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Phase II Environmental Site Assessment

Part of 5123 Hawthorne Road
Ottawa, Ontario

Prepared For

Fuller-Mariani Building Solutions

September 17, 2020

Report: PE5033-2

TABLE OF CONTENTS

List of Figures

List of Appendices

EXECUTIVE SUMMARY

Assessment

A Phase II ESA was conducted for the southeast portion of the property addressed 5123 Hawthorne Road, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address the area of potential environmental concern (APEC) that was identified on the Phase II Property during the Phase I ESA.

The Phase II ESA consisted of drilling four (4) boreholes on the Phase II Property, three (3) of which were constructed with groundwater monitoring well installations.

The soil profile encountered generally consisted of a layer of fill, overlying native sandy silt/silt with occasional gravel. Practical refusal was reached at depths ranging from 0.61 to 4.72 m below the existing grade, on inferred bedrock. Bedrock was confirmed by coring in BH1 and BH4. The bedrock consisted of limestone and sandstone. Soil samples were obtained from the boreholes and screened using vapour measurements along with visual and olfactory observations. No staining or Unusual odour was noted during the subsurface investigation.

Based on the screening results in combination with sample depth and location, five (5) soil samples were submitted for metals, PHC (fractions 2 to 4), PAH, electrical conductivity (EC), sodium absorption ratio (SAR) and pH analysis. All soil samples complied with the MECP Table 2 Standards. A comparison of the soil data to the MECP Table 1 Standards, indicated that the petroleum hydrocarbon fraction 3 and 4 concentrations in BH2-SS2, and molybdenum concentrations in BH2-AU1, BH2-SS2 and BH4-AU1 are in excess of the MECP Table 1 Standards.

Groundwater samples were recovered from the monitoring wells BH1 and BH4. It should be noted that BH3 could not be sample due to a damaged well screen.

No free-phase product was observed the during the groundwater sampling event. The groundwater samples were submitted for PHC (F1-F4), PAH, VOC and sodium and chloride analysis. No detectable PHC or PAH concentrations were identified in any of the groundwater samples analyzed. Chloroform concentrations were identified in both samples and exceeded the selected standards in one of the samples. The chloroform concentrations are considered to be a result of the use of municipal water during the rock coring process and should dissipate in the near future. Chloride and sodium concentrations were identified in both of the groundwater samples analyzed, although the results comply with the selected standards.

Based on the groundwater testing carried out, the groundwater beneath the subject site is in compliance with the MECP Table 2 Standards.

Recommendations

The investigation confirms that the fill is composed of waste road building materials, generally consisting of various soils, road based granular materials with occasional pieces of plastic and asphaltic concrete. No other deleterious materials or otherwise contaminated soils were identified. The analytical testing indicates that the fill complies with the selected MECP standards.

Based on the background of the site activity and our findings, no remediation of the soil is considered necessary, however, given the Table 1 exceedances for PHCs and molybdenum with the presence of asphalt in the some of the samples, it is our opinion that some of the fill is not clean for off-site disposal if it has to be removed from the property for construction purposes, although further testing/assessment of excess soil should be completed at the time of site redevelopment to confirm this opinion if excess soil is being generated. It may be used for on-site in landscaping or transferred to a similar industrial site for reuse.

Given the very low volatile readings obtained on the fill samples and the age of the asphalt, it is considered unlikely that the asphalt would pose any risk to interior air quality. As a precautionary measure, any significant deposits of asphalt encountered at the subgrade level below buildings should be removed. It has been assumed that any future building structure would be for commercial use building, constructed with a slab-on-grade foundation.

Monitoring Wells

If the monitoring wells installed on the subject site are not going to be used in the future, or will be destroyed during site redevelopment, they should be abandoned according to Ontario Regulation 903. In the meantime, the wells will be registered with the MECP under this regulation.

1.0 INTRODUCTION

At the request of Fuller-Mariani Building Solutions, Paterson Group (Paterson) conducted a Phase II Environmental Site Assessment for the southeast portion of the property addressed 5123 Hawthorne Road, in the City of Ottawa, Ontario, herein referred to as the Phase II Property. The purpose of this Phase II ESA was to address areas of potential environmental concern (APECs) identified on the Phase II Property, during the Phase I ESA conducted by Paterson.

1.1 Site Description

Address:	Part of 5123 Hawthorne Road, Ottawa, Ontario
Legal Description:	Part of Lot 26 and 27, Concession 6, now in the City of Ottawa, Ontario.
Location:	The Phase II Property is located on the southeast side of Somme Street, approximately 477 m east of Hawthorne Road, in the City of Ottawa, Ontario. Refer to Figure 1 - Key Plan in the Figures section following the text
Latitude and Longitude:	45° 18' 11.15" N, 75° 32' 51.87" W
Zoning:	DR – Development Reserve Zone
Configuration:	Irregular
Site Area:	1,226m^2 (approximate)

1.2 Property Ownership

Paterson was retained to complete this Phase II ESA by Mr. Toy Mariani of Fuller-Mariani Building Solutions. The head office of Fuller-Mariani Building Solutions is located at 2700 Queensview Drive, Ottawa, Ontario. Mr. Mariani can be reached by telephone at 613-913-2664.

1.3 Current and Proposed Future Uses

The Phase II Property is a vacant gavelled parcel of land that is presently occupied by a small fleet of trailers on the western portion of the property.

It is our understanding that the proposed site redevelopment for the Phase II Property consists of a commercial development. The footprint of the development will cover the majority of the western section of the site and it will rely upon private services (septic system and potable groundwater).

1.4 Applicable Site Condition Standard

The site condition standards for the property were obtained from Table 2 of the document entitled “Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act”, prepared by the Ministry of the Environment, Conservation and Parks (MECP), April 2011. The selected MECP Table 2 Standards are based on the following considerations:

- ❑ Coarse-grained soil conditions
- ❑ Full depth generic site condition
- ❑ Potable groundwater conditions
- ❑ Commercial land use

Section 35 of O.Reg. 153/04 does not apply to the Phase II Property in that the property is serviced using a potable water well and septic system.

Section 41 of O.Reg. 153/04 does not apply to the Phase II Property, as the property is not within 30m of an environmentally sensitive area.

Section 43.1 of O.Reg. 153/04 does not apply to the Phase II Property in that the property is not a Shallow Soil property and the property is not within 30m of a water body.

The proposed use of the Phase II ESA property is commercial; therefore, the Commercial/Industrial Standards are selected for the purpose of this Phase II ESA.

A comparison of the soil test data to the MECP Table 1 Standards was also conducted. The Table 1 standards are considered to be indicative of typical Ontario background concentrations and are commonly used to assess whether soil is clean for off-site disposal purposes.

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The Phase II Property is situated in an industrial area. Adjacent and neighbouring properties consist of commercial to light industrial land use and vacant lands.

The Phase II Property is an undeveloped vacant lot that has been used for storing large commercial containers and truck trailers. The land itself is grassed with evidence of imported fill material across the site.

Site drainage on the Phase II Property consists primarily of surface infiltration throughout the property. The site is relatively at the grade of the surrounding lands with the regional topography sloping downwards in a south-easterly direction.

2.2 Past Investigations

The Phase I ESA report, entitled *"Phase I-Environmental Site Assessment, Part Lot 26 & 27 Concession 6, Ottawa, Ontario,*" prepared by CRA, dated July 2008, was reviewed as part of this assessment.

The Phase I ESA indicated that a former waste disposal site was documented on the northern portion of the larger parcel of land addressed 5123 Hawthorne Road; however, they found no evidence through a review of aerial photographs or on-site observations including tests pits. CRA concluded that the designation of part of the lands as a waste disposal site was an error.

The Phase II ESA Report, entitled *"Phase II Environmental Site Assessment, 5123 Hawthorne Road, Part 4, Ottawa, Ontario,"* prepared by Paterson Group Inc. (Paterson), dated January 9, 2020 was reviewed as part of this assessment.

The Phase II – ESA was completed to assess the quality of the fill material that had been placed on site by R.W. Tomlinson, the previous owners of the land. The Ontario Ministry of Environment (MOE) approved the placement of non-recyclable asphalt and waste road building materials (MOE letter, 1990). In summary, the letter of approval authorized the placement of waste road building materials (granular materials, non-recyclable asphalt and presumably concrete) on-site, provided that no deleterious substances, building demolition materials or contaminated materials are deposited, and that there is no negative environmental impact on the land or groundwater.

The field program consisted of placing four (4) boreholes on the subject site. The boreholes were placed to obtain a general coverage of the area to address the unknown quality of the fill material on-site.

The soil profile encountered generally consisted of a layer of fill, overlying native sandy silt/silt with occasional gravel. Practical refusal was reached at depths ranging from 0.61 to 4.72 m below the existing grade, on inferred bedrock. Bedrock was confirmed by coring in BH1 and BH4. The bedrock consisted of limestone and sandstone.

The fill material consisted of a crushed stone in BH1 and BH4, while other fill material identified consisted of a mix of clay, silt, sand, gravel and some organics with occasional pieces of plastic and asphaltic concrete. The fill varied in thickness from 1.5 to 3.6 m

Five (5) soil samples were submitted for metals, PHC (fractions 2 to 4), PAH, electrical conductivity (EC), sodium absorption ratio (SAR) and pH analysis. All soil results complied with the MECP Table 2 Standards.

Groundwater samples were recovered from the monitoring wells on December 16, 2019. No visual or olfactory signs of contamination were noted in the groundwater. The groundwater samples were submitted for PHC (F1-F4), PAH, VOC and sodium and chloride analysis.

No detectable PHC or PAH concentrations were identified in any of the groundwater samples analyzed. Chloroform concentrations were identified in both samples and exceeded the selected standards in one of the samples. The chloroform concentrations are considered to be a result of the use of municipal water during the rock coring process and would readily dissipate. Chloride and sodium concentrations were identified in both of the groundwater samples analyzed, although the results comply with the selected standards.

A Phase I-ESA was conducted by Paterson in September of 2020 in general accordance with the Ontario Regulation (O.Reg.) 153/04, as amended. The Phase I ESA identified the following on-site PCA that generated an APEC on the Phase I Property:

- ❒ PCA 30 – "*Importation of Fill Material of Unknown Quality"* associated with handling and placement of fill material across the majority of the Phase I Property (APEC 1).

The remaining PCA, located approximately 200 m west of the site (Orgaworld), was not considered to result in an APEC based on the separation distance with respect to the subject land.

A Phase II ESA was recommended to address the aforementioned APEC on the Phase I Property.

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The subsurface investigation was conducted on September 9, 2019 in conjunction with a Geotechnical Investigation. The field program consisted of drilling four (4) boreholes, three (3) of which were instrumented with groundwater monitoring wells for environmental purposes. Boreholes were drilled to depths ranging from 4.42 to 4.80 m below the ground surface (mbgs).

3.2 Media Investigated

During the subsurface investigation, soil samples and groundwater samples were obtained and submitted for laboratory analysis. The rationale for sampling and analyzing this media is based on the Contaminants of Potential Concern (CPCs) identified in the Phase I ESA. These CPCs include petroleum hydrocarbons (PHC, F_1-F_4), polycyclic aromatic hydrocarbons (PAHs) and/or metals in soil and/or groundwater. Additionally, sodium adsorption ratio (SAR) and electrical conductivity (EC) were also considered CPCs in soil, and sodium and chloride in groundwater.

3.3 Phase I Conceptual Site Model

Geological and Hydrogeological Setting

According to the Geological Survey of Canada website, the bedrock in the area of the Phase I Property is reported to consist of dolomite of the Oxford Formation. The overburden ranges in thickness from 0 to 2 m across the site; however, the December 2019 subsurface investigation encountered the bedrock surface at depths ranging from 0.61 to 4.42 mbgs. Groundwater beneath the site was determined to flow in a north-easterly direction.

Fill Placement

Based on the historical review in combination with the site visit, the majority of the subject land has been used for fill placement. The unknown quality of the fill material imported on-site represents an APEC on the Phase I Property.

Existing Buildings and Structures

No buildings or structures are present on the phase I Property.

Drinking Water Wells

One potable water well was identifed on-site. It is expected that the site will be serviced by a private well and septic system.

Subsurface Structures and Utilities

The Phase I Property is not expected to have any subsurface structures or utilities on-site.

Areas of Natural Significance and Water Bodies

No areas of natural significance were identified within the Phase I Study Area. A tributary of Findley Creek is present approximately 157 m northwest of the Phase I Property and discharges into the North Caster River.

Neighbouring Land Use

Neighbouring land use in the Phase I Study Area consists primarily of vacant and/or undeveloped lands to the north and south, farmland to the east and industrial lands to the west.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

As per Section 7.1 of the Phase I ESA report, one PCA was considered to result in an APEC on the Phase I Property. This APEC has been summarized in Table 1, along with its respective location and contaminants of potential concern (CPCs) on the Phase I Property.

TABLE 1: Areas of Potential Environmental Concern					
Area of Potential Environmental Concern	**Location of Area of Potential Environmental Concern**	**Potentially Contaminating Activity**	**Location of PCA (on-site or off-site)**	**Contaminants of Potential Concern**	**Media Potentially Impacted (Groundwater, Soil, and/or Sediment)**
APEC 1: Resulting from fill material of unknown quality	Across the Phase I Property	PCA 30 – "*Importation of Fill Material of Unknown Quality.*"	On-site	PHCs PAHs Metals SAR/EC Sodium and chloride	Soil and/or Groundwater

As previously discussed in Section 7.1, the remaining off-site PCA was determined not to represent APECs on the Phase I Property.

Contaminants of Potential Concern

As per the APECs identified in Section 7.1, the contaminants of potential concern (CPCs) in soil and/or groundwater include:

- ❒ Petroleum hydrocarbons (PHCs, Fractions F_1-F_4).
- ❒ Polycyclic Aromatic Hydrocarbons (PAHs).
- ❒ Metals plus Mercury (Hg), and Hexavalent Chromium (CrVI).
- ❒ Sodium and Chloride.
- ❒ Sodium Adsorption Ratio (SAR) and Electrical Conductivity (EC).

The CPCs are expected to be present in the soil and/or groundwater of the Phase I Property.

Assessment of Uncertainty and/or Absence of Information

The information available for review as part of the preparation of this Phase I-ESA is considered to be sufficient to conclude that there is an on-site PCA that has resulted in an APEC on the Phase I Property.

A variety of independent sources were consulted as part of this assessment, and as such, the conclusions of this report are not affected by uncertainty which may be present with respect to the individual sources.

3.4 Deviations from Sampling and Analysis Plan

The Sampling and Analysis Plan for this project is included in Appendix 1 of this report. A groundwater sample could not be obtained from BH3 due to a damaged well screen.

3.5 Impediments

No physical impediments were encountered during the Phase II ESA program.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation was conducted on September 9, 2019. The field program consisted of drilling four (4) boreholes across the Phase II Property.

The boreholes were drilled to a maximum depth of 4.80 mbgs. Three (3) of the four (4) boreholes were completed as groundwater monitoring wells to access the groundwater table. All boreholes were completed using a track mounted drill rig provided by Marathon Drilling Ltd. of Ottawa, Ontario, under the full-time supervision of Paterson personnel. The borehole locations are indicated on the attached Drawing PE5033-3 – Test Hole Location Plan, appended to this report.

4.2 Soil Sampling

A total of seventeen (17) soil samples were obtained from the boreholes by means of grab sampling from auger flights and split spoon sampling. Split spoon samples were taken at approximate 0.76 m intervals. The depths at which auger samples and split spoon samples were obtained from the boreholes are shown as "**G**" and "**SS**" on the Soil Profile and Test Data Sheets appended to this report.

The soil profile encountered generally consisted of a layer of fill or crushed stone fill (in BH1 and BH4) overlying native sandy silt/silt with occasional gravel. Practical refusal was reached at depths ranging from 0.61 to 4.72 m below the existing grade, on inferred bedrock. Bedrock was confirmed by coring in BH1 and BH4. The bedrock consisted of limestone and sandstone.

4.3 Field Screening Measurements

All soil samples collected were subjected to a preliminary screening procedure, which included visual screening for colour and evidence of metals, as well as soil vapour screening with a MiniRAE 2000 Portable VOC Monitor.

The technical protocol was obtained from Appendix C of the MECP document entitled “Interim Guidelines for the Remediation of Petroleum Contamination at Operating Retail and Private Fuel Outlets in Ontario”, dated March 1992.

Soil samples recovered at the time of sampling were placed immediately into airtight plastic bags with nominal headspace. All lumps of soil inside the bags were broken by hand, and the soil was allowed to come to ambient temperature prior to conducting the vapour survey. Allowing the samples to stabilize to ambient temperature ensures consistency of readings between samples.

The soil vapours were measured by inserting the analyzer probe into the nominal headspace above the soil sample. Samples were then agitated/manipulated gently as the measurements were taken. The peak reading registered within the first 15 seconds was recorded as the vapour measurement.

The vapour readings were found to range from 5.3 ppm to 15.3 ppm. Vapour readings are noted on the Soil Profile and Test Data Sheets in Appendix 1.

No staining or unusual odours were noted during the field program. Soil samples were selected based on a combination of the results of the vapour screening, visual and olfactory screening, sample depth and/or sample location.

4.4 Groundwater Monitoring Well Installation

Three (3) groundwater monitoring wells were installed on the Phase II Property as part of the subsurface investigation. The monitoring wells consisted of 35 mm diameter, Schedule 40 threaded PVC risers and screens. Monitoring well construction details are listed below in Table 2 and are also presented on the Soil Profile and Test Data Sheets provided in Appendix 1. A summary of the monitoring well construction details is provided below in Table 2.

TABLE 2: Monitoring Well Construction Details						
Well ID	**Ground Surface Elevation**	**Total Depth (m BGS)**	**Screened Interval (m BGS)**	**Sand Pack (m BGS)**	**Bentonite Seal (m BGS)**	**Casing Type**
BH1	91.73	4.80	1.80-4.80	1.06-4.80	0.15-1.06	Stick-up
BH3	89.37	4.42	1.42-4.42	1.24-4.42	0.15-1.24	Stick-up
BH4	89.43	4.72	1.72-4.72	1.24-4.72	0.15-1.24	Stick-up

4.5 Field Measurement of Water Quality Parameters

Groundwater samples were collected on December 16, 2019 and more recently on August 19, 2020. The water levels were the only parameter measured in the field during the sampling event.

4.6 Groundwater Sampling

Groundwater sampling protocols were followed using the MECP document entitled “Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario”, dated May 1996. Groundwater samples were obtained from each monitoring well, using dedicated sampling equipment. Standing water was purged from each well prior to sampling.

Samples were stored in coolers to reduce analyte volatilization during transportation. Details of our standard operating procedure for groundwater sampling are provided in the Sampling and Analysis Plan in Appendix 1.

4.7 Analytical Testing

Based on the guidelines outlined in the Sampling and Analysis Plan in Appendix 1, the soil and groundwater samples submitted for analytical testing are presented in Tables 3 and 4.

TABLE 3: Soil Samples Submitted and Analyzed Parameters						
Sample ID	Sample Depth (m) and Stratigraphic Unit	Parameters Analyzed				Rationale
		SAR/EC	Metals	PHCs (F2-F4)	PAHs	
December 9, 2019						
BH2-AU1	0.0-0.61 Fill	X	X	X	X	Assess the quality of fill material on-site.
BH2-SS2	0.76-1.40 Fill		X	X	X	Assess the quality of fill material on-site.
BH3-AU1	0.0-0.61 Fill		X	X	X	Assess the quality of fill material on-site.
BH3-SS3	1.60-2.10 Fill		X	X	X	Assess the quality of fill material on-site.
BH4-AU1	0.0-0.61 Fill	X	X	X	X	Assess the quality of fill material on-site.

TABLE 4: Groundwater Samples Submitted and Analyzed Parameters						
Sample ID	Screened Interval (m) and Stratigraphy Unit	Parameters Analyzed				Rationale
		PHCs	PAHs	VOCs	Sodium Chloride	
December 16, 2019						
BH1-GW1	1.80-4.80 Fill	X	X	X	X	Assess potential impact in the groundwater.
BH4-GW1	1.72-472 Bedrock	X	X	X	X	Assess potential impact in the groundwater.

Paracel Laboratories (Paracel), of Ottawa, Ontario, performed the laboratory analysis on the samples submitted for analytical testing. Paracel is a member of the Standards Council of Canada/Canadian Association for Laboratory Accreditation (SCC/CALA). Paracel is accredited and certified by SCC/CALA for specific tests registered with the association.

4.8 Residue Management

All soil cuttings, purge water and fluids from equipment cleaning were retained on-site.

4.9 Elevation Surveying

The borehole locations were selected by Paterson for both environmental and geotechnical purposes. Boreholes were located and surveyed in the field by R.W. Tomlinson.

The locations and elevations of the boreholes are presented on Drawing PE5033-3 – Test Hole Location Plan, appended to this report.

4.10 Quality Assurance and Quality Control Measures

A summary of quality assurance and quality control (QA/QC) measures, including sampling containers, preservation, labelling, handling, and custody, equipment cleaning procedures, and field quality control measurements is provided in the Sampling and Analysis Plan in Appendix 1.

5.0 REVIEW AND EVALUATION

5.1 Geology

Site soils generally generally consisted of a layer of fill, overlying native sandy silt/silt with occasional gravel. Practical refusal was reached at depths ranging from 0.61 to 4.72 m below the existing grade, on inferred bedrock. Bedrock was confirmed by coring in BH1 and BH4. The bedrock consisted of limestone and sandstone.

Groundwater was encountered within either the fill or bedrock at depths ranging from approximately 1.10 to 1.32 mbgs. Site geology details are provided in the Soil Profile and Test Data Sheets provided in Appendix 1.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured during the groundwater sampling event on December 16, 2019, using an electronic water level meter. Groundwater levels are summarized below in Table 5.

TABLE 5: Groundwater Level Measurements

Borehole Location	Ground Surface Elevation (m)	Water Level Depth (m below grade)	Water Level Elevation (m ASL)	Date of Measurement
BH1	91.73	1.32	90.41	December 16, 2019
BH3	89.37	1.10	88.27	December 16, 2019
BH4	89.43	1.26	88.17	December 16, 2019

Based on the groundwater elevations measured during the sampling event, a groundwater contour plan was completed. The groundwater contour mapping is shown on Drawing PE5033-3 – Groundwater Contour Plan. Based on the contour mapping, groundwater flow beneath the Phase II Property is in a south-easterly direction. A horizontal hydraulic gradient of approximately 0.008 m/m was calculated.

5.3 Fine-Course Soil Texture

No grain size analysis was completed for the subject site. Coarse grained standards were chosen as a conservative approach.

5.4 Soil: Field Screening

Field screening of the soil samples collected resulted in vapour readings ranging from 5.3 ppm to 15.3 ppm.

No staining or unusual odours were noted during the field program. Soil samples were selected based on a combination of the results of the vapour screening, visual and olfactory screening, sample depth and/or sample location. The field screening results of each individual soil sample are provided on the Soil Profile and Test Data Sheets, appended to this report.

5.5 Soil Quality

Five (5) soil samples were submitted for BTEX, PHC (F_2-F_4), PAHs, metals, electrical conductivity (EC), sodium adsorption ratio (SAR) and/or pH analyses. The results of the analytical testing are presented in Tables 6 through 9. The laboratory certificate of analysis is provided in Appendix 1.

TABLE 6: Analytical Test Results – Soil – PHC (F2 to F4)					
Parameter	MDL (µg/g)	Soil Samples (ug/g)			MECP Table 2 Standards (µg/g)
		December 9, 2019			
		BH2-AU1	BH2-SS2	BH3-AU1	
PHCs - F2	4	nd	<40	nd	230
PHCs - F3	8	52	(280)	26	1700
PHCs - F4	6	58	(619)	15	3300
PHCs - F4 (gravimetric)	50	NA	(2090)	NA	3300

Notes:
- MDL - Method Detection Limit
- NA – Not analyzed
- nd - Not Detected (i.e <MDL)
- (-) – Results exceed the MECP Table 1 Background Standards

TABLE 6 Continued: Analytical Test Results – Soil – PHC (F2 to F4)				
Parameter	MDL (µg/g)	Soil Samples (ug/g)		MECP Table 2 Standards (µg/g)
		December 9, 2019		
		BH3-SS3	BH4-AU1	
PHCs - F2	4	9	nd	230
PHCs - F3	8	64	nd	1700
PHCs – F4	6	58	nd	3300
PHCs - F4 (gravimetric)	50	NA	NA	3300

Notes:
- MDL - Method Detection Limit
- NA – Not Analyzed
- nd - Not Detected (i.e <MDL)

Detectable PHC concentrations were identified in most of the soil samples analyzed. All parameters are in compliance with the MECP Table 2 Standards. PHC fractions 3 and 4 concentrations in sample BH2-SS2 are in excess of the MECP Table 1 Standards.

TABLE 7: Analytical Test Results – Soils – Metals					
Parameter	MDL (µg/g)	Soil Samples (µg/g)			MECP Table 2 Standards (µg/g)
		December 9, 2019			
		BH2-AU1	BH2-SS2	BH3-AU1	
Antimony	1.0	nd	nd	nd	40
Arsenic	1.0	5.1	10.6	5.2	18
Barium	1.0	142	104	114	670
Beryllium	0.5	nd	nd	0.6	8
Boron	5.0	10.7	9	7.6	120
Cadmium	0.5	nd	nd	nd	1.9
Chromium	5.0	26.6	17.3	33.7	160
Cobalt	1.0	7.8	11.8	9.5	80
Copper	5.0	15.9	14.3	20.6	230
Lead	1.0	21.6	21.7	11.7	120
Molybdenum	1.0	(5.4)	(21.8)	1.5	40
Nickel	5.0	16.2	24.2	23.5	270

TABLE 7: Analytical Test Results – Soils – Metals					
Parameter	MDL (µg/g)	Soil Samples (µg/g) December 9, 2019			MECP Table 2 Standards (µg/g)
		BH2-AU1	BH2-SS2	BH3-AU1	
Selenium	1.0	nd	nd	nd	5.5
Silver	0.3	nd	nd	nd	40
Thallium	1.0	nd	nd	nd	3.3
Uranium	1.0	nd	nd	nd	33
Vanadium	10.0	28.8	32.3	39.2	86
Zinc	20.0	32.1	31.4	48.8	340

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- (-) – Results exceed the MECP Table 1 Background Standards

TABLE 7 Continued: Analytical Test Results – Soils – Metals				
Parameter	MDL (µg/g)	Soil Samples (µg/g) December 9, 2019		MECP Table 2 Standards (µg/g)
		BH3-SS3	BH4-AU1	
Antimony	1.0	nd	nd	40
Arsenic	1.0	5.5	7.8	18
Barium	1.0	126	62	670
Beryllium	0.5	0.7	nd	8
Boron	5.0	11.9	nd	120
Cadmium	0.5	nd	nd	1.9
Chromium	5.0	24.5	9	160
Cobalt	1.0	10.3	6.8	80
Copper	5.0	23.1	5.4	230
Lead	1.0	12.9	10.2	120
Molybdenum	1.0	1.9	(4.1)	40
Nickel	5.0	23.7	11.1	270
Selenium	1.0	nd	nd	5.5
Silver	0.3	nd	nd	40
Thallium	1.0	nd	nd	3.3
Uranium	1.0	nd	nd	33
Vanadium	10.0	30.7	nd	86
Zinc	20.0	42.8	nd	340

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- (-) – Results exceed the MECP Table 1 Background Standards

The metal results comply with MECP Table 2 Standards. The molybdenum concentrations in samples BH2-AU1, BH2-SS2 and BH4-AU1 are in excess of the MECP Table 1 Standard.

TABLE 8: Analytical Test Results – Soil – PAH					
Parameter	MDL (µg/g)	Soil Samples (ug/g) December 9, 2019			MECP Table 2 Standards (µg/g)
		BH2-AU1	BH2-SS2	BH3-AU1	
Acenaphthene	0.02	nd	nd	nd	21
Acenaphthylene	0.02	nd	nd	nd	0.15
Anthracene	0.02	nd	nd	nd	0.67
Benzo[a]anthracene	0.02	0.03	0.05	nd	0.96
Benzo[a]pyrene	0.02	0.02	0.05	nd	0.3
Benzo[b]fluoranthene	0.02	0.05	0.08	nd	0.96
Benzo[g,h,i]perylene	0.02	0.02	0.04	nd	9.6
Benzo[k]fluoranthene	0.02	0.02	0.04	nd	0.96
Chrysene	0.02	0.03	0.05	nd	9.6
Dibenzo[a,h]anthracene	0.02	nd	nd	nd	0.1
Fluoranthene	0.02	0.05	0.11	nd	9.6
Fluorene	0.02	nd	nd	nd	62
Indeno[1,2,3-cd]pyrene	0.02	nd	0.03	nd	0.76
1-Methylnaphthalene	0.02	nd	nd	nd	30
2-Methylnaphthalene	0.02	nd	nd	nd	30
Methylnaphthalene (1&2)	0.04	nd	nd	nd	30
Naphthalene	0.01	nd	nd	nd	9.6
Phenanthrene	0.02	0.03	0.05	nd	12
Pyrene	0.02	0.04	0.08	nd	9.6

Notes:
- MDL - Method Detection Limit
- nd - Not Detected (i.e <MDL)

TABLE 8 Continued: Analytical Test Results – Soil – PAH				
Parameter	MDL (µg/g)	Soil Samples (ug/g) December 9, 2019		MECP Table 2 Standards (µg/g)
		BH3-SS3	BH4-AU1	
Acenaphthene	0.02	nd	nd	21
Acenaphthylene	0.02	nd	nd	0.15
Anthracene	0.02	nd	nd	0.67
Benzo[a]anthracene	0.02	0.06	nd	0.96
Benzo[a]pyrene	0.02	0.05	nd	0.3
Benzo[b]fluoranthene	0.02	0.12	nd	0.96
Benzo[g,h,i]perylene	0.02	0.04	nd	9.6
Benzo[k]fluoranthene	0.02	0.05	nd	0.96
Chrysene	0.02	0.07	nd	9.6
Dibenzo[a,h]anthracene	0.02	nd	nd	0.1
Fluoranthene	0.02	0.15	nd	9.6
Fluorene	0.02	nd	nd	62
Indeno[1,2,3-cd]pyrene	0.02	0.03	nd	0.76
1-Methylnaphthalene	0.02	nd	nd	30
2-Methylnaphthalene	0.02	nd	nd	30
Methylnaphthalene (1&2)	0.02	nd	nd	30
Naphthalene	0.01	nd	nd	9.6
Phenanthrene	0.02	0.12	nd	12
Pyrene	0.02	0.11	nd	9.6

Notes:
- MDL - Method Detection Limit
- nd - Not Detected (i.e <MDL)

All PAH parameters are in compliance with MECP Table 2 Standards, as well as Table 1 Standards.

TABLE 9: Analytical Test Results – Soil – EC, SAR and pH

Parameter	MDL	Soil Samples (ug/g)		MECP Table 2 Standards
		December 9, 2019	December 10, 2019	
		BH2-AU1	BH4-AU1	
SAR (N/A)	0.01	0.82	0.03	12
EC (µS/cm)	5	(1260)	(628)	1400
pH	0.05	NA	7.67	5-11

Notes:
- MDL - Method Detection Limit
- NA – Not analyzed
- nd - Not Detected (i.e <MDL)
- (-) – Results exceed the MECP Table 1 Background Standards

The conductivity, SAR and pH in all of the soil samples analyzed are in compliance with the MECP Table 2 Standards. The electrical conductivity in samples BH2-AU1 and BH4-AU1 are in excess of the MECP Table 1 Standard.

The analytical results in the soil samples analyzed with respect to borehole locations are shown on Drawing PE5033-4- Analytical Testing Plan.

The maximum concentrations of analyzed parameters in the soil at the site are summarized in Table 10.

TABLE 10: Maximum Concentrations – Soil

Parameter	Maximum Concentration (µg/g)	Soil Sample	Depth Interval (m BGS)
PHC F_2	<40	BH2-SS2	0.76-1.40, fill
PHC F_3	(280)	BH2-SS2	0.76-1.40, fill
PHC F_4	(619)	BH2-SS2	0.76-1.40, fill
PHCs - F4 (gravimetric)	(2090)	BH2-SS2	0.76-1.40, fill
Arsenic	10.6	BH2-SS2	0.76-1.40, fill
Barium	142	BH2-AU1	0.0-0.61, fill
Beryllium	0.6	BH3-AU1	0.0-0.61, fill
Boron	10.7	BH2-AU1	0.0-0.61, fill
Chromium	33.7	BH3-AU1	0.0-0.61, fill
Cobalt	11.8	BH2-SS2	0.76-1.40, fill
Copper	23.1	BH3-SS3	1.60-2.10, fill
Lead	21.7	BH2-SS2	0.76-1.40, fill
Molybdenum	(21.8)	BH2-SS2	0.76-1.40, fill
Nickel	24.2	BH2-SS2	0.76-1.40, fill
Vanadium	39.2	BH3-AU1	0.0-0.61, fill
Zinc	48.8	BH3-AU1	0.0-0.61, fill
Benzo[a]anthracene	0.06	BH3-SS3	1.60-2.10, fill
Benzo[a]pyrene	0.05	BH3-SS3	1.60-2.10, fill

TABLE 10: Maximum Concentrations – Soil			
Parameter	**Maximum Concentration (µg/g)**	**Soil Sample**	**Depth Interval (m BGS)**
Benzo[b]fluoranthene	0.12	BH3-SS3	1.60-2.10, fill
Benzo[g,h,i]perylene	0.04	BH3-SS3	1.60-2.10, fill
Benzo[k]fluoranthene	0.05	BH3-SS3	1.60-2.10, fill
Chrysene	0.07	BH3-SS3	1.60-2.10, fill
Fluoranthene	0.15	BH3-SS3	1.60-2.10, fill
Fluorene	0.03	BH3-SS3	1.60-2.10, fill
Phenanthrene	0.12	BH3-SS3	1.60-2.10, fill
Pyrene	0.11	BH3-SS3	1.60-2.10, fill

Notes:
- (-) – Results exceed the MECP Table 1 Background Standards

The remaining parameters were not detected above the laboratory method detection limits.

5.6 Groundwater Quality

Groundwater samples were submitted for laboratory analysis of PHC (F_1-F_4), PAHs and/or VOC parameters as well as chloride and sodium. The groundwater samples were obtained from the screened intervals noted in Table 2. The results of the analytical testing are presented in Tables 11 through 14. The laboratory certificates of analysis are provided in Appendix 1.

TABLE 11: Analytical Test Results – Groundwater – PHC (F1 – F4)				
Parameter	**MDL (µg/L)**	**Groundwater Samples (µg/L)**		**MECP Table 2 Standards (µg/L)**
		December 16, 2019		
		BH1-GW1	**BH4-GW1**	
PHC F1	25	nd	nd	750
PHC F2	100	nd	nd	150
PHC F3	100	nd	nd	500
PHC F4	100	nd	nd	500

Notes:
- MDL - Method Detection Limit
- nd - Not Detected (i.e <MDL)
- **Bold and underlined –** Results exceed selected MECP standard

No detectable PHC concentrations were identified in any of the groundwater samples analyzed. The PHC results comply with the MECP Table 2 Standards.

TABLE 12: Analytical Test Results – Groundwater – PAH				
Parameter	**MDL (µg/L)**	**Groundwater Samples (µg/L)**		**MECP Table 2 Standards (µg/L)**
		December 16, 2019		
		BH1-GW1	**BH4-GW1**	

TABLE 12: Analytical Test Results – Groundwater – PAH

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)		MECP Table 2 Standards (µg/L)
		December 16, 2019		
		BH1-GW1	BH4-GW1	
Acenaphthene	0.05	nd	nd	4.1
Acenaphthylene	0.05	nd	nd	1
Anthracene	0.01	nd	nd	2.4
Benzo[a]anthracene	0.01	nd	nd	1
Benzo[a]pyrene	0.01	nd	nd	0.01
Benzo[b]fluoranthene	0.05	nd	nd	0.1
Benzo[g,h,i]perylene	0.05	nd	nd	0.2
Benzo[k]fluoranthene	0.05	nd	nd	0.1
Chrysene	0.05	nd	nd	0.1
Dibenzo[a,h]anthracene	0.05	nd	nd	0.2
Fluoranthene	0.01	nd	nd	0.41
Fluorene	0.05	nd	nd	120
Indeno[1,2,3-cd]pyrene	0.05	nd	nd	0.2
1-Methylnaphthalene	0.05	nd	nd	3.2
2-Methylnaphthalene	0.05	nd	nd	3.2
Methylnaphthalene (1&2)	0.1	nd	nd	3.2
Naphthalene	0.05	nd	nd	11
Phenathrene	0.05	nd	nd	1
Pyrene	0.01	nd	nd	4.1

Notes:
- MDL - Method Detection Limit
- nd - Not Detected (i.e <MDL)
- **Bold and underlined –** Results exceed selected MECP standard

No detectable PAH concentrations were identified in any of the groundwater samples analyzed. The results are in compliance with the MECP Table 2 Standards.

TABLE 13: Analytical Test Results – Groundwater – VOC

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)		MECP Table 2 Standards (µg/L)
		December 16, 2019		
		BH1-GW1	BH4-GW1	
Acetone	5	nd	nd	2700
Benzene	0.5	nd	nd	5
Bromodichloromethane	0.5	nd	nd	16
Bromoform	0.5	nd	nd	25
Bromomethane	0.5	nd	nd	0.89
Carbon Tetrachloride	0.2	nd	nd	0.79
Chlorobenzene	0.5	nd	nd	30
Chloroform	0.5	2.4	**8**	2.4
Dibromochloromethane	0.5	nd	nd	25
Dichlorodifluoromethane	1	nd	nd	590
1,2-Dichlorobenzene	0.5	nd	nd	3
1,3-Dichlorobenzene	0.5	nd	nd	59
1,4-Dichlorobenzene	0.5	nd	nd	1
1,1-Dichloroethane	0.5	nd	nd	5
1,2-Dichloroethane	0.5	nd	nd	1.6
1,1-Dichloroethylene	0.5	nd	nd	1.6
cis-1,2-Dichloroethylene	0.5	nd	nd	1.6

TABLE 13: Analytical Test Results – Groundwater – VOC

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)		MECP Table 2 Standards (µg/L)
		December 16, 2019		
		BH1-GW1	BH4-GW1	
trans-1,2-Dichloroethylene	0.5	nd	nd	1.6
1,2-Dichloropropane	0.5	nd	nd	5
1,3-Dichloropropene, total	0.5	nd	nd	0.5
Ethylbenzene	0.5	nd	nd	2.4
Ethylene dibromide	0.2	nd	nd	0.2
Hexane	1	nd	nd	51
Methyl Ethyl Ketone	5	nd	nd	1800
Methyl Isobutyl Ketone	5	nd	nd	640
Methyl tert-butyl ether	2	nd	nd	15
Methylene Chloride	5	nd	nd	50
Styrene	0.5	nd	nd	5.4
1,1,1,2-Tetrachloroethane	0.5	nd	nd	1.1
1,1,2,2-Tetrachloroethane	0.5	nd	nd	1
Tetrachloroethylene	0.5	nd	nd	1.6
Toluene	0.5	nd	nd	24
1,1,1-Trichloroethane	0.5	nd	nd	200
1,1,2-Trichloroethane	0.5	nd	nd	4.7
Trichloroethylene	0.5	nd	nd	1.6
Trichlorofluoromethane	1	nd	nd	150
Vinyl Chloride	0.5	nd	nd	0.5
Xylenes, total	0.5	nd	nd	300

Notes:
- MDL - Method Detection Limit
- nd - Not Detected (i.e <MDL)
- **Bold and underlined –** Results exceed selected MECP standard

The chloroform concentrations in samples BH1-GW1 and BH4-GW1 were equal to and in excess of the MECP Table 2 Standard, respectively. The remaining results were in compliance with the MECP Table 2 Standard. The chloroform concentrations are considered to be a result of the use of municipal water during the rock coring process. These concentrations will dissipate in the near future and are not considered a contaminant of concern.

TABLE 14: Analytical Test Results – Groundwater – Salt (Sodium and Chloride)

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)		MECP Table 2 Standards (µg/L)
		December 16, 2019		
		BH1-GW1	BH4-GW1	
Chloride	1000	130,000	53,000	790,000
Sodium	200	69,700	31,400	490,000

Notes:
- MDL - Method Detection Limit
- nd - Not Detected (i.e <MDL)
- **Bold and underlined –** Results exceed selected MECP standard

The chloride and sodium concentrations comply with the MECP Table 2 Standards.

The analytical results in the groundwater with respect to borehole locations are shown on Drawing PE5033-4- Analytical Testing Plan.

The maximum concentrations of analyzed parameters in the groundwater beneath the site are summarized in Table 15.

TABLE 15: Maximum Concentrations – Groundwater

Parameter	Maximum Concentration (µg/L)	Groundwater Sample	Screened Interval (m BGS)
Chloroform	8	BH4-GW1	1.42-4.42
Chloride	130,000	BH1-GW1	1.72-4.72
Sodium	69,700	BH1-GW1	1.72-4.72

The remaining parameters were not detected above the laboratory method detection limits.

5.7 Quality Assurance and Quality Control Results

All samples submitted as part of the December 9 and December 16, 2019 sampling events were handled in accordance with the Analytical Protocol with respect to preservation method, storage requirement, and container type.

Overall, the quality of the field data collected during this Phase II-ESA is considered to be sufficient to meet the overall objectives of this assessment.

5.8 Phase II Conceptual Site Model

The following section has been prepared in general accordance with the requirements of O.Reg. 153/04, as amended by the Environmental Protection Act. Conclusions and recommendations are discussed in a subsequent section.

Site Description

Potentially Contaminating Activity and Areas of Potential Environmental Concern

As indicated in Section 2.2 of this report, PCA 30 was identified on the subject land, which resulted in an APEC on the Phase II Property.

TABLE 15: Areas of Potential Environmental Concern					
Area of Potential Environmental Concern	**Location of Area of Potential Environmental Concern**	**Potentially Contaminating Activity**	**Location of PCA (on-site or off-site)**	**Contaminants of Potential Concern**	**Media Potentially Impacted (Groundwater, Soil, and/or Sediment)**
APEC 1: Resulting from fill material of unknown quality	Across the Phase I Property	PCA 30 – "*Importation of Fill Material of Unknown Quality.*"	On-site	PHCs PAHs Metals SAR/EC Sodium and chloride	Soil and/or Groundwater

Contaminants of Potential Concern

Based on the APECs identified on the Phase II Property, the contaminants of potential concern (CPCs) are:

- Petroleum hydrocarbons (PHCs, Fractions F_1-F_4).
- Polycyclic Aromatic Hydrocarbons (PAHs).
- Metals
- Sodium and Chloride.
- Sodium Adsorption Ratio (SAR) and Electrical Conductivity (EC).

Subsurface Structures and Utilities

The Phase II Property is not expected to have any subsurface structures or utilities on it. Upon development, the Phase II Property will be serviced by a private septic system and a potable groundwater well.

Physical Setting

Site Stratigraphy

The site stratigraphy consists of:

- Fill material consisting of sandy silt to silty sand (with traces of organics, plastics and pieces of asphalt) or crushed stone in BH1 and BH4, extending to depths ranging from 0.61 to 1.68 mbgs. Groundwater was encountered in this layer at BH1 and BH3.
- Topsoil was encountered in BH1 beneath the fill material at 1.50 mbgs and extended to 1.80 mbgs.

- Shale fill material was encountered in BH3, beneath the silty sand fill layer and extended to a depth of 3.66 mbgs.
- Sandy Silt to silt with traces of gravel was encountered in BH1, BH2 and BH4 and extended to depths ranging from 2.54 to 4.72 mbgs.
- Bedrock was encountered in BH1 and BH4 at depths of 2.54 and 0.61 mbgs, respectively. Groundwater was encountered in this layer at BH4.

Hydrogeological Characteristics

Groundwater at the Phase II Property was generally encountered in the fill ranging at depths of approximately 1.10 to 1.36 mbgs. Groundwater flow was measured in a south-easterly direction with a hydraulic gradient of 0.008 m/m. Groundwater contours are shown on Drawing PE5033-3–Test Hole Location Plan.

Approximate Depth to Water Table

Depth to the water table at the subject site varies between approximately 1.10 to 1.32 mbgs.

Approximate Depth to Bedrock

Bedrock was confirmed during the drilling program. All boreholes were completed in either the native soil or bedrock. Bedrock was encountered at 0.61 and 2.54 mbgs in BH1and BH4, respectively. Practical refusal to augering was reached at depths ranging from 4.42 and 4.72mbgs in BH2 and BH3, respectively.

Sections 41 and 43.1 of the Regulation

Section 41 of the Regulation does not apply to the Phase II Property, in that the subject property is not within 30m of an environmentally sensitive area.

Section 43.1 of the Regulation does not apply to the Phase II Property as it is not a shallow soil property.

Fill Placement

Based on the findings of the subsurface investigation, the fill material consisted of a mix of clay, silt, sand, gravel and some organics with occasional pieces of plastic and asphaltic concrete. Fill material at BH1 and BH4 consisted of crushed stone only. The fill varied in thickness from 1.5 to 3.6 m

Existing Buildings and Structures

No buildings or structures are present on the Phase II Property.

Proposed Buildings and Other Structures

The proposed development for the Phase II Property includes a commercial development that will consist of a showroom, offices and retail space. The footprint of the development will cover the majority of the western portion of the site and it will be privately serviced (i.e. septic system and potable groundwater well).

Drinking Water Wells

No potable water wells are present on the Phase II Property; however, upon development, the subject land will be serviced by a potable water well.

Water Bodies and Areas of Natural Significance

No water bodies or areas of natural significance were identifed on the Phase II Property or within the 250 m search radius.

Environmental Condition

Areas Where Contaminants are Present

Based on the analytical results, all soil and groundwater results comply with the selected MECP Table 2 Commercial Standards, as shown on Drawing PE5033-4 – Analytical Testing Plan.

Types of Contaminants

Based on the analytical results for soil and groundwater, there are no contaminants of concern on the Phase II Property.

Contaminated Media

Based on the findings of the Phase II ESA, there is no impacted soil or groundwater on the Phase II Property.

What Is Known About Areas Where Contaminants Are Present

There are no contaminants of concern on the Phase II Property. All of the soil and groundwater results comply with the selected MECP Table 2 Standards.

Distribution and Migration of Contaminants

Based on the findings of the Phase II ESA, no distribution or migration of potential contaminants is considered to have occurred.

Discharge of Contaminants

Based on the findings of the Phase II ESA, no discharge of potential contaminants is considered to have occurred.

Climatic and Meteorological Conditions

In general, climatic and meteorological conditions have the potential to affect contaminant distribution. Two (2) ways by which climatic and meteorological conditions may affect contaminant distribution include the downward leaching of contaminants by means of the infiltration of precipitation, and the migration of contaminants via groundwater levels and/or flow, which may fluctuate seasonally.

Since no contaminants were identified in the soil or groundwater, climatic and meteorological conditions do not apply in this Phase II ESA.

Potential for Vapour Intrusion

Based on the findings of the Phase II ESA, there is no potential for vapour intrusion on the Phase II Property.

6.0 CONCLUSIONS

Assessment

A Phase II ESA was conducted for the southeast portion of the property addressed 5123 Hawthorne Road, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address the area of potential environmental concern (APEC) that was identified on the Phase II Property during the Phase I ESA.

The Phase II ESA consisted of drilling four (4) boreholes on the Phase II Property, three (3) of which were constructed with groundwater monitoring well installations.

The soil profile encountered generally consisted of a layer of fill, overlying native sandy silt/silt with occasional gravel. Practical refusal was reached at depths ranging from 0.61 to 4.72 m below the existing grade, on inferred bedrock. Bedrock was confirmed by coring in BH1 and BH4. The bedrock consisted of limestone and sandstone. Soil samples were obtained from the boreholes and screened using vapour measurements along with visual and olfactory observations. No staining or Unusual odour was noted during the subsurface investigation.

Based on the screening results in combination with sample depth and location, five (5) soil samples were submitted for metals, PHC (fractions 2 to 4), PAH, electrical conductivity (EC), sodium absorption ratio (SAR) and pH analysis. All soil samples complied with the MECP Table 2 Standards. A comparison of the soil data to the MECP Table 1 Standards, indicated that the petroleum hydrocarbon fraction 3 and 4 concentrations in BH2-SS2, and molybdenum concentrations in BH2-AU1, BH2-SS2 and BH4-AU1 are in excess of the MECP Table 1 Standards.

Groundwater samples were recovered from the monitoring wells BH1 and BH4. It should be noted that BH3 could not be sample due to a damaged well screen.

No free-phase product was observed the during the groundwater sampling event. The groundwater samples were submitted for PHC (F1-F4), PAH, VOC and sodium and chloride analysis. No detectable PHC or PAH concentrations were identified in any of the groundwater samples analyzed. Chloroform concentrations were identified in both samples and exceeded the selected standards in one of the samples. The chloroform concentrations are considered to be a result of the use of municipal water during the rock coring process and

should dissipate in the near future. Chloride and sodium concentrations were identified in both of the groundwater samples analyzed, although the results comply with the selected standards. Based on the groundwater testing carried out, the groundwater beneath the subject site is in compliance with the MECP Table 2 Standards.

Recommendations

The investigation confirms that the fill is composed of waste road building materials, generally consisting of various soils, road based granular materials with occasional pieces of plastic and asphaltic concrete. No other deleterious materials or otherwise contaminated soils were identified. The analytical testing indicates that the fill complies with the selected MECP standards.

Based on the background of the site activity and our findings, no remediation of the soil is considered necessary, however, given the Table 1 exceedances for PHCs and molybdenum with the presence of asphalt in the some of the samples, it is our opinion that some of the fill is not clean for off-site disposal if it has to be removed from the property for construction purposes, although further testing/assessment of excess soil should be completed at the time of site redevelopment to confirm this opinion if excess soil is being generated. It may be used for on-site in landscaping or transferred to a similar industrial site for reuse.

Given the very low volatile readings obtained on the fill samples and the age of the asphalt, it is considered unlikely that the asphalt would pose any risk to interior air quality. As a precautionary measure, any significant deposits of asphalt encountered at the subgrade level below buildings should be removed. It has been assumed that any future building structure would be for commercial use building, constructed with a slab-on-grade foundation.

Monitoring Wells

If the monitoring wells installed on the subject site are not going to be used in the future, or will be destroyed during site redevelopment, they should be abandoned according to Ontario Regulation 903. In the meantime, the wells will be registered with the MECP under this regulation.

7.0 STATEMENT OF LIMITATIONS

This Phase II - Environmental Site Assessment report has been prepared in general accordance with O.Reg. 153/04, as amended, and meets the requirements of CSA Z769-00. The conclusions presented herein are based on information gathered from a limited sampling and testing program. The test results represent conditions at specific test locations at the time of the field program.

The client should be aware that any information pertaining to soils and all test hole logs are furnished as a matter of general information only and test hole descriptions or logs are not to be interpreted as descriptive of conditions at locations other than those of the test holes themselves.

Should any conditions be encountered at the subject site and/or historical information that differ from our findings, we request that we be notified immediately in order to allow for a reassessment.

This report was prepared for the sole use of Fuller-Mariani Building Solutions. Notification from Fuller-Mariani Building Solutions and Paterson Group will be required to release this report to any other party.

Paterson Group Inc.

Mandy Witteman, B.Eng., M.A.Sc.

Mark D'Arcy, P.Eng., QP$_{ESA}$

Report Distribution:

- Fuller-Mariani Building Solutions
- Paterson Group

FIGURES

FIGURE 1 – KEY PLAN

DRAWING PE5033-3 – TEST HOLE LOCATION PLAN AND GROUNDWATER CONTOUR PLAN

DRAWING PE5033-4 – ANALYTICAL TESTING PLAN – SOIL & GROUNDWATER

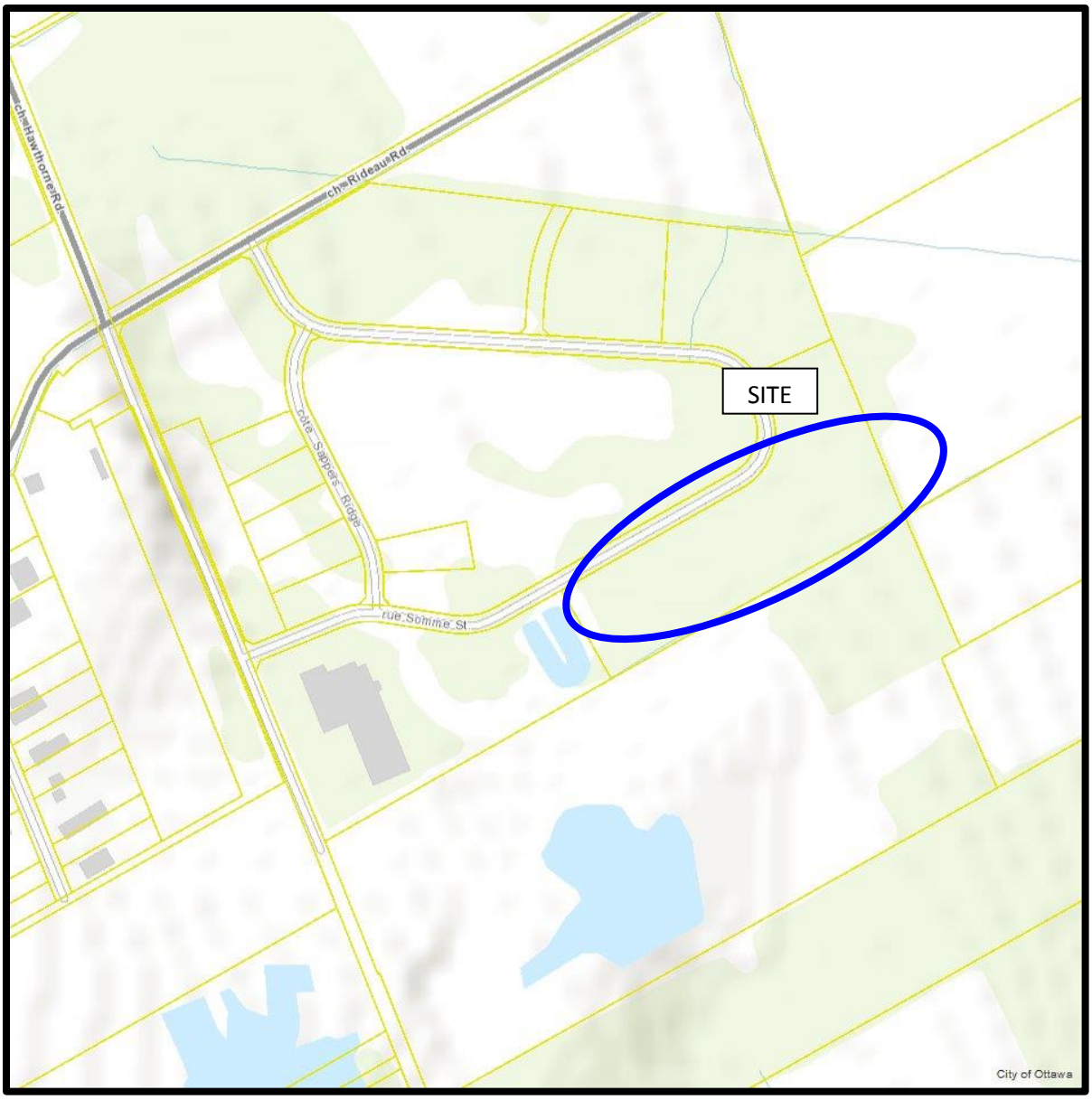
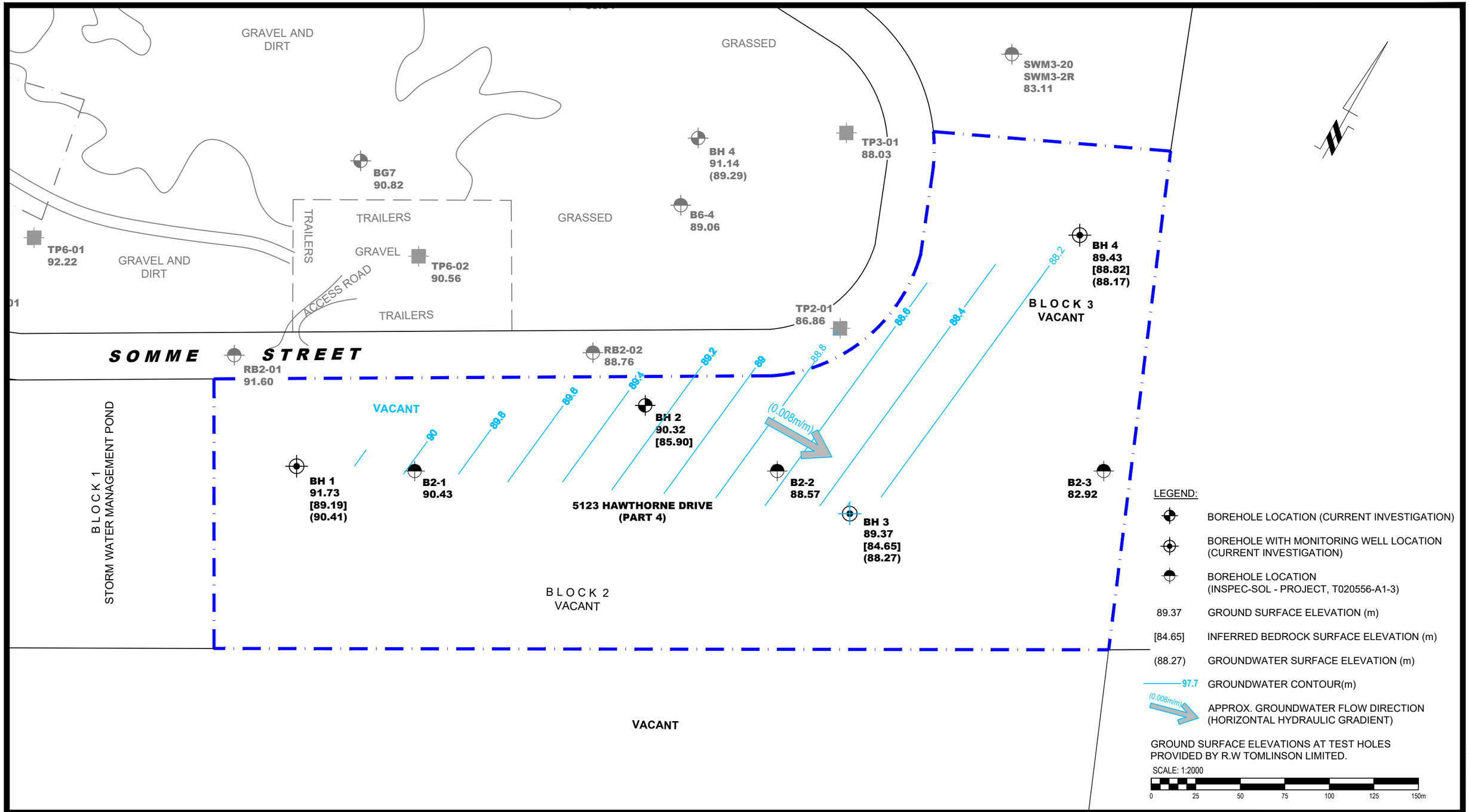


FIGURE 1

KEY PLAN



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NO.	REVISIONS	DATE	INITIAL

FULLER-MARIANI BUILDING SOLUTIONS

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
PART OF 5123 HAWTHORNE DRIVE

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:2000	Date: 09/2020
Drawn by: RCG	Report No.: PE5033-2
Checked by: MW	Dwg. No.: PE5033-3
Approved by: MSD	Revision No.:

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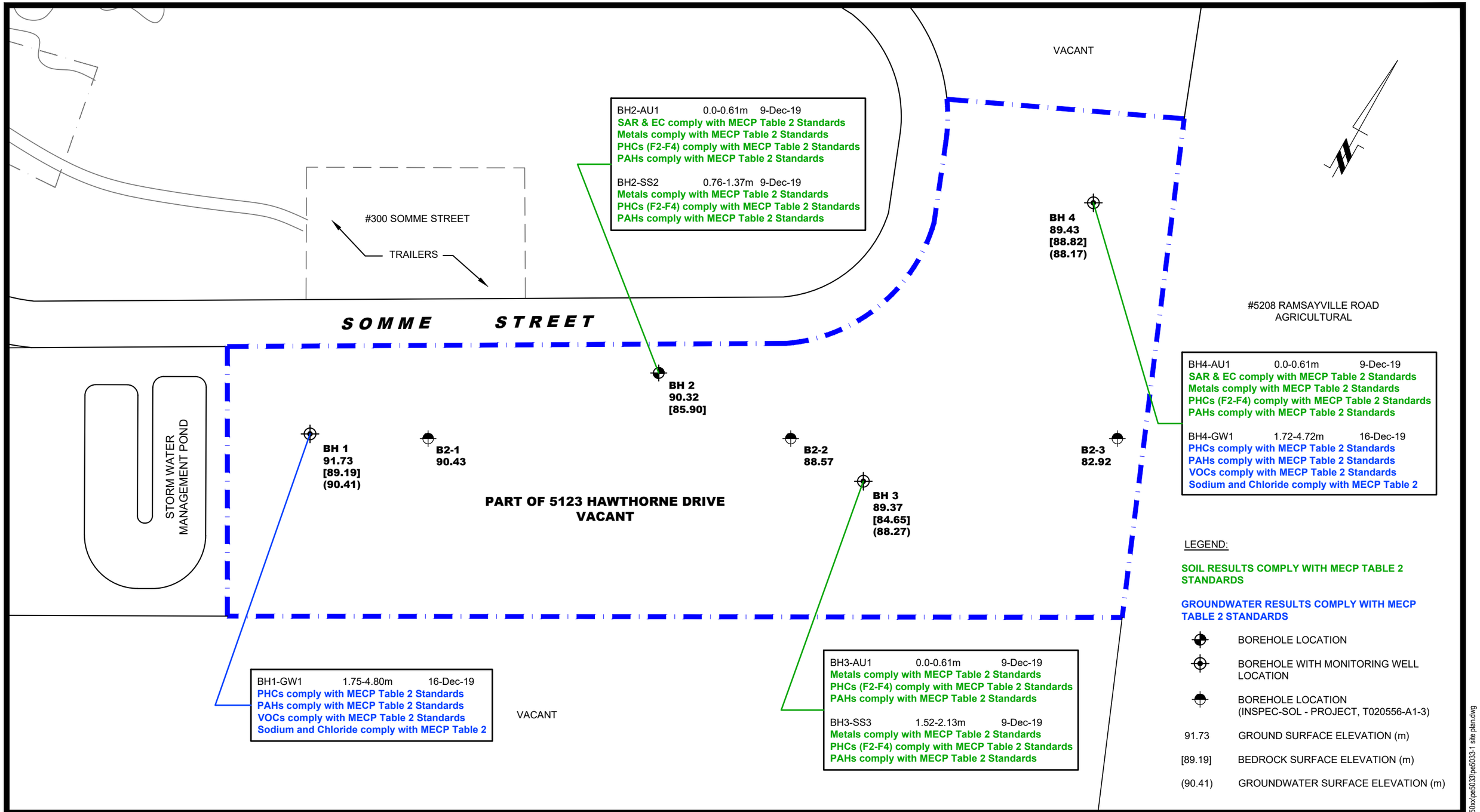

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NO.	REVISIONS	DATE	INITIAL

FULLER-MARIANI BUILDING SOLUTIONS

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
PART OF 5123 HAWTHORNE DRIVE

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL & GROUNDWATER

Scale: 1:2000	Date: 09/2020
Drawn by: MPG	Report No.: PE5033-2
Checked by: MW	Dwg. No.: PE5033-4
Approved by: MSD	Revision No.:

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APPENDIX 1

SAMPLING AND ANALYSIS PLAN

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

LABORATORY CERTIFICATES OF ANALYSIS

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

Paterson Group Inc.

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Sampling & Analysis Plan

Phase II Environmental Site Assessment
Part of 5123 Hawthorn Road
Ottawa, Ontario

Prepared For

Fuller-Mariani Building Solutions

December 2019

Report: PE5033-SAP

Table of Contents

1.0 SAMPLING PROGRAM

Paterson was retained by Mr. Tony Mariani of Fuller-Mariani Building Solutions, to conduct a Phase II Environmental Site Assessment (ESA) for the southern/south-eastern portion of the property addressed 5123 Hawthorne Road, in the City of Ottawa, Ontario.

The Phase II ESA was carried out to address the areas of potential environmental concern on the Phase II Property. The following subsurface investigation program was developed.

Borehole	Location & Rationale	Proposed Depth & Rationale
BH1	Place on the western side of the Phase II Property to assess the potential impact due to APEC 1.	Borehole to be advanced to approximately 4 mbgs to install monitoring well.
BH2	Place on the northern side of the Phase II Property to assess the potential impact due to APEC 1.	Borehole to be advanced to approximately 4 mbgs.
BH3	Place on the eastern side of the Phase II Property to assess the potential impact due to APEC 1.	Borehole to be advanced to approximately 4 mbgs to install monitoring well.
BH4	Place on the northeastern side of the Phase II Property to assess the potential impact due to APEC 1.	Borehole to be advanced to approximately 4 mbgs to install monitoring well.

At each borehole, split-spoon samples of overburden soils will be obtained at 0.76 m (2'6") intervals until practical refusal to augering. All soil samples will be retained, and samples will be selected for submission following a preliminary screening analysis.

Following borehole drilling, monitoring wells will be installed in selected boreholes (as above) for the measurement of water levels and the collection of groundwater samples. Borehole locations are shown on the Test Hole Location Plan appended to the main report.

2.0 ANALYTICAL TESTING PROGRAM

The analytical testing program for soil at the subject site is based on the following general considerations:

- ❒ At least one sample from each borehole should be submitted, in order to delineate the horizontal extent of contamination across the site.
- ❒ At least one sample from each stratigraphic unit should be submitted, in order to delineate the vertical extent of contamination at the site.
- ❒ In boreholes where there is visual or olfactory evidence of contamination, or where organic vapour meter or photoionization detector readings indicate the presence of contamination, the 'worst-case' sample from each borehole should be submitted for comparison with MOECC site condition standards.
- ❒ In boreholes with evidence of contamination as described above, a sample should be submitted from the stratigraphic unit below the 'worst-case' sample to determine whether the contaminant(s) have migrated downward.
- ❒ Parameters analyzed should be consistent with the Contaminants of Potential Concern identified in the Phase I ESA.

The analytical testing program for groundwater at the subject site is based on the following general considerations:

- ❒ Groundwater monitoring wells should be installed in all boreholes with visual or olfactory evidence of soil contamination, in stratigraphic units where soil contamination was encountered, where those stratigraphic units are at or below the water table (i.e. a water sample can be obtained).
- ❒ Groundwater monitoring well screens should straddle the water table at sites where the contaminants of concern are suspected to be LNAPLs.
- ❒ At least one groundwater monitoring well should be installed in a stratigraphic unit below the suspected contamination, where said stratigraphic unit is water-bearing.
- ❒ Parameters analyzed should be consistent with the Contaminants of Concern identified in the Phase I ESA and with the contaminants identified in the soil samples.

3.0 STANDARD OPERATING PROCEDURES

3.1 Environmental Drilling Procedure

Purpose

The purpose of environmental boreholes is to identify and/or delineate contamination within the soil and/or to install groundwater monitoring wells in order to identify contamination within the groundwater.

Equipment

The following is a list of equipment that is in addition to regular drilling equipment stated in the geotechnical drilling SOP:

- ❒ glass soil sample jars
- ❒ two buckets
- ❒ cleaning brush (toilet brush works well)
- ❒ dish detergent
- ❒ methyl hydrate
- ❒ water (if not available on site - water jugs available in trailer)
- ❒ latex or nitrile gloves (depending on suspected contaminant)
- ❒ RKI Eagle organic vapour meter or MiniRae photoionization detector (depending on contamination suspected)

Determining Borehole Locations

If conditions on site are not as suspected, and planned borehole locations cannot be drilled, **call the office to discuss**. Alternative borehole locations will be determined in conversation with the field technician and supervising engineer.

After drilling is completed a plan with the borehole locations must be provided. Distances should be measured using a measuring tape or wheel rather than paced off. Boreholes were located and surveyed in the field by Paterson. All borehole and test pit locations were measured at geodetic elevations.

Drilling Procedure

The actual drilling procedure for environmental boreholes is the same as geotechnical boreholes (see SOP for drilling and sampling) with a few exceptions as follows:

- ❒ Continuous split spoon samples (every 0.6 m or 2') or semi-continuous (every 0.76 m or 2'6") are required.
- ❒ Make sure samples are well sealed in plastic bags with no holes prior to screening and are kept cool but unfrozen.
- ❒ If sampling for VOCs, BTEX, or PHCs F1, a soil core from each soil sample which may be analyzed must be taken and placed in the laboratory-provided methanol vial.
- ❒ Note all and any odours or discolouration of samples.
- ❒ Split spoon samplers must be washed between samples.
- ❒ If obvious contamination is encountered, continue sampling until vertical extent of contamination is delineated.
- ❒ As a general rule, environmental boreholes should be deep enough to intercept the groundwater table (unless this is impossible/impractical - call project manager to discuss).
- ❒ If at all possible, soil samples should be submitted to a preliminary screening procedure on site, either using a RKI Eagle, PID, etc. depending on type of suspected contamination.

Spoon Washing Procedure

All sampling equipment (spilt spoons, etc.) must be washed between samples in order to prevent cross contamination of soil samples.

- ❒ Obtain two buckets of water (preferably hot if available)
- ❒ Add a small amount of dish soap to one bucket
- ❒ Scrub spoons with brush in soapy water, inside and out, including tip
- ❒ Rinse in clean water
- ❒ Apply a small amount of methyl hydrate to the inside of the spoon. (A spray bottle or water bottle with a small hole in the cap works well)
- ❒ Allow to dry (takes seconds)
- ❒ Rinse with distilled water, a spray bottle works well.

The methyl hydrate eliminates any soap residue that may be on the spoon, and is especially important when dealing with suspected VOCs.

Screening Procedure

The RKI Eagle is used to screen most soil samples, particularly where petroleum hydrocarbon contamination is suspected. The MiniRae is used when VOCs are suspected, however it also can be useful for detecting petroleum. These tools are for screening purposes only and cannot be used in place of laboratory testing. Vapour results obtained from the RKI Eagle and the PID are relative and must be interpreted.

Screening equipment should be calibrated on an approximately monthly basis, more frequently if heavily used.

- ❒ Samples should be brought to room temperature; this is specifically important in colder weather. Soil must not be frozen.
- ❒ Turn instrument on and allow to come to zero - calibrate if necessary
- ❒ If using RKI Eagle, ensure instrument is in methane elimination mode unless otherwise directed.
- ❒ Ensure measurement units are ppm (parts per million) initially. RKI Eagle will automatically switch to %LEL (lower explosive limit) if higher concentrations are encountered.
- ❒ Break up large lumps of soil in the sample bag, taking care not to puncture bag.
- ❒ Insert probe into soil bag, creating a seal with your hand around the opening.
- ❒ Gently manipulate soil in bag while observing instrument readings.
- ❒ Record the highest value obtained in the first 15 to 25 seconds
- ❒ Make sure to indicate scale (ppm or LEL); also note which instrument was used (RKI Eagle 1 or 2, or MiniRae).
- ❒ Jar samples and refrigerate as per Sampling and Analysis Plan.

3.2 Monitoring Well Installation Procedure

Equipment

- ❒ 5’ x 2” [1.52 m x 50 mm] threaded sections of Schedule 40 PVC slotted well screen (5’ x 1 ¼” [1.52 m x 32 mm] if installing in cored hole in bedrock)
- ❒ 5’ x 2” [1.52 m x 50 mm] threaded sections of Schedule 40 PVC riser pipe (5’ x 1 ¼” [1.52 m x 32 mm] if installing in cored hole in bedrock)
- ❒ Threaded end-cap
- ❒ Slip-cap or J-plug
- ❒ Asphalt cold patch or concrete
- ❒ Silica Sand
- ❒ Bentonite chips (Holeplug)
- ❒ Steel flushmount casing

Procedure

- ❒ Drill borehole to required depth, using drilling and sampling procedures described above.
- ❒ If borehole is deeper than required monitoring well, backfill with bentonite chips to required depth. This should only be done on wells where contamination is not suspected, in order to prevent downward migration of contamination.
- ❒ Only one monitoring well should be installed per borehole.
- ❒ Monitoring wells should not be screened across more than one stratigraphic unit to prevent potential migration of contaminants between units.
- ❒ Where LNAPLs are the suspected contaminants of concern, monitoring wells should be screened straddling the water table in order to capture any free product floating on top of the water table.
- ❒ Thread the end cap onto a section of screen. Thread second section of screen if required. Thread risers onto screen. Lower into borehole to required depth. Ensure slip-cap or J-plug is inserted to prevent backfill materials entering well.
- ❒ As drillers remove augers, backfill borehole annulus with silica sand until the level of sand is approximately 0.3 m above the top of the screen.
- ❒ Backfill with holeplug until at least 0.3 m of holeplug is present above the top of the silica sand.
- ❒ Backfill remainder of borehole with holeplug or with auger cuttings (if contamination is not suspected).
- ❒ Install flushmount casing. Seal space between flushmount and borehole annulus with concrete, cold patch, or holeplug to match surrounding ground surface.

3.3 Monitoring Well Sampling Procedure

Equipment

- ❒ Water level metre or interface probe on hydrocarbon/LNAPL sites
- ❒ Spray bottles containing water and methanol to clean water level tape or interface probe
- ❒ Peristaltic pump
- ❒ Polyethylene tubing for peristaltic pump
- ❒ Flexible tubing for peristaltic pump
- ❒ Latex or nitrile gloves (depending on suspected contaminant)
- ❒ Allen keys and/or 9/16" socket wrench to remove well caps
- ❒ Graduated bucket with volume measurements
- ❒ pH/Temperature/Conductivity combo pen
- ❒ Laboratory-supplied sample bottles

Sampling Procedure

- ❒ Locate well and use socket wrench or Allan key to open metal flush mount protector cap. Remove plastic well cap.
- ❒ Measure water level, with respect to existing ground surface, using water level meter or interface probe. If using interface probe on suspected NAPL site, measure the thickness of free product.
- ❒ Measure total depth of well.
- ❒ Clean water level tape or interface probe using methanol and water. Change gloves between wells.
- ❒ Calculate volume of standing water within well and record.
- ❒ Insert polyethylene tubing into well and attach to peristaltic pump. Turn on peristaltic pump and purge into graduated bucket. Purge at least three well volumes of water from the well. Measure and record field chemistry. Continue to purge, measuring field chemistry after every well volume purged, until appearance or field chemistry stabilizes.
- ❒ Note appearance of purge water, including colour, opacity (clear, cloudy, silty), sheen, presence of LNAPL, and odour. Note any other unusual features (particulate matter, effervescence (bubbling) of dissolved gas, etc.).
- ❒ Fill required sample bottles. If sampling for metals, attach 75-micron filter to discharge tube and filter metals sample. If sampling for VOCs, use low flow rate to ensure continuous stream of non-turbulent flow into sample bottles. Ensure no headspace is present in VOC vials.
- ❒ Replace well cap and flushmount casing cap.

4.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

The QA/QC program for this Phase II ESA is as follows:

- ❒ All non-dedicated sampling equipment (split spoons) will be decontaminated according to the SOPs listed above.
- ❒ All groundwater sampling equipment is dedicated (polyethylene and flexible peristaltic tubing is replaced for each well).
- ❒ Where groundwater samples are to be analyzed for VOCs, one laboratory-provided trip blank will be submitted for analysis with every laboratory submission.
- ❒ Approximately one (1) field duplicate will be submitted for every ten (10) samples submitted for laboratory analysis. A minimum of one (1) field duplicate per project will be submitted. Field duplicates will be submitted for soil and groundwater samples
- ❒ Where combo pens are used to measure field chemistry, they will be calibrated on an approximately monthly basis, according to frequency of use.

5.0 DATA QUALITY OBJECTIVES

The purpose of setting data quality objectives (DQOs) is to ensure that the level of uncertainty in data collected during the Phase II ESA is low enough that decision-making is not affected, and that the overall objectives of the investigation are met.

The quality of data is assessed by comparing field duplicates with original samples. If the relative percent difference (RPD) between the duplicate and the sample is within 20%, the data are considered to be of sufficient quality so as not to affect decision-making. The RPD is calculated as follows:

$$RPD = \left| \frac{x_1 - x_2}{(x_1 + x_2)/2} \right| \times 100\%$$

Where x_1 is the concentration of a given parameter in an original sample and x_2 is the concentration of that same parameter in the field duplicate sample.

For the purpose of calculating the RPD, it is desirable to select field duplicates from samples for which parameters are present in concentrations above laboratory detection limits, i.e. samples which are expected to be contaminated. If parameters are below laboratory detection limits for selected samples or duplicates, the RPD may be calculated using a concentration equal to one half (0.5 x) the laboratory detection limit.

It is also important to consider data quality in the overall context of the project. For example, if the DQOs are not met for a given sample, yet the concentrations of contaminants in both the sample and the duplicate exceed the MECP site remediation standards by a large margin, the decision-making usefulness of the sample may not be considered to be impaired. The proximity of other samples which meet the DQOs must also be considered in developing the Phase II Conceptual Site Model; often there are enough data available to produce a reliable Phase II Conceptual Site Model even if DQOs are not met for certain individual samples.

These considerations are discussed in the body of the report.

6.0 PHYSICAL IMPEDIMENTS TO SAMPLING & ANALYSIS PLAN

Physical impediments to the Sampling and Analysis plan may include:

- ❒ The location of underground utilities
- ❒ Poor recovery of split-spoon soil samples
- ❒ Insufficient groundwater volume for groundwater samples
- ❒ Breakage of sampling containers following sampling or while in transit to the laboratory
- ❒ Elevated detection limits due to matrix interference (generally related to soil colour or presence of organic material)
- ❒ Elevated detection limits due to high concentrations of certain parameters, necessitating dilution of samples in laboratory
- ❒ Drill rig breakdowns
- ❒ Winter conditions
- ❒ Other site-specific impediments

Site-specific impediments to the Sampling and Analysis plan are discussed in the body of the Phase II ESA report.

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
5123 Hawthorne Road
Ottawa, Ontario

DATUM Ground surface elevations provided by R.W. Tomlinson Limited.

FILE NO. PE5033

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** December 9, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.73
FILL: Grey crushed stone		AU	1				
		SS	2			1	90.73
1.50							
TOPSOIL		SS	3				
1.80						2	89.73
Brown **SANDY SILT**							
2.54							
		RC	1			3	88.73
BEDROCK: Dolostone, some quartz crystals							
		RC	2			4	87.73
4.80							
End of Borehole							
(GWL @ 1.32m - Dec. 16, 2019)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
5123 Hawthorne Road
Ottawa, Ontario

DATUM Ground surface elevations provided by R.W. Tomlinson Limited.

FILE NO. PE5033

REMARKS

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger **DATE** December 9, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.32
FILL: Brown sandy silt, trace gravel and organics		AU	1				
0.60							
FILL: Grey-brown silty sand, some gravel, piece of asphalt		SS	2	100	24	1	89.32
1.50							
		SS	3	67	17	2	88.32
Loose to compact, brown **SILT,** occasional sand and gravel		SS	4	71	7		
		SS	5	67	2	3	87.32
		SS	6	79	21	4	86.32
4.42							
End of Borehole							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
5123 Hawthorne Road
Ottawa, Ontario

DATUM Ground surface elevations provided by R.W. Tomlinson Limited.

FILE NO. PE5033

REMARKS

HOLE NO. BH 3

BORINGS BY CME 55 Power Auger **DATE** December 9, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.37
FILL: Brown sandy silt, trace organics and plastic		AU	1				
0.60							
FILL: Grey-brown silty sand, some gravel, pieces of asphalt		SS	2	33	13	1	88.37
1.68		SS	3	54	5		
SHALEY FILL		SS	4	67	50	2	87.37
		SS	5	54	6	3	86.37
3.66							
Loose to compact, brown **SILT,** occasional sand and gravel		SS	6	33	5	4	85.37
		SS	7	100	50+		
4.72							
End of Borehole							
(GWL @ 1.10m - Dec. 16, 2019)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
5123 Hawthorne Road
Ottawa, Ontario

DATUM Ground surface elevations provided by R.W. Tomlinson Limited.

FILE NO. PE5033

REMARKS

HOLE NO. BH 4

BORINGS BY CME 55 Power Auger **DATE** December 9, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.43
FILL: Grey crushed stone		AU	1				
0.61							
BEDROCK: Dolostone, some quartz crystals		RC	1			1	88.43
1.73							
		RC	2			2	87.43
BEDROCK: Sandstone						3	86.43
		RC	3			4	85.43
4.72							
End of Borehole							
(GWL @ 1.26m - Dec. 16, 2019)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the relative strength of cohesionless soils is the compactness condition, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm. An SPT N value of "P" denotes that the split-spoon sampler was pushed 300 mm into the soil without the use of a falling hammer.

Compactness Condition	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

Consistency	Undrained Shear Strength (kPa)	'N' Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their "sensitivity". The sensitivity, S_t, is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil. The classes of sensitivity may be defined as follows:

Low Sensitivity:	$S_t < 2$
Medium Sensitivity:	$2 < S_t < 4$
Sensitive:	$4 < S_t < 8$
Extra Sensitive:	$8 < S_t < 16$
Quick Clay:	$S_t > 16$

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NQ or larger size core. However, it can be used on smaller core sizes, such as BQ, if the bulk of the fractures caused by drilling stresses (called "mechanical breaks") are easily distinguishable from the normal in situ fractures.

RQD %	**ROCK QUALITY**
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube, generally recovered using a piston sampler
G	-	"Grab" sample from test pit or surface materials
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size BQ, NQ, HQ, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

WC%	-	Natural water content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic Limit, % (water content above which soil behaves plastically)
PI	-	Plasticity Index, % (difference between LL and PL)
Dxx	-	Grain size at which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu	-	Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay
(more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

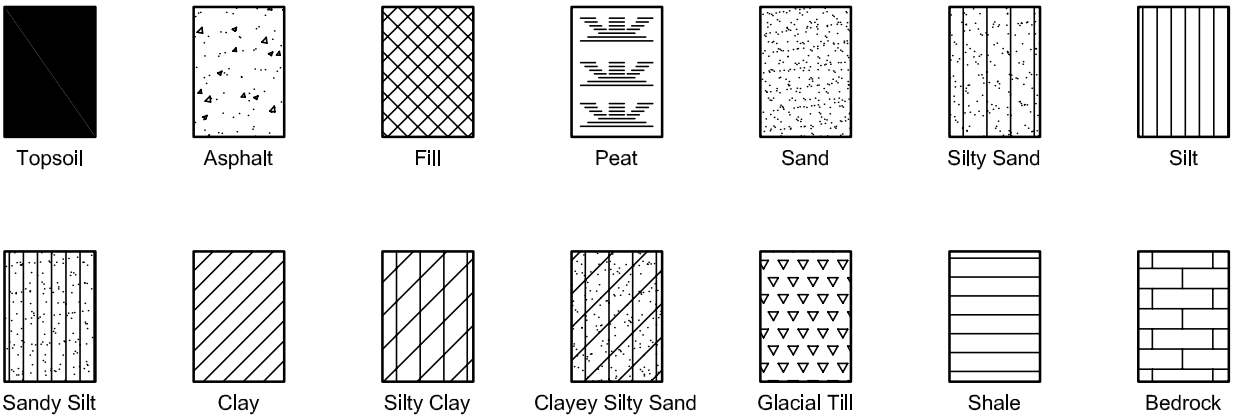
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
Wo	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

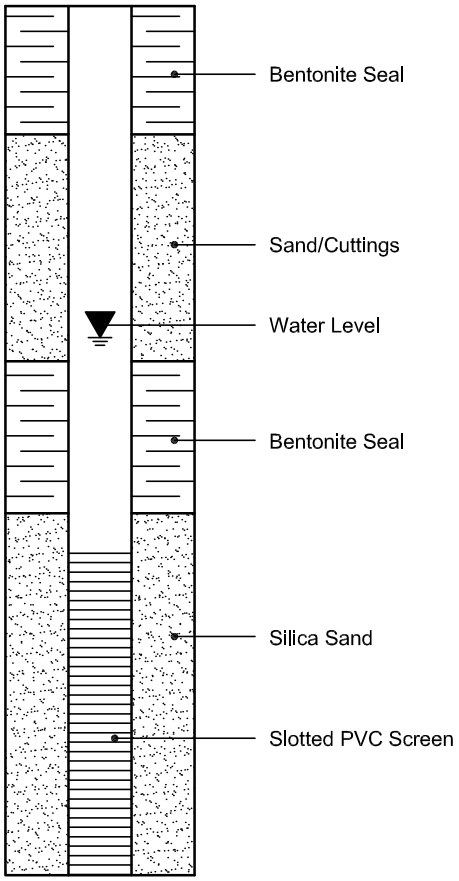
SYMBOLS AND TERMS (continued)

STRATA PLOT

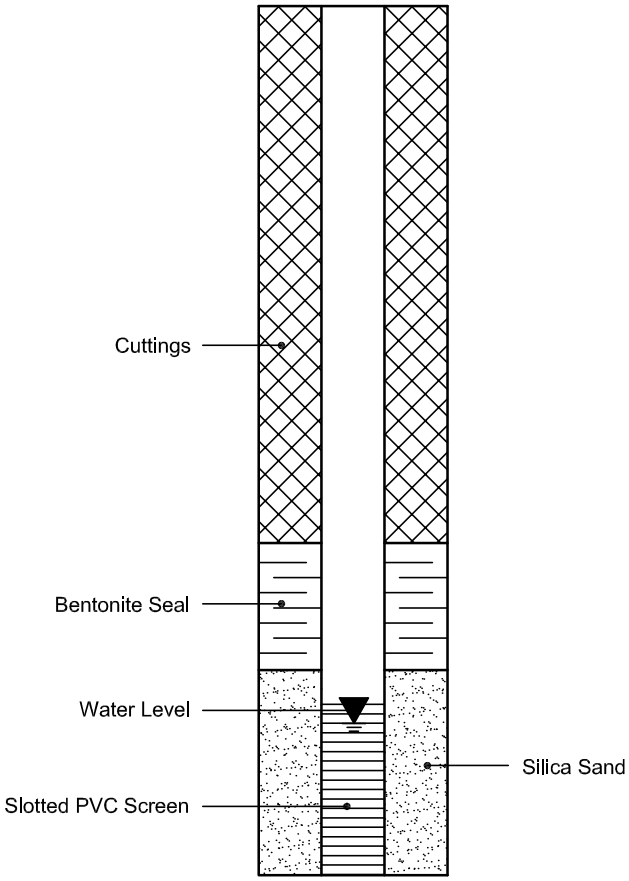


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Mark D'Arcy

Client PO: 29291
Project: PE4827
Custody: 51768

Report Date: 19-Dec-2019
Order Date: 13-Dec-2019

Order #: 1950642

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1950642-01	BH2-AU1
1950642-02	BH2-SS2
1950642-03	BH3-AU1
1950642-04	BH3-SS3
1950642-05	BH4-AU1

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 29291

Report Date: 19-Dec-2019
Order Date: 13-Dec-2019
Project Description: PE4827

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Conductivity	MOE E3138 - probe @25 °C, water ext	19-Dec-19	19-Dec-19
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	16-Dec-19	17-Dec-19
PHC F4G (gravimetric)	CWS Tier 1 - Extraction Gravimetric	19-Dec-19	19-Dec-19
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	16-Dec-19	18-Dec-19
REG 153: Metals by ICP/MS, soil	EPA 6020 - Digestion - ICP-MS	17-Dec-19	17-Dec-19
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	13-Dec-19	18-Dec-19
SAR	Calculated	18-Dec-19	19-Dec-19
Solids, %	Gravimetric, calculation	16-Dec-19	16-Dec-19

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 29291

Report Date: 19-Dec-2019

Order Date: 13-Dec-2019

Project Description: PE4827

	Client ID:	BH2-AU1	BH2-SS2	BH3-AU1	BH3-SS3
	Sample Date:	09-Dec-19 09:00	09-Dec-19 09:00	09-Dec-19 09:00	09-Dec-19 09:00
	Sample ID:	1950642-01	1950642-02	1950642-03	1950642-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	93.1	88.4	83.6	88.9
General Inorganics					
SAR	0.01 N/A	0.82	-	-	-
Conductivity	5 uS/cm	1260	-	-	-
Metals					
Antimony	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Arsenic	1.0 ug/g dry	5.1	10.6	5.2	5.5
Barium	1.0 ug/g dry	142	104	114	126
Beryllium	0.5 ug/g dry	<0.5	<0.5	0.6	0.7
Boron	5.0 ug/g dry	10.7	9.0	7.6	11.9
Cadmium	0.5 ug/g dry	<0.5	<0.5	<0.5	<0.5
Chromium	5.0 ug/g dry	26.6	17.3	33.7	24.5
Cobalt	1.0 ug/g dry	7.8	11.8	9.5	10.3
Copper	5.0 ug/g dry	15.9	14.3	20.6	23.1
Lead	1.0 ug/g dry	21.6	21.7	11.7	12.9
Molybdenum	1.0 ug/g dry	5.4	21.8	1.5	1.9
Nickel	5.0 ug/g dry	16.2	24.2	23.5	23.7
Selenium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Silver	0.3 ug/g dry	<0.3	<0.3	<0.3	<0.3
Thallium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Uranium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Vanadium	10.0 ug/g dry	28.8	32.3	39.2	30.7
Zinc	20.0 ug/g dry	32.1	31.4	48.8	42.8
Hydrocarbons					
F2 PHCs (C10-C16)	4 ug/g dry	<4	<40	<4	9
F3 PHCs (C16-C34)	8 ug/g dry	52	280	26	64
F4 PHCs (C34-C50)	6 ug/g dry	58	619 [1]	15	58
F4G PHCs (gravimetric)	50 ug/g dry	-	2090	-	-
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Acenaphthylene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Anthracene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Benzo [a] anthracene	0.02 ug/g dry	0.03	0.05	<0.02	0.06
Benzo [a] pyrene	0.02 ug/g dry	0.02	0.05	<0.02	0.05
Benzo [b] fluoranthene	0.02 ug/g dry	0.05	0.08	<0.02	0.12

Certificate of Analysis

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Report Date: 19-Dec-2019

Order Date: 13-Dec-2019

Project Description: PE4827

	Client ID:	BH2-AU1	BH2-SS2	BH3-AU1	BH3-SS3
	Sample Date:	09-Dec-19 09:00	09-Dec-19 09:00	09-Dec-19 09:00	09-Dec-19 09:00
	Sample ID:	1950642-01	1950642-02	1950642-03	1950642-04
	MDL/Units	Soil	Soil	Soil	Soil
Benzo [g,h,i] perylene	0.02 ug/g dry	0.02	0.04	<0.02	0.04
Benzo [k] fluoranthene	0.02 ug/g dry	0.02	0.04	<0.02	0.05
Chrysene	0.02 ug/g dry	0.03	0.05	<0.02	0.07
Dibenzo [a,h] anthracene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Fluoranthene	0.02 ug/g dry	0.05	0.11	<0.02	0.15
Fluorene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	<0.02	0.03	<0.02	0.03
1-Methylnaphthalene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Methylnaphthalene (1&2)	0.04 ug/g dry	<0.04	<0.04	<0.04	<0.04
Naphthalene	0.01 ug/g dry	<0.01	<0.01	<0.01	<0.01
Phenanthrene	0.02 ug/g dry	0.03	0.05	<0.02	0.12
Pyrene	0.02 ug/g dry	0.04	0.08	<0.02	0.11
2-Fluorobiphenyl	Surrogate	99.7%	78.9%	99.2%	102%
Terphenyl-d14	Surrogate	115%	86.1%	112%	124%

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 29291

Report Date: 19-Dec-2019

Order Date: 13-Dec-2019

Project Description: PE4827

	Client ID:	BH4-AU1	-	-	-
	Sample Date:	09-Dec-19 09:00	-	-	-
	Sample ID:	1950642-05	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	85.7	-	-	-
General Inorganics					
SAR	0.01 N/A	0.03	-	-	-
Conductivity	5 uS/cm	628	-	-	-
pH	0.05 pH Units	7.67	-	-	-
Metals					
Antimony	1.0 ug/g dry	<1.0	-	-	-
Arsenic	1.0 ug/g dry	7.8	-	-	-
Barium	1.0 ug/g dry	62.0	-	-	-
Beryllium	0.5 ug/g dry	<0.5	-	-	-
Boron	5.0 ug/g dry	<5.0	-	-	-
Cadmium	0.5 ug/g dry	<0.5	-	-	-
Chromium	5.0 ug/g dry	9.0	-	-	-
Cobalt	1.0 ug/g dry	6.8	-	-	-
Copper	5.0 ug/g dry	5.4	-	-	-
Lead	1.0 ug/g dry	10.2	-	-	-
Molybdenum	1.0 ug/g dry	4.1	-	-	-
Nickel	5.0 ug/g dry	11.1	-	-	-
Selenium	1.0 ug/g dry	<1.0	-	-	-
Silver	0.3 ug/g dry	<0.3	-	-	-
Thallium	1.0 ug/g dry	<1.0	-	-	-
Uranium	1.0 ug/g dry	<1.0	-	-	-
Vanadium	10.0 ug/g dry	<10.0	-	-	-
Zinc	20.0 ug/g dry	<20.0	-	-	-
Hydrocarbons					
F2 PHCs (C10-C16)	4 ug/g dry	<4	-	-	-
F3 PHCs (C16-C34)	8 ug/g dry	<8	-	-	-
F4 PHCs (C34-C50)	6 ug/g dry	<6	-	-	-
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	<0.02	-	-	-
Acenaphthylene	0.02 ug/g dry	<0.02	-	-	-
Anthracene	0.02 ug/g dry	<0.02	-	-	-
Benzo [a] anthracene	0.02 ug/g dry	<0.02	-	-	-
Benzo [a] pyrene	0.02 ug/g dry	<0.02	-	-	-
Benzo [b] fluoranthene	0.02 ug/g dry	<0.02	-	-	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 29291

Report Date: 19-Dec-2019

Order Date: 13-Dec-2019

Project Description: PE4827

	Client ID:	BH4-AU1	-	-	-
	Sample Date:	09-Dec-19 09:00	-	-	-
	Sample ID:	1950642-05	-	-	-
	MDL/Units	Soil	-	-	-
Benzo [g,h,i] perylene	0.02 ug/g dry	<0.02	-	-	-
Benzo [k] fluoranthene	0.02 ug/g dry	<0.02	-	-	-
Chrysene	0.02 ug/g dry	<0.02	-	-	-
Dibenzo [a,h] anthracene	0.02 ug/g dry	<0.02	-	-	-
Fluoranthene	0.02 ug/g dry	<0.02	-	-	-
Fluorene	0.02 ug/g dry	<0.02	-	-	-
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	<0.02	-	-	-
1-Methylnaphthalene	0.02 ug/g dry	<0.02	-	-	-
2-Methylnaphthalene	0.02 ug/g dry	<0.02	-	-	-
Methylnaphthalene (1&2)	0.04 ug/g dry	<0.04	-	-	-
Naphthalene	0.01 ug/g dry	<0.01	-	-	-
Phenanthrene	0.02 ug/g dry	<0.02	-	-	-
Pyrene	0.02 ug/g dry	<0.02	-	-	-
2-Fluorobiphenyl	Surrogate	99.5%	-	-	-
Terphenyl-d14	Surrogate	88.3%	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
Conductivity	ND	5	uS/cm						
Hydrocarbons									
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
F4G PHCs (gravimetric)	ND	50	ug/g						
Metals									
Antimony	ND	1.0	ug/g						
Arsenic	ND	1.0	ug/g						
Barium	ND	1.0	ug/g						
Beryllium	ND	0.5	ug/g						
Boron	ND	5.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium	ND	5.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	5.0	ug/g						
Lead	ND	1.0	ug/g						
Molybdenum	ND	1.0	ug/g						
Nickel	ND	5.0	ug/g						
Selenium	ND	1.0	ug/g						
Silver	ND	0.3	ug/g						
Thallium	ND	1.0	ug/g						
Uranium	ND	1.0	ug/g						
Vanadium	ND	10.0	ug/g						
Zinc	ND	20.0	ug/g						
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g						
Acenaphthylene	ND	0.02	ug/g						
Anthracene	ND	0.02	ug/g						
Benzo [a] anthracene	ND	0.02	ug/g						
Benzo [a] pyrene	ND	0.02	ug/g						
Benzo [b] fluoranthene	ND	0.02	ug/g						
Benzo [g,h,i] perylene	ND	0.02	ug/g						
Benzo [k] fluoranthene	ND	0.02	ug/g						
Chrysene	ND	0.02	ug/g						
Dibenzo [a,h] anthracene	ND	0.02	ug/g						
Fluoranthene	ND	0.02	ug/g						
Fluorene	ND	0.02	ug/g						
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g						
1-Methylnaphthalene	ND	0.02	ug/g						
2-Methylnaphthalene	ND	0.02	ug/g						
Methylnaphthalene (1&2)	ND	0.04	ug/g						
Naphthalene	ND	0.01	ug/g						
Phenanthrene	ND	0.02	ug/g						
Pyrene	ND	0.02	ug/g						
Surrogate: 2-Fluorobiphenyl	*1.61*		*ug/g*		*121*	*50-140*			
Surrogate: Terphenyl-d14	*1.63*		*ug/g*		*122*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
SAR	0.53	0.01	N/A	0.44			18.6	200	
Conductivity	966	5	uS/cm	974			0.8	5	
pH	10.83	0.05	pH Units	10.84			0.1	2.3	
Hydrocarbons									
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND				30	
F3 PHCs (C16-C34)	216	8	ug/g dry	152			34.7	30	QR-04
F4 PHCs (C34-C50)	117	6	ug/g dry	89			27.0	30	
Physical Characteristics									
% Solids	84.4	0.1	% by Wt.	84.1			0.4	25	
Semi-Volatiles									
Acenaphthene	0.442	0.02	ug/g dry	0.287			42.6	40	QR-04
Acenaphthylene	0.554	0.02	ug/g dry	0.353			44.5	40	QR-04
Anthracene	ND	0.02	ug/g dry	ND				40	
Benzo [a] anthracene	ND	0.02	ug/g dry	ND				40	
Benzo [a] pyrene	ND	0.02	ug/g dry	ND				40	
Benzo [b] fluoranthene	ND	0.02	ug/g dry	ND				40	
Benzo [g,h,i] perylene	ND	0.02	ug/g dry	ND				40	
Benzo [k] fluoranthene	ND	0.02	ug/g dry	ND				40	
Chrysene	ND	0.02	ug/g dry	ND				40	
Dibenzo [a,h] anthracene	ND	0.02	ug/g dry	ND				40	
Fluoranthene	0.041	0.02	ug/g dry	0.034			17.1	40	
Fluorene	1.21	0.02	ug/g dry	1.01			17.6	40	
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g dry	ND				40	
1-Methylnaphthalene	17.3	0.02	ug/g dry	14.6			17.1	40	
2-Methylnaphthalene	27.2	0.02	ug/g dry	21.2			24.9	40	
Naphthalene	7.77	0.01	ug/g dry	6.07			24.6	40	
Phenanthrene	2.66	0.02	ug/g dry	2.18			19.8	40	
Pyrene	0.118	0.02	ug/g dry	0.099			17.0	40	
Surrogate: 2-Fluorobiphenyl	*1.38*		*ug/g dry*		*87.6*	*50-140*			
Surrogate: Terphenyl-d14	*1.63*		*ug/g dry*		*104*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F2 PHCs (C10-C16)	102	4	ug/g	ND	114	60-140			
F3 PHCs (C16-C34)	381	8	ug/g	152	105	60-140			
F4 PHCs (C34-C50)	247	6	ug/g	89	114	60-140			
F4G PHCs (gravimetric)	910	50	ug/g		91.0	80-120			
Metals									
Antimony	45.8		ug/L	ND	91.3	70-130			
Arsenic	56.6		ug/L	1.3	111	70-130			
Barium	52.3		ug/L		105	70-130			
Beryllium	62.1		ug/L	ND	124	70-130			
Boron	55.5		ug/L	ND	105	70-130			
Cadmium	52.4		ug/L	ND	105	70-130			
Chromium	62.2		ug/L	18.6	87.2	70-130			
Cobalt	50.8		ug/L	4.0	93.7	70-130			
Copper	59.7		ug/L	8.6	102	70-130			
Lead	47.1		ug/L	7.6	78.9	70-130			
Molybdenum	56.7		ug/L	ND	113	70-130			
Nickel	59.1		ug/L	9.1	100	70-130			
Selenium	57.6		ug/L	ND	115	70-130			
Silver	48.4		ug/L	ND	96.6	70-130			
Thallium	46.8		ug/L	ND	93.3	70-130			
Uranium	48.5		ug/L	ND	96.1	70-130			
Vanadium	61.3		ug/L	21.6	79.4	70-130			
Zinc	55.5		ug/L	32.0	46.9	70-130			QM-07
Semi-Volatiles									
Acenaphthene	0.520	0.02	ug/g	0.287	119	50-140			
Acenaphthylene	0.569	0.02	ug/g	0.353	110	50-140			
Anthracene	0.213	0.02	ug/g	ND	108	50-140			
Benzo [a] anthracene	0.125	0.02	ug/g	ND	63.5	50-140			
Benzo [a] pyrene	0.101	0.02	ug/g	ND	51.2	50-140			
Benzo [b] fluoranthene	0.168	0.02	ug/g	ND	85.7	50-140			
Benzo [g,h,i] perylene	0.118	0.02	ug/g	ND	60.0	50-140			
Benzo [k] fluoranthene	0.149	0.02	ug/g	ND	76.0	50-140			
Chrysene	0.171	0.02	ug/g	ND	86.8	50-140			
Dibenzo [a,h] anthracene	0.105	0.02	ug/g	ND	53.6	50-140			
Fluoranthene	0.175	0.02	ug/g	0.034	71.4	50-140			
Fluorene	1.27	0.02	ug/g	1.01	129	50-140			
Indeno [1,2,3-cd] pyrene	0.095	0.02	ug/g	ND	48.6	50-140			QM-06
1-Methylnaphthalene	0.164	0.02	ug/g		98.4	50-140			
2-Methylnaphthalene	0.155	0.02	ug/g		92.7	50-140			
Naphthalene	0.140	0.01	ug/g		84.0	50-140			
Phenanthrene	0.143	0.02	ug/g		86.0	50-140			
Pyrene	0.227	0.02	ug/g	0.099	65.3	50-140			
Surrogate: 2-Fluorobiphenyl	*1.50*		*ug/g*		*95.2*	*50-140*			

Qualifier Notes:

Sample Qualifiers :

1 : GC-FID signal did not return to baseline by C50

QC Qualifiers :

QM-06 : Due to noted non-homogeneity of the QC sample matrix, the spike recoveries were out side the accepted range. Batch data accepted based on other QC.

QM-07 : The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on other acceptable QC.

QR-04 : Duplicate results exceeds RPD limits due to non-homogeneous matrix.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

Soil results are reported on a dry weight basis when the units are denoted with 'dry'.
Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.
- When reported, data for F4G has been processed using a silica gel cleanup.

PARACEL LABORATORIES LTD

Paracel ID: 1950642

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
1950642	№ 51768

Client Name: Paterson	Project Ref: 4827	Page 1 of 1
Contact Name: Mark D'Arcy	Quote #:	Turnaround Time
Address: 154 Colonnade Rd	PO #: 29291	☐ 1 day ☐ 3 day ☐ 2 day ☑ Regular
Telephone: 613 226 7381	E-mail: MDarcy@Patersongroup.ca	Date Required:

Regulation 153/04	Other Regulation
☐ Table 1 ☐ Res/Park ☐ Med/Fine	☐ REG 558 ☐ PWQO
☐ Table 2 ☐ Ind/Comm ☐ Coarse	☐ CCME ☐ MISA
☐ Table 3 ☐ Agri/Other	☐ SU - Sani ☐ SU - Storm
☐ Table	Mun:
For RSC: ☐ Yes ☐ No	☐ Other:

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	Required Analysis: ICP Metals	PHC (F2-F4)	PAH	pH								
1	BH2-AU1	S		2	9 Dec	—	✓	✓	✓								2x 120 mL	✓
2	BH2-SS2	S		2	↓	—	✓	✓	✓								↓	✓
3	BH3-AU1	S		2	↓	—	✓	✓	✓									✓
4	BH3-SS3	S		2	↓	—	✓	✓	✓									✓
5	BH4-AU1	S		2	↓	—	✓	✓	✓	✓							↓	✓
6																		
7																		
8																		
9																		
10																		

Comments:

Method of Delivery: PU

Relinquished By (Sign):	Received By Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): PHILIP PRICE	Date/Time:	Date/Time: Dec. 13/19 @ 10	Date/Time: Dec 13/19 4:49p
Date/Time: 12 Dec 2019 3pm	Temperature: °C	Temperature: 17.3 °C	pH Verified: ☐ By: N/A

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Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Mark D'Arcy

Client PO: 29295
Project: PE4827
Custody: 51174

Report Date: 23-Dec-2019
Order Date: 17-Dec-2019

Order #: 1951222

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1951222-01	BH1-GW1
1951222-02	BH4-GW1

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 29295

Report Date: 23-Dec-2019
Order Date: 17-Dec-2019
Project Description: PE4827

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC	18-Dec-19	18-Dec-19
Metals, ICP-MS	EPA 200.8 - ICP-MS	19-Dec-19	19-Dec-19
PHC F1	CWS Tier 1 - P&T GC-FID	20-Dec-19	20-Dec-19
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	19-Dec-19	20-Dec-19
REG 153: PAHs by GC-MS	EPA 625 - GC-MS, extraction	19-Dec-19	20-Dec-19
REG 153: VOCs by P&T GC/MS	EPA 624 - P&T GC-MS	20-Dec-19	20-Dec-19

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 29295

Report Date: 23-Dec-2019

Order Date: 17-Dec-2019

Project Description: PE4827

	Client ID:	BH1-GW1	BH4-GW1	-	-
	Sample Date:	16-Dec-19 10:10	16-Dec-19 11:50	-	-
	Sample ID:	1951222-01	1951222-02	-	-
	MDL/Units	Water	Water	-	-
Anions					
Chloride	1 mg/L	130	53	-	-
Metals					
Sodium	200 ug/L	69700	31400	-	-
Volatiles					
Acetone	5.0 ug/L	<5.0	<5.0	-	-
Benzene	0.5 ug/L	<0.5	<0.5	-	-
Bromodichloromethane	0.5 ug/L	<0.5	<0.5	-	-
Bromoform	0.5 ug/L	<0.5	<0.5	-	-
Bromomethane	0.5 ug/L	<0.5	<0.5	-	-
Carbon Tetrachloride	0.2 ug/L	<0.2	<0.2	-	-
Chlorobenzene	0.5 ug/L	<0.5	<0.5	-	-
Chloroform	0.5 ug/L	2.4	8.0	-	-
Dibromochloromethane	0.5 ug/L	<0.5	<0.5	-	-
Dichlorodifluoromethane	1.0 ug/L	<1.0	<1.0	-	-
1,2-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	-	-
1,3-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	-	-
1,4-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	-	-
1,1-Dichloroethane	0.5 ug/L	<0.5	<0.5	-	-
1,2-Dichloroethane	0.5 ug/L	<0.5	<0.5	-	-
1,1-Dichloroethylene	0.5 ug/L	<0.5	<0.5	-	-
cis-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	-	-
trans-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	-	-
1,2-Dichloropropane	0.5 ug/L	<0.5	<0.5	-	-
cis-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	-	-
trans-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	-	-
1,3-Dichloropropene, total	0.5 ug/L	<0.5	<0.5	-	-
Ethylbenzene	0.5 ug/L	<0.5	<0.5	-	-
Ethylene dibromide (dibromoethan	0.2 ug/L	<0.2	<0.2	-	-
Hexane	1.0 ug/L	<1.0	<1.0	-	-
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	<5.0	<5.0	-	-
Methyl Isobutyl Ketone	5.0 ug/L	<5.0	<5.0	-	-
Methyl tert-butyl ether	2.0 ug/L	<2.0	<2.0	-	-
Methylene Chloride	5.0 ug/L	<5.0	<5.0	-	-
Styrene	0.5 ug/L	<0.5	<0.5	-	-
1,1,1,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	-	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

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Project Description: PE4827

	Client ID:	BH1-GW1	BH4-GW1	-	-
	Sample Date:	16-Dec-19 10:10	16-Dec-19 11:50	-	-
	Sample ID:	1951222-01	1951222-02	-	-
	MDL/Units	Water	Water	-	-
1,1,2,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	-	-
Tetrachloroethylene	0.5 ug/L	<0.5	<0.5	-	-
Toluene	0.5 ug/L	<0.5	<0.5	-	-
1,1,1-Trichloroethane	0.5 ug/L	<0.5	<0.5	-	-
1,1,2-Trichloroethane	0.5 ug/L	<0.5	<0.5	-	-
Trichloroethylene	0.5 ug/L	<0.5	<0.5	-	-
Trichlorofluoromethane	1.0 ug/L	<1.0	<1.0	-	-
Vinyl chloride	0.5 ug/L	<0.5	<0.5	-	-
m,p-Xylenes	0.5 ug/L	<0.5	<0.5	-	-
o-Xylene	0.5 ug/L	<0.5	<0.5	-	-
Xylenes, total	0.5 ug/L	<0.5	<0.5	-	-
4-Bromofluorobenzene	Surrogate	110%	110%	-	-
Dibromofluoromethane	Surrogate	96.1%	100%	-	-
Toluene-d8	Surrogate	87.8%	88.2%	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	<25	-	-
F2 PHCs (C10-C16)	100 ug/L	<100	<100	-	-
F3 PHCs (C16-C34)	100 ug/L	<100	<100	-	-
F4 PHCs (C34-C50)	100 ug/L	<100	<100	-	-
Semi-Volatiles					
Acenaphthene	0.05 ug/L	<0.05	<0.05	-	-
Acenaphthylene	0.05 ug/L	<0.05	<0.05	-	-
Anthracene	0.01 ug/L	<0.01	<0.01	-	-
Benzo [a] anthracene	0.01 ug/L	<0.01	<0.01	-	-
Benzo [a] pyrene	0.01 ug/L	<0.01	<0.01	-	-
Benzo [b] fluoranthene	0.05 ug/L	<0.05	<0.05	-	-
Benzo [g,h,i] perylene	0.05 ug/L	<0.05	<0.05	-	-
Benzo [k] fluoranthene	0.05 ug/L	<0.05	<0.05	-	-
Chrysene	0.05 ug/L	<0.05	<0.05	-	-
Dibenzo [a,h] anthracene	0.05 ug/L	<0.05	<0.05	-	-
Fluoranthene	0.01 ug/L	<0.01	<0.01	-	-
Fluorene	0.05 ug/L	<0.05	<0.05	-	-
Indeno [1,2,3-cd] pyrene	0.05 ug/L	<0.05	<0.05	-	-
1-Methylnaphthalene	0.05 ug/L	<0.05	<0.05	-	-
2-Methylnaphthalene	0.05 ug/L	<0.05	<0.05	-	-
Methylnaphthalene (1&2)	0.10 ug/L	<0.10	<0.10	-	-

Certificate of Analysis

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Client PO: 29295

Report Date: 23-Dec-2019

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Project Description: PE4827

	Client ID:	BH1-GW1	BH4-GW1	-	-
	Sample Date:	16-Dec-19 10:10	16-Dec-19 11:50	-	-
	Sample ID:	1951222-01	1951222-02	-	-
	MDL/Units	Water	Water	-	-
Naphthalene	0.05 ug/L	<0.05	<0.05	-	-
Phenanthrene	0.05 ug/L	<0.05	<0.05	-	-
Pyrene	0.01 ug/L	<0.01	<0.01	-	-
2-Fluorobiphenyl	Surrogate	105%	92.3%	-	-
Terphenyl-d14	Surrogate	117%	96.5%	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L						
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
Metals									
Sodium	ND	200	ug/L						
Semi-Volatiles									
Acenaphthene	ND	0.05	ug/L						
Acenaphthylene	ND	0.05	ug/L						
Anthracene	ND	0.01	ug/L						
Benzo [a] anthracene	ND	0.01	ug/L						
Benzo [a] pyrene	ND	0.01	ug/L						
Benzo [b] fluoranthene	ND	0.05	ug/L						
Benzo [g,h,i] perylene	ND	0.05	ug/L						
Benzo [k] fluoranthene	ND	0.05	ug/L						
Chrysene	ND	0.05	ug/L						
Dibenzo [a,h] anthracene	ND	0.05	ug/L						
Fluoranthene	ND	0.01	ug/L						
Fluorene	ND	0.05	ug/L						
Indeno [1,2,3-cd] pyrene	ND	0.05	ug/L						
1-Methylnaphthalene	ND	0.05	ug/L						
2-Methylnaphthalene	ND	0.05	ug/L						
Methylnaphthalene (1&2)	ND	0.10	ug/L						
Naphthalene	ND	0.05	ug/L						
Phenanthrene	ND	0.05	ug/L						
Pyrene	ND	0.01	ug/L						
Surrogate: 2-Fluorobiphenyl	*22.0*		*ug/L*		*110*	*50-140*			
Surrogate: Terphenyl-d14	*24.1*		*ug/L*		*120*	*50-140*			
Volatiles									
Acetone	ND	5.0	ug/L						
Benzene	ND	0.5	ug/L						
Bromodichloromethane	ND	0.5	ug/L						
Bromoform	ND	0.5	ug/L						
Bromomethane	ND	0.5	ug/L						
Carbon Tetrachloride	ND	0.2	ug/L						
Chlorobenzene	ND	0.5	ug/L						
Chloroform	ND	0.5	ug/L						
Dibromochloromethane	ND	0.5	ug/L						
Dichlorodifluoromethane	ND	1.0	ug/L						
1,2-Dichlorobenzene	ND	0.5	ug/L						
1,3-Dichlorobenzene	ND	0.5	ug/L						
1,4-Dichlorobenzene	ND	0.5	ug/L						
1,1-Dichloroethane	ND	0.5	ug/L						
1,2-Dichloroethane	ND	0.5	ug/L						
1,1-Dichloroethylene	ND	0.5	ug/L						
cis-1,2-Dichloroethylene	ND	0.5	ug/L						
trans-1,2-Dichloroethylene	ND	0.5	ug/L						
1,2-Dichloropropane	ND	0.5	ug/L						
cis-1,3-Dichloropropylene	ND	0.5	ug/L						
trans-1,3-Dichloropropylene	ND	0.5	ug/L						
1,3-Dichloropropene, total	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Ethylene dibromide (dibromoethane	ND	0.2	ug/L						
Hexane	ND	1.0	ug/L						
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L						

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 29295

Report Date: 23-Dec-2019
Order Date: 17-Dec-2019
Project Description: PE4827

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Methyl Isobutyl Ketone	ND	5.0	ug/L						
Methyl tert-butyl ether	ND	2.0	ug/L						
Methylene Chloride	ND	5.0	ug/L						
Styrene	ND	0.5	ug/L						
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L						
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L						
Tetrachloroethylene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
1,1,1-Trichloroethane	ND	0.5	ug/L						
1,1,2-Trichloroethane	ND	0.5	ug/L						
Trichloroethylene	ND	0.5	ug/L						
Trichlorofluoromethane	ND	1.0	ug/L						
Vinyl chloride	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: 4-Bromofluorobenzene	*82.9*		*ug/L*		*104*	*50-140*			
Surrogate: Dibromofluoromethane	*93.0*		*ug/L*		*116*	*50-140*			
Surrogate: Toluene-d8	*70.2*		*ug/L*		*87.7*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	2320	20	mg/L	2400			3.4	10	
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND				30	
Metals									
Sodium	29000	200	ug/L	261000			160.0	20	
Volatiles									
Acetone	ND	5.0	ug/L	ND				30	
Benzene	ND	0.5	ug/L	ND				30	
Bromodichloromethane	3.91	0.5	ug/L	3.82			2.3	30	
Bromoform	ND	0.5	ug/L	ND				30	
Bromomethane	ND	0.5	ug/L	ND				30	
Carbon Tetrachloride	ND	0.2	ug/L	ND				30	
Chlorobenzene	ND	0.5	ug/L	ND				30	
Chloroform	5.58	0.5	ug/L	5.69			2.0	30	
Dibromochloromethane	ND	0.5	ug/L	ND				30	
Dichlorodifluoromethane	ND	1.0	ug/L	ND				30	
1,2-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,3-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,4-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,1-Dichloroethane	ND	0.5	ug/L	ND				30	
1,2-Dichloroethane	ND	0.5	ug/L	ND				30	
1,1-Dichloroethylene	ND	0.5	ug/L	ND				30	
cis-1,2-Dichloroethylene	ND	0.5	ug/L	ND				30	
trans-1,2-Dichloroethylene	ND	0.5	ug/L	ND				30	
1,2-Dichloropropane	ND	0.5	ug/L	ND				30	
cis-1,3-Dichloropropylene	ND	0.5	ug/L	ND				30	
trans-1,3-Dichloropropylene	ND	0.5	ug/L	ND				30	
Ethylbenzene	ND	0.5	ug/L	ND				30	
Ethylene dibromide (dibromoethane	ND	0.2	ug/L	ND				30	
Hexane	ND	1.0	ug/L	ND				30	
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L	ND				30	
Methyl Isobutyl Ketone	ND	5.0	ug/L	ND				30	
Methyl tert-butyl ether	ND	2.0	ug/L	ND				30	
Methylene Chloride	ND	5.0	ug/L	ND				30	
Styrene	ND	0.5	ug/L	ND				30	
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L	ND				30	
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L	ND				30	
Tetrachloroethylene	ND	0.5	ug/L	ND				30	
Toluene	ND	0.5	ug/L	ND				30	
1,1,1-Trichloroethane	ND	0.5	ug/L	ND				30	
1,1,2-Trichloroethane	ND	0.5	ug/L	ND				30	
Trichloroethylene	ND	0.5	ug/L	ND				30	
Trichlorofluoromethane	ND	1.0	ug/L	ND				30	
Vinyl chloride	ND	0.5	ug/L	ND				30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: 4-Bromofluorobenzene	*87.8*		*ug/L*		*110*	*50-140*			
Surrogate: Dibromofluoromethane	*72.2*		*ug/L*		*90.2*	*50-140*			
Surrogate: Toluene-d8	*69.4*		*ug/L*		*86.8*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	10.8	1	mg/L		108	85-115			
Hydrocarbons									
F1 PHCs (C6-C10)	1940	25	ug/L		96.8	68-117			
F2 PHCs (C10-C16)	1600	100	ug/L		100	60-140			
F3 PHCs (C16-C34)	4150	100	ug/L		106	60-140			
F4 PHCs (C34-C50)	2700	100	ug/L		109	60-140			
Metals									
Sodium	10200		ug/L		102	80-120			
Semi-Volatiles									
Acenaphthene	4.59	0.05	ug/L		91.8	50-140			
Acenaphthylene	3.93	0.05	ug/L		78.6	50-140			
Anthracene	4.73	0.01	ug/L		94.6	50-140			
Benzo [a] anthracene	4.37	0.01	ug/L		87.4	50-140			
Benzo [a] pyrene	3.68	0.01	ug/L		73.6	50-140			
Benzo [b] fluoranthene	6.16	0.05	ug/L		123	50-140			
Benzo [g,h,i] perylene	4.20	0.05	ug/L		84.1	50-140			
Benzo [k] fluoranthene	5.97	0.05	ug/L		119	50-140			
Chrysene	5.43	0.05	ug/L		109	50-140			
Dibenzo [a,h] anthracene	3.68	0.05	ug/L		73.6	50-140			
Fluoranthene	4.69	0.01	ug/L		93.8	50-140			
Fluorene	4.51	0.05	ug/L		90.1	50-140			
Indeno [1,2,3-cd] pyrene	3.67	0.05	ug/L		73.3	50-140			
1-Methylnaphthalene	6.60	0.05	ug/L		132	50-140			
2-Methylnaphthalene	5.56	0.05	ug/L		111	50-140			
Naphthalene	5.12	0.05	ug/L		102	50-140			
Phenanthrene	4.49	0.05	ug/L		89.8	50-140			
Pyrene	4.75	0.01	ug/L		95.0	50-140			
Surrogate: 2-Fluorobiphenyl	*20.3*		*ug/L*		*101*	*50-140*			
Volatiles									
Acetone	85.4	5.0	ug/L		85.4	50-140			
Benzene	39.0	0.5	ug/L		97.5	60-130			
Bromodichloromethane	41.2	0.5	ug/L		103	60-130			
Bromoform	33.3	0.5	ug/L		83.3	60-130			
Bromomethane	36.9	0.5	ug/L		92.2	50-140			
Carbon Tetrachloride	34.5	0.2	ug/L		86.2	60-130			
Chlorobenzene	35.5	0.5	ug/L		88.8	60-130			
Chloroform	42.4	0.5	ug/L		106	60-130			
Dibromochloromethane	36.8	0.5	ug/L		92.0	60-130			
Dichlorodifluoromethane	26.0	1.0	ug/L		65.0	50-140			
1,2-Dichlorobenzene	33.7	0.5	ug/L		84.2	60-130			
1,3-Dichlorobenzene	34.8	0.5	ug/L		87.1	60-130			
1,4-Dichlorobenzene	32.1	0.5	ug/L		80.3	60-130			
1,1-Dichloroethane	44.4	0.5	ug/L		111	60-130			
1,2-Dichloroethane	28.5	0.5	ug/L		71.2	60-130			
1,1-Dichloroethylene	51.2	0.5	ug/L		128	60-130			
cis-1,2-Dichloroethylene	50.3	0.5	ug/L		126	60-130			
trans-1,2-Dichloroethylene	51.2	0.5	ug/L		128	60-130			
1,2-Dichloropropane	31.2	0.5	ug/L		78.1	60-130			
cis-1,3-Dichloropropylene	38.3	0.5	ug/L		95.7	60-130			
trans-1,3-Dichloropropylene	38.3	0.5	ug/L		95.7	60-130			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Ethylbenzene	32.3	0.5	ug/L		80.7	60-130			
Ethylene dibromide (dibromoethane	29.2	0.2	ug/L		73.0	60-130			
Hexane	45.2	1.0	ug/L		113	60-130			
Methyl Ethyl Ketone (2-Butanone)	80.6	5.0	ug/L		80.6	50-140			
Methyl Isobutyl Ketone	86.3	5.0	ug/L		86.3	50-140			
Methyl tert-butyl ether	105	2.0	ug/L		105	50-140			
Methylene Chloride	41.0	5.0	ug/L		103	60-130			
Styrene	35.1	0.5	ug/L		87.8	60-130			
1,1,1,2-Tetrachloroethane	37.0	0.5	ug/L		92.5	60-130			
1,1,2,2-Tetrachloroethane	28.2	0.5	ug/L		70.6	60-130			
Tetrachloroethylene	37.6	0.5	ug/L		94.0	60-130			
Toluene	32.6	0.5	ug/L		81.6	60-130			
1,1,1-Trichloroethane	48.1	0.5	ug/L		120	60-130			
1,1,2-Trichloroethane	36.4	0.5	ug/L		91.1	60-130			
Trichloroethylene	32.9	0.5	ug/L		82.2	60-130			
Trichlorofluoromethane	36.7	1.0	ug/L		91.8	60-130			
Vinyl chloride	42.8	0.5	ug/L		107	50-140			
m,p-Xylenes	67.9	0.5	ug/L		84.8	60-130			
o-Xylene	33.7	0.5	ug/L		84.3	60-130			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.
- When reported, data for F4G has been processed using a silica gel cleanup.

PARACEL LABORATORIES LTD.

Paracel ID: 1951222

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
1951222	№ 51774

Client Name: Paterson Group	Project Ref: PE4827	Page 1 of 1
Contact Name: Mark D'Arcy	Quote #:	**Turnaround Time**
Address: 154 Colonnade Road	PO #: 29295	☐ 1 day ☐ 3 day
	E-mail: mdarcy@patersongroup.ca	☐ 2 day ☒ Regular
Telephone: 613-226-7381		Date Required:

Regulation 153/04	Other Regulation
☐ Table 1 ☐ Res/Park ☐ Med/Fine	☐ REG 558 ☐ PWQO
☐ Table 2 ☐ Ind/Comm ☐ Coarse	☐ CCME ☐ MISA
☒ Table 3 ☐ Agri/Other	☐ SU - Sani ☐ SU - Storm
☐ Table ___	Mun:
For RSC: ☐ Yes ☒ No	☐ Other:

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	PAHs	VOCs	PHCs (F1 - F4)	Na+	Cl- (Inorganic)
1	[redacted] Bit1 - GW1	GW		6	Dec 16/19	10:10 AM	✓	✓	✓	✓	✓
2	[redacted] Bit4 - GW1	GW		6	Dec 16/19	11:50 AM	✓	✓	✓	✓	✓
3											
4											
5											
6											
7											
8											
9											
10											

Comments: Thiosulphate VOCs

Method of Delivery: Paracel

Relinquished By (Sign):	Received By Driver/Depot: T. Louie	Received at Lab: Blam	Verified By: Blam
Relinquished By (Print): Mike B.	Date/Time: 17/12/19 2:10	Date/Time: 12/17/19 17:25	Date/Time: 12/17/19 18:11
Date/Time: Dec 17/19.	Temperature: °C PH	Temperature: 12.0 °C	pH Verified: ☑ By: BJ