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Phase II Environmental Site Assessment

2070 Scott Street
328 Winona Avenue
Ottawa, Ontario

Prepared For

Westboro Point Developments Ltd.

March 17, 2020

Report: PE4435-2R

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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_1-F_4), 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_1-F_4), 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 and 328 Winona Avenue, 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 revised Phase I ESA conducted by Paterson in March 2020.

1.1 Site Description

Address:	2070 Scott Street and 328 Winona Avenue, Ottawa, Ontario.
Legal Description:	Part of Lots 15, 16, 17 and 18, Registered Plan 37; in the City of Ottawa.
Property Identification Number(s):	04020-0215, 04020-0217
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^2 (approximate)
Zoning:	TM – Traditional Mainstreet Zone
	R4 – Residential 4th Density
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 and 328 Winona Avenue 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

2070 Scott Street is currently vacant and no buildings exist on the property. 328 Winona Avenue is currently occupied with a residential dwelling. It is our understanding that the subject property will be developed with a multi-storey residential building.

The proposed future use of 2070 Scott Street requires a Record of Site Condition. No change of land use will occur at 328 Winona Avenue, therefore a Record of Site Condition is not required for 328 Winona Avenue.

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 surface of 2070 Scott Street consists of sand and gravel with light vegetation, as well as paved asphaltic concrete on the east and west portions of the property. The surface of 328 Winona Avenue consists of landscaped and paved areas.

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 for 2070 Scott Street. 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_1) 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 potion 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.

Table 1
Areas of Potential Environmental Concern (APECs)

Area of Potential Environmental Concern	Location of APEC	Potentially Contaminating Activity (O.Reg 153/04 - Table 2)	Location of PCA	Contaminants of Potential Concern	Media Potentially Impacted
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_1 - F_4), 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

Based on available mapping information from NRCAN, 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.

Based on the results of previous subsurface investigations on the subject site, the groundwater is expected to be encountered in the bedrock approximately 3.0 to 7.0 m below the existing grade. Groundwater levels are expected to fluctuate throughout the year with seasonal variations.

Existing Buildings and Structures

2070 Scott Street is currently vacant and not developed with any existing buildings or structures. 328 Winona Avenue is developed with a residential dwelling.

Water Bodies

There are no water bodies present on the subject site or within the Phase I study area.

Areas of Natural Significance

There are no areas of natural and scientific interest on the subject site or within the Phase I study area.

Drinking Water Wells

The subject site is located within a municipally supplied 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.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

As per section 6.1 of this report, the following Potentially Contaminating Activities were identified on the subject site:

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

All three (3) of the PCAs identified on the subject site are considered to represent APECs with respect to the subject property.

The following PCAs were identified off of the subject site, yet within the Phase I study area:

- An existing auto service garage, located on the property addressed 2046 Scott Street, approximately 70 m northeast of the subject site.
- A former railway line (Canadian Pacific Railway Main Line) located immediately north of and parallel to Scott Street, approximately 25 m north of the subject site.
- A former lumber mill, with an associated railway line, coal storage shed, manufacturing centre for asphalt shingles, piling ground for lumber and shingles, storage warehouses and sheds, as well as one (1) underground fuel

tank, located on the property addressed 303 Churchill Avenue North, approximately 55 m north of the subject site.

- A former pump repair business with one (1) underground fuel tank, located on the property addressed 2050 Scott Street, approximately 55 m northeast of the subject site.
- A former storage building with one (1) underground fuel tank, located on the property addressed 2116 Scott Street, approximately 100 m west of the subject site.
- A former contractor's storage yard, located on the property addressed 306 Athlone Avenue, approximately 160 m northeast of the subject site.
- A former auto body repair shop, located on the property addressed 277 Richmond Road, approximately 240 m southeast of the subject site.
- An existing auto service garage and former retail fuel outlet with four (4) underground fuel tanks, located on the property addressed 319 Richmond Road, approximately 250 m south of the subject site.
- A former dry-cleaning business, located on the property addressed 376 Wilmont Avenue, approximately 155 m southwest of the subject site
- An existing auto body repair shop and former car dealership, located on the property addressed 2020 Scott Street (formerly 314 Athlone Avenue).
- A former dry-cleaning business, located on the property addressed 339 Churchill Avenue North, approximately 55 m south of the subject site.
- A former printing business, located at the property addressed 329 Churchill Avenue North, immediately south of the subject site.
- A former printing business, located at the property addressed 376 Churchill Avenue North, approximately 180 m south of the subject site.

The majority of these sites were noted to be located in a down-gradient or cross-gradient orientation with respect to the subject site, while other sites are located at a significant distance from the subject property. As a result, the above list of PCAs within the Phase I study area are not considered to be APECs.

Assessment of Uncertainty and/or Absence of Information

The information available for review as part of the preparation of this Phase I ESA is considered to be sufficient to conclude that the PCAs identified on the subject site are considered to represent on-site APECs, whereas the PCAs identified off of the subject site, yet within the Phase I Study area, do not

represent APECs with respect to the subject property. The presence of PCAs 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 RKI 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.

Table 2
Monitoring Well Construction Details

Well ID	Ground Surface Elevation (m ASL)	Total Depth (m BGS)	Screened Interval (m BGS)	Sand Pack (m BGS)	Bentonite Seal (m BGS)	Casing Type
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:

Table 3
Soil Samples Submitted

Sample ID	Sample Depth & Stratigraphic Unit	Parameters Analyzed					Rationale
		PHCs (F_1-F_4)	BTEX	PAHs	Metals[1]	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

Table 4
Groundwater Samples Submitted

Sample ID	Screened Interval & Stratigraphic Unit	Parameters Analyzed				Rationale
		PHCs (F_1-F_4)	BTEX	PAHs	Metals[1]	
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.

Table 5
Groundwater Level Measurements

Borehole Location	Ground Surface Elevation (m)	Water Level Depth (m below grade)	Water Level Elevation (m ASL)	Date of Measurement
BH1/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_1-F_4), 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_1-F_4)

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_1	7	nd	nd	nd	55
PHC F_2	4	nd	nd	7	98
PHC F_3	8	nd	36	110	300
PHC F_4	6	nd	54	58	2,800

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – Value exceeds selected MECP Standards

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) May 15, 2019			MECP Table 7 Residential Standards (µg/g)
		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:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – Value exceeds selected MECP Standards

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) May 15, 2019			MECP Table 7 Residential Standards (µg/g)
		BH4-19-AU1	BH5-19-SS2	BH6-19-SS2	
Antimony	1.0	nd	nd	**9.1**	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	**1.5**	1.2
Chromium	5.0	14.8	55.8	**245**	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	**264**	140
Lead	1.0	11.3	6.3	**472**	120
Mercury	0.1	nd	nd	0.2	0.27
Molybdenum	1.0	nd	nd	**11.3**	6.9
Nickel	5.0	12.0	29.5	**121**	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	**363**	340

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – Value exceeds selected MECP Standards

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 May 15, 2019		MECP Table 7 Residential Standards (µg/g)
		BH4-19-SS4	BH6-19-SS2	
pH Level	0.05 pH Units	7.80	8.15	5.00 – 11.00

Notes:
- MDL – Method Detection Limit

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

Table 10
Maximum Concentrations - Soil

Parameter	Maximum Concentration	Sample ID	Depth Interval (m BGS)
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	**9.1**	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	**1.5**	BH6-19-SS2	0.76 - 1.37
Chromium	**245**	BH6-19-SS2	0.76 - 1.37
Cobalt	11.7	BH6-19-SS2	0.76 - 1.37
Copper	**264**	BH6-19-SS2	0.76 - 1.37
Lead	**472**	BH6-19-SS2	0.76 - 1.37
Mercury	0.2	BH6-19-SS2	0.76 - 1.37
Molybdenum	**11.3**	BH6-19-SS2	0.76 - 1.37
Nickel	**121**	BH6-19-SS2	0.76 - 1.37
Vanadium	57.6	BH5-19-SS2	0.76 - 1.37
Zinc	**363**	BH6-19-SS2	0.76 - 1.37
PHCs F_2	7	BH6-19-SS2	0.76 - 1.37
PHCs F_3	110	BH6-19-SS2	0.76 - 1.37
PHCs F_4	58	BH6-19-SS2	0.76 - 1.37
pH Level	8.15	BH6-19-SS2	0.76 - 1.37

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – Value exceeds selected MECP Standards

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_1-F_4), 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.

Table 11
Analytical Test Results – Groundwater – BTEX and PHCs (F_1-F_4)

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	**4.1**	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:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – Value exceeds selected MECP Standards

The concentration of benzene in the sample recovered form 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:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – Value exceeds selected MECP Standards

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:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – Value exceeds selected MECP Standards

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

Table 14
Maximum Concentrations – Groundwater

Parameter	Maximum Concentration	Sample ID	Depth Interval (m BGS)
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	**4.1**	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_1	308	BH1-GW2	7.50 - 13.50

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – Value exceeds selected MECP Standards

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 an 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.

Table 15
QA/QC Calculations – Groundwater – BTEX

Parameter	MDL (µg/L)	BH6-19-GW1	DUP 1	RPD (%)	QA/QC Result
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:
- MDL – Method Detection Limit
- nd – not detected above the MDL

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_1-F_4), 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, natural gas and sewage services.

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 with a footprint covering the entire site in the future.

Existing Buildings and Structures

A residential dwelling is present on the southeast corner of the subject site.

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.

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, the potential for vapour intrusion into the existing building on site is considered to be minimal as the groundwater test results nearest to the building are in compliance with the applicable standards. 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 and 328 Winona Avenue, 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_1-F_4), 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_1-F_4), 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.

Michael Beaudoin, P.Eng., QP_{ESA}

Mark S. D'Arcy, P.Eng., QP_{ESA}

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)

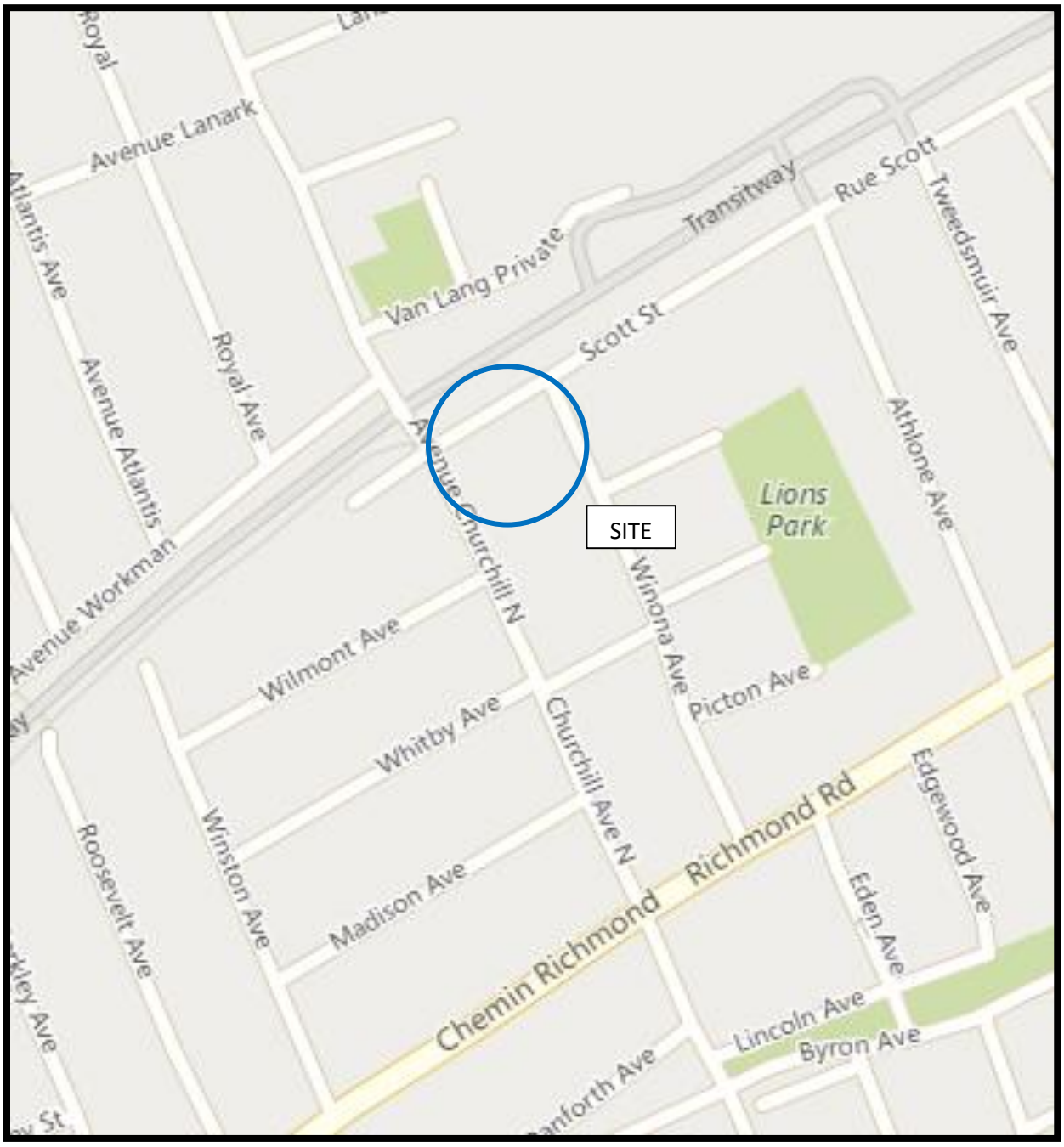
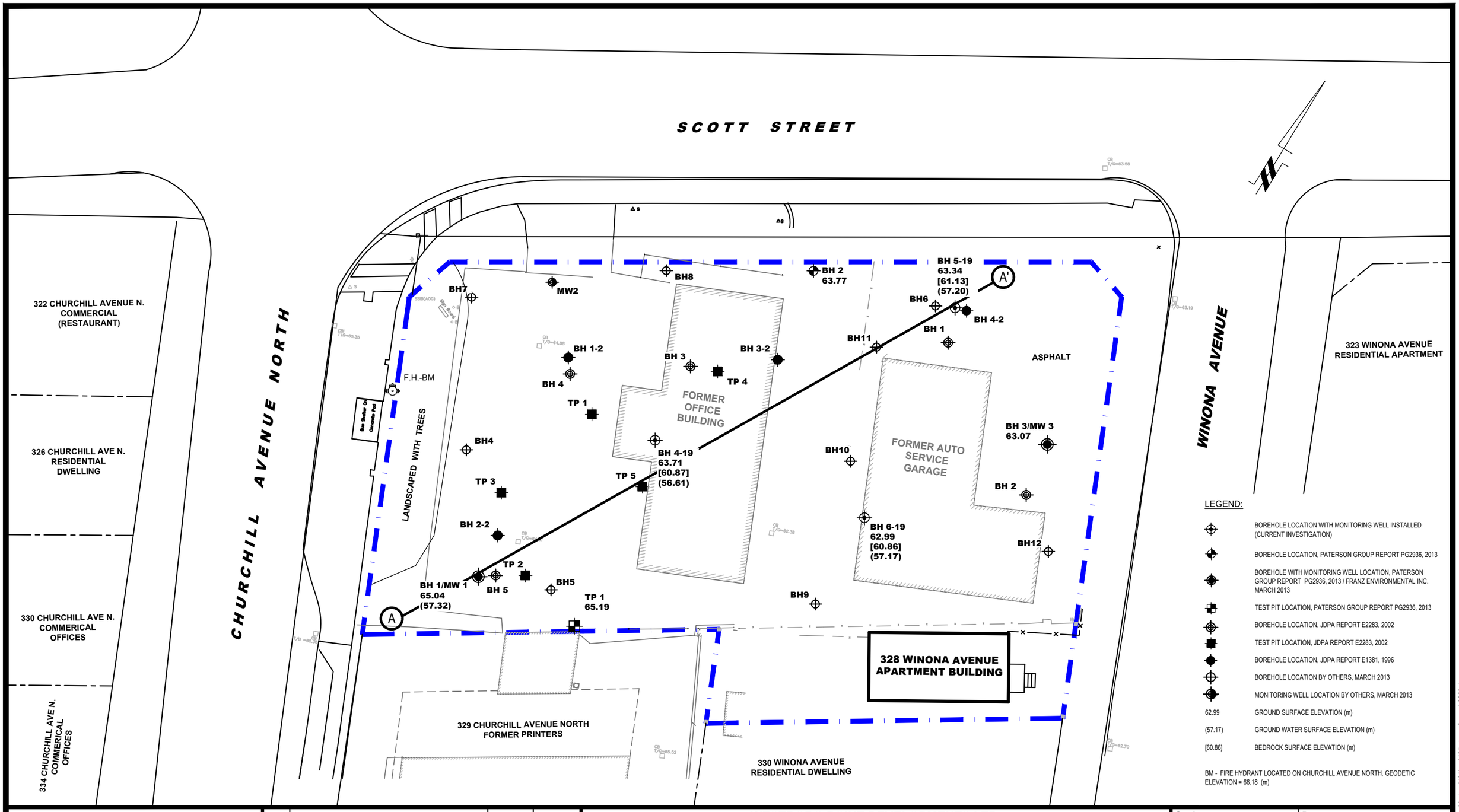


FIGURE 1

KEY PLAN



LEGEND:

- BOREHOLE LOCATION WITH MONITORING WELL INSTALLED (CURRENT INVESTIGATION)
- BOREHOLE LOCATION, PATERSON GROUP REPORT PG2936, 2013
- BOREHOLE WITH MONITORING WELL LOCATION, PATERSON GROUP REPORT PG2936, 2013 / FRANZ ENVIRONMENTAL INC. MARCH 2013
- TEST PIT LOCATION, PATERSON GROUP REPORT PG2936, 2013
- BOREHOLE LOCATION, JDPA REPORT E2283, 2002
- TEST PIT LOCATION, JDPA REPORT E2283, 2002
- BOREHOLE LOCATION, JDPA REPORT E1381, 1996
- BOREHOLE LOCATION BY OTHERS, MARCH 2013
- MONITORING WELL LOCATION BY OTHERS, MARCH 2013
- 62.99 GROUND SURFACE ELEVATION (m)
- (57.17) GROUND WATER SURFACE ELEVATION (m)
- [60.86] BEDROCK SURFACE ELEVATION (m)

BM - FIRE HYDRANT LOCATED ON CHURCHILL AVENUE NORTH. GEODETIC ELEVATION = 66.18 (m)

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Ottawa, Ontario K2E 7J5
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NO.	REVISIONS	DATE	INITIAL
0			

WESTBORO POINT DEVELOPMENTS LTD.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
2070 SCOTT STREET AND 328 WINONA AVENUE

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:300	Date: 03/2020
Drawn by: YA	Report No.: PE4435
Checked by: MB	Dwg. No.: PE4435-3R
Approved by: MSD	Revision No.: 0

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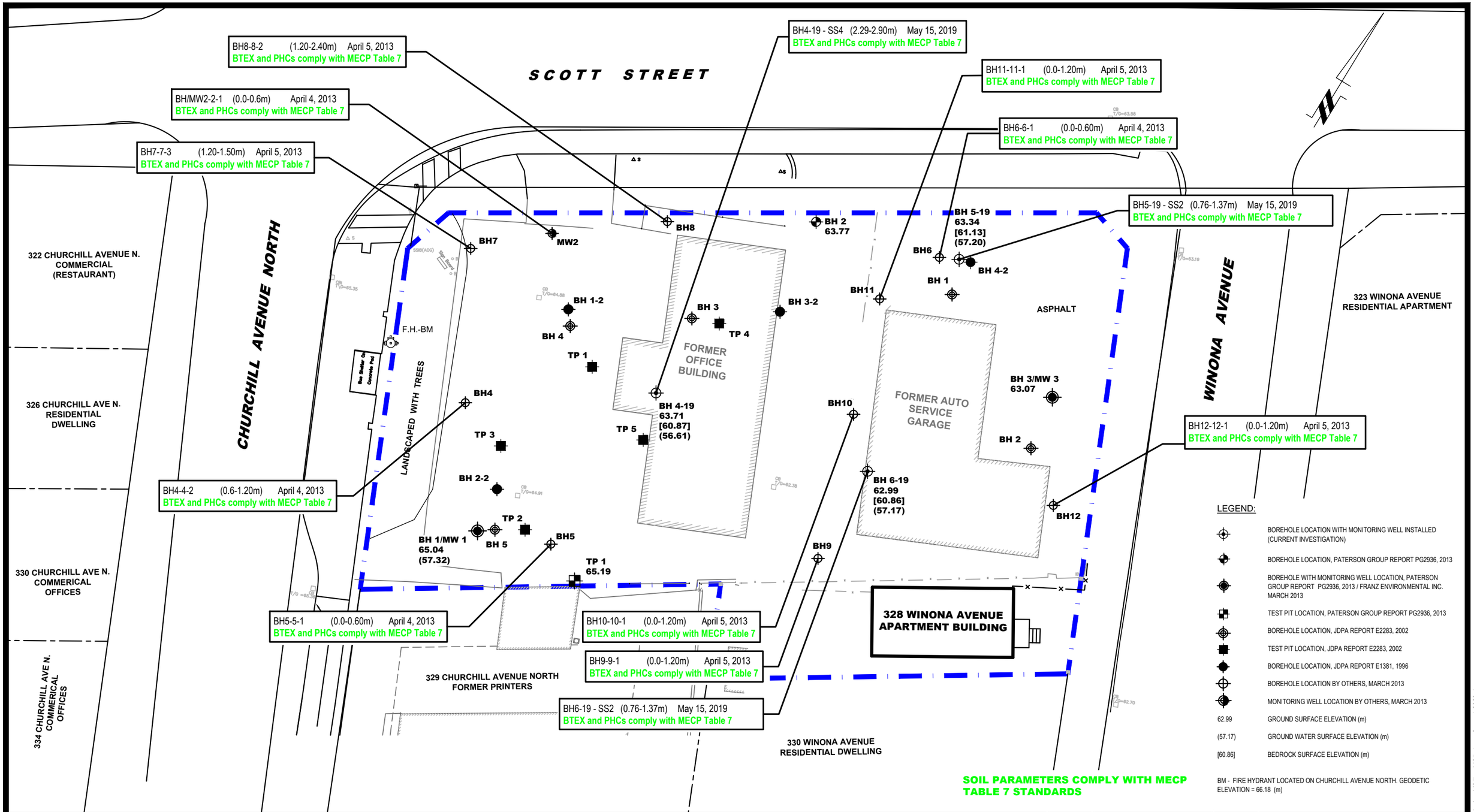

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
2070 SCOTT STREET AND 328 WINONA AVENUE

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL (BTEX, PHC)

Scale: 1:300	Date: 03/2020
Drawn by: YA	Report No.: PE4435
Checked by: MB	Dwg. No.: PE4435-4AR
Approved by: MSD	Revision No.: 0

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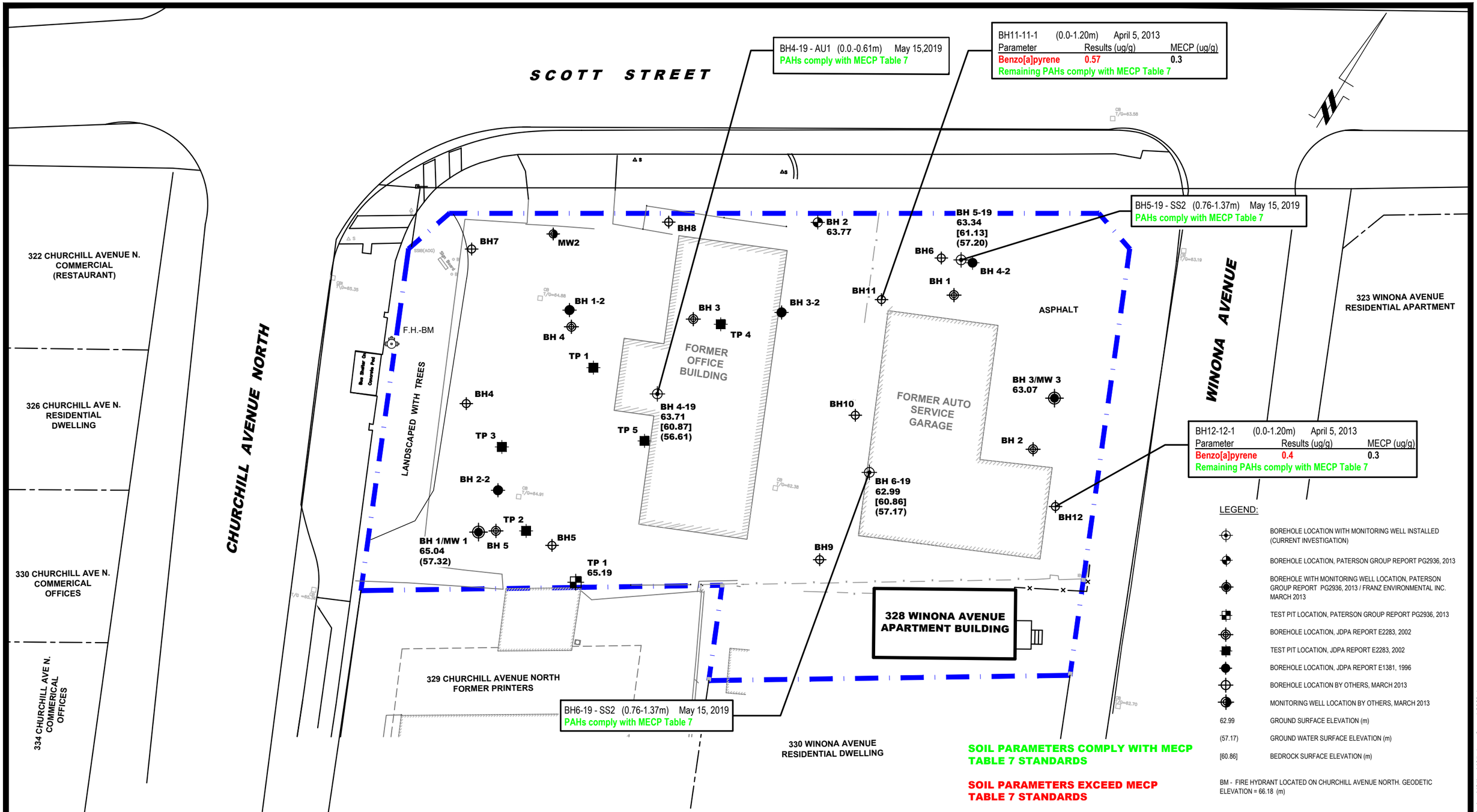

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NO.	REVISIONS	DATE	INITIAL
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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
2070 SCOTT STREET AND 328 WINONA AVENUE

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL (PAH)

Scale: 1:300	Date: 03/2020
Drawn by: YA	Report No.: PE4435
Checked by: MB	Dwg. No.: PE4435-4BR
Approved by: MSD	Revision No.: 0

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BH10-10-1 (0.0-1.20m) April 5, 2013
Metals comply with MECP Table 7

BH8-8-2 (1.20-2.40m) April 54, 2013
Metals comply with MECP Table 7

SCOTT STREET

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

BH/MW2-2-1 (0.0-0.60m) April 4, 2013
Metals comply with MECP Table 7

BH6-6-1 (0.0-0.60m) April 4, 2013
Metals comply with MECP Table 7

BH7-7-3 (1.20-1.50m) April 5, 2013
Metals comply with MECP Table 7

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

322 CHURCHILL AVENUE N.
COMMERCIAL
(RESTAURANT)

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

BH4-4-2 (0.60-1.20m) April 4, 2013
Metals comply with MECP Table 7

326 CHURCHILL AVE N.
RESIDENTIAL
DWELLING

CHURCHILL AVENUE NORTH

330 CHURCHILL AVE N.
COMMERICAL
OFFICES

334 CHURCHILL AVE N.
COMMERICAL
OFFICES

BH7
MW2
BH8
BH 2
63.77
BH 5-19
63.34
[61.13]
(57.20)
BH6
BH 4-2
BH11
BH 1
ASPHALT
BH 1-2
BH 4
BH 3
TP 4
BH 3-2
F.H.-BM
TP 1
FORMER
OFFICE
BUILDING
LANDSCAPED WITH TREES
BH4
BH 4-19
63.71
[60.87]
(56.61)
TP 5
BH10
FORMER AUTO
SERVICE
GARAGE
BH 3/MW 3
63.07
BH 2
TP 3
BH 2-2
TP 2
BH 6-19
62.99
[60.86]
(57.17)
BH12
BH 1/MW 1
65.04
(57.32)
BH 5
BH5
TP 1
65.19
BH9
WINONA AVENUE
323 WINONA AVENUE
RESIDENTIAL APARTMENT

BH12-12-1 (0.0-1.20m) April 5, 2013

Parameter	Results (ug/g)	MECP (ug/g)
Arsenic	22	18
Copper	320	230
Lead	480	120
Zinc	1000	340

Remaining Metals comply with MECP Table 7

BH5-5-1 (0.0-0.60m) April 4, 2013
Metals comply with MECP Table 7

BH9-9-1 (0.0-1.20m) April 5, 2013
Metals comply with MECP Table 7

328 WINONA AVENUE
APARTMENT BUILDING

329 CHURCHILL AVENUE NORTH
FORMER PRINTERS

BH6-19 - SS2 (0.76-1.37m) May 15, 2019

Parameter	Results (ug/g)	MECP (ug/g)
Antimony	9.1	7.5
Cadmium	1.5	1.2
Chromium	245	160
Copper	264	230
Lead	472	120
Molybdenum	11.3	6.9
Nickel	121	100
Zinc	363	340

Remaining Metals comply with MECP Table 7

330 WINONA AVENUE
RESIDENTIAL DWELLING

SOIL PARAMETERS COMPLY WITH MECP TABLE 7 STANDARDS

SOIL PARAMETERS EXCEED MECP TABLE 7 STANDARDS

LEGEND:

- BOREHOLE LOCATION WITH MONITORING WELL INSTALLED (CURRENT INVESTIGATION)
- BOREHOLE LOCATION, PATERSON GROUP REPORT PG2936, 2013
- BOREHOLE WITH MONITORING WELL LOCATION, PATERSON GROUP REPORT PG2936, 2013 / FRANZ ENVIRONMENTAL INC. MARCH 2013
- TEST PIT LOCATION, PATERSON GROUP REPORT PG2936, 2013
- BOREHOLE LOCATION, JDPA REPORT E2283, 2002
- TEST PIT LOCATION, JDPA REPORT E2283, 2002
- BOREHOLE LOCATION, JDPA REPORT E1381, 1996
- BOREHOLE LOCATION BY OTHERS, MARCH 2013
- MONITORING WELL LOCATION BY OTHERS, MARCH 2013
- 62.99 GROUND SURFACE ELEVATION (m)
- (57.17) GROUND WATER SURFACE ELEVATION (m)
- [60.86] BEDROCK SURFACE ELEVATION (m)

BM - FIRE HYDRANT LOCATED ON CHURCHILL AVENUE NORTH. GEODETIC ELEVATION = 66.18 (m)

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WESTBORO POINT DEVELOPMENTS LTD.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
2070 SCOTT STREET AND 328 WINONA AVENUE

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL (METALS)

Scale: 1:300	Date: 03/2020
Drawn by: YA	Report No.: PE4435
Checked by: MB	Dwg. No.: PE4435-4CR
Approved by: MSD	Revision No.: 0

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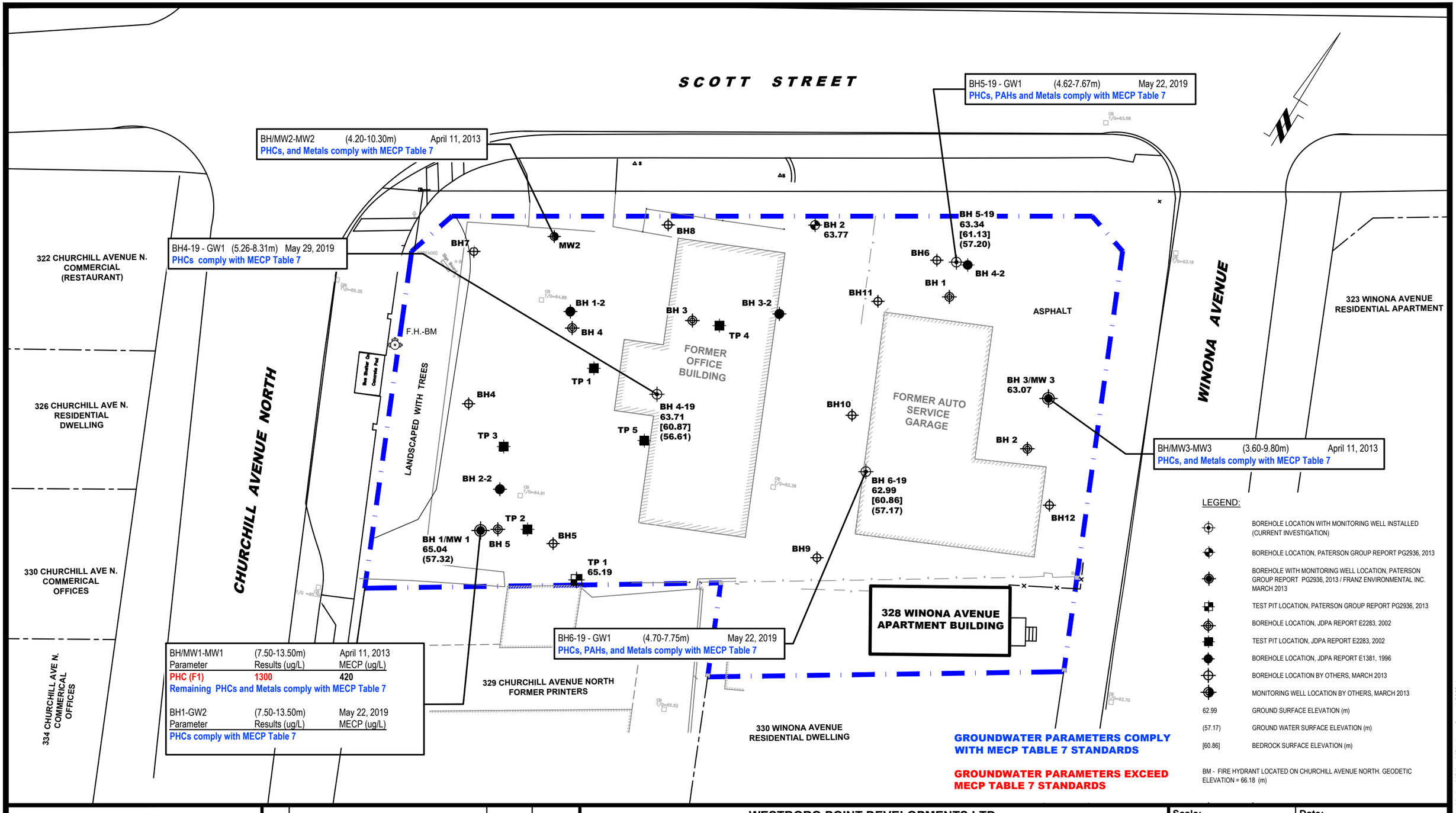

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WESTBORO POINT DEVELOPMENTS LTD.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
2070 SCOTT STREET AND 328 WINONA AVENUE

OTTAWA, ONTARIO

Title:

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

Scale: 1:300	Date: 03/2020
Drawn by: YA	Report No.: PE4435
Checked by: MB	Dwg. No.: PE4435-5AR
Approved by: MSD	Revision No.: 0

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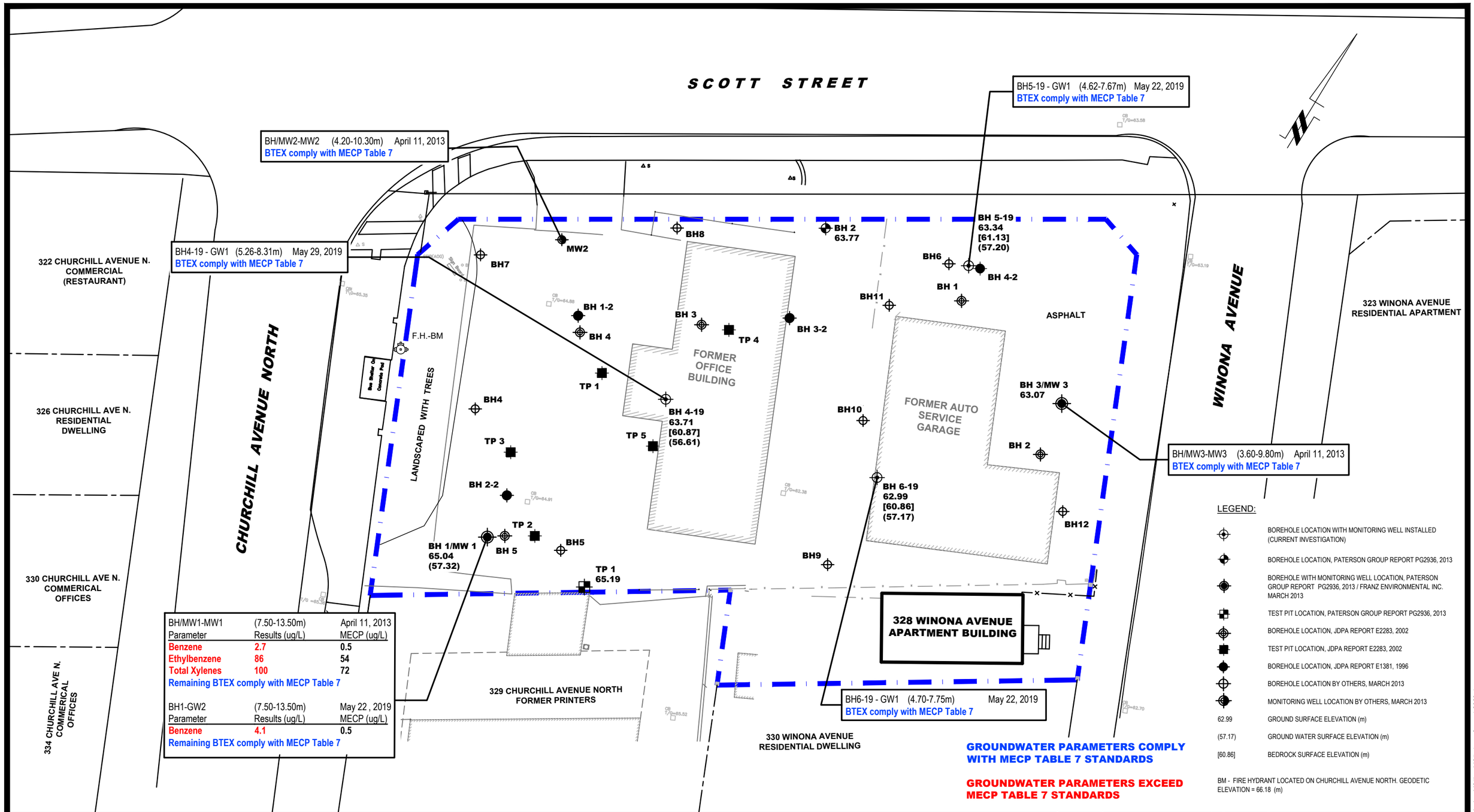

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
2070 SCOTT STREET AND 328 WINONA AVENUE

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - GROUNDWATER (BTEX)

Scale: 1:300	Date: 03/2020
Drawn by: YA	Report No.: PE4435
Checked by: MB	Dwg. No.: PE4435-5BR
Approved by: MSD	Revision No.: 0

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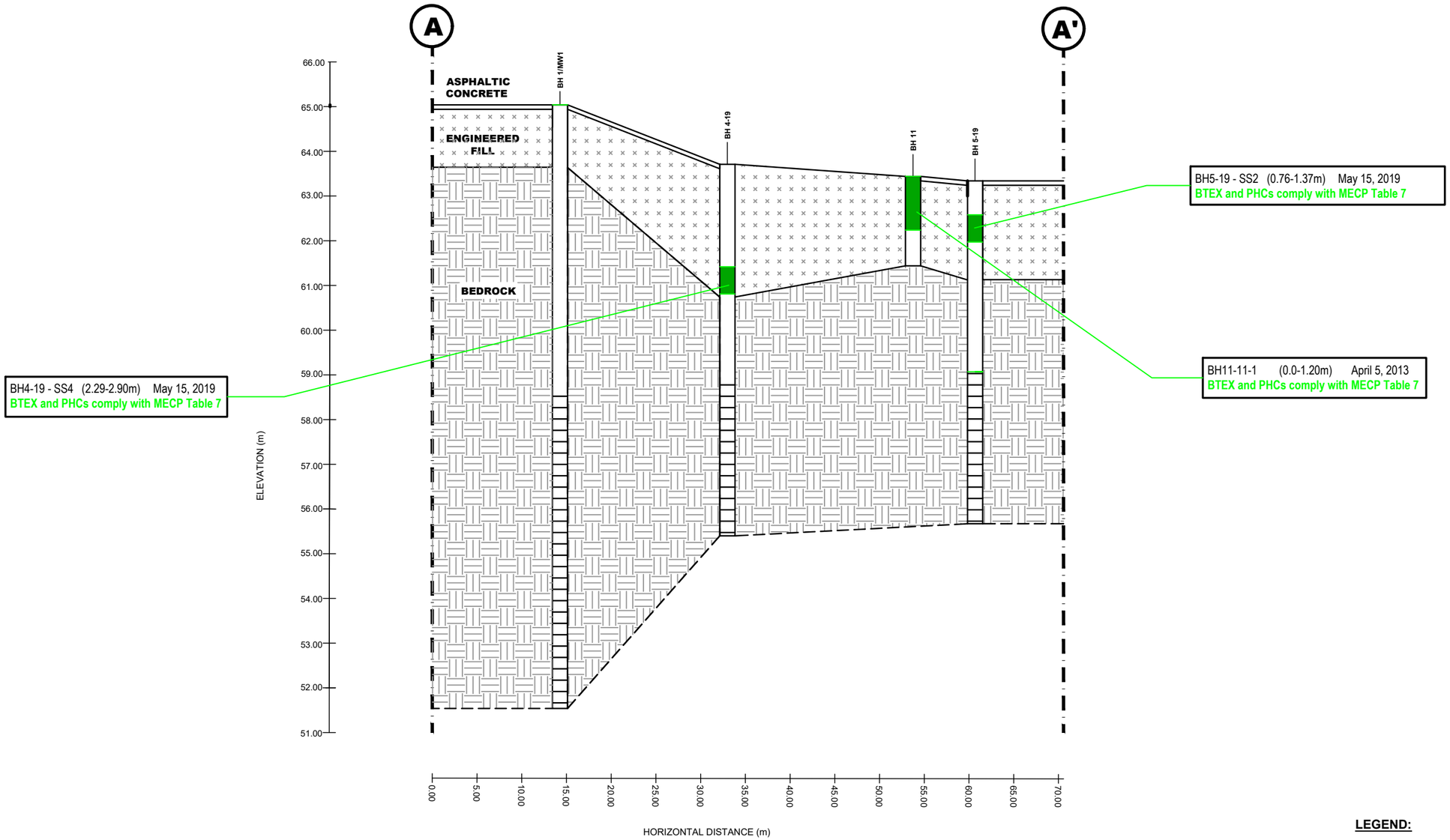

BH4-19 - SS4 (2.29-2.90m) May 15, 2019
BTEX and PHCs comply with MECP Table 7

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

BH11-11-1 (0.0-1.20m) April 5, 2013
BTEX and PHCs comply with MECP Table 7

LEGEND:

SOIL RESULT IN COMPLIANCE WITH MECP TABLE 7 STANDARDS

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WESTBORO POINT DEVELOPMENTS LTD.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
2070 SCOTT STREET AND 328 WINONA AVENUE

OTTAWA, ONTARIO

Title:

CROSS SECTION A-A- SOIL (BTEX, PHC)

Scale: 1:500	Date: 03/2020
Drawn by: YA	Report No.: PE4435
Checked by: MB	Dwg. No.: PE4435-6AR
Approved by: MSD	Revision No.: 0

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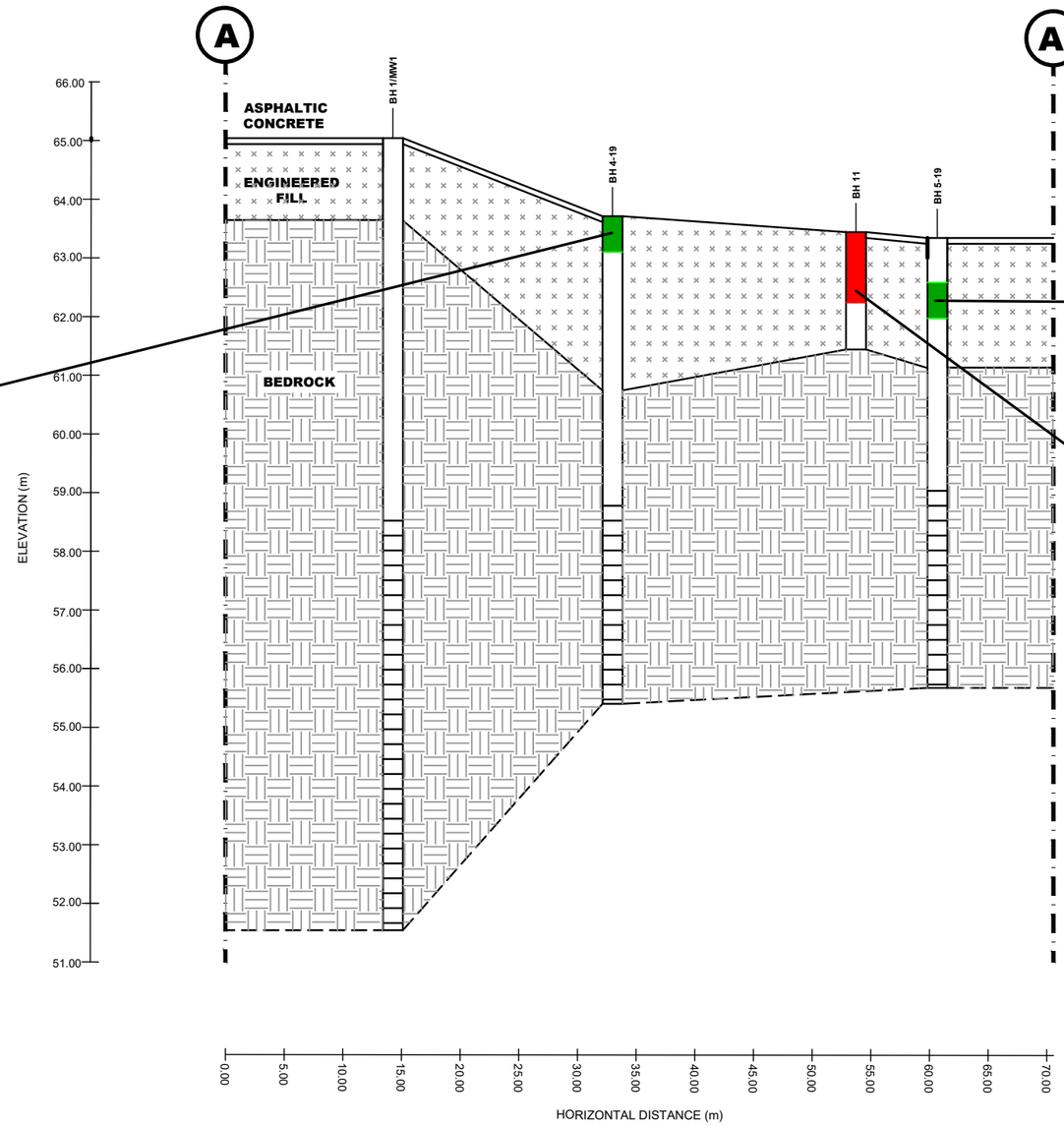

BH4-19 - AU1 (0.0.-0.61m) May 15,2019
PAHs comply with MECP Table 7

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)
Benzo[a]pyrene	0.57	0.3

Remaining PAHs 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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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
2070 SCOTT STREET AND 328 WINONA AVENUE

OTTAWA, ONTARIO

Title:

CROSS SECTION A-A- SOIL (PAH)

Scale: 1:500	Date: 03/2020
Drawn by: YA	Report No.: PE4435
Checked by: MB	Dwg. No.: PE4435-6BR
Approved by: MSD	Revision No.: 0

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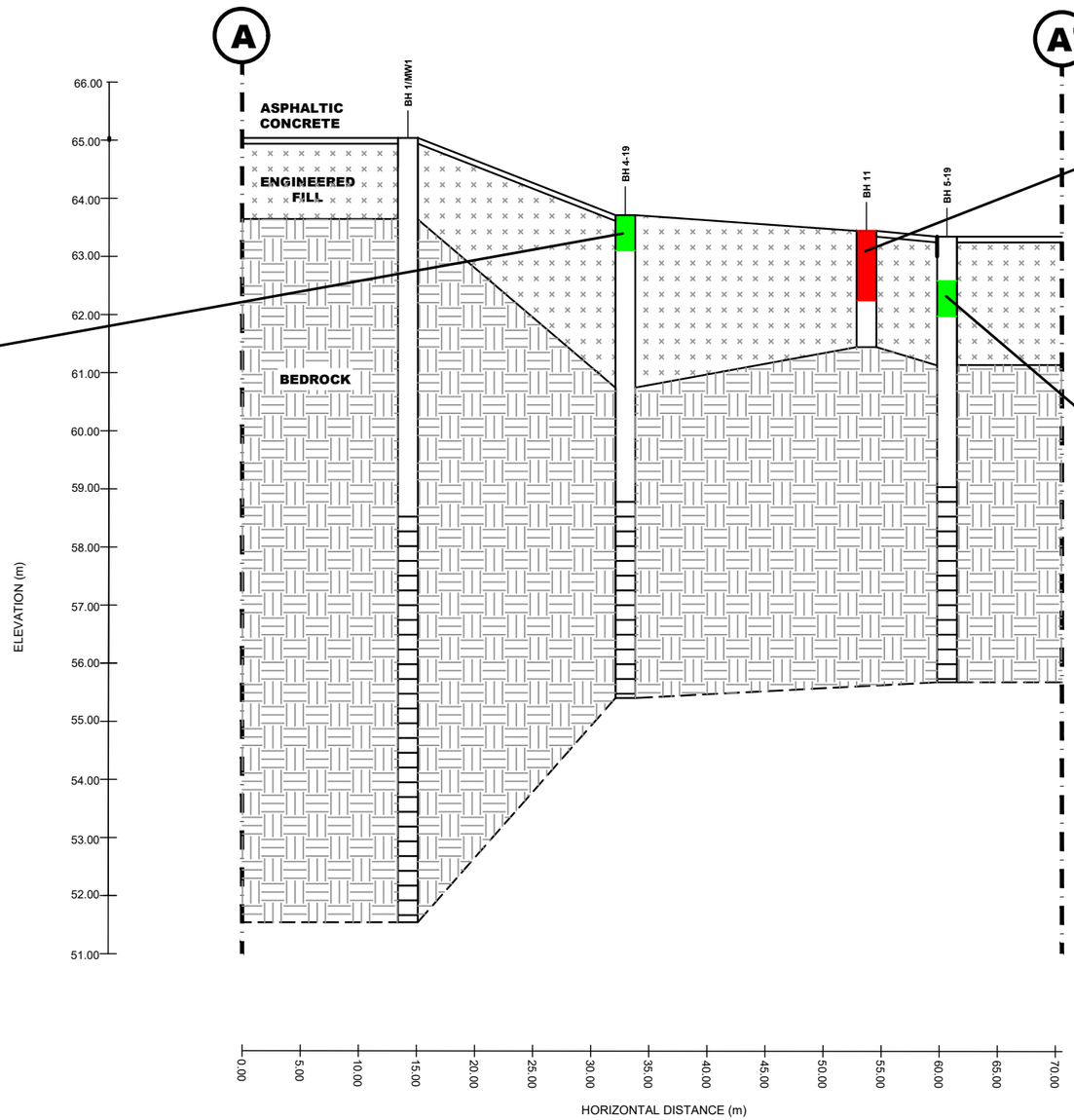

BH4-19 - AU1 (0.0-0.61m) May 15, 2019
Metals comply with MECP Table 7

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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2070 SCOTT STREET AND 328 WINONA AVENUE

OTTAWA, ONTARIO

Title:

CROSS SECTION A-A- SOIL (METALS)

Scale: 1:500	Date: 03/2020
Drawn by: YA	Report No.: PE4435
Checked by: MB	Dwg. No.: PE4435-6CR
Approved by: MSD	Revision No.: 0

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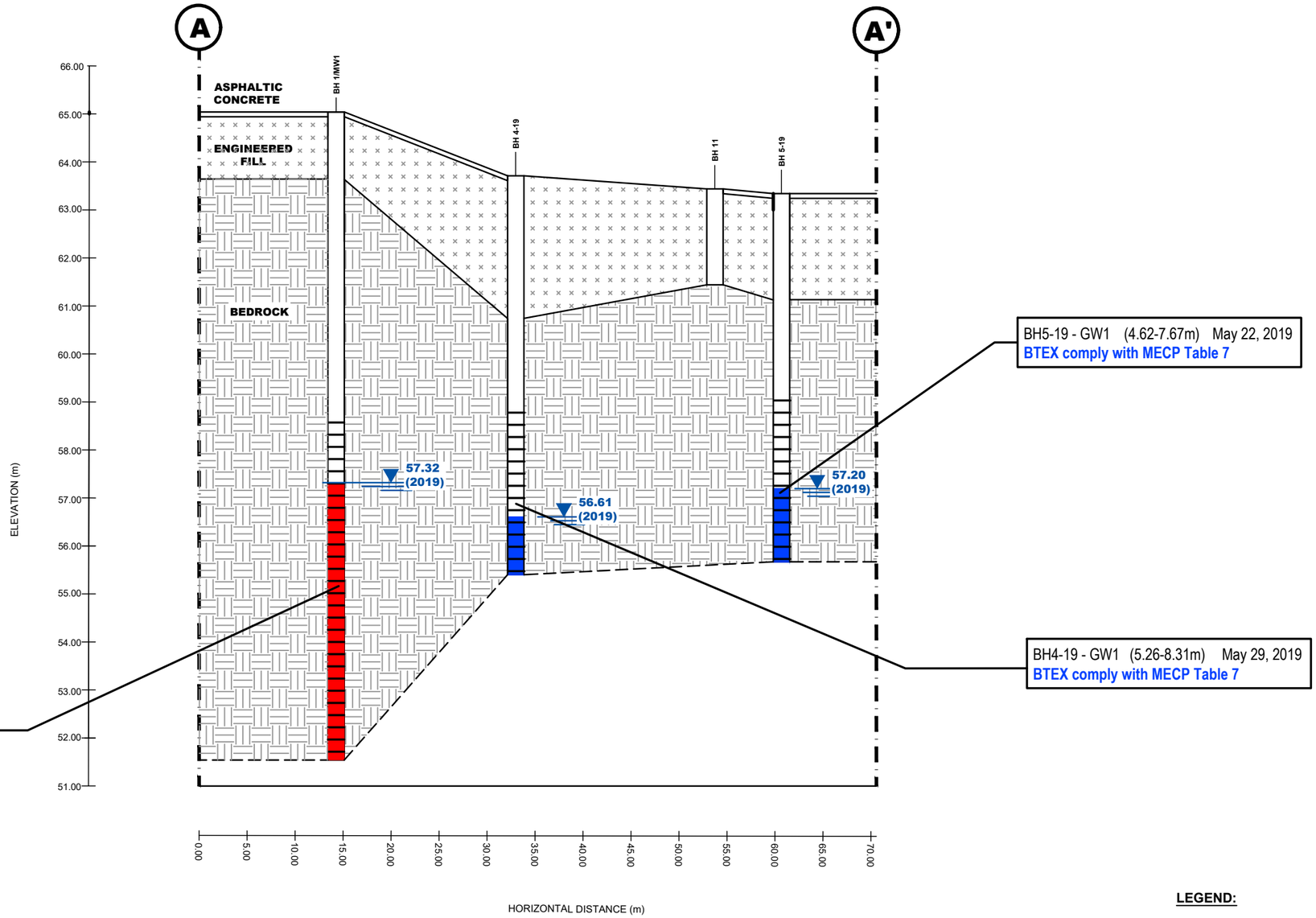

BH5-19 - GW1 (4.62-7.67m) May 22, 2019
BTEX comply with MECP Table 7

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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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
2070 SCOTT STREET AND 328 WINONA AVENUE

OTTAWA, ONTARIO

Title:

CROSS SECTION A-A- GROUNDWATER (BTEX)

Scale: 1:500	**Date:** 03/2020
Drawn by: YA	**Report No.:** PE4435
Checked by: MB	**Dwg. No.:** PE4435-7AR
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

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patersongroup

Sampling & Analysis Plan

Phase II Environmental Site Assessment
2070 Scott Street
328 Winona Avenue
Ottawa, Ontario

Prepared For

Westboro Point Developments Ltd.

May 2019

Report: PE4435-SAP

Table of Contents

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 ¼” if installing in cored hole in bedrock)
- ❒ 5’ x 2” threaded sections of Schedule 40 PVC riser pipe (5’ x 1 ¼” 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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
2070 Scott Street
Ottawa, Ontario

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

FILE NO. PE4435

REMARKS

HOLE NO. BH 4-19

BORINGS BY CME 55 Power Auger **DATE** 2019 May 15

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	63.71
		AU	1				
FILL: Brown silty sand and gravel		SS	2	21	6	1	62.71
		SS	3	54	53	2	61.71
2.13							
FILL: Brown silty sand with crushed stone		SS	4	56	50+		
2.84						3	60.71
		RC	1	88	45	4	59.71
		RC	2	100	75	5	58.71
BEDROCK: Grey limestone						6	57.71
		RC	3	100	26	7	56.71
		RC	4	100	58	8	55.71
8.31							
End of Borehole							
(GWL @ 7.10m - May 22, 2019)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
2070 Scott Street
Ottawa, Ontario

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

FILE NO. PE4435

REMARKS

HOLE NO. BH 5-19

BORINGS BY CME 55 Power Auger **DATE** 2019 May 15

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

Photo Ionization Detector: ● Volatile Organic Rdg. (ppm); ○ Lower Explosive Limit %

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
2070 Scott Street
Ottawa, Ontario

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

FILE NO. PE4435

REMARKS

HOLE NO. BH 6-19

BORINGS BY CME 55 Power Auger **DATE** 2019 May 15

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

Photo Ionization Detector: ● Volatile Organic Rdg. (ppm)

○ Lower Explosive Limit %

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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 strength of cohesionless soils is the relative density, 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.

Relative Density	'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 vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

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 is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

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 NXL size core. However, it can be used on smaller core sizes, such as BX, 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
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC%	-	Natural moisture 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 which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu	-	Uniformity coefficient = D60 / D10

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

CONSOLIDATION TEST

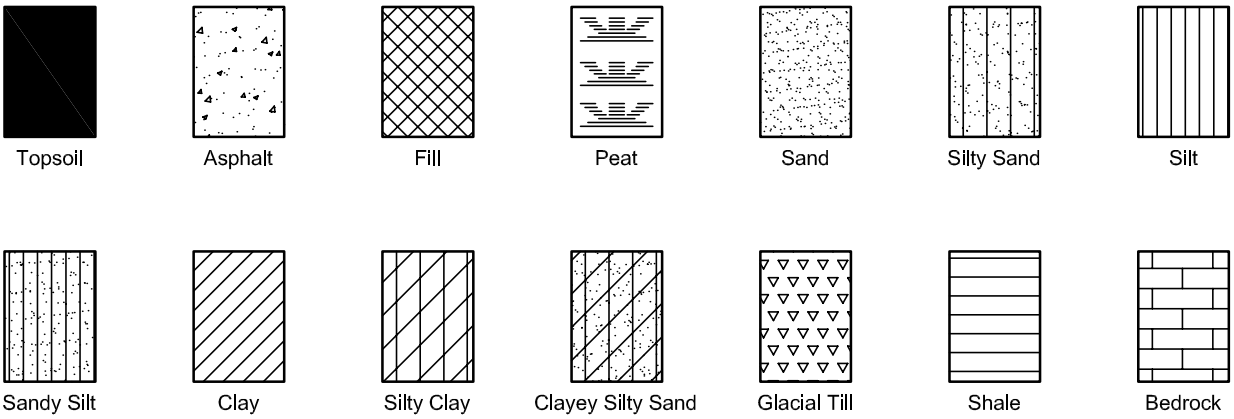
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

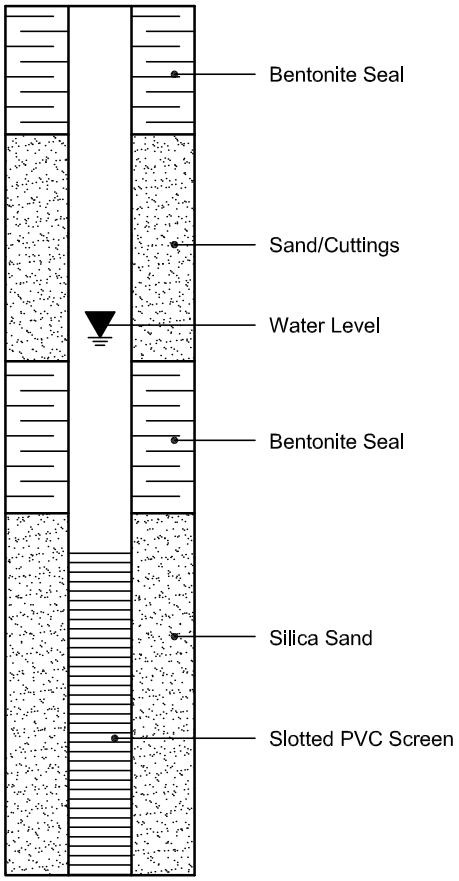
SYMBOLS AND TERMS (continued)

STRATA PLOT

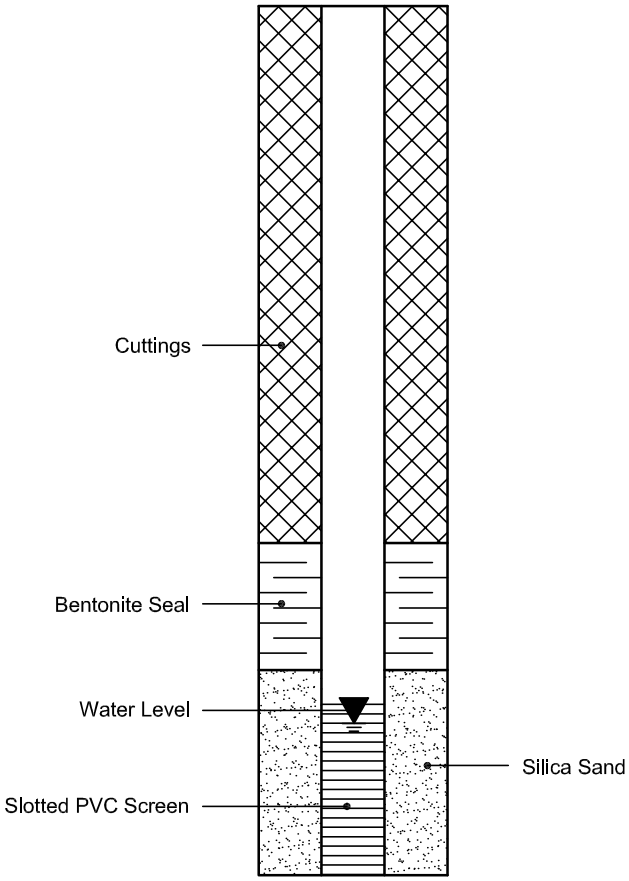


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 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

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

Client: Paterson Group Consulting Engineers

Client PO: 26491

Report Date: 23-May-2019

Order Date: 16-May-2019

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
General Inorganics					
pH	0.05 pH Units	-	7.80	-	8.15
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

Client: Paterson Group Consulting Engineers

Client PO: 26491

Report Date: 23-May-2019

Order Date: 16-May-2019

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
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
Client: Paterson Group Consulting Engineers
Client PO: 26491

Report Date: 23-May-2019
Order Date: 16-May-2019
Project Description: PE4435

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
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						
Metals									
Antimony	ND	1.0	ug/g						
Arsenic	ND	1.0	ug/g						
Barium	ND	1.0	ug/g						
Beryllium	ND	0.5	ug/g						
Boron	ND	5.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium (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						
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g						
Acenaphthylene	ND	0.02	ug/g						
Anthracene	ND	0.02	ug/g						
Benzo [a] anthracene	ND	0.02	ug/g						
Benzo [a] pyrene	ND	0.02	ug/g						
Benzo [b] fluoranthene	ND	0.02	ug/g						
Benzo [g,h,i] perylene	ND	0.02	ug/g						
Benzo [k] fluoranthene	ND	0.02	ug/g						
Chrysene	ND	0.02	ug/g						
Dibenzo [a,h] anthracene	ND	0.02	ug/g						
Fluoranthene	ND	0.02	ug/g						
Fluorene	ND	0.02	ug/g						
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g						
1-Methylnaphthalene	ND	0.02	ug/g						
2-Methylnaphthalene	ND	0.02	ug/g						
Methylnaphthalene (1&2)	ND	0.04	ug/g						
Naphthalene	ND	0.01	ug/g						
Phenanthrene	ND	0.02	ug/g						
Pyrene	ND	0.02	ug/g						
Surrogate: 2-Fluorobiphenyl	*1.03*		*ug/g*		*77.1*	*50-140*			
Surrogate: Terphenyl-d14	*1.33*		*ug/g*		*100*	*50-140*			
Volatiles									
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
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
General Inorganics									
pH	7.70	0.05	pH Units	7.62			1.0	10	
Hydrocarbons									
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	
Metals									
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	
Physical Characteristics									
% Solids	89.4	0.1	% by Wt.	89.8			0.4	25	
Semi-Volatiles									
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*			
Volatiles									
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
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
Hydrocarbons									
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			
Metals									
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			
Semi-Volatiles									
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*			
Volatiles									
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			

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.

PARACEL LABORATORIES LTD.

Paracel ID: 1920640

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300-2319 St. Laurent Blvd.
Ottawa, Ontario K1G 4J8
p: 1-800-749-1947
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Chain of Custody
(Lab Use Only)
No 122124

Page 1 of 1

Client Name: Paterson Group	Project Reference: PE4435
Contact Name: 226-7381	Quote #
Address:	PO # 4- 26491
Telephone: 226-7381	Email Address:

Turnaround Time:
☐ 1 Day ☐ 3 Day
☐ 2 Day ☑ Regular
Date Required:

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)

Required Analyses

Paracel Order Number: 1920640

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	pH						
1	BH4-~~19~~-AU1	S		2	May 15/19	10 am			✓	✓	✓	✓						2x 120 mL		
2	BH4-~~19~~-SS4	S		2	"	10 am	✓							✓				120mL+1vial		
3	BH5-19-SS2 ✓	S		3	"	11 am	✓		✓	✓	✓	✓						2x 120mL+1vial		
4	BH5-19-SS3	S		1	"	11 am												HOLD	120mL	
5	BH6-19-SS2	S		3	"	2 pm	✓		✓	✓	✓	✓		✓				2x 120mL+1vial		
6																				
7																				
8																				
9																				
10																				

Comments: No 3 For 1 Jar 120 mL Sample Project read = PE-4434. (May 15, 2019) Report on 4435 RR

Method of Delivery: Swift

Relinquished By (Sign):	Received by Driver/Depot: #7482	Received at Lab: Vineeram Rahmoi	Verified By:
Relinquished By (Print): Mack St Pierre	Date/Time:	Date/Time: May 16, 2019 09:29	Date/Time: May 16/19 4:30
Date/Time:	Temperature: °C	Temperature: 22.6 °C	pH Verified [ ] By:

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 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

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:	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
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%	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
Metals									
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						
Semi-Volatiles									
Acenaphthene	ND	0.05	ug/L						
Acenaphthylene	ND	0.05	ug/L						
Anthracene	ND	0.01	ug/L						
Benzo [a] anthracene	ND	0.01	ug/L						
Benzo [a] pyrene	ND	0.01	ug/L						
Benzo [b] fluoranthene	ND	0.05	ug/L						
Benzo [g,h,i] perylene	ND	0.05	ug/L						
Benzo [k] fluoranthene	ND	0.05	ug/L						
Chrysene	ND	0.05	ug/L						
Dibenzo [a,h] anthracene	ND	0.05	ug/L						
Fluoranthene	ND	0.01	ug/L						
Fluorene	ND	0.05	ug/L						
Indeno [1,2,3-cd] pyrene	ND	0.05	ug/L						
1-Methylnaphthalene	ND	0.05	ug/L						
2-Methylnaphthalene	ND	0.05	ug/L						
Methylnaphthalene (1&2)	ND	0.10	ug/L						
Naphthalene	ND	0.05	ug/L						
Phenanthrene	ND	0.05	ug/L						
Pyrene	ND	0.01	ug/L						
Surrogate: 2-Fluorobiphenyl	*17.9*		*ug/L*		*89.4*	*50-140*			
Surrogate: Terphenyl-d14	*21.1*		*ug/L*		*105*	*50-140*			
Volatiles									
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*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND				30	
Metals									
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	
Volatiles									
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*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
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			
Metals									
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			
Semi-Volatiles									
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*			
Volatiles									
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			

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			

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.

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PARACEL WO: 1921379

Head Office
300-2319 St. Laurent Blvd.
Ottawa, Ontario K1G 4J8
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e: paracel@paracellabs.com

Chain of Custody
(Lab Use Only)
№ 122136

Page 1 of 1

Client Name: Paterson Group	Project Reference: ~~PE4935~~ PE4435
Contact Name: Mark D'Arcy	Quote #
Address: 154 Colonnade St S	PO # 26739
Telephone: (613) 226-7381	Email Address: mdarcy@patersongroup.ca

Turnaround Time:
☐ 1 Day ☐ 3 Day
☐ 2 Day ☑ Regular
Date Required: _____

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)

Required Analyses

Paracel Order Number: 1921379

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	BTEX
1	BH1 - GW2	GW		3	May22/19	11:45am	✓							
2	BH5-19 - GW1	GW		7	↓	1:10pm	✓		✓	✓	✓	✓		
3	BH6-19 - GW1	GW		7	↓	1:50pm	✓		✓	✓	✓	✓		
4	DUP	GW		2	↓	1:50pm	✓							✓
5														
6														
7														
8														
9														
10														

→ missing bottles to be submitted May 24th per Mark D. &c

Comments:
Sample 1 missing PHC bottle, #2+3 missing PAH Bottle

Sumeeporn Rokmai

Method of Delivery: SWIFT

Relinquished By (Sign):	Received by Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print):	Date/Time:	Date/Time: May 23, 2019 04:35	
Date/Time:	Temperature: °C	Temperature: 19.8 °C	pH Verified By: May 24/19 2:40p

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1-800-749-1947
www.paracellabs.com

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	Client ID
1922498-01	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

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

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
Volatiles									
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*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND				30	
Volatiles									
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*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
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			
Volatiles									
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*			

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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- When reported, data for F4G has been processed using a silica gel cleanup.

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Chain of Custody
(Lab Use Only)
№ 122164

Page ___ of ___

Client Name: Paterson	Project Reference: ~~164935~~ PE4435
Contact Name: Mark D'Arcy	Quote #
Address: 154 Colonnade St. S	PO # 26834
Telephone: (613) 226-7381	Email Address: mdarcy@patersongroup.ca

Turnaround Time:
☐ 1 Day ☐ 3 Day
☐ 2 Day ☑ Regular
Date Required: _____

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)

Required Analyses

Paracel Order Number: 1922498

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)						
1	BH4-19-GW1	GW		3	May 29/19	2:30pm	✓												✓
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			

Comments:

Method of Delivery: Paracel

Relinquished By (Sign):	Received by Driver/Depot: M. Stouse	Received at Lab: Jinneeporm Dhimaj	Verified By:
Relinquished By (Print): MIKE B	Date/Time: 30/05/19 11:30	Date/Time: May 30, 2019 12:10	Date/Time: 05-30-19 14:18
Date/Time:	Temperature: °C AM	Temperature: 13.5 °C	pH Verified [ ] By: