APPENDIX A

GEOTECHNICAL REPORTS

Part II

GEOTECHNICAL INVESTIGATION AND LIMITED CHEMICAL TESTING PROGRAM PORT DALHOUSIE HARBOUR WALL ST. CATHARINES, ONTARIO

for

AECOM

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PML Ref.: 16HF019
Report: 2
January 2017

Peto MacCallum Ltd.
CONSULTING ENGINEERS

February 16, 2017

PML Ref.: 16HF019
Report: 2

Mr. James Wallace, P.Eng.
AECOM
300 Water Street
Whitby, Ontario
L1N 9J2

Dear Mr. Wallace

Geotechnical Investigation and
Limited Chemical Testing Program
Port Dalhousie Harbour Wall
St. Catharines, Ontario

Peto MacCallum Ltd. (PML) is pleased to present the results of the geotechnical investigation and limited chemical testing program recently completed for this project. Authorization to proceed with this assignment was provided by Mr. James Wallace in an email dated November 23, 2016. Services were provided in accordance with the PML proposal, provided in an email dated November 15, 2016.

It is understood that Fisheries and Oceans Canada (DFO) plans to rehabilitate the Port Dalhousie west and east harbour walls located in St. Catharines, Ontario. Current plans call for the rehabilitation to include sheet pile walls and/or rock berms for approximately 176 m of the west wall east of to the Royal Canadian Legion and Lockhart Point parking lot and approximately 170 m of the east harbour wall located west of the waterfront trail off Lighthouse Road.

PML has previously carried out several geotechnical investigations at the Port Dalhousie Harbour:

- Geotechnical Investigation, Port Dalhousie Pier, St. Catharines, Ontario, PML Ref.: 14HF051, Report: 1, dated January 16, 2015

- Geotechnical Investigation, Port Dalhousie Harbour Wall, St. Catharines, Ontario, PML Ref.: 16HF019, Report 1, dated January 16, 2015

The purpose of this geotechnical investigation was to establish the subsurface soil and ground water conditions along the wall and based on the findings, provide geotechnical recommendations for lateral earth pressure parameters of the subsurface soil.

A limited chemical testing program was included with the geotechnical work to check the geoenvironmental quality of the site soil in order to provide comments regarding on site or off site re-use and/or disposal options of excess soil. It should be noted that ground water sampling and testing was not part of the Terms of Reference for this assignment and no work was carried out in this regard.

The subsurface stratigraphy revealed in the boreholes typically comprised fill over organic silt overlying sand underlain by silt till/shale complex mantling weathered shale bedrock.

The results of the limited chemical testing program indicate the chemical quality of the tested soil samples did not meet the site condition standards for Table 1 residential/parkland/institutional/ industrial/commercial/community, Table 2 and 3 residential/parkland/institutional and Table 9 residential/parkland/institutional/industrial/commercial/community property use for cadmium, zinc, boron (hot water soluble) and/or pH in Boreholes 102 and 103. The results met the site condition standards for Table 2 and 3 industrial/commercial/community property uses.

Detailed comments and recommendations concerning the lateral earth pressure parameters and allowable bearing capacities of the subsurface soil, as well as the results of the limited screening are provided in the attached report.

We trust the information presented in the attached report will be sufficient for your present purposes. If you have any questions, please do not hesitate to contact our office.

Sincerely

Peto MacCallum Ltd.

Matthew D. St Denis, P.Eng.
Manager, Geotechnical Services

KF:ld

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1. INTRODUCTION

Peto MacCallum Ltd. (PML) is pleased to present the results of the geotechnical investigation and limited chemical testing program recently completed for this project. Authorization to proceed with this assignment was provided by Mr. James Wallace in an email dated November 23, 2016. Services were provided in accordance with the PML proposal, provided in an email dated November 15, 2016.

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The comments and recommendations provided in this report are based on the site conditions at the time of the investigation, and are applicable only to the proposed project as described in the report. Any changes in the project, including finished grades and layout will require review by PML to assess the validity of the report, and may require modified recommendations, additional investigation and/or analysis.

2. INVESTIGATION PROCEDURES

The field work was carried out on December 21 to 23, 2016 and consisted of a total of three boreholes (Boreholes 101 to 103) drilled to termination depths of 10.2 to 18.3 m. The borehole locations are shown on Drawing 2-1, appended.

The borehole location was selected in coordination with AECOM and established in the field by PML. The ground surface elevation and UTM co-ordinates at the borehole location was determined by PML. The following benchmark (BM) was used for vertical reference:

BM: Tablet in west concrete foundation wall of inner lighthouse at entrance to harbour, 1.70 m from northwest corner, 1.35 m from southwest corner, 20 cm below shingle siding (Geodetic Survey of Canada BM No. 561F). Elevation: 75.822 m (metric, geodetic).

The boreholes were advanced using continuous flight hollow stem augers, wash boring and tri-coning inside HW size casing and HQ diamond coring, powered by a track-mounted CME-55 drill rig, supplied and operated by a specialist drilling contractor, working under the full time supervision of a member of the PML engineering staff. It is noted that Boreholes 101 and 102 were completed on land; Borehole 103 was completed over water.

Representative samples of the overburden were recovered at frequent depth intervals using a conventional split-spoon sampler during drilling. Standard penetration, dynamic cone penetration and pocket penetrometer tests were conducted simultaneously with the sampling operation to assess the strength characteristics of the substrata.

The ground water conditions at the borehole locations were assessed during drilling by visual examination of the soil, the sampler and the drill rods as the samples were retrieved and when appropriate by measurement of the water level in the open borehole.

The lake water elevation was obtained from The Canadian Hydrographic Service water level gauging station located in Port Weller, Ontario. The water level elevations are referenced to the International Great Lakes Datum 1985.

The recovered samples were returned to our laboratory for detailed visual examination, classification and moisture content determinations. Selected soil samples were submitted to AGAT Laboratories to assess the environmental properties of the soil. Details concerning the environmental sampling and testing protocol are provided in Section 5.

3. SUMMARIZED SUBSURFACE CONDITIONS

Reference is made to the appended Log of Borehole sheets for details of the subsurface conditions including soil classifications, inferred stratigraphy, standard penetration test N values, rock coring details, ground water observations and the results of laboratory moisture content determinations.

Due to the soil sampling procedures and limited sample size, the depth demarcations on the borehole logs must be viewed as transitional zones between layers and cannot be construed as exact geologic boundaries between layers. PML would be pleased to assist in defining geologic boundaries during construction if required.

The subsurface stratigraphy revealed in the boreholes typically comprised fill over organic silt overlying sand underlain by silt till/shale complex mantling weathered shale bedrock.

3.1 Fill

A 225 to 325 mm thick topsoil fill layer was encountered surficially in Boreholes 101 and 102. The topsoil fill comprised silt judged to be damp.

A 6.8 and 6.7 m thick fill layer was contacted below the topsoil fill in Boreholes 101 and 102, respectively, and penetrated at 7.0 m (elevation 68.9). The fill layer generally consisted of cobbles, boulders, wood, sand and gravel.

3.2 Organic Silt

Organic silt was contacted below the fill at 7.0 m (elevation 68.9) in Boreholes 101 and 102, respectively, and was penetrated at 15.6 and 14.3 m (elevation 60.3 and 61.6). The condition of the silt was very loose to loose. The silt was interspersed with layers of sandy or clayey composition and had variable levels of organic content.

3.3 Sand

Very loose to compact sand was contacted below organic silt at 15.6 and 14.3 m (elevation 60.3 and 61.6) and was penetrated at 16.2 m (elevation 59.7) in Boreholes 101 and 102, respectively. Locally, in Borehole 103, the sand was contacted at the base of the harbour at 5.5 m (elevation 70.7) and was penetrated at 7.0 m (elevation 69.2). The moisture content of the sand typically was 15 to 21% and was judged to be saturated.

3.4 Clay Till/Shale Complex

Clay till/shale complex was contacted below the sand deposit at 16.2 m (elevation 59.7) in Boreholes 101 and 102, respectively. This material generally consisted of clay till with variable amounts of silt, sand, gravel, and shale fragments and represents the transition to the underlying weathered shale bedrock.

3.5 Shale

Shale bedrock was contacted at 17.8 and 17.6 m (elevation 58. 1 and 58.3) in Boreholes 101 and 102, respectively, and extended to the termination depths of 18.3 m (elevation 57.6). Locally, in Borehole 103, shale was contacted at 7.0 m (elevation 69.2) to the termination depth of 10.2 m (elevation 66.0) The shale bedrock was red shale of the Queenston Formation and was judged to

be highly weathered to weathered. It is noted that numerous and frequent grey hard layers were encountered within the shale.

Diamond rock coring of the shale was completed from 7.7 to 10.2 m in Borehole 103. The Total Core Recovery (TCR) of the rock cores ranged from 98 to 100%. The Rock Quality Designation (RQD) ranged from 44 to 66%.

Based on the TCR, RQD and visual examination of the rock cores, the shale was medium bedded, poor to fair quality, very thinly to thinly bedded with grey hard layers. The rock cores are documented in Photograph 1, appended.

3.6 Ground Water Conditions

Upon completion of drilling, free water was observed at 0.8 and 1.5 m (elevation 75.1 and 74.4) with cave to 5.7 and 4.8 m (elevation 70.2 and 71.1) in Borehole s 101 and 102 respectively.

At the time of drilling, the water level in Lake Ontario ranged from elevation 74.4 to 74.5. The lake water elevation was obtained from The Canadian Hydrographic Service water level gauging station located in Port Weller, Ontario. The elevation is referenced to the International Great Lakes Datum 1985.

Ground water levels may fluctuate subject to seasonal variations and precipitation patterns.

4. ENGINEERING DISCUSSION AND RECOMMENDATIONS

It is understood that Fisheries and Oceans Canada (DFO) plans to rehabilitate the Port Dalhousie west and east harbour walls located in St. Catharines, Ontario. Current plans call for the rehabilitation to include sheet pile walls and/or rock berms for approximately 176 m of the west wall east of to the Royal Canadian Legion and Lockhart Point parking lot and approximately 170 m of the east harbour wall located west of the waterfront trail off Lighthouse Road.

The purpose of the geotechnical investigation was to establish the subsurface soil and ground water conditions along the piers and based on the findings, provide geotechnical recommendations for lateral earth pressure parameters and allowable bearing capacities of the subsurface soil.

The subsurface stratigraphy revealed in the boreholes typically comprised fill over organic silt overlying sand underlain by silt till/shale complex mantling weathered shale bedrock.

For the weathered shale, a factored net bearing resistance at ULS of 500 kPa can be used for design. Serviceability Limit State (SLS) resistance is not expected to govern the design since the bearing pressure required to mobilize 25 mm of settlement would be greater than the ULS resistance

Due to the variability, organic content and low 'N' Values in the fill, sand and organic and alluvial silt and clay layers, significant post-construction settlement would be anticipated. Further analysis of the soil units and details regarding proposed loads, construction procedures and allowable settlement would be required to provide ULS and SLS bearing values and to quantify the order of magnitude of settlement.

The geotechnical lateral earth pressure design parameters for the main soil types encountered in the boreholes are provided in the following table:

Table 1

Design Parameters for Main Soil Types

Soil Type	Saturated/ Submerged Unit Weight (kN/m^3)	Undrained Shear Strength (kPa) (Short Term)	Undrained Friction Angle (°) (Long Term)	Rankine Coefficient of Active Earth Pressure (K_a)	Rankine Coefficient of Passive Earth Pressure (K_p)*
Fill	18.0 / 8.2	NA	25	0.41	2.5
Organic Silt	16.0 / 6.2	NA	22	0.45	2.2
Sand	19.0 / 9.2	NA	30	0.33	3.0
Clay Till/Shale Complex	22.0 / 12.2	5	27	0.38	2.7

* Coefficient does not include a Factor of Safety.

5. GEOENVIRONMENTAL CONSIDERATIONS

PML understands that excess soil may be generated during construction; the volume of which is unknown at this time. A limited chemical testing program was carried out to check the geoenvironmental quality of the soil at selected sampling locations in order to provide comments regarding on site or off site re-use and/or disposal options of excess soil.

A Phase One Environmental Site Assessment (ESA) was not within the scope of work for this assignment. Accordingly, soil and ground water impairment that has not been identified by the limited chemical testing program may exist elsewhere at the site. The limited chemical testing program does not constitute an Environmental Site Assessment as defined under the Environmental Protection Act and O. Reg. 153/04, as amended.

5.1 Chemical Testing Protocol

Representative samples collected during the geotechnical investigation were returned to our laboratory for detailed visual examination. Soil samples were submitted for chemical analysis to AGAT Laboratories Limited (AGAT), a Canadian Association for Laboratory Accreditation Inc. (CALA) accredited laboratory in Mississauga, Ontario. The chemical analyses conducted by AGAT were in accordance with the O. Reg. 153/04, as amended Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act dated March 9, 2004, amended as of July 1, 2011.

As part of the geoenvironmental procedural protocol, all recovered soil samples were examined for visual and olfactory evidence of potential contamination.

Samples were reviewed and selected for chemical testing in accordance with the quote whereby three samples were selected and analyzed for general screening for metals and inorganic parameters.

A list of all samples submitted for analysis is included as Table A1, appended.

5.2 Pertinent Regulatory Standards

The Ontario Ministry of the Environment and Climate Change (MOECC) has developed a set of Soil, Ground water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act (April 15, 2011) and O. Reg. 153/04, as amended. The standards consist of nine tables (Table 1 through Table 9) that provide criteria for maximum concentrations of various contaminants. In general, the applicable O. Reg. 153/04, as amended Site Condition Standards (SCSs) depend on the site location, land use, soil texture, bedrock depth, soil pH and source of potable water at the investigation site.

Based on current information, a Table 1 (T1) residential/parkland/institutional/industrial/ commercial/community (RPI/ICC) site condition standard (SCS) applies to the site since pH in one sample was elevated above the acceptable range for surface soil, however a full evaluation of applicable SCSs in accordance with Sections 41 and 43.1 of O. Reg. 153/04, as amended, was not within the scope of this assignment and further environmental work would be required to confirm this.

For the option of re-using the excess soils with minimal environmental restrictions, the O. Reg. 153/04, as amended, Full Depth Background T1 SCSs for RPI/ICC property uses were utilized.

For the option of re-using the excess soils at a property (or properties) with a potable ground water condition, the O. Reg. 153/04, as amended, Full Depth Generic Table 2 (T2) SCSs were utilized for both RPI and ICC land uses.

For the option of re-using the excess soils at a property (or properties) with a non potable ground water condition, the O. Reg. 153/04, as amended, Full Depth Generic Table 3 (T3) SCSs were utilized for both RPI and ICC land uses.

It is noted that a comparison to the Tables 4 and 5 SCSs for stratified site condition, Tables 6 and 7 SCSs for shallow bedrock condition and Tables 8 for use within 30 m of a water body (potable and non potable ground water conditions) were not conducted as part of this assignment.

If the potential receiving site for excess soil falls within one of these categories, additional evaluation by PML will be required to confirm conformance.

Since the land is Federal property, the results were also compared to the Canadian Council of Ministers of the Environment (CCME) Guidelines for Residential/Parkland (R/P) land use (coarse textured soil).

5.3 Analytical Findings

Laboratory Certificates of Analysis compared to T1, T2, T3, T9 and CCME SCSs are included in Appendix A. The measured values and corresponding SCSs (labelled as G/S for Guideline/ Standard) are shown on the certificates of analysis. In the event of an exceedance of the SCSs, the level is shown in **bold** text, where applicable.

5.3.1 On Site Re-Use

Based on the results of chemical testing the measured concentration of the tested parameters complied with the T9 RPI/ICC SCSs with the following exceptions:

LOCATION	SAMPLE	PARAMETERS
Borehole 102	BH102 SS1B	pH
	BH102 SS3	Cadmium Zinc
Borehole 103	BH103 SS2	Boron (Hot Water Soluble)

5.3.2 Off Site Re-Use

A comparison of the results was carried out against the SCSs of T1, T2 and T3 and CCME**.** The following table outlines a summary of the suitability for re-use of excess soil material based on the limited chemical testing.

Table 1 (RPI/ICC)	Table 2 (RPI)	Table 2 (ICC)	Table 3 (RPI)	Table 3 (ICC)	CCME (R/P)	Licensed Landfill
No	No	No[1]	No	No[1]	No	TCLP Testing would be required

Notes:

1. Due to elevated pH
2. TCLP - Toxicity Characteristic Leaching Procedure

5.4 Discussion and Recommendations

It is noted that a sample of the sediment was not obtained during this investigation. In this regard, if excess soil to be removed from site includes the sediment, it is recommended that additional sampling and chemical testing should be carried out during construction to verify the chemical quality to assess the appropriate management/disposal options for the soil leaving the site.

If the excess soil is to be removed from the site for off site re-use, the following conditions must be met:

- Soil with elevated pH is delineated and disposed of off-site to landfill
- The work must be completed in accordance with local by-laws governing soil movement and/or placement at other sites;
- All analytical results and environmental assessment reports must be fully disclosed to the receiving site owners/authorities and they have agreed to receive the material;
- The applicable SCSs for the receiving site have been determined, as confirmed by the environmental consultant and the SCSs are consistent with the chemical quality of the soil originating at the source site;
- The excess soil cannot be taken to a property for which a Record of Site Condition (RSC) has been previously filed unless the soil quality meets the SCSs contained in the RSC;
- The excess soil cannot be taken to a property for which a RSC is being filed as outlined in O. Reg. 153/04, as amended, unless the chemical testing program is completed in accordance with the Regulation;

- Transportation and placement of the excess soil is monitored by the environmental consultant to check the material is appropriately placed at the pre-approved site;
- The receiving site must be arranged and/or approved well in advance of excavation in order to avoid delays during construction. As well, it is noted the chemical testing requirements for various receiving sites is site-specific and additional testing may be required, beyond that provided in this report.

The excavation work should be conducted in accordance with a written Soil Management Plan prepared by a qualified professional to ensure that all excess excavated material is tested and managed appropriately, and that imported fill material is of suitable quality and meets the SCSs applicable to the site. Re-use of excess excavated soil on site is also subject to acceptance for re-use by the geotechnical consultant at the time of construction based on geotechnical considerations.

Additional sampling and chemical testing should be carried out during construction to verify the chemical quality of the excess soil to assess the appropriate management/disposal options for the soil leaving the site.

It is recommended that transportation of fill material from the Source Site(s) to the Receiving Site(s) be carried out in accordance with the MOECC *document Management of Excess Soil – A Guide for Best Management Practices* dated January 2014.

It should be noted that the soil conditions between and beyond the sampled locations may differ from those encountered during this assignment. PML should be contacted if impacted soil conditions become apparent during future development to further assess and appropriately handle the materials, if any, and evaluate whether modifications to the conclusions documented in this report are necessary.

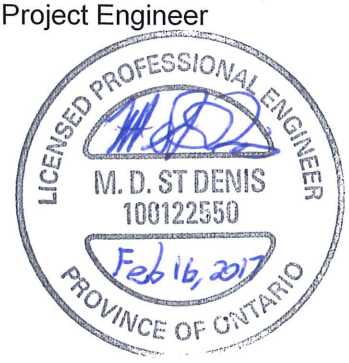
There is no legal requirement to remove or treat the soil that exceeds the SCSs applicable to the site provided it is demonstrated that there is no on site or off site impact/contaminant migration or adverse effect. However, if contaminated soil is left on site, the landowner assumes liability

associated with the contamination. The liability concerns could include potential scrutiny from the MOECC, neighbouring property owners and the public, potential for decreased value of the land and issues during potential divesting of the property due to environmental liability concerns on the part of future owners or their financiers/insurers.

We trust the information presented in this report is sufficient for your present purposes. If you have any questions, please do not hesitate to contact our office.

Sincerely
Peto MacCallum Ltd.

Karel Furbacher, P.Eng.
Project Engineer



Matthew D. St. Denis, P.Eng.
Manager, Geotechnical Services

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Photograph 1: Borehole 2 – RC3 and RC4 – 7.7 to 10.2 m

LIST OF ABBREVIATIONS

PENETRATION RESISTANCE

Standard Penetration Resistance N: - The number of blows required to advance a standard split spoon sampler 0.3 m into the subsoil. Driven by means of a 63.5 kg hammer falling freely a distance of 0.76 m.

Dynamic Penetration Resistance: - The number of blows required to advance a 51 mm, 60 degree cone, fitted to the end of drill rods, 0.3 m into the subsoil. The driving energy being 475 J per blow.

DESCRIPTION OF SOIL

The consistency of cohesive soils and the relative density or denseness of cohesionless soils are described in the following terms:

CONSISTENCY	N (blows/0.3 m)	c (kPa)	DENSENESS	N (blows/0.3 m)
Very Soft	0 - 2	0 - 12	Very Loose	0 - 4
Soft	2 - 4	12 - 25	Loose	4 - 10
Firm	4 - 8	25 - 50	Compact	10 - 30
Stiff	8 - 15	50 - 100	Dense	30 - 50
Very Stiff	15 - 30	100 - 200	Very Dense	> 50
Hard	> 30	> 200		

WTPL	Wetter Than Plastic Limit
APL	About Plastic Limit
DTPL	Drier Than Plastic Limit

TYPE OF SAMPLE

SS	Split Spoon	TW	Thinwall Open
WS	Washed Sample	TP	Thinwall Piston
SB	Scraper Bucket Sample	OS	Oesterberg Sample
AS	Auger Sample	FS	Foil Sample
CS	Chunk Sample	RC	Rock Core
ST	Slotted Tube Sample		

PH	Sample Advanced Hydraulically
PM	Sample Advanced Manually

SOIL TESTS

Qu	Unconfined Compression	LV	Laboratory Vane
Q	Undrained Triaxial	FV	Field Vane
Qcu	Consolidated Undrained Triaxial	C	Consolidation
Qd	Drained Triaxial		

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 101

17T 640986E 4784672N

PROJECT Port Dalhousie Harbour Wall — **PML REF.** 16HF019

LOCATION St. Catharines, Ontario — **BORING DATE** December 22, 2016 — **ENGINEER** M. D. St. Denis

BORING METHOD C.F.H.S.A and HW Wash Boring — **TECHNICIAN** K. Pettitt

DEPTH (metres)	ELEV	DESCRIPTION	NUMBER	TYPE	"N" VALUES
		SURFACE ELEVATION 75.93			
0.0	75.93				
0.22	75.71	TOPSOIL FILL: 220 mm reddish brown sandy silt topsoil fill, trace clay, damp; low orgainc	1A	SS	16
			1B[1]		
0.68	75.25	FILL: Compact, grey crushed limestone granular, damp	2	SS	50/25 mm
1.1	74.8	sandy gravel fill, trace silt, numerous cobbles, occasional boulders, moist			
		cobble fill, numerous boulders, trace sand and silt, saturated; with occasional wood fragments	3	SS	50/25 mm
2.3	73.6	gravelley sand fill, trace silt; with occassional cobbles and boulders	4	SS	23
			5	SS	18
			6	SS	63/275 mm
7.0	68.9	ORGANIC SILT: Firm, grey organic clayey silt, trace sand, WTPL; with black staining	7	SS	4
			8	SS	5
				FV	
10.2	65.7	becoming brown; with occasional decayed plant matter, peat	9	SS	5
11.5	64.4	becoming very soft, grey	10	SS	0
				FV	
13.2	62.7	with occasional white shells, wood fragments	11	SS	0
		CONTINUED			

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

El. 74.5 Lake Ontario Water Level

NOTES 1. Sample submitted for chemical testing

SENSITIVITY

HYDROSTATIC GROUND WATER LEVEL

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 101

17T 640986E 4784672N

PROJECT Port Dalhousie Harbour Wall — **PML REF.** 16HF019

LOCATION St. Catharines, Ontario — **BORING DATE** December 22, 2016 — **ENGINEER** M. D. St. Denis

BORING METHOD C.F.H.S.A and HW Wash Boring — **TECHNICIAN** K. Pettitt

DEPTH / ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	ELEVATION SCALE
15.0	CONTINUED FROM PREVIOUS PAGE					
60.9 / 15.6	ORGANIC SILT: Firm, grey organic clayey silt, trace sand, WTPL; with black staining		12A	SS	2	
60.3 / 16.2	SAND: Very loose, grey gravelly sand, trace silt, saturated; with occasional shale fragments		12B			
59.7 / 17.8	CLAY TILL/SHALE COMPLEX: Very stiff, reddish brown clay till/shale complex, trace sand and gravel, DTPL		13	SS	44	60 / 59
58.1 / 18.3	SHALE: Weathered red shale; with grey hard layers		14	SS	50/0 mm and bouncing	58
57.6	BOREHOLE TERMINATED AT 18.3 m					

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Upon completion of augering, free water to 0.8 m, cave at 5.7 m

NOTES 1. Sample submitted for chemical testing

$+^3$ SENSITIVITY

▽ HYDROSTATIC GROUND WATER LEVEL

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 102

17T 640969E 4784569N

PROJECT Port Dalhousie Harbour Wall — **PML REF.** 16HF019

LOCATION St. Catharines, Ontario — **BORING DATE** December 21, 2016 — **ENGINEER** M. D. St. Denis

BORING METHOD C.F.H.S.A and HW Wash Boring — **TECHNICIAN** K. Pettitt

DEPTH (metres)	ELEV	DESCRIPTION	NUMBER	TYPE	"N" VALUES
		SURFACE ELEVATION 75.91			
0.0	75.91	TOPSOIL FILL: 325 mm reddish brown sandy silt topsoil fill, trace clay, damp; low orgainc	1A	SS	21
0.33	75.58		1B[1]		
0.68	75.23	FILL: Grey crushed limestone granular	2	SS	50/75 mm
1.2	74.7	very dense cobble fill, occasional boulder, some crushed gravel	3	SS	50/50 mm and bouncing
		reddish brown sandy gravel fill, trace silt, saturated; numerous cobbles and boulders, saturated			
2.3	73.6	cobble fill, numerous boulders, trace sand and silt, saturated	4	SS	50/0 mm and bouncing
			5	SS	3
			6	SS	50/0 mm and bouncing
			7	SS	20
5.5	70.4	becoming compact, grey sandy silt, trace clay, some crushed limestone; occasional wood fragments	8	SS	16
7.0	68.9	ORGANIC SILT: Firm, grey organic clayey silt, some sand, trace gravel, WTPL; with black staining; occasional rootlets	9	SS	5
8.5	67.4	becoming soft	10	SS	3
11.5	64.4	becoming very soft	11	SS	2
			12	SS	0
				FV	
			13	SS	0
14.3	61.6	SAND: Compact, reddish brown gravelly sand, trace silt, saturated; with occasional shale fragments			
15.0		CONTINUED			

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS

GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

El. 74.5
Lake Ontario Water Level

NOTES 1. Sample submitted for chemical testing

+3 SENSITIVITY

HYDROSTATIC GROUND WATER LEVEL

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 102

17T 640969E 4784569N

PROJECT Port Dalhousie Harbour Wall — **PML REF.** 16HF019

LOCATION St. Catharines, Ontario — **BORING DATE** December 21, 2016 — **ENGINEER** M. D. St. Denis

BORING METHOD C.F.H.S.A and HW Wash Boring — **TECHNICIAN** K. Pettitt

DEPTH (metres) / ELEV	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES
15.0	CONTINUED FROM PREVIOUS PAGE				
60.9	SAND: Compact, reddish brown gravelly sand, trace silt, saturated; with occasional shale fragments		14	SS	15
16.2					
59.7	CLAY TILL/SHALE COMPLEX: Very stiff, reddish brown clay till/shale complex, trace sand and gravel, DTPL		15	SS	50/275 mm
17.6					
58.3	SHALE: Weathered red shale; with grey hard layers		16	SS	50/25 mm
18.3					
57.6	BOREHOLE TERMINATED AT 18.3 m				

ELEVATION SCALE: 60, 59, 58

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Upon completion of augering, free water to 1.5 m, cave at 4.8 m

NOTES 1. Sample submitted for chemical testing

$+^3$ SENSITIVITY

▽ HYDROSTATIC GROUND WATER LEVEL

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 103

17T 641109E 4784603N

PROJECT Port Dalhousie Harbour Wall — **PML REF.** 16HF019

LOCATION St. Catharines, Ontario — **BORING DATE** December 23, 2016 — **ENGINEER** M. D. St. Denis

BORING METHOD C.F.H.S.A, HW Wash Boring and HQ Diamond Coring — **TECHNICIAN** K. Pettitt

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE
		SURFACE ELEVATION 76.20					
0.0	0.14	DECK					76
	76.06						
1.0							75
	1.7						
	74.5	WATER					
2.0							74
3.0							73
4.0							72
5.0							71
	5.5						
	70.7	SAND: Very loose, black gravelly sand, trace silt, saturated; with occasional shell fragments		1	SS	3	70
6.0							
	7.0						
7.0	69.2	SHALE: Highly weathered to moderately weathered, medium bedded, red, poor to fair quality, very weak to weak, shale, very thinly to thinly bedded with slightly weathered, grey, weak to medium strong, hard layers		2[1]	SS	50/100 mm	69
				3	RC		68
8.0							
9.0				4	RC		67
10.0	10.2						66
	66.0	BOREHOLE TERMINATED AT 10.2 m					
11.0							
12.0							
13.0							
14.0							
15.0							

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

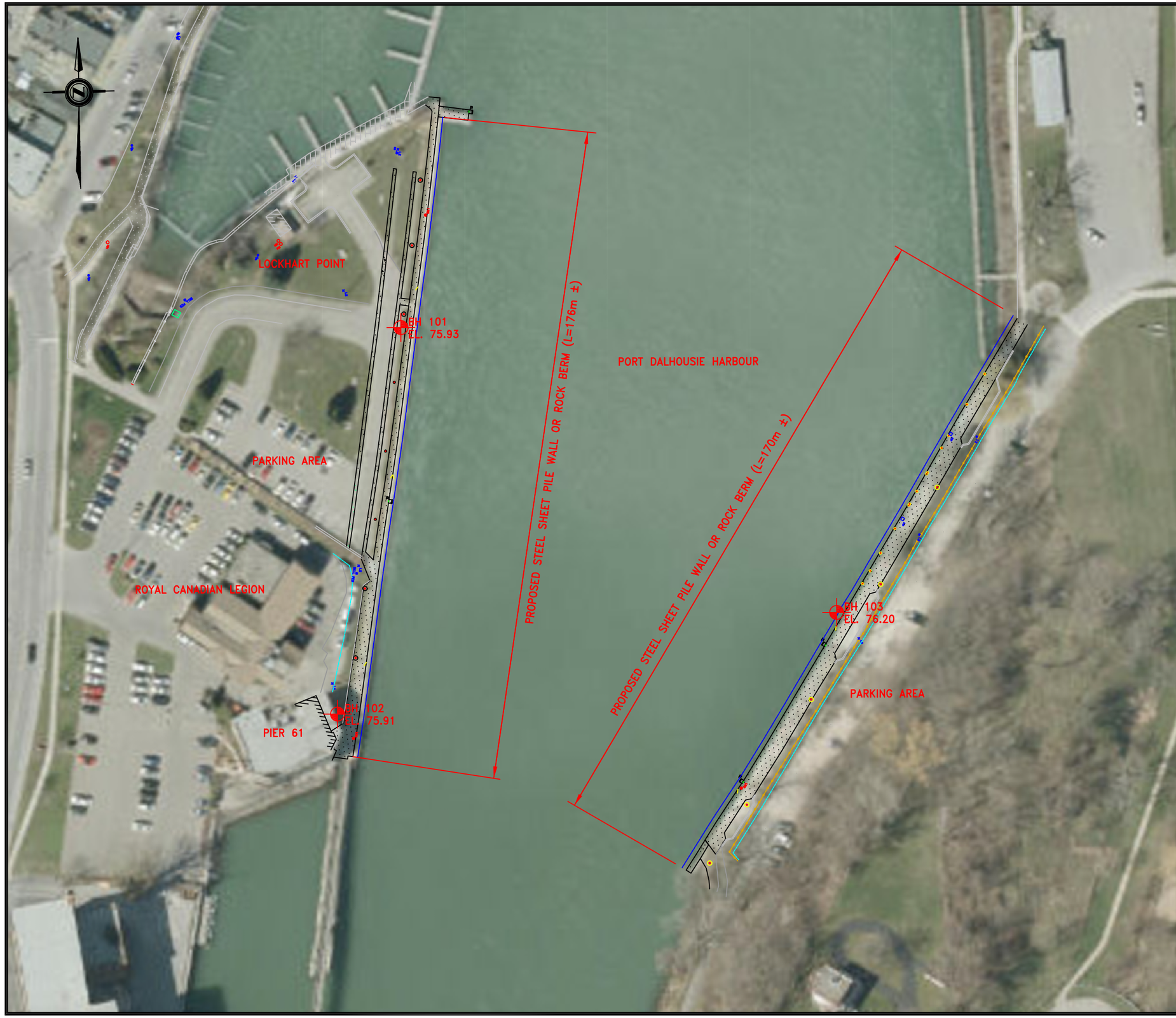
▽ El. 74.5 Lake Ontario Water Level

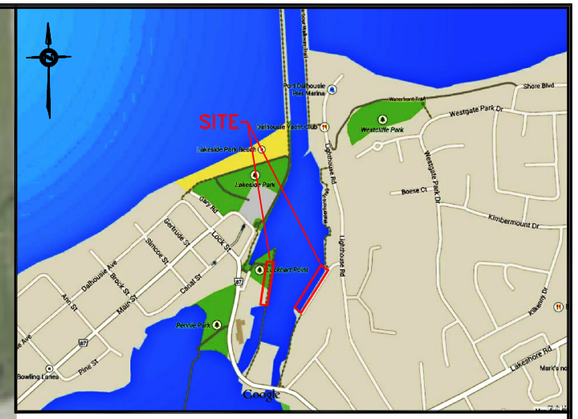
RC3
Run = 1.0 m
Recovery = 100%
RQD = 44%

RC4
Run = 1.5 m
Recovery = 98%
RQD = 66%

NOTES 1. Sample submitted for chemical testing

▽ HYDROSTATIC GROUND WATER LEVEL





KEY PLAN
ST. CATHARINES, ONTARIO

LEGEND:

BH 103
EL. 76.20 — PML BOREHOLE (BH) LOCATION

BENCHMARK:

TABLET IN WEST CONCRETE FOUNDATION WALL OF INNER LIGHTHOUSE AT ENTRANCE OF HARBOUR, 1.70 m FROM NORTHWEST CORNER, 1.35 m FROM SOUTHWEST CORNER, 20 cm BELOW SHINGLE SIDING (GEODETIC SURVEY OF CANADA BM NO. 561F)
ELEVATION: 75.822 m (METRIC, GEODETIC)

REFERENCE:

PLAN PRODUCED FROM A DRAWING TITLED "FOR PETO" PROVIDED BY AECOM AND FROM GIS INFORMATION FROM THE NIAGARA REGION ONLINE INTERACTIVE MAPPING SERVICE.

NOTE:

THE INFERRED STRATIGRAPHY REFERRED TO IN THE REPORT IS BASED ON THE DATA FROM THESE BOREHOLES SUPPLEMENTED BY GEOLOGICAL EVIDENCE. THE ACTUAL STRATIGRAPHY BETWEEN THE BOREHOLES MAY VARY.

0m 10 20 30 40 50 75
SCALE
(1:1000)

AECOM

GEOTECHNICAL INVESTIGATION
PORT DALHOUSIE HARBOUR WALL
ST. CATHARINES

BOREHOLE LOCATION PLAN

Peto MacCallum Ltd.
CONSULTING ENGINEERS

DRAWN	KF	DATE	SCALE	PML REF.	DRAWING NO.
CHECKED	MDS	JAN. 2017	AS SHOWN	16HF019	2–1
APPROVED	MDS				

Appendix A

Geoenvironmental Screening

Table A1 – Soil Samples Submitted for Chemical Testing

AGAT Laboratories Limited - Certificates of Analysis

TABLE A1

Summary of Samples Submitted for Geoenvironmental Chemical Testing

Location	Sample ID	Approx. Depth (m)	Description
Borehole 101	BH101 SS1B	0.2 – 0.5	Fill
Borehole 102	BH102 SS1B	0.3 – 0.5	Fill
Borehole 103	BH103 SS2	7.5 – 7.7	Shale

Note: All samples submitted for O. Reg. 153/04, as amended, metals and inorganics package chemical testing.

O. Reg. 153/04, As Amended, Table 1 Site Condition Standards

(RPI/ICC Property Use)

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: PETO MACCALLUM LIMITED
45 BURFORD ROAD
HAMILTON, ON L8E3C5
(905) 561-2231

ATTENTION TO: Karel Furbacher

PROJECT: 16HF019

AGAT WORK ORDER: 16H174195

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

DATE REPORTED: Jan 05, 2017

PAGES (INCLUDING COVER): 7

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

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MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 16H174195

PROJECT: 16HF019

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Karel Furbacher

SAMPLING SITE:

SAMPLED BY:Kurtis Pettit

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2016-12-28

DATE REPORTED: 2017-01-05

		SAMPLE DESCRIPTION:		BH 103-SS2	BH 102-SS1B	BH101-SS1B
		SAMPLE TYPE:		Soil	Soil	Soil
		DATE SAMPLED:		2016-12-23	2016-12-21	2016-12-22
Parameter	Unit	G / S	RDL	8110199	8110200	8110201
Antimony	µg/g	1.3	0.8	<0.8	<0.8	<0.8
Arsenic	µg/g	18	1	3	8	8
Barium	µg/g	220	2	110	48	64
Beryllium	µg/g	2.5	0.5	0.7	<0.5	<0.5
Boron	µg/g	36	5	21	11	8
Boron (Hot Water Soluble)	µg/g	NA	0.10	1.70	0.26	0.15
Cadmium	µg/g	1.2	0.5	<0.5	**1.6**	<0.5
Chromium	µg/g	70	2	24	10	8
Chromium VI	µg/g	0.66	0.2	<0.2	<0.2	<0.2
Cobalt	µg/g	21	0.5	12.3	4.0	3.4
Copper	µg/g	92	1	5	18	17
Cyanide	µg/g	0.051	0.040	<0.040	<0.040	<0.040
Electrical Conductivity	mS/cm	0.57	0.005	0.211	0.436	0.181
Lead	µg/g	120	1	14	82	52
Mercury	µg/g	0.27	0.10	<0.10	<0.10	<0.10
Molybdenum	µg/g	2	0.5	1.5	0.7	<0.5
Nickel	µg/g	82	1	31	9	9
Selenium	µg/g	1.5	0.4	<0.4	0.4	<0.4
Silver	µg/g	0.5	0.2	<0.2	<0.2	<0.2
Sodium Adsorption Ratio	NA	2.4	NA	1.03	0.276	0.513
Thallium	µg/g	1	0.4	<0.4	<0.4	<0.4
Uranium	µg/g	2.5	0.5	0.9	<0.5	<0.5
Vanadium	µg/g	86	1	27	12	11
Zinc	µg/g	290	5	85	**328**	41
pH, 2:1 CaCl2 Extraction	pH Units		NA	7.93	10.9	8.02

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use

8110199-8110201 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Certified By: Amanjot Bhela

AGAT Laboratories

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FAX (905)712-5122
http://www.agatlabs.com

Guideline Violation

AGAT WORK ORDER: 16H174195

PROJECT: 16HF019

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Karel Furbacher

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
8110200	BH 102-SS1B	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Cadmium	µg/g	1.2	1.6
8110200	BH 102-SS1B	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Zinc	µg/g	290	328

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Quality Assurance

CLIENT NAME: PETO MACCALLUM LIMITED

AGAT WORK ORDER: 16H174195

PROJECT: 16HF019

ATTENTION TO: Karel Furbacher

SAMPLING SITE:

SAMPLED BY:Kurtis Pettit

Soil Analysis

RPT Date: Jan 05, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	8111438		<0.8	<0.8	NA	< 0.8	107%	70%	130%	96%	80%	120%	91%	70%	130%
Arsenic	8111438		2	2	NA	< 1	110%	70%	130%	106%	80%	120%	98%	70%	130%
Barium	8111438		64	64	0.0%	< 2	106%	70%	130%	104%	80%	120%	95%	70%	130%
Beryllium	8111438		<0.5	<0.5	NA	< 0.5	90%	70%	130%	108%	80%	120%	80%	70%	130%
Boron	8111438		6	6	NA	< 5	79%	70%	130%	98%	80%	120%	79%	70%	130%
Boron (Hot Water Soluble)	8111032		<0.10	<0.10	NA	< 0.10	114%	60%	140%	101%	70%	130%	97%	60%	140%
Cadmium	8111438		<0.5	<0.5	NA	< 0.5	106%	70%	130%	110%	80%	120%	105%	70%	130%
Chromium	8111438		15	15	0.0%	< 2	95%	70%	130%	106%	80%	120%	100%	70%	130%
Chromium VI	8104122		<0.2	<0.2	NA	< 0.2	96%	70%	130%	104%	80%	120%	108%	70%	130%
Cobalt	8111438		5.2	5.7	9.2%	< 0.5	87%	70%	130%	99%	80%	120%	91%	70%	130%
Copper	8111438		11	11	0.0%	< 1	102%	70%	130%	100%	80%	120%	80%	70%	130%
Cyanide	8109413		<0.040	<0.040	NA	< 0.040	90%	70%	130%	102%	80%	120%	104%	70%	130%
Electrical Conductivity	8111032		1.12	1.27	12.6%	< 0.005	99%	90%	110%	NA			NA		
Lead	8111438		6	6	0.0%	< 1	108%	70%	130%	107%	80%	120%	96%	70%	130%
Mercury	8111438		<0.10	<0.10	NA	< 0.10	104%	70%	130%	94%	80%	120%	87%	70%	130%
Molybdenum	8111438		<0.5	<0.5	NA	< 0.5	99%	70%	130%	101%	80%	120%	107%	70%	130%
Nickel	8111438		13	13	0.0%	< 1	101%	70%	130%	112%	80%	120%	103%	70%	130%
Selenium	8111438		<0.4	<0.4	NA	< 0.4	118%	70%	130%	110%	80%	120%	102%	70%	130%
Silver	8111438		<0.2	<0.2	NA	< 0.2	97%	70%	130%	121%	80%	120%	101%	70%	130%
Sodium Adsorption Ratio	8110364		17.5	18.1	3.4%	NA	NA			NA			NA		
Thallium	8111438		<0.4	<0.4	NA	< 0.4	99%	70%	130%	119%	80%	120%	107%	70%	130%
Uranium	8111438		<0.5	<0.5	NA	< 0.5	99%	70%	130%	117%	80%	120%	86%	70%	130%
Vanadium	8111438		21	21	0.0%	< 1	86%	70%	130%	94%	80%	120%	97%	70%	130%
Zinc	8111438		29	30	3.4%	< 5	104%	70%	130%	104%	80%	120%	103%	70%	130%
pH, 2:1 CaCl2 Extraction	8110201	8110201	8.02	8.06	0.5%	NA	100%	80%	120%	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.
QA Qualifier for metals - Silver: For a multi-element scan for lab control standards and matrix spikes,up to 10% of analytes may exceed the quoted limits by up to 10% absolute and it is considered acceptable.

Certified By: Amanjot Bhela

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

QA Violation

CLIENT NAME: PETO MACCALLUM LIMITED

AGAT WORK ORDER: 16H174195

PROJECT: 16HF019

ATTENTION TO: Karel Furbacher

RPT Date: Jan 05, 2017			REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Sample Id	Sample Description	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
				Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)											
Silver		BH 103-SS2	97%	70%	130%	121%	80%	120%	101%	70%	130%

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.
QA Qualifier for metals - Silver: For a multi-element scan for lab control standards and matrix spikes,up to 10% of analytes may exceed the quoted limits by up to 10% absolute and it is considered acceptable.

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Method Summary

CLIENT NAME: PETO MACCALLUM LIMITED

AGAT WORK ORDER: 16H174195

PROJECT: 16HF019

ATTENTION TO: Karel Furbacher

SAMPLING SITE:

SAMPLED BY:Kurtis Pettit

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	EPA SW 846 6010C; MSA, Part 3, Ch.21	ICP/OES
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium VI	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cyanide	INOR-93-6052	MOE CN-3015 & E 3009 A;SM 4500 CN	TECHNICON AUTO ANALYZER
Electrical Conductivity	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010B	ICP/OES
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER

AGAT Laboratories

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water intended for human consumption)

Laboratory Use Only

Work Order #: 16H174195

Cooler Quantity: 16 cooler

Arrival Temperatures: 4.6 | 4.5 | 4.4
3.1 | 2.6 | 2.9

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes: ON ICE

Report Information:

Company: PETO MACALLUM LTD.
Contact: KAREL FURBACHER
Address: 45 BURFORD RD
HAMILTON, ON
Phone: 905-561-2231 Fax:
Reports to be sent to:
1. Email: KFURBACHER@PETOMACALLUM.COM
2. Email: DDURISH@PETOMACALLUM.COM

Regulatory Requirements:

☐ No Regulatory Requirement
(Please check all applicable boxes)

☒ Regulation 153/04
Table 1 (Indicate One)
☐ Ind/Com
☐ Res/Park
☐ Agriculture
Soil Texture (Check One)
☐ Coarse
☐ Fine

☐ Sewer Use
☐ Sanitary
☐ Storm
Region (Indicate One)

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
(Indicate One)

Turnaround Time (TAT) Required:

Regular TAT ☒ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 16HF019
Site Location:
Sampled By: K. PETTITT
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Is this submission for a **Record of Site Condition?** ☐ Yes ☒ No

Report Guideline on *Certificate of Analysis* ☒ Yes ☐ No

Invoice Information:

Bill To Same: Yes ☒ No ☐

Company:
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Y/N)	O. Reg 153: Metals and Inorganics	All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals	ORPs: ☐ B-HWS ☐ Cl⁻ ☐ CN⁻ ☐ Cr⁶⁺ ☐ EC ☐ FOC ☐ Hg ☐ pH ☐ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	CCME Fractions 1 to 4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use
BH103-SS2	12/23/16	11:00PM	1	SOIL			X													
BH102-SS1B	12/21/16	2:10PM	1	↓			X													
BH101-SS1D	12/22/16	10:30AM	1	↓			X													

Samples Relinquished By (Print Name and Sign): Kurtis Puttitt	Date: 12/28/16	Time: 11:50AM	Samples Received By (Print Name and Sign): Daniella Jaic	Date: 12/28/16	Time: 11:30am		
Samples Relinquished By (Print Name and Sign): Daniella Jaic	Date: 12/28/16	Time: 1:10pm	Samples Received By (Print Name and Sign): Scott Kois	Date: 12/28/16	Time: 1310 hrs	Page 1 of 1	
Samples Relinquished By (Print Name and Sign):	Date:	Time:	Samples Received By (Print Name and Sign): Shanmu Dec28/16	Date: 3:00	Time:	Nº: T 039150	

Document ID: DIV-78-1511-013

Pink Copy - Client | Yellow Copy - AGAT | White Copy- AGAT

Date Issued: September 20, 2016

O. Reg. 153/04, As Amended, Table 2 Site Condition Standards

(RPI Property Use)

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Certificate of Analysis

AGAT WORK ORDER: 16H174195

PROJECT: 16HF019

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Karel Furbacher

SAMPLING SITE:

SAMPLED BY:Kurtis Pettit

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2016-12-28

DATE REPORTED: 2017-01-05

		SAMPLE DESCRIPTION:		BH 103-SS2	BH 102-SS1B	BH101-SS1B
		SAMPLE TYPE:		Soil	Soil	Soil
		DATE SAMPLED:		12/23/2016	12/21/2016	12/22/2016
Parameter	Unit	G / S	RDL	8110199	8110200	8110201
Antimony	µg/g	7.5	0.8	<0.8	<0.8	<0.8
Arsenic	µg/g	18	1	3	8	8
Barium	µg/g	390	2	110	48	64
Beryllium	µg/g	4	0.5	0.7	<0.5	<0.5
Boron	µg/g	120	5	21	11	8
Boron (Hot Water Soluble)	µg/g	1.5	0.10	1.70	0.26	0.15
Cadmium	µg/g	1.2	0.5	<0.5	1.6	<0.5
Chromium	µg/g	160	2	24	10	8
Chromium VI	µg/g	8	0.2	<0.2	<0.2	<0.2
Cobalt	µg/g	22	0.5	12.3	4.0	3.4
Copper	µg/g	140	1	5	18	17
Cyanide	µg/g	0.051	0.040	<0.040	<0.040	<0.040
Electrical Conductivity	mS/cm	0.7	0.005	0.211	0.436	0.181
Lead	µg/g	120	1	14	82	52
Mercury	µg/g	0.27	0.10	<0.10	<0.10	<0.10
Molybdenum	µg/g	6.9	0.5	1.5	0.7	<0.5
Nickel	µg/g	100	1	31	9	9
Selenium	µg/g	2.4	0.4	<0.4	0.4	<0.4
Silver	µg/g	20	0.2	<0.2	<0.2	<0.2
Sodium Adsorption Ratio	NA	5	NA	1.03	0.276	0.513
Thallium	µg/g	1	0.4	<0.4	<0.4	<0.4
Uranium	µg/g	23	0.5	0.9	<0.5	<0.5
Vanadium	µg/g	86	1	27	12	11
Zinc	µg/g	340	5	85	328	41
pH, 2:1 CaCl2 Extraction	pH Units		NA	7.93	10.9	8.02

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON T2 S RPI CT

8110199-8110201 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Certified By: Amanjot Bhela

AGAT Laboratories

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Guideline Violation

AGAT WORK ORDER: 16H174195

PROJECT: 16HF019

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Karel Furbacher

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
8110199	BH 103-SS2	ON T2 S RPI CT	O. Reg. 153(511) - Metals & Inorganics (Soil)	Boron (Hot Water Soluble)	1.5	1.70
8110200	BH 102-SS1B	ON T2 S RPI CT	O. Reg. 153(511) - Metals & Inorganics (Soil)	Cadmium	1.2	1.6

O. Reg. 153/04, As Amended, Table 2 Site Condition Standards

(ICC Property Use)

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Certificate of Analysis

AGAT WORK ORDER: 16H174195

PROJECT: 16HF019

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Karel Furbacher

SAMPLING SITE:

SAMPLED BY:Kurtis Pettit

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2016-12-28

DATE REPORTED: 2017-01-05

		SAMPLE DESCRIPTION:		BH 103-SS2	BH 102-SS1B	BH101-SS1B
		SAMPLE TYPE:		Soil	Soil	Soil
		DATE SAMPLED:		12/23/2016	12/21/2016	12/22/2016
Parameter	Unit	G / S	RDL	8110199	8110200	8110201
Antimony	µg/g	40	0.8	<0.8	<0.8	<0.8
Arsenic	µg/g	18	1	3	8	8
Barium	µg/g	670	2	110	48	64
Beryllium	µg/g	8	0.5	0.7	<0.5	<0.5
Boron	µg/g	120	5	21	11	8
Boron (Hot Water Soluble)	µg/g	2	0.10	1.70	0.26	0.15
Cadmium	µg/g	1.9	0.5	<0.5	1.6	<0.5
Chromium	µg/g	160	2	24	10	8
Chromium VI	µg/g	8	0.2	<0.2	<0.2	<0.2
Cobalt	µg/g	80	0.5	12.3	4.0	3.4
Copper	µg/g	230	1	5	18	17
Cyanide	µg/g	0.051	0.040	<0.040	<0.040	<0.040
Electrical Conductivity	mS/cm	1.4	0.005	0.211	0.436	0.181
Lead	µg/g	120	1	14	82	52
Mercury	µg/g	3.9	0.10	<0.10	<0.10	<0.10
Molybdenum	µg/g	40	0.5	1.5	0.7	<0.5
Nickel	µg/g	270	1	31	9	9
Selenium	µg/g	5.5	0.4	<0.4	0.4	<0.4
Silver	µg/g	40	0.2	<0.2	<0.2	<0.2
Sodium Adsorption Ratio	NA	12	NA	1.03	0.276	0.513
Thallium	µg/g	3.3	0.4	<0.4	<0.4	<0.4
Uranium	µg/g	33	0.5	0.9	<0.5	<0.5
Vanadium	µg/g	86	1	27	12	11
Zinc	µg/g	340	5	85	328	41
pH, 2:1 CaCl2 Extraction	pH Units		NA	7.93	10.9	8.02

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON T2 S ICC CT

8110199-8110201 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Certified By: Amanjot Bhela

O. Reg. 153/04, As Amended, Table 3 Site Condition Standards

(RPI Property Use)

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Certificate of Analysis

AGAT WORK ORDER: 16H174195

PROJECT: 16HF019

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Karel Furbacher

SAMPLING SITE:

SAMPLED BY:Kurtis Pettit

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2016-12-28

DATE REPORTED: 2017-01-05

		SAMPLE DESCRIPTION:		BH 103-SS2	BH 102-SS1B	BH101-SS1B
		SAMPLE TYPE:		Soil	Soil	Soil
		DATE SAMPLED:		12/23/2016	12/21/2016	12/22/2016
Parameter	Unit	G / S	RDL	8110199	8110200	8110201
Antimony	µg/g	7.5	0.8	<0.8	<0.8	<0.8
Arsenic	µg/g	18	1	3	8	8
Barium	µg/g	390	2	110	48	64
Beryllium	µg/g	4	0.5	0.7	<0.5	<0.5
Boron	µg/g	120	5	21	11	8
Boron (Hot Water Soluble)	µg/g	1.5	0.10	1.70	0.26	0.15
Cadmium	µg/g	1.2	0.5	<0.5	1.6	<0.5
Chromium	µg/g	160	2	24	10	8
Chromium VI	µg/g	8	0.2	<0.2	<0.2	<0.2
Cobalt	µg/g	22	0.5	12.3	4.0	3.4
Copper	µg/g	140	1	5	18	17
Cyanide	µg/g	0.051	0.040	<0.040	<0.040	<0.040
Electrical Conductivity	mS/cm	0.7	0.005	0.211	0.436	0.181
Lead	µg/g	120	1	14	82	52
Mercury	µg/g	0.27	0.10	<0.10	<0.10	<0.10
Molybdenum	µg/g	6.9	0.5	1.5	0.7	<0.5
Nickel	µg/g	100	1	31	9	9
Selenium	µg/g	2.4	0.4	<0.4	0.4	<0.4
Silver	µg/g	20	0.2	<0.2	<0.2	<0.2
Sodium Adsorption Ratio	NA	5	NA	1.03	0.276	0.513
Thallium	µg/g	1	0.4	<0.4	<0.4	<0.4
Uranium	µg/g	23	0.5	0.9	<0.5	<0.5
Vanadium	µg/g	86	1	27	12	11
Zinc	µg/g	340	5	85	328	41
pH, 2:1 CaCl2 Extraction	pH Units		NA	7.93	10.9	8.02

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON T3 S RPI CT

8110199-8110201 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Certified By: Amanjot Bhela

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Guideline Violation

AGAT WORK ORDER: 16H174195

PROJECT: 16HF019

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Karel Furbacher

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
8110199	BH 103-SS2	ON T3 S RPI CT	O. Reg. 153(511) - Metals & Inorganics (Soil)	Boron (Hot Water Soluble)	1.5	1.70
8110200	BH 102-SS1B	ON T3 S RPI CT	O. Reg. 153(511) - Metals & Inorganics (Soil)	Cadmium	1.2	1.6

O. Reg. 153/04, As Amended, Table 3 Site Condition Standards

(ICC Property Use)

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Certificate of Analysis

AGAT WORK ORDER: 16H174195

PROJECT: 16HF019

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Karel Furbacher

SAMPLING SITE:

SAMPLED BY:Kurtis Pettit

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2016-12-28

DATE REPORTED: 2017-01-05

		SAMPLE DESCRIPTION:		BH 103-SS2	BH 102-SS1B	BH101-SS1B
		SAMPLE TYPE:		Soil	Soil	Soil
		DATE SAMPLED:		12/23/2016	12/21/2016	12/22/2016
Parameter	Unit	G / S	RDL	8110199	8110200	8110201
Antimony	µg/g	40	0.8	<0.8	<0.8	<0.8
Arsenic	µg/g	18	1	3	8	8
Barium	µg/g	670	2	110	48	64
Beryllium	µg/g	8	0.5	0.7	<0.5	<0.5
Boron	µg/g	120	5	21	11	8
Boron (Hot Water Soluble)	µg/g	2	0.10	1.70	0.26	0.15
Cadmium	µg/g	1.9	0.5	<0.5	1.6	<0.5
Chromium	µg/g	160	2	24	10	8
Chromium VI	µg/g	8	0.2	<0.2	<0.2	<0.2
Cobalt	µg/g	80	0.5	12.3	4.0	3.4
Copper	µg/g	230	1	5	18	17
Cyanide	µg/g	0.051	0.040	<0.040	<0.040	<0.040
Electrical Conductivity	mS/cm	1.4	0.005	0.211	0.436	0.181
Lead	µg/g	120	1	14	82	52
Mercury	µg/g	3.9	0.10	<0.10	<0.10	<0.10
Molybdenum	µg/g	40	0.5	1.5	0.7	<0.5
Nickel	µg/g	270	1	31	9	9
Selenium	µg/g	5.5	0.4	<0.4	0.4	<0.4
Silver	µg/g	40	0.2	<0.2	<0.2	<0.2
Sodium Adsorption Ratio	NA	12	NA	1.03	0.276	0.513
Thallium	µg/g	3.3	0.4	<0.4	<0.4	<0.4
Uranium	µg/g	33	0.5	0.9	<0.5	<0.5
Vanadium	µg/g	86	1	27	12	11
Zinc	µg/g	340	5	85	328	41
pH, 2:1 CaCl2 Extraction	pH Units		NA	7.93	10.9	8.02

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON T3 S ICC CT

8110199-8110201 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Certified By: Amanjot Bhela

Canadian Council of Ministers of the Environment (CCME)

Residential/Parkland Guidelines

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Certificate of Analysis

AGAT WORK ORDER: 16H174195

PROJECT: 16HF019

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Karel Furbacher

SAMPLING SITE:

SAMPLED BY:Kurtis Pettit

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2016-12-28

DATE REPORTED: 2017-01-05

		SAMPLE DESCRIPTION:		BH 103-SS2	BH 102-SS1B	BH101-SS1B
		SAMPLE TYPE:		Soil	Soil	Soil
		DATE SAMPLED:		12/23/2016	12/21/2016	12/22/2016
Parameter	Unit	G / S	RDL	8110199	8110200	8110201
Antimony	µg/g		0.8	<0.8	<0.8	<0.8
Arsenic	µg/g		1	3	8	8
Barium	µg/g		2	110	48	64
Beryllium	µg/g	4	0.5	0.7	<0.5	<0.5
Boron	µg/g	NA	5	21	11	8
Boron (Hot Water Soluble)	µg/g	NA	0.10	1.70	0.26	0.15
Cadmium	µg/g		0.5	<0.5	1.6	<0.5
Chromium	µg/g	64	2	24	10	8
Chromium VI	µg/g	0.4	0.2	<0.2	<0.2	<0.2
Cobalt	µg/g	50	0.5	12.3	4.0	3.4
Copper	µg/g	63	1	5	18	17
Cyanide	µg/g	0.9	0.040	<0.040	<0.040	<0.040
Electrical Conductivity	mS/cm	2	0.005	0.211	0.436	0.181
Lead	µg/g	140	1	14	82	52
Mercury	µg/g	6.6	0.10	<0.10	<0.10	<0.10
Molybdenum	µg/g	10	0.5	1.5	0.7	<0.5
Nickel	µg/g	50	1	31	9	9
Selenium	µg/g	1	0.4	<0.4	0.4	<0.4
Silver	µg/g	20	0.2	<0.2	<0.2	<0.2
Sodium Adsorption Ratio	NA	5	NA	1.03	0.276	0.513
Thallium	µg/g	1	0.4	<0.4	<0.4	<0.4
Uranium	µg/g	23	0.5	0.9	<0.5	<0.5
Vanadium	µg/g	130	1	27	12	11
Zinc	µg/g	200	5	85	328	41
pH, 2:1 CaCl2 Extraction	pH Units	6.0-8.0	NA	7.93	10.9	8.02

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to CCME (R/P,C)

8110199-8110201 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Certified By: Amanjot Bhela

AGAT Laboratories

Guideline Violation

AGAT WORK ORDER: 16H174195

PROJECT: 16HF019

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CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Karel Furbacher

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
8110200	BH 102-SS1B	CCME (R/P,C)	O. Reg. 153(511) - Metals & Inorganics (Soil)	Zinc	200	328
8110200	BH 102-SS1B	CCME (R/P,C)	O. Reg. 153(511) - Metals & Inorganics (Soil)	pH, 2:1 CaCl2 Extraction	6.0-8.0	10.9
8110201	BH101-SS1B	CCME (R/P,C)	O. Reg. 153(511) - Metals & Inorganics (Soil)	pH, 2:1 CaCl2 Extraction	6.0-8.0	8.02