



FINAL REPORT

FOUNDATION INVESTIGATION REPORT Proposed Garage at Beardmore Patrol Yard, Highway 11, Municipality of Greenstone, Ontario

**Agreement No. 6017-E-0066
Assignment No. 6
GWP 6078-18-00
MTO GEOCRES No.42E-32**

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exp Services Inc.
August 19, 2019

Ontario Ministry of Transportation

Northwestern Region Geotechnical Section

Foundation Investigation Report

Agreement No. 6017-E-0066

Assignment No. 6

GWP 6044-18-00

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Proposed Garage at Beardmore Patrol Yard, Highway 11, Municipality of Greenstone, Ontario

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Part I: FOUNDATION INVESTIGATION REPORT

1.1 Introduction

This foundation investigation report presents the results of a geotechnical investigation completed by EXP Services Inc. for the proposed garage at the Beardmore Patrol Yard, located on Highway 11, at the junction of Highway 11 and 580, in the town of Beardmore, in the Municipality of Greenstone, in the District of Thunder Bay, the Ministry of Transportation (MTO) Northwestern Region. The work was undertaken under Agreement # 6017-E-0066, Assignment No. 6 (GWP 6044-18-00). The terms of reference (TOR) were as presented in the MTO letter, dated May 06, 2019.

Based on the information provided and our observations, the proposed garage is located in a treed/forested area at the west part of the Beardmore Patrol Yard.

The purpose of the investigation was to evaluate the subsurface conditions at the proposed building location, to permit detailed design. The site specific geotechnical investigation consisted of borings, soil sampling, borehole logging, and field and laboratory testing.

This foundation investigation report has been prepared specifically and solely for the project described herein. It contains the factual results of the investigation and the laboratory testing completed for this project.

1.2 Site Description and Geological Setting

1.2.1 Site Description

As shown on Drawing 1 (Appendix B), the proposed garage is located at the junction of Highway 11 and 580, in the town of Beardmore, in the Municipality of Greenstone, in the District of Thunder Bay. The proposed garage, which is about 45 m by 15 m in footprint size, is located at the west part of the patrol yard.

At the time of the investigation (May 24 and 25, 2019), the site conditions were assessed. The proposed garage was located in a treed / forested area, and immediately east of the proposed building footprint, was asphalt paved parking/driving areas. Ditching, consisting of sand and gravel, for the existing paved area was observed along the proposed east wall of the building. In addition, what appears to be a potable dug well, was noted near the center of the proposed garage (in the treed area).

The site topography was generally flat; however, uneven terrain (e.g. ditching and treed area) was present. Crater Lake and the Blackwater River are located about 130 m south and about 200 m east of the proposed structure, respectively.

Select photographs are provided in Appendix A.

1.2.2 Geological Setting

According to the MNR Northern Ontario Engineering Geology Terrain Data Base Map, Ontario Geological Survey Map 5077, Scale 1:100,000, dated 1979, the underlying native soil at the site

consists of sand outwash plain deposits with a subordinate landform consisting of sand alluvial plain deposits; mainly low local relief, undulating to rolling and mixed wet and dry surface conditions.

1.3 Investigation Procedures

1.3.1 Site Investigation and Field Testing

The field investigation was performed on May 24 and 25, 2019. The field program consisted of drilling five (5) sampled boreholes (BH-B1 to BH-B5) within the proposed building footprint. The location are shown on Drawing 1 in Appendix B.

All the boreholes (BH-B1 to BH-B5) were advanced using a CME 55 rubber track mounted drill rig supplied and operated by RPM Drilling Inc. The drill rig was equipped with hollow stem continuous flight augers, standard soil sampling equipment (includes 51 mm outside diameter split spoon samplers and *in situ* shear vane testing equipment). The boreholes were advanced to depths ranging between about 9.6 m and 12.7 m below ground surface (geodetic elevations ranging between about 295.6 m and 299.1 m).

During the drilling, air-tight plastic Ziploc® bags were half-filled with the representative soil from the split spoon samplers to allow for the measurement of sample headspace combustible vapour levels (HCVLs). The bagged samples were allowed to equilibrate for at least fifteen minutes at ambient temperature and were then agitated before the headspace vapour measurements were taken using an RKI Eagle 2 gas monitor, which is calibrated to hexane standards on a regular basis. The instrument was operated in methane elimination mode to avoid false positive readings from naturally occurring methane that may have been present in the soil. Headspace vapour concentrations can be useful indicators of relative hydrocarbon impacts, particularly by volatile petroleum products (i.e., gasoline, solvents). The recorded HCVLs of the collected soil samples were all < 10 ppm (i.e. very low).

The borehole locations were referenced to the MTM ON-14 NAD83 coordinate system and their ground surface elevations were surveyed by EXP personnel. The ground surface elevations, were referenced to a geodetic benchmark (BM) provided by the MTO (tablet in concrete at east exterior wall of existing garage [I.D. GBM 00819728107] with an elevation of 308.789). The location of the BM is shown on Drawing 1, in Appendix B.

During the drilling of the boreholes, soil samples were obtained using a 51 mm outside diameter (O.D.) split-spoon sampler in accordance with Standard Penetration Test (SPT) procedures (ASTM D1586), and were performed at intervals of about 0.75 m in the upper 5 m, and at about 1.5 m intervals thereafter. The original field (uncorrected) SPT “N” values were recorded on the borehole logs as recommended in the Canadian Foundation Engineering Manual and used to provide an assessment of *in-situ* compactness (cohesionless) or consistency (cohesive) soils.

Upon completion of the boreholes, groundwater level measurements were carried out in boreholes in accordance with the Ministry of Transportation guidelines. The measured groundwater levels after completion of augering at the boreholes were recorded on borehole log sheets in Appendix C. The boreholes were backfilled with a mixture of bentonite and auger cuttings. The borehole

decommissioning was in general accordance with the Ministry of the Environment Regulation 903, as amended by Regulation 128/03 (the well regulation under the *Ontario Water Resources Act*).

The fieldwork was supervised by a member of EXP's engineering staff who directed the drilling and sampling operation, logged borehole data in accordance with MTO and/or ASTM Standards for Soils Classification, and retrieved soil samples. All of the recovered soil samples were placed in labelled moisture-proof bags which were brought to EXP's Thunder Bay laboratory for additional visual, textual and olfactory examination, and for subsequent examination by a geotechnical engineer and laboratory testing.

1.3.2 Laboratory Testing

All samples brought to the laboratory were subjected to visual examination and classification. The laboratory testing program included the determination of natural moisture content and particle size distribution for approximately 25% of the collected soil samples. All of the laboratory tests were carried out in accordance with MTO and/or ASTM Standards, as appropriate, at the EXP laboratory in Thunder Bay, Ontario.

The laboratory test results are provided on the attached borehole log sheets in Appendix C as well as graphically in Appendix D.

In addition, three (3) select soil samples were submitted for chemical analyses. The samples were sent via courier, in a secure cooler under chain of custody, to Maxxam Analytics Inc., a CALA-certified and accredited laboratory in Mississauga, Ontario. Details of the chemical testing are discussed below and the lab results are included in Appendix E.

1.4 Subsurface Conditions

The detailed subsurface conditions encountered in the boreholes advanced during this investigation are presented on the Borehole Records in Appendix C. Laboratory test results are provided in Appendix D. The "Explanation of Terms Used on Borehole Records" preceding the borehole logs in Appendix C forms an integral part of and should be read in conjunction with this report.

A borehole location plan and stratigraphic sections are provided in Appendix B. It should be noted that the stratigraphic boundaries indicated on the borehole log and stratigraphic sections are inferred from semi-continuous sampling, observations of drilling progress and results of Standard Penetration Tests. These boundaries typically represent transitions from one soil type to another and should not be interpreted as exact planes of geological change. Furthermore, subsurface conditions may vary between and beyond the borehole locations.

In general, the subsurface conditions at the proposed garage consists of a surface layer of topsoil in the treed/forested areas, and sand and gravel fill to silty sand fill in the non-treed/forested area. Underlying the topsoil and fill was a mixture of sandy silt to silt. A more detailed summary of the subsurface conditions encountered in the boreholes is provided in the following sections.

1.4.1 Topsoil or Sand and Gravel to Silty Sand Fill

Topsoil was encountered surfacing the boreholes located in the treed/forested areas, and sand and gravel fill to silty sand fill was encountered surfacing the boreholes outside the treed/forested area. The topsoil was described as soft, brown to dark brown, moist to wet, and containing some sand, some silt, trace to some peat and some organics. The topsoil was about 0.1 m thick and extended to about 0.1 m below ground surface (elevations between 308.1 m and 309.1 m). The fill was described as loose to compact, brown and moist. Trace asphalt pieces and trace organics were noted at BH-B5. The SPT “N” values at the fill, were 8 and 10 blows per 300 mm penetration, with an average “N” value of about 9. The fill extended to about 0.8 m below ground surface (elevation between 307.4 m and 307.7 m).

Laboratory testing performed on selected samples consisted of moisture content. The test results are as follows:

Moisture content (topsoil):

- 23.8% to 38.4%

Moisture content (fill):

- 5.9% to 9.2%

The results of the moisture content tests are provided on the record of borehole sheets in Appendix C.

1.4.2 Sandy Silt to Silt

Sandy silt to silt was encountered beneath the topsoil and fill in all boreholes except in BH-B5. The sandy silt to silt was described as loose to compact, light brown, and moist to wet at depth. At BH-B1 and a BH-B5, a clayey silt seam, about 80 mm in thickness was noted at about 6.3 m and 10.7 m below ground surface, respectively. The SPT “N” values ranged between 3 and 22 blows per 300 mm penetration, with an average “N” value of about 12. The sandy silt to silt extended to the termination depths ranging between about 9.6 m and 12.7 m below ground surface (geodetic elevations ranging between about 295.6 m and 299.1 m).

Laboratory testing performed on selected samples consisted of moisture content and grain size distribution tests. The test results are as follows:

Moisture content (saturated and unsaturated):

- 9% to 27.7%

Moisture content (saturated – below groundwater table):

- 16.9% to 27.7%

Grain size distribution:

- 0% to 1% gravel;
- 3% to 54% sand;

- 43% to 93% silt; and
- 2% to 7% clay.

Total saturated unit weights have been calculated based on the moisture contents and are estimated to range from about 19.4 to 21.3 kN/m³.

The results of the moisture content and grain size distribution tests are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution tests are also provided on Figures 1 to 4, in Appendix D.

1.4.3 Sand

A layer of sand was encountered beneath the silty sand fill in BH-B5. This sand layer was described as loose, light brown, and moist. The SPT “N” values ranged between 2 and 8 blows per 300 mm penetration, with an average “N” value of about 6. The layer of sand extends from a 0.8 m depth to 3.3 m depth, corresponding to elevation between 307.4 m and 305 m.

Laboratory testing performed on selected samples consisted of moisture content and grain size distribution tests. The test results are as follows:

Moisture content:

- 4.8% to 21%

Grain size distribution:

- 0% gravel;
- 96% sand;
- 4% silt and clay.

Total saturated unit weights have been calculated based on the moisture contents and are estimated to range from about 18.8 to 20.5 kN/m³.

The results of the moisture content and grain size distribution tests are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution tests are also provided on Figures 1 to 4, in Appendix D.

1.5 Groundwater and Surface Water Conditions

Information on groundwater levels at the site was obtained by measuring the water levels in the open boreholes after completion of augering at the boreholes. It is noted that due to the fine grained soils present, the groundwater levels may not have stabilized prior to measurements. The groundwater levels encountered in the boreholes are shown on the borehole logs and presented below in Table 1.1.

Seasonal variations in the water table should be expected, with higher levels occurring during wetter periods of the year and lower levels during drier periods.

August 19, 2019

Table 1.1. Groundwater data

Borehole	Date Completed	Date Measured	Ground Surface Elevation ²	Depth to Water ³	Groundwater Elevation
BH-B1	May 25/19	May 25/19	309.2	5.35	303.85
BH-B2	May 25/19	May 25/19	308.4	Not encountered ⁴	--
BH-B3	May 25/19	May 25/19	308.7	5.40	303.30
BH-B4	May 25/19	May 25/19	308.2	Not encountered ⁴	--
BH-B5	May 24/19	May 24/19	308.2	Not encountered ⁴	--
Notes: 1) All units in metres. 2) The ground surface elevations, were referenced to a geodetic benchmark (BM) provided by the MTO (tablet in concrete at east exterior wall of existing garage [I.D. GBM 00819728107] with an elevation of 308.789). 3) Depths are relative to ground surface. 4) Borehole caved and no groundwater level measurements were obtainable.					

1.6 Chemical Analyses

One (1) soil sample was selected for corrosivity chemical analyses. In addition, one (1) soil sample (BH-B2, S1) was selected and submitted for petroleum hydrocarbon chemical analyses, and one (1) soil sample (BH-B3, S2) was selected and submitted for metals and inorganics chemical analyses. The samples were sent via courier, in a secure chilled cooler under chain of custody, to Maxxam Analytics Inc., a CALA-certified and accredited laboratory in Mississauga, Ontario. The analytical laboratory results are presented in Appendix E, and the corrosivity results are summarized in Table 1.2, below.

Table 1.2. Summary results of soil corrosivity chemical analysis

Sample Identification	pH (unitless)	Soluble Chloride (ppm)	Soluble Sulphate (ppm)	Resistivity (ohm-cm)	Conductivity (µS/cm)
BH-B3, S4	7.98	<20	<20	14,000	72

August 19, 2019

Part II: CLOSURE

A subsurface investigation is a limited sampling of a site; the subsurface conditions have been established only at the test hole locations. Should conditions at the site be encountered which differ from those reported at the test locations, we require that we be notified immediately in order to assess this additional information and our recommendations, as appropriate. It may then be necessary to perform additional investigation and analysis.

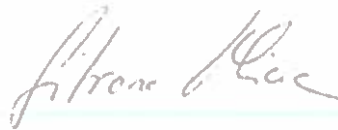
Contractors bidding on or undertaking any proposed work at this site should, relative to the subsurface conditions, decide on their own investigations, if deemed necessary, as well as their own interpretations of the factual results provided herein, so they may draw their own conclusions as to how the subsurface conditions may affect them.

This Foundation Investigation Report has been prepared by Ahileas Mitsopoulos, P.Eng. and Silvana Micic, Ph.D., P.Eng., and reviewed by TaeChul Kim, M.E.Sc., P.Eng. and Stan E. Gonsalves, M.Eng., P.Eng., MTO Designated Foundation Contact. The field investigation was conducted by Phillips Laframboise.

EXP Services Inc.



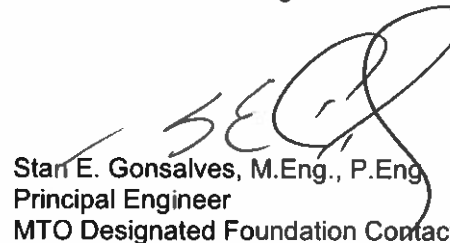
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Encl.

Appendix A – Site Photographs



Photo 1. Looking southwest at the proposed garage location. Drill rig located at BH-B2.



Photo 2. Looking west at proposed garage location. Drill rig at BH-B1.



Photo 3. Possible dug well located near the center of the proposed garage (treed area).



Photo 4. Looking west. Drill rig at BH-B4.

Appendix B – Drawings

Appendix C – Borehole Logs

Explanation of Terms Used on Borehole Records

SOIL DESCRIPTION

Terminology describing common soil genesis:

Topsoil: mixture of soil and humus capable of supporting good vegetative growth.

Peat: fibrous fragments of visible and invisible decayed organic matter.

Fill: where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc.; none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.

Till: the term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Terminology describing soil structure:

Desiccated: having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.

Stratified: alternating layers of varying material or color with the layers greater than 6 mm thick.

Laminated: alternating layers of varying material or color with the layers less than 6 mm thick.

Fissured: material breaks along plane of fracture.

Varved: composed of regular alternating layers of silt and clay.

Slickensided: fracture planes appear polished or glossy, sometimes striated.

Blocky: cohesive soil that can be broken down into small angular lumps which resist further breakdown.

Lensed: inclusion of small pockets of different soil, such as small lenses of sand scattered through a mass of clay; not thickness.

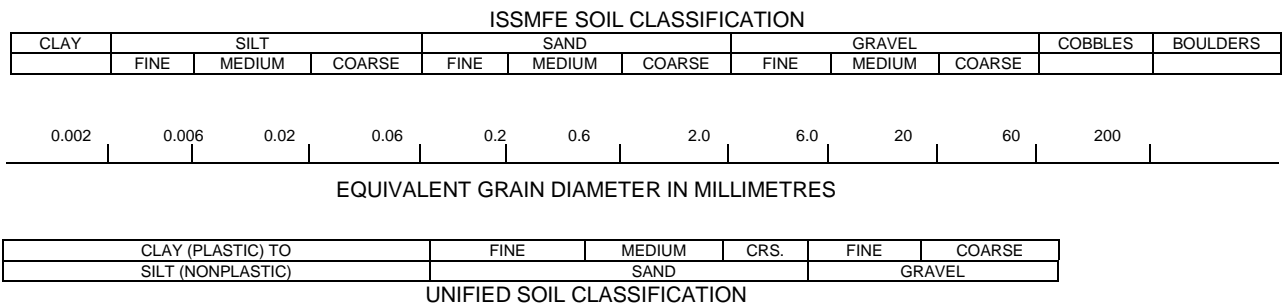
Seam: a thin, confined layer of soil having different particle size, texture, or color from materials above and below.

Homogeneous: same color and appearance throughout.

Well Graded: having wide range in grain sized and substantial amounts of all predominantly on grain size.

Uniformly Graded: predominantly on grain size.

All soil sample descriptions included in this report follow generally the ASTM D2487-11 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) with some modification to reflect current MTO practices. The system divides soils into three major categories: (1) coarse grained, (2) fine-grained, and (3) highly organic. The soil is then subdivided based on either gradation or plasticity characteristics. The system provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification. The classification excludes particles larger than 76 mm. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually in accordance with ASTM D2488-09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems. Others may use different classification systems; one such system is the ISSMFE Soil Classification.



Terminology describing materials outside the USCS, (e.g. particles larger than 76 mm, visible organic matter, construction debris) is based upon the proportion of these materials present and as described below in accordance with Canadian Foundation Engineering Manual (CFEM):

Table a: Percent or Proportion of Soil

	Criteria
Trace	1% - 10%
Some	10% - 20%
Little	20% - 35%
Some	>35% and main fraction

The standard terminology to describe cohesionless soils includes the compactness as determined by the Standard Penetration Test 'N' value:

Table b: Apparent Density of Cohesionless Soil

	'N' Value (blows/0.3 m)
Very Loose	N<5
Loose	5≤N<10
Compact	10≤N<30
Dense	30≤N<50
Very Dense	50≤N

The standard terminology to describe cohesive soils includes consistency, which is based on undrained shear strength as measured by insitu vane tests, penetrometer tests, unconfined compression tests or similar field and laboratory analysis, Standard Penetration Test 'N' values can also be used to provide an approximate indication of the consistency and shear strength of fine grained, cohesive soils:

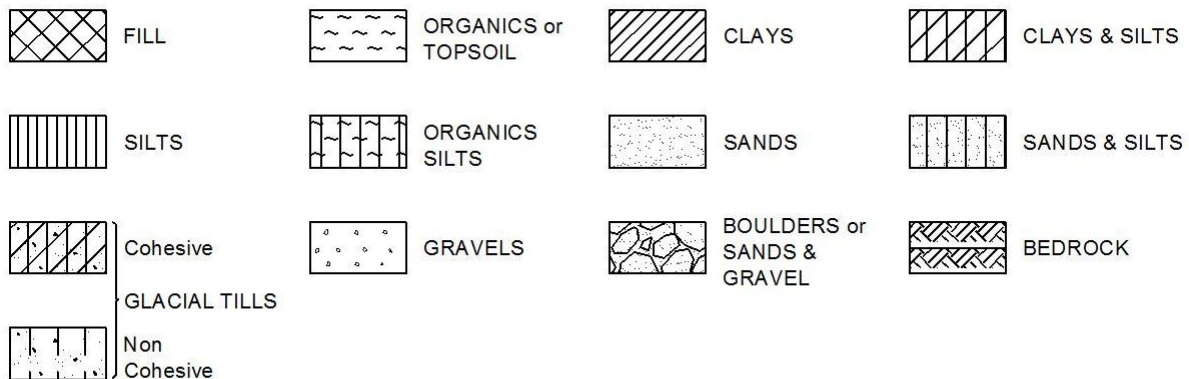
Table c: Consistency of Cohesive Soil

Consistency	Vane Shear Measurement (kPa)	'N' Value
Very Soft	<12.5	<2
Soft	12.5-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

Note: 'N' Value - The Standard Penetration Test records the number of blows of a 140 pound (64kg) hammer falling 30 inches (760mm), required to drive a 2 inch (50.8mm) O.D. split spoon sampler 1 foot (305mm). For split spoon samples where full penetration is not achieved, the number of blows is reported over the sampler penetration in meters (e.g. 50/0.15).

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols:



WATER LEVEL MEASUREMENT



Open Borehole or Test Pit



Monitoring Well, Piezometer or Standpipe

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

SS	Split spoon sample (obtained from the Standard Penetration Test)
WS	Wash sample
BS	Bulk sample
TW	Thin wall sample or Shelby tube
PS	Piston sample
AS	Auger sample
VT	Vane test
GS	Grab sample
HQ, NQ, etc.	Rock core samples obtained with the use of standard size diamond drilling bits

STRESS AND STRAIN

u_w	kPa	Pore water pressure
r_u	1	Pore pressure ratio
σ	kPa	Total normal stress
σ'	kPa	Effective normal stress
τ	kPa	Shear stress
$\sigma_1, \sigma_2, \sigma_3$	kPa	Principal stresses
ε	%	Linear strain
$\varepsilon_1, \varepsilon_2, \varepsilon_3$	%	Principal strains
E	kPa	Modulus of linear deformation
G	kPa	Modulus of shear deformation
μ	1	Coefficient of friction

MECHANICAL PROPERTIES OF SOIL

m_v	kPa ⁻¹	Coefficient of volume change
c_c	1	Compression index
c_s	1	Swelling index
c_r	1	Recompression index
c_v	m ² /s	Coefficient of consolidation
H	m	Drainage path
T_v	1	Time factor
U	%	Degree of consolidation
σ'_{v0}	kPa	Effective overburden pressure
σ'_p	kPa	Preconsolidation pressure
τ_f	kPa	Shear strength
c'	kPa	Effective cohesion intercept
ϕ'	—°	Effective angle of internal friction
c_u	kPa	Apparent cohesion intercept
ϕ_u	—°	Apparent angle of internal friction
τ_R	kPa	Residual shear strength
τ_r	kPa	Remoulded shear strength
S_t	1	Sensitivity = c_u/τ_r

PHYSICAL PROPERTIES OF SOIL

P_s	kg/m ³	Density of solid particles
γ_s	kN/m ³	Unit weight of solid particles
ρ_w	kg/m ³	Density of water
γ_w	kN/m ³	Unit weight of water
ρ	kg/m ³	Density of soil
γ	kN/m ³	Unit weight of soil
ρ_d	kg/m ³	Density of dry soil
γ_d	kN/m ³	Unit weight of dry soil
ρ_{sat}	kg/m ³	Density of saturated soil
γ_{sat}	kN/m ³	Unit weight of saturated soil
ρ'	kg/m ³	Density of submerged soil
γ'	kN/m ³	Unit weight of submerged soil
e	1, %	Void ratio
n	1, %	Porosity
w	1, %	Water content
S_r	%	Degree of saturation
W_L	%	Liquid limit
W_P	%	Plastic limit
W_s	%	Shrinkage limit
I_p	%	Plasticity index = $(W_L - W_P)$
I_L	%	Liquidity index = $(W - W_P)/I_p$
I_C	%	Consistency index = $(W_L - W)/I_p$
e_{max}	1, %	Void ratio in loosest state
e_{min}	1, %	Void ratio in densest state
I_D	1	Density index = $(e_{max} - e)/(e_{max} - e_{min})$
D	mm	Grain diameter
D_n	mm	N percent - diameter
C_u	1	Uniformity coefficient
h	m	Hydraulic head or potential
q	m ³ /s	Rate of discharge
v	m/s	Discharge velocity
i	1	Hydraulic gradient
k	m/s	Hydraulic conductivity
j	kN/m ³	Seepage force

Brampton, Ontario

RECORD OF BOREHOLE No BH-B1

1 OF 1

METRIC

W.P. _____ LOCATION Beardmore Patrol Yard - Proposed Garage MTM ON-14 235845E 5497780N ORIGINATED BY EF
 DIST 61 HWY 11 BOREHOLE TYPE CME 55 Rubber Track / HSA COMPILED BY KK
 DATUM Geodetic DATE 2019.05.25 - 2019.05.25 LATITUDE 49.61381 LONGITUDE -87.95425 CHECKED BY AM/DG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)			GR	SA	SI	CL
								○ UNCONFINED + FIELD VANE	○	○					○	○	○				
309.2	Topsoil		S1A	SS	5											1	89	(11)			
308.9			S1B	SS																	
308.9			S1C	SS																	
0.3			S2	SS	12																
			S3	SS	14												0	35	61 4		
			S4	SS	10																
			S5	SS	17																
			S6	SS	14																
			S7	SS	14																
			S8	SS	6																
		S9	SS	8												0	43	54 3			
		S10	SS	10																	
		S11	SS	13																	
		S12	SS	20																	
296.5	End of Borehole																				
12.7	Notes: Groundwater level measured at 5.35 m below ground surface.																				

ONTARIO MTO F-19115-AG - ADM-00248798-F0 - MTO 6 - BEARDMORE BUIL - COPY.GPJ ONTARIO.MTO.GDT 8/16/19

Brampton, Ontario

RECORD OF BOREHOLE No BH-B2

1 OF 1

METRIC

W.P. _____ LOCATION Beardmore Patrol Yard - Proposed Garage MTM ON-14 235862E 5497775N ORIGINATED BY EF
 DIST 61 HWY 11 BOREHOLE TYPE CME 55 Rubber Track / HSA COMPILED BY KK
 DATUM Geodetic DATE 2019.05.24 - 2019.05.25 LATITUDE 49.61377 LONGITUDE -87.95401 CHECKED BY AM/DG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X P. PENETROMETER												
308.4	Fill							20	40	60	80	100		20	40	60		GR SA SI CL		
0.0	Sand and Gravel (FILL) - some silt, brown, moist, loose to compact,		S1	SS	10		308						○							
307.7																				
0.8	Sandy SILT to SILT - trace clay, light brown, moist, loose to compact		S2	SS	12		307						○							
			S3	SS	11								○							
			S4	SS	10		306						○				0 7 89 5			
			S5	SS	17		305						○				0 50 46 3			
			S6	SS	15		304						○				0 18 78 4			
	- becoming wet at about 4.6 m depth		S7	SS	12		303													
	- becoming loose to very loose at about 6.1 m depth		S8	SS	4		302						○							
							301													
			S9	SS	3		300						○							
	- becoming compact at about 9.1 m depth		S10	SS	17		299						○							
298.7	End of Borehole																			
9.8	Notes: Borehole caved to about 4.5 m and no groundwater was encountered in upper 4.5 m																			

ONTARIO MTO F-19115-AG - ADM-00248798-F0 - MTO 6 - BEARDMORE BUIL - COPY.GPJ ONTARIO.MTO.GDT 8/16/19

Brampton, Ontario

RECORD OF BOREHOLE No BH-B3

1 OF 1

METRIC

W.P. _____ LOCATION Beardmore Patrol Yard - Proposed Garage MTM ON-14 235838E 5497770N ORIGINATED BY EF
 DIST 61 HWY 11 BOREHOLE TYPE CME 55 Rubber Track / HSA COMPILED BY KK
 DATUM Geodetic DATE 2019.05.25 - 2019.05.25 LATITUDE 49.61372 LONGITUDE -87.95434 CHECKED BY AM/DG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		WATER CONTENT (%)								
								○ UNCONFINED + FIELD VANE										
						● QUICK TRIAXIAL X P. PENETROMETER							GR	SA	SI	CL		
308.7	Topsoil		S1A	SS	3	308												
308.0	TOPSOIL - some silt, some peat, roots and rootlets, dark brown, moist to wet, soft SILT - roots and rootlets, rusty brown, moist, very loose Sandy SILT to SILT - trace clay, light brown, moist, compact		S1B	SS														
308.5			S1C	SS														
0.3			S2	SS	17													
			S3	SS	20													
			S4	SS	14													
	- becoming wet at about 3.0 m depth		S5	SS	18													
		S6	SS	21														
		S7	SS	18														
	- becoming loose at about 6.1 m depth	S8	SS	9														
	- becoming compact at about 7.6 m depth	S9	SS	13														
		S10	SS	22														
299.1	End of Borehole																	
9.6	Notes: Groundwater level measured at 5.40 m below ground surface.																	

ONTARIO MTO F-19115-AG - ADM-00248798-F0 - MTO 6 - BEARDMORE BUIL - COPY.GPJ ONTARIO.MTO.GDT 8/16/19

Brampton, Ontario

RECORD OF BOREHOLE No BH-B4

1 OF 1

METRIC

W.P. _____ LOCATION Beardmore Patrol Yard - Proposed Garage MTM ON-14 235825E 5497760N ORIGINATED BY EF
 DIST 61 HWY 11 BOREHOLE TYPE CME 55 Rubber Track / HSA COMPILED BY KK
 DATUM Geodetic DATE 2019.05.25 - 2019.05.25 LATITUDE 49.61363 LONGITUDE -87.95452 CHECKED BY AM/DG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)			
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL P. PENETROMETER												
308.2	Topsoil		S1A	SS		308									0 7 89 5					
308.1	TOPSOIL - trace peat, roots and rootlets, dark brown, moist to wet, loose SILT - some sand, roots and rootlets, rusty brown, moist, loose to compact Sandy SILT to SILT - light brown, moist, loose to compact - becoming wet at about 3.8 m depth		S1B	SS	5													0 50 46 4		
307.9			S1C	SS																
0.3			S2	SS	6															
			S3	SS	14															
			S4	SS	9															
			S5	SS	22															
			S6	SS	10															
			S7	SS	12															
			S8	SS	10															
			S9	SS	15															
			S10	SS	13															
298.5			End of Borehole						299											
9.8	Notes: Borehole caved to about 4.5 m and no groundwater was encountered in upper 4.5 m																			

ONTARIO MTO F-19115-AG - ADM-00248798-F0 - MTO 6 - BEARDMORE BUIL - COPY.GPJ ONTARIO.MTO.GDT 8/16/19

Brampton, Ontario

RECORD OF BOREHOLE No BH-B5

1 OF 1

METRIC

W.P. _____ LOCATION Beardmore Patrol Yard - Proposed Garage MTM ON-14 235836E 5497746N ORIGINATED BY EF
 DIST 61 HWY 11 BOREHOLE TYPE CME 55 Rubber Track / HSA COMPILED BY KK
 DATUM Geodetic DATE 2019.05.24 - 2019.05.24 LATITUDE 49.6135 LONGITUDE -87.95437 CHECKED BY AM/DG

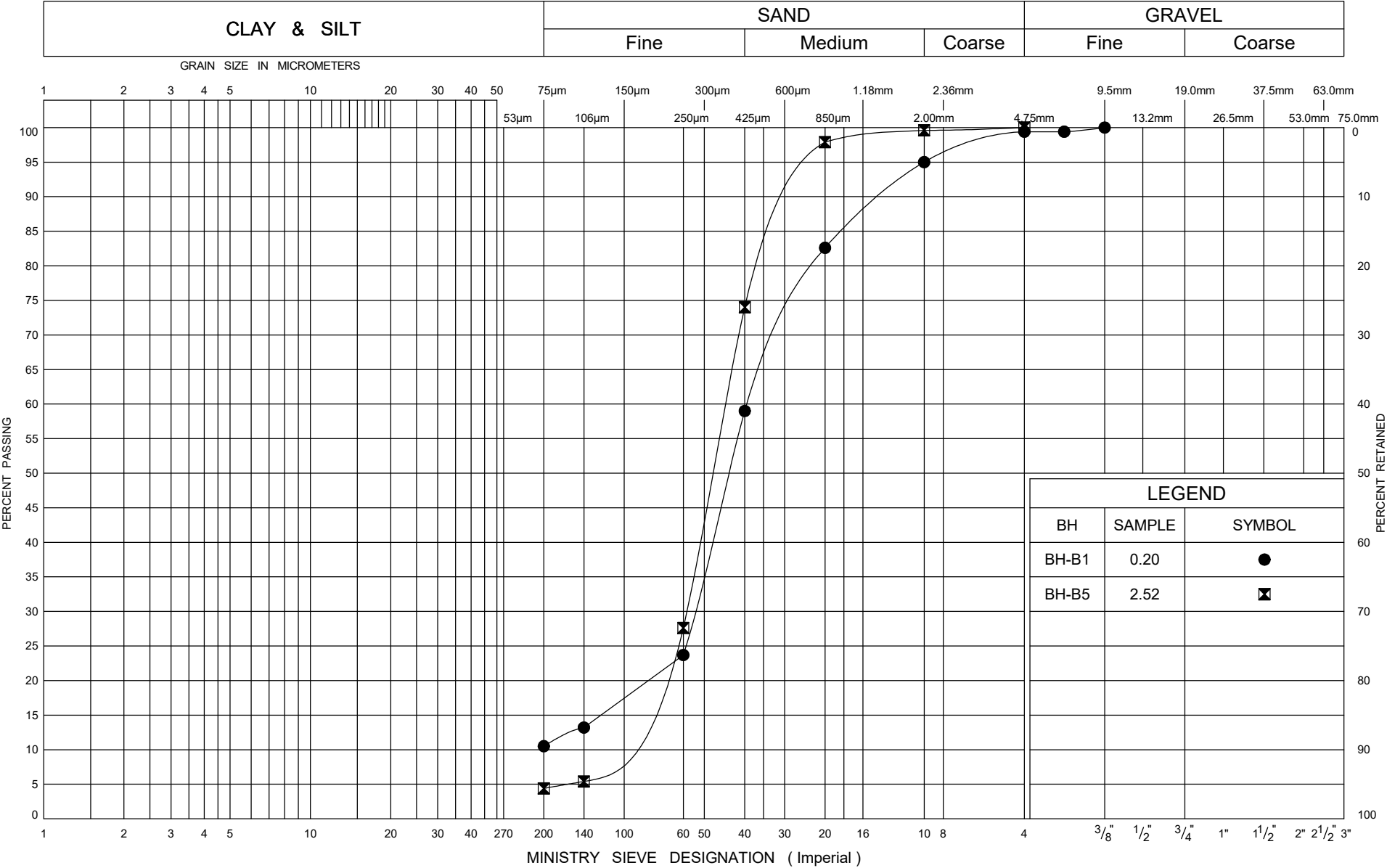
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
308.2	Fill													
0.0	Silty SAND (FILL) - trace asphalt pieces, trace organics, brown, moist, loose		S1	SS	8		308							
307.4														
0.8	Poorly Graded SAND - rusty brown to light brown, moist, loose		S2	SS	8		307							
			S3	SS	7		306							
	- becoming wet at about 2.3 m depth													
			S4	SS	7		305							
305.0	- becoming brown at about 3.0 m depth		S5A	SS	2		304							
3.3	SILT - trace to some sand, trace clay, light brown, wet, very loose to compact		S5B	SS	3		303							
			S6	SS	15		302							
			S7	SS	14		301							
							300							
			S8	SS	9		299							
							298							
			S9	SS	9		297							
							296							
			S10	SS	12									
			S11	SS	13									
			S12	SS	8									
295.6	End of Borehole													
12.7	Notes: Borehole caved to about 2.3 m and no groundwater was encountered in upper 2.3 m													

ONTARIO MTO F-19115-AG - ADM-00248798-F0 - MTO 6 - BEARDMORE BUIL - COPY.GPJ ONTARIO.MTO.GDT 8/16/19

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

Appendix D – Laboratory Data

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

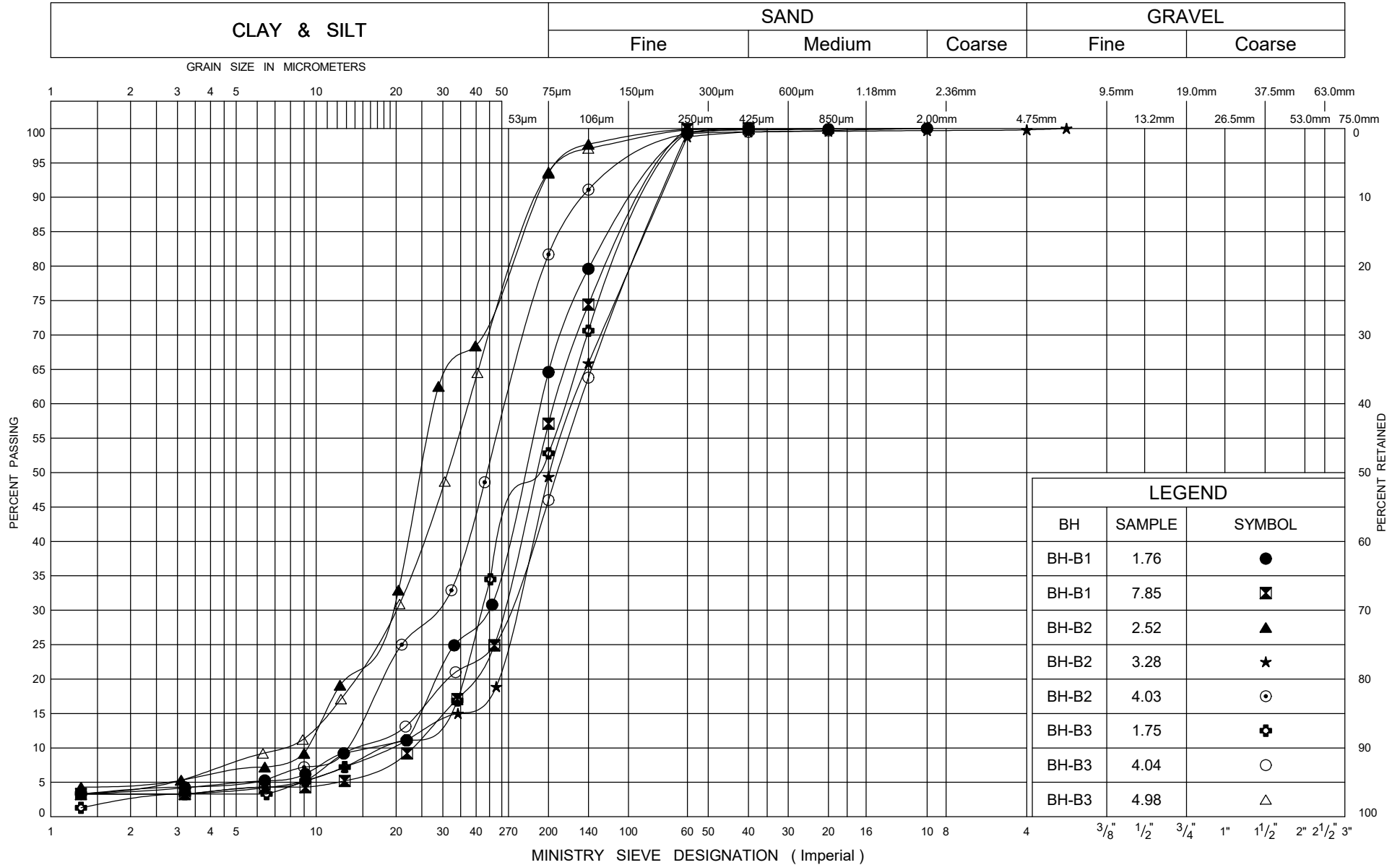
GRAIN SIZE DISTRIBUTION
Well Graded SAND to Poorly Graded SAND

FIG No 1

W P

6017-E-0066, Assignment 6

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

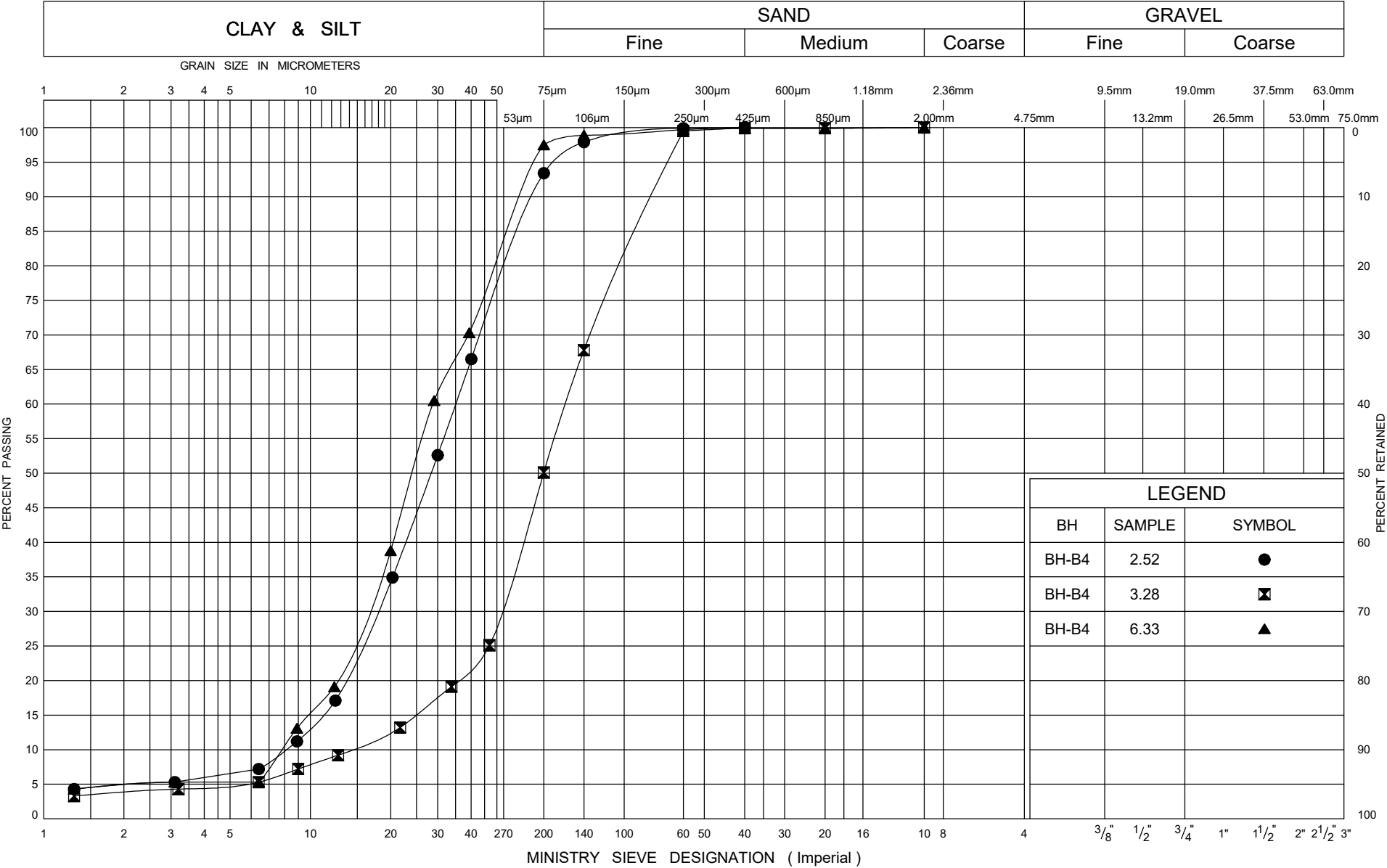
Sandy Silt to Silt

FIG No 2

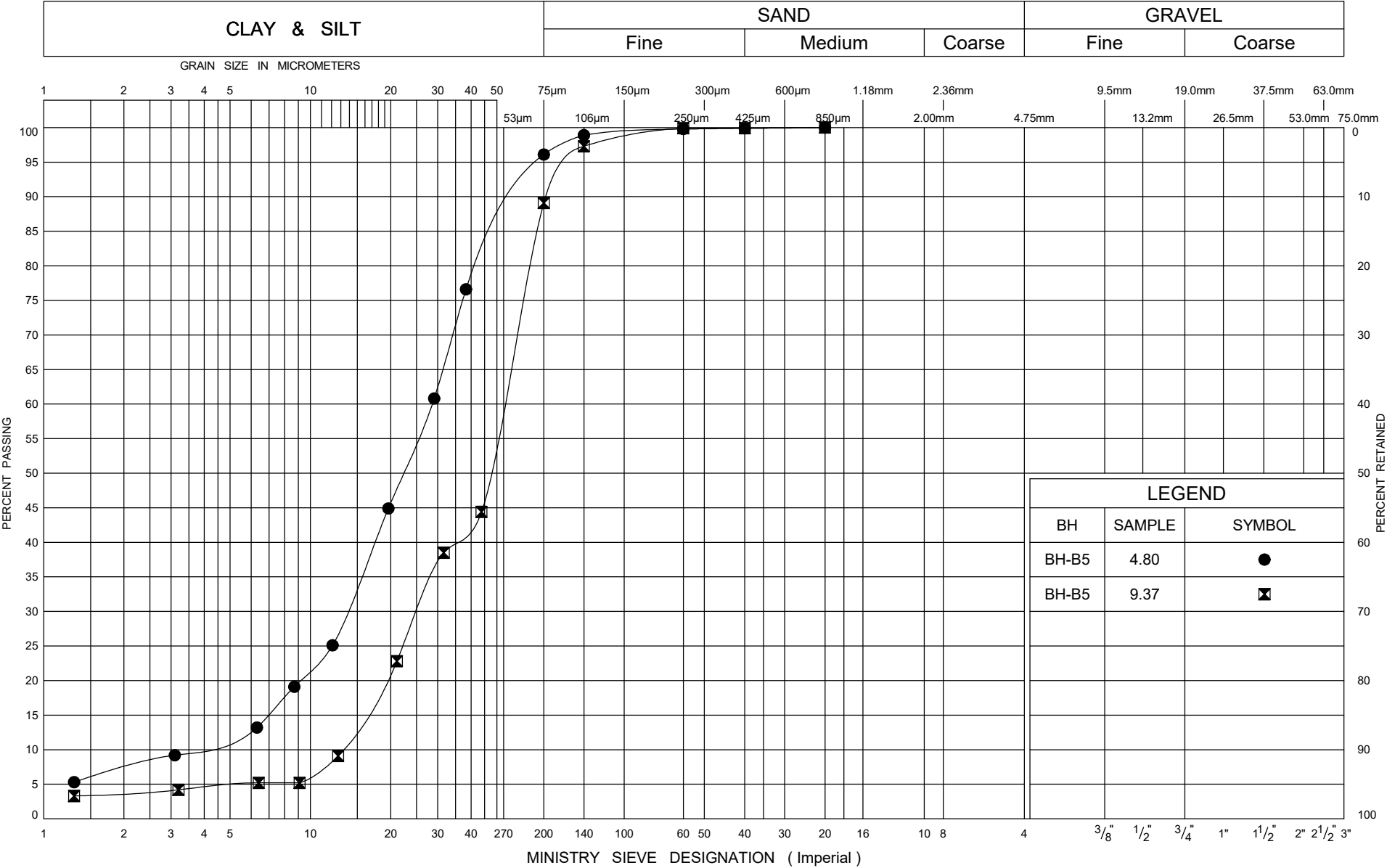
W P

6017-E-0066, Assignment 6

UNIFIED SOIL CLASSIFICATION SYSTEM



UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

Silt

FIG No 4

W P

6017-E-0066, Assignment 6

Appendix E – Results of Chemical Analyses



Your Project #: ADM-00248798-F0
 Site#: MTO #6
 Site Location: BEARDMORE AND SHABAQUA PATROL YARD
 Your C.O.C. #: n.a.

Attention: Kristof Karpiuk

exp Services Inc
 Thunder Bay Branch
 1142 Roland St
 Thunder Bay, ON
 CANADA P7B 5M4

Report Date: 2019/06/03
 Report #: R5737144
 Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: B9E2322

Received: 2019/05/28, 12:55

Sample Matrix: Soil
 # Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Hot Water Extractable Boron	2	2019/05/30	2019/05/31	CAM SOP-00408	R153 Ana. Prot. 2011
Chloride (20:1 extract)	2	2019/05/31	2019/05/31	CAM SOP-00463	SM 4500-Cl E m
Free (WAD) Cyanide	2	2019/05/29	2019/05/30	CAM SOP-00457	OMOE E3015 m
Conductivity	4	2019/05/30	2019/05/30	CAM SOP-00414	OMOE E3530 v1 m
Hexavalent Chromium in Soil by IC (1)	2	2019/05/29	2019/05/30	CAM SOP-00436	EPA 3060/7199 m
Petroleum Hydro. CCME F1 & BTEX in Soil (2)	2	N/A	2019/05/30	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydrocarbons F2-F4 in Soil (3)	2	2019/05/30	2019/05/31	CAM SOP-00316	CCME CWS m
F4G (CCME Hydrocarbons Gravimetric)	1	2019/06/03	2019/06/03	CAM SOP-00316	CCME PHC-CWS m
Strong Acid Leachable Metals by ICPMS	2	2019/05/30	2019/05/30	CAM SOP-00447	EPA 6020B m
Moisture	4	N/A	2019/05/29	CAM SOP-00445	Carter 2nd ed 51.2 m
pH CaCl2 EXTRACT	4	2019/05/30	2019/05/30	CAM SOP-00413	EPA 9045 D m
Resistivity of Soil	2	2019/05/28	2019/05/30	CAM SOP-00414	SM 23 2510 m
Sodium Adsorption Ratio (SAR)	2	N/A	2019/05/31	CAM SOP-00102	EPA 6010C
Sulphate (20:1 Extract)	2	2019/05/31	2019/05/31	CAM SOP-00464	EPA 375.4 m

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.



Your Project #: ADM-00248798-F0
Site#: MTO #6
Site Location: BEARDMORE AND SHABAQUA PATROL YARD
Your C.O.C. #: n.a.

Attention: Kristof Karpiuk

exp Services Inc
Thunder Bay Branch
1142 Roland St
Thunder Bay, ON
CANADA P7B 5M4

Report Date: 2019/06/03
Report #: R5737144
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: B9E2322

Received: 2019/05/28, 12:55

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

(1) Soils are reported on a dry weight basis unless otherwise specified.

(2) No lab extraction date is given for F1BTX & VOC samples that are field preserved with methanol. Extraction date is the date sampled unless otherwise stated.

(3) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Bureau Veritas Laboratories conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following "Alberta Environment's Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003". Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1

Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Michelle Brescacin, Project Manager Assistant

Email: Michelle.Brescacin@bvlabs.com

Phone# (807)344-4220

=====

This report has been generated and distributed using a secure automated process.

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



BUREAU
VERITAS

BV Labs Job #: B9E2322

Report Date: 2019/06/03

exp Services Inc

Client Project #: ADM-00248798-F0

Site Location: BEARDMORE AND SHABAQUA PATROL YARD

Sampler Initials: EF

O.REG 153 METALS & INORGANICS PKG (SOIL)

BV Labs ID			JVE978	JVE982		
Sampling Date			2019/05/22 18:50	2019/05/25 13:30		
COC Number			n.a.	n.a.		
	UNITS	Criteria	BHS2-S2	BHB3-S2	RDL	QC Batch
Calculated Parameters						
Sodium Adsorption Ratio	N/A	12	57	0.40		6143782
Inorganics						
Conductivity	mS/cm	1.4	1.7	0.069	0.002	6149194
Moisture	%	-	44	15	1.0	6147037
Available (CaCl ₂) pH	pH	-	8.21	8.04		6148972
WAD Cyanide (Free)	ug/g	0.051	0.03	0.01	0.01	6147385
Chromium (VI)	ug/g	8	0.3	<0.2	0.2	6147357
Metals						
Hot Water Ext. Boron (B)	ug/g	2	0.093	<0.050	0.050	6149195
Acid Extractable Antimony (Sb)	ug/g	40	0.20	<0.20	0.20	6149117
Acid Extractable Arsenic (As)	ug/g	18	3.2	1.6	1.0	6149117
Acid Extractable Barium (Ba)	ug/g	670	220	7.1	0.50	6149117
Acid Extractable Beryllium (Be)	ug/g	8	1.3	<0.20	0.20	6149117
Acid Extractable Boron (B)	ug/g	120	15	5.1	5.0	6149117
Acid Extractable Cadmium (Cd)	ug/g	1.9	0.15	<0.10	0.10	6149117
Acid Extractable Chromium (Cr)	ug/g	160	66	11	1.0	6149117
Acid Extractable Cobalt (Co)	ug/g	80	22	2.5	0.10	6149117
Acid Extractable Copper (Cu)	ug/g	230	76	6.0	0.50	6149117
Acid Extractable Lead (Pb)	ug/g	120	10	2.0	1.0	6149117
Acid Extractable Molybdenum (Mo)	ug/g	40	<0.50	<0.50	0.50	6149117
Acid Extractable Nickel (Ni)	ug/g	270	58	6.3	0.50	6149117
Acid Extractable Selenium (Se)	ug/g	5.5	<0.50	<0.50	0.50	6149117
Acid Extractable Silver (Ag)	ug/g	40	<0.20	<0.20	0.20	6149117
Acid Extractable Thallium (Tl)	ug/g	3.3	0.24	<0.050	0.050	6149117
Acid Extractable Uranium (U)	ug/g	33	1.1	0.32	0.050	6149117
Acid Extractable Vanadium (V)	ug/g	86	79	14	5.0	6149117
Acid Extractable Zinc (Zn)	ug/g	340	80	9.2	5.0	6149117
Acid Extractable Mercury (Hg)	ug/g	3.9	<0.050	<0.050	0.050	6149117
RDL = Reportable Detection Limit						
QC Batch = Quality Control Batch						
Criteria: Ontario Reg. 153/04 (Amended April 15, 2011)						
Table 3: Full Depth Generic Site Condition Standards in a Non-Potable Ground Water Condition						
Soil - Industrial/Commercial/Community - Coarse Textured Soil						



BV Labs Job #: B9E2322
Report Date: 2019/06/03

exp Services Inc
Client Project #: ADM-00248798-F0
Site Location: BEARDMORE AND SHABAQUA PATROL YARD
Sampler Initials: EF

O.REG 153 PETROLEUM HYDROCARBONS (SOIL)

BV Labs ID			JVE977	JVE980			JVE980		
Sampling Date			2019/05/22 18:50	2019/05/24 18:35			2019/05/24 18:35		
COC Number			n.a.	n.a.			n.a.		
	UNITS	Criteria	BHS3-S1	BHB2-S1	RDL	QC Batch	BHB2-S1 Lab-Dup	RDL	QC Batch
Inorganics									
Moisture	%	-	17	12	1.0	6147037	11	1.0	6147037
BTEX & F1 Hydrocarbons									
Benzene	ug/g	0.32	<0.020	<0.020	0.020	6149410			
Toluene	ug/g	68	<0.020	<0.020	0.020	6149410			
Ethylbenzene	ug/g	9.5	<0.020	<0.020	0.020	6149410			
o-Xylene	ug/g	-	<0.020	0.027	0.020	6149410			
p+m-Xylene	ug/g	-	<0.040	0.053	0.040	6149410			
Total Xylenes	ug/g	26	<0.040	0.080	0.040	6149410			
F1 (C6-C10)	ug/g	55	<10	<10	10	6149410			
F1 (C6-C10) - BTEX	ug/g	55	<10	<10	10	6149410			
F2-F4 Hydrocarbons									
F2 (C10-C16 Hydrocarbons)	ug/g	230	<10	<10	10	6149547			
F3 (C16-C34 Hydrocarbons)	ug/g	1700	140	<50	50	6149547			
F4 (C34-C50 Hydrocarbons)	ug/g	3300	170	<50	50	6149547			
Reached Baseline at C50	ug/g	-	No	Yes		6149547			
Surrogate Recovery (%)									
1,4-Difluorobenzene	%	-	101	101		6149410			
4-Bromofluorobenzene	%	-	100	99		6149410			
D10-Ethylbenzene	%	-	95	105		6149410			
D4-1,2-Dichloroethane	%	-	96	96		6149410			
o-Terphenyl	%	-	96	96		6149547			
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate Criteria: Ontario Reg. 153/04 (Amended April 15, 2011) Table 3: Full Depth Generic Site Condition Standards in a Non-Potable Ground Water Condition Soil - Industrial/Commercial/Community - Coarse Textured Soil									



RESULTS OF ANALYSES OF SOIL

BV Labs ID			JVE979			JVE979			JVE981		
Sampling Date			2019/05/22 18:50			2019/05/22 18:50			2019/05/25 13:30		
COC Number			n.a.			n.a.			n.a.		
	UNITS	Criteria	BHS3-S3	RDL	QC Batch	BHS3-S3 Lab-Dup	RDL	QC Batch	BHB3-S4	RDL	QC Batch
Calculated Parameters											
Resistivity	ohm-cm	-	110		6144440				14000		6144440
Inorganics											
Soluble (20:1) Chloride (Cl-)	ug/g	-	6900	400	6151107	6800	400	6151107	<20	20	6151107
Conductivity	mS/cm	1.4	9.1	0.002	6149194				0.072	0.002	6149194
Available (CaCl2) pH	pH	-	8.17		6148972				7.98		6148972
Soluble (20:1) Sulphate (SO4)	ug/g	-	390	20	6151111				<20	20	6151111
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate Criteria: Ontario Reg. 153/04 (Amended April 15, 2011) Table 3: Full Depth Generic Site Condition Standards in a Non-Potable Ground Water Condition Soil - Industrial/Commercial/Community - Coarse Textured Soil											

BV Labs ID			JVE981		
Sampling Date			2019/05/25 13:30		
COC Number			n.a.		
	UNITS	Criteria	BHB3-S4 Lab-Dup	RDL	QC Batch
Inorganics					
Soluble (20:1) Sulphate (SO4)	ug/g	-	<20	20	6151111
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate Criteria: Ontario Reg. 153/04 (Amended April 15, 2011) Table 3: Full Depth Generic Site Condition Standards in a Non-Potable Ground Water Condition Soil - Industrial/Commercial/Community - Coarse Textured Soil					



PETROLEUM HYDROCARBONS (CCME)

BV Labs ID			JVE977	JVE977		
Sampling Date			2019/05/22 18:50	2019/05/22 18:50		
COC Number			n.a.	n.a.		
	UNITS	Criteria	BHS3-S1	BHS3-S1 Lab-Dup	RDL	QC Batch
F2-F4 Hydrocarbons						
F4G-sg (Grav. Heavy Hydrocarbons)	ug/g	3300	490	490	100	6154383
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate Criteria: Ontario Reg. 153/04 (Amended April 15, 2011) Table 3: Full Depth Generic Site Condition Standards in a Non-Potable Ground Water Condition Soil - Industrial/Commercial/Community - Coarse Textured Soil						



BUREAU
VERITAS

BV Labs Job #: B9E2322
Report Date: 2019/06/03

exp Services Inc
Client Project #: ADM-00248798-F0
Site Location: BEARDMORE AND SHABAQUA PATROL YARD
Sampler Initials: EF

TEST SUMMARY

BV Labs ID: JVE977
Sample ID: BHS3-S1
Matrix: Soil

Collected: 2019/05/22
Shipped:
Received: 2019/05/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	6149410	N/A	2019/05/30	Haibin Wu
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	6149547	2019/05/30	2019/05/31	Prabhjot Gulati
F4G (CCME Hydrocarbons Gravimetric)	BAL	6154383	2019/06/03	2019/06/03	Simarpreet Kaur
Moisture	BAL	6147037	N/A	2019/05/29	Mithunaa Sasitheepan

BV Labs ID: JVE977 Dup
Sample ID: BHS3-S1
Matrix: Soil

Collected: 2019/05/22
Shipped:
Received: 2019/05/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
F4G (CCME Hydrocarbons Gravimetric)	BAL	6154383	2019/06/03	2019/06/03	Simarpreet Kaur

BV Labs ID: JVE978
Sample ID: BHS2-S2
Matrix: Soil

Collected: 2019/05/22
Shipped:
Received: 2019/05/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hot Water Extractable Boron	ICP	6149195	2019/05/30	2019/05/31	Archana Patel
Free (WAD) Cyanide	TECH	6147385	2019/05/29	2019/05/30	Barbara Kalbasi Esfahani
Conductivity	AT	6149194	2019/05/30	2019/05/30	Neil Dassanayake
Hexavalent Chromium in Soil by IC	IC/SPEC	6147357	2019/05/29	2019/05/30	Sally Norouz
Strong Acid Leachable Metals by ICPMS	ICP/MS	6149117	2019/05/30	2019/05/30	Viviana Canzonieri
Moisture	BAL	6147037	N/A	2019/05/29	Mithunaa Sasitheepan
pH CaCl2 EXTRACT	AT	6148972	2019/05/30	2019/05/30	Gnana Thomas
Sodium Adsorption Ratio (SAR)	CALC/MET	6143782	N/A	2019/05/31	Automated Statchk

BV Labs ID: JVE979
Sample ID: BHS3-S3
Matrix: Soil

Collected: 2019/05/22
Shipped:
Received: 2019/05/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	6151107	2019/05/31	2019/05/31	Deonarine Ramnarine
Conductivity	AT	6149194	2019/05/30	2019/05/30	Neil Dassanayake
pH CaCl2 EXTRACT	AT	6148972	2019/05/30	2019/05/30	Gnana Thomas
Resistivity of Soil		6144440	2019/05/30	2019/05/30	Ewa Pranjic
Sulphate (20:1 Extract)	KONE/EC	6151111	2019/05/31	2019/05/31	Deonarine Ramnarine

BV Labs ID: JVE979 Dup
Sample ID: BHS3-S3
Matrix: Soil

Collected: 2019/05/22
Shipped:
Received: 2019/05/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	6151107	2019/05/31	2019/05/31	Deonarine Ramnarine



BUREAU
VERITAS

BV Labs Job #: B9E2322

Report Date: 2019/06/03

exp Services Inc

Client Project #: ADM-00248798-F0

Site Location: BEARDMORE AND SHABAQUA PATROL YARD

Sampler Initials: EF

TEST SUMMARY

BV Labs ID: JVE980
Sample ID: BHB2-S1
Matrix: Soil

Collected: 2019/05/24
Shipped:
Received: 2019/05/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	6149410	N/A	2019/05/30	Haibin Wu
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	6149547	2019/05/30	2019/05/31	Prabhjot Gulati
Moisture	BAL	6147037	N/A	2019/05/29	Mithunaa Sasitheepan

BV Labs ID: JVE980 Dup
Sample ID: BHB2-S1
Matrix: Soil

Collected: 2019/05/24
Shipped:
Received: 2019/05/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	6147037	N/A	2019/05/29	Mithunaa Sasitheepan

BV Labs ID: JVE981
Sample ID: BHB3-S4
Matrix: Soil

Collected: 2019/05/25
Shipped:
Received: 2019/05/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	6151107	2019/05/31	2019/05/31	Deonarine Ramnarine
Conductivity	AT	6149194	2019/05/30	2019/05/30	Neil Dassanayake
pH CaCl2 EXTRACT	AT	6148972	2019/05/30	2019/05/30	Gnana Thomas
Resistivity of Soil		6144440	2019/05/30	2019/05/30	Ewa Pranjic
Sulphate (20:1 Extract)	KONE/EC	6151111	2019/05/31	2019/05/31	Deonarine Ramnarine

BV Labs ID: JVE981 Dup
Sample ID: BHB3-S4
Matrix: Soil

Collected: 2019/05/25
Shipped:
Received: 2019/05/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphate (20:1 Extract)	KONE/EC	6151111	2019/05/31	2019/05/31	Deonarine Ramnarine

BV Labs ID: JVE982
Sample ID: BHB3-S2
Matrix: Soil

Collected: 2019/05/25
Shipped:
Received: 2019/05/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hot Water Extractable Boron	ICP	6149195	2019/05/30	2019/05/31	Archana Patel
Free (WAD) Cyanide	TECH	6147385	2019/05/29	2019/05/30	Barbara Kalbasi Esfahani
Conductivity	AT	6149194	2019/05/30	2019/05/30	Neil Dassanayake
Hexavalent Chromium in Soil by IC	IC/SPEC	6147357	2019/05/29	2019/05/30	Sally Norouz
Strong Acid Leachable Metals by ICPMS	ICP/MS	6149117	2019/05/30	2019/05/30	Viviana Canzonieri
Moisture	BAL	6147037	N/A	2019/05/29	Mithunaa Sasitheepan
pH CaCl2 EXTRACT	AT	6148972	2019/05/30	2019/05/30	Gnana Thomas
Sodium Adsorption Ratio (SAR)	CALC/MET	6143782	N/A	2019/05/31	Automated Statchk



GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	3.0°C
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Sample JVE982 [BHB3-S2] : SAR Analysis: Sodium was not detected. To report SAR the sodium detection limit was used in the calculation. This value represents a maximum ratio.

Results relate only to the items tested.

BUREAU
VERITAS

BV Labs Job #: B9E2322

Report Date: 2019/06/03

QUALITY ASSURANCE REPORT

exp Services Inc

Client Project #: ADM-00248798-F0

Site Location: BEARDMORE AND SHABAQUA PATROL YARD

Sampler Initials: EF

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
6149410	1,4-Difluorobenzene	2019/05/30	99	60 - 140	101	60 - 140	101	%		
6149410	4-Bromofluorobenzene	2019/05/30	101	60 - 140	103	60 - 140	101	%		
6149410	D10-Ethylbenzene	2019/05/30	93	60 - 140	95	60 - 140	95	%		
6149410	D4-1,2-Dichloroethane	2019/05/30	95	60 - 140	100	60 - 140	98	%		
6149547	o-Terphenyl	2019/05/31	105	60 - 130	97	60 - 130	96	%		
6147037	Moisture	2019/05/29							5.3	20
6147357	Chromium (VI)	2019/05/30	80	70 - 130	94	80 - 120	<0.2	ug/g	NC	35
6147385	WAD Cyanide (Free)	2019/05/30	95	75 - 125	94	80 - 120	<0.01	ug/g	NC	35
6148972	Available (CaCl ₂) pH	2019/05/30			100	97 - 103			0.24	N/A
6149117	Acid Extractable Antimony (Sb)	2019/05/30	98	75 - 125	101	80 - 120	<0.20	ug/g		
6149117	Acid Extractable Arsenic (As)	2019/05/30	102	75 - 125	101	80 - 120	<1.0	ug/g		
6149117	Acid Extractable Barium (Ba)	2019/05/30	NC	75 - 125	99	80 - 120	<0.50	ug/g	0.75	30
6149117	Acid Extractable Beryllium (Be)	2019/05/30	102	75 - 125	99	80 - 120	<0.20	ug/g	0.33	30
6149117	Acid Extractable Boron (B)	2019/05/30	101	75 - 125	101	80 - 120	<5.0	ug/g	2.1	30
6149117	Acid Extractable Cadmium (Cd)	2019/05/30	99	75 - 125	99	80 - 120	<0.10	ug/g	28	30
6149117	Acid Extractable Chromium (Cr)	2019/05/30	102	75 - 125	100	80 - 120	<1.0	ug/g	2.5	30
6149117	Acid Extractable Cobalt (Co)	2019/05/30	99	75 - 125	99	80 - 120	<0.10	ug/g	3.6	30
6149117	Acid Extractable Copper (Cu)	2019/05/30	100	75 - 125	98	80 - 120	<0.50	ug/g	0.77	30
6149117	Acid Extractable Lead (Pb)	2019/05/30	102	75 - 125	101	80 - 120	<1.0	ug/g	4.3	30
6149117	Acid Extractable Mercury (Hg)	2019/05/30	90	75 - 125	92	80 - 120	<0.050	ug/g		
6149117	Acid Extractable Molybdenum (Mo)	2019/05/30	104	75 - 125	97	80 - 120	<0.50	ug/g	1.3	30
6149117	Acid Extractable Nickel (Ni)	2019/05/30	103	75 - 125	99	80 - 120	<0.50	ug/g	2.4	30
6149117	Acid Extractable Selenium (Se)	2019/05/30	104	75 - 125	103	80 - 120	<0.50	ug/g		
6149117	Acid Extractable Silver (Ag)	2019/05/30	98	75 - 125	99	80 - 120	<0.20	ug/g	NC	30
6149117	Acid Extractable Thallium (Tl)	2019/05/30	100	75 - 125	100	80 - 120	<0.050	ug/g	1.1	30
6149117	Acid Extractable Uranium (U)	2019/05/30	101	75 - 125	100	80 - 120	<0.050	ug/g	0.18	30
6149117	Acid Extractable Vanadium (V)	2019/05/30	NC	75 - 125	101	80 - 120	<5.0	ug/g	5.4	30
6149117	Acid Extractable Zinc (Zn)	2019/05/30	NC	75 - 125	103	80 - 120	<5.0	ug/g	0.68	30
6149194	Conductivity	2019/05/30			104	90 - 110	<0.002	mS/cm	3.4	10
6149195	Hot Water Ext. Boron (B)	2019/05/31	112	75 - 125	109	75 - 125	<0.050	ug/g	1.6	40
6149410	Benzene	2019/05/30	81	60 - 140	90	60 - 140	<0.020	ug/g	NC	50
6149410	Ethylbenzene	2019/05/30	84	60 - 140	96	60 - 140	<0.020	ug/g	NC	50

BUREAU
VERITAS

BV Labs Job #: B9E2322

Report Date: 2019/06/03

QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc

Client Project #: ADM-00248798-F0

Site Location: BEARDMORE AND SHABAQUA PATROL YARD

Sampler Initials: EF

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
6149410	F1 (C6-C10) - BTEX	2019/05/30					<10	ug/g	NC	30
6149410	F1 (C6-C10)	2019/05/30	86	60 - 140	94	80 - 120	<10	ug/g	NC	30
6149410	o-Xylene	2019/05/30	83	60 - 140	96	60 - 140	<0.020	ug/g	NC	50
6149410	p+m-Xylene	2019/05/30	83	60 - 140	96	60 - 140	<0.040	ug/g	NC	50
6149410	Toluene	2019/05/30	84	60 - 140	96	60 - 140	<0.020	ug/g	NC	50
6149410	Total Xylenes	2019/05/30					<0.040	ug/g	NC	50
6149547	F2 (C10-C16 Hydrocarbons)	2019/05/31	101	50 - 130	93	80 - 120	<10	ug/g	NC	30
6149547	F3 (C16-C34 Hydrocarbons)	2019/05/31	106	50 - 130	95	80 - 120	<50	ug/g	NC	30
6149547	F4 (C34-C50 Hydrocarbons)	2019/05/31	105	50 - 130	95	80 - 120	<50	ug/g	NC	30
6151107	Soluble (20:1) Chloride (Cl-)	2019/05/31	NC	70 - 130	105	70 - 130	<20	ug/g	0.89	35
6151111	Soluble (20:1) Sulphate (SO4)	2019/05/31	121	70 - 130	112	70 - 130	<20	ug/g	NC	35
6154383	F4G-sg (Grav. Heavy Hydrocarbons)	2019/06/03	103	65 - 135	101	65 - 135	<100	ug/g	0	50

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).





BUREAU
VERITAS

BV Labs Job #: B9E2322
Report Date: 2019/06/03

exp Services Inc
Client Project #: ADM-00248798-F0
Site Location: BEARDMORE AND SHABAQUA PATROL YARD
Sampler Initials: EF

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Ewa Pranjić, M.Sc., C.Chem, Scientific Specialist

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

CHAIN OF CUSTODY RECORD

Page 1 OF 1

Invoice Information		Report Information (if differs from invoice)		Project Information (where applicable)		Turnaround Time (TAT) Required							
Company Name: #17501 Exp Service Inc		Company Name:		Quotation #:		<input checked="" type="checkbox"/> Regular TAT (5-7 days) Most analyses							
Contact Name: Accounts Payable		Contact Name:		P.O. #/ AFE#:		PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS							
Address: 1142 Roland St		Address:		Project #: ADM00248798-FO		Rush TAT (Surcharges will be applied)							
Thunder Bay ON P7B 5M4				Site Location: Beardmore and Shabaqua Patrol Yard		<input type="checkbox"/> 1 Day <input type="checkbox"/> 2 Days <input type="checkbox"/> 3-4 Days							
Phone: (807) 623-9495 Fax: (807) 623-8070		Phone: Fax:		Site #: MT0 #6		Date Required:							
Email: Ahileas.Mitsopoulos@exp.com, Karen.Burke@exp.com		Email: Kristof.Karpiuk@exp.com, Navjot.Kanwar@exp.com		Site Location Province: ONTARIO		Rush Confirmation #:							
MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY													
Regulation 153		Other Regulations		Analysis Requested		LABORATORY USE ONLY							
<input type="checkbox"/> Table 1 <input type="checkbox"/> Res/Park <input type="checkbox"/> Med/ Fine <input type="checkbox"/> Table 2 <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Coarse <input checked="" type="checkbox"/> Table 3 <input type="checkbox"/> Agri/ Other <input type="checkbox"/> Table _____ FOR RSC (PLEASE CIRCLE) Y / N		<input type="checkbox"/> CCME <input type="checkbox"/> Sanitary Sewer Bylaw <input type="checkbox"/> MISA <input type="checkbox"/> Storm Sewer Bylaw <input type="checkbox"/> PWQO Region <input type="checkbox"/> Other (Specify) <input type="checkbox"/> REG 558 (MIN. 3 DAY TAT REQUIRED)		# OF CONTAINERS SUBMITTED FIELD FILTERED (CIRCLE) Metals / Hg / CVI PHC (incl. BTEX) pH Water Soluble Sulphate Resistivity Conductivity Chloride Metals & Inorganics, Hg, HWSB, CrVI, SAR, pH, EC, Free CN		CUSTODY SEAL Y / N Present Intact N N/A 4/4/1 COOLING MEDIA PRESENT: Y / N COMMENTS							
SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM													
SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED (CIRCLE) Metals / Hg / CVI	PHC (incl. BTEX)	pH	Water Soluble Sulphate	Resistivity	Conductivity	Chloride	Metals & Inorganics, Hg, HWSB, CrVI, SAR, pH, EC, Free CN	HOLD- DO NOT ANALYZE
1 BHS3-S1	5/22/2019	6:50 PM	Soil	3	X								
2 BHS2-S2	5/22/2019	6:50 PM	Soil	1								X	
3 BHS3-S3	5/22/2019	6:50 PM	Soil	1			X	X	X	X	X		
4 BHB2-S1	5/24/2019	6:35 PM	Soil	3	X								
5 BHB3-S4	5/25/2019	1:30 PM	Soil	1			X	X	X	X	X		
6 BHB3-S2	5/25/2019	1:30 PM	Soil	1								X	
7													
8													
9													
10													
RELINQUISHED BY: (Signature/Print)		DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)		DATE: (YYYY/MM/DD)		TIME: (HH:MM)					
		5/28/2019	12:05 AM			2019/05/28		12:55					
						2019/05/29		1027					

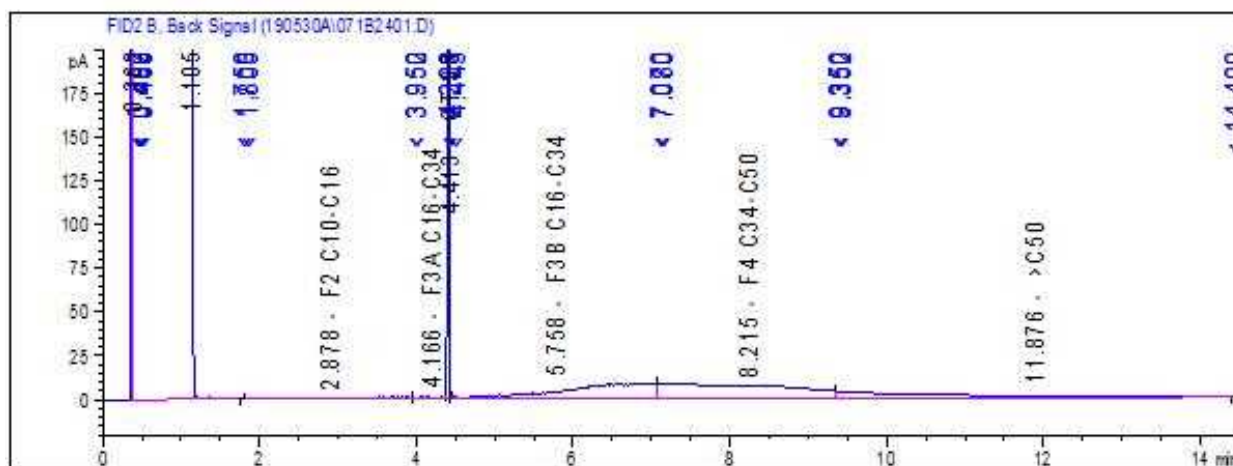
RECEIVED
 T Bay

28-May-19 12:55
 Michelle Brescacin

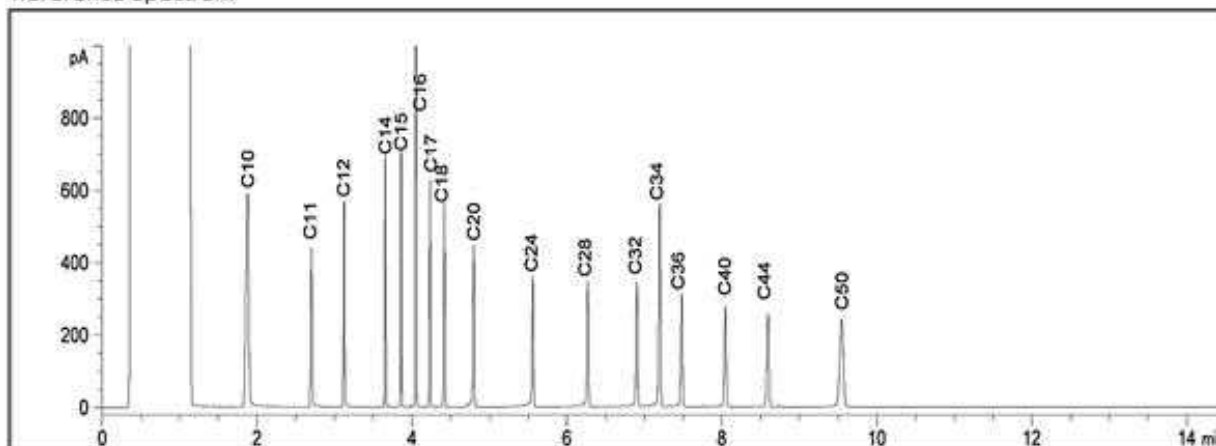
 B9E2322

2/1/21cp

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram



Reference Spectrum



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline: C6 - C12

Diesel: C10 - C24

Jet Fuels: C6 - C16

Varsol: C8 - C12

Fuel Oils: C6 - C32

Creosote: C10 - C26

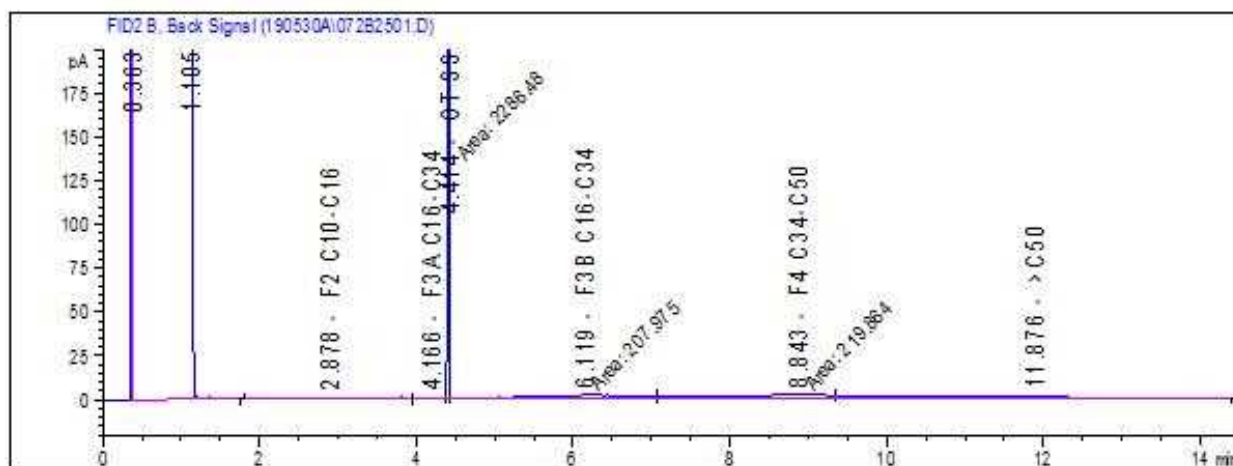
Kerosene: C8 - C16

Motor Oils: C16 - C50

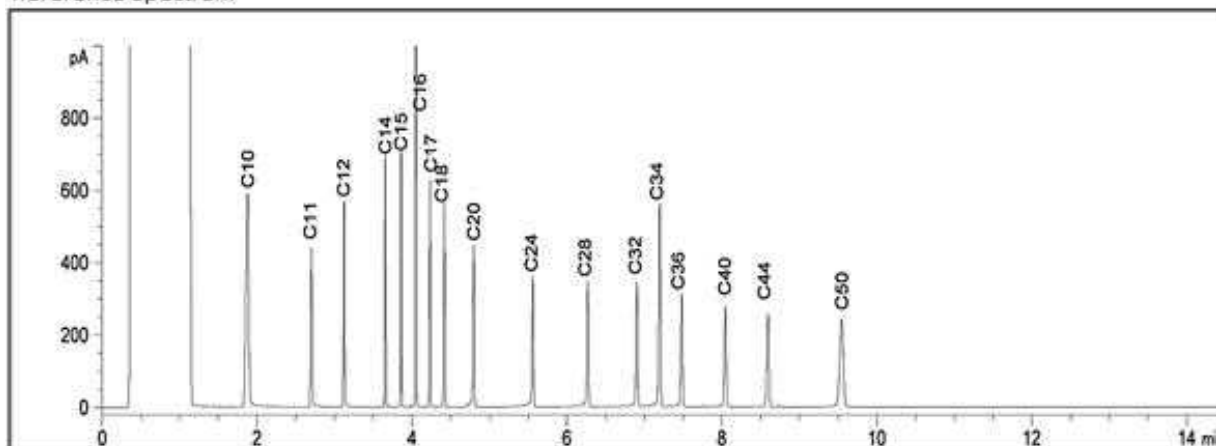
Asphalt: C18 - C50+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram



Reference Spectrum



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline: C6 - C12

Diesel: C10 - C24

Jet Fuels: C6 - C16

Varsol: C8 - C12

Fuel Oils: C6 - C32

Creosote: C10 - C26

Kerosene: C8 - C16

Motor Oils: C16 - C50

Asphalt: C18 - C50+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.