

**FOUNDATION INVESTIGATION
FINAL REPORT**

**PROPOSED OVERHEAD SIGN
HIGHWAY 417/WOODROFFE
W-N/S RAMP
OTTAWA, ONTARIO**

**MTO – WP 4349-06-00
GEOCRES NO. 31G5-217**

Submitted to:

**Ministry of Transportation
Geotechnical Section
Eastern Region
1355 John Counter Boulevard
Postal Bag 4000
Kingston, Ontario K7L 5A3
Canada**

Submitted by:

**AMEC Earth and Environmental
A division of AMEC Americas Limited
210 Colonnade Road South, Unit 300
Ottawa, Ontario, K2E 7L5
Canada**

19 November 2007

TZ71046

Distribution

- Ministry of Transportation (Eastern Region) – 6 bound copies and 2 electronic copies
- Greer Galloway Group Inc. – 1 copy
- AMEC Earth & Environmental – 2 copies

19 November 2007

TZ71046

The Greer Galloway Group Inc.
973 Crawford Drive
Peterborough, ON K9J 3X1

Attention: Mr. Ravie Erathasari

Dear Mr. Erathasari:

**RE: Final Report
Geotechnical Investigation – Proposed Overhead Sign
Highway 417/Woodroffe - W-N/S Ramp
Ottawa, Ontario**

We take pleasure in enclosing seven hard copies and two digital copies of our Final Geotechnical Investigation Report carried out for the above-mentioned project and we will be glad to discuss any questions arising from this work.

Soil samples will be retained for a period of twelve months, and will thereafter be disposed of unless we are otherwise instructed.

We thank you for giving us this opportunity to be of service to you.

Sincerely,

**AMEC Earth & Environmental
a division of AMEC Americas Limited**

Wissam Farah, M.Sc., M.Eng., P.Eng., PMP
Senior Project Manager/
Geotechnical and Materials
Engineering Group Leader

Encl.

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1.0 INTRODUCTION

AMEC Earth & Environmental, a division of AMEC Americas Limited (AMEC), Consulting Geotechnical, Construction Quality Control and Environmental Engineers, was retained by the Ministry of Transportation (Southern Region), c/o The Greer Galloway Group Inc., to conduct a foundation investigation for a proposed overhead sign at the W-N/S Ramp connecting the East Bound Lane (EBL) of Highway 417 with Woodroffe Avenue in Ottawa, Ontario. A key plan showing the location of the proposed overhead sign is presented on Figure No. 1 in Appendix A of this report.

The purpose of this investigation is to determine the subsurface conditions at the proposed overhead sign location. Authorization to proceed with this investigation was provided by MTO, c/o The Greer Galloway Group Inc. The work was carried out by AMEC according to the MTO Terms of Reference dated April 2007 and AMEC's Proposal No. OP8519 dated April 2007 and revised on 11 May 2007.

The investigation was carried out by means of a limited number of boreholes, in-situ tests and laboratory tests on selected samples.

2.0 SITE AND PROJECT DESCRIPTIONS

A new tri-chord or monotube overhead sign that is associated with a future widening of the W-N/S Ramp terminal at the EBL of Highway 417 and Woodroffe Avenue is proposed. The location of the overhead sign is at approximately 33 m to the west of the curb line along the west side of Woodroffe Avenue. The sign will be placed on two posts. Each post will be placed at approximately 5 m to 6 m from the existing curb lines along both sides of the ramp. The northern post will be located within the existing grassed island. The proposed location for the southern post is presently in the middle of the right turn lane of the existing ramp. It is understood that the existing right turn lane will be closed and removed and a new right turn lane will be constructed along a new alignment and as part of the ramp improvement and widening project.

3.0 SCOPE OF WORK

The scope of work for this geotechnical investigation was conducted in accordance with the requirements detailed in the Terms of Reference published by MTO for this project and it included the following:

- Two 6 m deep foundation boreholes are to be advanced at the proposed locations of the sign posts, as provided by The Greer Galloway Group Inc.;
- Perform laboratory tests, including moisture content and soil grain size distribution test analyses in addition to chemical tests on selected samples; and
- Document the results of the field and laboratory programmes in a Foundation Investigation Report.

4.0 INVESTIGATION PROCEDURES

4.1 Field Investigation

In accordance with the Terms of Reference for this assignment and AMEC's proposal for this investigation the following drilling programme was completed:

Two 6.7 m deep foundation boreholes numbered BH07-30 and BH07-31 were advanced at the proposed locations for the foundations of the sign posts. The boreholes were drilled on 28 and 29 June 2007. The borehole locations are indicated on the Borehole Location Plan Figure No. 2 in Appendix A of this report. One of the borehole locations had to be moved slightly in order to avoid existing underground service lines. It should be noted that a major storm sewer line runs along the middle of the grassed island to the north of the existing ramp. This service line intersects with the proposed location of the northern post for the overhead sign.

The boreholes were advanced to slightly deeper than the indicated depths shown in the Terms of Reference. Soil samples were normally taken at 1.5 m intervals to a depth of 6.7 m during the performance of Standard Penetration Test (SPT) in hollow stem augers and in accordance with ASTM D1586. The use of hollow stem augers prevented soil cave-in during the investigation. Soil boiling/heaving at the bottom of the hollow stem augers had not been observed. This consisted of freely dropping a 63.5 kg (140 lbs.) hammer for a vertical distance of 0.76 m (30 inches) to drive a 51 mm (2 inches) diameter O.D. split-barrel (split spoon) sampler into the ground. The number of blows of the hammer required to drive the sampler into the relatively undisturbed ground by a vertical distance of 0.30 m (12 inches) was recorded as SPT 'N' value of the soil which indicated the consistency of cohesive soils or the relative density of non-cohesive soils.

The borehole locations and ground surface elevations at these locations were surveyed in the field by a survey crew from McIntosh Perry of Ottawa. The borehole locations established in the field by the survey crew are presented in a table shown on the Borehole Location Plan Figure No. 2 and included in Appendix A of this report. The coordinates and the geodetic ground surface elevations at the specified borehole locations were surveyed by the surveyor and confirmed by a hand-held GPS unit (NAD 83 system) after the completion of drilling. Existing geodetic benchmarks located within or close to the sites were used for reference in surveying the borehole locations and elevations. The coordinates and elevations of the boreholes are within 2 cm of accuracy.

Upon completion of drilling, the test holes were backfilled with bentonite then patched with cold asphalt mix where applicable. The soil samples were transported to AMEC's Advanced Soil Laboratory for further examination and laboratory soil testing. The programme of laboratory

testing included, where applicable, grain size analysis, Atterberg Limits and natural water content determination on more than 25% of the retrieved samples.

4.2 Laboratory Tests

Representative soil samples were subjected to geotechnical laboratory testing in AMEC's Advanced Soil Laboratory for soil classification. Two selected samples were sent to Caduceon Environmental Laboratories for chemical testing. The following tests were conducted:

- Natural water content determination (23);
- Grain size distribution analysis (3);
- Atterberg Limits (1); and
- Chemical tests for pH, Sulphate, Chloride and resistivity (2).

The encountered soil strata and the results of the field and laboratory tests are presented on the Borehole Records in Appendix B. The grain size distribution curves and the chemical test results are presented in Appendix C.

5.0 INVESTIGATION RESULTS

This section of the report summarizes the encountered surface and subsurface conditions at the overhead sign site. The field and laboratory test results along with the encountered soil strata are detailed below.

5.1 Surface Conditions

The location of the overhead sign is at, approximately, 33 m to the west of the curb line along the west side of Woodroffe Avenue. The sign will be placed on two posts. One post will be located within the existing grassed island where the ground surface is covered with tall and wild grass. The ground surface at the location of eastern post is covered with asphaltic concrete pavement as part of the right turn lane of the ramp.

The ground surface along the Woodroffe W-N/S ramp slopes gently downward toward the west. A maximum ground surface elevation difference of 0.1 m was recorded at the borehole locations.

5.2 Subsurface Conditions

The following soil strata were encountered at this site:

Asphaltic Concrete

A surficial 250 mm thick layer of asphaltic concrete was encountered at the location of BH07-30.

Fill

Various fill materials were encountered underlying the asphaltic concrete layer at the location of BH07-30. Surficial silty sand fill material overlying various fill soils was encountered at the location of BH07-31. The fill extended to variable depths ranging between 1.0 m (Elev. 76.3 m) and 1.5 m (Elev. 75.6 m) below ground surface.

The fill at BH07-30 consisted of approximately, 300 mm (Elev. 76.7 m) thick layer of crushed gravelly sand with trace to some silt followed by 400 mm (Elev. 76.3 m) of sand fill with trace silt. The upper 100 mm (Elev. 77.1 m) of the encountered fill at BH07-31 contained silty sand with roots and trace organics. A 0.9 m (Elev. 76.2 m) thick layer of sand fill material with trace silt and gravel was encountered under the upper silty sand fill at BH07-31. A 500 mm (Elev. 75.6 m) thick zone of dark brown clayey silt fill was encountered in BH07-31 at 1.0 m depth and extended to 1.5 m depth below ground surface.

The compactness of the fill was variable and generally loose to compact as indicated by the recorded SPT 'N'-values which ranged between 8 and 22 blows per 300 mm of penetration.

Laboratory testing on several fill samples indicated moisture contents between 3% and 18% for the tested samples. A grain size distribution analysis test was conducted on one selected sample from the sand fill. The results of the gradation test are recorded below and presented in Figure No. 3, titled "Grain Size Distribution", which is included in Appendix C of this report. The non-plastic sand fill included the following gradation percentages:

Gravel:	0%
Sand:	95%
Silt and Clay:	5%

Silt

A brown or grey silt deposit was encountered underlying the fill layers in both boreholes at depths between 1.0 m (Elev. 76.3 m) and 1.5 m (Elev. 75.6 m) below ground surface. The silt extended to maximum depths ranging between 1.5 m (Elev. 75.8 m) and 2.6 m (Elev. 74.6 m) below ground surface. The silt contained trace clay. The silt was firm to stiff as indicated by the SPT 'N'- values which ranged between 4 and 8 blows per 300 mm of penetration.

Laboratory tests on several selected silt samples indicated moisture contents of 15% and 38% denoting moist to wet conditions. Atterberg Limits test conducted on one silt sample revealed a liquid limit of 42, a plastic limit of 29 and a plasticity index of 13. The soil should therefore be classified as silt with intermediate plasticity (MI). The results of the Atterberg Limits test are presented in Figure No. 6, titled "Plasticity Chart", which is included in Appendix C of this report.

Glacial Till

A glacial till deposit was encountered underlying the silt deposit in both boreholes. The till was encountered at depths ranging between 1.5 m (Elev. 75.8 m) and 2.6 m (Elev. 74.6 m) below ground surface. The till extended to the maximum depth of exploration, where refusal on bedrock was encountered. The till consisted mainly of sand, some silt, some gravel with trace clay. The till was generally loose to very dense as indicated by the recorded SPT 'N' values which ranged between 2 and more than 67 blows per 300 mm of penetration.

Laboratory testing on several till samples indicated moisture contents between 9% and 23% for the tested samples. Grain size distribution analyses were conducted on two selected till samples. The results of the gradation tests are recorded below and presented in Figure Nos. 4 and 5, titled "Grain Size Distribution", which are included in Appendix C of this report. The till included the following components:

Gravel:	12% to 22%
Sand:	61% to 70%
Silt and Clay:	17% to 18%

Bedrock

Possible bedrock was contacted at refusal by auger in all of the boreholes at depths ranging between 6.6 m (Elev. 70.7 m) and 6.7 m (Elev. 70.5 m) below existing grades. The encountered refusal depth is consistent with the indicated depth of bedrock as per the available geology maps for this site. However, the depth to bedrock and the rock conditions have not been confirmed by rock coring.

5.3 Groundwater

The groundwater was encountered in both boreholes as shown in the table below:

Borehole No.	Groundwater Depth, m
BH07-30	2.3 (Elev. 75.0 m)
BH07-31	5.6 (Elev. 71.5 m)

Fluctuations in the groundwater level due to seasonal variations or in response to a particular precipitation event should be anticipated.

5.4 Chemical Test Results

Two selected soil samples from this site were sent to Caduceon Environmental Laboratories in Ottawa to test for pH, sulphate, chloride concentrations and resistivity. The results are summarized in the table below. The certificate of testing is included in Appendix C.

Borehole/ Sample #	BH07-30 SS 3	BH07-31 SS 4B
pH	8.04	7.9
Sulphate µg/g	40	80
Chloride µg/g	500	617
Resistivity Ohm-cm	1400	1110

6.0 CLOSURE

Allowance should be made for boulders and cobbles that should always be expected in glacial till deposits. **Contractors should refer to the Non-Standard Special Provisions (NSSP) included in Appendix D of this report.**

It should also be noted that loose fill and sand materials were encountered during the investigation programme. Therefore, casing installation prior to auguring is recommended during the auguring process for the concrete caisson installation in order to protect sides of the augured hole from collapsing or caving in. **Contractors should refer to the Non-Standard Special Provisions (NSSP) included in Appendix D of this report.**

The sub-soil information contained in this report should be used solely for the purpose of foundation assessment of this site. The attached Report Limitations, in Appendix E, are an integral part of this report. Should you have any questions, please contact the undersigned.

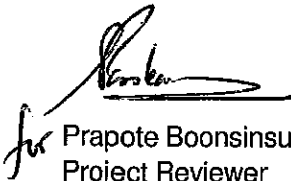
Sincerely,

AMEC Earth & Environmental
A division of AMEC Americas Limited

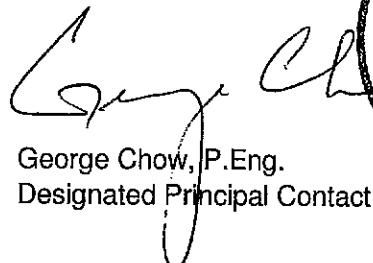


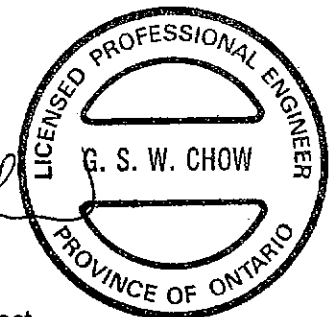
Wissam G. G. Farah, M.Sc., M.Eng., P.Eng., PMP
Project Manager




for Prapote Boonsinsuk, Ph.D., P.Eng.
Project Reviewer

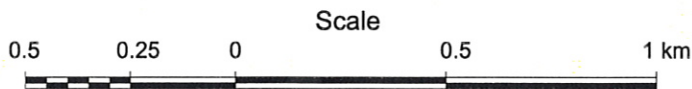
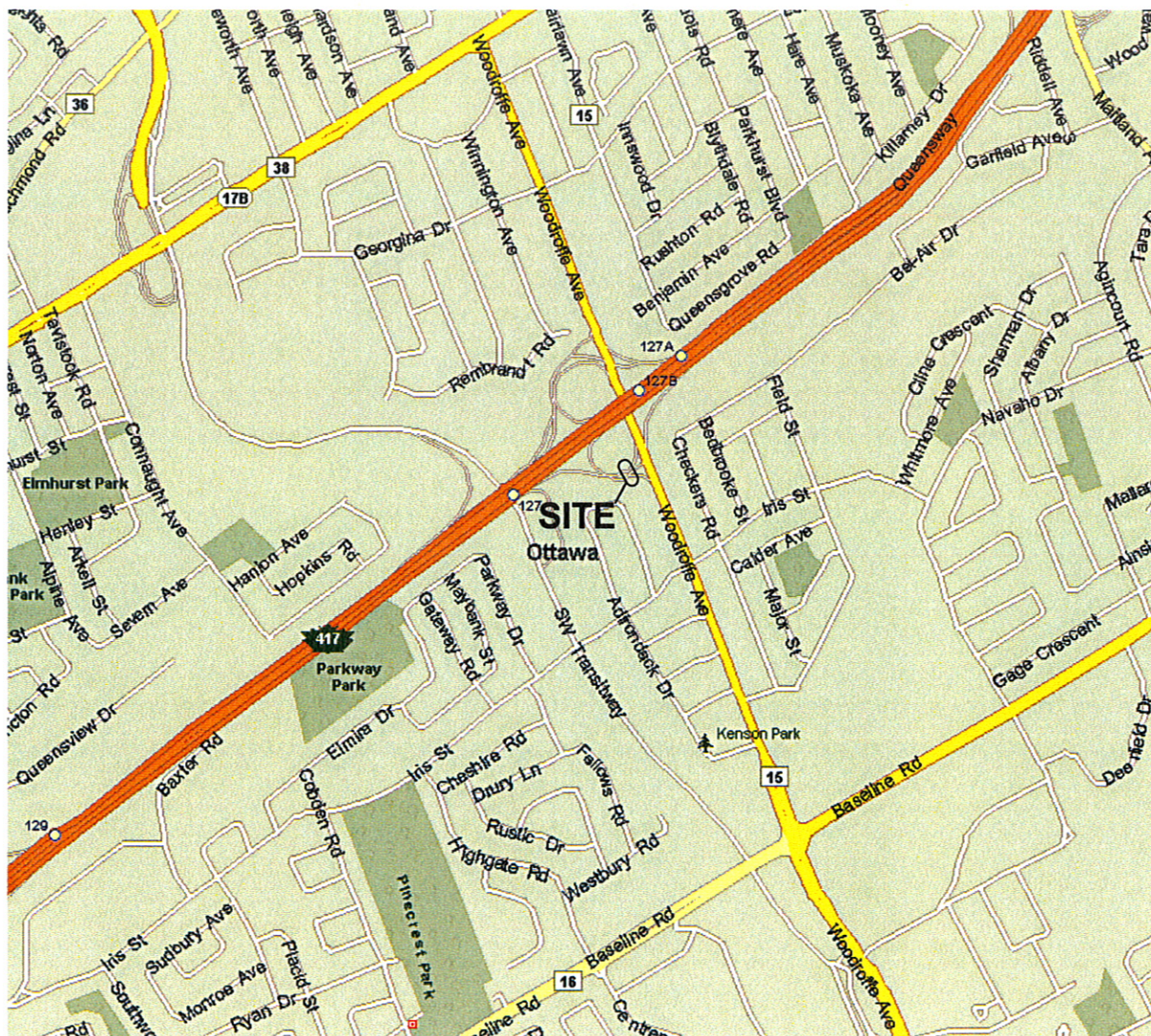





George Chow, P.Eng.
Designated Principal Contact

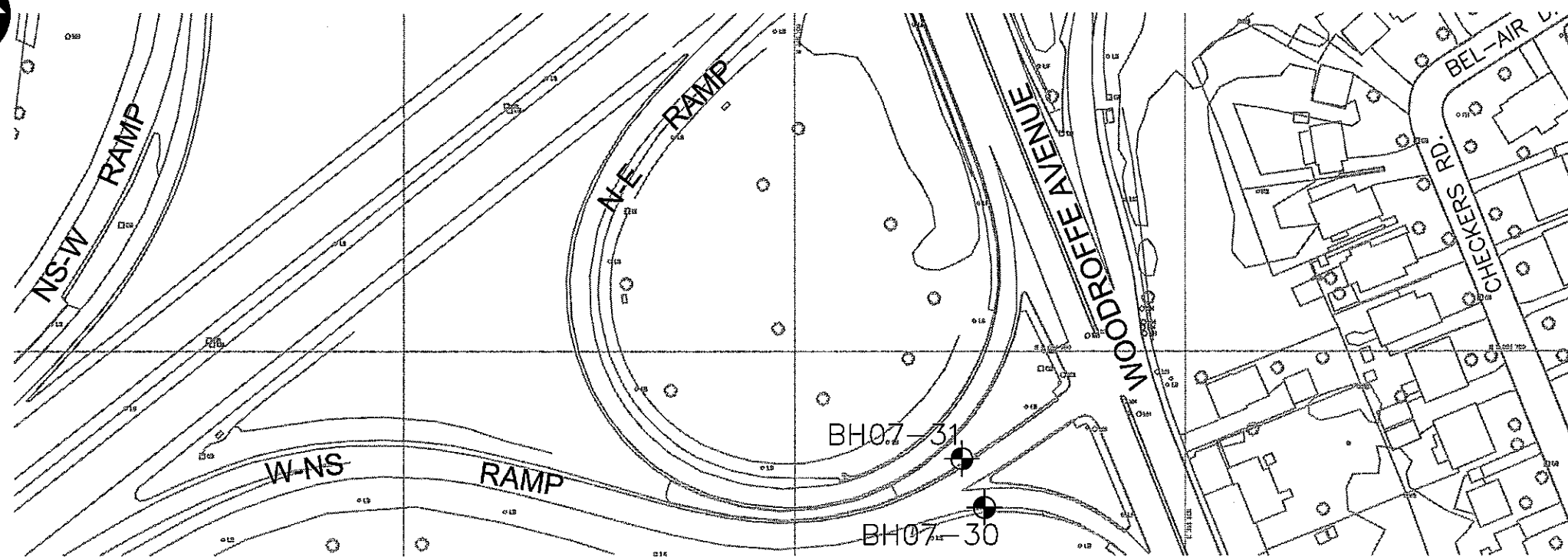


APPENDIX A

KEY AND BOREHOLE LOCATION PLANS (FIGURE NOS. 1 AND 2)



AMEC Earth & Environmental a Division of AMEC Americas Limited			CLIENT LOGO 	CLIENT MINISTRY OF TRANSPORTATION ONTARIO	
TITLE SITE MAP		DWN BY: KW	DATUM: -	DATE: July 2007	
PROJECT FOUNDATION INVESTIGATION FOR OVERHEAD SIGN Highway 417 / Woodroffe W-N/S Ottawa, Ontario		CHK'D BY: PB	REV. NO.: A	PROJECT NO: TZ71046	
		PROJECTION: -	SCALE: AS SHOWN	FIGURE No. 1	



METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

AGREEMENT No.

4006-E-0042

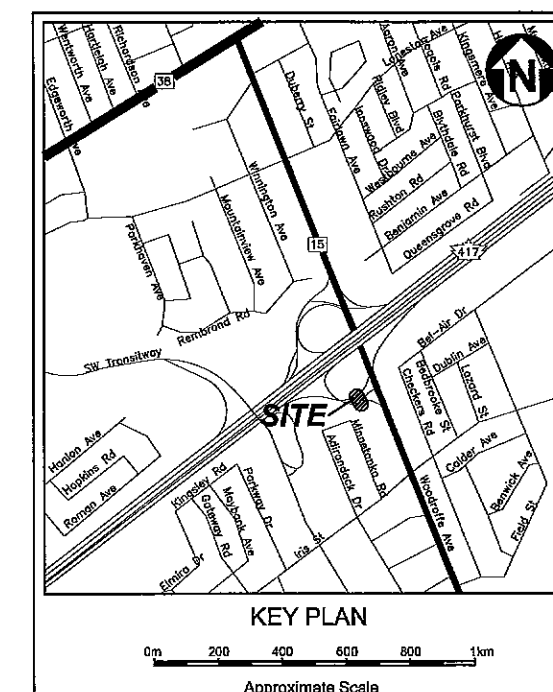
G.W.P. No.


4349-06-00

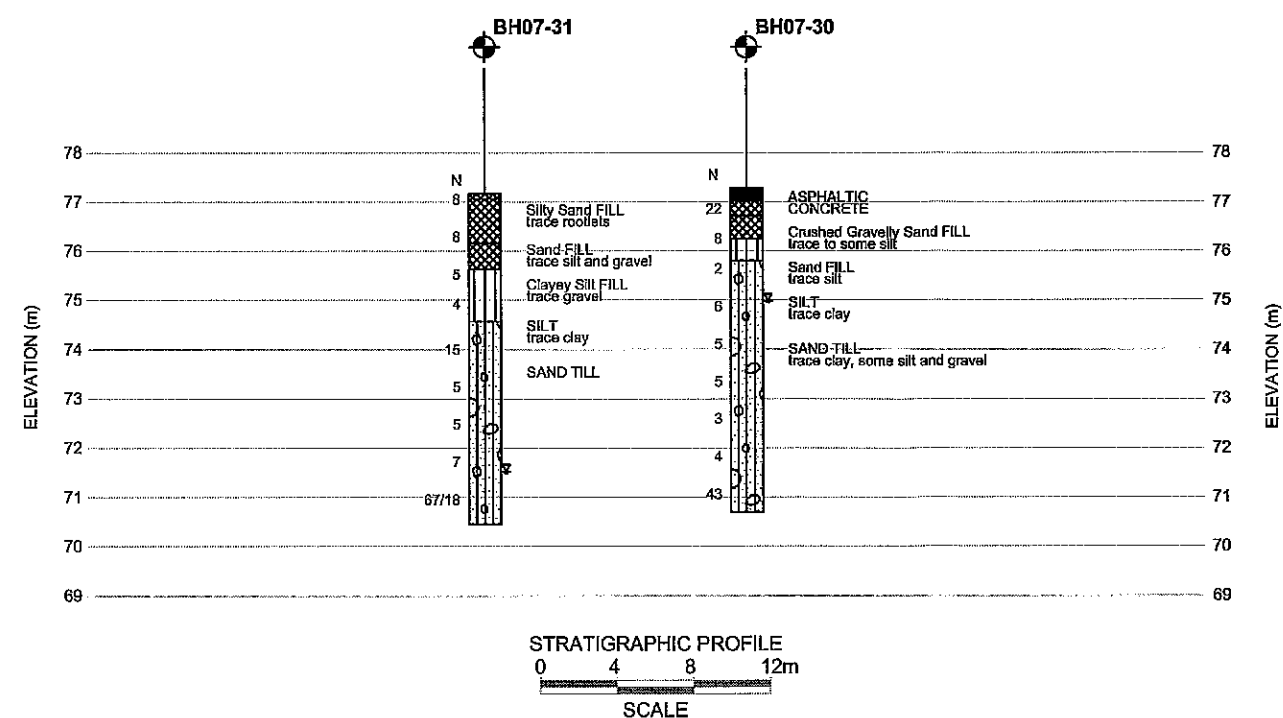
FOUNDATION INVESTIGATION FOR
OVERHEAD SIGN
HIGHWAY 417 / WOODROFFE W-N/S, OTTAWA, ON

amec

AMEC Earth & Environmental,
a Division of AMEC Americas Limited



LEGEND			
 BOREHOLE LOCATION			
BOREHOLE	MTM COORDINATES		ELEVATION (m)
	NORTHING	EASTING	
BH07-30	5024660	362149	77.27
BH07-31	5024673	362143	77.16



APPENDIX B

BOREHOLE RECORDS (BH07-30 AND BH07-31)

EXPLANATION OF BOREHOLE LOG

This form describes some of the information provided on the borehole logs, which is based primarily on examination of the recovered samples, and the results of the field and laboratory tests. Additional description of the soil/rock encountered is given in the accompanying geotechnical report.

GENERAL INFORMATION

Project details, borehole number, location coordinates and type of drilling equipment used are given at the top of the borehole log.

SOIL LITHOLOGY

Elevation and Depth

This column gives the elevation and depth of inferred geologic layers. The elevation is referred to the datum shown in the Description column.

Lithology Plot

This column presents a graphic depiction of the soil and rock stratigraphy encountered within the borehole.

Description

This column gives a description of the soil strata, based on visual and tactile examination of the samples augmented with field and laboratory test results. Each stratum is described according to the *Modified Unified Soil Classification System*.

The compactness condition of cohesionless soils (SPT) and the consistency of cohesive soils (undrained shear strength) are defined as follows (*Ref. Canadian Foundation Engineering Manual*):

Compactness of		Consistency of		Undrained Shear Strength	
<u>Cohesionless</u>	<u>SPT N-Value</u>	<u>Cohesive Soils</u>	<u>kPa</u>	<u>psf</u>	
<u>Soils</u>					
Very loose	0 to 4	Very soft	0 to 12	0 to 250	
Loose	4 to 10	Soft	12 to 25	250 to 500	
Compact	10 to 30	Firm	25 to 50	500 to 1000	
Dense	30 to 50	Stiff	50 to 100	1000 to 2000	
Very Dense	> 50	Very stiff	100 to 200	2000 to 4000	
		Hard	Over 200	Over 4000	

Soil Sampling

Sample types are abbreviated as follows:

SS	Split Spoon	TW	Thin Wall Open (Pushed)	RC	Rock Core
AS	Auger Sample	TP	Thin Wall Piston (Pushed)	WS	Washed Sample

Additional information provided in this section includes sample numbering, sample recovery and numerical testing results.

Field and Laboratory Testing

Results of field testing (e.g., SPT, pocket penetrometer, and vane testing) and laboratory testing (e.g., natural moisture content, and limits) executed on the recovered samples are plotted in this section.

Instrumentation Installation

Instrumentation installations (monitoring wells, piezometers, inclinometers, etc.) are plotted in this section. Water levels, if measured during fieldwork, are also plotted. These water levels may or may not be representative of the static groundwater level depending on the nature of soil stratum where the piezometer tips are located, the time elapsed from installation to reading and other applicable factors.

Comments

This column is used to describe non-standard situations or notes of interest.

MODIFIED "UNIFIED CLASSIFICATION SYSTEM FOR SOILS"						
"The soil of each stratum is described using the Unified Soil Classification System (Technical Memorandum 38-357 prepared by Waterways Experiment Station, Vicksburg, Mississippi, Corps of Engineers, U.S. Army, Vol. 1 March 1953.) modified slightly so that an inorganic clay of 'medium plasticity' is recognized."						
MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA	
COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75µm)	GRAVELS MORE THAN HALF THE COARSE FRACTION LARGER THAN 4.75mm	CLEAN GRAVELS (TRACE OR NO FINES)	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} \geq 4; C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$	
			GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS	
		DIRTY GRAVELS (WITH SOME OR MORE FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I. MORE THAN 4	
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I. MORE THAN 7	
	SANDS MORE THAN HALF THE COARSE FRACTION SMALLER THAN 4.75mm	CLEAN SANDS (TRACE OR NO FINES)	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} \geq 6; C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$	
			SP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS	
		DIRTY SANDS (WITH SOME OR MORE FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I. MORE THAN 4	
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I. MORE THAN 7	
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75µm)	SILTS BELOW "A" LINE (NEGLECTIBLE ORGANIC CONTENT)	$W_L < 50\%$	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW)	
		$W_L < 50\%$	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS		
	CLAYS ABOVE "A" LINE (NEGLECTIBLE ORGANIC CONTENT)	$W_L < 30\%$	CL	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY OR SILTY CLAYS, LEAN CLAYS		
		$30\% < W_L < 50\%$	CI	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS		
		$W_L < 50\%$	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS		
	ORGANIC SILTS & CLAYS BELOW "A" LINE	$W_L < 50\%$	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	WHENEVER THE NATURE OF THE FINES CONTENT HAS NOT BEEN DETERMINED, IT IS DESIGNATED BY THE LETTER "P", E.G. SF IS A MIXTURE OF SAND WITH SILT OR CLAY	
		$W_L < 50\%$	OH	ORGANIC CLAYS OF HIGH PLASTICITY		
	HIGH ORGANIC SOILS			PI	PEAT AND OTHER HIGHLY ORGANIC SOILS	

SOIL COMPONENTS					
FRACTION	U.S. STANDARD SIEVE SIZE		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS		
GRAVEL	COARSE	PASSING	RETAINED	PERCENT	DESCRIPTOR
		75 mm	10 mm	35-50	AND
	FINE	10 mm	4.75 mm	20-35	VERY
SAND	COARSE	4.75 mm	2.00 mm	10-20	SOME
	MEDIUM	2.00 mm	425 µm	1-10	TRACE
	FINE	425 µm	75 µm		
FINES (SILT OR CLAY BASED ON PLASTICITY)		75 µm			
OVERSIZED MATERIAL					
ROUNDED OR SUBROUNDED: COBBLES 75 mm TO 200 mm BOULDERS > 200 mm			NOT ROUNDED: ROCK FRAGMENTS > 75 mm ROCKS > 0.76 CUBIC METRE IN VOLUME		

Plasticity Chart for Soil Passing 425 Micron Sieve

AMEC Earth & Environmental
104 Crockford Boulevard
Scarborough, ON M1R 3C3
Ph: (416) 751-6565
Fax: (416) 751-7592
www.amec.com

amec

Note 1: Soils are classified and described according to their engineering properties and behaviour.
Note 2: The modifying adjectives used to define the actual or estimated percentage range by weight of minor components are consistent with the Canadian Foundation Engineering Manual (3rd Edition, Canadian Geotechnical Society, 1992.)
Rev 5 Nov. '06

1 OF 1

G.W.P. 4349-06-00	LOCATION HWY 417 / Woodroffe Ave. W-N/S Ramp (N:5024660.33 E:362148.53)	ORIGINATED BY CM
DIST HWY 417, Ottawa	BOREHOLE TYPE Hollow Stem Augering	COMPILED BY SN
DATUM Geodetic	DATE June 28, 2007	CHECKED BY WF
PROJECT Woodroffe W-N/S Ramp - Overhead Sign		JOB NO. TZ71046

[illegible]

+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

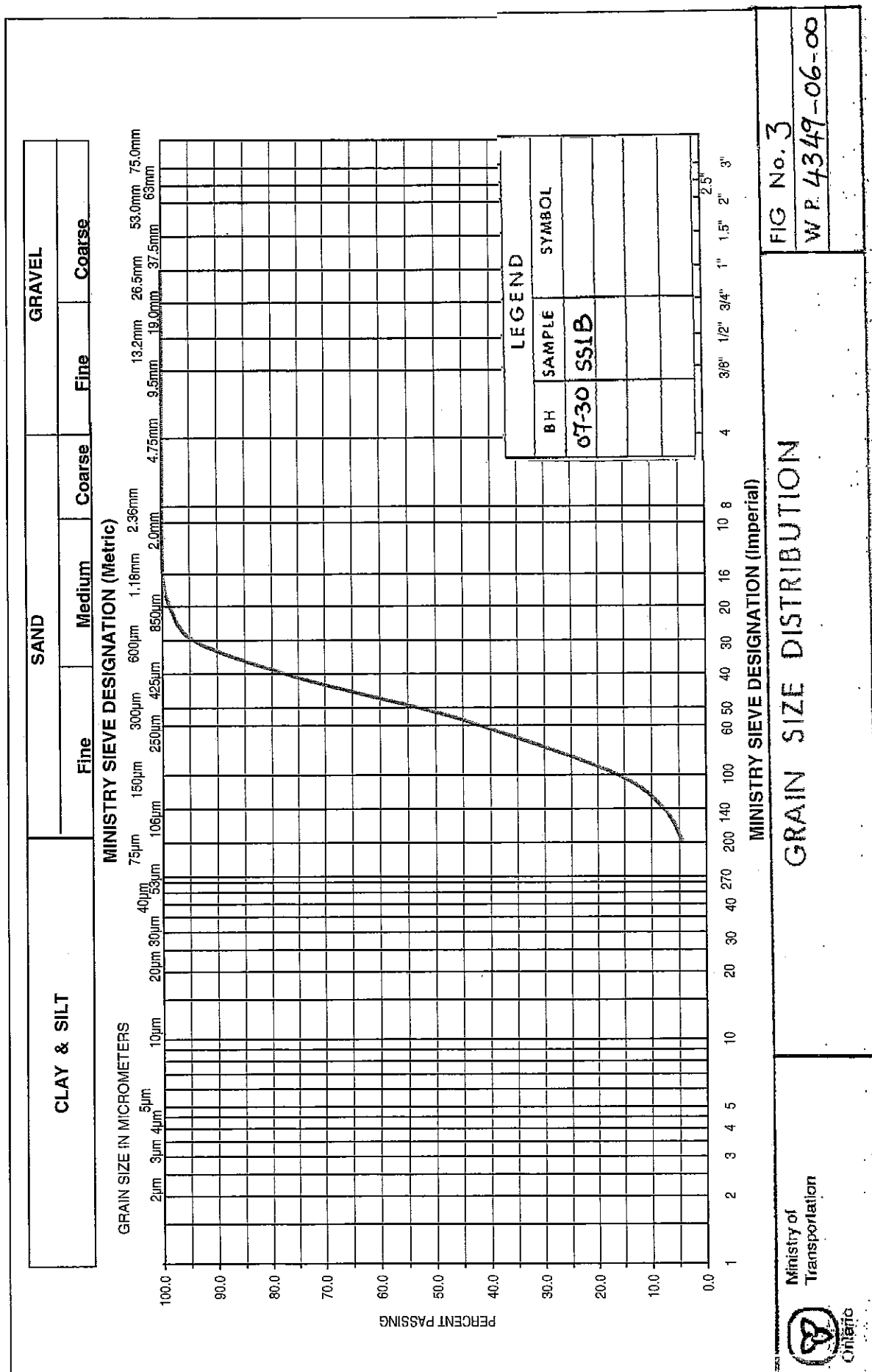
RECORD OF BOREHOLE No BH 07-31

G.W.P. 4349-06-00 LOCATION HWY 417 / Woodroffe Ave. W-N/S Ramp (N:5024672.69 E:362142.74) 1 OF 1 ORIGINATED BY CM
 DIST HWY 417, Ottawa BOREHOLE TYPE Hollow Stem Augering COMPILED BY SN
 DATUM Geodetic DATE June 29, 2007 CHECKED BY WF
 PROJECT Woodroffe W-N/S Ramp - Overhead Sign JOB NO. TZ71046

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION SCALE m	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 (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa									WATER CONTENT (%)		
									○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE								
77.2 0.1	dark brown Silty Sand FILL trace rootlets brown Sand FILL trace silt and gravel		1	SS	8															
76.2 1.0	dark brown Clayey Silt FILL trace gravel		2	SS	8															
75.6 1.5	brown SILT trace clay firm		3	SS	5															
74.6 2.6	grey SAND TILL some silt and gravel, trace clay loose to very dense moist to wet		4	SS	4															
			5	SS	15															
			6	SS	5															
			7	SS	5															
			8	SS	7															
			9	SS	67/18															
70.5 6.7	End of Borehole Auger refusal on possible bedrock at 6.7 m depth Groundwater in open borehole on completion: 5.6 m																			

APPENDIX C

LABORATORY TEST RESULTS (FIGURE NOS. 3, 4, 5 AND 6)



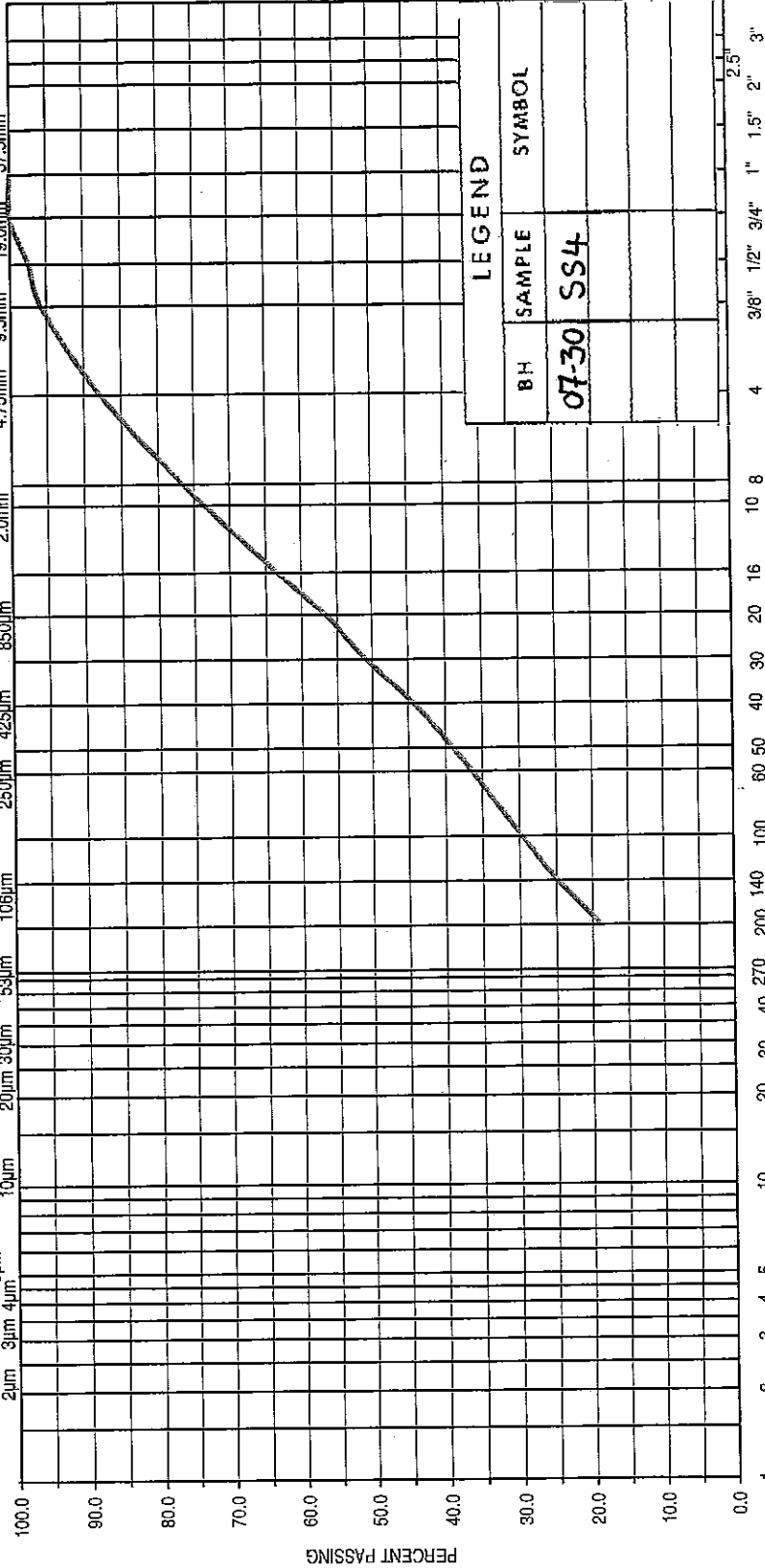
UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse

MINISTRY SIEVE DESIGNATION (Metric)

GRAIN SIZE IN MICROMETERS

2µm	3µm	4µm	5µm	10µm	20µm	30µm	40µm	50µm	60µm	75µm	106µm	150µm	200µm	250µm	300µm	425µm	600µm	850µm	1.18mm	1.18mm	2.36mm	4.75mm	9.5mm	19.0mm	26.5mm	53.0mm	75.0mm
-----	-----	-----	-----	------	------	------	------	------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------	--------	--------	-------	--------	--------	--------	--------



LEGEND

BH	SAMPLE	SYMBOL
07-30	SS4	

MINISTRY SIEVE DESIGNATION (Imperial)

GRAIN SIZE DISTRIBUTION

FIG No. 4

W.P. 4349-06-00

Ministry of
Transportation



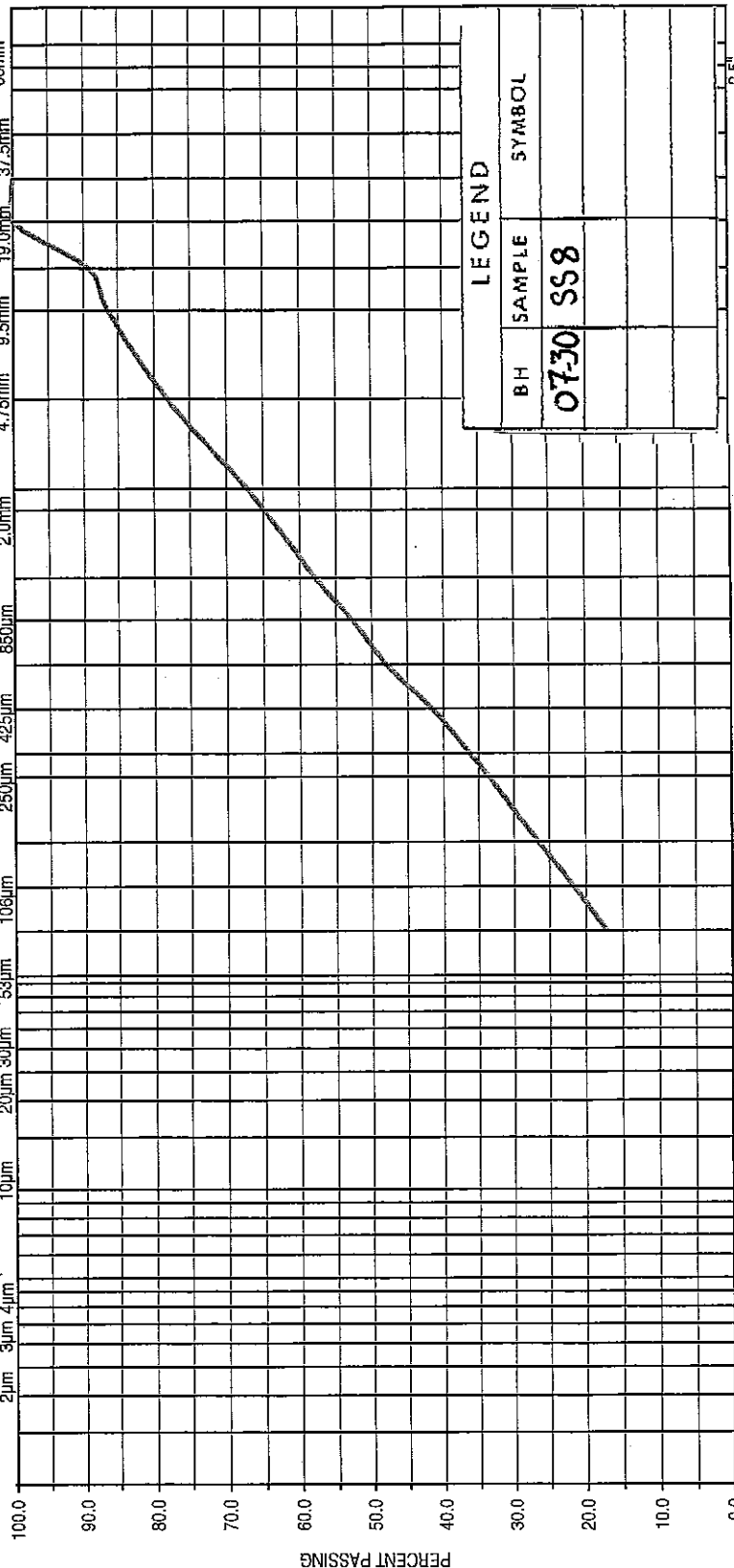
UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse

MINISTRY SIEVE DESIGNATION (Metric)

GRAIN SIZE IN MICROMETERS

2µm	3µm	4µm	5µm	10µm	20µm	30µm	40µm	50µm	60µm	75µm	106µm	150µm	200µm	250µm	300µm	425µm	600µm	850µm	1.18mm	2.36mm	4.75mm	9.5mm	19.0mm	28.5mm	37.5mm	53.0mm	75.0mm
-----	-----	-----	-----	------	------	------	------	------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------



LEGEND

BH	SAMPLE	SYMBOL
0730	SS8	

MINISTRY SIEVE DESIGNATION (Imperial)

1	2	3	4	5	10	20	30	40	60	100	140	200	270	30	40	60	100	140	200	270	300	425	600	850	1.18	2.36	4.75	9.5	19	28.5	37.5	53	75
---	---	---	---	---	----	----	----	----	----	-----	-----	-----	-----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	------	------	------	-----	----	------	------	----	----

GRAIN SIZE DISTRIBUTION

Ministry of
Transportation



FIG No. 5

W P 4349-06-00

C.O.C.: 123417

REPORT No. B07-20572

Report To:

AMEC
300 - 210 Colonnade Road South
Nepean, Ontario, K2E 7L5

Attention: Wissam Farah

Caduceon Environmental Laboratories

2378 Holly Lane
Ottawa, Ontario, K1V 7P1
Tel: 613-526-0123
Fax: 613-526-1244

DATE RECEIVED: 13-Jul-07

JOB/PROJECT NO.: TZ71046 MTO


DATE REPORTED: 23-Jul-07

P.O. NUMBER:

SAMPLE MATRIX: Soil

WATERWORKS NO.

			Client I.D.:	07-31 SS4B	07-30 SS3		
			Sample I.D.:	B07-20572-1	B07-20572-2		
			Date Collected:				
Parameter	Units	M.D.L.	Reference Method	Date Analyzed			
pH	pH Units		EPA 150.1	20-Jul-07	7.90	8.04	
Resistivity	ohms-cm		SM 2510	20-Jul-07	1110	1400	
Chloride	µg/g	5	EPA 300.0	22-Jul-07	617	500	
Sulphate	µg/g	10	EPA 300.0	22-Jul-07	80	40	



Gord Murphy
Lab Supervisor

M.D.L. = Method Detection Limit

Accredited by the Standards Council of Canada and CAEAL for specific tests.

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior written consent from Caduceon Environmental Laboratories.

APPENDIX D

NON-STANDARD SPECIAL PROVISIONS (NSSP)

NON STANDARD SPECIAL PROVISION (NSSP)

The following NSSP should be considered in the construction:

1. The soil conditions at the site contain cobbles / boulders which will have to be removed from the excavation for foundation and / or the augured holes for the post foundations.
2. It should also be noted that loose fill and sand materials were encountered during the investigation programme. Therefore, casing installation prior to auguring is recommended during the auguring process for the concrete caisson installation in order to protect sides of the augured hole from collapsing or caving in.

APPENDIX E

REPORT LIMITATIONS

REPORT LIMITATIONS

The conclusions and recommendations given in this report are based on information determined at the testhole locations. The information contained herein in no way reflects on the environmental aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the testholes may differ from those encountered at the testhole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. It is recommended practice that the Geotechnical Engineer be retained during the construction to confirm that the subsurface conditions across the site do not deviate materially from those encountered in the testholes.

The design recommendations given in this report are applicable only to the project described in the text, and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, we recommend that we be retained during the final design stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid.

The comments made in this report relating to potential construction problems and possible methods of construction are intended only for the guidance of the designer. The number of testholes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices. No other warranty is expressed or implied.

The benchmark and elevations mentioned in this report were obtained strictly for use by this office in the geotechnical design of the project. They should not be used by any other party for any other purpose.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. AMEC Earth & Environmental accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

