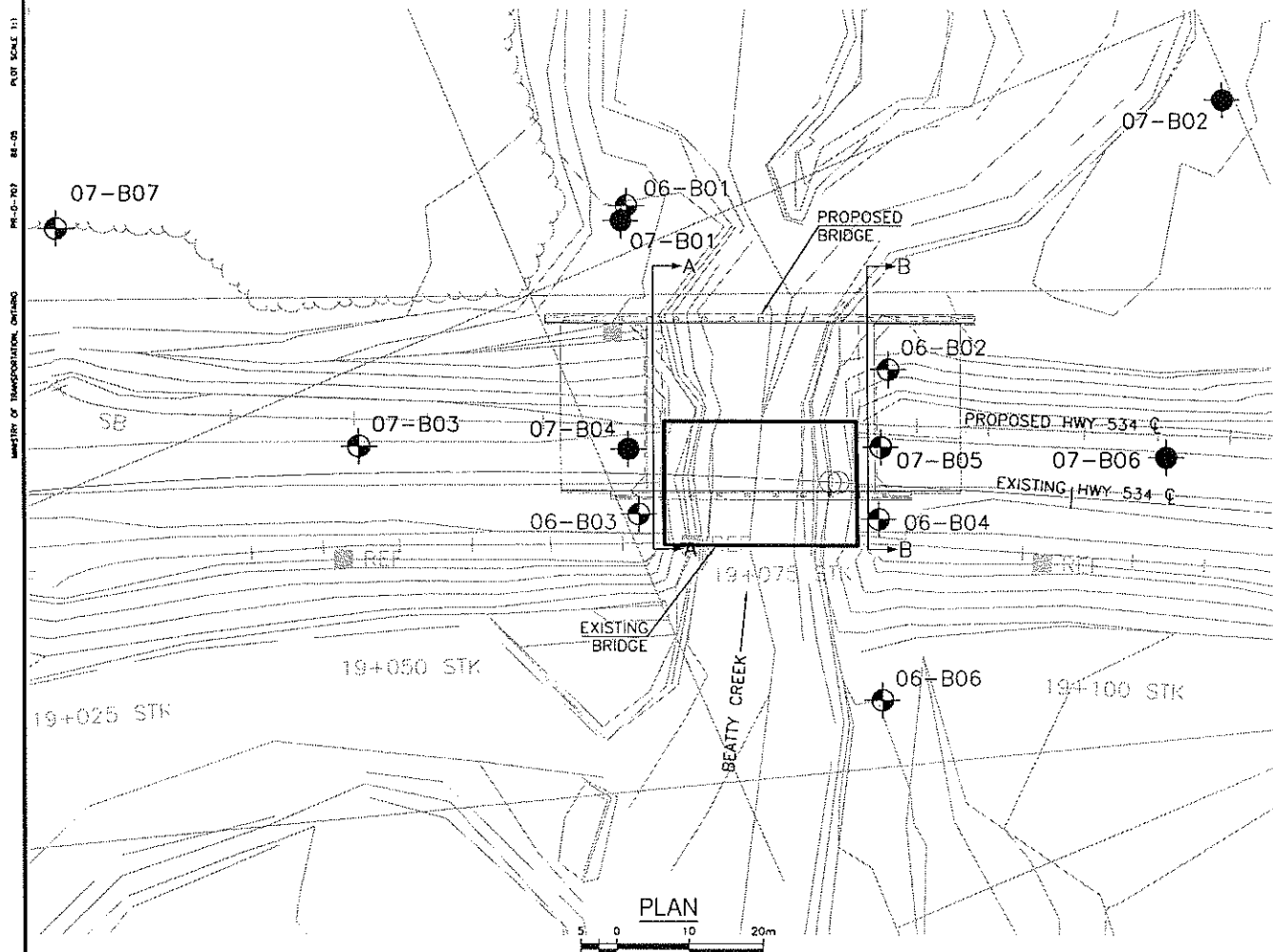
TABLE C1 – PIEZOMETER DETAILS

Piezometer Location	Tip Position (m)		Completion Details
	Depth	Elevation	
BH06-B01	42.7	154.4	Sand filter and screen from 42.7 to 40.8 m, bentonite seal to 39.6, grout to 9.1 m, bentonite to surface.
BH06-B02	40.5	156.9	Sand filter and screen from 40.5 to 38.7 m, bentonite seal to surface.
BH06-B06	42.5	154.5	Sand filter and screen from 42.5 to 40.7 m, bentonite seal to surface.
BH06-B08	16.8	181.2	Sand filter and screen from 16.8 to 14.9 m, bentonite seal to 14.0 m, grout to 6.1 m, bentonite to surface.
BH06-B10	20.1	179.4	Sand filter and screen from 20.1 to 17.7 m, bentonite seal to surface.
BH07-B1	4.6	192.6	Grout from 15.2 to 5.5 m, bentonite seal to 4.6 m, sand filter and screen from 4.6 to 2.7 m, bentonite to 1.8 m, grout to 0.9 m, bentonite to surface.
BH07-B2	10.7	186.3	Grout from 15.2 to 11.3 m, bentonite seal to 10.7 m, sand filter and screen from 10.7 to 8.8 m, bentonite to 8.2 m, grout to 4.6 m, concrete to surface.
BH07-B4	23.8	175.2	Grout from 45.3 to 25.0 m, bentonite seal to 24.4 m, sand filter and screen from 24.4 to 21.9 m, bentonite to 21.3 m, grout to 3.0 m, sand to 0.9 m, bentonite to 0.45 m, sand to 0.15 m, asphalt to surface.
BH07-B5	9.0	190.0	Grout from 45.5 to 9.0 m, sand filter and screen from 45.5 to 6.2 m, bentonite to 1.1 m, sand to surface.
BH07-B7	7.6	190.6	Grout from 38.7 to 9.1 m, bentonite seal to 7.6 m, sand filter and screen from 7.6 to 5.8 m, bentonite to 4.9 m, grout to 1.5 m, bentonite to surface.
BH07-B8	9.1	189.1	Grout from 41.1 to 11.0 m, bentonite seal to 9.1 m, sand filter and screen from 9.1 to 7.3 m, bentonite to 6.4 m, grout to 1.2 m, bentonite to surface.

## **Appendix D**

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





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

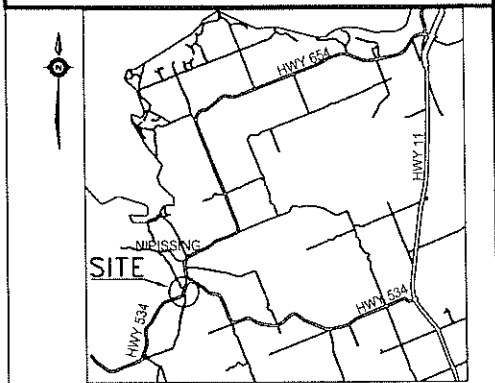
CONT No  
GWP No.5200-03-00

HIGHWAY 534  
BEATTY CREEK BRIDGE  
REPLACEMENT  
BOREHOLE LOCATIONS AND SOIL STRATA

McCORMICK RANKIN  
CORPORATION

SHEET

THURBER ENGINEERING LTD.  
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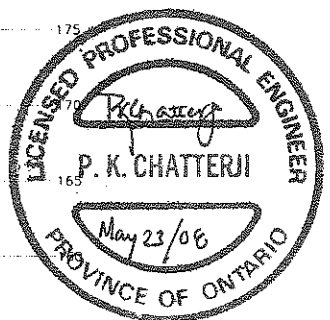
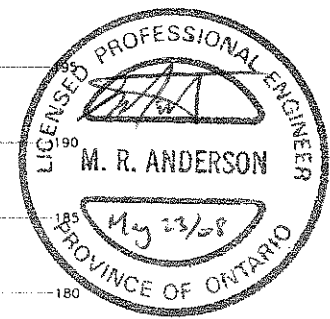
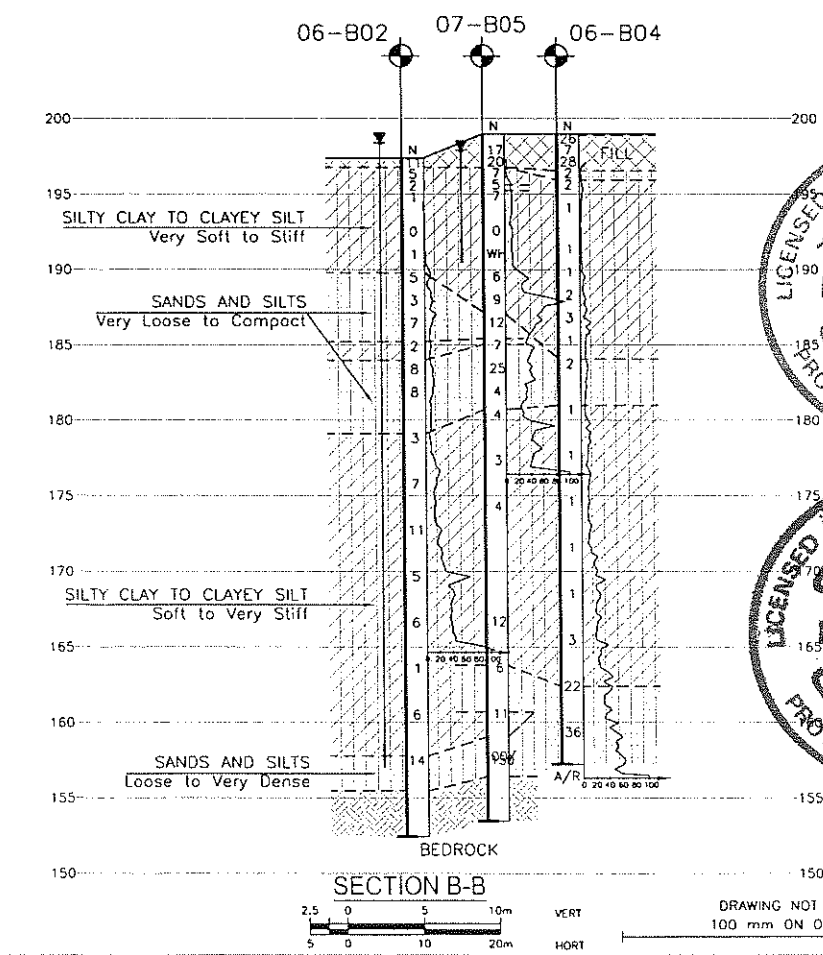
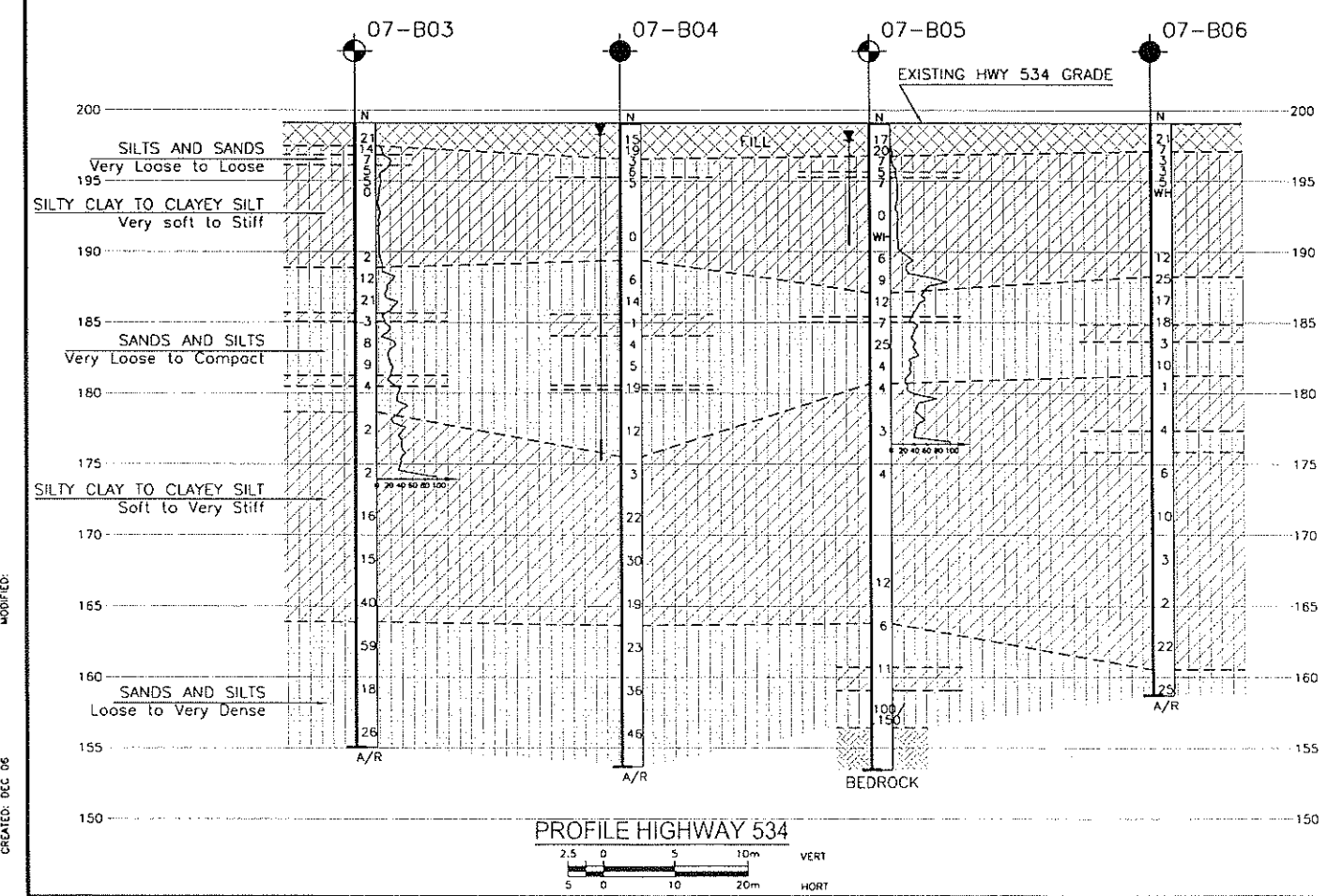


**KEYPLAN  
LEGEND**

- Borehole
- Borehole and Cone
- 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
06-B01	197.1	5 105 308.55	303 697.02
06-B02	197.4	5 105 320.69	303 714.37
06-B03	199.0	5 105 301.00	303 716.81
06-B04	199.0	5 105 316.00	303 723.57
06-B06	197.0	5 105 311.29	303 735.18
06-B07	197.9	5 105 093.68	303 642.56
06-B08	198.0	5 105 196.21	303 667.23
06-B09	198.1	5 105 202.30	303 701.05
06-B10	199.5	5 105 376.19	303 758.13
07-B01	197.2	5 105 307.80	303 697.80
07-B02	197.0	5 105 349.20	303 706.40
07-B03	199.1	5 105 285.10	303 705.00
07-B04	199.0	5 105 302.10	303 712.40
07-B05	199.0	5 105 318.10	303 719.10
07-B06	199.1	5 105 335.90	303 727.40
07-B07	198.2	5 105 271.90	303 683.20
07-B08	198.2	5 105 376.10	303 735.30
07-B09	200.3	5 105 413.50	303 761.10

- 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. 31L-120**

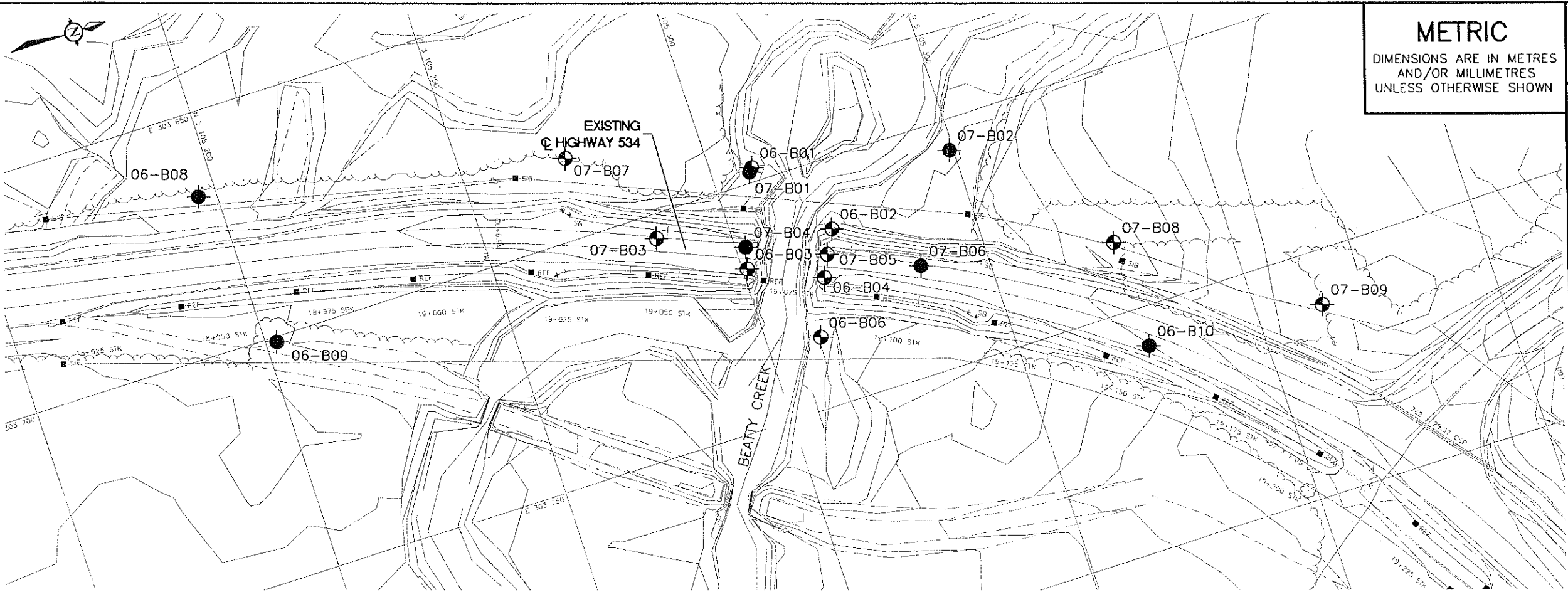


REVISIONS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
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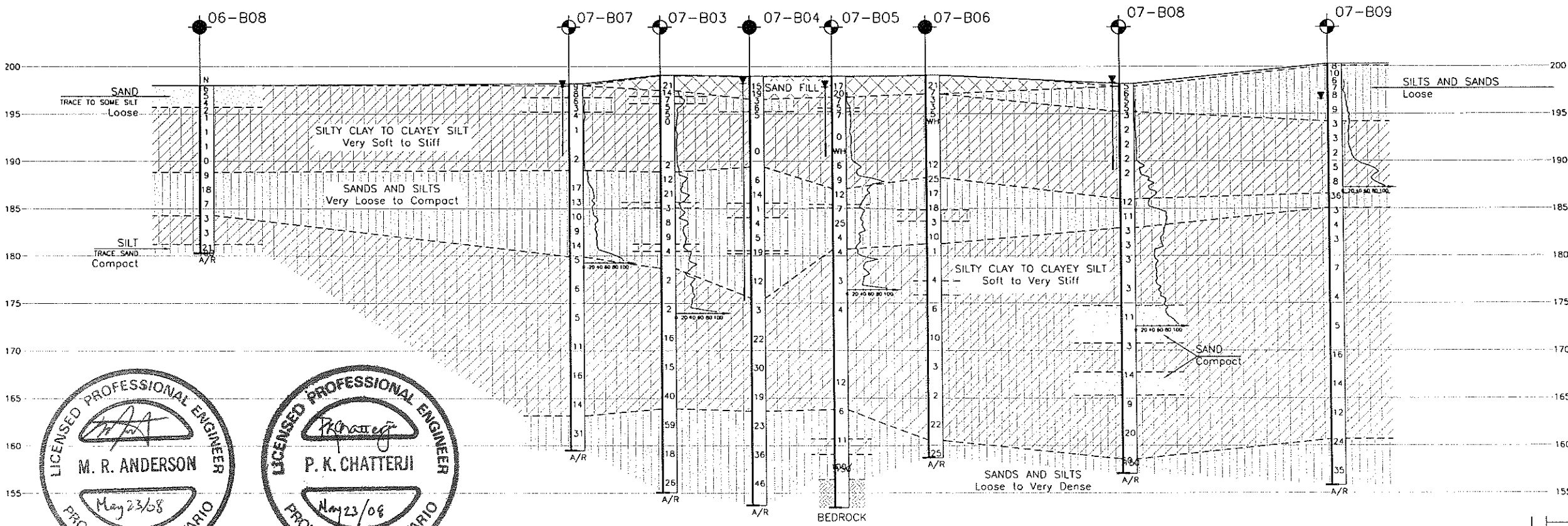
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CREATED: DEC 06

FILENAME: C:\09 FILES\19\13\198 Beatty Creek\Ted5198-BeattyBridge07.dwg  
PLOTDATE: May 21, 2008 11:47am

MINISTRY OF TRANSPORTATION, ONTARIO  
PE-2-107 84-05  
PLOT SCALE 1:1



PLAN  
0 10 20m



PROFILE HIGHWAY 534  
0 10 20m

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

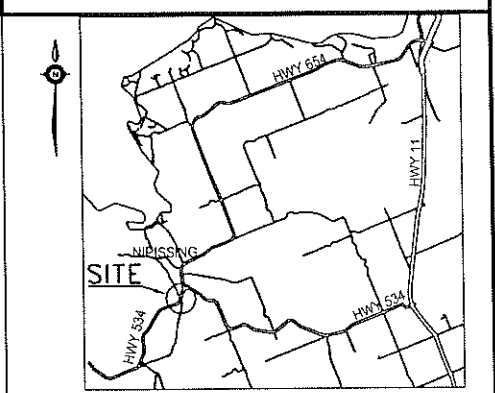
CONT No  
GWP No.5200-03-00

HIGHWAY 534  
BEATTY CREEK BRIDGE  
REPLACEMENT  
BOREHOLE LOCATIONS AND SOIL STRATA

McCORMICK RANKIN  
CORPORATION

SHEET

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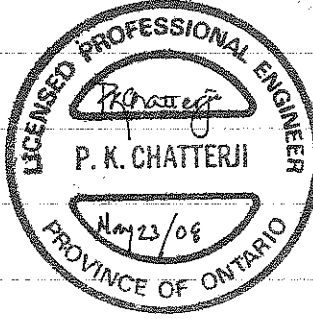
KEYPLAN

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

NO	ELEVATION	NORTHING	EASTING
06-B01	197.1	5 105 308.55	303 697.02
06-B02	197.4	5 105 320.69	303 714.37
06-B03	199.0	5 105 301.00	303 716.81
06-B04	199.0	5 105 316.00	303 723.57
06-B06	197.0	5 105 311.29	303 735.18
06-B07	197.9	5 105 093.68	303 642.56
06-B08	198.0	5 105 196.21	303 667.23
06-B09	198.1	5 105 202.30	303 701.05
06-B10	199.5	5 105 376.19	303 758.13
07-B01	197.2	5 105 307.80	303 697.80
07-B02	197.0	5 105 349.20	303 706.40
07-B03	199.1	5 105 285.10	303 705.00
07-B04	199.0	5 105 302.10	303 712.40
07-B05	199.0	5 105 318.10	303 719.10
07-B06	199.1	5 105 335.90	303 727.40
07-B07	198.2	5 105 271.90	303 683.20
07-B08	198.2	5 105 376.10	303 735.30
07-B09	200.3	5 105 413.50	303 761.10

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

GEOCREs No. 31L-120



REVISIONS		DATE		BY	DESCRIPTION	
DESIGN	MRA	CHK	PKC	CODE	LOAD	DATE NOV 2007
DRAWN	MFA	CHK	MRA	SITE 44-016	STRUCT	DWG 2

DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

DRAWING NAME: TEO3186Beatty  
CREATED: DEC 06  
MODIFIED:

FILENAME: C:\08 FILES\10\151\08 Wndmays and Beatty Creek\Teo3186-Beatty07.dwg  
PLOTDATE: May 21, 2008 12:20pm