

**FOUNDATION INVESTIGATION REPORT
BREAKAWAY SIGN SUPPORTS
HIGHWAY 11 FOUR-LANING
FROM 0.5 km NORTH OF HIGHWAY 520 NORTHERLY 5.7 km
G.W.P. No. 473-93-00**

Geocres Number: 31E-297

Report to

MMM Group Limited

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

August 24, 2009
File: 19-5161-16

H:\19\5161\16 Hwy11 N of Hwy520\Reports & Memos\Hwy
11- BREAKAWAY SIGNS-FIDR final.doc

TABLE OF CONTENTS

PART 1 FACTUAL INFORMATION

1	INTRODUCTION	1
2	SITE DESCRIPTION	1
3	SITE INVESTIGATION AND FIELD TESTING	2
4	LABORATORY TESTING	3
5	DESCRIPTION OF SUBSURFACE CONDITIONS	3
5.1	Silty Clay	3
5.2	Clayey Silt.....	4
5.3	Silt.....	5
5.4	Sandy Silt to Silty Sand	5
5.5	Sand to Sand and Gravel.....	6
5.6	Bedrock.....	6
5.7	Groundwater Levels.....	7
6	MISCELLANEOUS	7

Table

Table 1	Point Load Test Results
---------	-------------------------

Appendices

Appendix A	Record of Borehole Sheets
Appendix B	Laboratory Test Results
Appendix C	Borehole Location Drawings

**FOUNDATION INVESTIGATION REPORT
BREAKAWAY SIGN SUPPORTS
HIGHWAY 11 FOUR-LANING
FROM 0.5 km NORTH OF HIGHWAY 520 NORTHERLY 5.7 km
G.W.P. No. 473-93-00**

Geocres Number: 31E-297

PART 1: FACTUAL INFORMATION

1 INTRODUCTION

This report presents the factual findings obtained from a foundation investigation for the detailed design of breakaway sign supports along Highway 11 from approximately 1 km south of Highway 520, northerly 7.2 km. The investigation is part of the Highway 11 four laning from 0.5 km north of Highway 520, northerly 5.7 km in the District of Parry Sound, Ontario.

The purpose of the investigation was to explore the subsurface conditions in the general vicinity of the proposed breakaway sign foundations and, based on the data obtained, to provide a borehole location plan, records of boreholes, laboratory test results and a written description of the subsurface conditions.

Thurber Engineering Ltd. (Thurber) was retained by MMM Group Limited (MMM) to carry out the geotechnical investigation at this site under the Ministry of Transportation Ontario (MTO) Agreement Number 5006-E-0063.

2 SITE DESCRIPTION

The areas along the highway corridor are predominantly undeveloped with heavy vegetation. The south eastern limit of the site is occupied by the Village of Burk's Falls which consists of a mixture of residential dwellings and commercial buildings.

The site is located in the Physiographic Region known as the Highway 11 Strip, which is characterized by a narrow strip that was positioned just below the shoreline of Glacial Lake Algonquin. The overburden materials are typically composed of sand, silt and clay deposited by watercourses entering the lake. Sands were deposited in shallow waters near the abandoned shoreline as deltas while the finer particles were deposited as deep water sediments further offshore. The bedrock is composed of black to grey gneissic granite that has undergone extensive tectonization and

distinct changes in lithology which delineates the various geologic regions and sub-regions in the Muskoka, Algonquin and Parry Sound Districts.

3 SITE INVESTIGATION AND FIELD TESTING

The site investigation and field testing for the proposed breakaway sign foundations consisted of drilling and sampling a total of eight (8) boreholes at selected locations within 3 m of the proposed breakaway sign. This report compiles the boreholes drilled and sampled for the breakaway sign foundations. A summary of the borehole designations for the breakaway sign foundations is provided in Table 3.1.

Table 3.1 – Borehole Designations

Borehole (Sign Location)	Location	Drilling Date (2009)	Borehole Termination Depth (m)	Stratum at Termination Depth
09-01	West side of Highway 11, approx. 600 m south of Highway 520	February 18	8.2	Sand
09-02	East side of Highway 11, approx. 150 m north of Highway 520	February 20	8.2	Sandy Silt
09-03	East side of Highway 11, approx. 265 m south of Ontario St. S-E,W ramp	Not accessible		
09-04	West side of Highway 11, approx. 165 m south of Ontario St. S-E,W ramp	February 21	8.8	Sandy Silt
09-05	West side of Highway 11, approx. 265 m north of Oke Drive	February 18	4.7	Gneissic Granite
09-06	East side of Highway 11, approx. 650 m north of Oke Drive	February 20	7.7	Silty Sand
09-07	West side of Highway 11, approx. 200 m north of Pine Lane	February 19	7.9	Silty Sand
09-08	West side of Highway 11, approx. 500 m north of Pine Lane	February 19	7.8	Silty Sand
09-09	West side of Highway 11, approx. 800 m north of Pine Lane	February 20	8.2	Sandy Silt

The approximate borehole locations are shown on the Borehole Location Drawings in Appendix D. The coordinates and elevations of the boreholes are given on these drawings and on the individual Record of Borehole Sheets in Appendix A. The location of the borehole for Sign 3 was inaccessible.

Prior to commencement of drilling, utility clearances were obtained by Thurber for each borehole location.

Solid stem augers were used to advance the boreholes in the overburden. Samples of the overburden material were obtained at selected intervals using a 50 mm diameter split spoon sampler in conjunction with Standard Penetration Testing (SPT). NQ2 rock coring equipment was used to recover core samples of the bedrock in one borehole.

A member of Thurber's engineering staff supervised the drilling and sampling operations on a full time basis. The supervisor logged the boreholes, visually examined the recovered samples, and transported them in air tight containers to Thurber's laboratory for further examination and testing.

All rock cores were logged, and the Total Core Recovery (TCR) and the Rock Quality Designation (RQD) were determined, immediately upon recovery of the rock samples.

Groundwater conditions in the open boreholes were observed throughout the drilling operations.

4 LABORATORY TESTING

All recovered soil and rock samples were subjected to Visual Identification (VI) and geological logging. Moisture content determinations were carried out on all soil samples. A total of 37% of the recovered soil samples were subjected to grain size distribution analyses (sieve and hydrometer) and Atterberg Limits testing where appropriate. The results of this testing program are presented on the Record of Borehole sheets in Appendix A and on the figures contained in Appendix B.

Core samples of the granite bedrock were stored in wooden core boxes and protected to minimize damage during transport to the laboratory.

Point load tests were carried out on selected samples of intact rock cores to assist evaluation of the compressive strength of the bedrock. The results of point load tests on the selected rock core samples are shown on the Record of Borehole sheets and in Table 1, immediately following the text.

5 DESCRIPTION OF SUBSURFACE CONDITIONS

This section presents a generalized summary of the subsurface conditions encountered at the borehole locations drilled specifically for the breakaway sign foundations (Boreholes 09-01 to 09-09). Reference is made to the Records of Borehole sheets in Appendix A. An overall description of the stratigraphy encountered in Boreholes 09-01 to 09-09 is given in the following paragraphs. However, the factual data presented in the Record of Borehole Sheets governs any interpretation of the site conditions.

In general terms, the soil stratigraphy encountered at this site consists of a surficial cohesive layer in the southern and northern limits of the site and a mixture of sand and silt in the boreholes drilled near the centre of the project limits. The surficial deposits are typically underlain by a sand/silty sand to sandy silt deposit, which in turn overlie a gneissic granite bedrock. More detailed descriptions of the individual strata are presented below.

5.1 Silty Clay

A layer of silty clay with trace sand and trace organics was encountered from the ground surface in Boreholes 09-01, 09-02, 09-08 and 09-09. In Borehole 09-01, the silty clay was found to extend to a depth of 0.3 m (El. 298.3 m), while in the remaining three boreholes, the silty clay was observed to extend to a depth of 0.8 m below the surface (El. 297.9 to 319.8 m). A second layer of silty clay was encountered in Borehole 09-09 at a depth of 2.3 m (El.

318.3 m). The base of the second silty clay layer was contacted at a depth of 6.1 m below the ground surface (El. 314.5 m).

The SPT N-values in the silty clay were observed to range from 0 to 32 blows for 0.3 m of penetration indicating a very soft to hard consistency, though the material was typically soft.

Grain size analyses conducted on two (2) samples of the cohesive silty clay are presented on Figure B1 in Appendix B and Atterberg limits testing carried out on one (1) sample of the silty clay are presented on Figure B7 in Appendix B.

The result of the laboratory gradation test is summarized as follows:

Gravel %	0
Sand %	1 to 7
Silt %	45 to 64
Clay %	28 to 54
Liquid Limit %	48
Plastic Limit %	25

Natural moisture contents were measured to range from 19 to 57% in the samples recovered from the various silty clay deposits.

5.2 Clayey Silt

Immediately below the silty clay, a layer of clayey silt with some sand was encountered in Boreholes 09-08 and 09-09. In these two boreholes, the clayey silt was contacted at a depth of 0.8 m (El. 310.8 to 319.8 m) and observed to extend to a depth of 2.3 m below the ground surface (El. 309.3 to 318.3 m).

The SPT N-values in the clayey silt were observed to range from 9 to 30 blows for 0.3 m of penetration indicating a stiff to hard consistency.

Grain size analyses conducted on two (2) samples of the clayey silt are presented on the individual Record of Borehole Sheets attached in Appendix A and on Figure B2 in Appendix B and Atterberg limits testing carried out on two (2) samples of the clayey silt are presented on Figure B7 in Appendix B.

The result of the laboratory gradation test is summarized as follows:

Gravel %	0
Sand %	16 to 20
Silt %	59 to 65
Clay %	19 to 21
Liquid Limit %	21 to 24
Plastic Limit %	15

Natural moisture contents of the clayey silt layer were measured to range from 14 to 31%.

5.3 Silt

A layer of silt with trace of clay and sand and occasional rootlets was encountered from the ground surface in Borehole 09-07. The silt was observed to extend to a depth of 0.8 m (El. 316.7 m).

The SPT N-value recorded in the silt layer was 2 blows for 0.3 m of penetration indicating a very loose relative density.

A single grain size analysis carried out on the silt layer is presented on the individual Record of Borehole Sheet in Appendix A and on Figure B3 of Appendix B. The results of the laboratory gradation test are summarized as follows:

Gravel %	0
Sand %	9
Silt %	84
Clay %	7

The natural moisture content of the silt layer was measured as 53% in the single sample recovered from Borehole 09-07.

5.4 Sandy Silt to Silty Sand

In Boreholes 09-02 and 09-04 to 09-09 deposits of sandy silt to silty sand with trace to some clay and trace of gravel were first contacted from ground surface up to a depth of 6.1 m (El. 297.9 to 329.7 m). A second layer of sandy silt was also encountered in Borehole 09-02 at depth of 7.6 m below the ground surface (El. 291.0 m).

Where the sandy silt to silty sand overlays other deposits of overburden (Borehole 09-02), the base of the cohesionless material was contacted at a depth of 3.0 m (El. 295.6 m). Except for Borehole 09-05, the remaining boreholes were terminated in cohesionless soils.

SPT N-values in the sandy silt to silty sand ranged widely from 2 to 66 blows for 0.3 m of penetration. Several SPT N-values in the silty sand were found to be greater than 50 blows for 0.05 m of penetration (Boreholes 09-06 and 09-07). Based on the observed N-values, the sandy silt to silty sand is described to have a very loose to very dense relative density; though is typically compact in the sandy silt deposits and dense to very dense in the silty sand deposits.

Grain size distribution curves for twelve (12) samples tested are presented on the Record of Borehole Sheets and on Figure B4 and B5 of Appendix B.

The results of laboratory gradation and Atterberg Limits tests are summarized as follows:

Gravel %	0 to 6
Sand %	17 to 70
Silt %	31 to 71 (where hydrometer conducted)
Clay %	5 to 15 (where hydrometer conducted)
Silt and Clay %	28 to 43 (sieve only)

The natural moisture contents of the sandy silt layers ranged from 8 to 34%.

5.5 Sand to Sand and Gravel

A layer of poorly graded sand to sand and gravel was encountered from the ground surface in Borehole 09-04 and below a thin layer of cohesive material in Boreholes 09-01 and 09-02 at depths ranging from 0.3 to 3.0 m (El. 295.6 to 306.2 m). Where encountered, the cohesionless deposit contains trace silt. The lower limit of the sand was contacted at depths ranging from 2.3 to 7.6 m below the ground surface (El. 291.0 to 303.9 m). In Borehole 09-01, the sand was found to extend beyond the depth of the borehole.

Grain size analyses conducted on four (4) samples are presented on the Record of Borehole Sheets and on Figure B6 of Appendix B. The result of the laboratory tests carried out on the sand to sand and gravel deposit are summarized as follows:

Gravel %	0 to 17
Sand %	71 to 95
Silt and Clay %	5 to 11

SPT N-values obtained in the cohesionless layer ranged from 13 to 62 blows per 0.3 m of penetration, indicating a compact to very dense relative density.

The moisture content of the recovered samples ranged from 4 to 17%.

5.6 Bedrock

At Borehole 09-05, the soils described above were found to be underlain by a light brown to grey gneissic granite bedrock, as confirmed in core samples recovered from the borehole. The surface of the bedrock was encountered in 09-05 at a depth of 1.7 m below the ground surface (El. 328.0 m).

The granite encountered in the borehole is described as coarse-grained, light brown to grey in colour. The bedrock is described as fresh to very strong.

Though not tested, experience with similar materials has shown that the bedrock is generally very strong possessing Uniaxial Compressive Strengths (UCS) in excess of 150 MPa in intact samples.

The results of Point Load tests conducted on rock core samples indicated unconfined compressive strength (UCS) values of 68 to 225 MPa, typically around 150 MPa indicating a

very strong rock. One UCS of 18 MPa occurred in a single point load test conducted on a sample from 4.5 m depth; this sample was obtained from a fractured zone and is not considered representative of the bedrock mass.

Bedrock cores were collected using NQ2 sized coring equipment. Total Core Recovery (TCR) in the bedrock was found to be 100% in both of the recovered runs. The RQD values recorded in the two core runs ranged from 83 to 90% indicating a good to excellent rock quality.

5.7 Groundwater Levels

The groundwater levels were observed in the open boreholes during and upon completion of drilling. None of the open boreholes indicated the presence of groundwater seepage following the completion of the drilling operations.

The groundwater observations in the boreholes are very short term. In the longer-term, the groundwater levels may stabilize at levels within the depth of exploration and seasonal fluctuations are to be expected. In particular, groundwater may be present at higher elevations after the spring snowmelt or periods of heavy rainfall. Further, perched water may be encountered in lenses or zones of more permeable sands and silts.

6 MISCELLANEOUS

Borehole locations and ground surface elevations were supplied to Thurber by MMM.

The drilling and sampling equipment was supplied and operated by Eastern Ontario Diamond Drilling Ltd. from Hawkesbury, Ontario. The field work was supervised on a full time basis by Mr. Luke Gilarski of Thurber Engineering Ltd.

Laboratory testing was carried out at Thurber's MTO approved laboratory in Oakville, Ontario.

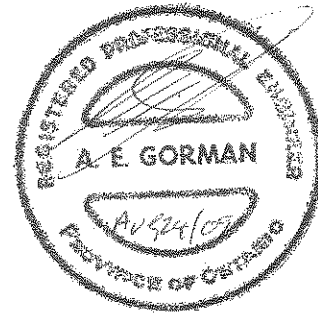
Supervision of the field program, was conducted by Mr. David E. Elwood, P.Eng. Interpretation of the field data and preparation of the investigation report was conducted by Mr. David E. Elwood, P.Eng. Mr. Alastair E. Gorman, P.Eng. and Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects, reviewed the report.

THURBER ENGINEERING LTD.

David E. Elwood, P.Eng.
Geotechnical Engineer

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

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

NOTE: Hierarchy of Soil Strength Prediction

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

4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

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

5. LEGEND FOR RECORDS OF BOREHOLES

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

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



Water Level

C_{pen}

Shear Strength Determination by Pocket Penetrometer

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

UNIFIED SOILS CLASSIFICATION



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

RECORD OF BOREHOLE No 09-01

1 OF 1

METRIC

G.W.P. 473-93-00 LOCATION N 5 052 379.7 E 311 549.3 ORIGINATED BY LG
HWY 11 BOREHOLE TYPE Hollow Stem Auger COMPILED BY LG
DATUM Geodetic DATE 2009.02.18 - 2009.02.18 CHECKED BY DE

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
								<div><div>20406080100</div><div>○ UNCONFINED + FIELD VANE</div><div>● QUICK TRIAXIAL x LAB VANE</div></div>							
298.6															
0.0	Frozen Clay for 0.3m.		1	SS	22										
298.3															
0.3	SAND, some silt, trace gravel Compact Brown Moist Dense		2	SS	31										
	Compact		3	SS	15										
			4	SS	13										
			5	SS	23										
			6	SS	21										
	Dense		7	SS	32										
			8	SS	24										
	Trace to some gravel Very Dense		9	SS	62										
290.4															
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE FILLED WITH HOLE PLUG AND CUTTINGS TO SURFACE.														

ONTMT4S 6116.GPJ 4/14/09

+³, X³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 09-02

1 OF 1

METRIC

G.W.P. 473-93-00 LOCATION N 5 053 115.6 E 311 437.9 ORIGINATED BY LG
 HWY 11 BOREHOLE TYPE Hollow Stem Auger COMPILED BY LG
 DATUM Geodetic DATE 2009.02.20 - 2009.02.20 CHECKED BY DE

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100 20 40 6						

ONTMT4S 6116.GPJ 4/14/09

RECORD OF BOREHOLE No 09-04

1 OF 1

METRIC

G.W.P. 473-93-00 LOCATION N 5 054 160.2 E 311 482.2 ORIGINATED BY LG
 HWY 11 BOREHOLE TYPE Hollow Stem Auger COMPILED BY LG
 DATUM Geodetic DATE 2009.02.21 - 2009.02.21 CHECKED BY DE

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
306.2							20 40 60 80 100							
0.0	SAND and GRAVEL, trace silt Compact Black Moist		1	SS	13		○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE							
			2	SS	15		WATER CONTENT (%)							
			3	SS	16		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT							
303.9							w _p w w _L							
2.3	Sandy SILT, trace to some clay, trace gravel Loose Brown Moist		4	SS	9									
			5	SS	8									
			6	SS	2									
			7	SS	5									
			8	SS	8									
			9	SS	6									
	Compact		10	SS	17									
297.4														
8.8	END OF BOREHOLE AT 8.8m. BOREHOLE FILLED WITH HOLE PLUG AND CUTTINGS TO SURFACE.													



ONTMT4S 6116.GPJ 4/14/09

RECORD OF BOREHOLE No 09-05

1 OF 1

METRIC

G.W.P. 473-93-00 LOCATION N 5 055 378.7 E 311 330.1 ORIGINATED BY LG
 HWY 11 BOREHOLE TYPE Hollow Stem Auger COMPILED BY LG
 DATUM Geodetic DATE 2009.02.18 - 2009.02.19 CHECKED BY DE

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
329.7								20	40	60	80	100					
0.0	Silty SAND, trace gravel, trace organics		1	SS	2												
	Dense Reddish Brown Moist		2	SS	36												
328.0			3	SS	771												
1.7	BEDROCK, Gneissic Granite Light Brown to Grey Fresh Very Strong		1	RUN													
	45° Fracture at 3.0m		2	RUN													
	Light Brown-Green Fractures every 50mm																
325.0																	
4.7	END OF BOREHOLE AT 4.7m. BOREHOLE FILLED WITH HOLE PLUG AND CUTTINGS TO SURFACE.																

+ 3 . X 3 : Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 09-06

1 OF 1

METRIC

G.W.P. 473-93-00 LOCATION N 5 055 778.5 E 311 331.1 ORIGINATED BY LG
HWY 11 BOREHOLE TYPE Hollow Stem Auger COMPILED BY LG
DATUM Geodetic DATE 2009.02.20 - 2009.02.20 CHECKED BY DE

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
327.0	Sandy SILT Loose to Dense Brown Moist Compact		1	SS	2		20 40 60 80 100					PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT		
324.7	Silty SAND, trace clay, trace gravel Very Dense Grey Moist		2	SS	40		40 80 120 160 200	○ UNCONFINED + FIELD VANE				W _P	W	W _L		
			3	SS	25			● QUICK TRIAXIAL × LAB VANE				WATER CONTENT (%)				
2.3			4	SS	100			○ UNCONFINED + FIELD VANE				WATER CONTENT (%)				
			5	SS	100/ .225			● QUICK TRIAXIAL × LAB VANE				WATER CONTENT (%)				
			6	SS	100/ 275			○ UNCONFINED + FIELD VANE				WATER CONTENT (%)				
			7	SS	100/ .200			● QUICK TRIAXIAL × LAB VANE				WATER CONTENT (%)				
			8	SS	100/ 250			○ UNCONFINED + FIELD VANE				WATER CONTENT (%)				
			9	SS	50/ .050			● QUICK TRIAXIAL × LAB VANE				WATER CONTENT (%)				
319.3	END OF BOREHOLE AT 7.7m. BOREHOLE FILLED WITH HOLE PLUG AND CUTTINGS TO SURFACE.							○ UNCONFINED + FIELD VANE				WATER CONTENT (%)				
7.7																

ONTMT4S 6116.GPJ 4/14/09

METRIC







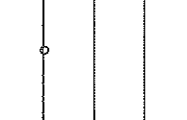



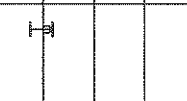





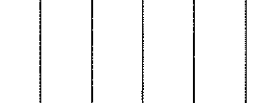



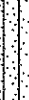



+ 3, x 3: Numbers refer to Sensitivity

RECORD OF BOREHOLE No 09-08

1 OF 1

METRIC

G.W.P. 473-93-00 LOCATION N 5 056 656.9 E 311 490.5 ORIGINATED BY LG
 HWY 11 BOREHOLE TYPE Hollow Stem Auger COMPILED BY LG
 DATUM Geodetic DATE 2009.02.19 - 2009.02.19 CHECKED BY DE

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL								
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa														
311.6	Silty CLAY, trace sand, trace organics Very Soft Brown Moist		1	SS	0		311															
0.0																						
310.8	Clayey SILT, some sand Very Stiff Mottled Brown-Grey Moist Stiff		2	SS	16							310										
0.8																						
309.3																						
2.3	Silty SAND, trace gravel Dense Brown Moist Compact Very Dense		4	SS	32							309										
			5	SS	38												308					
			6	SS	14																307	
			7	SS	21	306																
8				SS	100/. 225					305												
303.8	END OF BOREHOLE AT 7.8m. BOREHOLE FILLED WITH HOLE PLUG AND CUTTINGS TO SURFACE.		9	SS	100/. 175	304																
7.8																						





ONTMT4S 6116.GPJ 4/14/09

RECORD OF BOREHOLE No 09-09

1 OF 1

METRIC

G.W.P. 473-93-00 LOCATION N 5 056 947.4 E 311 540.4 ORIGINATED BY LG
 HWY 11 BOREHOLE TYPE Hollow Stem Auger COMPILED BY LG
 DATUM Geodetic DATE 2009.02.20 - 2009.02.20 CHECKED BY DE

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								UNCONFINED + FIELD VANE									
								QUICK TRIAXIAL x LAB VANE									
320.6							20	40	60	80	100	PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L			
0.0	Silty CLAY, some sand, trace organics Firm Brown Moist		1	SS	4												
319.8																	
0.8	Clayey SILT, some sand Firm Brown Moist Stiff		2	SS	30												0 16 65 19
			3	SS	14												
318.3																	
2.3	Silty CLAY, trace sand Firm Grey Moist		4	SS	7												
			5	SS	6												
	Soft		6	SS	3												
	Moist		7	SS	2												0 1 45 54
314.5																	
6.1	Sandy SILT, trace clay Compact Brown Wet		8	SS	10												

ONTM14S 6116.GPJ 4/14/09

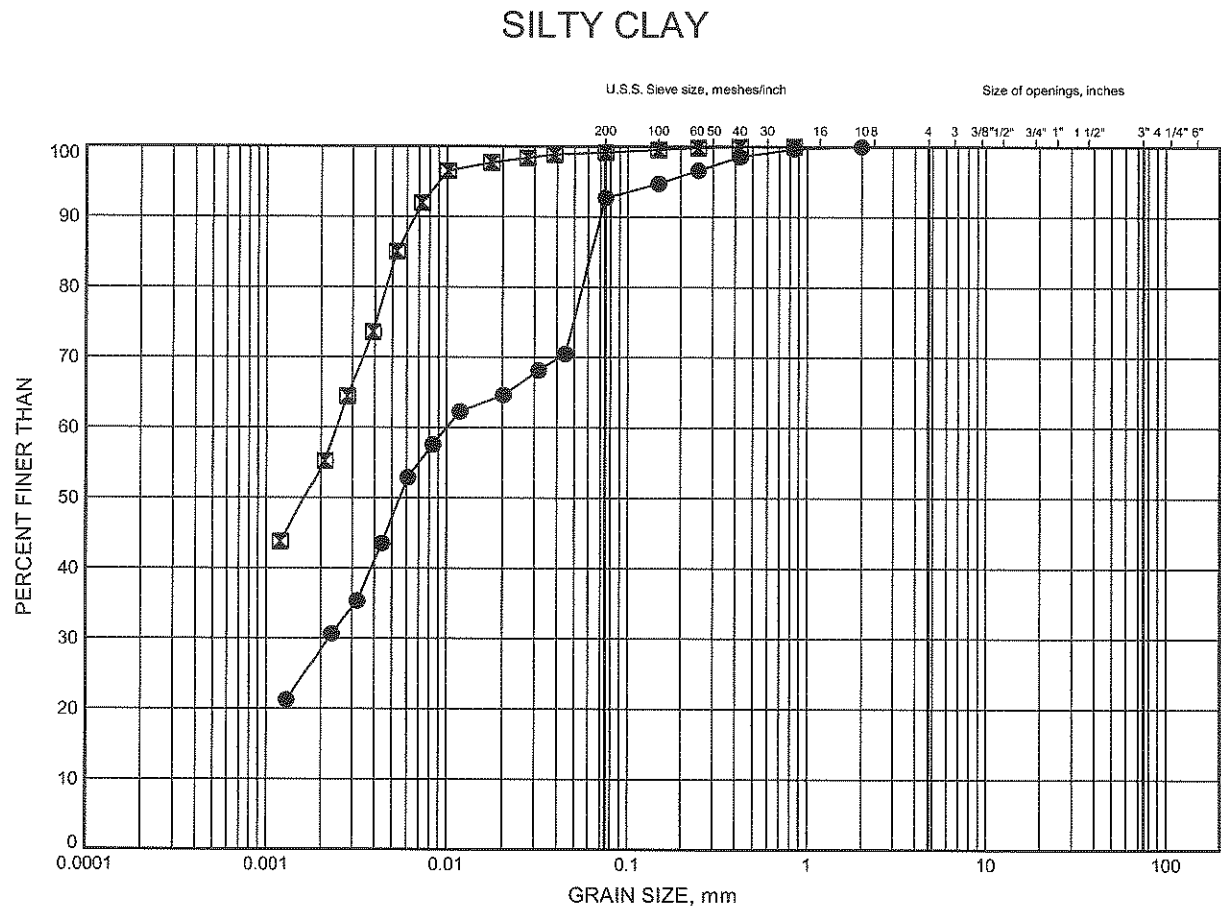
Appendix B

Laboratory Test Results

Hwy 11-Four-Laning from 0.5km N of Hwy 520 northerly 5.7km

GRAIN SIZE DISTRIBUTION

FIGURE B1



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-08	0.30	311.27
×	09-09	4.88	315.69



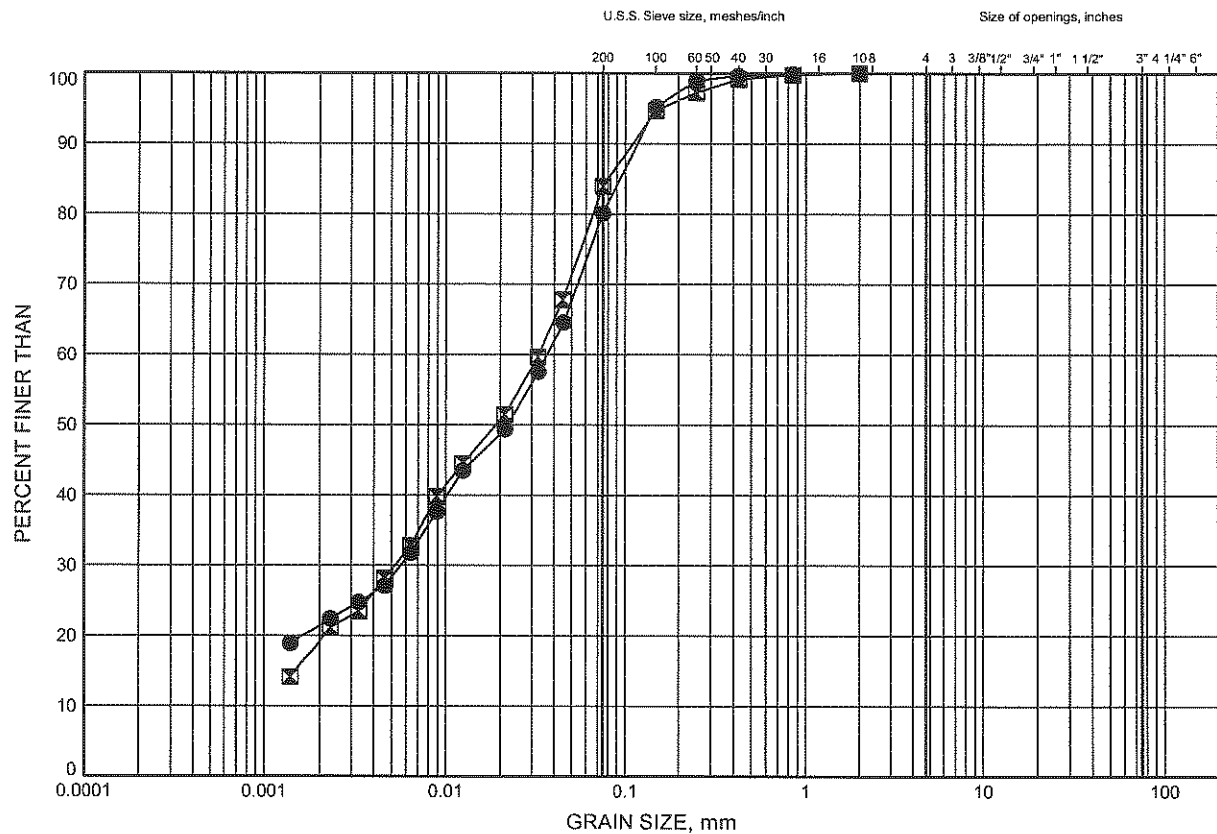
W.P.# .473-93-00.....
 Prepared By .AN.....
 Checked By .RPR.....

Hwy 11-Four-Laning from 0.5km N of Hwy 520 northerly 5.7km

GRAIN SIZE DISTRIBUTION

FIGURE B2

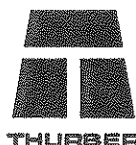
CLAYEY SILT



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-08	1.83	309.75
⊠	09-09	1.07	319.50

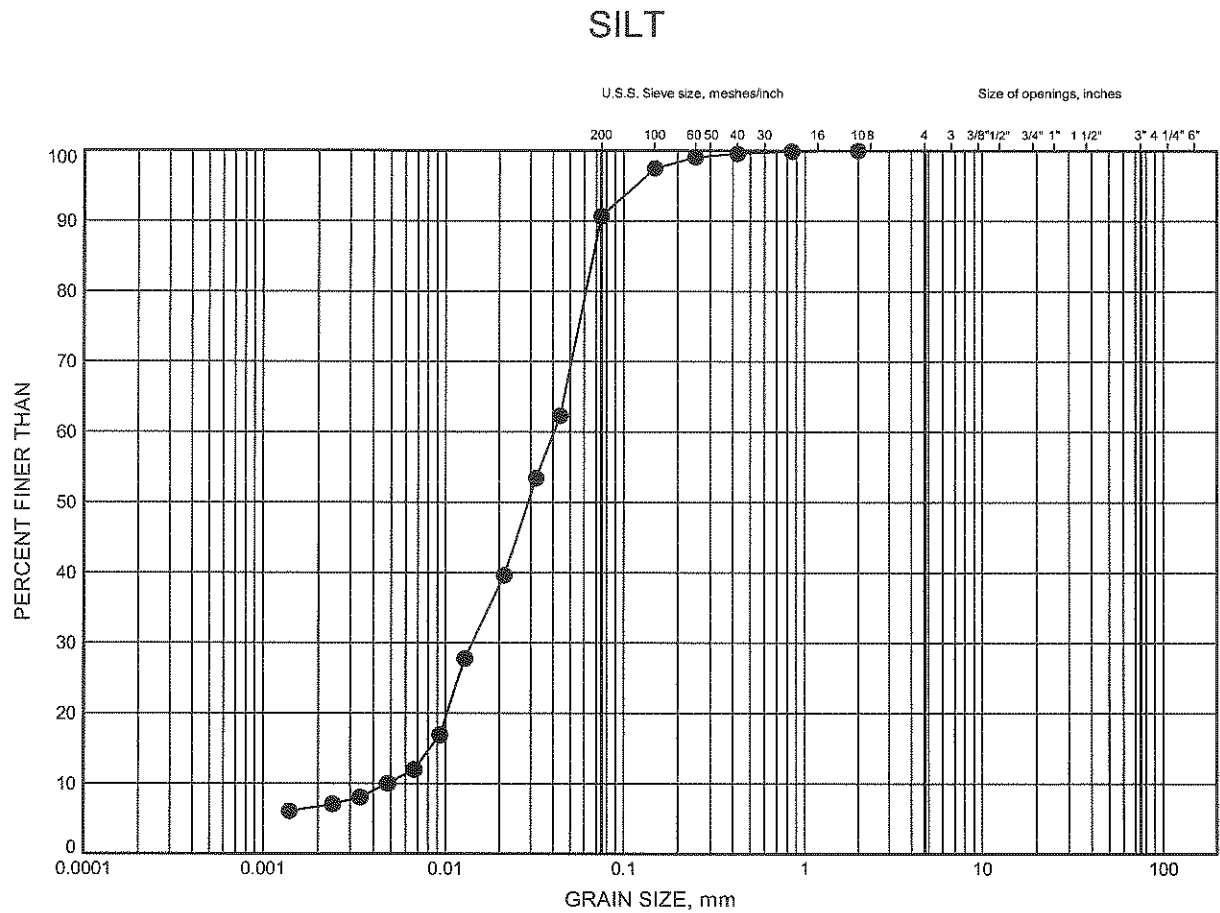


W.P.# .473-93-00.....
 Prepared By .AN.....
 Checked By .RPR.....

Hwy 11-Four-Laning from 0.5km N of Hwy 520 northerly 5.7km

GRAIN SIZE DISTRIBUTION

FIGURE B3



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-07	0.30	317.15



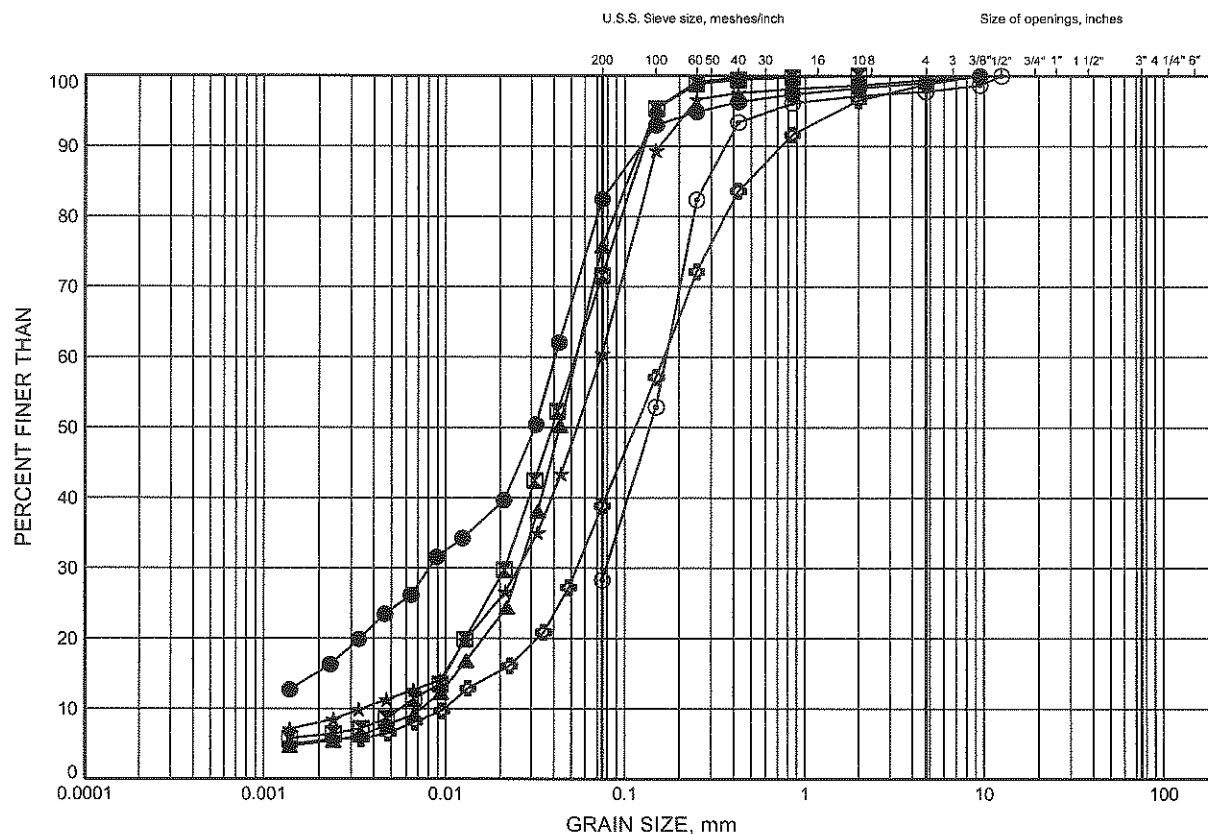
W.P.# .473-93-00.....
 Prepared By .AN.....
 Checked By .RPR.....

Hwy 11-Four-Laning from 0.5km N of Hwy 520 northerly 5.7km

GRAIN SIZE DISTRIBUTION

FIGURE B4

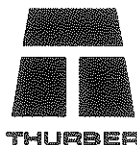
SANDY SILT to SILTY SAND



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-02	1.07	297.55
⊠	09-02	1.83	296.79
▲	09-02	7.92	290.70
★	09-04	6.40	299.82
⊙	09-05	1.07	328.63
⊕	09-06	2.59	324.38

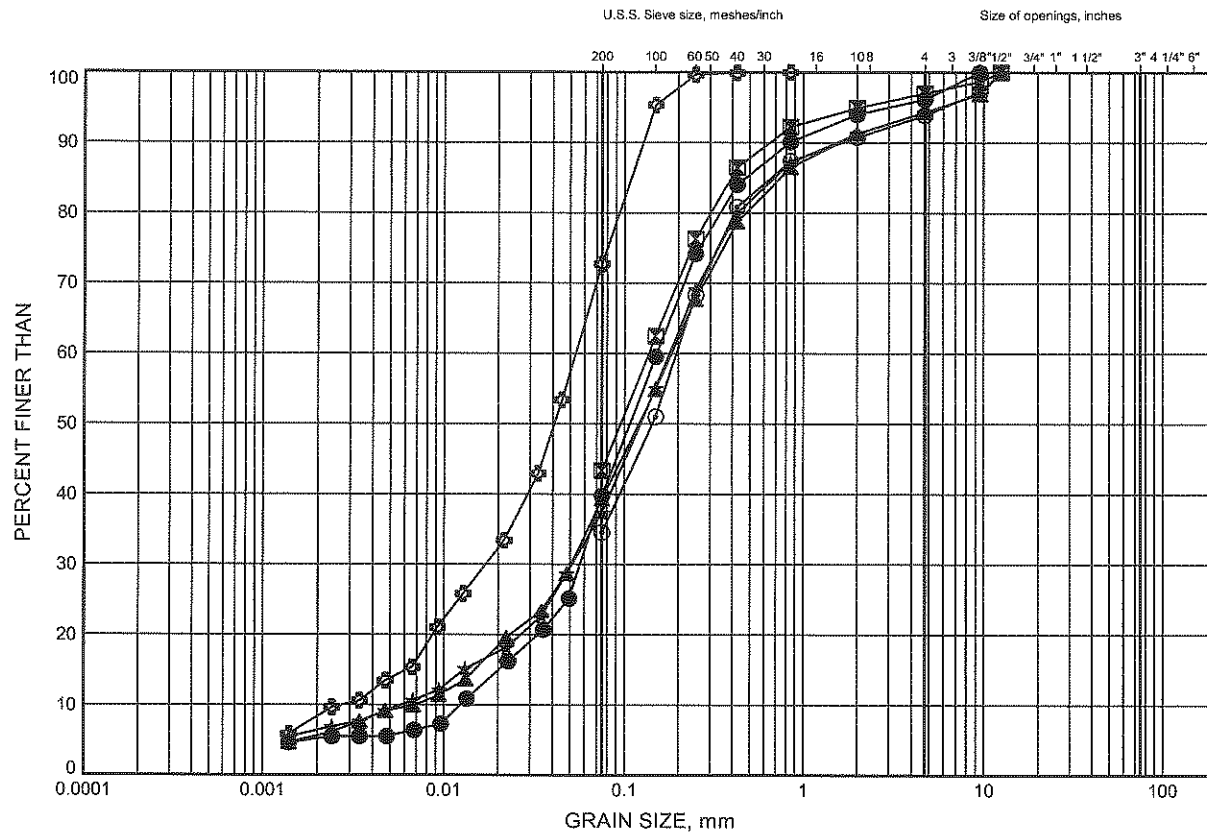


W.P.# .473-93-00.....
 Prepared By .AN.....
 Checked By .RPR.....

Hwy 11-Four-Laning from 0.5km N of Hwy 520 northerly 5.7km
GRAIN SIZE DISTRIBUTION

FIGURE B5

SANDY SILT to SILTY SAND



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-06	4.11	322.85
⊠	09-06	6.40	320.57
▲	09-07	2.20	315.26
★	09-07	4.88	312.58
⊙	09-08	4.11	307.46
⊕	09-09	7.92	312.64



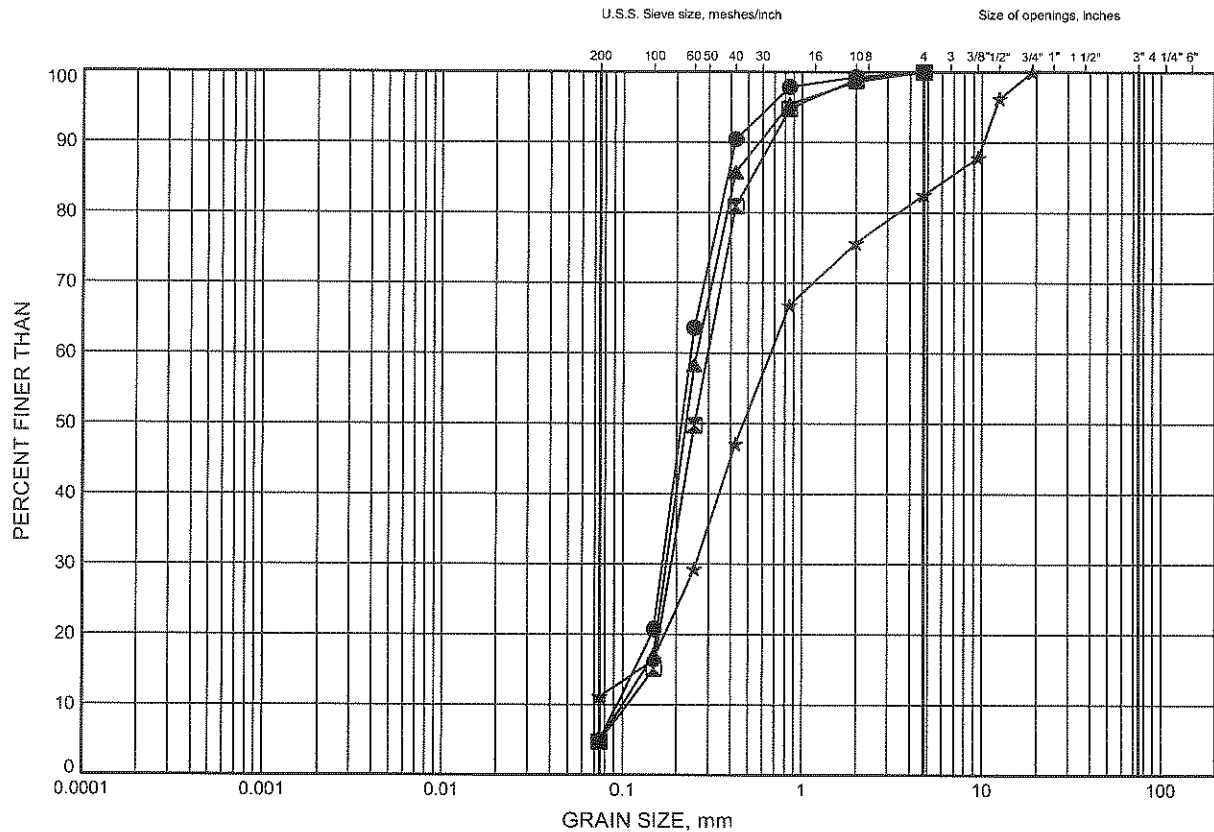
W.P.# 473-93-00.....
 Prepared By .AN.....
 Checked By .RPR.....

Hwy 11-Four-Laning from 0.5km N of Hwy 520 northerly 5.7km

GRAIN SIZE DISTRIBUTION

FIGURE B6

SAND to SAND and GRAVEL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-01	1.07	297.58
⊠	09-01	2.59	296.05
▲	09-01	4.11	294.53
★	09-04	1.83	304.39

GRAIN SIZE DISTRIBUTION - THURBER 6116.GPJ 4/14/09

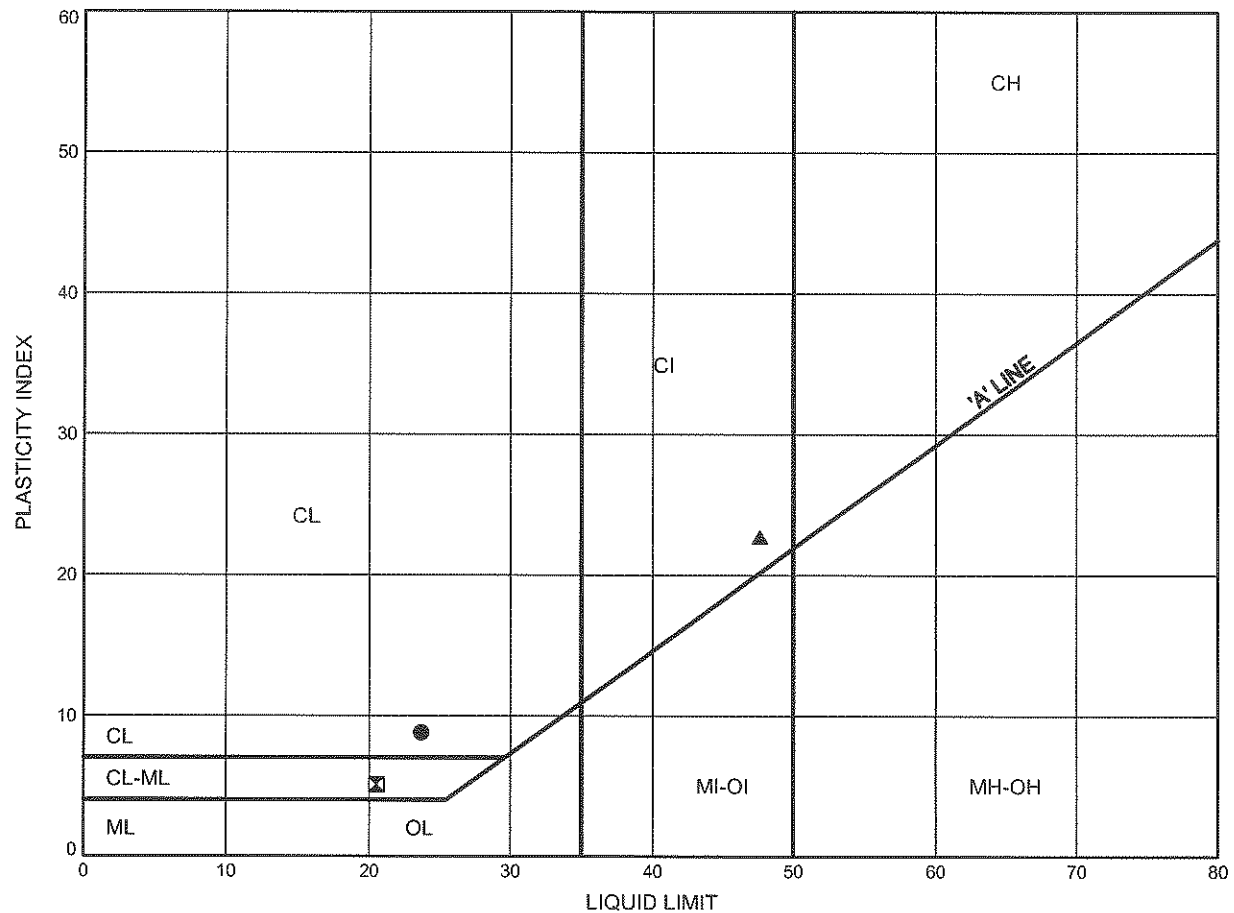
W.P.# .473-93-00.....
 Prepared By .AN.....
 Checked By .RPR.....



Hwy 11-Four-Laning from 0.5km N of Hwy 520 northerly 5.7km
ATTERBERG LIMITS TEST RESULTS

FIGURE B7

SILTY CLAY to CLAYEY SILT



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	09-08	1.83	309.75
⊠	09-09	1.07	319.50
▲	09-09	4.88	315.69

Date April 2009
 Project 473-93-00

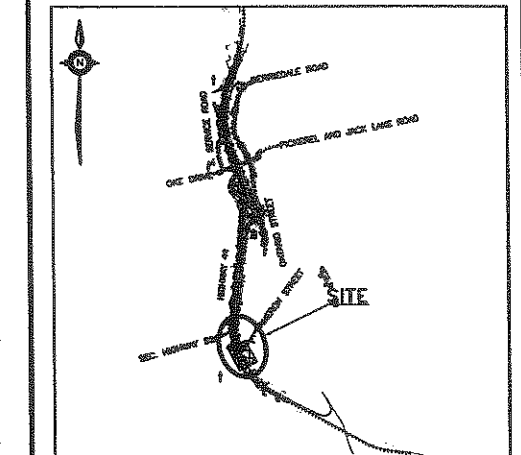


Prep'd AN
 Chkd. RPR

Appendix C






Borehole Location Drawings

SHEET



KEYPLAN

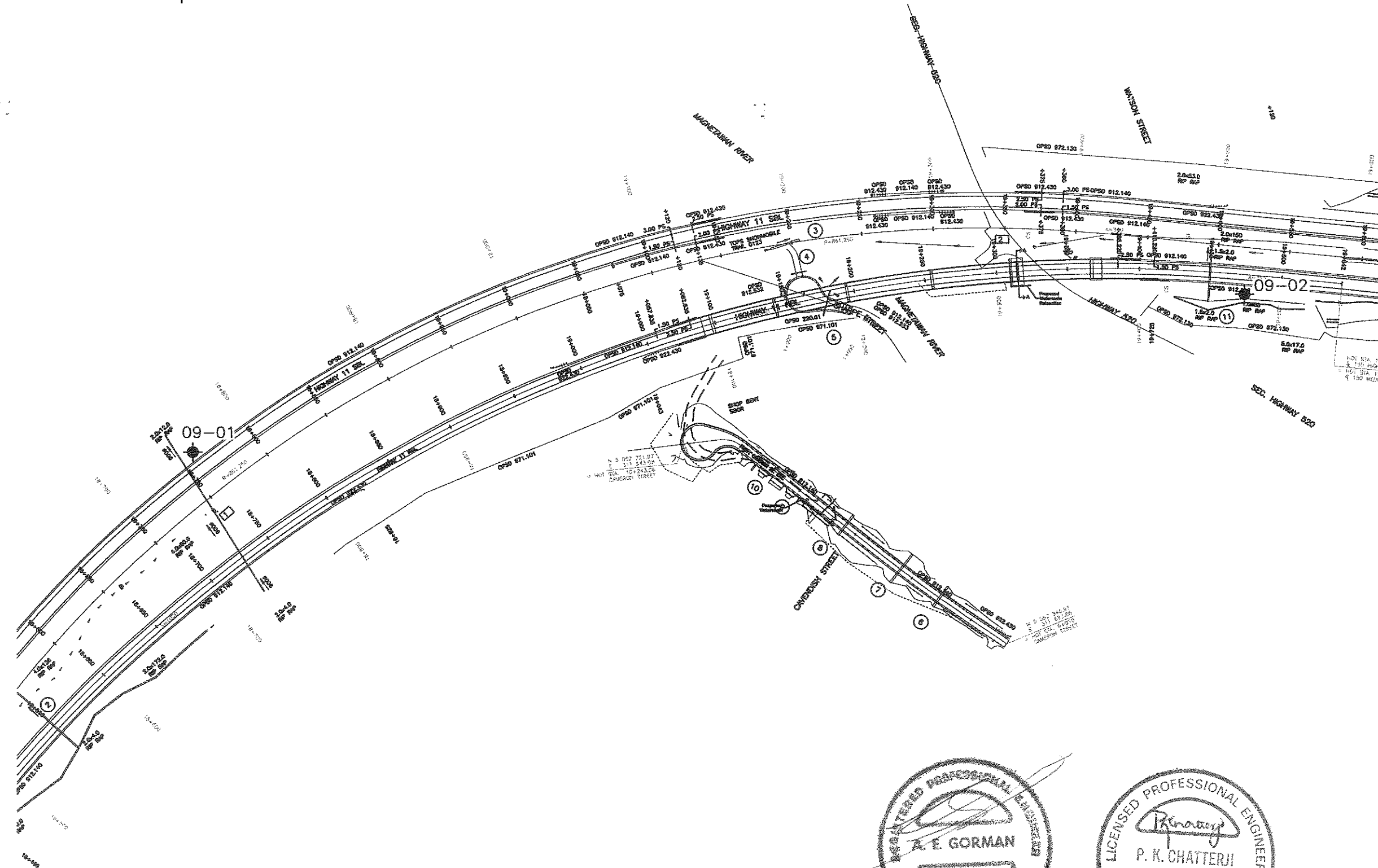
LEGEND

	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

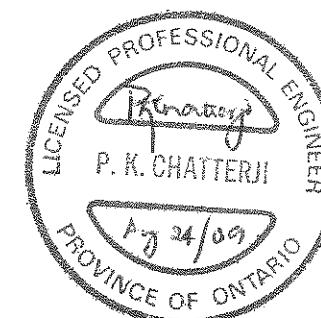
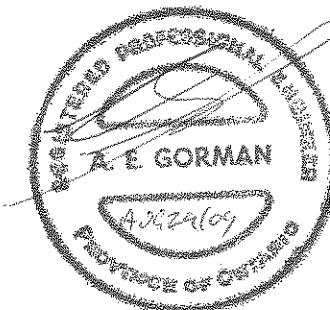
NO	ELEVATION	NORTHING	EASTING
OHS-01	298.6	5 052 379.7	311 549.3
OHS-02	298.6	5 053 115.6	311 437.9

[illegible]

GEOCRES No. 31E-297



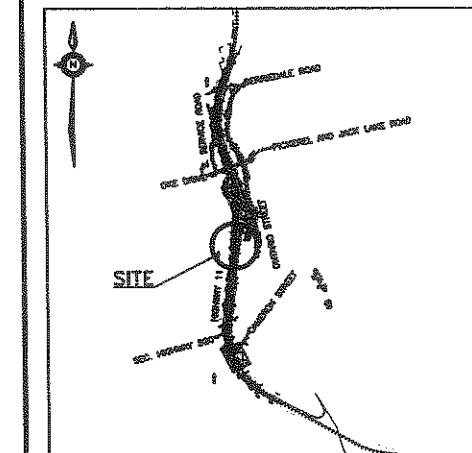
PLAN

[illegible]






CONT No
GWP No 473-93-00
HIGHWAY 11 FOUR-LANING
FROM 0.5KM NORTH OF HWY 520
NORTHERLY 5.7KM
BOREHOLE LOCATIONS



SHEET



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 |

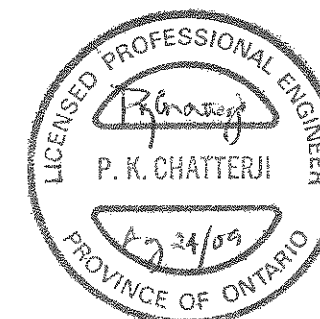
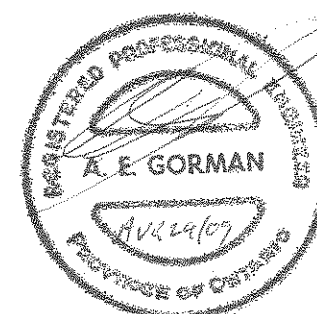
[illegible]

GEOCREs No. 31E-297

NOTES.

- NOTES:
1. UTILITY LOCATIONS SHOWN ON THIS PLAN ARE APPROXIMATE ONLY. IN ADDITION TO THE GENERAL CONDITIONS IN THE CONTRACT DOCUMENTS, THE CONTRACTOR IS TO CONSULT WITH THE UTILITY COMPANIES TO CONFIRM THE LOCATIONS.
 2. FOR ONTARIO STREET/S-EW RAMP INTERSECTION DETAILS (I.e. OPSD's, STATION'S, ETC.), SEE PAVEMENT ELEVATION DRAWINGS.

PLAN

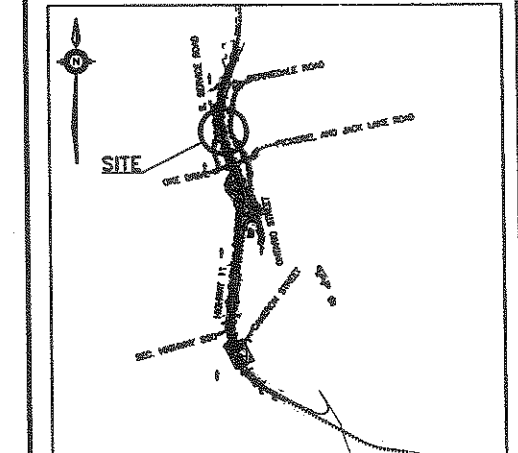
[illegible]

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

CONT No
GWP No 473-93-00
HIGHWAY 11 FOUR-LANING
FROM 0.5KM NORTH OF HWY 520
NORTHERLY 5.7KM
BOREHOLE LOCATIONS



SHEET

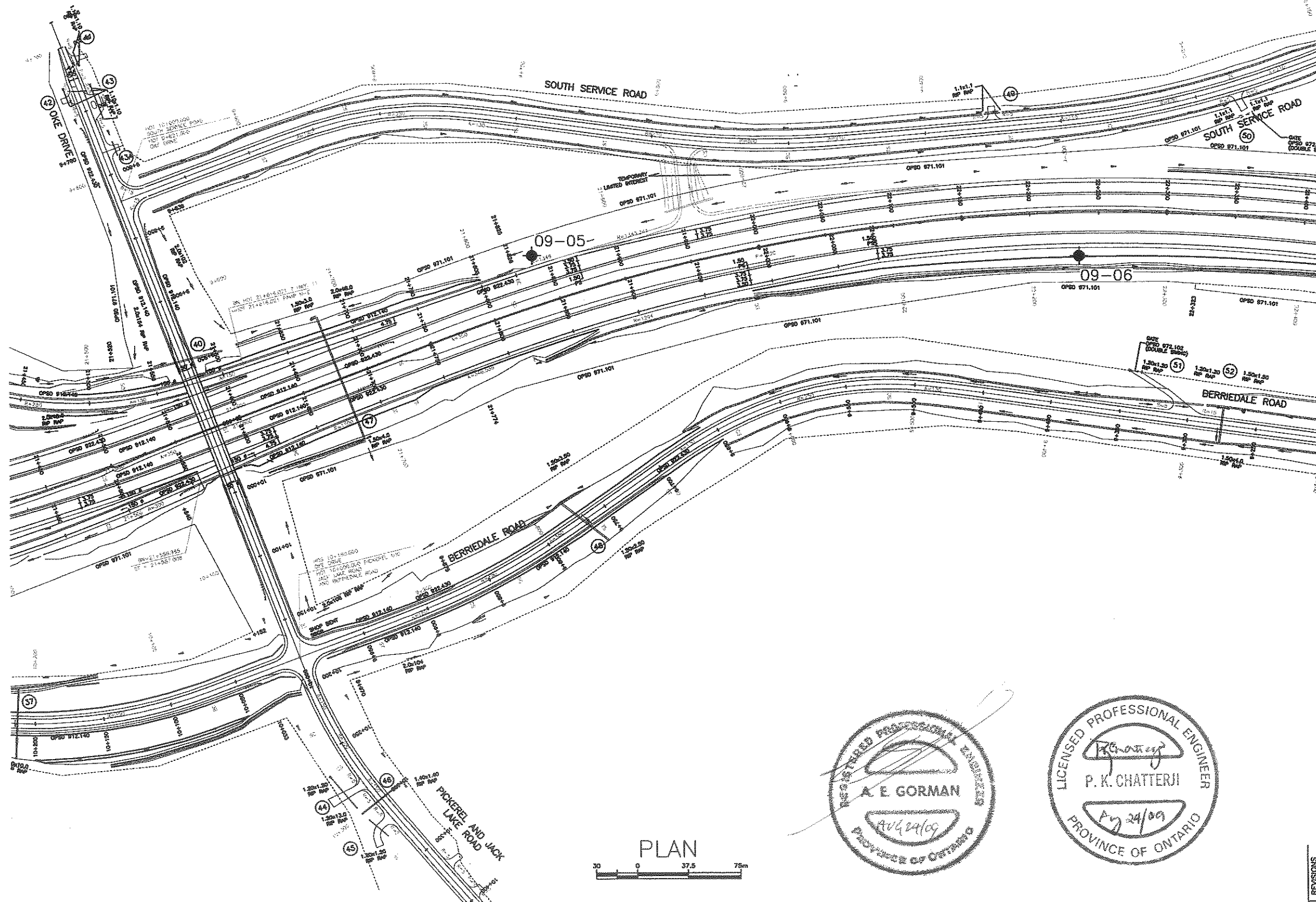


**KEYPLAN
LEGEND**

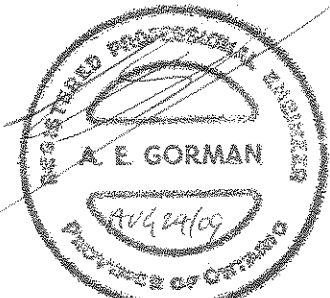
- Borehole
- Borehole and Cone
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- W Water Level
- HA Head Artesian Water
- PZ Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
OHS-05	329.7	5 055 378.7	311 330.1
OHS-06	327.0	5 055 778.5	311 331.1

GEOCREs No. 31E-297



PLAN



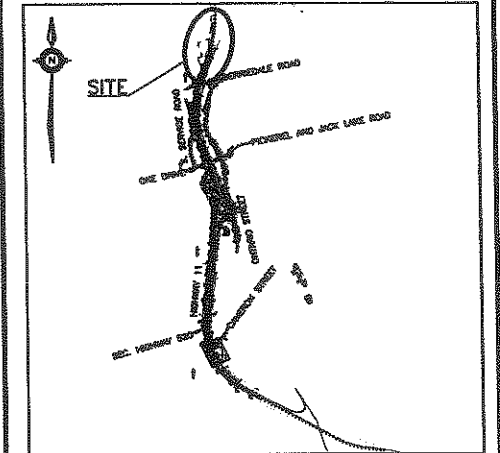
REVISIONS	DATE	BY	DESCRIPTION
DESIGN	DEC	CHK AEG	CODE
DRAWN	MFA	CHK PKC	SITE

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

CONT No
GWP No 473-93-00
HIGHWAY 11 FOUR-LANING
FROM 0.5KM NORTH OF HWY 520
NORTHERLY 5.7KM
BOREHOLE LOCATIONS



SHEET

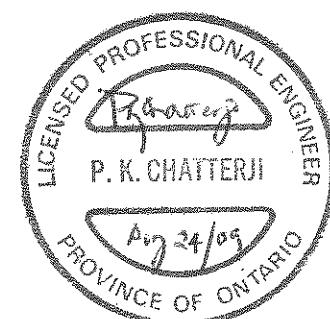
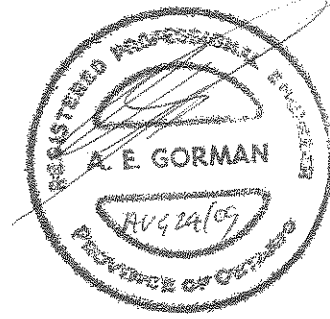
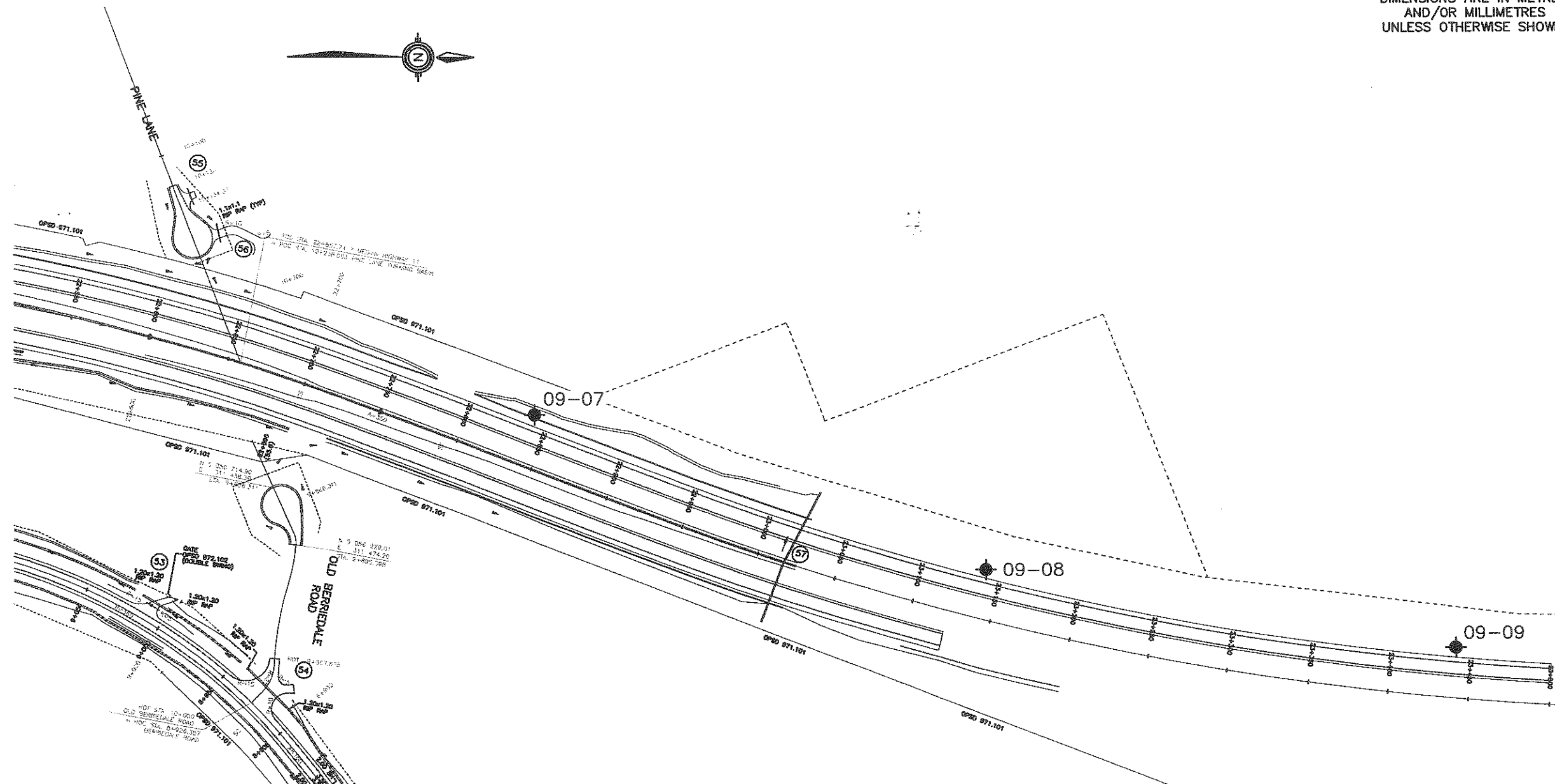


**KEYPLAN
LEGEND**

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

NO	ELEVATION	NORTHING	EASTING
OHS-07	317.5	5 056 377.3	311 393.1
OHS-08	311.6	5 056 656.9	311 490.5
OHS-09	320.6	5 056 947.4	311 540.4

GEOCREs No. 31E-297



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	DEE	CHK AEG	CODE
DRAWN	MFA	CHK PKC	SITE
			STRUCT
			DWG