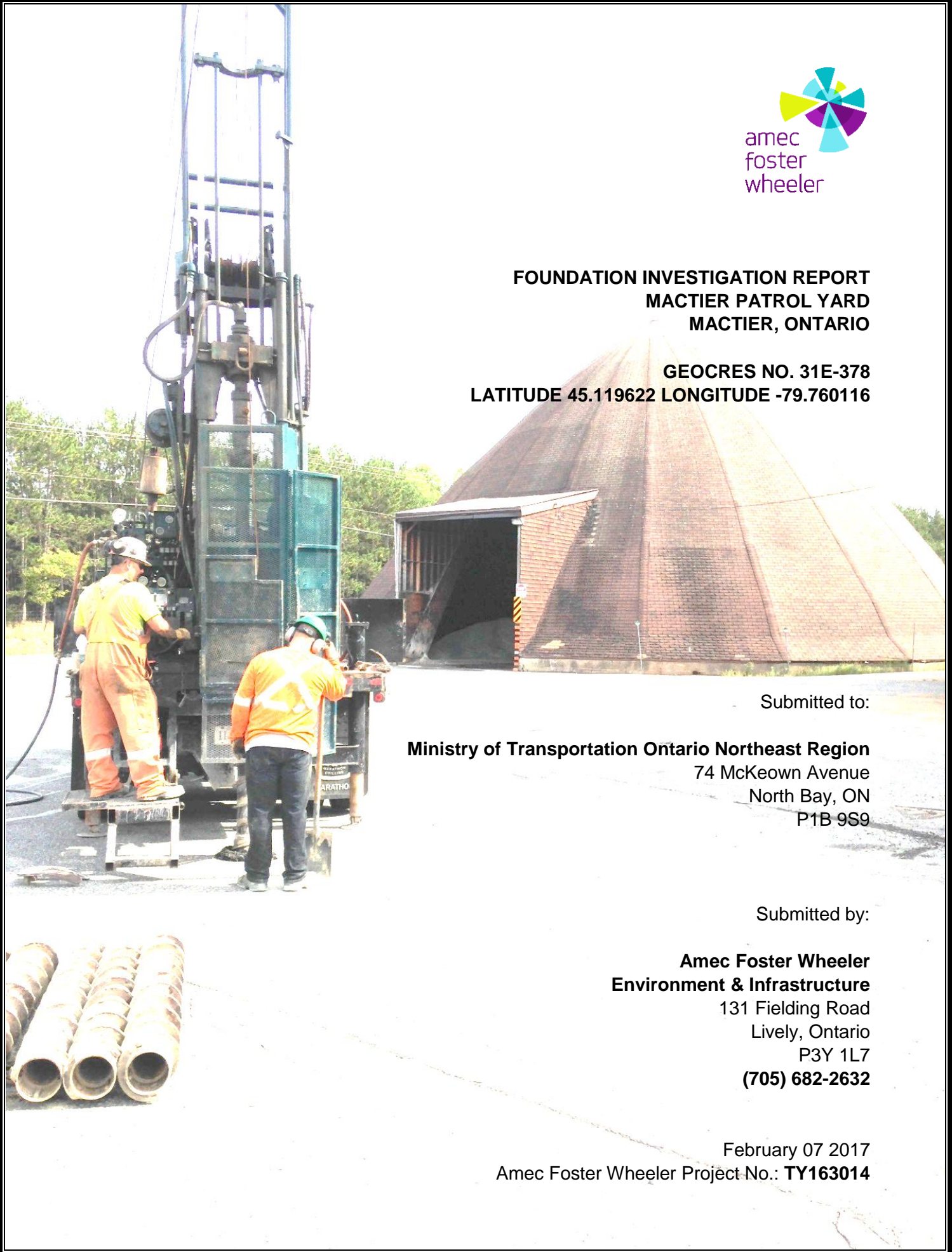




**FOUNDATION INVESTIGATION REPORT
MACTIER PATROL YARD
MACTIER, ONTARIO**

**GEOCRES NO. 31E-378
LATITUDE 45.119622 LONGITUDE -79.760116**



Submitted to:

**Ministry of Transportation Ontario Northeast Region
74 McKeown Avenue
North Bay, ON
P1B 9S9**

Submitted by:

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Environment & Infrastructure
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February 07 2017
Amec Foster Wheeler Project No.: **TY163014**

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PART A

FOUNDATION INVESTIGATION REPORT
MACTIER PATROL YARD
MACTIER, ONTARIO

1.0 INTRODUCTION

1.1 Background

Amec Foster Wheeler Environment & Infrastructure (Amec Foster Wheeler) has been retained by The Ministry of Transportation Ontario, Northeast Region (MTO), for provision of foundation engineering services at six Patrol Yards as part of the Assignment No. 5015-E-0064.

This report addresses the results of the subsurface investigation carried out by Amec Foster Wheeler at the MTO MacTier Patrol Yard, located on the west side of Muskoka Road 11 (High Street) in MacTier, Ontario as shown on Drawing 1.

The terms of reference and scope of work for the foundation engineering services are outlined in MTO's Request for Quotation (RFQ), and associated Addendum and clarification responses for the Assignment.

The purpose of this investigation was to determine the subsurface and groundwater conditions as well as relevant soil properties within the subject site in order to provide recommendations for the foundation design aspects of the proposed development at the yard. Amec Foster Wheeler understands the MTO plans to construct a new sand/salt storage building structure at the MacTier Patrol Yard. This structure is to have an approximate area of 432 m² (18 m by 24 m), as shown on Drawing 1.

1.2 Site Description

The patrol yard is located in MacTier within the Township of Georgian Bay, Ontario. The entrance to the site is at the intersection of Muskoka Road 11 (High Street), and Curling Club Road approximately 4.4 km northeast of the intersection of Lake Joseph Road and Highway 69. The latitude and longitude coordinates for the site are Latitude 45.119622 and Longitude -79.760116.

At the time of the investigation, two salt/sand storage domes were located at the south portion of the Patrol Yard. One office/garage building was located to the north of the domes, adjacent to the site entrance. The remaining areas of the yard were generally vacant land, stockpile areas, and vehicle parking areas. Photographs of the site are included in Appendix A.

The proposed new structure is planned to be constructed between the most westerly sand/salt dome and the MTO office/garage as shown on Drawing 1.

1.3 Site Geology

The general surficial geology in the area of the site, can be characterized as coarse textured glaciolacustrine sand and gravel deposits with minor deposits of sands and silts overlying bedrock, according to Ministry of Northern Development and Mines (MNDM) "Surficial Geology" map,

The bedrock in the area of the site can be described as Precambrian (Proterozoic): aged migmatitic rocks and gneisses of undetermined protolith according to MNDM “Geology Survey August 2003, 1:250,000 Bedrock Geology of Ontario” map. The area is located in the Grenville geological province.

2.0 INVESTIGATION PROGRAM

2.1 Soil Drilling Investigation

The fieldwork at the site was carried out on September 20 and 21, 2016, when five boreholes (BH16-01 to BH16-05) were advanced within the proposed maintenance structure footprint to depths between 3.6 m and 12.1 m below the existing ground surface.

The borehole locations (referenced to the MTM NAD83 Zone 10 northing and easting co-ordinate system), the ground surface elevations (referenced to Geodetic datum) and the drilled depths are summarized below and are shown on Drawing 1.

Table 1: MacTier Borehole Summary

Approximate Area	Borehole Designation	Location (MTM NAD83 Zone 10)		Ground Surface Elevation (m)	Borehole Depth ¹ (m)
		Northing (m)	Easting (m)		
Northeast Corner	BH16-01	4,997,724	284,377	242.7	10.1
Southwest Corner	BH16-02	4,997,693	284,359	241.2	12.4
Northwest Corner	BH16-03	4,997,714	284,351	242.2	3.6
Centre	BH16-04	4,997,707	284,370.	242.0	12.1
Southeast Corner	BH16-05	4,997,703	284,385	241.7	11.3

1 – Depth includes depth of coring.

The ground surface elevation at the borehole locations were surveyed by Amec Foster Wheeler personnel. The existing footing of the MTO Garage with a known elevation of 242.870 m was used as a local benchmark. The borehole locations were also geo-referenced to MTM co-ordinates using a hand-held Global Positioning System (GPS) unit. The elevation and GPS co-ordinates can also be found on the Record of Borehole sheets.

The boreholes were advanced using hollow stem augers and conventional soil sampling methods under the supervision of an Amec Foster Wheeler technician, providing soils information along

with relative soil density under the direction of the Amec Foster Wheeler project manager. Soil samples were collected at predetermined depth intervals in accordance with Standard Penetration Testing (SPT) procedures (ASTM D-1586) utilizing a mechanical hammer. Test results are recorded on the Record of Borehole sheets as 'N'-values. These values provide an indication of the various soil strata's condition with respect to compactness or consistency. The samples were placed in plastic bags and delivered to Amec Foster Wheeler's geotechnical laboratory in Sudbury for further examination and testing. One soil sample was submitted to AGAT Laboratories in Mississauga, Ontario, for analytical testing for pH, chlorides, sulphates and resistivity.

2.2 Laboratory Testing

In accordance with the TOR and Amec Foster Wheeler's proposal for this investigation, the following laboratory tests were conducted:

- Natural water content (41)
- Grain size distribution (11)
- Hydrometer (5)
- pH, chlorides, sulphates, resistivity (1)

The results of in-situ and laboratory tests are presented in the Record of Boreholes in Appendix B. The grain size distribution curves and plasticity chart, and the results of soil corrosivity tests are included in Appendix C

3.0 SUB-SURFACE CONDITIONS

A summary of the subsurface conditions encountered in the boreholes is presented below and the Record of Borehole sheets are included in Appendix B.

3.1 Asphalt

Surficial asphaltic concrete pavement was encountered in Boreholes BH16-01, BH16-04 and BH16-05. Asphalt was not present at Boreholes BH16-02 and BH16-03. The thickness of the asphalt was approximately 75 mm at the borehole locations.

3.2 Fill

An approximately 0.6 m thick layer of sand fill containing trace gravel was encountered below the asphalt in Boreholes BH16-01, and BH16-05. Sand fill was present at the ground surface at Boreholes BH16-02 and BH16-03. The fill thickness at these two boreholes was between 0.7m and 0.9 m. Measured SPT 'N' values within the fill ranged from 16 blows to 43 blows per 0.3 m of penetration, indicating a compact to dense compactness.

Laboratory testing on selected fill samples measured water contents ranging from 3% to 7% of the material's dry weight.

3.3 Sand

Sand was encountered below the asphalt in Borehole BH16-04 and underlying the fill in Boreholes BH16-01, BH16-02 and BH16-03. The sand consisted of trace gravel and trace to some silt. The deposit extended to depths ranging from 3.1 m to 7.6 m (Elevation 239.2 m to 233.6 m). The colour of the deposit changed with depth from orange/yellow sand, which was encountered in the first metre, to brownish grey sand with depth.

SPT 'N' values measured within the deposit ranged between 13 blows and 40 blows per 0.3 m of penetration, indicating a compact to dense compactness, predominantly compact to dense. The natural moisture content, as measured for collected split spoon samples recovered from the boreholes ranged from 3% to 21%.

Seven grain size distribution tests were completed on selected samples of the deposit, the results are as follows:

- Gravel (%): 0 to 5
- Sand (%): 81 to 95
- Silt and Clay Size (%): 3 to 19

The grain size distribution curves are presented in Appendix C.

3.4 Silty Sand

Silty sand was encountered below the fill in Borehole BH16-05. The silty sand consisted of trace gravel. The deposit extended to 7.6 m depth (Elevation 234.1).

SPT 'N' values measured within the deposit ranged between 8 blows and 45 blows per 0.3 m of penetration, indicating a loose to dense compactness, predominantly compact to dense. The natural moisture content, as measured for collected split spoon samples recovered from the boreholes ranged from 7% to 22%.

Two grain size distribution tests were completed on selected samples of the deposit, the results are as follows:

- Gravel (%): 0 to 1
- Sand (%): 61 to 69
- Silt and Clay Size (%): 30 to 39

The grain size distribution curves are presented in Appendix C.

3.5 Silty Sand (Till)

A layer of silty sand till, trace gravel was encountered below the sand in Boreholes BH-01 to BH-04. The layer ranged in thickness from 0.4 m to 3.3 m, extending to the termination depth of each of the four boreholes, where refusal to the drilling equipment on possible cobbles/boulders or bedrock was encountered. SPT 'N' values within the silty sand till ranged from 18 blows per 0.3 m of penetration to greater than 50 blows per 0.25 of penetration indicating a compact to very dense condition.

The natural moisture content, as measured for selected samples of the silty sand till ranged from 9% to 21%. One grain size distribution test was completed on a split spoon sample collected of the silty sand, the results are as follows:

- Gravel (%): 0
- Sand (%): 70
- Silt (%): 30

The grain size distribution curve is presented in Appendix C.

Three atterberg limits tests were attempted on the silty sand on the split spoon samples collected of the silty sand till and the results indicated that the fine portion of the silty sand till is non-plastic.

3.6 Sand (Till)

Sand till, some silt and some gravel was encountered below the silty sand in Borehole BH-05. The thickness of the sand till layer was 3.7 m, extending to the termination depth of the borehole, where refusal to the drilling equipment on possible cobbles/boulders or bedrock was encountered. SPT 'N' values within the sand till ranged from 17 blows to 61 blows per 0.3 m of penetration indicating a compact to very dense condition.

The natural moisture content, as measured for selected samples of the sand till ranged from 14% to 20%. One grain size distribution test was completed on a split spoon sample collected of the sand till, the results are as follows:

- Gravel (%): 11
- Sand (%): 77
- Silt (%): 12

The grain size distribution curve is presented in Appendix C.

3.7 Bedrock

Bedrock was inferred by auger refusal in Boreholes BH16-03 and BH16-05 and was confirmed by coring in Boreholes BH16-01, BH16-02, and BH16-04. The bedrock coring was extended to the borehole termination depths ranging from 10.1 m to 12.4 m below the existing ground surface (Elevation 232.6 m to 228.8 m). The bedrock is comprised of Precambrian (Proterozoic) aged migmatitic rocks and gneisses of the Central Gneiss Belt. The Total Core Recovery (TCR) ranged from 67% to 100% and the Solid Core Recovery (SCR) ranged from 25% to 100%. The Rock Quality Designation (RQD) varied between 0% and 100%, with RQD quality increasing with depth in all boreholes, indicating a rock mass quality of very poor to excellent.

Photographs of the rock core are included in Appendix B.

3.8 Groundwater Conditions

Upon completion of drilling, groundwater was measured at a depth of between 3.9 m and 5.7 m below the existing grade. Coring was completed using drilling fluid in Boreholes BH16-01, BH16-02 and BH16-04. The use of the drilling fluid is expected to temporarily raise the groundwater level at the borehole locations where rock coring was carried out. The water level was measured twice in Borehole BH16-01, upon completion of drilling and several hours following completion. The water level was also measured twice in Borehole BH16-02, upon completion of drilling and the next morning upon arrival to site. The groundwater measurements are shown on the Record of Borehole sheets and are summarized below. In both boreholes, the water level dropped between 0.7 m and 0.8 m between the two water level measurements.

The groundwater at the site is expected to fluctuate seasonally and can be expected to be somewhat higher during the spring months and in response to major weather events.

Table 2: MacTier Groundwater Measurements

Approximate Area ¹	Borehole Designation	Location (MTM NAD83 Zone 10)		Ground Surface Elevation (m)	Water Level Depth Below Ground Surface ¹ (m)
		Northing (m)	Easting (m)		
Northeast Corner	BH16-01	4,997,724	284,377	242.7	3.9 and 4.7
Southwest Corner	BH16-02	4,997,693	284,359	241.2	4.0 and 4.7
Northwest Corner	BH16-03	4,997,714	284,351	242.2	N/A
Centre	BH16-04	4,997,707	284,370	242.0	4.7
Southeast Corner	BH16-05	4,997,703	284,385	241.7	5.7

¹ – BH16-01 and 02 water level measurements were taken 2 times (once at borehole completion and once several hours later).

3.9 Analytical (Chemical) Test Results

Split spoon sample number 4 from BH16-04 was sent to an independent laboratory for analytical testing comprising pH, sulphate, resistivity and chloride determination. The test results are presented in Appendix D.

4.0 CLOSURE

The Limitations of Report, as presented in Appendix E, forms an integral part of this report.

This Foundation Investigation Report was prepared by Nicholas Kicz, EIT, and reviewed by Mr. Mehdi Mostakhdemi, M.Sc., P.Eng. Mr. Ty Garde, M.Eng, P.Eng., a Designated MTO Foundations Contact for Amec Foster Wheeler, conducted an independent review of this report.

Respectfully submitted,

**Amec Foster Wheeler Environment & Infrastructure,
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APPENDIX A

SITE PHOTOGRAPHS

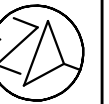
METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN



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Wheeler
Environment &
Infrastructure
A Division of Avec
Foster Wheeler
Americas Limited

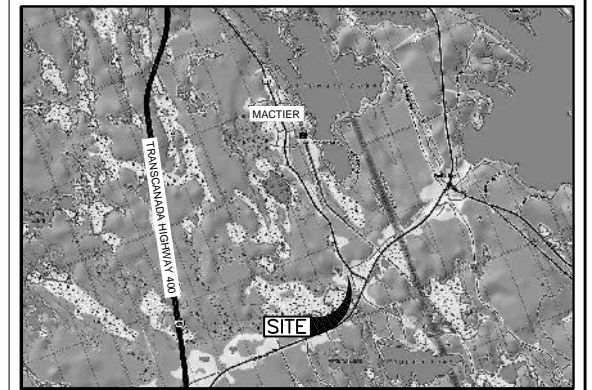
Foundation Investigation
and Design
Assignment No. 5015-E-0064
MacTier Patrol Yard
MacTier, Ontario



DRAWING

1

PROPOSED STORAGE STRUCTURE
BOREHOLE LOCATION PLAN AND
SOIL STRATA SECTION



KEY PLAN
0 0.5 1.0 1.5 2.0 2.5
Approximate Scale (km)

LEGEND

- BOREHOLE LOCATION - 2016 INVESTIGATION
- N SPT STANDARD PENETRATION TEST VALUE
- 10 BLOWS/0.3m UNLESS OTHERWISE STATED
(STD. PEN. TEST, 475 J/BLOW)
- REC RECOVERY
- R REFUSAL
- % ROCK QUALITY DESIGNATION (RQD)
- WATER LEVEL UPON COMPLETION OF DRILLING
- WATER LEVEL MEASURED SEVERAL
HOURS AFTER COMPLETION
- EXISTING STRUCTURE
- PROPOSED STRUCTURE

NOTES

- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH
THE ACCOMPANYING FOUNDATION DESIGN REPORT.
- THE INTERPRETED STRATIGRAPHY REPRESENTS
SIMPLIFIED SUBSURFACE CONDITIONS. THE
BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN
DEFINED AT BOREHOLE LOCATIONS ONLY. CONDITIONS
BETWEEN BOREHOLE LOCATIONS COULD DIFFER FROM
ILLUSTRATED CONDITIONS.
- ELEVATIONS ARE REFERENCED TO GEODETIC DATUM.

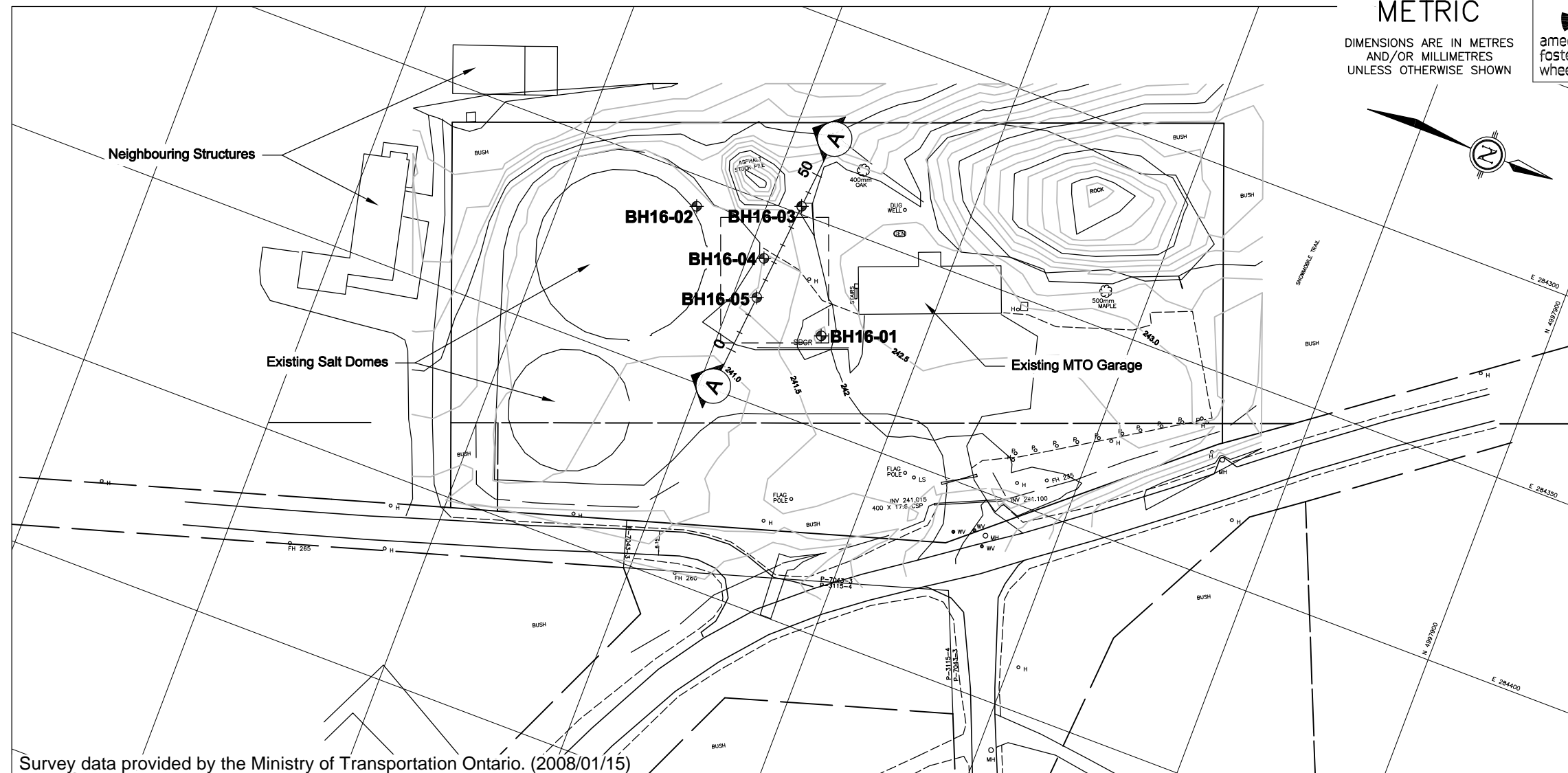
NUMBER	ELEVATION	CO-ORDINATES (MTM, NAD 83 ZONE 10)	
		NORTHING	EASTING
TESTHOLES BY OTHERS			
BH16-01	242.7	4997725	0284377
BH16-02	241.2	4997693	0284359
BH16-03	242.2	4997715	0284351
BH16-04	242.0	4997708	0284371
BH16-05	241.7	4997703	0284386

CENTER OF PROPOSED STRUCTURE
LATITUDE/LONGITUDE 45.119622, -79.760116

0 20 40 60
Approximate Scale (m)

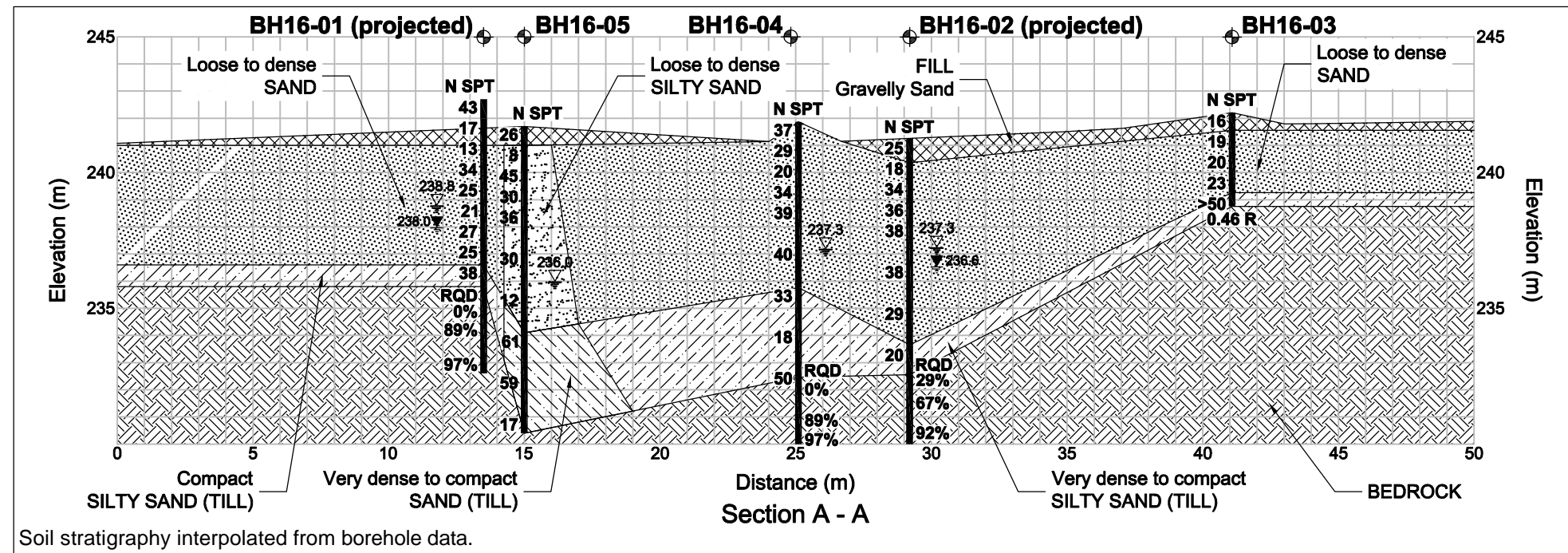
REVISIONS	DATE	REV.	BY	DESCRIPTION
02/09/2017	1	NK		REVISED PER MTO COMMENTS
DESIGN	NFK	CHK	DMC	CODE
DRAWN	MAT	CHK	NFK	DATE

DOC: TY163014 - MACTIER



Survey data provided by the Ministry of Transportation Ontario. (2008/01/15)

PLAN



Soil stratigraphy interpolated from borehole data.

CENTERLINE PROFILE





Photo 1

View of drilling operations facing north. The southwest corner of the MTO garage is shown on the left hand side.

20 Sept 2016



Photo 2

View of drill over BH16-02. The larger dome is visible in the background

20 Sept 2016

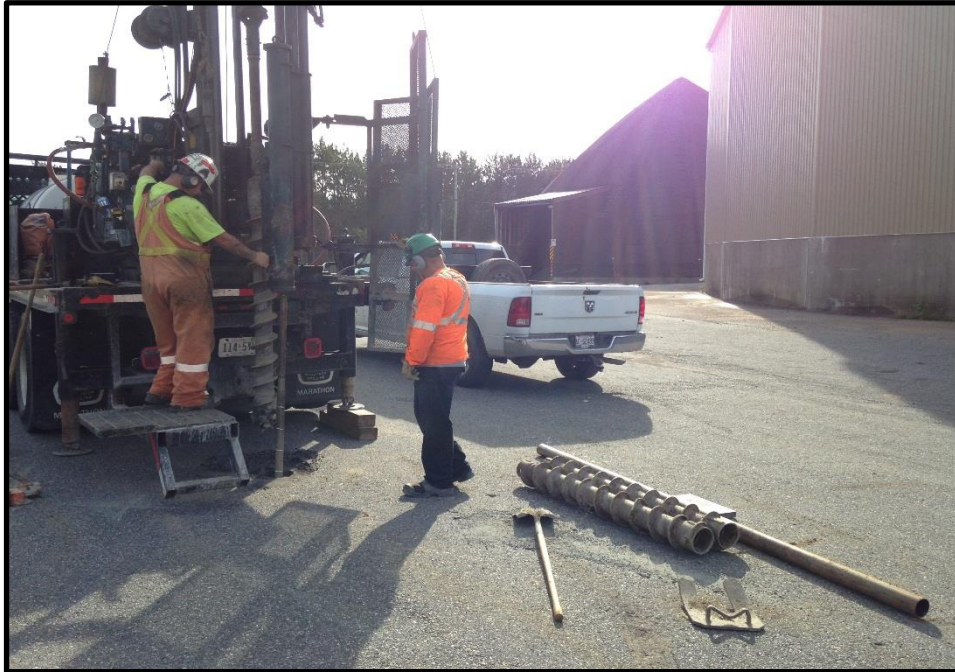


Photo 3

Drilling of borehole shown, with both domes shown in the background. Photo taken facing southeast

21 Sept 2016

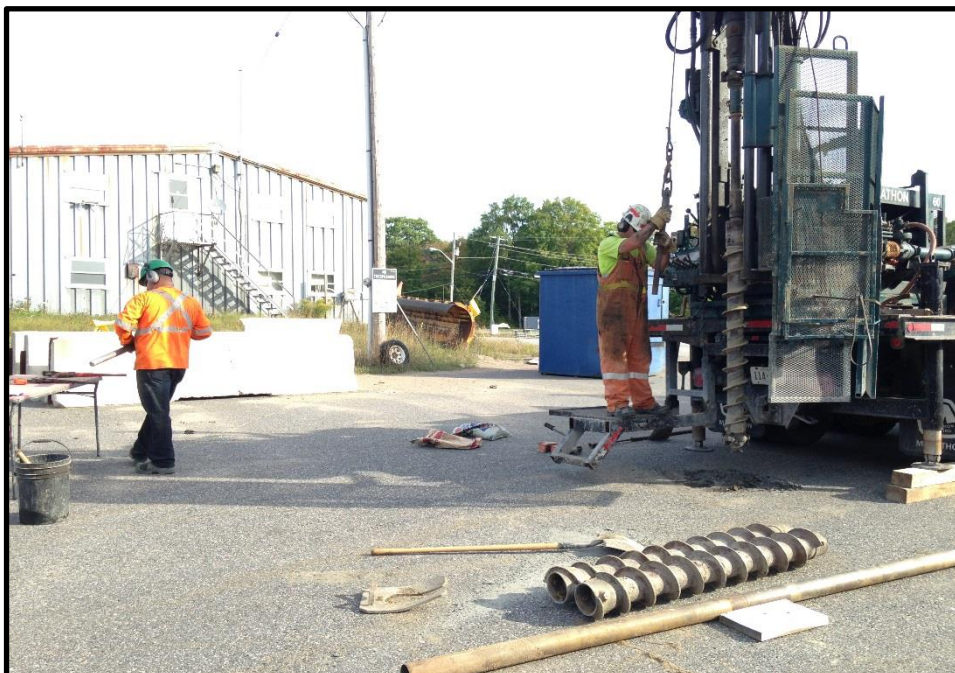


Photo 4

View of BH16-03 being drilled, with MTO Garage in the background. Photo taken facing northeast

20 Sept 2016

APPENDIX B

RECORD OF BOREHOLE NO. BH16-01 to BH 16-05

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 *MTC Soil Classification Manual*.

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

Compactness of Cohesionless Soils	SPT N-Value*
Very loose	0 to 5
Loose	5 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	> 50

Consistency of Cohesive Soils	Undrained Shear Strength kPa
Very soft	0 to 12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very stiff	100 to 200
Hard	Over 200

* For penetration of less than 0.3 m, N-values are indicated as the number of blows for the penetration achieved (e.g. 50/25: 50 blows for 25 centimeter penetration).

Soil Sampling

Sample types are abbreviated as follows:

SS Split Spoon	TW Thin Wall Open (Pushed)	RC Rock Core	GS Grab Sample
AS Auger Sample	TP Thin Wall Piston (Pushed)	WS Washed Sample	AR Air Return 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.

BEDROCK DESCRIPTION

STRENGTH CLASSIFICATION

Term (Grade)	Field Identification	Approximate Range of Uniaxial Compressive Strength (MPa)
Extremely Weak (R0)	Indented by thumbnail.	0.25 – 1.0
Very Weak (R1)	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife.	1.0 – 5.0
Weak (R2)	Can be peeled with a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer.	5.0 – 25
Medium Strong (R3)	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with a single firm blow of geological hammer.	25 – 50
Strong (R4)	Specimen requires more than one blow of geological hammer to fracture it.	50 – 100
Very Strong (R5)	Specimen requires many blows of geological hammer to fracture it.	100 – 250
Extremely Strong (R6)	Specimen can only be chipped with geological hammer.	>250

JOINT SPACING CLASSIFICATION

Term	Average Joint Spacing (m)
Extremely close	< 0.02
Very close	0.02 – 0.06
Close	0.06 – 0.20
Moderately close	0.20 – 0.6
Wide	0.6 – 2.0
Very wide	2.0 – 6.0
Extremely wide	> 6.0

ROCK QUALITY CLASSIFICATION

Rock Quality Designation, RQD (%)	Description of Rock Quality
0 – 25	Very Poor
25 – 50	Poor
50 – 75	Fair
75 – 90	Good
90 – 100	Excellent

Reference: Deere et al, 1967

WEATHERING CLASSIFICATION

Term (Grade)	Description
Fresh (W1)	No visible sign of rock material weathering; perhaps slight discoloration on major discontinuity surfaces.
Slightly Weathered (W2)	Discoloration indicates weathering of rock material on discontinuity surfaces. Less than 5 % of rock mass altered.
Moderately Weathered (W3)	Less than half of the rock material is decomposed and/or disintegrated into a soil. Fresh or discoloured rock is present either as a continuous framework or as core stones.
Highly Weathered (W4)	More than half of the rock material is decomposed and/or disintegrated into a soil. Fresh or discoloured rock is present either as a discontinuous framework or as core stones.
Completely Weathered (W5)	All rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.
Residual Soil (W6)	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume but the soil has not been significantly transported.

Reference: Brown, 1981, "Suggested Methods for Rock Characterization Testing and Monitoring". International Society for Rock Mechanics.

TERMINOLOGY

Rock Quality Designation (RQD) is defined as the percentage of intact core pieces longer than 100 mm (4 inches) to the total length of core. The core should be at least NW size (54.7 mm or 2.15 inches in diameter) and typically 5 ft (nominally 1.5 m) in length.

Solid Core Recovery (SCR) is defined as the percentage of intact cylindrical core pieces to the total length of core.

Total Core Recovery (TCR) is defined as the percentage of intact core pieces to the total length of core.

GROUNDWATER

▽ Groundwater level at completion of drilling.

▼ Groundwater level several hours after completion of drilling.

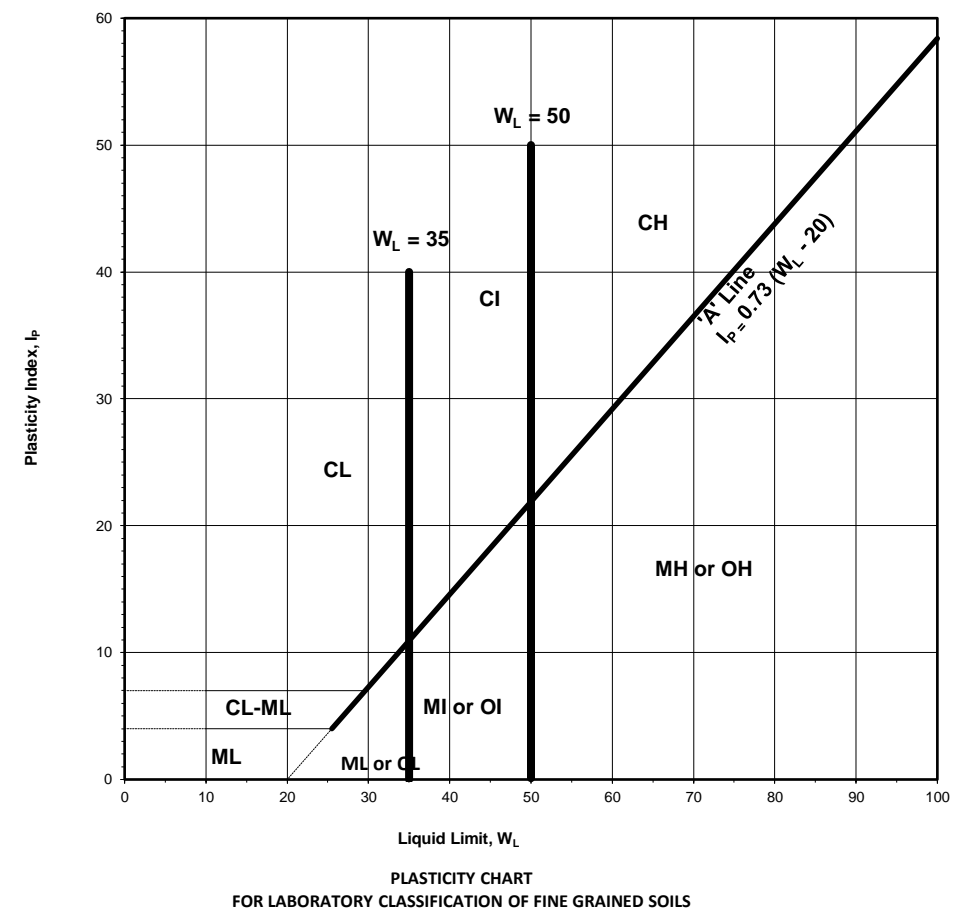


MTC SOIL CLASSIFICATION
Based on MTC Soil Classification Manual



MAJOR DIVISION					GROUP SYMBOL	TYPICAL DESCRIPTION	INFORMATION REQUIRED FOR DESCRIBING SOILS	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 (LITTLE OR NO FINES)	WIDE RANGE IN GRAIN SIZE & SUBSTANTIAL AMOUNTS OF ALL INTERMEDIATE PARTICAL SIZE		GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	GIVE TYPE, NAME, IF NECESSARY, INDICATE APPROX % OF SAND & GRAVEL ; MAX SIZE; ANGULARITY, SURFACE CONDITION, & HARDNESSOF THE COARSE GRAINS, LOCAL OR GEOLOGICAL NAME & OTHER PERTINENT DESCRIPTIVE INFORMATION, & SYMBOL IN PARENTHESIS. FOR UNDISTURBED SOILS ADD INFORMATION ON STRATIFICATION, DEGREE OF COMPACTNESS, CEMENTATION, MOISTURE CONDITION & DRAINAGE CHARACTERISTICS	$C_u = \frac{D_{60}}{D_{10}}$ GREATER THAN 4;			
			PREDOMINANTLY ONE SIZE OF A RANGE OF SIZES WITH STONE INTERMEDIATE SIZES MISSING		GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES		$C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ BETWEEN 1 AND 3			
		GRAVEL WITH FINES (APPLICABLE AMOUNT OF FINES)	NON PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE ML BELOW)		GM	SILTY GRAVELS, POORLY GRADED GRAVEL-SAND- SILT MIXTURES		NOT MEETING ALL GRADATION REQUIREMENTS FOR GW			
			PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE CL BELOW)		GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES					
	SANDS MORE THAN HALF THE COARSE FRACTION SMALLER THAN 4.75mm	CLEAN SANDS (LITTLE OR NO FINES)	WIDE RANGE IN GRAIN SIZE & SUBSTANTIAL AMOUNT OF ALL INTERMEDIATE PARTICLE SIZES		SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES		ATTENERBERG LIMITS BELOW A-LINE OR Ip LESS THAN 4			
			PREDOMINANTLY ONE SIZE OR A RANGE OF SIZES WITH SOME INTERMEDIATE SIZE MISSING		SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES					
		SANDS WITH FINES (APPLICABLE AMOUNT OF FINES)	NON PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE ML BELOW)		SM	SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES		ATTENERBERG LIMITS ABOVE A- LINE WITH Ip GREATER THAN 7			
			PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE CL BELOW)		SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES					
		FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75µm)	IDENTIFICATION PROCEDURE ON FRACTION SMALLER THAN 425µm							DETERMINE PERCENTAGE OF GRAVEL & SAND FROM GRAIN SIZE CURVE. DEPENDING ON PERCENTAGE OF FINES (FRACTION SMALLER THAN 75 µm) COARSE GRAINED SOILS ARE CLASSIFIED AS FOLLOWS: LESS THAN 5% GW, GP, SW, SP MORE THAN 12% GM, GC, SM, SC 5% TO 12% <u>BORDER LINE</u> CASES REQUIRE USE OF DUAL SYMBOL. USE GRAIN SIZE CURVE IN IDENTIFYING THE FACTORS AS GIVEN UNDER FIELD IDENTIFICATION	
			SILT AND CLAYS	LIQUID LIMIT LESS THAN 35	DRY STRENGTH (CRUSHING CHARACTERISTICS)	DILATANCY (REACTION TO SHAKING)		TOUGHNESS (CONSISTENCY NEAR PLASTIC LIMIT)			
NONE	QUICK				NONE	ML	INORGANIC SILTS & SANDY SILTS OR SLIGHTLY PLASTICITY, ROCK FLOUR				
MEDIUM TO HIGH	NONE TO VERY SLOW				MEDIUM	CL	SILTY CLAYS (INORGANIC), GRAVELLY CLAYS, SANDY CLAYS, LEAN CLAYS				
SLIGHT TO MEDIUM	SLOW				SLIGHT	OL	ORGANIC SILT OF LOW PLASTICITY, ORGANIC SANDY SILTS				
LIQUID LIMIT BETWEEN 35 AND 50	NONE TO SLIGHT			SLOW TO QUICK	SLIGHT	MI	INORGANIC COMPRESSIBLE FINE SANDY SILT WITH CLAY OF MEDIUM PLASTICIT, CLAYEY SILTS				
	HIGH			NONE	MEDIUM TO HIGH	CI	SILTY CLAYS (INORGANIC) OF MEDIUM PLASTICITY				
	SLIGHT TO MEDIUM			VERY SLOW	SLIGHT	OI	ORGANIC SILTY CLAYS OF MEDIUM PLASTICITY				
LIQUID LIMIT GREATER THAN 50	SLIGHT TO MEDIUM			SLOW TO NONE	MEDIUM	MH	INORGANIC SILTS, HIGHLY COMPRESSIBLE MICACEOUS OR DIATOMEACACOUS FINE SANDY SILTS, ELASTIC SILTS				
	HIGH TO VERY HIGH			NONE	HIGH	CH	CLAYS (INORGANIC) OF HIGH PLASTICITY, FAT CLAYS				
	MEDIUM TO HIGH			NONE TO VERY SLOW	SLIGHT TO MEDIUM	OH	ORGANIC CLAYS OF HIGH PLASTICITY				
HIGH ORGANIC SOILS READILY IDENTIFIED BY COLOUR, ODOUR, SPONGY FEEL & FREQUENTLY BY FIBROUS TEXTURE					Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS	ATTENERBERG LIMITS BELOW A- LINE OR Ip LESS THAN 4				
							ATTENERBERG LIMITS ABOVE A- LINE WITH Ip GREATER THAN 7				

FRACTION					
U.S STANDARD SIEVE SIZE			DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS		
GRAVEL	COARSE	PASSING	RETAINED	PERCENT	DESCRIPTOR
		75 mm	26.5 mm	Over 30	AND / WITH
	FINE	26.5 mm	4.75 mm	20-30	(ey) or (y)
SAND	COARSE	4.75 mm	2.00 mm	12-20	Some
	MEDIUM	2.00 mm	425 µm	5-12	Trace to some
	FINE	425 µm	75 µm	1-5	Trace
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	



BOUNDARY CLASSIFICATION: BOUNDARY CLASSIFICATION: SOILS POSSESSING CHARACTERISTICS OF TWO GROUPS ARE DESIGNATED BY COMBINATIONS OF GROUP SYMBOLS FOE EXAMPLE GW-GC
WELL GRADED GRAVEL-SAND MIXTURE WITH CLAY BINDER



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RECORD OF BOREHOLE No. BH16-01

1 OF 2

G.W.P. 5015-E-0064 LOCATION 284377.343 E, 4997724.872 N ORIGINATED BY MAS
DIST HWY BOREHOLE TYPE Hollow Stem Augers COMPILED BY PW
DATUM MTM NAD 83 ZONE 10 DATE 20 September 2016 - 20 September 2016 CHECKED BY TJG
PROJECT Foundation Investigation and Design Report - MacTier Patrol Yard, MacTier, Ontario JOB NO. TY163014

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT			SOIL VAPOUR READING	REMARKS & GRAIN SIZE DISTRIBUTION (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa					W _P	W	W _L		COV/ TOV (ppm)	GR	SA	SI	CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No. BH16-01

2 OF 2

G.W.P. 5015-E-0064	LOCATION 284377.343 E, 4997724.872 N	ORIGINATED BY MAS
DIST _____ HWY _____	BOREHOLE TYPE Hollow Stem Augers	COMPILED BY PW
DATUM MTM NAD 83 ZONE 10	DATE 20 September 2016 - 20 September 2016	CHECKED BY TJG
PROJECT Foundation Investigation and Design Report - MacTier Patrol Yard, MacTier, Ontario	JOB NO. TY163014	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	SOIL VAPOUR READING COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa										
									20 40 60 80 100										
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%)								
						20 40 60 80 100					20 40 60								
235.5	precambrian aged migmatite rocks and gneisses		10	RC															
7.2	TCR = 67% SCR = 25% RQD = 0% TCR = 98% SCR = 93% RQD = 89%		11	RC															
234.1	TCR = 100% SCR = 100% RQD = 97%		12	RC															
8.6																			
232.6	END OF BOREHOLE																		
10.1	Notes: 1) Groundwater was encountered at a depth of 3.9 m at completion. 2) Groundwater was measured at a depth of 4.7 m at 5:00 pm on September 20, 2016 in open borehole. 3) Borehole was backfilled with bentonite and auger cuttings on completion.																		

RECORD OF BOREHOLE No. BH16-02

1 OF 2

G.W.P. 5015-E-0064 LOCATION 284359.106 E, 4997693.499 N ORIGINATED BY MAS
DIST HWY BOREHOLE TYPE Hollow Stem Augers COMPILED BY PW
DATUM MTM NAD 83 ZONE 10 DATE 20 September 2016 - 20 September 2016 CHECKED BY TJG
PROJECT Foundation Investigation and Design Report - MacTier Patrol Yard, MacTier, Ontario JOB NO. TY163014

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	SOIL VAPOUR READING COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa									WATER CONTENT (%)			GR	SA	SI	CL
									○ UNCONFINED	● QUICK TRIAXIAL	+ FIELD VANE	× LAB VANE	20					40	60	80				
241.2	SW Corner of Proposed Building								20	40	60	80	100											
0.0	SAND trace gravel compact (FILL)		SS	1	25			241							5 _○									
240.3																								
0.9	SAND trace gravel dense to compact moist		SS	2	18		1	240							11 _○					5	83	(12)		
			SS	3	34		2								11 _○									
								239																
			SS	4	36		3								12 _○									
			SS	5	38			238							15 _○									







Continued Next Page

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

RECORD OF BOREHOLE No. BH16-02

2 OF 2

G.W.P. 5015-E-0064	LOCATION 284359.106 E, 4997693.499 N	ORIGINATED BY MAS
DIST _____ HWY _____	BOREHOLE TYPE Hollow Stem Augers	COMPILED BY PW
DATUM MTM NAD 83 ZONE 10	DATE 20 September 2016 - 20 September 2016	CHECKED BY TJG
PROJECT Foundation Investigation and Design Report - MacTier Patrol Yard, MacTier, Ontario		JOB NO. TY163014

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT			SOIL VAPOUR READING	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa					WATER CONTENT (%)							
														W _p	W	W _L					
○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE																					
									20	40	60	80	100	20	40	60	COV/ TOV (ppm)	GR	SA	SI	CL
								234													
233.6																					
7.6	SILTY SAND trace gravel compact (TILL)		SS	8	20		8	233								13					
232.5																					
8.7	BEDROCK precambrian aged migmatite rocks and gneisses TCR = 90% SCR = 38% RQD = 29%		RC	9			9	232													
231.4																					
9.8	TCR = 100% SCR = 100% RQD = 67%		RC	10			10	231													
231.0																					
10.2	TCR = 92% SCR = 92% RQD = 92%		RC	11			11	230													
229.7																					
11.5	TCR = 100% SCR = 100% RQD = 100%		RC	12			12	229													
228.8																					
12.4	END OF BOREHOLE																				
	Notes: 1) Groundwater was encountered at a depth of 4.0 m at completion. 2) Groundwater was encountered at a depth of 4.7 m on September 21, 2016 in open borehole. 3) Borehole was backfilled with bentonite and auger cuttings on completion.																				

RECORD OF BOREHOLE No. BH16-03

1 OF 1

G.W.P. 5015-E-0064	LOCATION 284351.193 E, 4997714.607 N	ORIGINATED BY MAS
DIST _____ HWY _____	BOREHOLE TYPE Hollow Stem Augers	COMPILED BY PW
DATUM MTM NAD 83 ZONE 10	DATE 21 September 2016 - 21 September 2016	CHECKED BY TJG
PROJECT Foundation Investigation and Design Report - MacTier Patrol Yard, MacTier, Ontario		JOB NO. TY163014

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	SOIL VAPOUR READING COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa										WATER CONTENT (%)		
									20	40	60	80	100						20	40	60
242.2	NW Corner of Proposed Building																				
0.0	SAND trace gravel compact (FILL)		SS	1	16			242						7 ₀							
241.5																					
0.7	SAND trace silt compact																				
			SS	2	19		1	241						8 ₀							
			SS	3	20		2							7 ₀		2 95	(3)				
								240													
			SS	4	23									4 ₀							
239.2							3														
3.1	SILTY SAND some gravel dense (TILL)		SS	5	50+ / 460mm			239						9 ₀		0 70	(30)				
238.7																Non Plastic					
3.5	END OF BOREHOLE DUE TO REFUSAL ON PROBABLE BOULDERS / COBBLES OR BEDROCK																				
	Notes: 1) Borehole was backfilled with bentonite and auger cuttings on completion.																				

RECORD OF BOREHOLE No. BH16-04

1 OF 2

G.W.P. 5015-E-0064 LOCATION 284370.768 E, 4997707.640 N ORIGINATED BY MAS
DIST HWY BOREHOLE TYPE Hollow Stem Augers COMPILED BY PW
DATUM MTM NAD 83 ZONE 10 DATE 21 September 2016 - 21 September 2016 CHECKED BY TJG
PROJECT Foundation Investigation and Design Report - MacTier Patrol Yard, MacTier, Ontario JOB NO. TY163014

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	SOIL VAPOUR READING COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa									WATER CONTENT (%)			GR	SA	SI	CL
									○ UNCONFINED	● QUICK TRIAXIAL	+ FIELD VANE	× LAB VANE	20					40	60	80				
242.0	Center of Proposed Building																							
240.0	75 mm ASPHALT																							
0.1	SAND, some silt trace gravel compact to dense, moist		SS	1	37													3	90 (7)					
			SS	2	29		1	241																
			SS	3	20																			
							2	240																
			SS	4	34																			
							3	239																
			SS	5	39																			
							4	238																
			SS	6	40																			

Continued Next Page

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

RECORD OF BOREHOLE No. BH16-04

2 OF 2

G.W.P. 5015-E-0064	LOCATION 284370.768 E, 4997707.640 N	ORIGINATED BY MAS
DIST _____ HWY _____	BOREHOLE TYPE Hollow Stem Augers	COMPILED BY PW
DATUM MTM NAD 83 ZONE 10	DATE 21 September 2016 - 21 September 2016	CHECKED BY TJG
PROJECT Foundation Investigation and Design Report - MacTier Patrol Yard, MacTier, Ontario		JOB NO. TY163014

[illegible]

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

RECORD OF BOREHOLE No. BH16-05

1 OF 2

G.W.P. 5015-E-0064 LOCATION 284385.523 E, 4997703.490 N ORIGINATED BY MAS
DIST HWY BOREHOLE TYPE Hollow Stem Augers COMPILED BY PW
DATUM MTM NAD 83 ZONE 10 DATE 21 September 2016 - 21 September 2016 CHECKED BY TJG
PROJECT Foundation Investigation and Design Report - MacTier Patrol Yard, MacTier, Ontario JOB NO. TY163014

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT			SOIL VAPOUR READING	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa					WATER CONTENT (%)				COV/ TOV (ppm)	GR	SA	SI	CL
									20	40	60	80	100	W _p	W	W _L						
241.7	SE Corner of Proposed Building																					
241.6	ASPHALT																					
0.1	SAND trace gravel dense (FILL)		SS	1	26																	
241.0								241														
0.7	SILTY SAND loose to dense moist		SS	2	8			1										1	69 (30)			
			SS	3	45			240														
								2														
			SS	4	30			239														
								3														
			SS	5	36													0	61 (39)			
								238											Non Plastic			
								4														
			SS	6	30			237														
								5														
								236														
								6														
			SS	7	12																	
								235														

Continued Next Page

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

RECORD OF BOREHOLE No. BH16-05

2 OF 2

G.W.P. 5015-E-0064	LOCATION 284385.523 E, 4997703.490 N	ORIGINATED BY MAS
DIST _____ HWY _____	BOREHOLE TYPE Hollow Stem Augers	COMPILED BY PW
DATUM MTM NAD 83 ZONE 10	DATE 21 September 2016 - 21 September 2016	CHECKED BY TJG
PROJECT Foundation Investigation and Design Report - MacTier Patrol Yard, MacTier, Ontario		JOB NO. TY163014

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT						PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			SOIL VAPOUR READING	REMARKS & GRAIN SIZE DISTRIBUTION (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa						WATER CONTENT (%)				COV/ TOV (ppm)	GR	SA	SI	CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
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+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE



Photo 5

Photo of rock
cores from
BH16-01

20 Sept 2016



Photo 6

Photo of rock
core taken from
BH16-04

21 Sept 2016



Photo 7

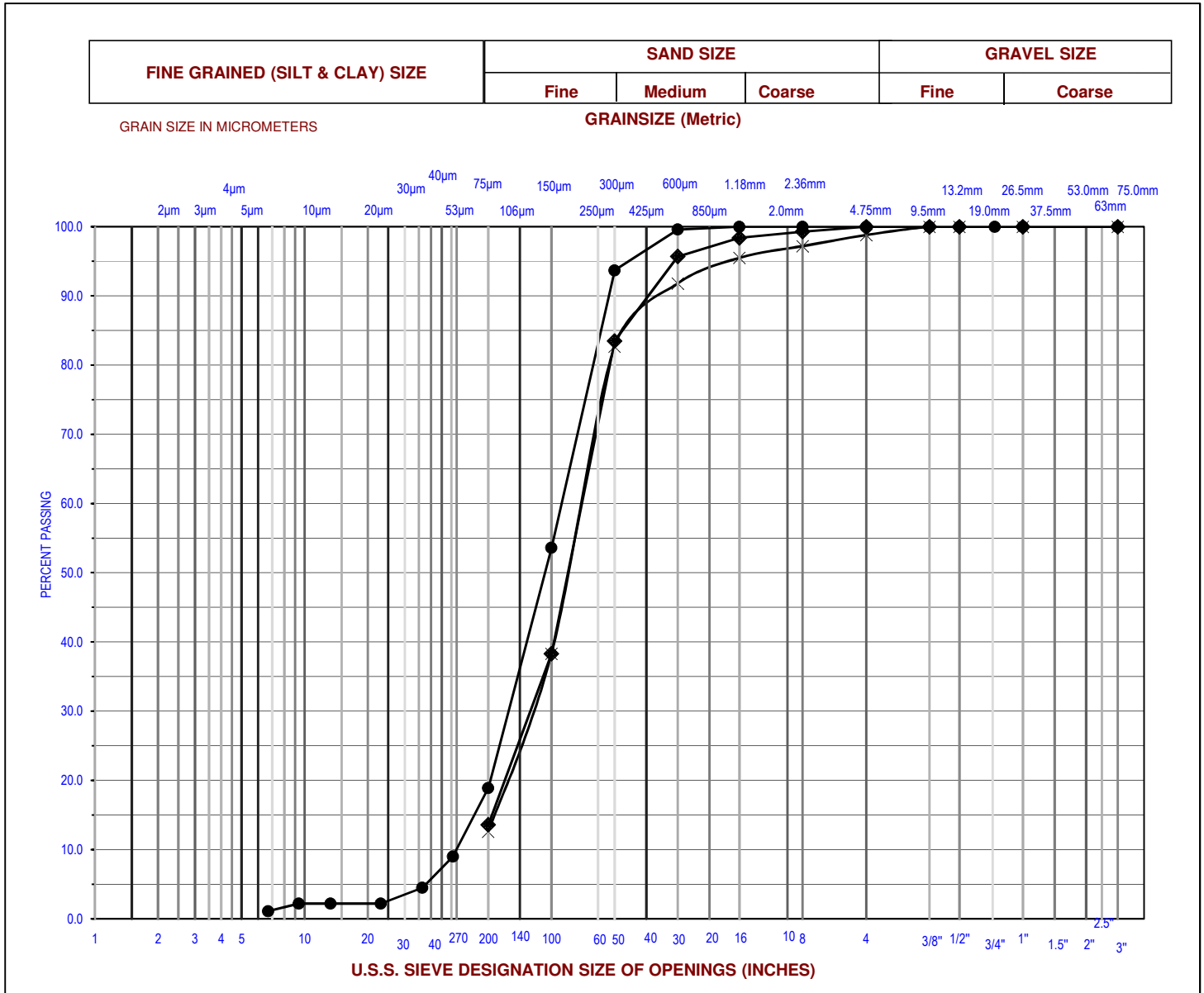
Photo of rock
core taken from
BH16-02
20 Sept 2016

APPENDIX C

LABORATORY TESTING RESULTS

FIGURE C1 - GRAIN SIZE DISTRIBUTION

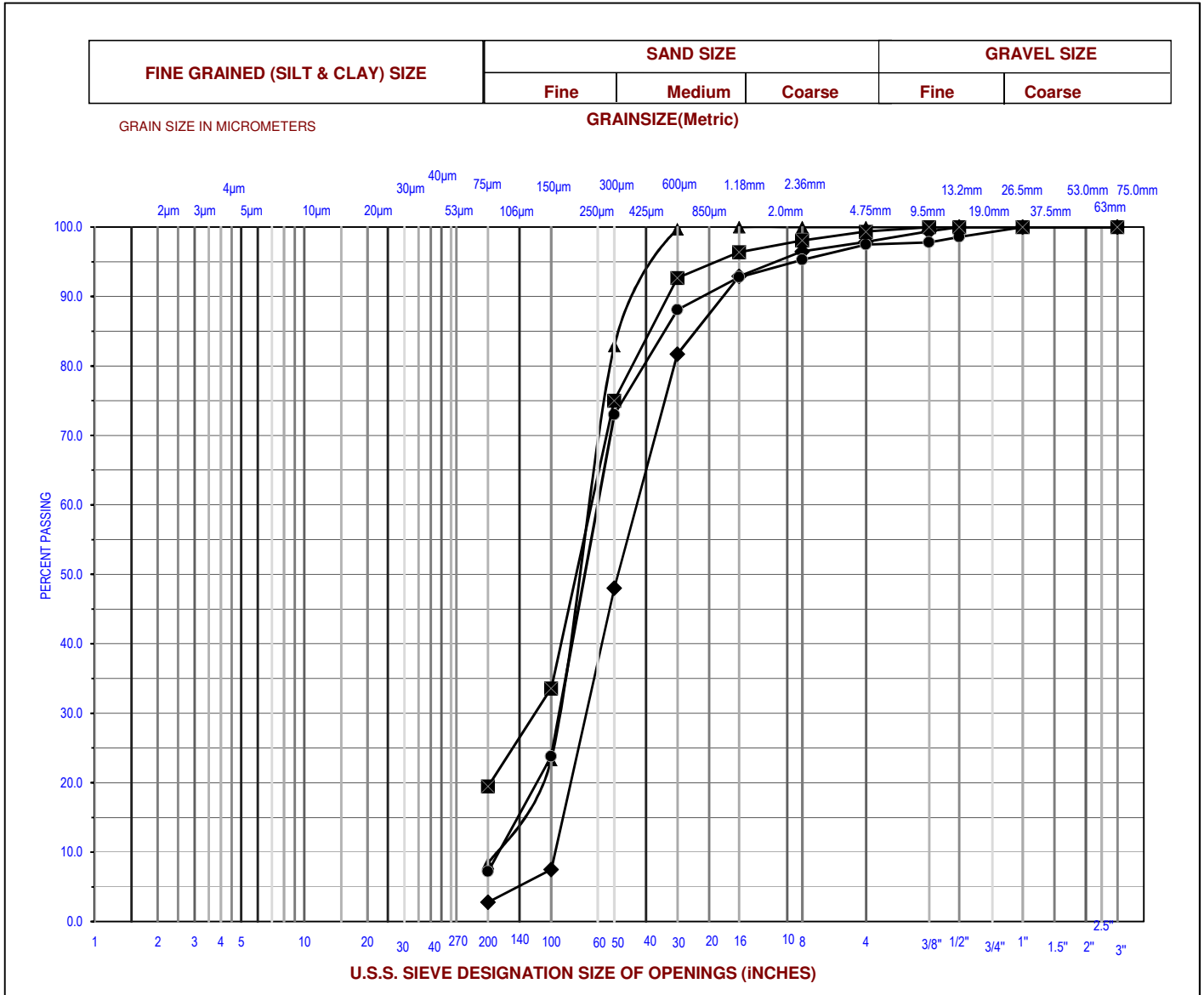
SAND, some silt


LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION (m)	GRAVEL(%)	SAND (%)	SILT & CLAY(%)
X	16-01	SS2	241.7	1	86	13
◆	16-01	SS8	237.2	0	86	14
●	16-04	SS6	237.1	0	81	19

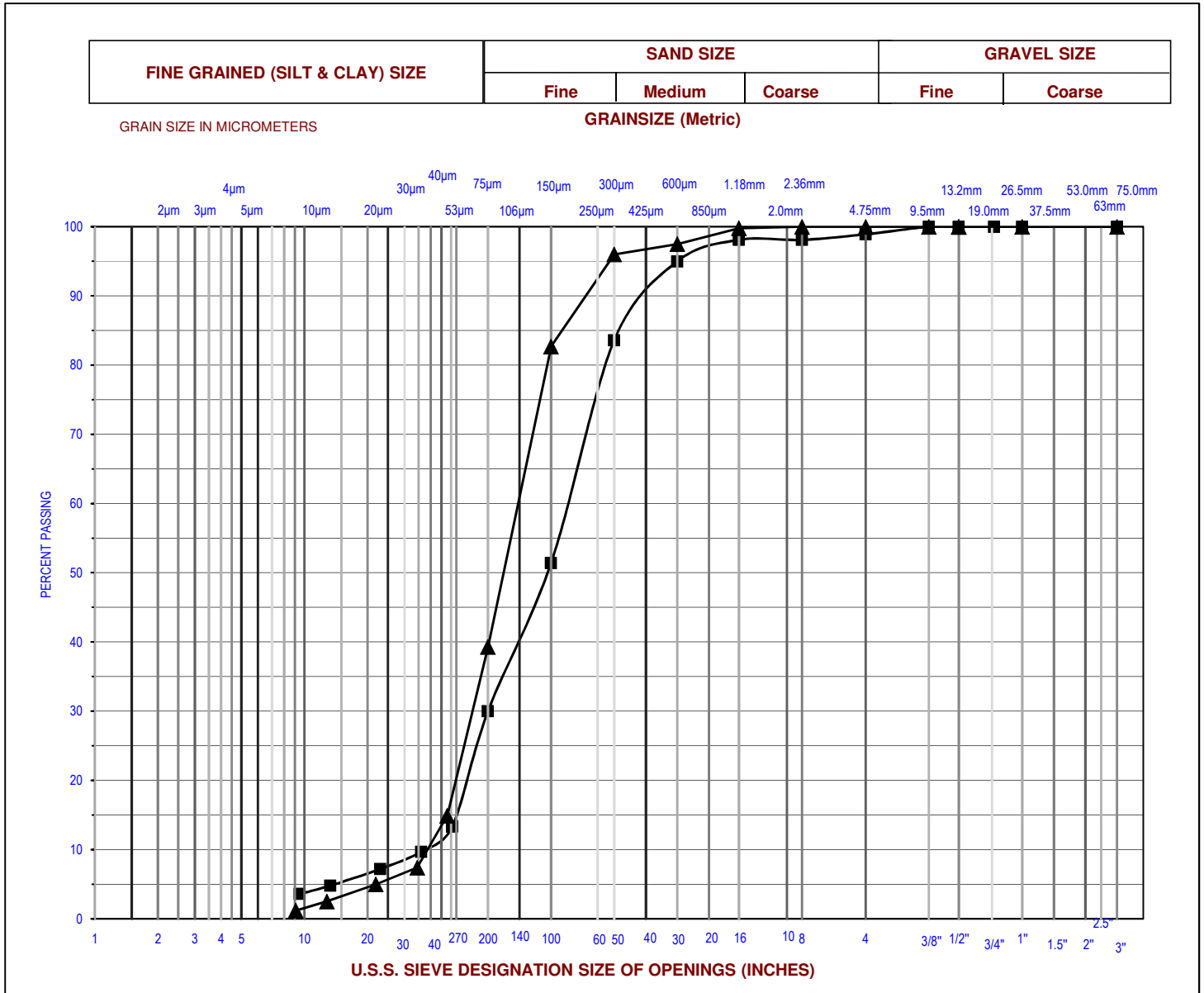
FIGURE C2 - GRAIN SIZE DISTRIBUTION

SAND, trace to some silt, trace gravel



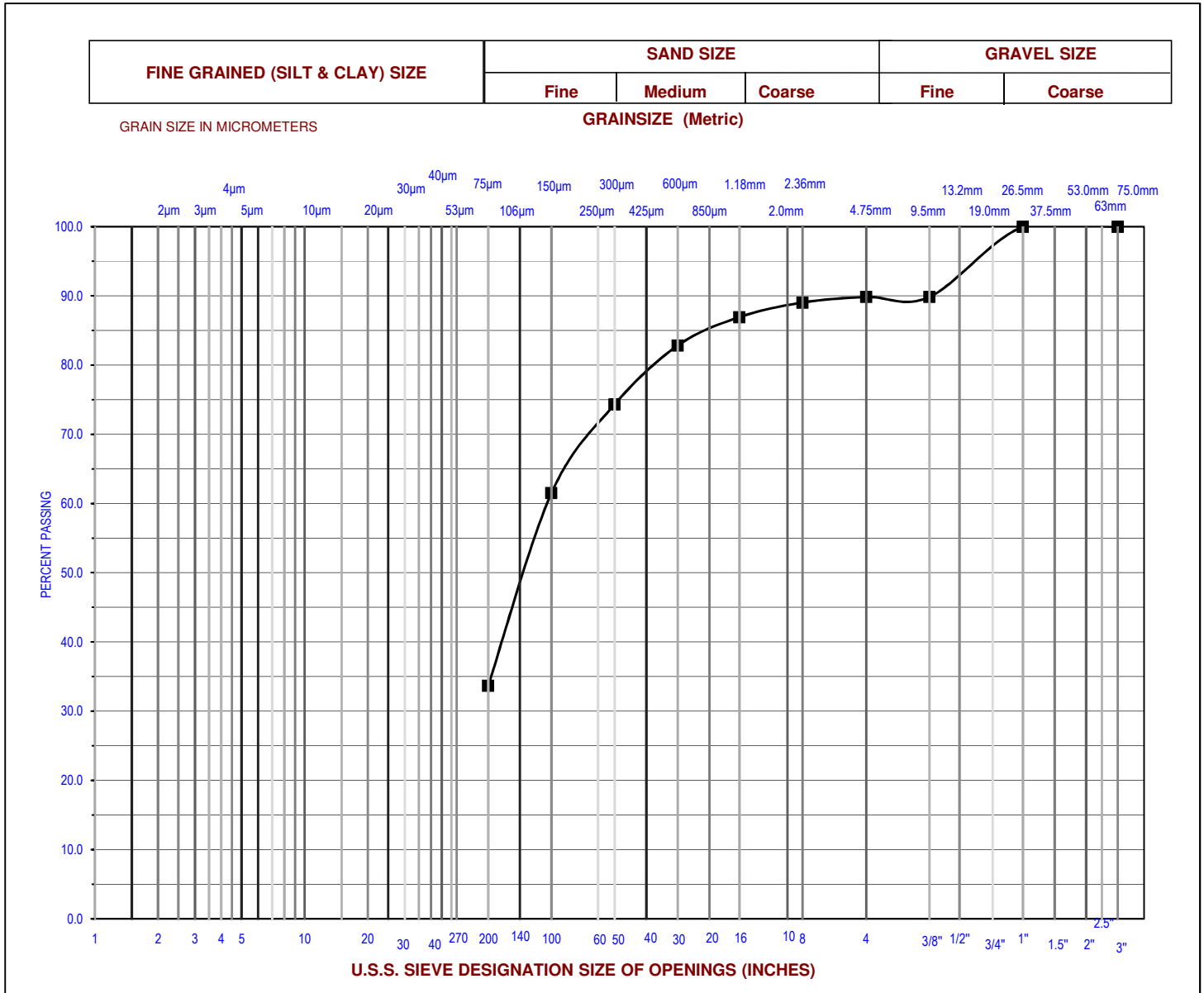
LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION (m)	GRAVEL(%)	SAND (%)	SILT & CLAY (%)
X	16-02	SS6	236.3	0	91	9
◊	16-03	SS3	240.4	2	95	3
•	16-04	SS1	241.6	3	90	7
■	16-02	SS2	240.2	5	83	12

FIGURE C3 - GRAIN SIZE DISTRIBUTION
SILTY SAND

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION (m)	GRAVEL(%)	SAND (%)	SILT & CLAY (%)
■	16-05	SS2	240.6	1	69	30
▲	16-05	SS5	238.4	0	61	39

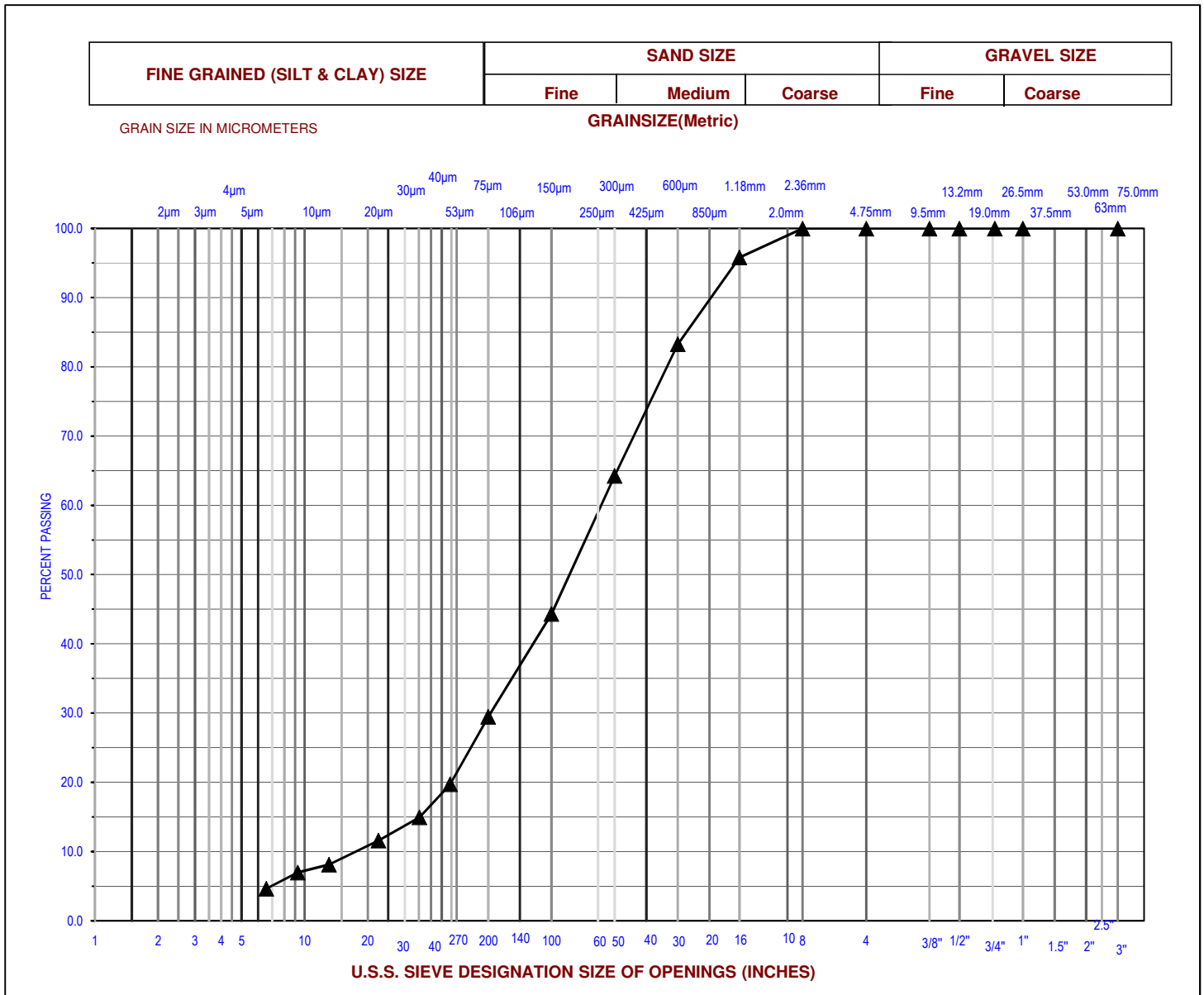
FIGURE C4 - GRAIN SIZE DISTRIBUTION
SILTY SAND (TILL)



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION (m)	GRAVEL(%)	SAND (%)	SILT & CLAY (%)
■	16-03	SS5	238.5	0	70	30

Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited 131 Fielding Road, Lively, Ontario Canada, P3Y1L7 PH: (705) 682-2632, FX: (705) 682-2260 www.amecfw.com	GRAIN SIZE DISTRIBUTION	Project No.: TY163014	
		Tested By: MMD Reviewed By: TG	
		MMD TG	

FIGURE C5 - GRAIN SIZE DISTRIBUTION
SAND (TILL)

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION (m)	GRAVEL(%)	SAND (%)	SILT & CLAY (%)
▲	16-05	SS9	232.3	11	77	12

APPENDIX D

ANALYTICAL RESULTS

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR
131 FIELDING ROAD
LIVELY, ON P3Y1L7
(705) 682-2632

ATTENTION TO: David Brown

PROJECT: TY163014

AGAT WORK ORDER: 16U147324

SOIL ANALYSIS REVIEWED BY: Sofka Pehlyova, Senior Analyst

DATE REPORTED: Oct 18, 2016

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

***NOTES**

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.



AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 16U147324

PROJECT: TY163014

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
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CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

ATTENTION TO: David Brown

SAMPLING SITE:

SAMPLED BY:

Inorganic Chemistry (Soil)

DATE RECEIVED: 2016-10-11

DATE REPORTED: 2016-10-18

MacTier				
SAMPLE DESCRIPTION: BH16-04 SS04				
SAMPLE TYPE: Soil				
DATE SAMPLED: 9/21/2016				
Parameter	Unit	G / S	RDL	7919209
Chloride (2:1)	µg/g		2	46
Sulphate (2:1)	µg/g		2	<2
pH (2:1)	pH Units		NA	7.22
Electrical Conductivity (2:1)	mS/cm		0.005	0.126
Resistivity (2:1)	ohm.cm		1	7940

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

7919209 EC/Resistivity, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

Certified By:

Sofra Pehlyora

Quality Assurance

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 16U147324

PROJECT: TY163014

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Soil Analysis

RPT Date: Oct 18, 2016			DUPLICATE			Method Blank	REFERENCE MATERIAL		METHOD BLANK SPIKE			MATRIX SPIKE			
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Inorganic Chemistry (Soil)

Chloride (2:1)	7918090		3	3	NA	< 2	93%	80%	120%	98%	80%	120%	102%	70%	130%
Sulphate (2:1)	7918090		26	26	0.0%	< 2	94%	80%	120%	100%	80%	120%	102%	70%	130%
pH (2:1)	7918090		8.45	8.47	0.2%	NA	101%	90%	110%	NA			NA		
Electrical Conductivity (2:1)	7919402		0.188	0.188	0.0%	< 0.005	99%	90%	110%	NA			NA		

Comments: NA signifies Not Applicable.

Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By:





Method Summary

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PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Electrical Conductivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Resistivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B, SSA #5 Part 3	CALCULATION

APPENDIX E

LIMITATIONS OF REPORT

AMEC FOSTER WHEELER ENVIRONMENT & INFRASTRUCTURE

LIMITATIONS OF REPORT

The conclusions and recommendations given in this report are based on information determined at the borehole 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 test holes may differ from those encountered at the test hole 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 construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in test holes.

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 on potential construction problems and possible methods are intended only for the guidance of the designer. The number of boreholes 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.

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 Foster Wheeler accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.