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## **Phase II Environmental Site Assessment**

2070 Scott Street  
Ottawa, Ontario

**Prepared For**

Westboro Point Developments Ltd.

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## TABLE OF CONTENTS

EXECUTIVE SUMMARY .....	iii
1.0 INTRODUCTION .....	1
1.1 Site Description .....	1
1.2 Property Ownership .....	1
1.3 Current and Proposed Future Uses .....	2
1.4 Applicable Site Condition Standard .....	2
2.0 BACKGROUND INFORMATION .....	2
2.1 Physical Setting .....	2
2.2 Past Investigations .....	3
3.0 SCOPE OF INVESTIGATION .....	4
3.1 Overview of Site Investigation .....	4
3.2 Media Investigated .....	4
3.3 Phase I Conceptual Site Model .....	5
4.0 INVESTIGATION METHOD .....	6
4.1 Subsurface Investigation .....	6
4.2 Soil Sampling .....	7
4.3 Field Screening Measurements .....	7
4.4 Groundwater Monitoring Well Installation .....	7
4.5 Field Measurement of Water Quality Parameters .....	8
4.6 Groundwater Sampling .....	8
4.7 Analytical Testing .....	9
4.8 Residue Management .....	10
4.9 Elevation Surveying .....	10
4.10 Quality Assurance and Quality Control Measures .....	11
5.0 REVIEW AND EVALUATION .....	11
5.1 Geology .....	11
5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient .....	11
5.3 Fine/Coarse Soil Texture .....	11
5.4 Field Screening .....	12
5.5 Soil Quality .....	12
5.6 Groundwater Quality .....	16
5.7 Quality Assurance and Quality Control Results .....	19
5.8 Phase II Conceptual Site Model .....	20
6.0 CONCLUSIONS .....	25
7.0 STATEMENT OF LIMITATIONS .....	27

## **List of Figures**

Figure 1 - Key Plan

Drawing PE4435-3 – Test Hole Location Plan

Drawing PE4435-4A – Analytical Testing Plan – Soil (BTEX, PHCs)

Drawing PE4435-4B – Analytical Testing Plan – Soil (PAHs)

Drawing PE4435-4C – Analytical Testing Plan – Soil (Metals)

Drawing PE4435-5A – Analytical Testing Plan – Groundwater (PHCs, PAHs, Metals)

Drawing PE4435-5B – Analytical Testing Plan – Groundwater (BTEX)

Drawing PE4435-6A – Cross-Section A-A' – Soil (BTEX, PHCs)

Drawing PE4435-6B – Cross-Section A-A' – Soil (PAH)

Drawing PE4435-6C – Cross-Section A-A' – Soil (Metals)

Drawing PE4435-7A – Cross Section A-A' – Groundwater (BTEX)

Drawing PE4435-7B – Cross Section A-A' – Groundwater (PHCs, PAHs, Metals)

## **List of Appendices**

Appendix 1    Sampling and Analysis Plan

Soil Profile and Test Data Sheets

Symbols and Terms

Laboratory Certificates of Analysis

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## **EXECUTIVE SUMMARY**

### **Assessment**

A Phase II ESA was conducted for the property addressed 2070 Scott Street, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address the potentially contaminating activities (PCAs) that were identified during the Phase I ESA and considered to result in areas of potential environmental concern (APECs) on the subject property. The subsurface investigation consisted of drilling three (3) boreholes, all of which were installed with groundwater monitoring wells.

Soil samples were obtained from the boreholes and screened using visual observations and organic vapour measurements. Four (4) soil samples were submitted for laboratory analysis of benzene, toluene, ethylbenzene and xylenes (BTEX), petroleum hydrocarbons (PHCs F<sub>1</sub>-F<sub>4</sub>), metals, and polycyclic aromatic hydrocarbons (PAHs). Several metals parameters in the vicinity of BH6-19 exceeded the selected MECP Table 7 standards. The impacted fill material was identified in the southeast portion of subject property, where the former automotive service garage was located. The extent of the impacted fill material is considered to be limited to the fill material present on the eastern portion of the property.

Groundwater samples recovered from monitoring wells installed in BH1/MW1, BH4-19, BH5-19, and BH6-19 were submitted for analysis of BTEX, PHCs (F<sub>1</sub>-F<sub>4</sub>), PAHs, and metals parameters. The concentration of benzene in the sample recovered from BH1/MW1 was marginally in excess of the selected MECP Table 7 standards. The impacted groundwater was identified in the southwest portion of the subject property only, where the tank nest associated with the former retail fuel outlet was located. The extent of the impacted groundwater is considered to be limited to a small radius within the southwest portion of the property.

### **Recommendations**

Based on the findings of the Phase II ESA, metal and PAH impacted fill material as well as benzene impacted groundwater is present on the subject property, requiring some remedial work. It is our understanding that the subject site is to be developed with a multi-floor residential building in the near future.

It is our recommendation that an environmental site remediation program be completed in conjunction with site redevelopment. This will require the segregation of clean soil from impacted soils, the latter of which will require disposal at an approved waste disposal facility.

With regard to the impacted groundwater in BH1/MW1, it is recommended that further testing of this well water be carried out to confirm the water quality and the recent test results.

Prior to offsite disposal at a licenced landfill site, a leachate analysis of a representative sample of contaminated soil must be conducted in accordance with Ontario Regulation 347/558.

It is recommended that Paterson personnel be present on-site during remediation activities to direct the excavation and segregation of impacted soil as well as to conduct confirmatory sampling as required.

## **1.0 INTRODUCTION**

At the request of Mr. John Thomas and Westboro Point Developments Ltd., Paterson Group (Paterson) conducted a Phase II Environmental Site Assessment of 2070 Scott Street, in the City of Ottawa, Ontario. The purpose of this Phase II ESA has been to address areas of potential environmental concern (APECs) identified on the Phase II Property, during the Phase I ESA conducted by Paterson in May 2019.

### **1.1 Site Description**

Address:	2070 (and formerly 2074) Scott Street, Ottawa, Ontario.
Legal Description:	Part of Lots 15, 16, and 17, Plan 37; Part 4 of Registered Plan 4R-18177, in the City of Ottawa.
Property Identification Number(s):	04020-0215
Location:	The subject site is located on the south side of Scott Street between Churchill Avenue North and Winona Avenue, in the City of Ottawa, Ontario.
Latitude and Longitude:	45° 23' 41.5" N, 75° 45' 16.5" W
Configuration:	Irregular
Site Area:	1,870 m <sup>2</sup> (approximate)
Zoning:	TM – Traditional Mainstreet Zone
Current Use:	The subject site is currently vacant.
Services:	The subject site is in a municipally serviced area.

### **1.2 Property Ownership**

The current registered property owner of 2070 Scott Street is Westboro Point Developments Ltd. Paterson was retained to complete this Phase II ESA by Mr. John Thomas of Westboro Point Developments Ltd. Westboro Point Developments Ltd.'s office is located at 929 Richmond Road, in Ottawa, Ontario. Mr. Thomas can be contacted by telephone at 613-596-4133.

### **1.3 Current and Proposed Future Uses**

The subject site is currently vacant and no buildings exist on the property. It is our understanding that the subject property will be developed with a multi-storey residential building.

### **1.4 Applicable Site Condition Standard**

The site condition standards for the property were obtained from Table 7 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 MECP selected Table 7 Standards are based on the following considerations:

- ☐ Coarse-grained soil conditions
- ☐ Shallow depth generic site conditions
- ☐ Non-potable groundwater conditions
- ☐ Residential land use

The residential standards were selected based on the future land use of the subject site. Coarse grained soil standards were chosen as a conservative approach. Grain size analysis was not completed.

## **2.0 BACKGROUND INFORMATION**

### **2.1 Physical Setting**

The subject property is situated in a residential area with commercial businesses present along Churchill Avenue North (west of the subject site). The subject property surface consists of sand and gravel with light vegetation, as well as paved asphaltic concrete on the east and west portions of the property.

The site topography slopes sharply down towards the east, while the regional topography slopes gradually down to the northeast. The subject site is at grade with respect to Churchill Avenue North (west) and Winona Avenue (east) and is below grade with respect to Scott Street (north). Water drainage on the subject site occurs primarily via infiltration in the grassed and gravel areas, as well as sheet flow towards catch basins located on the adjacent streets.

## **2.2 Past Investigations**

In 2013, Franz Environmental Inc. (Franz) completed a Phase II ESA on the subject site. A total of twelve (12) boreholes were placed on-site, with three (3) of the boreholes completed with bedrock groundwater monitoring wells. Boreholes BH1 to BH 6 were advanced via a truck-mounted drill and boreholes BH7 to BH12 were advanced via a Geoprobe with hollow stem augers. All boreholes were drilled to bedrock refusal at a maximum depth of 4.52 m below ground surface. BH1/MW1, MW2, and BH3/MW3 were cored to a maximum depth of 13.50 m below ground surface to intersect the ground water table. Groundwater was measured at depths ranging from 5.20 m to 7.18 m below ground surface.

Selected soil samples, submitted for laboratory analysis, identified concentrations of PAHs (benzo[a]pyrene) in BH11 and BH12 (northeast and southeast portions of the subject property) which were in excess of the selected MOE (2011) Table 7 site condition standards. The analysis also identified concentrations of metals (cadmium and lead in BH11 as well as arsenic, copper, lead, and zinc in BH12) which were in excess of the MOE (2011) Table 7 site condition standards.

Groundwater testing identified concentrations of benzene, ethylbenzene, xylenes, and petroleum hydrocarbons (PHC F<sub>1</sub>) in BH1/MW1, (southwest portion of the property), which were in excess of the selected MOE (2011) Table 7 site condition standards. The results of the 2013 Phase II ESA investigation are presented on Drawings PE4435-4A, PE4435-4B, PE4435-4C, PE4435-5A, PE4435-5B – Analytical Testing Plans in the figures section of this report.

Paterson completed a Phase I ESA for the subject site in July 2019. The Phase I ESA identified three (3) on-site Potentially Contaminating Activities (PCAs) resulting in Areas of Potential Environmental Concern (APECs) with respect to the subject property. Historically, a former retail fuel outlet operated on the west portion of the property and a former automotive service garage operated on the east portion of the property. Additionally, during the site inspection conducted as part of the Phase I ESA, fill material of unknown quality was observed on the east portion of the subject property.

PCAs that represent APECs on the subject property, as well as the Contaminants of Potential Concern (CPCs) are presented below in Table 1.



<b>Table 1 Areas of Potential Environmental Concern (APECs)</b>					
<b>Area of Potential Environmental Concern</b>	<b>Location of APEC</b>	<b>Potentially Contaminating Activity (O.Reg 153/04 - Table 2)</b>	<b>Location of PCA</b>	<b>Contaminants of Potential Concern</b>	<b>Media Potentially Impacted</b>
Former Retail Fuel Outlet	Eastern and Western portions of subject property	Item 28 – Gasoline and Associated Products Stored in Fixed Tanks.	On-Site	PHCs BTEX	Soil and Groundwater
Former Automotive Service Garage	Eastern portion of subject property	Item 52 – Storage, maintenance, fuelling and repair of equipment, vehicles, and materials used to maintain transportation systems.	On-Site	PHCs BTEX	Soil and/or Groundwater
Fill Material of Unknown Quality	Eastern portion of subject property	Item 30 – Importation of Fill Material of Unknown Quality.	On-Site	Metals PAHs	Soil and/or Groundwater

A Phase II ESA was recommended to address the aforementioned APECs.

## **3.0 SCOPE OF INVESTIGATION**

### **3.1 Overview of Site Investigation**

The subsurface investigation was conducted on May 15, 2019. The field program consisted of drilling three (3) boreholes, all of which were instrumented with groundwater monitoring wells. Boreholes were drilled to depths ranging from 7.67 m to 8.31 m below the existing grade.

### **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 identified in the Phase I ESA. Contaminants of concern for soil and groundwater include petroleum hydrocarbons (PHCs, Fractions F<sub>1</sub> - F<sub>4</sub>), benzene, toluene, ethylbenzene, and xylenes (BTEX), metals, as well as polycyclic aromatic hydrocarbons (PAHs).

### **3.3 Phase I Conceptual Site Model**

#### **Geological and Hydrogeological Setting**

The Geological Survey of Canada website on the Urban Geology of the National Capital Area was consulted as part of this assessment. Based on available mapping information, the bedrock in the area of the subject site consists of interbedded limestone and dolomite of the Gull River Formation, with a glacial till plain overburden ranging from 1 to 2 m in thickness.

The site topography slopes sharply down to the east, while the regional topography slopes down towards the north, in the direction of the Ottawa River. The regional groundwater flow is anticipated to flow to the north, towards the Ottawa River.

#### **Contaminants of Potential Concern**

As per Section 6.1 of the Phase I ESA report, petroleum hydrocarbons (PHCs), and benzene, toluene, ethylbenzene and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAHs) and metals were identified as contaminants of potential concern (CPCs) on the subject site.

#### **Existing Buildings and Structures**

No buildings or structures currently exist on the subject property.

#### **Water Bodies and Areas of Natural Significance**

There are no water bodies on the subject site or within the Phase I study area. The nearest named water body is the Ottawa River, located approximately 500 m west of the subject property. No areas of natural and scientific interest were identified on the subject property or within the Phase I study area.

#### **Drinking Water Wells**

The subject site is located within a municipally supplied potable water area. Based on the available MECP Water Well Records, no drinking water wells are expected to be present within the Phase I study area.

#### **Neighbouring Land Use**

Neighbouring land use in the Phase I study area consists mainly of residential and commercial properties. Land use is shown on Drawing PE4435-2 Surrounding Land Use Plan in the Phase I ESA report.

## **Potentially Contaminating Activities and Areas of Potential Environmental Concern**

As per Section 6.1 of the Phase I ESA report, three (3) Potentially Contaminating Activities (PCAs) identified on the subject property are considered to represent Areas of Potential Environmental Concern (APECs):

- ☐ A former retail fuel outlet, located on the western portion of the subject site.
- ☐ A former auto service garage, located on the eastern portion of the subject site.
- ☐ Existing fill material of an unknown quality, located on the eastern portion of the subject site.

## **Assessment of Uncertainty and/or Absence of Information**

The information available for review as part of the preparation of the Phase I ESA is considered to be sufficient to conclude that there are areas of potential environmental concern on the subject site which have the potential to have impacted the subject site. The presence of potentially contaminating activities was confirmed by a variety of independent sources, and as such, the conclusions of this report are not affected by uncertainty which may be present with respect to the individual sources.

## **4.0 INVESTIGATION METHOD**

### **4.1 Subsurface Investigation**

The subsurface investigation was conducted on May 15, 2019. The field program consisted of drilling three (3) boreholes, all of which were instrumented with groundwater monitoring wells. Boreholes were drilled to depths ranging from 7.67 m to 8.31 m below the existing grade.

The boreholes were placed to address the aforementioned APECs. The boreholes were drilled with a track-mounted drill rig provided by George Downing Estate Drilling. Borehole locations are shown on Drawing PE4435-3 – Test Hole Location Plan, appended to this report.

## **4.2 Soil Sampling**

A total of ten (10) soil samples and fourteen (14) rock core samples were obtained from the boreholes by means of sampling from split spoon sampling, grab samples and diamond coring. The depths at which grab samples, rock coring, and split spoon samples were obtained from the boreholes are shown as “G”, “RC” and “SS” respectively on the Soil Profile and Test Data Sheets, appended to this report.

Site soils generally consist of fill material comprised of brown silty sand, gravel, crushed stone, and concrete, underlain by limestone bedrock. The fill material encountered during the drilling program extended to depths ranging from 2.13 m to 2.84 m. The bedrock, consisting of grey limestone, was encountered at depths ranging from 2.13 m to 2.84 m

## **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 an RKL Eagle Gas Detector calibrated for hexane.

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 10 ppm to 45 ppm. Vapour readings are noted on the Soil Profile and Test Data Sheets in Appendix 1.

## **4.4 Groundwater Monitoring Well Installation**

Three (3) groundwater monitoring wells were installed on the subject site as part of the current Phase II investigation. The monitoring wells consisted of 32 mm diameter Schedule 40 threaded PVC risers and screens. A summary of the 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. Upon completion, the borehole elevations were subsequently surveyed with respect to the fire hydrant located on Churchill Avenue North, adjacent to the subject property.

<b>Table 2 Monitoring Well Construction Details</b>						
<b>Well ID</b>	<b>Ground Surface Elevation (m ASL)</b>	<b>Total Depth (m BGS)</b>	<b>Screened Interval (m BGS)</b>	<b>Sand Pack (m BGS)</b>	<b>Bentonite Seal (m BGS)</b>	<b>Casing Type</b>
BH4-19	63.71	8.31	5.26 - 8.31	5.03 - 8.31	0.13 - 5.03	Flushmount
BH5-19	63.34	7.67	4.62 - 7.67	4.42 - 7.67	0.20 - 4.42	Flushmount
BH6-19	62.99	7.75	4.70 - 7.75	4.39 - 7.75	0.15 - 4.39	Flushmount

## 4.5 Field Measurement of Water Quality Parameters

Groundwater sampling was conducted at BH1/MW1, BH4-19, BH5-19, and BH6-19 on May 22, 2019 and May 29, 2019. No water quality parameters were measured in the field at that time.

## 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

The following soil and groundwater samples were submitted for analysis:

<b>Table 3 Soil Samples Submitted</b>							
Sample ID	Sample Depth & Stratigraphic Unit	Parameters Analyzed					Rationale
		PHCs (F <sub>1</sub> -F <sub>4</sub> )	BTEX	PAHs	Metals <sup>1</sup>	pH	
BH4-19-AU1	0.00 - 0.61 m Fill Material			X	X		Assess soil for potential impacts on the central portion of the subject property due to overlying fill material.
BH4-19-SS4	2.29 - 2.90 m Fill Material	X	X			X	Assess soil for potential impacts on the central portion of the subject property due to the former on-site retail fuel outlet.
BH5-19-SS2	0.76 - 1.37 m Fill Material	X	X	X	X		Assess the extent of soil for potential impacts on the east portion of the subject property due to the former on-site automotive service garage and overlying fill material.
BH6-19-SS2	0.76 - 1.37 m Fill Material	X	X	X	X	X	Assess the extent of soil for potential impacts on the east portion of the subject property due to the former on-site automotive service garage and overlying fill material.
1 – Including Chromium VI and Mercury							

<b>Table 4 Groundwater Samples Submitted</b>						
<b>Sample ID</b>	<b>Screened Interval &amp; Stratigraphic Unit</b>	<b>Parameters Analyzed</b>				<b>Rationale</b>
		<b>PHCs (F<sub>1</sub>-F<sub>4</sub>)</b>	<b>BTEX</b>	<b>PAHs</b>	<b>Metals<sup>1</sup></b>	
BH1-GW2	7.50 - 13.50 m Bedrock	X	X			Assess potential impacts on the subject property due to the tank nest associated with the former retail fuel outlet.
BH4-19-GW1	5.26 - 8.31 m Bedrock	X	X			Assess potential impacts on the subject property due to the former retail fuel outlet.
BH5-19-GW1	4.62 - 7.67 m Bedrock	X	X	X	X	Assess potential impacts on the subject property due to the former automotive service garage and overlying fill material.
BH6-19-GW1	4.70 - 7.75 m Bedrock	X	X	X	X	Assess potential impacts on the subject property due to the former automotive service garage and overlying fill material.
1 – Including Chromium VI and Mercury						

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 purge water and fluids from equipment cleaning were retained on-site.

## 4.9 Elevation Surveying

Borehole elevations were surveyed with respect to the top spindle of the fire hydrant located on Churchill Avenue North, adjacent to the subject property. The top spindle of the fire hydrant is known to have a geodetic elevation of approximately 66.18 m above sea level.

## 4.10 Quality Assurance and Quality Control Measures

A summary of the quality assurance and quality control (QA/QC) measures, undertaken as part of this assessment, is provided in the Sampling and Analysis Plan in Appendix 1.

## 5.0 REVIEW AND EVALUATION

### 5.1 Geology

Site soils generally consist of brown silty sand and gravel fill material, underlain by grey limestone bedrock. The groundwater was encountered within the bedrock unit at depths ranging from approximately 6.14 m to 7.72 m below the existing grade. Site geology details are provided in the Soil Profile and Test Data Sheets in Appendix 1.

### 5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured during the groundwater sampling event on May 22, 2019 using an electronic water level meter. Groundwater levels are summarized below in Table 5.

<b>Table 5 Groundwater Level Measurements</b>				
<b>Borehole Location</b>	<b>Ground Surface Elevation (m)</b>	<b>Water Level Depth (m below grade)</b>	<b>Water Level Elevation (m ASL)</b>	<b>Date of Measurement</b>
BH1/MW1	65.04 m	7.72 m	57.32 m	May 22, 2019
BH2	-	7.50 m	-	May 22, 2019
BH4-GW1	63.71 m	7.10 m	56.61 m	May 22, 2019
BH5-GW1	63.34 m	6.14 m	57.20 m	May 22, 2019
BH6-GW1	62.99 m	5.82 m	57.17 m	May 22, 2019

Based on the water levels and configuration of the borehole locations on the subject site, it was not possible to triangulate the groundwater direction and a hydraulic gradient. The groundwater direction, however, is assumed to flow in a northerly direction.

### 5.3 Fine/Coarse Soil Texture

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



## 5.4 Field Screening

Field screening of the soil samples collected during drilling resulted in vapour readings ranging from 10 ppm to 45 ppm. Some minor demolition debris material was identified in the soil samples recovered from BH5 and BH6 however no significant indications of potential environmental concerns were identified in the soil samples. 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

Four (4) soil samples were submitted for analysis of BTEX and PHCs (F<sub>1</sub>-F<sub>4</sub>), PAHs, metals, and pH levels. The results of the analytical testing are presented below in Tables 6, 7, 8 and 9. The laboratory certificate of analysis is provided in Appendix 1.

Table 6 Analytical Test Results – Soil – BTEX and PHCs (F <sub>1</sub> -F <sub>4</sub> )					
Parameter	MDL (µg/g)	Soil Samples (µg/g)			MECP Table 7 Residential Standards (µg/g)
		May 15, 2019			
		BH4-19-SS4	BH5-19-SS2	BH6-19-SS2	
Benzene	0.02	nd	nd	nd	0.21
Ethylbenzene	0.05	nd	nd	nd	2
Toluene	0.05	nd	nd	nd	2.3
Xylenes (Total)	0.05	nd	nd	nd	3.1
PHC F <sub>1</sub>	7	nd	nd	nd	55
PHC F <sub>2</sub>	4	nd	nd	7	98
PHC F <sub>3</sub>	8	nd	36	110	300
PHC F <sub>4</sub>	6	nd	54	58	2,800
Notes:					
<ul style="list-style-type: none"><li>MDL – Method Detection Limit</li><li>nd – not detected above the MDL</li><li><b><u>Value exceeds selected MECP Standards</u></b></li></ul>					

All BTEX and PHC concentrations are in compliance with the selected MECP Table 7 standards.

Table 7 Analytical Test Results – Soil – PAHs					
Parameter	MDL (µg/g)	Soil Samples (µg/g)			MECP Table 7 Residential Standards (µg/g)
		May 15, 2019			
		BH4-19-AU1	BH5-19-SS2	BH6-19-SS2	
Acenaphthene	0.02	nd	nd	0.04	7.9
Acenaphthylene	0.02	nd	0.05	0.03	0.15
Anthracene	0.02	nd	0.03	0.06	0.67
Benzo[a]anthracene	0.02	0.02	0.08	0.10	0.5
Benzo[a]pyrene	0.02	nd	0.09	0.08	0.3
Benzo[b]fluoranthene	0.02	0.02	0.08	0.14	0.78
Benzo[g,h,i]perylene	0.02	nd	0.06	0.06	6.6
Benzo[k]fluoranthene	0.02	nd	0.04	0.07	0.78
Chrysene	0.02	0.02	0.09	0.14	7
Dibenzo[a,h]anthracene	0.02	nd	nd	nd	0.1
Fluoranthene	0.02	0.04	0.14	0.25	0.69
Fluorene	0.02	nd	nd	0.02	62
Indeno[1,2,3-cd]pyrene	0.02	nd	0.06	0.05	0.38
Methylnaphthalene(1,2)	0.04	nd	nd	0.08	0.99
Naphthalene	0.01	nd	nd	0.03	0.6
Phenanthrene	0.02	0.02	0.04	0.24	6.2
Pyrene	0.02	0.04	0.12	0.21	78
Notes:					
<ul style="list-style-type: none"><li>MDL – Method Detection Limit</li><li>nd – not detected above the MDL</li><li><b><u>Value exceeds selected MECP Standards</u></b></li></ul>					

All PAH concentrations are in compliance with the selected MECP Table 7 standards.

Table 8 Analytical Test Results – Soil – Metals					
Parameter	MDL (µg/g)	Soil Samples (µg/g)			MECP Table 7 Residential Standards (µg/g)
		May 15, 2019			
		BH4-19-AU1	BH5-19-SS2	BH6-19-SS2	
Antimony	1.0	nd	nd	<b><u>9.1</u></b>	7.5
Arsenic	1.0	2.6	3.3	14.2	18
Barium	1.0	67.2	132	218	390
Beryllium	0.5	nd	nd	nd	4
Boron	5.0	9.9	nd	26.5	120
Cadmium	0.5	nd	nd	<b><u>1.5</u></b>	1.2
Chromium	5.0	14.8	55.8	<b><u>245</u></b>	160
Chromium (VI)	0.2	nd	nd	nd	8
Cobalt	1.0	6.8	11.0	11.7	22
Copper	5.0	13.9	25.7	<b><u>264</u></b>	140
Lead	1.0	11.3	6.3	<b><u>472</u></b>	120
Mercury	0.1	nd	nd	0.2	0.27
Molybdenum	1.0	nd	nd	<b><u>11.3</u></b>	6.9
Nickel	5.0	12.0	29.5	<b><u>121</u></b>	100
Selenium	1.0	nd	nd	nd	2.4
Silver	0.3	nd	nd	nd	20
Thallium	1.0	nd	nd	nd	1
Uranium	1.0	nd	nd	nd	23
Vanadium	10.0	19.3	57.6	48.6	86
Zinc	20.0	25.7	59.0	<b><u>363</u></b>	340
Notes:					
<ul style="list-style-type: none"><li>MDL – Method Detection Limit</li><li>nd – not detected above the MDL</li><li><b>Bold and Underlined</b> – Value exceeds selected MECP Standards</li></ul>					

The concentrations of antimony, cadmium, chromium, copper, lead, molybdenum, nickel, and zinc in soil sample BH6-19-SS2 were in excess of the selected MECP Table 7 standards.

Table 9 Analytical Test Results – Soil – pH Levels				
Parameter	MDL	Soil Samples		MECP Table 7 Residential Standards (µg/g)
		May 15, 2019		
		BH4-19-SS4	BH6-19-SS2	
pH Level	0.05 pH Units	7.80	8.15	5.00 – 11.00
Notes: <ul style="list-style-type: none"><li>MDL – Method Detection Limit</li></ul>				

The pH levels of the soil samples analyzed were in compliance with the selected MECP Table 7 standards.

<b>Table 10 Maximum Concentrations - Soil</b>			
<b>Parameter</b>	<b>Maximum Concentration</b>	<b>Sample ID</b>	<b>Depth Interval (m BGS)</b>
Acenaphthene	0.04	BH6-19-SS2	0.76 - 1.37
Acenaphthylene	0.05	BH5-19-SS2	0.76 - 1.37
Anthracene	0.06	BH6-19-SS2	0.76 - 1.37
Benzo[a]anthracene	0.10	BH6-19-SS2	0.76 - 1.37
Benzo[a]pyrene	0.09	BH5-19-SS2	0.76 - 1.37
Benzo[b]fluoranthene	0.14	BH6-19-SS2	0.76 - 1.37
Benzo[g,h,i]perylene	0.06	BH5-19-SS2 / BH6-19-SS2	0.76 - 1.37 / 0.76 - 1.37
Benzo[k]fluoranthene	0.07	BH6-19-SS2	0.76 - 1.37
Chrysene	0.14	BH6-19-SS2	0.76 - 1.37
Fluoranthene	0.25	BH6-19-SS2	0.76 - 1.37
Fluorene	0.02	BH6-19-SS2	0.76 - 1.37
Indeno[1,2,3-cd]pyrene	0.06	BH5-19-SS2	0.76 - 1.37
Methylnaphthalene(1,2)	0.08	BH6-19-SS2	0.76 - 1.37
Naphthalene	0.03	BH6-19-SS2	0.76 - 1.37
Phenanthrene	0.24	BH6-19-SS2	0.76 - 1.37
Pyrene	0.21	BH6-19-SS2	0.76 - 1.37
Antimony	<b>9.1</b>	BH6-19-SS2	0.76 - 1.37
Arsenic	14.2	BH6-19-SS2	0.76 - 1.37
Barium	218	BH6-19-SS2	0.76 - 1.37
Boron	26.5	BH6-19-SS2	0.76 - 1.37
Cadmium	<b>1.5</b>	BH6-19-SS2	0.76 - 1.37
Chromium	<b>245</b>	BH6-19-SS2	0.76 - 1.37
Cobalt	11.7	BH6-19-SS2	0.76 - 1.37
Copper	<b>264</b>	BH6-19-SS2	0.76 - 1.37
Lead	<b>472</b>	BH6-19-SS2	0.76 - 1.37
Mercury	0.2	BH6-19-SS2	0.76 - 1.37
Molybdenum	<b>11.3</b>	BH6-19-SS2	0.76 - 1.37
Nickel	<b>121</b>	BH6-19-SS2	0.76 - 1.37
Vanadium	57.6	BH5-19-SS2	0.76 - 1.37
Zinc	<b>363</b>	BH6-19-SS2	0.76 - 1.37
PHCs F <sub>2</sub>	7	BH6-19-SS2	0.76 - 1.37
PHCs F <sub>3</sub>	110	BH6-19-SS2	0.76 - 1.37
PHCs F <sub>4</sub>	58	BH6-19-SS2	0.76 - 1.37
pH Level	8.15	BH6-19-SS2	0.76 - 1.37
Notes:			
<ul style="list-style-type: none"> <li>MDL – Method Detection Limit</li> <li>nd – not detected above the MDL</li> <li><b><u>Bold and Underlined</u></b> – Value exceeds selected MECP Standards</li> </ul>			

All other parameter concentrations analyzed were below the laboratory detection limits. The laboratory certificates of analysis are provided in Appendix 1.

## 5.6 Groundwater Quality

Groundwater samples from monitoring wells installed in BH1/MW1, BH4-19, BH5-19, and BH6-19 were submitted for laboratory analysis of BTEX and PHCs (F<sub>1</sub>-F<sub>4</sub>), PAHs, and metals. The groundwater samples were obtained from the screened intervals noted on Table 2. The results of the analytical testing are presented below in Tables 11, 12, and 13. The laboratory certificates of analysis are provided in Appendix 1.

<b>Table 11 Analytical Test Results – Groundwater – BTEX and PHCs (F<sub>1</sub>-F<sub>4</sub>)</b>						
Parameter	MDL (µg/L)	Groundwater Samples (µg/L)				MECP Table 7 Residential Standards (µg/L)
		May 22, 2019			May 29, 2019	
		BH1- GW2	BH5-19- GW1	BH6-19- GW1	BH4-19- GW1	
Benzene	0.5	<b><u>4.1</u></b>	nd	nd	nd	0.5
Ethylbenzene	0.5	5.0	nd	nd	nd	54
Toluene	0.5	1.4	nd	nd	nd	320
Xylenes (Total)	0.5	1.9	nd	nd	nd	72
PHC F1	25	308	nd	nd	nd	420
PHC F2	100	nd	nd	nd	nd	150
PHC F3	100	nd	nd	nd	nd	500
PHC F4	100	nd	nd	nd	nd	500
Notes: <ul style="list-style-type: none"> <li>MDL – Method Detection Limit</li> <li>nd – not detected above the MDL</li> <li><b><u>Bold and Underlined</u></b> – Value exceeds selected MECP Standards</li> </ul>						

The concentration of benzene in the sample recovered from BH1 was in excess of the selected MECP Table 7 standards.

Table 12 Analytical Test Results – Groundwater – PAHs				
Parameter	MDL (µg/L)	Groundwater Samples (µg/L)		MECP Table 7 Residential Standards (µg/L)
		May 22, 2019		
		BH5-19-GW1	BH6-19-GW1	
Acenaphthene	0.05	nd	nd	17
Acenaphthylene	0.05	nd	nd	1
Anthracene	0.01	nd	nd	1
Benzo[a]anthracene	0.01	nd	nd	1.8
Benzo[a]pyrene	0.01	nd	nd	0.81
Benzo[b]fluoranthene	0.05	nd	nd	0.75
Benzo[g,h,i]perylene	0.05	nd	nd	0.2
Benzo[k]fluoranthene	0.05	nd	nd	0.4
Chrysene	0.05	nd	nd	0.7
Dibenzo[a,h]anthracene	0.05	nd	nd	0.4
Fluoranthene	0.01	nd	nd	44
Fluorene	0.05	nd	nd	290
Indeno[1,2,3-cd]pyrene	0.05	nd	nd	0.2
Methylnaphthalene(1,2)	0.10	nd	nd	1,500
Naphthalene	0.05	nd	nd	7
Phenanthrene	0.05	nd	nd	380
Pyrene	0.01	nd	nd	5.7
Notes:				
<ul style="list-style-type: none"><li>MDL – Method Detection Limit</li><li>nd – not detected above the MDL</li><li><b><u>Value exceeds selected MECP Standards</u></b></li></ul>				

All PAH concentrations are in compliance with the selected MECP Table 7 standards.

Table 13				
Analytical Test Results – Groundwater – Metals				
Parameter	MDL (µg/L)	Groundwater Samples (µg/L)		MECP Table 7 Residential Standards (µg/L)
		May 22, 2019		
		BH5-19-GW1	BH6-19-GW1	
Antimony	0.5	nd	nd	16,000
Arsenic	1	nd	nd	1,500
Barium	1	52	55	23,000
Beryllium	0.5	nd	nd	53
Boron	10	101	161	36,000
Cadmium	0.1	nd	nd	2.1
Chromium	1	nd	nd	640
Chromium (VI)	10	nd	nd	110
Cobalt	0.5	1.0	nd	52
Copper	0.5	2.0	2.1	69
Lead	0.1	0.1	nd	20
Mercury	0.1	nd	nd	0.1
Molybdenum	0.5	3.3	2.5	7,300
Nickel	1	6	3	390
Selenium	1	nd	nd	50
Silver	0.1	nd	nd	1.2
Sodium	200	826,000	188,000	1,800,000
Thallium	0.1	0.3	0.2	400
Uranium	0.1	2.7	2.9	330
Vanadium	0.5	nd	nd	200
Zinc	5	nd	8	890
Notes:				
<ul style="list-style-type: none"><li>MDL – Method Detection Limit</li><li>nd – not detected above the MDL</li><li><b><u>Value exceeds selected MECP Standards</u></b></li></ul>				

All metals concentrations are in compliance with the selected MECP Table 7 standards.

<b>Table 14 Maximum Concentrations – Groundwater</b>			
<b>Parameter</b>	<b>Maximum Concentration</b>	<b>Sample ID</b>	<b>Depth Interval (m BGS)</b>
Barium	55	BH6-19-GW1	4.70 - 7.75
Boron	161	BH6-19-GW1	4.70 - 7.75
Cobalt	1.0	BH5-19-GW1	4.62 - 7.67
Copper	2.1	BH6-19-GW1	4.70 - 7.75
Lead	0.1	BH5-19-GW1	4.62 - 7.67
Molybdenum	3.3	BH5-19-GW1	4.62 - 7.67
Nickel	6	BH5-19-GW1	4.62 - 7.67
Sodium	826,000	BH5-19-GW1	4.62 - 7.67
Thallium	0.3	BH5-19-GW1	4.62 - 7.67
Uranium	2.9	BH6-19-GW1	4.70 - 7.75
Zinc	8	BH6-19-GW1	4.70 - 7.75
Benzene	<b><u>4.1</u></b>	BH1-GW2	7.50 - 13.50
Ethylbenzene	5.0	BH1-GW2	7.50 - 13.50
Toluene	1.4	BH1-GW2	7.50 - 13.50
Xylenes (Total)	1.9	BH1-GW2	7.50 - 13.50
PHCs F <sub>1</sub>	308	BH1-GW2	7.50 - 13.50
Notes:			
<ul style="list-style-type: none"> <li>▪ MDL – Method Detection Limit</li> <li>▪ nd – not detected above the MDL</li> <li>▪ <b><u>Bold and Underlined</u></b> – Value exceeds selected MECP Standards</li> </ul>			

All other parameter concentrations analyzed were below the laboratory detection limits. The laboratory certificates of analysis are provided in Appendix 1.

## 5.7 Quality Assurance and Quality Control Results

All samples submitted as part of this Phase II ESA were handled in accordance with the Analytical Protocol with respect to holding time, preservation method, storage requirement, and container type.

As per Subsection 47(3) of O.Reg. 153/04, as amended by the Environmental Protection Act, a Certificate of Analysis has been received for each sample submitted for analysis and all Certificates of Analysis are appended to this report.

As per the Sampling and Analysis Plan, a duplicate groundwater sample was obtained at BH6-19 during the May 22, 2019 sampling event and analyzed for BTEX. The relative percent different (RPD) calculations for the original and duplicate samples are provided below in Table 15.



<b>Table 15</b>					
<b>QA/QC Calculations – Groundwater – BTEX</b>					
<b>Parameter</b>	<b>MDL (µg/L)</b>	<b>BH6-19-GW1</b>	<b>DUP 1</b>	<b>RPD (%)</b>	<b>QA/QC Result</b>
Benzene	0.5	nd	nd	0	Meets Target
Ethylbenzene	0.5	nd	nd	0	Meets Target
Toluene	0.5	nd	nd	0	Meets Target
Xylenes (Total)	0.5	nd	nd	0	Meets Target
Notes:					
<ul style="list-style-type: none"> <li>▪ MDL – Method Detection Limit</li> <li>▪ nd – not detected above the MDL</li> </ul>					

The parameter concentrations for both the original and duplicate sample were below the laboratory detection limits, and as such, are considered acceptable. As a result, 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 accordance with the requirements of O.Reg. 269/11 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 the Phase I ESA report and Section 2.2 of this report, the following PCAs, as per Table 2, O.Reg. 153/04 as amended by Environmental Protection Act, are considered to result in APECs on the subject property:

- ☐ *Item 28: “Gasoline and Associated Products Storage in Fixed Tanks”*
  - This PCA was identified on the subject site as a result of the former retail fuel outlet on the western portion of the property.
- ☐ *Item 30: “Importation of Fill Material of Unknown Quality”*
  - This PCA was identified on the subject site as a result of the importation of backfill material following the demolition of the former auto service garage;
- ☐ *Item 52: “Storage, maintenance, fuelling and repair of equipment, vehicles, and materials used to maintain transportation systems”*
  - this PCA was identified on the subject site as a result of the former auto service garage on the eastern portion of the property.

Other PCAs identified within the vicinity of the subject site are not considered to result in APECs, based on their separation distances as well as their down-gradient or cross-gradient locations with respect to the subject site.

### **Contaminants of Potential Concern**

Contaminants of potential concern associated with the aforementioned PCAs include PHCs (F<sub>1</sub>-F<sub>4</sub>), BTEXs, PAHs, and metals in the soil and/or groundwater.

### **Subsurface Structures and Utilities**

Underground service locates were completed prior to the subsurface investigation. Underground utilities on the subject property include hydro, telecommunication lines, water, and sewage services. The underground water and sewage pipes on the subject property are privately owned.

## **Physical Setting**

### **Site Stratigraphy**

The site stratigraphy, from ground surface to the deepest aquifer or aquitard investigated, is provided in the Soil Profile and Test Data Sheets in Appendix 1. The stratigraphy of the subject site generally consists of:

- ☐ Paved asphalt/concrete, extending to depths ranging from approximately 0.00 m to 0.10 m below grade (east and west portions of the property only);
- ☐ Fill material (brown silty sand with gravel and crushed stone), extending to depths ranging from approximately 2.10 m to 2.84 m below grade;
- ☐ Bedrock (limestone), ranging from approximately 2.13 m to 2.84 m below grade.

### **Hydrogeological Characteristics**

Groundwater at the subject property was encountered within the limestone bedrock. This unit is interpreted to function as a local aquifer at the subject site.

Groundwater levels were measured at the subject site on May 22, 2019, with depths ranging from 5.82 m to 7.72 m below grade. Based on the water levels and configuration of the borehole locations on the subject site, it was not possible to triangulate the groundwater flow direction and a hydraulic gradient. The groundwater, however, is assumed to flow in a northerly direction.

### **Approximate Depth to Bedrock**

Bedrock is present at approximately 2.13 m to 2.84 m below the existing grade, as determined by rock coring conducted at the subject site.

### **Approximate Depth to Water Table**

The depth to the water table at the subject site varies between approximately 5.82 m to 7.72 m below the existing grade.

### **Sections 41 and 43.1 of the Regulation**

Section 41 of the Regulation does not apply to the subject site as there are no areas of natural significance or bodies of water located on the subject site or within 30 m of the subject site. The subject site is not considered to be environmentally sensitive.

Section 43.1 of the Regulation applies to the subject site as bedrock is located at a depth of less than 2 m below the ground surface, and thus is considered to be a Shallow Soil Property.

### **Fill Placement**

Fill material identified during the site inspection consisted of silty sand with gravel and crushed stone. The fill material is expected to have been imported and placed on-site following the demolition of the former auto service garage on the eastern portion of the subject property.

### **Proposed Buildings and Other Structures**

It is our understanding that the subject site is to be redeveloped with a multi-storey residential building in the future.

### **Existing Buildings and Structures**

No buildings currently exist on the subject property.

### **Areas of Natural Significance and Water Bodies**

No areas of natural significance or water bodies are present on or within the vicinity of the subject property. The nearest water body to the subject site is the Ottawa River, located approximately 500 m west of the subject property.

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## **Environmental Condition**

### **Areas Where Contaminants are Present**

Based on the analytical test results, the soil (fill) is impacted metals in the area of BH6-19, BH11, and BH12 as well as with PAHs in the area of BH11 and BH12.

The groundwater within BH1/MW1 contained a benzene concentration in excess of the MECP Table 7 standards.

Analytical test results for soil and groundwater are shown on Drawings PE4435-4A, PE4435-4B, PE4435-4C, PE4435-5A, and PE4435-5B Analytical Testing Plans in the figures section of this report.

### **Types of Contaminants**

Based on the PCAs resulting in APECs on the subject property as well as the results of the analytical testing, the contaminants of concern present on-site include metals (antimony, cadmium, chromium, copper, lead, molybdenum, nickel, and zinc) as well as PAHs (benzo[a]pyrene) in the soil. Benzene was also identified in the groundwater at one borehole location.

### **Contaminated Media**

Based on the results of the Phase II ESA, the fill material in the vicinity of BH6-19, BH11, and BH12 is impacted with metals and PAHs and the groundwater in BH1 is impacted with benzene.

### **What Is Known About Areas Where Contaminants Are Present**

The fill material is impacted with metals and PAHs on the eastern portion of the subject site, in the former location of the automotive service garage. The groundwater is impacted with benzene in the southwestern portion of the subject site where the former underground fuel tanks used to reside.

### **Distribution and Migration of Contaminants**

As previously noted, metal and PAH impacted fill material was identified in the eastern portion of the subject site in the area of BH6-19, BH11, and BH12. Based on their low mobility, as well as the clean groundwater results, it is anticipated that the metal and PAH impacts are contained within the fill material.

Benzene impacted groundwater was identified in the southwestern portion of the property. Based on the very low benzene concentration in BH1/MW1 as well as the clean groundwater results in all other wells, it is not anticipated that there is any significant potential for the migration of this impacted groundwater.

### **Discharge of Contaminants**

The metal impacted soil is considered to have resulted from the importation of fill material and/or the presence of former building demolition debris. The benzene impacted groundwater is considered to have resulted from the former retail fuel outlet.

### **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.

Leaching is not considered to be a concern regarding the metal and PAH impacted soil, as metals do not readily dissolve, and the groundwater has not been contaminated by metals or PAHs based on our testing.

### **Potential for Vapour Intrusion**

Although benzene was identified in the groundwater, there are currently no structures or buildings present on the subject site. With regard to future development of the site, the groundwater will be remediated, thus removing any potential risk for vapour intrusion.

## **6.0 CONCLUSIONS**

### **Assessment**

A Phase II ESA was conducted for the property addressed 2070 Scott Street, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address the potentially contaminating activities (PCAs) that were identified during the Phase I ESA and considered to result in areas of potential environmental concern (APECs) on the subject property. The subsurface investigation consisted of drilling three (3) boreholes, all of which were installed with groundwater monitoring wells.

Soil samples were obtained from the boreholes and screened using visual observations and organic vapour measurements. Four (4) soil samples were submitted for laboratory analysis of benzene, toluene, ethylbenzene and xylenes (BTEX), petroleum hydrocarbons (PHCs F<sub>1</sub>-F<sub>4</sub>), metals, and polycyclic aromatic hydrocarbons (PAHs). Several metals parameters in the vicinity of BH6-19 exceeded the selected MECP Table 7 standards. The impacted fill material was identified in the southeast portion of subject property, where the former automotive service garage was located. The extent of the impacted fill material is considered to be limited to the fill material present on the eastern portion of the property.

Groundwater samples recovered from monitoring wells installed in BH1/MW1, BH4-19, BH5-19, and BH6-19 were submitted for analysis of BTEX, PHCs (F<sub>1</sub>-F<sub>4</sub>), PAHs, and metals parameters. The concentration of benzene in the sample recovered from BH1/MW1 was marginally in excess of the selected MECP Table 7 standards. The impacted groundwater was identified in the southwest portion of the subject property only, where the tank nest associated with the former retail fuel outlet was located. The extent of the impacted groundwater is considered to be limited to a small radius within the southwest portion of the property.

### **Recommendations**

Based on the findings of the Phase II ESA, metal and PAH impacted fill material as well as benzene impacted groundwater is present on the subject property, requiring some remedial work. It is our understanding that the subject site is to be developed with a multi-floor residential building in the near future.

It is our recommendation that an environmental site remediation program be completed in conjunction with site redevelopment. This will require the segregation of clean soil from impacted soils, the latter of which will require disposal at an approved waste disposal facility.

With regard to the impacted groundwater in BH1/MW1, it is recommended that further testing of this well water be carried out to confirm the water quality and the recent test results.

Prior to offsite disposal at a licenced landfill site, a leachate analysis of a representative sample of contaminated soil must be conducted in accordance with Ontario Regulation 347/558.

It is recommended that Paterson personnel be present on-site during remediation activities to direct the excavation and segregation of impacted soil as well as to conduct confirmatory sampling as required.

## 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 Westboro Point Developments Ltd. Notification from Westboro Point Developments Ltd. and Paterson Group will be required prior to the release of this report to any other party.

### **Paterson Group Inc.**



Nick Sullivan, B.Sc.



Mark S. D'Arcy, P.Eng.



### **Report Distribution:**

- Westboro Point Developments Ltd.
- Paterson Group Inc.



# **FIGURES**

## **FIGURE 1 – KEY PLAN**

**Drawing PE4435-3 – Test Hole Location Plan**

**Drawing PE4435-4A – Analytical Testing Plan – Soil (BTEX, PHCs)**

**Drawing PE4435-4B – Analytical Testing Plan – Soil (PAHs)**

**Drawing PE4435-4C – Analytical Testing Plan – Soil (Metals)**

**Drawing PE4435-5A – Analytical Testing Plan – Groundwater  
(PHCs, PAHs, Metals)**

**Drawing PE4435-5B – Analytical Testing Plan – Groundwater (BTEX)**

**Drawing PE4435-6A – Cross-Section A-A' – Soil (BTEX, PHCs)**

**Drawing PE4435-6B – Cross-Section A-A' – Soil (PAH)**

**Drawing PE4435-6C – Cross-Section A-A' – Soil (Metals)**

**Drawing PE4435-7A – Cross Section A-A' – Groundwater (BTEX)**

**Drawing PE4435-7B – Cross Section A-A' – Groundwater  
(PHCs, PAHs, Metals)**

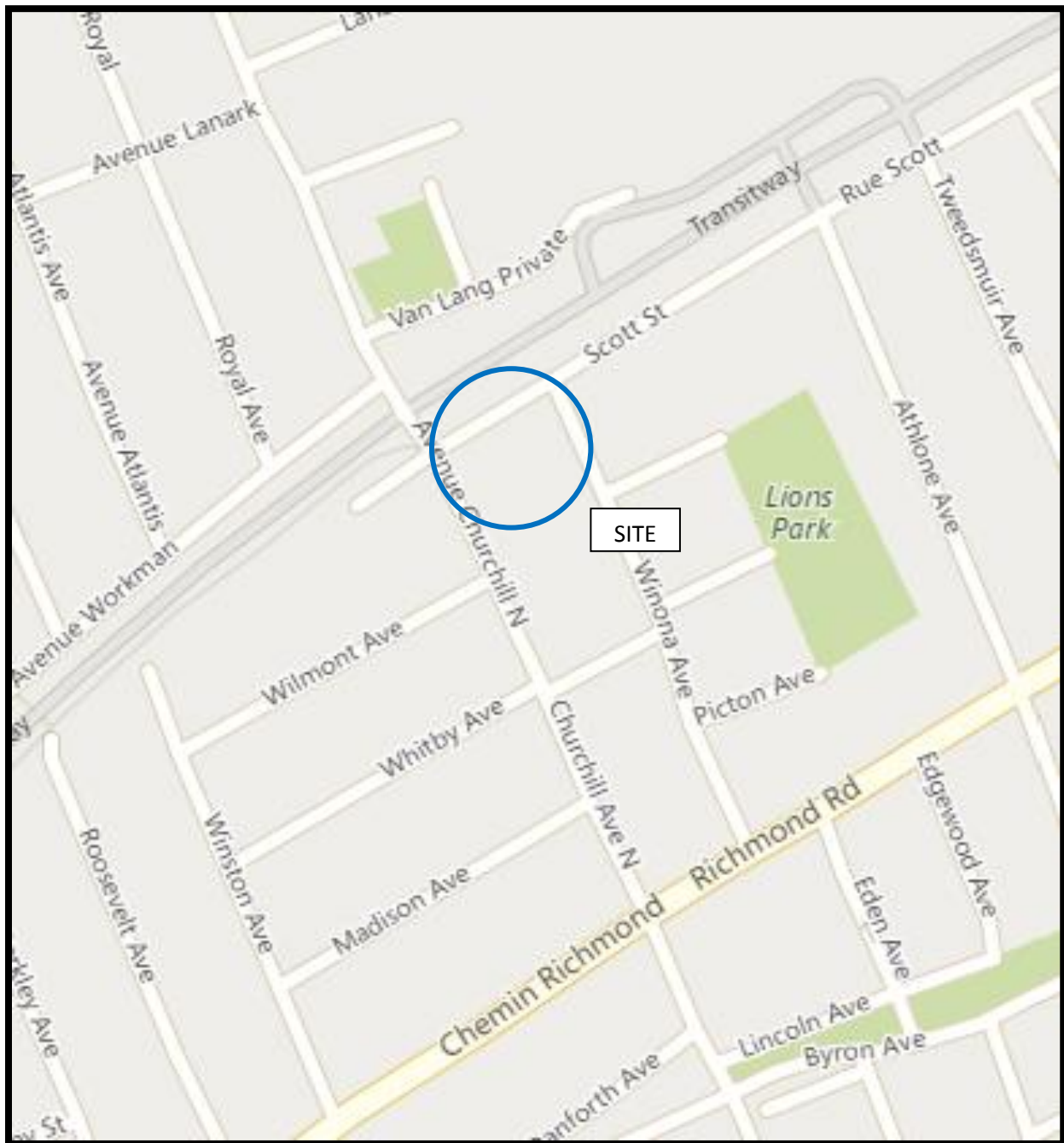
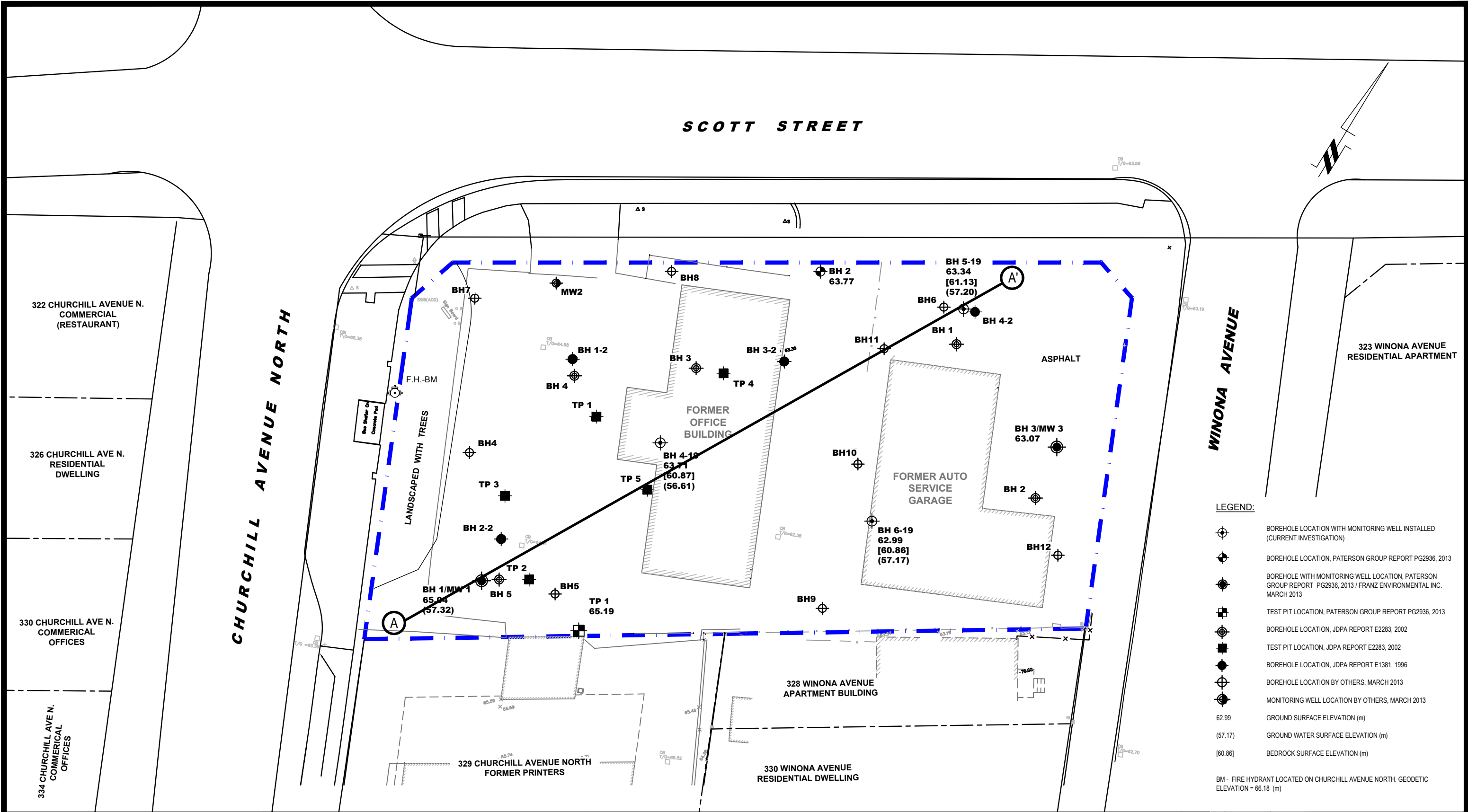


FIGURE 1  
KEY PLAN



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Tel: (613) 226-7381 Fax: (613) 226-6344

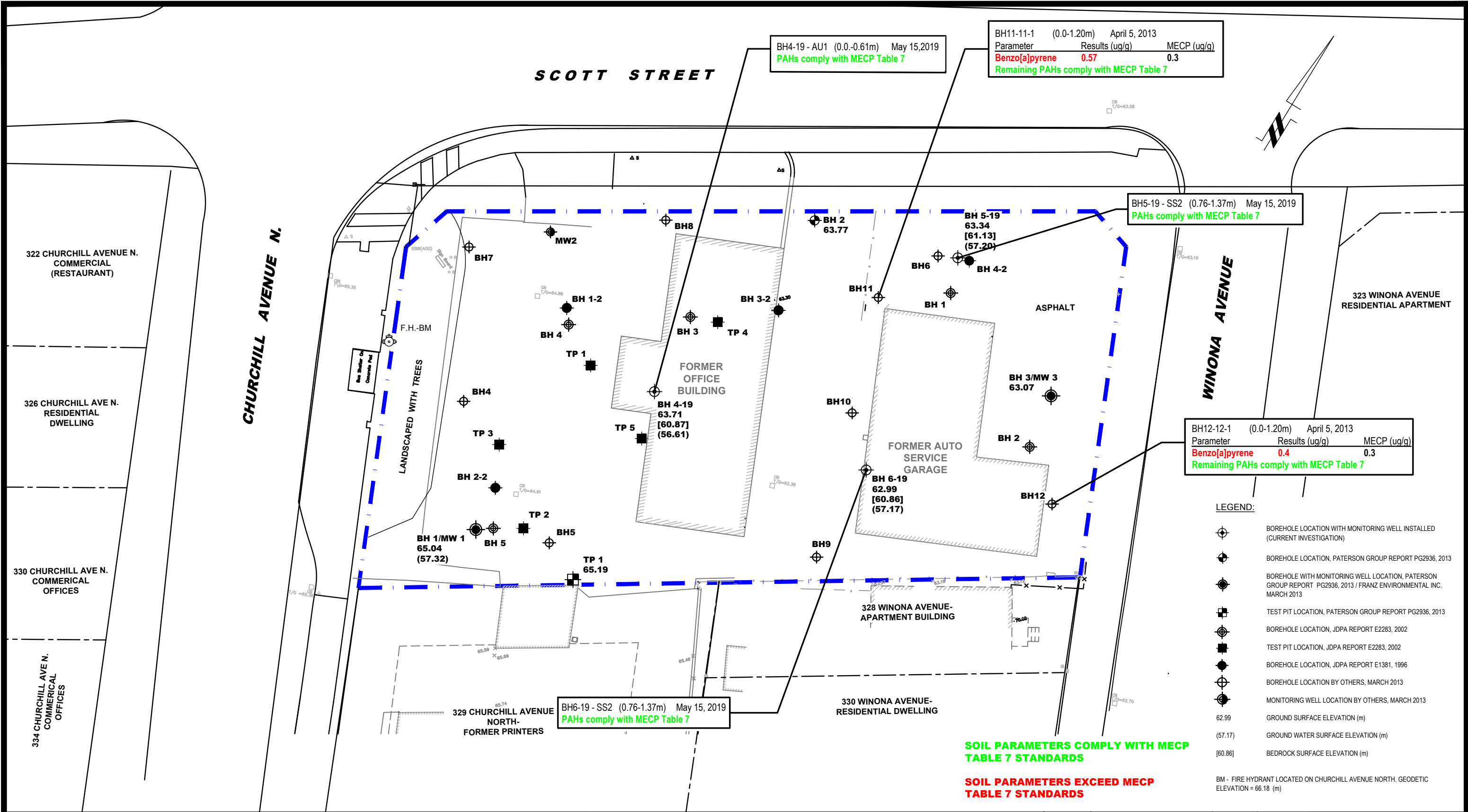
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NO.	REVISIONS	DATE	INITIAL

WESTBORO POINT DEVELOPMENTS LTD.  
PHASE II - ENVIRONMENTAL SITE ASSESSMENT  
2070 SCOTT STREET

OTTAWA, ONTARIO  
Title: **TEST HOLE LOCATION PLAN**

Scale:	1:300	Date:	08/2019
Drawn by:	YA	Report No.:	PE4435-2
Checked by:	NS	Dwg. No.:	<b>PE4435-3</b>
Approved by:	MSD	Revision No.:	0





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NO.	REVISIONS	DATE	INITIAL
0			

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2070 SCOTT STREET

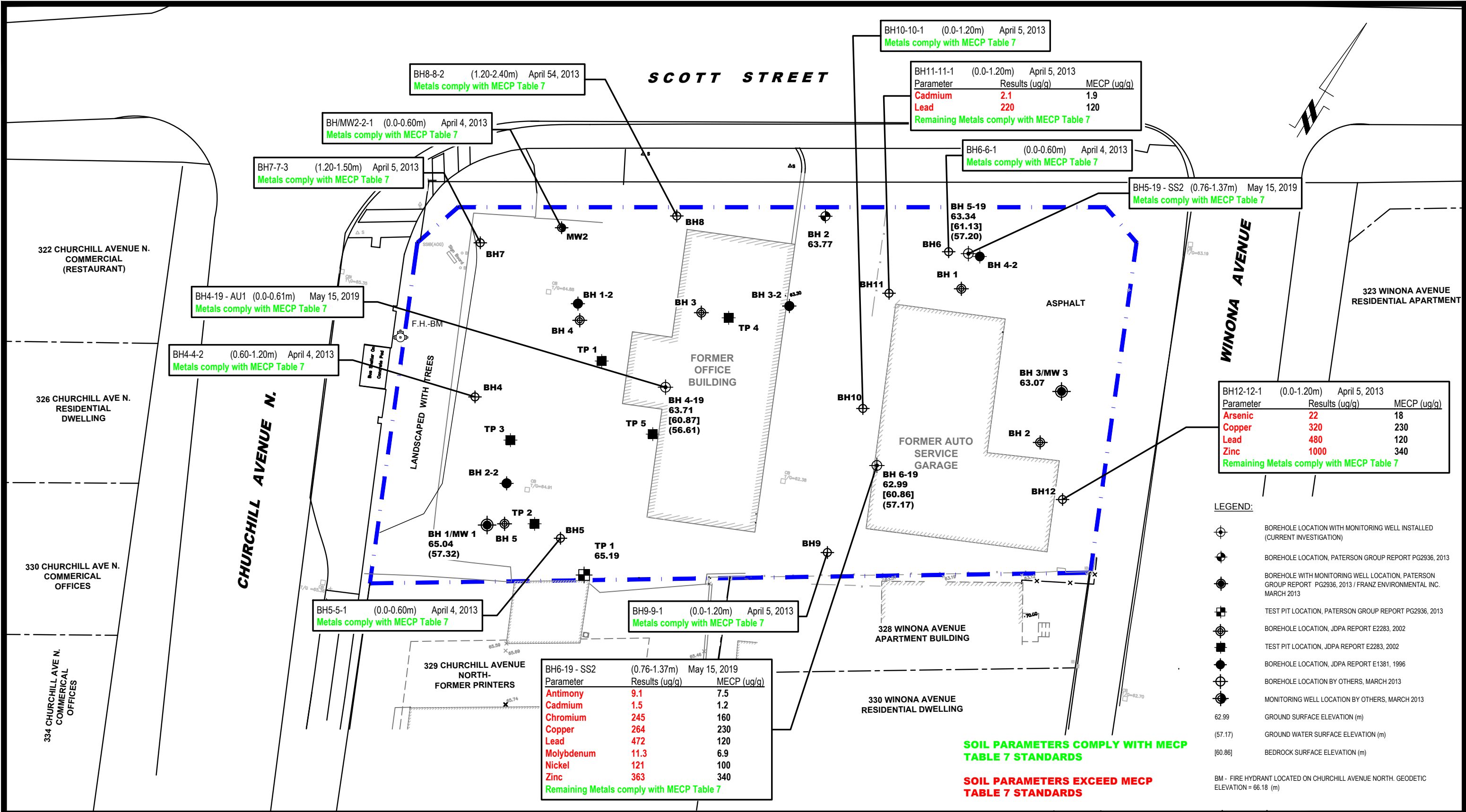
OTTAWA, ONTARIO

Title: ANALYTICAL TESTING PLAN - SOIL (PAH)

Scale:	1:300	Date:	08/2019
Drawn by:	YA	Report No.:	PE4435-2
Checked by:	NS	Dwg. No.:	PE4435-4B
Approved by:	MSD	Revision No.:	0

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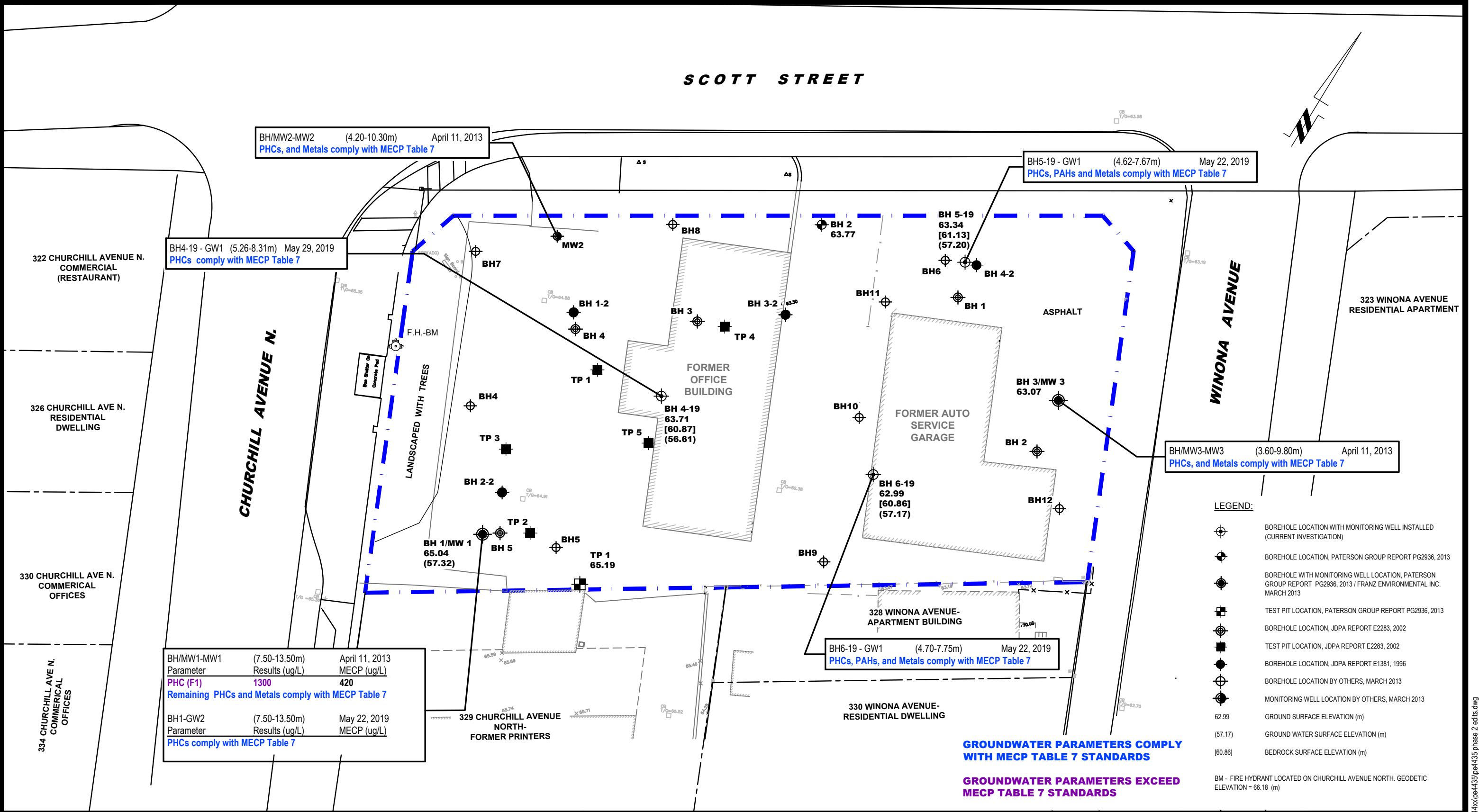
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WESTBORO POINT DEVELOPMENTS LTD.  
PHASE II - ENVIRONMENTAL SITE ASSESSMENT  
2070 SCOTT STREET

OTTAWA, ONTARIO

Title: ANALYTICAL TESTING PLAN - SOIL (METALS)

Scale:	1:300	Date:	08/2019
Drawn by:	YA	Report No.:	PE4435-2
Checked by:	NS	Dwg. No.:	PE4435-4C
Approved by:	MSD	Revision No.:	0



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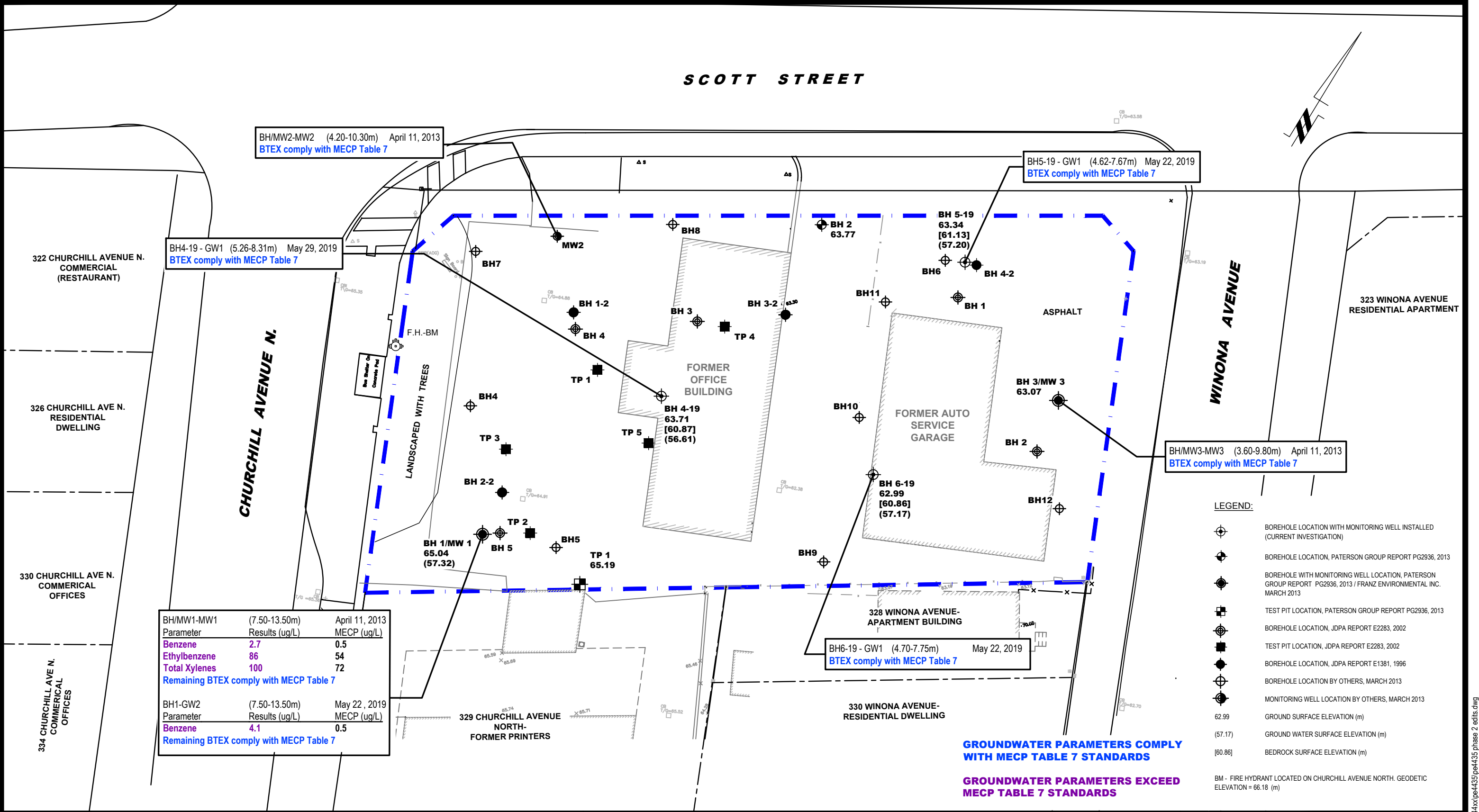
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PHASE II - ENVIRONMENTAL SITE ASSESSMENT  
2070 SCOTT STREET

OTTAWA, ONTARIO

Title:  
ANALYTICAL TESTING PLAN - GROUNDWATER (PHC, PAH, METALS)

Scale:	1:300	Date:	08/2019
Drawn by:	YA	Report No.:	PE4435-2
Checked by:	NS	Dwg. No.:	PE4435-5A
Approved by:	MSD	Revision No.:	0

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BH/MW1-MW1	(7.50-13.50m)	April 11, 2013
Parameter	Results (ug/L)	MECP (ug/L)
Benzene	2.7	0.5
Ethylbenzene	86	54
Total Xylenes	100	72
Remaining BTEX comply with MECP Table 7		
BH1-GW2	(7.50-13.50m)	May 22, 2019
Parameter	Results (ug/L)	MECP (ug/L)
Benzene	4.1	0.5
Remaining BTEX comply with MECP Table 7		

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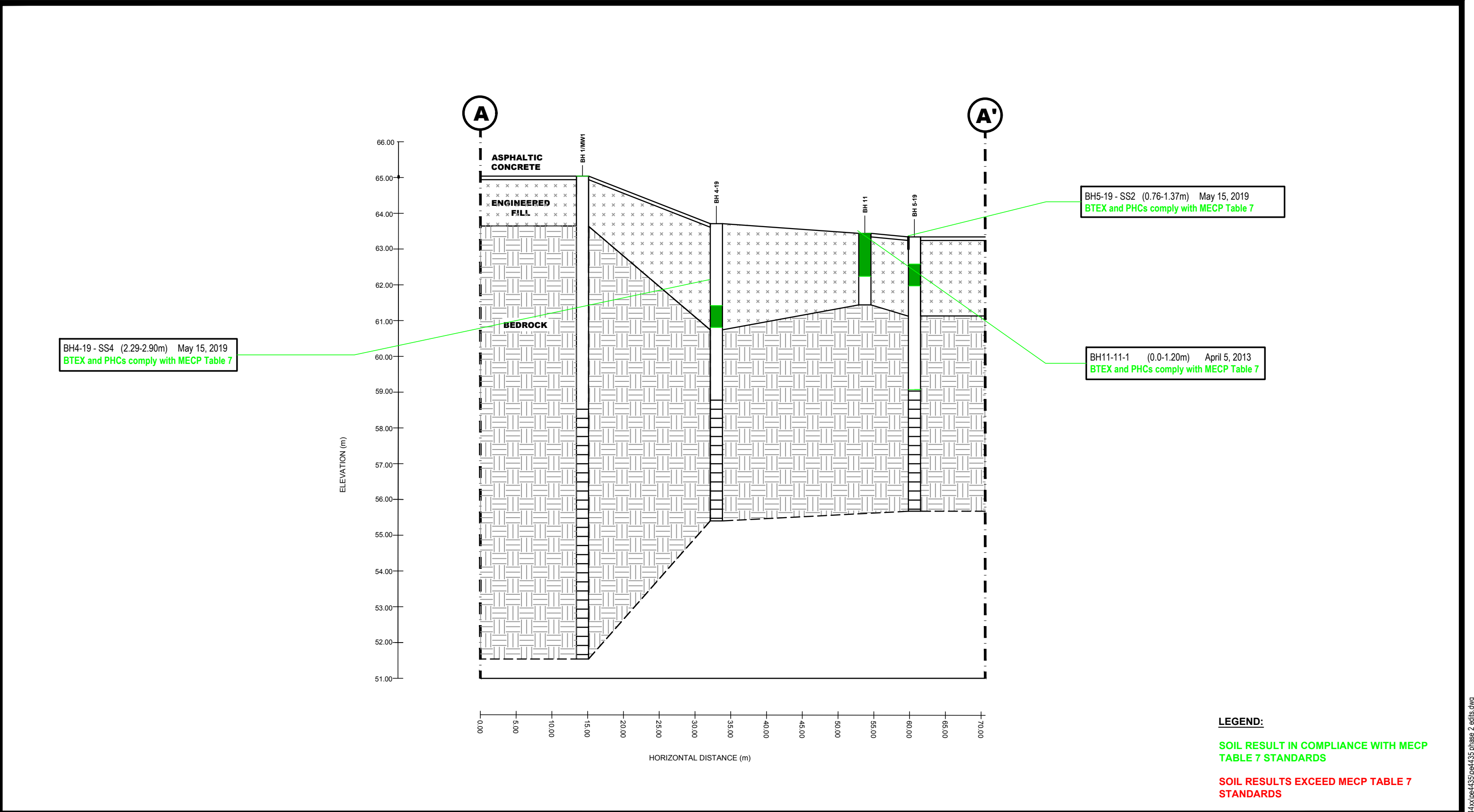
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PHASE II - ENVIRONMENTAL SITE ASSESSMENT  
2070 SCOTT STREET  
OTTAWA, ONTARIO

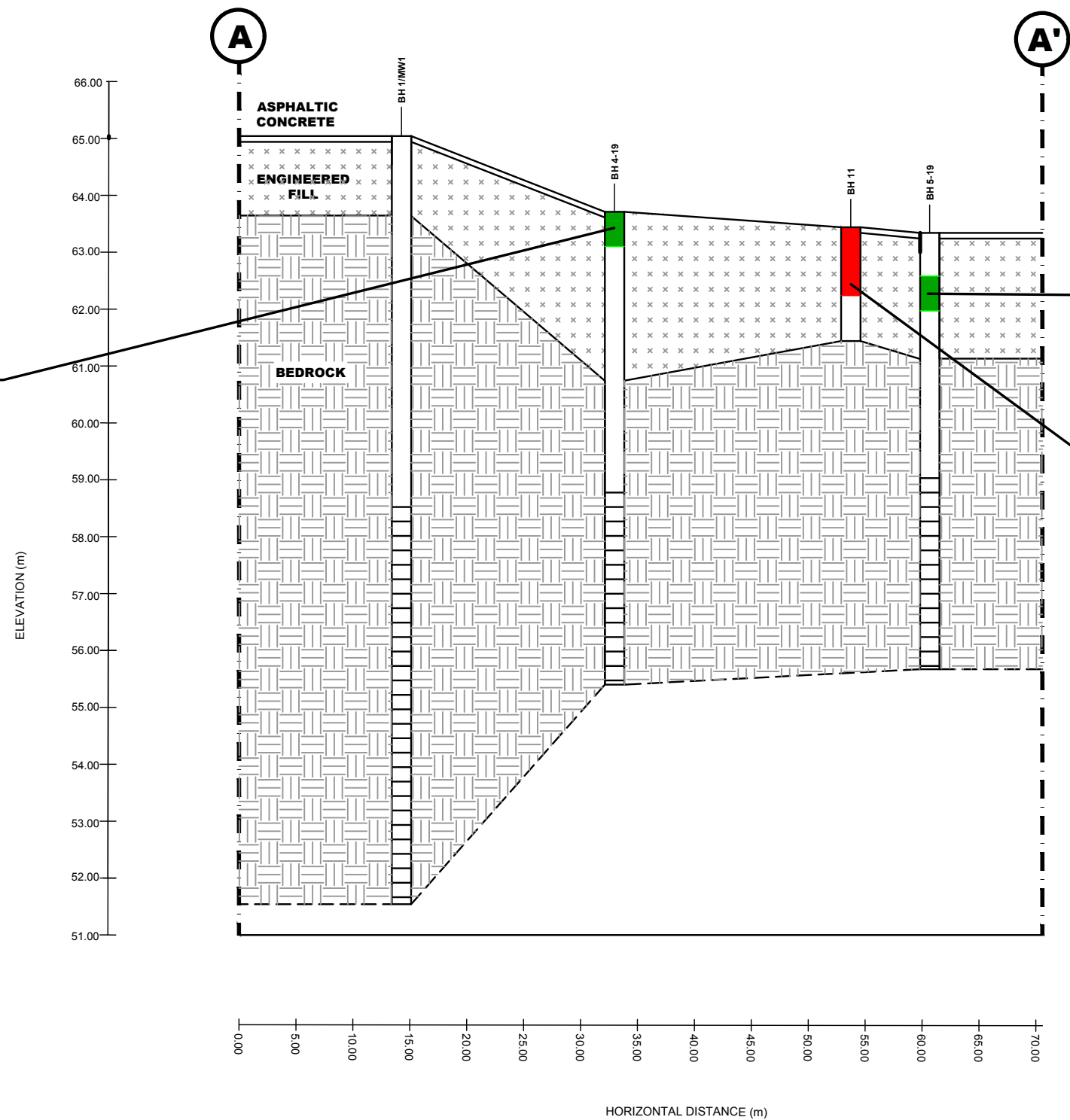
Title:  
**ANALYTICAL TESTING PLAN - GROUNDWATER (BTEX)**

Scale:	1:300	Date:	08/2019
Drawn by:	YA	Report No.:	PE4435-2
Checked by:	NS	Dwg. No.:	<b>PE4435-5B</b>
Approved by:	MSD	Revision No.:	0





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						Drawn by:	YA	Report No.:	PE4435-2
						Checked by:	NS	Dwg. No.:	PE4435-6A
						Approved by:	MSD	Revision No.:	0
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NO.	REVISIONS			DATE	INITIAL				



BH5-19 - SS2 (0.76-1.37m) May 15, 2019  
**PAHs comply with MECP Table 7**

BH11-11-1 (0.0-1.20m) April 5, 2013		
Parameter	Results (ug/g)	MECP (ug/g)
<b>Benzo[a]pyrene</b>	<b>0.57</b>	<b>0.3</b>
<b>Remaining PAHs comply with MECP Table 7</b>		

**LEGEND:**

**SOIL RESULT IN COMPLIANCE WITH MECP TABLE 7 STANDARDS**

**SOIL RESULTS EXCEED MECP TABLE 7 STANDARDS**

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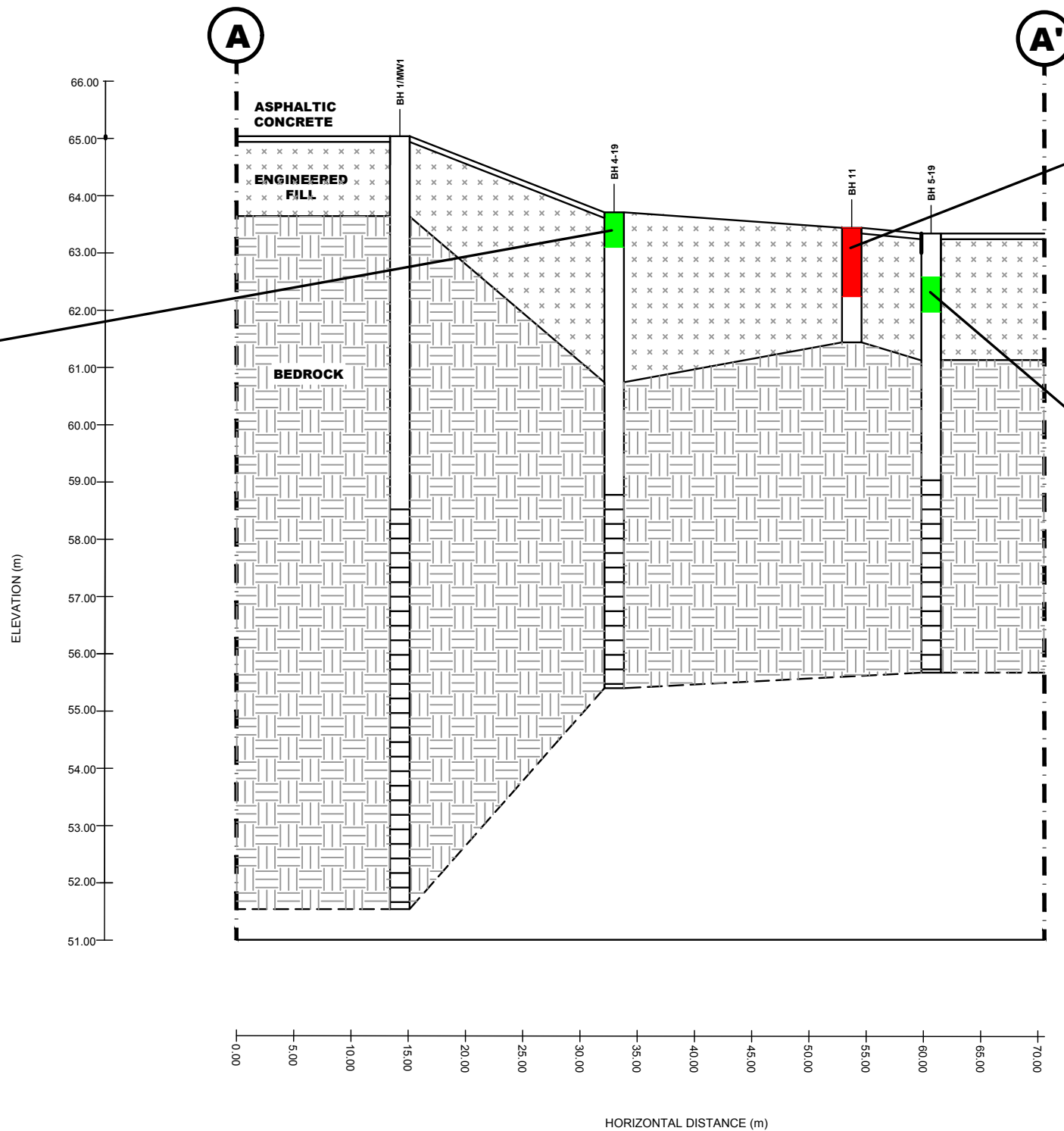
2070 SCOTT STREET

OTTAWA, ONTARIO

Title:

**CROSS SECTION A-A- SOIL (PAH)**

Scale:	1:500	Date:	08/2019
Drawn by:	YA	Report No.:	PE4435-2
Checked by:	NS	Dwg. No.:	<b>PE4435-6B</b>
Approved by:	MSD	Revision No.:	0



BH4-19 - AU1 (0.0-0.61m) May 15, 2019  
Metals comply with MECP Table 7

BH11-11-1	(0.0-1.20m)	April 5, 2013
Parameter	Results (ug/g)	MECP (ug/g)
Cadmium	2.1	1.9
Lead	220	120
Remaining Metals comply with MECP Table 7		

BH5-19 - SS2 (0.76-1.37m) May 15, 2019  
Metals comply with MECP Table 7

LEGEND:

SOIL RESULT IN COMPLIANCE WITH MECP TABLE 7 STANDARDS

SOIL RESULTS EXCEED MECP TABLE 7 STANDARDS

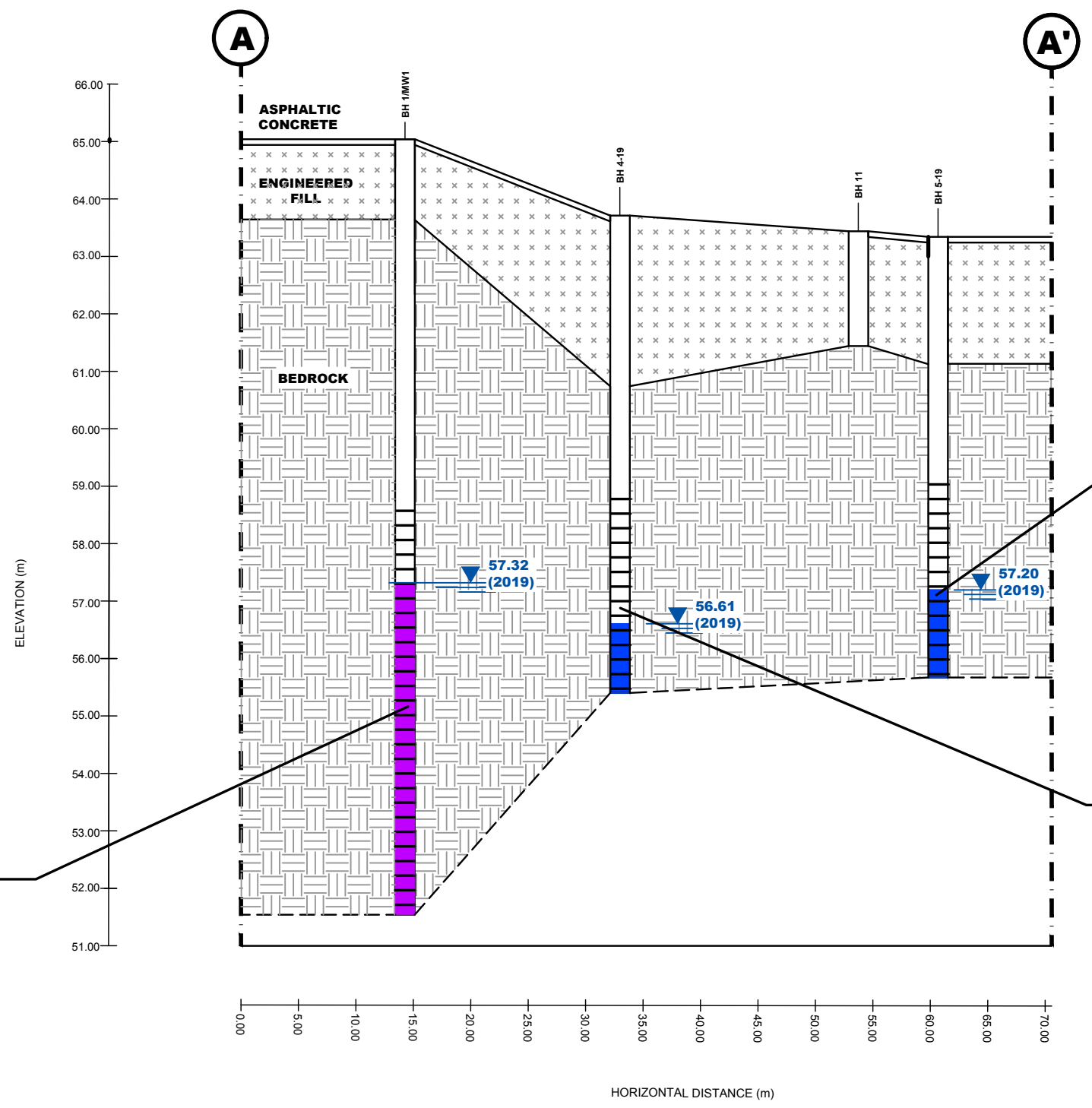
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NO.	REVISIONS	DATE	INITIAL

WESTBORO POINT DEVELOPMENTS LTD.	
PHASE II - ENVIRONMENTAL SITE ASSESSMENT	
2070 SCOTT STREET	
OTTAWA,	ONTARIO
Title: CROSS SECTION A-A- SOIL (METALS)	

Scale:	1:500	Date:	08/2019
Drawn by:	YA	Report No.:	PE4435-2
Checked by:	NS	Dwg. No.:	PE4435-6C
Approved by:	MSD	Revision No.:	0



BH5-19 - GW1 (4.62-7.67m) May 22, 2019  
 BTEX comply with MECP Table 7

BH4-19 - GW1 (5.26-8.31m) May 29, 2019  
 BTEX comply with MECP Table 7

BH/MW1-MW1	(7.50-13.50m)	April 11, 2013
Parameter	Results (ug/L)	MECP (ug/L)
Benzene	2.7	0.5
Ethylbenzene	86	54
Total Xylenes	100	72
Remaining BTEX comply with MECP Table 7		
BH1-GW2	(7.50-13.50m)	May 22, 2019
Parameter	Results (ug/L)	MECP (ug/L)
Benzene	4.1	0.5
Remaining BTEX comply with MECP Table 7		

**LEGEND:**

GROUNDWATER PARAMETERS COMPLY WITH MECP TABLE 7 STANDARDS

GROUNDWATER PARAMETERS EXCEED MECP TABLE 7 STANDARDS

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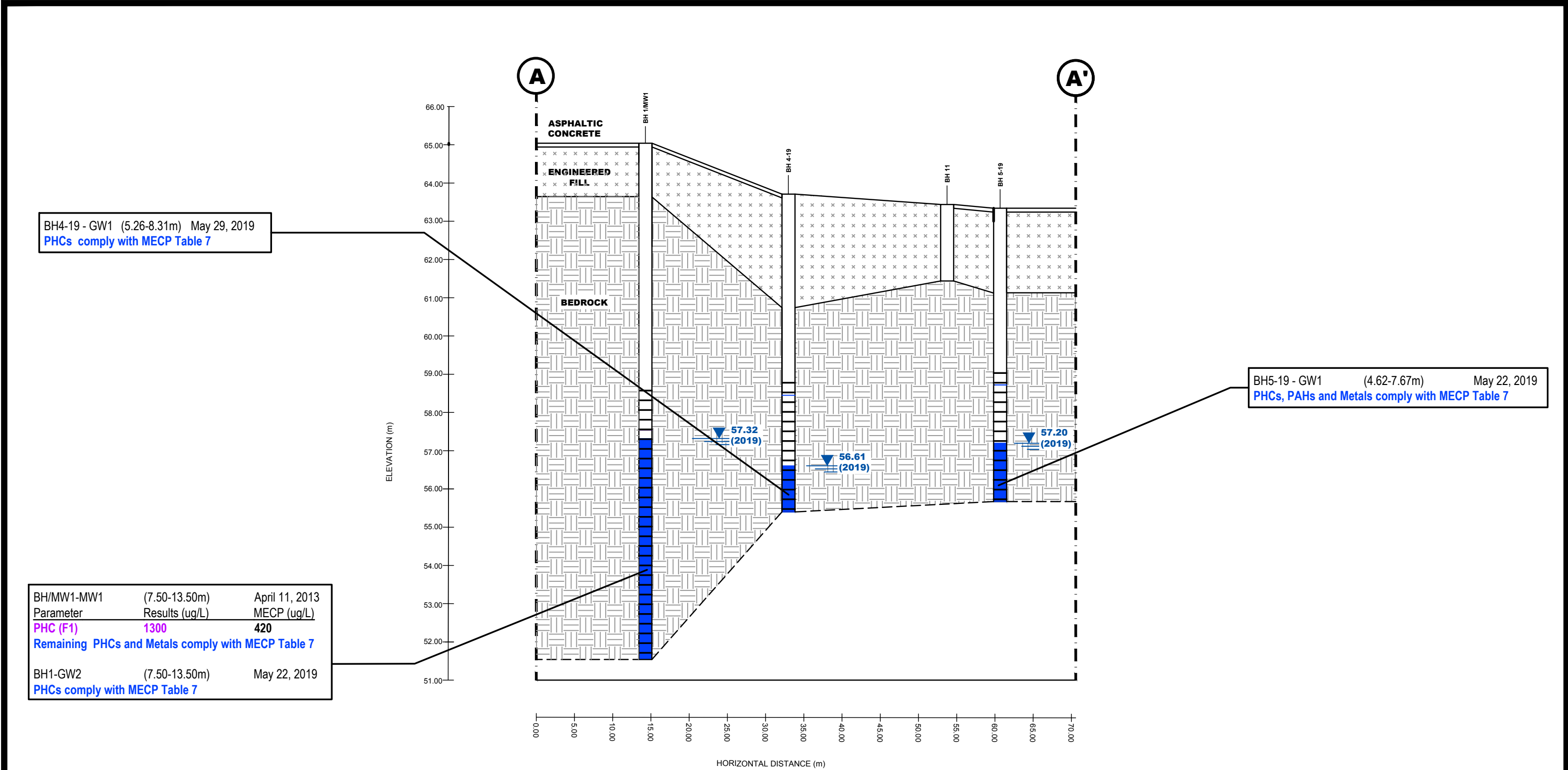
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 2070 SCOTT STREET  
 OTTAWA, ONTARIO

Title: **CROSS SECTION A-A- GROUNDWATER (BTEX)**

Scale:	1:500	Date:	08/2019
Drawn by:	YA	Report No.:	PE4435-2
Checked by:	NS	Dwg. No.:	<b>PE4435-7A</b>
Approved by:	MSD	Revision No.:	0

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**LEGEND:**

GROUNDWATER PARAMETERS COMPLY WITH MECP TABLE 7 STANDARDS

GROUNDWATER PARAMETERS EXCEED MECP TABLE 7 STANDARDS

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						Drawn by:	YA	Report No.:	PE4435-2
						Checked by:	NS	Dwg. No.:	PE4435-7B
						Approved by:	MSD	Revision No.:	0
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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**

**paterson**group

## **Sampling & Analysis Plan**

Phase II Environmental Site Assessment  
2070 Scott Street  
Ottawa, Ontario

**Prepared For**

Westboro Point Developments Ltd.

### **Paterson Group Inc.**

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**May 1, 2019**

Report: PE4435-SAP

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## Table of Contents

1.0	SAMPLING PROGRAM .....	1
2.0	ANALYTICAL TESTING PROGRAM.....	2
3.0	STANDARD OPERATING PROCEDURES .....	3
3.1	Environmental Drilling Procedure .....	3
3.2	Monitoring Well Installation Procedure .....	6
3.3	Monitoring Well Sampling Procedure .....	7
4.0	QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) .....	8
5.0	DATA QUALITY OBJECTIVES .....	9
6.0	PHYSICAL IMPEDIMENTS.....	10



## 1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by Westboro Point Developments Ltd. to conduct a Phase II Environmental Site Assessment (Phase II ESA) for the property addressed 2070 Scott Street, Ottawa, Ontario. Based on a Phase I ESA previously completed by Paterson for the subject property, the following subsurface investigation program, consisting of borehole drilling, was developed:

Borehole	Location & Rationale	Proposed Depth & Rationale
BH4-19	West-central portion of the property; to address potential concerns associated with the former on-site retail fuel outlet.	6-10 m; to intercept the groundwater table for the purpose of installing a groundwater monitoring well.
BH5-19	Northeastern portion of the property; to address potential concerns associated with the former on-site auto service garage.	6-10 m; to intercept the groundwater table for the purpose of installing a groundwater monitoring well.
BH6-19	East-central portion of the property; to address potential concerns associated with the former on-site auto service garage.	6-10 m; to intercept the groundwater table for the purpose of installing a groundwater monitoring well.

Borehole locations are shown on the Test Hole Location Plan appended to the main report.

At each borehole, split-spoon samples of the 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 BH4-19, BH5-19 and BH6-19 for the collection of groundwater samples. Three (3) groundwater samples will be collected from the monitoring wells, and one (1) additional sample will be collected from BH1/MW1 (previously installed by Franz Environmental Inc. during a 2013 Phase II ESA conducted on the property), if sufficient groundwater is present, for a total of four (4) groundwater samples.

## 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 MECP 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 and orientations of boreholes with respect to site features (buildings, roadways, etc.) must be provided. Distances should be measured using a measuring tape or wheel rather than paced off. Ground surface elevations at each borehole should be surveyed relative to a geodetic benchmark, if one is available, or a temporary site benchmark which can be tied in at a later date if necessary.

## **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" threaded sections of Schedule 40 PVC slotted well screen (5' x 1 1/4" if installing in cored hole in bedrock)
- ☐ 5' x 2" threaded sections of Schedule 40 PVC riser pipe (5' x 1 1/4" 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 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 MOE 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

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

**DATUM** BM - Top spindle of fire hydrant located on the west side of Churchill Avenue, along the west property line. Geodetic elevation = 66.18m.

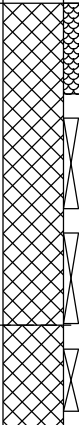



**REMARKS**

**BORINGS BY** CME 55 Power Auger

**DATE** 2019 May 15

**FILE NO.**  
**PE4435**

**HOLE NO.**  
**BH 4-19**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction	
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			● Volatile Organic Rdg. (ppm)	○ Lower Explosive Limit %				
GROUND SURFACE								20	40	60	80		
FILL: Brown silty sand and gravel		AU	1			0	63.71	△					
		SS	2	21	6	1	62.71	△					
		SS	3	54	53	2	61.71	△					
		SS	4	56	50+			△					
FILL: Brown silty sand with crushed stone													
BEDROCK: Grey limestone		RC	1	88	45	3	60.71						
						4	59.71						
		RC	2	100	75	5	58.71						
						6	57.71						
		RC	3	100	26	7	56.71						
		RC	4	100	58	8	55.71						
End of Borehole													
(GWL @ 7.10m - May 22, 2019)													
								100	200	300	400	500	
								RKI Eagle Rdg. (ppm)					
								▲ Full Gas Resp. △ Methane Elim.					

**DATUM** BM - Top spindle of fire hydrant located on the west side of Churchill Avenue, along the west property line. Geodetic elevation = 66.18m.

**REMARKS**

**BORINGS BY** CME 55 Power Auger

**DATE** 2019 May 15

**FILE NO.**  
**PE4435**

**HOLE NO.**  
**BH 5-19**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			● Volatile Organic Rdg. (ppm)	○ Lower Explosive Limit %			
GROUND SURFACE								20	40	60	80	
Asphaltic concrete	0.13	AU	1			0	63.34	△				
FILL: Brown silty sand		SS	2	46	11	1	62.34	△				
	1.37	SS	3	24	3	2	61.34	△				
FILL: Brown silty sand, some clay, trace brick		RC	1	100	39							
	2.21	RC	2	100	52	3	60.34					
		RC	3	100	56	4	59.34					
BEDROCK: Grey limestone		RC	4	100	73	5	58.34					
		RC	5	100	38	6	57.34					
						7	56.34					
End of Borehole	7.67											
(GWL @ 6.14m - May 22, 2019)												
								100	200	300	400	500
								RKI Eagle Rdg. (ppm)				
								▲ Full Gas Resp. △ Methane Elim.				

**DATUM** BM - Top spindle of fire hydrant located on the west side of Churchill Avenue, along the west property line. Geodetic elevation = 66.18m.

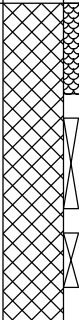


**REMARKS**

**BORINGS BY** CME 55 Power Auger

**DATE** 2019 May 15

**FILE NO.**  
**PE4435**

**HOLE NO.**  
**BH 6-19**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction	
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			● Volatile Organic Rdg. (ppm)	○ Lower Explosive Limit %				
GROUND SURFACE								20	40	60	80		
FILL: Brown silty sand and crushed rock, some concrete		AU	1			0	62.99	△					
		SS	2	25	13	1	61.99	△					
		SS	3	64	50+			△					
2.13					2	60.99							
BEDROCK: Grey limestone		RC	1	100	20								
		RC	2	100	64	3	59.99						
		RC	3	98	60	4	58.99						
		RC	4	100	85	5	57.99						
		RC	5	100	74	6	56.99						
						7	55.99						
7.75													
End of Borehole													
(GWL @ 5.82m - May 22, 2019)													
								100	200	300	400	500	
								RKI Eagle Rdg. (ppm)					
								▲ Full Gas Resp. △ Methane Elim.					

# 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 = $(D_{30})^2 / (D_{10} \times D_{60})$
Cu	-	Uniformity coefficient = $D_{60} / D_{10}$

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		Overconsolidation 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)

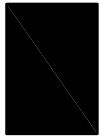
### PERMEABILITY TEST

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.
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## SYMBOLS AND TERMS (continued)

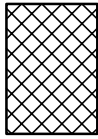
### STRATA PLOT



Topsoil



Asphalt



Fill



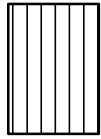
Peat



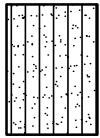
Sand



Silty Sand



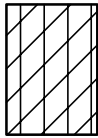
Silt



Sandy Silt



Clay



Silty Clay



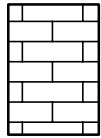
Clayey Silty Sand



Glacial Till



Shale



Bedrock

### MONITORING WELL AND PIEZOMETER CONSTRUCTION

#### MONITORING WELL CONSTRUCTION



#### PIEZOMETER CONSTRUCTION



## Certificate of Analysis

### Paterson Group Consulting Engineers

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

Client PO: 26491  
Project: PE4435  
Custody: 122124

Report Date: 23-May-2019  
Order Date: 16-May-2019

**Order #: 1920640**

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

Paracel ID	Client ID
1920640-01	BH4-19 AU1
1920640-02	BH4-19 SS4
1920640-03	BH5-19 SS2
1920640-04	BH6-19-SS2

Approved By:



Mark Foto, M.Sc.  
Lab Supervisor

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26491

Report Date: 23-May-2019

Order Date: 16-May-2019

Project Description: PE4435

## Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	17-May-19	21-May-19
Chromium, hexavalent - soil	MOE E3056 - Extraction, colourimetric	17-May-19	22-May-19
Mercury by CVAA	EPA 7471B - CVAA, digestion	22-May-19	22-May-19
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	17-May-19	18-May-19
PHC F1	CWS Tier 1 - P&T GC-FID	17-May-19	21-May-19
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	17-May-19	21-May-19
REG 153: Metals by ICP/MS, soil	EPA 6020 - Digestion - ICP-MS	22-May-19	22-May-19
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	17-May-19	18-May-19
Solids, %	Gravimetric, calculation	21-May-19	21-May-19

Certificate of Analysis

Report Date: 23-May-2019

Client: Paterson Group Consulting Engineers

Order Date: 16-May-2019

Client PO: 26491

Project Description: PE4435

Client ID:	BH4-19 AU1	BH4-19 SS4	BH5-19 SS2	BH6-19-SS2
Sample Date:	15-May-19 10:00	15-May-19 10:00	15-May-19 10:00	15-May-19 10:00
Sample ID:	1920640-01	1920640-02	1920640-03	1920640-04
MDL/Units	Soil	Soil	Soil	Soil

#### Physical Characteristics

% Solids	0.1 % by Wt.	93.8	92.8	88.6	91.3
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#### General Inorganics

pH	0.05 pH Units	-	7.80	-	8.15
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#### Metals

Antimony	1.0 ug/g dry	<1.0	-	<1.0	9.1
Arsenic	1.0 ug/g dry	2.6	-	3.3	14.2
Barium	1.0 ug/g dry	67.2	-	132	218
Beryllium	0.5 ug/g dry	<0.5	-	<0.5	<0.5
Boron	5.0 ug/g dry	9.9	-	<5.0	26.5
Cadmium	0.5 ug/g dry	<0.5	-	<0.5	1.5
Chromium	5.0 ug/g dry	14.8	-	55.8	245
Chromium (VI)	0.2 ug/g dry	<0.2	-	<0.2	<0.2
Cobalt	1.0 ug/g dry	6.8	-	11.0	11.7
Copper	5.0 ug/g dry	13.9	-	25.7	264
Lead	1.0 ug/g dry	11.3	-	6.3	472
Mercury	0.1 ug/g dry	<0.1	-	<0.1	0.2
Molybdenum	1.0 ug/g dry	<1.0	-	<1.0	11.3
Nickel	5.0 ug/g dry	12.0	-	29.5	121
Selenium	1.0 ug/g dry	<1.0	-	<1.0	<1.0
Silver	0.3 ug/g dry	<0.3	-	<0.3	<0.3
Thallium	1.0 ug/g dry	<1.0	-	<1.0	<1.0
Uranium	1.0 ug/g dry	<1.0	-	<1.0	<1.0
Vanadium	10.0 ug/g dry	19.3	-	57.6	48.6
Zinc	20.0 ug/g dry	25.7	-	59.0	363

#### Volatiles

Benzene	0.02 ug/g dry	-	<0.02	<0.02	<0.02
Ethylbenzene	0.05 ug/g dry	-	<0.05	<0.05	<0.05
Toluene	0.05 ug/g dry	-	<0.05	<0.05	<0.05
m,p-Xylenes	0.05 ug/g dry	-	<0.05	<0.05	<0.05
o-Xylene	0.05 ug/g dry	-	<0.05	<0.05	<0.05
Xylenes, total	0.05 ug/g dry	-	<0.05	<0.05	<0.05
Toluene-d8	Surrogate	-	104%	105%	108%

#### Hydrocarbons

F1 PHCs (C6-C10)	7 ug/g dry	-	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	-	<4	<4	7

Certificate of Analysis

Report Date: 23-May-2019

Client: Paterson Group Consulting Engineers

Order Date: 16-May-2019

Client PO: 26491

Project Description: PE4435

	Client ID: Sample Date: Sample ID:	BH4-19 AU1 15-May-19 10:00 1920640-01 Soil	BH4-19 SS4 15-May-19 10:00 1920640-02 Soil	BH5-19 SS2 15-May-19 10:00 1920640-03 Soil	BH6-19-SS2 15-May-19 10:00 1920640-04 Soil
	MDL/Units				
F3 PHCs (C16-C34)	8 ug/g dry	-	<8	36	110
F4 PHCs (C34-C50)	6 ug/g dry	-	<6	54	58

#### Semi-Volatiles

Acenaphthene	0.02 ug/g dry	<0.02	-	<0.02	0.04
Acenaphthylene	0.02 ug/g dry	<0.02	-	0.05	0.03
Anthracene	0.02 ug/g dry	<0.02	-	0.03	0.06
Benzo [a] anthracene	0.02 ug/g dry	0.02	-	0.08	0.10
Benzo [a] pyrene	0.02 ug/g dry	<0.02	-	0.09	0.08
Benzo [b] fluoranthene	0.02 ug/g dry	0.02	-	0.08	0.14
Benzo [g,h,i] perylene	0.02 ug/g dry	<0.02	-	0.06	0.06
Benzo [k] fluoranthene	0.02 ug/g dry	<0.02	-	0.04	0.07
Chrysene	0.02 ug/g dry	0.02	-	0.09	0.14
Dibenzo [a,h] anthracene	0.02 ug/g dry	<0.02	-	<0.02	<0.02
Fluoranthene	0.02 ug/g dry	0.04	-	0.14	0.25
Fluorene	0.02 ug/g dry	<0.02	-	<0.02	0.02
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	<0.02	-	0.06	0.05
1-Methylnaphthalene	0.02 ug/g dry	<0.02	-	<0.02	0.03
2-Methylnaphthalene	0.02 ug/g dry	<0.02	-	<0.02	0.05
Methylnaphthalene (1&2)	0.04 ug/g dry	<0.04	-	<0.04	0.08
Naphthalene	0.01 ug/g dry	<0.01	-	<0.01	0.03
Phenanthrene	0.02 ug/g dry	0.02	-	0.04	0.24
Pyrene	0.02 ug/g dry	0.04	-	0.12	0.21
2-Fluorobiphenyl	Surrogate	109%	-	110%	108%
Terphenyl-d14	Surrogate	126%	-	115%	111%

Certificate of Analysis

Report Date: 23-May-2019

Client: Paterson Group Consulting Engineers

Order Date: 16-May-2019

Client PO: 26491

Project Description: PE4435

## Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>Hydrocarbons</b>									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
<b>Metals</b>									
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 (VI)	ND	0.2	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						
Mercury	ND	0.1	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						
<b>Semi-Volatiles</b>									
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	1.03		ug/g		77.1	50-140			
Surrogate: Terphenyl-d14	1.33		ug/g		100	50-140			
<b>Volatiles</b>									
Benzene	ND	0.02	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: Toluene-d8	8.22		ug/g		103	50-140			

Certificate of Analysis

Report Date: 23-May-2019

Client: Paterson Group Consulting Engineers

Order Date: 16-May-2019

Client PO: 26491

Project Description: PE4435

## Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>General Inorganics</b>									
pH	7.70	0.05	pH Units	7.62			1.0	10	
<b>Hydrocarbons</b>									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND				30	
F3 PHCs (C16-C34)	ND	8	ug/g dry	ND				30	
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND				30	
<b>Metals</b>									
Antimony	ND	1.0	ug/g dry	ND			0.0	30	
Arsenic	3.1	1.0	ug/g dry	2.6			16.5	30	
Barium	76.6	1.0	ug/g dry	67.2			13.0	30	
Beryllium	ND	0.5	ug/g dry	ND			0.0	30	
Boron	11.7	5.0	ug/g dry	9.9			16.4	30	
Cadmium	ND	0.5	ug/g dry	ND			0.0	30	
Chromium (VI)	ND	0.2	ug/g dry	ND				35	
Chromium	17.5	5.0	ug/g dry	14.8			16.6	30	
Cobalt	7.7	1.0	ug/g dry	6.8			11.5	30	
Copper	17.0	5.0	ug/g dry	13.9			19.8	30	
Lead	12.5	1.0	ug/g dry	11.3			10.2	30	
Mercury	ND	0.1	ug/g dry	ND			0.0	30	
Molybdenum	ND	1.0	ug/g dry	ND			0.0	30	
Nickel	13.5	5.0	ug/g dry	12.0			12.4	30	
Selenium	ND	1.0	ug/g dry	ND			0.0	30	
Silver	ND	0.3	ug/g dry	ND			0.0	30	
Thallium	ND	1.0	ug/g dry	ND			0.0	30	
Uranium	ND	1.0	ug/g dry	ND			0.0	30	
Vanadium	21.9	10.0	ug/g dry	19.3			12.5	30	
Zinc	28.8	20.0	ug/g dry	25.7			11.5	30	
<b>Physical Characteristics</b>									
% Solids	89.4	0.1	% by Wt.	89.8			0.4	25	
<b>Semi-Volatiles</b>									
Acenaphthene	ND	0.02	ug/g dry	ND				40	
Acenaphthylene	ND	0.02	ug/g dry	ND				40	
Anthracene	ND	0.02	ug/g dry	ND			0.0	40	
Benzo [a] anthracene	ND	0.02	ug/g dry	ND			0.0	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			0.0	40	
Benzo [k] fluoranthene	ND	0.02	ug/g dry	ND				40	
Chrysene	ND	0.02	ug/g dry	ND			0.0	40	
Dibenzo [a,h] anthracene	ND	0.02	ug/g dry	ND				40	
Fluoranthene	ND	0.02	ug/g dry	ND			0.0	40	
Fluorene	ND	0.02	ug/g dry	ND				40	
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g dry	ND			0.0	40	
1-Methylnaphthalene	ND	0.02	ug/g dry	ND				40	
2-Methylnaphthalene	ND	0.02	ug/g dry	ND				40	
Naphthalene	ND	0.01	ug/g dry	ND				40	
Phenanthrene	ND	0.02	ug/g dry	ND				40	
Pyrene	ND	0.02	ug/g dry	ND			0.0	40	
Surrogate: 2-Fluorobiphenyl	1.15		ug/g dry		68.5	50-140			
Surrogate: Terphenyl-d14	1.85		ug/g dry		110	50-140			
<b>Volatiles</b>									
Benzene	ND	0.02	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26491

Report Date: 23-May-2019

Order Date: 16-May-2019

Project Description: PE4435

### Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Surrogate: Toluene-d8	11.2		ug/g dry		110	50-140			



Certificate of Analysis

Report Date: 23-May-2019

Client: Paterson Group Consulting Engineers

Order Date: 16-May-2019

Client PO: 26491

Project Description: PE4435

## Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>Hydrocarbons</b>									
F1 PHCs (C6-C10)	186	7	ug/g		92.8	80-120			
F2 PHCs (C10-C16)	94	4	ug/g	ND	109	60-140			
F3 PHCs (C16-C34)	237	8	ug/g	ND	112	60-140			
F4 PHCs (C34-C50)	126	6	ug/g	ND	94.2	60-140			
<b>Metals</b>									
Antimony	42.7		ug/L	ND	85.3	70-130			
Arsenic	50.5		ug/L	1.0	98.9	70-130			
Barium	76.3		ug/L	26.9	98.9	70-130			
Beryllium	48.3		ug/L	ND	96.3	70-130			
Boron	48.1		ug/L	ND	88.3	70-130			
Cadmium	46.5		ug/L	ND	93.0	70-130			
Chromium (VI)	0.1		mg/L	ND	52.5	70-130			QM-01
Chromium	57.4		ug/L	5.9	103	70-130			
Cobalt	51.5		ug/L	2.7	97.6	70-130			
Copper	54.8		ug/L	5.6	98.5	70-130			
Lead	48.6		ug/L	4.5	88.2	70-130			
Mercury	1.59	0.1	ug/g	ND	106	70-130			
Molybdenum	49.2		ug/L	ND	97.9	70-130			
Nickel	54.5		ug/L	ND	99.5	70-130			
Selenium	47.2		ug/L	ND	94.1	70-130			
Silver	44.8		ug/L	ND	89.5	70-130			
Thallium	46.8		ug/L	ND	93.5	70-130			
Uranium	48.8		ug/L	ND	97.3	70-130			
Vanadium	62.2		ug/L	ND	109	70-130			
Zinc	59.4		ug/L	ND	98.2	70-130			
<b>Semi-Volatiles</b>									
Acenaphthene	0.174	0.02	ug/g	ND	82.7	50-140			
Acenaphthylene	0.169	0.02	ug/g	ND	80.5	50-140			
Anthracene	0.229	0.02	ug/g	ND	109	50-140			
Benzo [a] anthracene	0.196	0.02	ug/g	ND	93.3	50-140			
Benzo [a] pyrene	0.156	0.02	ug/g	ND	74.1	50-140			
Benzo [b] fluoranthene	0.237	0.02	ug/g	ND	113	50-140			
Benzo [g,h,i] perylene	0.148	0.02	ug/g	ND	70.5	50-140			
Benzo [k] fluoranthene	0.205	0.02	ug/g	ND	97.9	50-140			
Chrysene	0.208	0.02	ug/g	ND	98.9	50-140			
Dibenzo [a,h] anthracene	0.145	0.02	ug/g	ND	69.0	50-140			
Fluoranthene	0.218	0.02	ug/g	ND	104	50-140			
Fluorene	0.188	0.02	ug/g	ND	89.6	50-140			
Indeno [1,2,3-cd] pyrene	0.156	0.02	ug/g	ND	74.3	50-140			
1-Methylnaphthalene	0.153	0.02	ug/g	ND	72.8	50-140			
2-Methylnaphthalene	0.179	0.02	ug/g	ND	85.4	50-140			
Naphthalene	0.159	0.01	ug/g	ND	75.8	50-140			
Phenanthrene	0.212	0.02	ug/g	ND	101	50-140			
Pyrene	0.212	0.02	ug/g	ND	101	50-140			
Surrogate: 2-Fluorobiphenyl	1.36		ug/g		80.9	50-140			
<b>Volatiles</b>									
Benzene	3.36	0.02	ug/g		84.0	60-130			
Ethylbenzene	3.09	0.05	ug/g		77.3	60-130			
Toluene	3.39	0.05	ug/g		84.8	60-130			
m,p-Xylenes	6.32	0.05	ug/g		79.0	60-130			

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26491

Report Date: 23-May-2019

Order Date: 16-May-2019

Project Description: PE4435

### Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
o-Xylene	3.34	0.05	ug/g		83.4	60-130			

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26491

Report Date: 23-May-2019

Order Date: 16-May-2019

Project Description: PE4435

**Qualifier Notes:****QC Qualifiers :**

QM-01 : The spike recovery for this QC sample is outside of established control limits due to sample matrix interference.

**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.



## Certificate of Analysis

### Paterson Group Consulting Engineers

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

Client PO: 26739  
Project: PE4435  
Custody: 122136

Report Date: 30-May-2019  
Order Date: 23-May-2019

**Order #: 1921379**

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

Paracel ID	Client ID
1921379-01	BH1-GW2
1921379-02	BH5-19-GW1
1921379-03	BH6-19-GW1
1921379-04	DUP

Approved By:



Mark Foto, M.Sc.  
Lab Supervisor

Certificate of Analysis

**Client: Paterson Group Consulting Engineers**

**Client PO: 26739**

Report Date: 30-May-2019

Order Date: 23-May-2019

**Project Description: PE4435**

## Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	27-May-19	27-May-19
Chromium, hexavalent - water	MOE E3056 - colourimetric	27-May-19	27-May-19
Mercury by CVAA	EPA 245.2 - Cold Vapour AA	27-May-19	27-May-19
Metals, ICP-MS	EPA 200.8 - ICP-MS	28-May-19	29-May-19
PHC F1	CWS Tier 1 - P&T GC-FID	25-May-19	27-May-19
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	26-May-19	27-May-19
REG 153: PAHs by GC-MS	EPA 625 - GC-MS, extraction	29-May-19	30-May-19

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26739

Report Date: 30-May-2019

Order Date: 23-May-2019

Project Description: PE4435

Client ID:	BH1-GW2	BH5-19-GW1	BH6-19-GW1	DUP
Sample Date:	22-May-19 11:45	22-May-19 13:10	22-May-19 13:50	22-May-19 13:50
Sample ID:	1921379-01	1921379-02	1921379-03	1921379-04
MDL/Units	Water	Water	Water	Water

**Metals**

Mercury	0.1 ug/L	-	<0.1	<0.1	-
Antimony	0.5 ug/L	-	<0.5	<0.5	-
Arsenic	1 ug/L	-	<1	<1	-
Barium	1 ug/L	-	52	55	-
Beryllium	0.5 ug/L	-	<0.5	<0.5	-
Boron	10 ug/L	-	101	161	-
Cadmium	0.1 ug/L	-	<0.1	<0.1	-
Chromium	1 ug/L	-	<1	<1	-
Chromium (VI)	10 ug/L	-	<10	<10	-
Cobalt	0.5 ug/L	-	1.0	<0.5	-
Copper	0.5 ug/L	-	2.0	2.1	-
Lead	0.1 ug/L	-	0.1	<0.1	-
Molybdenum	0.5 ug/L	-	3.3	2.5	-
Nickel	1 ug/L	-	6	3	-
Selenium	1 ug/L	-	<1	<1	-
Silver	0.1 ug/L	-	<0.1	<0.1	-
Sodium	200 ug/L	-	826000	188000	-
Thallium	0.1 ug/L	-	0.3	0.2	-
Uranium	0.1 ug/L	-	2.7	2.9	-
Vanadium	0.5 ug/L	-	<0.5	<0.5	-
Zinc	5 ug/L	-	<5	8	-

**Volatiles**

Benzene	0.5 ug/L	4.1	<0.5	<0.5	<0.5
Ethylbenzene	0.5 ug/L	5.0	<0.5	<0.5	<0.5
Toluene	0.5 ug/L	1.4	<0.5	<0.5	<0.5
m,p-Xylenes	0.5 ug/L	1.9	<0.5	<0.5	<0.5
o-Xylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Xylenes, total	0.5 ug/L	1.9	<0.5	<0.5	<0.5
Toluene-d8	Surrogate	102%	101%	101%	104%

**Hydrocarbons**

F1 PHCs (C6-C10)	25 ug/L	308	<25	<25	-
F2 PHCs (C10-C16)	100 ug/L	<100	<100	<100	-
F3 PHCs (C16-C34)	100 ug/L	<100	<100	<100	-
F4 PHCs (C34-C50)	100 ug/L	<100	<100	<100	-

**Semi-Volatiles**



Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26739

Report Date: 30-May-2019

Order Date: 23-May-2019

Project Description: PE4435

	Client ID: Sample Date: Sample ID:	BH1-GW2 22-May-19 11:45 1921379-01 Water	BH5-19-GW1 22-May-19 13:10 1921379-02 Water	BH6-19-GW1 22-May-19 13:50 1921379-03 Water	DUP 22-May-19 13:50 1921379-04 Water
	MDL/Units				
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	-
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	-	91.1%	84.3%	-
Terphenyl-d14	Surrogate	-	118%	115%	-



Certificate of Analysis

Report Date: 30-May-2019

Client: Paterson Group Consulting Engineers

Order Date: 23-May-2019

Client PO: 26739

Project Description: PE4435

## Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>Hydrocarbons</b>									
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						
<b>Metals</b>									
Mercury	ND	0.1	ug/L						
Antimony	ND	0.5	ug/L						
Arsenic	ND	1	ug/L						
Barium	ND	1	ug/L						
Beryllium	ND	0.5	ug/L						
Boron	ND	10	ug/L						
Cadmium	ND	0.1	ug/L						
Chromium (VI)	ND	10	ug/L						
Chromium	ND	1	ug/L						
Cobalt	ND	0.5	ug/L						
Copper	ND	0.5	ug/L						
Lead	ND	0.1	ug/L						
Molybdenum	ND	0.5	ug/L						
Nickel	ND	1	ug/L						
Selenium	ND	1	ug/L						
Silver	ND	0.1	ug/L						
Sodium	ND	200	ug/L						
Thallium	ND	0.1	ug/L						
Uranium	ND	0.1	ug/L						
Vanadium	ND	0.5	ug/L						
Zinc	ND	5	ug/L						
<b>Semi-Volatiles</b>									
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	17.9		ug/L		89.4	50-140			
Surrogate: Terphenyl-d14	21.1		ug/L		105	50-140			
<b>Volatiles</b>									
Benzene	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Toluene	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: Toluene-d8	81.1		ug/L		101	50-140			

Certificate of Analysis

Report Date: 30-May-2019

Client: Paterson Group Consulting Engineers

Order Date: 23-May-2019

Client PO: 26739

Project Description: PE4435

### Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>Hydrocarbons</b>									
F1 PHCs (C6-C10)	ND	25	ug/L	ND				30	
<b>Metals</b>									
Mercury	ND	0.1	ug/L	ND			0.0	20	
Antimony	ND	0.5	ug/L	ND				20	
Arsenic	ND	1	ug/L	ND			0.0	20	
Barium	51.4	1	ug/L	52.4			1.9	20	
Beryllium	ND	0.5	ug/L	ND			0.0	20	
Boron	121	10	ug/L	101			18.8	20	
Cadmium	ND	0.1	ug/L	ND			0.0	20	
Chromium (VI)	ND	10	ug/L	ND				20	
Chromium	ND	1	ug/L	ND			0.0	20	
Cobalt	0.99	0.5	ug/L	1.03			3.6	20	
Copper	2.01	0.5	ug/L	2.02			0.6	20	
Lead	0.13	0.1	ug/L	0.11			15.2	20	
Molybdenum	3.29	0.5	ug/L	3.35			1.7	20	
Nickel	6.2	1	ug/L	6.0			2.8	20	
Selenium	ND	1	ug/L	ND			0.0	20	
Silver	0.12	0.1	ug/L	ND			0.0	20	
Sodium	ND	200	ug/L	826000			0.0	20	
Thallium	0.26	0.1	ug/L	0.27			3.9	20	
Uranium	2.4	0.1	ug/L	2.7			11.0	20	
Vanadium	ND	0.5	ug/L	ND			0.0	20	
Zinc	ND	5	ug/L	ND			0.0	20	
<b>Volatiles</b>									
Benzene	ND	0.5	ug/L	ND				30	
Ethylbenzene	ND	0.5	ug/L	ND				30	
Toluene	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: Toluene-d8	78.0		ug/L		97.6	50-140			

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26739

Report Date: 30-May-2019

Order Date: 23-May-2019

Project Description: PE4435

## Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>Hydrocarbons</b>									
F1 PHCs (C6-C10)	1810	25	ug/L		90.5	68-117			
F2 PHCs (C10-C16)	1470	100	ug/L		91.9	60-140			
F3 PHCs (C16-C34)	3740	100	ug/L		95.4	60-140			
F4 PHCs (C34-C50)	1980	100	ug/L		80.0	60-140			
<b>Metals</b>									
Mercury	2.77	0.1	ug/L	ND	92.3	70-130			
Antimony	40.8		ug/L	ND	81.6	80-120			
Arsenic	51.2		ug/L	ND	102	80-120			
Barium	99.1		ug/L	52.4	93.4	80-120			
Beryllium	48.3		ug/L	ND	96.5	80-120			
Boron	145		ug/L	101	88.3	80-120			
Cadmium	43.6		ug/L	ND	87.2	80-120			
Chromium (VI)	164	10	ug/L	ND	82.0	70-130			
Chromium	59.9		ug/L	ND	119	80-120			
Cobalt	56.1		ug/L	1.03	110	80-120			
Copper	52.9		ug/L	2.02	102	80-120			
Lead	40.8		ug/L	0.11	81.4	80-120			
Molybdenum	52.0		ug/L	3.35	97.2	80-120			
Nickel	58.5		ug/L	6.0	105	80-120			
Selenium	44.9		ug/L	ND	88.1	80-120			
Silver	46.5		ug/L	ND	92.8	80-120			
Sodium	9950		ug/L		99.5	80-120			
Thallium	47.1		ug/L	0.27	93.6	80-120			
Uranium	54.9		ug/L	2.7	104	80-120			
Vanadium	52.2		ug/L		104	80-120			
Zinc	45		ug/L	5	80.6	80-120			
<b>Semi-Volatiles</b>									
Acenaphthene	5.31	0.05	ug/L		106	50-140			
Acenaphthylene	5.20	0.05	ug/L		104	50-140			
Anthracene	4.28	0.01	ug/L		85.6	50-140			
Benzo [a] anthracene	4.93	0.01	ug/L		98.5	50-140			
Benzo [a] pyrene	4.44	0.01	ug/L		88.8	50-140			
Benzo [b] fluoranthene	5.35	0.05	ug/L		107	50-140			
Benzo [g,h,i] perylene	3.87	0.05	ug/L		77.4	50-140			
Benzo [k] fluoranthene	4.85	0.05	ug/L		96.9	50-140			
Chrysene	5.12	0.05	ug/L		102	50-140			
Dibenzo [a,h] anthracene	4.32	0.05	ug/L		86.3	50-140			
Fluoranthene	4.53	0.01	ug/L		90.7	50-140			
Fluorene	4.68	0.05	ug/L		93.5	50-140			
Indeno [1,2,3-cd] pyrene	4.28	0.05	ug/L		85.6	50-140			
1-Methylnaphthalene	6.09	0.05	ug/L		122	50-140			
2-Methylnaphthalene	5.86	0.05	ug/L		117	50-140			
Naphthalene	5.75	0.05	ug/L		115	50-140			
Phenanthrene	4.13	0.05	ug/L		82.7	50-140			
Pyrene	4.70	0.01	ug/L		94.0	50-140			
Surrogate: 2-Fluorobiphenyl	23.0		ug/L		115	50-140			
<b>Volatiles</b>									
Benzene	28.7	0.5	ug/L		71.7	60-130			
Ethylbenzene	28.6	0.5	ug/L		71.4	60-130			
Toluene	29.6	0.5	ug/L		74.0	60-130			

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26739

Report Date: 30-May-2019

Order Date: 23-May-2019

Project Description: PE4435

### Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
m,p-Xylenes	65.0	0.5	ug/L		81.2	60-130			
o-Xylene	32.8	0.5	ug/L		81.9	60-130			

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26739

Report Date: 30-May-2019

Order Date: 23-May-2019

Project Description: PE4435

**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.


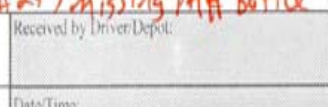
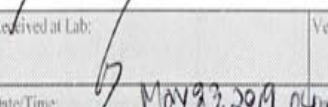
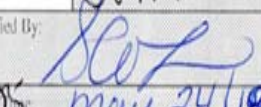
Client Name: Paterson Group	Project Reference: <del>PE4435</del> PE4435	Turnaround Time: <input type="checkbox"/> 1 Day <input type="checkbox"/> 3 Day <input type="checkbox"/> 2 Day <input checked="" type="checkbox"/> Regular Date Required:
Contact Name: Mark D'Arcy	Quote #	
Address: 154 Colonnade St. S	PO # 26739	
Telephone: (613) 226-7381	Email Address: mdcarcy@patersongroup.ca	

Criteria: ☒ O. Reg. 153/04 (As Amended) Table ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ☐ Other:

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

Paracel Order Number: 1921379			Sample Taken		Required Analyses									
Sample ID/Location Name	Matrix	Air Volume	# of Containers	Date	Time	PHCs F1-F4 + BTEX	VOCs	PAHs	Metals by ICP	Hg	Cd	B (HWS)	BTEX	
1 BH1 - GW2	GW	9	3	May 22/19	11:45am	✓								
2 BH5-19 - GW1	GW	9	7		1:10pm	✓	✓	✓	✓	✓				
3 BH6-19 - GW1	GW	9	7		1:50pm	✓	✓	✓	✓	✓				
4 DUP	GW	2			1:50pm	✓						✓		
5														
6														
7														
8														
9														
10														

Comments: Sample 1 missing PHC bottle, 2, 3 missing PAH bottle

Relinquished By (Sign):  Received by Driver/Depot:  Received at Lab:  Verified By: 

Relinquished By (Print): Date/Time: May 23, 2019 04:05 Date/Time: May 24/19

Date/Time: Temperature: °C Temperature: 19.8 °C pH Verified by: 2:40p

## Certificate of Analysis

### Paterson Group Consulting Engineers

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

Client PO: 26834  
Project: PE4435  
Custody: 122164

Report Date: 5-Jun-2019  
Order Date: 30-May-2019

**Order #: 1922498**

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

**Paracel ID**  
1922498-01

**Client ID**  
BH4-19-GW1

Approved By:



Dale Robertson, BSc  
Laboratory Director



Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26834

Report Date: 05-Jun-2019

Order Date: 30-May-2019

Project Description: PE4435

**Analysis Summary Table**

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	2-Jun-19	2-Jun-19
PHC F1	CWS Tier 1 - P&T GC-FID	31-May-19	2-Jun-19
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	4-Jun-19	5-Jun-19



**Certificate of Analysis**

**Client: Paterson Group Consulting Engineers**

**Client PO: 26834**

Report Date: 05-Jun-2019

Order Date: 30-May-2019

**Project Description: PE4435**

<b>Client ID:</b>	BH4-19-GW1	-	-	-
<b>Sample Date:</b>	29-May-19 14:30	-	-	-
<b>Sample ID:</b>	1922498-01	-	-	-
<b>MDL/Units</b>	Water	-	-	-

**Volatiles**

Benzene	0.5 ug/L	<0.5	-	-	-
Ethylbenzene	0.5 ug/L	<0.5	-	-	-
Toluene	0.5 ug/L	<0.5	-	-	-
m,p-Xylenes	0.5 ug/L	<0.5	-	-	-
o-Xylene	0.5 ug/L	<0.5	-	-	-
Xylenes, total	0.5 ug/L	<0.5	-	-	-
Toluene-d8	Surrogate	121%	-	-	-

**Hydrocarbons**

F1 PHCs (C6-C10)	25 ug/L	<25	-	-	-
F2 PHCs (C10-C16)	100 ug/L	<100	-	-	-
F3 PHCs (C16-C34)	100 ug/L	<100	-	-	-
F4 PHCs (C34-C50)	100 ug/L	<100	-	-	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26834

Report Date: 05-Jun-2019

Order Date: 30-May-2019

Project Description: PE4435

**Method Quality Control: Blank**

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>Hydrocarbons</b>									
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						
<b>Volatiles</b>									
Benzene	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Toluene	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: Toluene-d8	41.3		ug/L		129	50-140			

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26834

Report Date: 05-Jun-2019

Order Date: 30-May-2019

Project Description: PE4435

### Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>Hydrocarbons</b>									
F1 PHCs (C6-C10)	ND	25	ug/L	ND				30	
<b>Volatiles</b>									
Benzene	ND	0.5	ug/L	ND			0.0	30	
Ethylbenzene	ND	0.5	ug/L	ND			0.0	30	
Toluene	ND	0.5	ug/L	ND			0.0	30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: Toluene-d8	42.0		ug/L		131	50-140			

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26834

Report Date: 05-Jun-2019

Order Date: 30-May-2019

Project Description: PE4435

### Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>Hydrocarbons</b>									
F1 PHCs (C6-C10)	1770	25	ug/L		88.6	68-117			
F2 PHCs (C10-C16)	1250	100	ug/L		78.1	60-140			
F3 PHCs (C16-C34)	3360	100	ug/L		85.8	60-140			
F4 PHCs (C34-C50)	2060	100	ug/L		82.9	60-140			
<b>Volatiles</b>									
Benzene	43.5	0.5	ug/L		109	60-130			
Ethylbenzene	32.1	0.5	ug/L		80.4	60-130			
Toluene	41.6	0.5	ug/L		104	60-130			
m,p-Xylenes	83.7	0.5	ug/L		105	60-130			
o-Xylene	35.9	0.5	ug/L		89.7	60-130			
Surrogate: Toluene-d8	25.7		ug/L		80.3	50-140			

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26834

Report Date: 05-Jun-2019

Order Date: 30-May-2019

Project Description: PE4435

**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:***

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