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Phase II Environmental Site Assessment

200 Baribeau Street
Ottawa, Ontario

Prepared For

Boulet Construction
c/o Urban Logic Research and Advisory

July 5, 2019

Report: PE4597-2

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EXECUTIVE SUMMARY

Assessment

A Phase II ESA investigation was conducted by Paterson for 200 Baribeau Street in Ottawa, Ontario in April 2019. Paterson completed a supplemental investigation in June of 2019. The purpose of the initial investigation was to address the areas of potential concern identified in the Phase I ESA, in particular the existing furnace oil tank in the building, the existing automotive service garage to the south of the site and the former use of the property as a landfill. The supplemental Phase II ESA was carried out in an attempt to delineate the impacted fill material identified in BH2. The subsurface investigations consisted of drilling a total of 17 boreholes, three of which were instrumented with groundwater monitoring wells.

Soil samples obtained from the boreholes were screened using visual observations and organic vapour measurements. A total of fifteen soil samples were submitted for laboratory analysis for a combination of PHC, BTEX, metals and/or PAH parameters. Multiple metals and PAH parameters were identified in the fill material in BH2, on the west side of the property. All other soil samples were in compliance with the MECP Table 3 standards. As part of the supplemental work, an additional 12 boreholes were drilled to assess the fill. Ten soil samples were submitted from these boreholes, all of which (with the exception of BH15) exceeded the MECP Table 3 Standards for at least one metal or PAH parameter.

Groundwater samples were obtained from the 3 monitoring wells on the subject site in April 2019. The groundwater samples were submitted for analysis of BTEX, VOCs, PHCs, Metals and/or PAHs. Based on the analytical test results, all groundwater samples were in compliance with the MECP Table 3 standards.

Recommendations

Based on the findings of the Phase II ESA, fill impacted with Metals and PAHs is present on the western portion of the Phase II Property at concentrations which exceed the MECP Table 3 standards. It is our understanding that the subject site is to be redeveloped with multiple residential townhomes. It is our recommendation that an environmental site remediation program, involving the removal of all contaminated soil, be completed concurrently with the site redevelopment.

Prior to off-site disposal at a registered landfill site, a representative sample of the impacted soil will require a leachate analysis, in accordance with Ontario Regulation 558, to confirm the material is non-hazardous. It is also recommended that a member of this firm be present at the time of the removal of the impacted soil in order to provide direction and to obtain confirmatory soil samples upon the completion of the remediation program.

1.0 INTRODUCTION

At the request of Boulet Construction c/o Urban Logic Research and Advisory (Boulet) Paterson Group (Paterson) conducted a Phase II Environmental Site Assessment of 200 Baribeau Street, in the City of Ottawa, Ontario. The purpose of this Phase II ESA was to assess the environmental conditions for the purposes of redevelopment.

1.1 Site Description

Address:	200 Baribeau Street, Ottawa, Ontario.
Legal Description:	Ahlul-Bayt Centre, Plan M44 E Part Block A, City of Ottawa, Ontario.
Property Identification Number:	04236-0380.
Location:	The subject site is located at the southwest corner of the Landry Street and Baribeau Street intersection. The subject site is shown on Figure 1 - Key Plan following the body of this report.
Latitude and Longitude:	45° 26' 17" N, 75° 40' 4" W.
Configuration:	Rectangular
Site Area:	1.23 hectares (approximate).

1.2 Property Ownership

Paterson was retained to complete this Phase II ESA by a potential purchaser, Boulet Construction c/o Urban Logic Research and Advisory (ULRA). Mr. Kevin McMahon of ULRA commissioned Paterson to complete the investigation. ULRAs offices are located at 1285 Teron Road, Suite 203, Ottawa, Ontario. Mr. McMahon can be reached by telephone at (613) 900-0830.

1.3 Current and Proposed Future Uses

The subject site is currently occupied by Ahlul-Bayt Islamic School. It is our understanding that the buildings on the subject site will be demolished and the subject site will be redeveloped as a residential development.

1.4 Applicable Site Condition Standard

The site condition standards for the property were obtained from Table 3 of the document entitled “Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act”, prepared by the Ontario Ministry of the Environment, Conservation and Parks (MECP), April 2011. The MECP selected Table 3 Standards are based on the following considerations:

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

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The subject site is located at the southwest corner of the Landry Street and Baribeau Street intersection, in the City of Ottawa, Ontario. The subject building sits along the Baribeau Street frontage, with a schoolyard behind. The school yard is partially paved, with the remainder landscaped. Sheet drainage consists sheet flow to on-site catch basins and the adjacent roadways as well as infiltration in the landscaped areas. No signs of surficial contamination were identified on the exterior of the property at the time of the site visit.

2.2 Past Investigations

Paterson completed a Phase I prior to the completion of the Phase II ESA. This report, the findings of which are discussed below, is provided under separate cover.

Based on the available historical information sources, the Phase I Property was vacant and used for fill placement and landfilling by the Dominion Bridge Company until the initial development with a school in the 1950s. The subject site has remained a school since that time. The fill placement and landfilling operations at the subject site are considered to pose an APEC on the Phase I ESA property.

Following the historical review, a site visit was conducted. The Phase I Property is still used as a school. During the site visit an AST, was identified in the basement of the building and a private automotive service garage with an exterior AST was identified to the south of the Phase I ESA property. These two activities identified during the Phase I ESA site visit are considered to represent APECs on the Phase I ESA property.

Based on the findings of the site visit and the available historical information sources, three PCAs resulting in APECs were identified on the subject site. Several other PCAs were identified during the historical research and the site visit that are not considered to pose an environmental concern to the site due to their separation distance and down/cross gradient locations related to the subject site.

A Phase II ESA was recommended to address these environmental concerns.

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

Initial subsurface investigation were conducted for the Phase II Property on April 22, 2019 and consisted of drilling five boreholes on the subject site, three of which were instrumented with groundwater monitoring wells upon their completion. Boreholes were completed to depths ranging from 3.66 to 6.35m below 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 these media is based on the Contaminants of Potential Concern identified in the Phase I ESA.

Contaminants of concern for soil and groundwater include benzene, toluene, ethylbenzene and xylenes (BTEX), petroleum hydrocarbons (PHCs, F_1-F_4) and

volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), and metals (including CrVI and Hg).

3.3 Phase I Conceptual Site Model

Geological and Hydrogeological Setting

The Geological Survey of Canada website on the Urban Geology of the National Capital Area was consulted as part of this assessment. Based on this information, the bedrock in the area of the subject site consists of shale of the Billings Formation. Overburden soils are shown as glacial till, with a drift thickness on the order of 2 to 3 m.

The regional groundwater flow is expected to be towards the west, towards the Rideau River.

Buildings and Structures

A single storey school building with one basement level is present on the subject site. The building is finished on the exterior with brick and concrete block and was constructed in the mid-1950s. A small outbuilding used for storage is also present on the northwest corner of the property. No access was granted to the outbuilding.

Water Bodies

No water bodies are present on the Phase I Property. The closest water body is the Rideau River, located approximately 350m west of the subject site.

Areas of Natural Significance

No areas of natural significance were identified on the Phase I Property or within the Phase I Study Area.

Water Well Records

The MECP online interactive well record mapping system was accessed on June 15, 2019. No former well records were identified on the Phase I Property.

One (1) non-potable well record was identified for the former steel fabrication yard within the study area. According to the well record, the well was installed for a cooling system in 1951. Based on the age of the well and the redevelopment of the Dominion Steel property, the well is no longer considered to be present. Additionally, one (1) monitoring well record was identified within the Phase I

Study Area northeast of the Phase I Property, associated with a geotechnical investigation. No concerns were identified in the well records.

Neighbouring Land Use

Neighbouring land use in the Phase I Study Area consists of residential and commercial land use.

Potentially Contaminating Activities (PCAs) and Areas of Potential Environmental Concern (APECs)

The following PCAs identified on the Phase I ESA property and within the Phase I ESA study area are considered to pose an area potential environmental concern (APEC) to the subject site;

- Existing Furnace Oil Tank, Item 28 – Gasoline and Associated Products Storage in Fixed Tanks – This APEC is related to the furnace oil AST located in the basement of the school building. The AST is no longer in use and the furnace has been converted to natural gas.
- Former Landfilling Operations, Item 30 – Importation of Fill Material of Unknown Quality – This APEC is related to the former landfills that operated in the area of the subject site between the 1920s and the 1950s. Based on air photos, fill placement has occurred throughout the subject site.
- Existing Automotive Service Garage, Item 52 – Storage, maintenance, fuelling and repair of equipment, vehicles, and material used to maintain transportation systems – This APEC is related to an observed private automotive service garage with an AST along the south property line of the subject site.

Based on the separation distances in combination with their cross-gradient orientations any other PCAs identified within the Phase I ESA study area are not considered pose an APEC on the subject site.

Contaminants of Potential Concern (CPCs)

CPCs on the subject site include BTEX, VOCs, PHCs, Metals (including Cr VI and Hg) and PAHs.

Assessment of Uncertainty and/or Absence of Information

The information available for review as part of the preparation of this Phase I-ESA is considered to be sufficient to conclude that there are APECs on the Phase I Property. The historical research 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.

3.4 Deviations from Sampling and Analysis Plan

The Sampling and Analysis Plan for this project is included in Appendix 1 of this report. Duplicate and trip blank samples were not collected as part of the Phase II ESA. Appropriate duplicates and trip blank samples will be collected as part of a future program.

3.5 Impediments

Physical impediments encountered during the Phase II Environmental Site Assessment, include the utility services and the limited access available during the school activities.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation was conducted on April 22, 2019, with supplemental investigation work carried out on June 19, 2019. The intial subsurface investigation consisted of the drilling five boreholes on the Phase II Property, three of which were completed with groundwater monitoring wells. The boreholes were placed to provide general coverage of the Phase II Property and to address the aforementioned areas of potential environmental concern. The boreholes were drilled with a truck mounted CME 55 power auger drill rig. The supplemental subsurface investigation consisted of twelve boreholes to attempt to delineate the results of the initial investigation. The supplemental boreholes were drilled using a Geoprobe. The truck mounted drill rig and Geoprobe were provided by George Downing Estate Drilling of Hawkesbury, Ontario. Borehole locations are shown on Drawing PE4597-3 – Test Hole Location Plan, appended to this report.

4.2 Soil Sampling

A total of 95 soil samples were obtained from the boreholes by means of auger and split spoon sampling during the field program. The depths at which split spoon samples were obtained from the boreholes are shown as "**AU**" and "**SS**" on the Soil Profile and Test Data Sheets, appended to this report.

Site soils consist of asphalt or concrete underlain by fill material consisting of silty sand with trace gravel and debris. Beneath the fill material a layer of topsoil/peat was identified above native glacial till. The fill layer was approximately 2m in thickness throughout the site.

All of the boreholes ended within the native glacial till underlying the Phase II Property, at depths of 3.66 to 6.35m below ground surface.

4.3 Field Screening Measurements

All soil samples collected underwent a preliminary screening procedure, which included visual screening for colour and evidence of deleterious fill, as well as screening with a MiniRAE 2000 portable vapour analyser.

The soil vapours were measured by inserting the analyzer probe into the nominal headspace above the soil sample. Samples were then agitated and the peak readings recorded. The vapour readings identified were considered to be nominal. Vapour readings are noted on the Soil Profile and Test Data Sheets in Appendix 1.

Soil samples were selected for analysis based on visual appearance, location, and vapour readings.

4.4 Groundwater Monitoring Well Installation

Three groundwater monitoring wells were installed on the Phase II Property during the intital subsurface investigation. Copies of the borehole logs for these wells are included in Appendix 1. The monitoring wells consisted of 50mm diameter Schedule 40 threaded PVC risers and screens. Monitoring well construction details are listed below in Table 1.

Table 1: Monitoring Well Construction Details						
Well ID	**Ground Surface Elevation**	**Total Depth (m BGS)**	**Screened Interval (m BGS)**	**Sand Pack (m BGS)**	**Bentonite Seal (m BGS)**	**Casing Type**
BH1	98.70	4.22	1.22-4.22	1.12-4.22	0.30-1.12	Flushmount
BH2	98.69	4.62	1.62-4.62	1.52-4.62	0.30-1.52	Flushmount
BH3	98.57	4.62	1.62-4.62	1.52-4.62	0.30-1.52	Flushmount

4.5 Field Measurement of Water Quality Parameters

Prior to sampling, attempts were made to measure water quality parameters in the field using a multi-parameter analyzer. All wells were purged of three (3) well volumes or purged dry and allowed to stabilize prior to sampling.

4.6 Groundwater Sampling

Groundwater sampling protocols were followed using the MECP document entitled “Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario”, dated May 1996. Groundwater samples were obtained from each monitoring well, using dedicated sampling equipment. Standing water was purged from each well prior to sampling. Samples were stored in coolers to reduce analyte volatilization during transportation. Details of our standard operating procedure for groundwater sampling are provided in the Sampling and Analysis Plan in Appendix 1.

4.7 Analytical Testing

Based on the guidelines outlined in the Sampling and Analysis Plan appended to this report, the following soil and groundwater samples were submitted for analysis:

Table 2: Soil Samples Submitted

Sample ID	Sample Depth / Stratigraphic Unit	Parameters Analyzed				Rationale
		BTEX	PHCs (F_1-F_4)	Metals[1]	PAHs	
BH1-SS3	1.52-2.26m, Fill	X	X			Assess the existing fuel storage tank within the building
BH2-SS2	0.76-1.37m, Fill			X	X	Assess Fill Material of Unknown Quality
BH3-SS2	0.76-1.37m, Fill			X		
BH4-SS3	1.52-2.26m, Fill			X	X	
BH5-SS2	0.76-1.37m, Fill			X		
BH6-SS3	1.22-1.83m, Fill			X	X	Delineate impacts identified in BH2-SS2
BH7-SS3	1.22-1.83m, Fill			X	X	
BH9-SS2	0.61-1.22m, Fill			X	X	
BH10-SS2	0.61-1.22m, Fill			X	X	
BH12-SS2	1.22-1.42m, Fill			X	X	
BH13-SS3	1.22-1.83m, Fill			X	X	
BH14-SS2	0.61-1.22m, Fill			X	X	
BH15-SS2	0.61-1.22m, Fill			X	X	
BH16-SS2	0.61-1.22m, Fill			X	X	
BH17-SS2	0.61-1.22m, Fill			X	X	

1 – Metals including Mercury and Chromium VI

Table 3: Groundwater Samples Submitted

Sample ID	Screened Interval / Stratigraphic Unit	Parameters Analyzed				Rationale
		VOCs	PHCs (F_1-F_4)	Metals[1]	PAHs	
BH1-GW1	1.22-4.22m, Glacial Till / Weathered Shale	X[2]	X			Assess the existing fuel storage tank within the building
BH2-GW1	1.62-4.62, Glacial Till / Weathered Shale			X	X	Assess the potential for groundwater impacts related to the fill material
BH3-GW1	1.62-4.62Glacial Till / Weathered Shale	X	X			Assess the potential for groundwater impacts related to the existing off-site automotive service garage

1 – Metals including Mercury and Chromium VI
2 – Analysed for BTEX only

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

4.9 Elevation Surveying

An elevation survey of all borehole locations was completed by Paterson at the time of the subsurface investigation. All borehole elevations are relative to a temporary benchmark (top spindle of the fire hydrant located at the northeast corner of the subject site) with an assumed elevation of 100.00m.

4.10 Quality Assurance and Quality Control Measures

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

5.0 REVIEW AND EVALUATION

5.1 Geology

Site soils generally consist of a fill layer below the asphaltic concrete and topsoil over the in-situ native topsoil/peat and glacial till. Bedrock is considered to consist of shale from the Billings Formation and is more than 6m below ground surface. Site stratigraphy is shown on Drawing PE4597-6A – Cross-Section A-A'.

Groundwater was encountered within the fill material at depths ranging from approximately 0.82-1.55m below existing grade.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured during groundwater sampling event carried out on April 25, 2019, using an electronic water level meter.

Table 4: Groundwater Level Measurements

Borehole Location	Ground Surface Elevation (m)	Water Level Depth (m below grade)	Water Level Elevation (m ASL)	Date of Measurement
BH1	98.70	1.55	97.15	April 25, 2019
BH2	98.69	1.45	97.24	April 25, 2019
BH3	98.57	0.82	97.75	April 25, 2019

Based on the groundwater elevations from the April 25, 2019 sampling event, groundwater contour mapping was completed. Groundwater contours are shown on Drawing PE4597-3 – Test Hole Location Plan. Based on the contour mapping, groundwater flow beneath the Phase II Property appears to flow towards the north. An average horizontal hydraulic gradient of approximately 0.007 m/m was calculated.

Free product was not observed in any of the monitoring wells at the time of the sampling event.

5.3 Fine-Coarse Soil Texture

Based on field soil observations, fine-grained soil standards are not applicable to the subject site.

5.4 Soil: Field Screening

Field screening during drilling resulted in negligible soil vapour results. 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

A total of fifteen soil samples were submitted for analysis of a combination of PHCs (F1-F4), BTEX, VOCs, metals, and/or PAHs. The results of the analytical testing are presented below in Tables 5, 6, and 7. The laboratory certificates of analysis are provided in Appendix 1.

Table 5: Analytical Test Results – Soil – BTEX and PHCs (F1-F4)			
Parameter	MDL (µg/g)	Soil Samples (µg/g)	MECP Table 3 Residential Standards (µg/g)
		BH1-SS3	
Benzene	0.02	nd	0.21
Ethylbenzene	0.05	nd	2
Toluene	0.05	nd	2.3
Xylenes	0.05	nd	3.1
PHC F1	7	nd	55
PHC F2	4	nd	98
PHC F3	8	146	300
PHC F4	6	79	2,800

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – Value exceeds MECP Table 3 standards

No BTEX or PHC parameters were detected above the MECP Table 3 Standards.

Table 6: Analytical Test Results – Soil – Metals						
Parameter	MDL (µg/g)	Soil Samples (µg/g)				MECP Table 3 Residential Standards (µg/g)
		BH2-SS2	BH3-SS2	BH4-SS3	BH5-SS2	
Chromium (VI)	0.2	nd	nd	nd	nd	8
Mercury	0.1	**3**	nd	nd	nd	0.27
Antimony	1	**20.1**	nd	nd	1.3	7.5
Arsenic	1	**23.5**	4.9	3.4	5.3	18
Barium	1	**1030**	76.1	65.1	126	390
Beryllium	0.5	0.9	0.5	0.5	0.5	4
Boron	5	16.5	nd	7.0	8.1	120
Cadmium	0.5	**2.1**	nd	nd	nd	1.2
Chromium	5	40.5	26.8	25.7	17.9	160
Cobalt	1	10.6	8.7	8.3	8.1	22
Copper	5	**195**	22.0	25.9	29.8	140
Lead	1	**1480**	20.0	10.4	46.5	120
Molybdenum	1	3.8	2.2	1.1	3.2	6.9
Nickel	5	37.5	26.7	27.1	26.5	100
Selenium	1	**3.7**	nd	nd	nd	2.4
Silver	0.3	1.5	nd	nd	nd	20
Thallium	1	nd	nd	nd	nd	1
Uranium	1	nd	nd	1.1	1.2	23
Vanadium	10	28.5	41.5	42.1	24.1	86
Zinc	20	**1120**	55.6	48.4	66.8	340

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – Value exceeds MECP Table 3 standards

Several metals parameters exceeding the MECP Table 3 Standards were identified during the April 2019 drilling program in BH2-SS2. A follow-up subsurface investigation to delineate the impacts was carried out in June 2019.

The results of the Metals testing during the supplemental work is shown in Table 7.

Table 7: Analytical Test Results – Soil – Metals

Parameter	MDL (µg/g)	Soil Samples (µg/g)					MECP Table 3 Residential Standards (µg/g)
		BH6-SS3	BH7-SS3	BH9-SS2	BH10-SS2	BH12-SS2	
Mercury	0.1	**5.2**	**10.6**	**1.1**	**0.7**	**0.7**	0.27
Antimony	1	**11.2**	**55.6**	**76.5**	**7.6**	**21.1**	7.5
Arsenic	1	**28.6**	**28.7**	**20.0**	16.2	**40.2**	18
Barium	1	**1070**	**1420**	**1010**	**957**	**528**	390
Beryllium	0.5	0.7	3.1	0.9	0.7	1.2	4
Boron	5	13.2	51.0	7.4	13.6	67.3	120
Cadmium	0.5	**2.9**	**2.6**	**1.5**	**1.8**	**3.4**	1.2
Chromium	5	158	57.3	37.3	55.5	52.6	160
Cobalt	1	9.8	**36.0**	10.7	14.2	**39.1**	22
Copper	5	**161**	**284**	**188**	129	**957**	140
Lead	1	**1420**	**5290**	**1010**	**957**	**907**	120
Molybdenum	1	**7.4**	**9.4**	3.4	6.1	6.3	6.9
Nickel	5	36.3	88.3	34.4	47.2	72.9	100
Selenium	1	**2.9**	**3.4**	1.7	**4.8**	**4.8**	2.4
Silver	0.3	1.4	1.0	0.8	0.8	1.0	20
Thallium	1	nd	nd	nd	nd	nd	1
Uranium	1	nd	5.9	nd	1.8	1.6	23
Vanadium	10	26.5	66.8	30.4	31.3	32.1	86
Zinc	20	**1340**	**1100**	**983**	**699**	**1960**	340

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – Value exceeds MECP Table 3 standards

Table 7 (continued): Analytical Test Results – Soil – Metals

Parameter	MDL (µg/g)	Soil Samples (µg/g)					MECP Table 3 Residential Standards (µg/g)
		BH13-SS2	BH14-SS2	BH15-SS2	BH16-SS2	BH17-SS2	
Mercury	0.1	**1.9**	**1.3**	nd	**1.3**	**0.6**	0.27
Antimony	1	**23.7**	**9.6**	nd	**52.4**	7.4	7.5
Arsenic	1	**112**	**275**	6.5	**60.5**	15.6	18
Barium	1	**1100**	**1020**	74.9	**3000**	**1710**	390
Beryllium	0.5	1.5	1.4	0.6	1.5	0.8	4
Boron	5	34.3	15.3	11.0	24.5	10.7	120
Cadmium	0.5	**3.2**	**2.0**	nd	**3.0**	1.0	1.2
Chromium	5	77.8	41.9	18.0	61.3	69.2	160
Cobalt	1	18.2	13.3	9.2	16.7	11.0	22
Copper	5	**627**	**172**	25.9	**290**	**178**	140
Lead	1	**4230**	**1150**	17.9	**5660**	**1520**	120
Molybdenum	1	**8.0**	**16.9**	3.1	**8.3**	3.0	6.9
Nickel	5	51.8	72.4	30.8	53.7	36.7	100
Selenium	1	**25.5**	**31.3**	nd	**10.5**	**2.5**	2.4
Silver	0.3	2.4	1.1	nd	2.8	1.9	20
Thallium	1	**1.2**	**2.8**	nd	nd	nd	1
Uranium	1	nd	nd	1.5	nd	nd	23
Vanadium	10	38.4	33.6	28.9	40.0	34.3	86
Zinc	20	**1580**	**563**	36.4	**1540**	**833**	340

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – Value exceeds MECP Table 3 standards

As shown in Table 7 fill material exceeding the MECP Table 3 Standards was identified in nine of the ten samples submitted for analytical testing from the supplemental investigation.

Table 8: Analytical Test Results – Soil – PAHs

Parameter	MDL (µg/g)	Soil Samples (µg/g)		MECP Table 3 Residential Standards (µg/g)
		BH2-SS2	BH4-SS3	
Acenaphthene	0.2	0.26	nd	7.9
Acenaphthylene	0.2	**0.36**	nd	0.15
Anthracene	0.2	**1.22**	nd	0.67
Benzo[a]anthracene	0.2	**2.56**	nd	0.5
Benzo[a]pyrene	0.2	**1.96**	nd	0.3
Benzo[b]fluoranthene	0.2	**2.67**	nd	0.78
Benzo[g,h,i]perylene	0.2	0.96	nd	6.6
Benzo[k]fluoranthene	0.2	**1.53**	nd	0.78
Chrysene	0.2	2.79	nd	7
Dibenzo[a,h]anthracene	0.2	**0.30**	nd	0.1
Fluoranthene	0.2	**4.97**	nd	0.69
Fluorene	0.2	0.34	nd	62
Indeno[1,2,3-cd]pyrene	0.2	**1.02**	nd	0.38
1-Methylnapthalene	0.2	0.13	nd	0.99
2-Methylnapthalene	0.2	0.18	nd	0.99
Methylnapthalene (1&2)	0.4	0.30	nd	0.99
Napthalene	0.2	0.57	nd	0.6
Phenanthrene	0.2	3.48	nd	6.2
Pyrene	0.2	4.15	nd	78

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – Value exceeds MECP Table 3 standards

Several PAH parameters exceeding the MECP Table 3 Standards were identified during the April 2019 drilling program in BH2-SS2. A follow-up subsurface investigation to delineate the impacts was carried out in June 2019. The results of the PAH testing during the supplemental work is shown in Table 9.

Table 9: Analytical Test Results – Soil – PAHs

Parameter	MDL (µg/g)	Soil Samples (µg/g)					MECP Table 3 Residential Standards (µg/g)
		BH6-SS3	BH7-SS3	BH9-SS2	BH10-SS2	BH12-SS2	
Acenaphthene	0.2	0.07	0.03	0.05	0.05	nd	7.9
Acenaphthylene	0.2	**0.25**	0.06	**0.47**	**0.17**	nd	0.15
Anthracene	0.2	0.36	0.09	0.31	0.28	nd	0.67
Benzo[a]anthracene	0.2	**1.16**	0.23	**1.46**	**0.83**	0.04	0.5
Benzo[a]pyrene	0.2	**0.95**	0.22	**1.56**	**0.68**	0.04	0.3
Benzo[b]fluoranthene	0.2	**1.35**	0.31	**1.72**	**0.92**	0.05	0.78
Benzo[g,h,i]perylene	0.2	0.65	0.16	0.81	0.40	0.02	6.6
Benzo[k]fluoranthene	0.2	**0.86**	0.16	**1.01**	0.44	0.02	0.78
Chrysene	0.2	1.31	0.31	1.62	0.95	0.05	7
Dibenzo[a,h]anthracene	0.2	**0.16**	0.04	**0.25**	**0.11**	nd	0.1
Fluoranthene	0.2	**2.06**	0.46	**1.64**	**1.57**	0.09	0.69
Fluorene	0.2	0.09	nd	0.04	0.06	nd	62
Indeno[1,2,3-cd]pyrene	0.2	**0.58**	0.14	**0.79**	0.38	0.02	0.38
1-Methylnapthalene	0.2	0.04	nd	nd	0.02	nd	0.99
2-Methylnapthalene	0.2	0.06	nd	0.04	0.03	nd	0.99
Methylnapthalene (1&2)	0.4	0.10	nd	0.06	0.05	nd	0.99
Napthalene	0.2	0.12	0.04	0.09	0.03	0.01	0.6
Phenanthrene	0.2	0.93	0.25	0.61	0.80	0.06	6.2
Pyrene	0.2	1.84	0.40	1.56	1.36	0.08	78

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – Value exceeds MECP Table 3 standards

Table 9 (continued): Analytical Test Results – Soil – PAHs

Parameter	MDL (µg/g)	Soil Samples (µg/g)					MECP Table 3 Residential Standards (µg/g)
		BH13-SS3	BH14-SS2	BH15-SS2	BH16-SS2	BH17-SS2	
Acenaphthene	0.2	0.53	0.57	nd	0.06	4.33	7.9
Acenaphthylene	0.2	**0.16**	**6.86**	nd	**0.21**	**2.40**	0.15
Anthracene	0.2	**1.73**	**5.69**	nd	0.52	**12.2**	0.67
Benzo[a]anthracene	0.2	**3.38**	**13.0**	nd	**0.98**	**30.8**	0.5
Benzo[a]pyrene	0.2	**2.34**	**12.6**	nd	**0.81**	**24.2**	0.3
Benzo[b]fluoranthene	0.2	**3.45**	**15.3**	nd	**1.36**	**33.4**	0.78
Benzo[g,h,i]perylene	0.2	1.50	6.33	nd	0.75	**13.6**	6.6
Benzo[k]fluoranthene	0.2	**1.68**	**7.88**	nd	0.71	**14.9**	0.78
Chrysene	0.2	3.74	**11.0**	nd	1.21	**35.2**	7
Dibenzo[a,h]anthracene	0.2	**0.41**	**2.08**	nd	**0.16**	**3.77**	0.1
Fluoranthene	0.2	**6.56**	**20.0**	nd	**1.62**	**72.9**	0.69
Fluorene	0.2	0.72	0.99	nd	0.06	3.90	62
Indeno[1,2,3-cd]pyrene	0.2	**1.27**	**6.41**	nd	**0.66**	**12.9**	0.38
1-Methylnapthalene	0.2	0.08	nd	nd	0.02	0.89	0.99
2-Methylnapthalene	0.2	0.13	nd	nd	0.08	0.98	0.99
Methylnapthalene (1&2)	0.4	0.21	nd	nd	0.10	**1.87**	0.99
Napthalene	0.2	0.17	0.24	nd	0.06	**1.70**	0.6
Phenanthrene	0.2	5.77	**8.63**	nd	0.77	**50.9**	6.2
Pyrene	0.2	4.90	19.5	nd	1.54	57.7	78

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – Value exceeds MECP Table 3 standards

As shown in Table 9, fill material exceeding the MECP Table 3 Standards was identified in seven of the ten samples submitted for analytical testing from the supplemental investigation.

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

Table 10: Maximum Concentrations – Soil

Parameter	Maximum Concentration (µg/g)	Borehole	Depth Interval (m BGS)
Mercury	**10.6**	BH7-SS3	1.22-1.83m
Antimony	**76.5**	BH9-SS2	0.61-1.22m
Arsenic	**23.5**	BH2-SS2	0.76-1.37m
Barium	**1030**	BH2-SS2	0.76-1.37m
Beryllium	1.5	BH13-SS3	1.22-1.83m
		BH16-SS2	0.61-1.22m
Boron	67.3	BH12-SS2	1.22-1.42m
Cadmium	**3.4**	BH12-SS2	1.22-1.42m
Chromium	77.8	BH13-SS2	1.22-1.83m
Cobalt	**39.1**	BH12-SS2	1.22-1.42m
Copper	**957**	BH12-SS2	1.22-1.42m
Lead	**5660**	BH16-SS2	0.61-1.22m
Molydenum	**16.9**	BH14-SS2	0.61-1.22m
Nickel	88.3	BH7-SS3	1.22-1.83m
Selenium	**31.3**	BH14-SS2	0.61-1.22m
Silver	2.8	BH16-SS2	0.61-1.22m
Thallium	**2.8**	BH14-SS2	0.61-1.22m
Uranium	5.9	BH7-SS3	1.22-1.83m
Vanadium	66.8	BH7-SS3	1.22-1.83m
Zinc	**1960**	BH12-SS2	1.22-1.42m
PHC F3	146	BH1-SS3	1.52-2.26m
PHC F4	79	BH1-SS3	1.52-2.26m
Acenaphthene	4.33	BH17-SS2	0.61-1.22m
Acenaphthylene	**2.40**	BH17-SS2	0.61-1.22m
Anthracene	**12.2**	BH17-SS2	0.61-1.22m
Benzo[a]anthracene	**30.8**	BH17-SS2	0.61-1.22m
Benzo[a]pyrene	**24.2**	BH17-SS2	0.61-1.22m
Benzo[b]fluoranthene	**33.4**	BH17-SS2	0.61-1.22m
Benzo[g,h,i]perylene	**13.6**	BH17-SS2	0.61-1.22m
Benzo[k]fluoranthene	**14.9**	BH17-SS2	0.61-1.22m
Chrysene	**35.2**	BH17-SS2	0.61-1.22m
Dibenzo[a,h]anthracene	**3.77**	BH17-SS2	0.61-1.22m
Fluoranthene	**72.9**	BH17-SS2	0.61-1.22m
Fluorene	3.90	BH17-SS2	0.61-1.22m
Indeno[1,2,3-cd]pyrene	**12.9**	BH17-SS2	0.61-1.22m
1-Methylnapthalene	0.89	BH17-SS2	0.61-1.22m
2-Methylnapthalene	0.98	BH17-SS2	0.61-1.22m
Methylnapthalene (1&2)	**1.87**	BH17-SS2	0.61-1.22m
Napthalene	**1.70**	BH17-SS2	0.61-1.22m

Table 10: Maximum Concentrations – Soil			
Parameter	**Maximum Concentration (µg/g)**	**Borehole**	**Depth Interval (m BGS)**
Phenanthrene	**50.9**	BH17-SS2	0.61-1.22m
Pyrene	27.7	BH17-SS2	0.61-1.22m
Notes: ▪ **Bold and Underlined** – Value exceeds MECP Table 3 standards			

Several metals and PAH parameters exceed the MECP Table 3 Standards. All other parameter concentrations were below laboratory detection limits.

5.6 Groundwater Quality

During the groundwater sampling event, samples collected from monitoring wells installed in BH1, BH2, and BH3 were submitted for laboratory analysis of PHC, BTEX, metals, PAHs and/or VOC parameters. 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.

Copies of the laboratory Certificates of Analysis are provided in Appendix 1.

Table 11: Analytical Test Results – Groundwater - PHCs (F1-F4)				
Parameter	**MDL (µg/L)**	**Groundwater Samples (µg/L)**		**MECP Table 3 Standards (µg/L)**
		BH1-GW1	**BH3-GW1**	
PHC F1	25	nd	nd	750
PHC F2	100	nd	nd	150
PHC F3	100	nd	nd	500
PHC F4	100	nd	nd	500
Notes: ▪ MDL – Method Detection Limit ▪ nd – not detected above the MDL				

No PHC parameters were identified above the method detection limits in the two groundwater samples submitted for analysis.

Table 12: Analytical Test Results – Groundwater – BTEX and VOCs				
Parameter	**MDL (µg/L)**	**Groundwater Samples (µg/L)**		**MECP Table 3 Standards (µg/L)**
		BH1-GW1	**BH3-GW1**	
Acetone	5.0	NA	nd	130,000
Benzene	0.5	nd	nd	44
Bromodichloromethane	0.5	NA	nd	85,000
Bromoform	0.5	NA	nd	380
Bromomethane	0.5	NA	nd	5.6
Carbon Tetrachloride	0.2	NA	nd	0.79
Chlorobenzene	0.5	NA	nd	630
Chloroform	0.5	NA	nd	2.4
Dibromochloromethane	0.5	NA	nd	82,000
Dichlorodifluoromethane	1.0	NA	nd	4,400

Table 12: Analytical Test Results – Groundwater – BTEX and VOCs				
Parameter	MDL (µg/L)	Groundwater Samples (µg/L)		MECP Table 3 Standards (µg/L)
		BH1-GW1	BH3-GW1	
1,2-Dibromoethane	0.2	NA	nd	0.25
1,2-Dichlorobenzene	0.5	NA	nd	4,600
1,3-Dichlorobenzene	0.5	NA	nd	9,600
1,4-Dichlorobenzene	0.5	NA	nd	8
1,1-Dichloroethane	0.5	NA	nd	320
1,2-Dichloroethane	0.5	NA	nd	1.6
1,1-Dichloroethylene	0.5	NA	nd	1.6
cis-1,2-Dichloroethylene	0.5	NA	nd	1.6
trans-1,2-Dichloroethylene	0.5	NA	nd	1.6
1,2-Dichloropropane	0.5	NA	nd	16
1,3-Dichloropropene	0.5	NA	nd	5.2
Ethylbenzene	0.5	nd	4.4	2,300
Hexane	1.0	NA	nd	51
Methyl Ethyl Ketone	5.0	NA	nd	470,000
Methyl Isobutyl Ketone	5.0	NA	nd	140,000
Methyl tert-butyl Ether	2.0	NA	nd	1900
Methylene Chloride	5.0	NA	nd	610
Styrene	0.5	NA	nd	1,300
1,1,1,2-Tetrachloroethane	0.5	NA	nd	3.4
1,1,2,2-Tetrachloroethane	0.5	NA	nd	3.2
Tetrachloroethylene	0.5	NA	nd	1.6
Toluene	0.5	nd	nd	18,000
1,1,1-Trichloroethane	0.5	NA	5	640
1,1,2-Trichloroethane	0.5	NA	nd	4.7
Trichloroethylene	0.5	NA	nd	1.6
Trichlorofluoromethane	1.0	NA	nd	2,500
Vinyl Chloride	0.5	NA	nd	0.5
Xylenes	0.5	nd	5	4,200

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL

The BTEX and VOC results are in compliance with the MECP Table 3 standards.

Table 13: Analytical Test Results - Groundwater - Metals			
Parameter	MDL (µg/L)	Groundwater Samples (µg/L)	MECP Table 3 Standards (µg/L)
		BH2-GW1	
Mercury	0.1	nd	0.29
Antimony	0.5	5	20,000
Arsenic	1	nd	1,900
Barium	1	303	29,000
Beryllium	0.5	nd	67
Boron	10	65	45,000
Cadmium	0.1	1.1	2.7
Chromium	1	nd	810
Chromium VI	10	nd	
Cobalt	0.5	0.8	66
Copper	0.5	7.8	87
Lead	0.1	0.8	25
Molybdenum	0.5	0.8	9,200

Table 13: Analytical Test Results - Groundwater - Metals			
Parameter	**MDL (µg/L)**	**Groundwater Samples (µg/L)**	**MECP Table 3 Standards (µg/L)**
		BH2-GW1	
Nickel	1	7	490
Selenium	1	6	63
Silver	0.1	nd	1.5
Sodium	200	360000	2,300,000
Thallium	0.1	nd	510
Uranium	0.1	1.3	420
Vanadium	0.5	0.6	250
Zinc	5	453	1,100

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL

No metals parameters were identified above the applicable MECP standards from BH2-GW1.

Table 14: Analytical Test Results Groundwater – Polycyclic Aromatic Hydrocarbons (PAHs)			
Parameter	**MDL (µg/L)**	**Groundwater Samples (µg/L)**	**MECP Table 3 Standards (µg/L)**
		BH2-GW1	
Acenaphthene	0.05	nd	600
Acenaphthylene	0.05	nd	1.8
Anthracene	0.01	nd	2.4
Benzo[a]anthracene	0.01	nd	4.7
Benzo[a]pyrene	0.01	nd	0.81
Benzo[b]fluoranthene	0.05	nd	0.75
Benzo[g,h,i]perylene	0.05	nd	0.2
Benzo[k]fluoranthene	0.05	nd	0.4
Chrysene	0.05	nd	1
Dibenzo[a,h]anthracene	0.05	nd	0.52
Flouranthene	0.01	0.04	130
Fluorene	0.05	nd	400
Indeno[1,2,3-cd]pyrene	0.05	nd	0.2
1-Methylnaphthalene	0.05	nd	1,800
2-Methylnaphthalene	0.05	nd	1800
Methylnapthalene (1&2)	0.10	nd	1800
Naphthalene	0.05	nd	1,400
Phenanthrene	0.05	nd	580
Pyrene	0.01	0.04	68

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL

No PAH parameters were identified above the applicable MECP standards from BH2-GW1.

The maximum final concentrations of analyzed parameters in the groundwater at the site are summarized below in Table 15.

Table 15: Maximum Concentrations – Groundwater

Parameter	Maximum Concentration (µg/L)	Borehole	Depth Interval (m BGS)
Antimony	5.0	BH2-GW1	1.62-4.62
Barium	303	BH2-GW1	1.62-4.62
Boron	65	BH2-GW1	1.62-4.62
Cadmium	1.1	BH2-GW1	1.62-4.62
Cobalt	0.8	BH2-GW1	1.62-4.62
Copper	7.8	BH2-GW1	1.62-4.62
Lead	0.8	BH2-GW1	1.62-4.62
Molybdenum	0.8	BH2-GW1	1.62-4.62
Nickel	7	BH2-GW1	1.62-4.62
Selenium	6	BH2-GW1	1.62-4.62
Uranium	1.3	BH2-GW1	1.62-4.62
Vanadium	0.6	BH2-GW1	1.62-4.62
Zinc	453	BH2-GW1	1.62-4.62
Ethylbenzene	4.4	BH3-GW1	1.62-4.62
1,1,1-Trichloroethane	5.0	BH3-GW1	1.62-4.62
Toluene	5.0	BH3-GW1	1.62-4.62
Xylenes	5.0	BH3-GW1	1.62-4.62
Fluoranthene	0.04	BH2-GW1	1.62-4.62
Pyrene	0.04	BH2-GW1	1.62-4.62

All the detected groundwater parameter concentrations were in compliance with the MECP Table 3 standards. Remaining parameters were not detected above method detection limits.

It is our interpretation that the analyzed parameter concentrations do not indicate the potential presence of light non-aqueous phase liquids (LNAPLs) or dense non-aqueous phase liquids (DNAPLs). No free phase hydrocarbons were noted in the wells sampled at the time of sampling and no visual (hydrocarbon sheen) or olfactory observations of contamination were identified on the purge water during the sampling event.

5.7 Quality Assurance and Quality Control Results

No duplicate or trip blank samples were collected at the time of this field program. During subsequent remedial work appropriate duplicate and trip blank samples will be collected, as required. The conclusions of the report are not considered to be affected by this, as all of the analyzed groundwater parameters are in compliance with the selected MECP standards.

All samples submitted 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 O.Reg. 269/11, a Certificate of Analysis has been received for each sample submitted for analysis during each sampling event, and all Certificates of Analysis are appended to this port.

Overall, the quality of the field data collected during the Phase II ESA programs 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 amending O.Reg. 153/04 - Record of Site Condition regulation, made under 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 per Table 1 in Section 3.3, two on-site PCAs and one off-site PCA are considered to result in three APECs on the Phase I Property. The PCAs are associated with the existing furnace oil tank in the furnace room of the school, the existing automobile service garage to the south of the property, and the former use of the property as a landfill.

Contaminants of potential concern (CPC) associated with the aforementioned APECs include Metals (including CrVI and Mercury), PAHs, BTEX, VOCs and PHCs (F1-F4).

Subsurface Structures and Utilities

Underground service locates were completed prior to the subsurface investigations. Public utility services are present along the Baribeau Street frontage. Private utilities, including catch basins for storm sewers and electrical service trenches are present on the west side of the property.

Physical Setting

Site Stratigraphy

The site stratigraphy, from ground surface to the deepest aquifer or aquitard investigated, is illustrated on Drawing PE4597-7 - Cross-Section A-A' Stratigraphy consists of:

- Asphaltic concrete overlying fill material consisting of brown silty sand with trace brick, mortar, and organics, varying in depth up to 2.29m.
- Peat and/or topsoil in the majority of the boreholes beneath the fill material, typically approximately 1m in thickness. Groundwater was encountered in this layer.
- Sandy silt and glacial till consisting of brown silty sand with gravel and cobbles. Groundwater was encountered in this layer.

Hydrogeological Characteristics

Groundwater was encountered in the peat/topsoil layer and the glacial till layer at the subject site. This unit is interpreted to function as a local aquifer at the subject site. Water levels were most recently measured at the subject site on April 25, 2019 and are summarized above in Section 5.2 of this report.

Based on the groundwater elevations from the April 2019 monitoring event, groundwater contour mapping was completed and the horizontal hydraulic gradient for the subject site was calculated. As shown on Drawing PE4597-1– Test Hole Location Plan, groundwater flow at the subject site is interpreted to be in a northerly direction. A hydraulic gradient of approximately 0.007m/m was calculated.

Approximate Depth to Bedrock

Bedrock was not encountered in the boreholes advanced on the subject site, with the exception of BH4, where a DCPT was advanced to refusal at 6.35m below the existing ground surface. According to the geological maps consulted as part of the Phase I – ESA, bedrock depth is suspected to be approximately 2-3m below ground surface.

Approximate Depth to Water Table

Based on most recent groundwater measurements, depth to water table at the subject site varies between approximately 0.85-1.55m below existing grade.

Sections 41 and 43.1 of the Regulation

Section 41 of the Regulation (Site Condition Standards, Environmentally Sensitive Areas) does not apply to the subject site.

Section 43.1 of the Regulation does not apply to the subject site in that the subject site is not a Shallow Soil Property.

Fill Placement

Fill material, consisting of silty sand with debris (including brick, mortar, ash, trace slag and glass) was identified at the subject site. The fill is present throughout the site to depths between 1.5 and 2m below the existing ground surface. The fill is suspected to have been placed on the subject site as part of the previous landfilling activities at the subject site. The fill contains evidence of deleterious material.

Proposed Buildings and Other Structures

It is our understanding that the site is to be redeveloped for residential purposes.

Existing Buildings and Structures

The subject site is currently occupied by a school and several small outbuildings and play structures.

Water Bodies

There are no water bodies on the subject site or within the Phase I Study Area.

Areas of Natural Significance

No areas of natural significance are present on the Phase II Property or within the Phase I Study Area.

Environmental Condition

Areas Where Contaminants are Present

Based on the findings of the Phase II ESA, contaminants are present in the fill material to the west of the school building. The impacts exceeding MECP Table 3 standards are considered to be present throughout the fill material in this area. Groundwater beneath the Phase II Property is in compliance with the MECP Table 3 standards. Areas where contaminants are present are illustrated on Drawings PE4597– Analytical Testing Plans.

Types of Contaminants

The following contaminants of concern exceeding MECP Table 3 standards, were identified in the soil: Metals (including Mercury) and PAHs. There were no contaminant concentrations exceeding MECP Table 3 standards identified in the groundwater beneath the Phase II Property.

Contaminated Media

Based on the analytical test results, the fill material on the west portion of the property is impacted with Metals and PAHs. Groundwater beneath the Phase II Property was determined to be in compliance with the MECP Table 3 Standards.

What Is Known About Areas Where Contaminants Are Present

Based on historical information, including aerial photos, it appears that the property was used as a landfill until sometime in the late 1940s by the Dominion Bridge Company. The impacted fill material is considered to be related to this use.

Distribution and Migration of Contaminants

The impacted material is expected to be confined to the fill layer, in the western portion of the site. Although analytical testing did not identify impacted fill on the eastern and southern portion of the property it is expected that small pockets of impacted fill will be encountered during an excavation program. Additional screening and sampling will be required during the soil remediation program to fully delineate the limit of the contamination.

Discharge of Contaminants

The fill on the northwestern portion of the Phase II Property is expected to be a result of the former use of the property as a landfill by the Dominion Bridge Company.

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 have contributed to contaminant migration due to

the Phase II Property being covered by buildings and paved areas. Fluctuating groundwater levels and groundwater flow are not considered to have contributed to contaminant migration due to the low solubility of the impacted material, and the clean analytical test results for all groundwater samples analysed.

Potential for Vapour Intrusion

Given the high vapour pressure of the impacted material and the lack of underground structures on the subject site, there is a low potential for vapours to be present within the non-saturated zone and therefore the potential for vapour intrusion within the on-site building. The construction of the building, largely consisting of a slab-on-grade foundation, limits the potential for vapour intrusion. Potential vapour intrusion is not considered to be a safety hazard.

Based on the findings of the Phase II ESA and the slab-on-grade construction of the building, the potential for vapour intrusion on the Phase II Property is considered to be negligible.

6.0 CONCLUSIONS

Assessment

A Phase II ESA investigation was conducted by Paterson for 200 Baribeau Street in Ottawa, Ontario in April 2019. Paterson completed a supplemental investigation in June of 2019. The purpose of the initial investigation was to address the areas of potential concern identified in the Phase I ESA, in particular the existing furnace oil tank in the building, the existing automotive service garage to the south of the site and the former use of the property as a landfill. The supplemental Phase II ESA was carried out in an attempt to delineate the impacted fill material identified in BH2. The subsurface investigations consisted of drilling a total of 17 boreholes, three of which were instrumented with groundwater monitoring wells.

Soil samples obtained from the boreholes were screened using visual observations and organic vapour measurements. A total of fifteen soil samples were submitted for laboratory analysis for a combination of PHC, BTEX, metals and/or PAH parameters. Multiple metals and PAH parameters were identified in the fill material in BH2, on the west side of the property. All other soil samples were in compliance with the MECP Table 3 standards. As part of the supplemental work, an additional 12 boreholes were drilled to assess the fill. Ten soil samples were submitted from these boreholes, all of which (with the exception of BH15) exceeded the MECP Table 3 Standards for at least one metal or PAH parameter.

Groundwater samples were obtained from the 3 monitoring wells on the subject site in April 2019. The groundwater samples were submitted for analysis of BTEX, VOCs, PHCs, Metals and/or PAHs. Based on the analytical test results, all groundwater samples were in compliance with the MECP Table 3 standards.

Recommendations

Based on the findings of the Phase II ESA, fill impacted with Metals and PAHs is present on the western portion of the Phase II Property at concentrations which exceed the MECP Table 3 standards. It is our understanding that the subject site is to be redeveloped with multiple residential townhomes. It is our recommendation that an environmental site remediation program, involving the removal of all contaminated soil, be completed concurrently with the site redevelopment.

Prior to off-site disposal at a registered landfill site, a representative sample of the impacted soil will require a leachate analysis, in accordance with Ontario Regulation 558, to confirm the material is non-hazardous. It is also recommended that a member of this firm be present at the time of the removal of the impacted soil in order to provide direction and to obtain confirmatory soil samples upon the completion of the remediation program.

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 by O.Reg. 269/11, 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 Boulet Construction and notification from Boulet and Paterson will be required to release 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:

- Boulet Construction. (3 copies)
- Paterson Group (1 copy)

FIGURES

FIGURE 1 – KEY PLAN

Drawing PE4597-3 - Test Hole Location Plan

Drawing PE4597-4A – Analytical Testing Plan – Soil (BTEX and PHCs)

Drawing PE4597-4B – Analytical Testing Plan – Soil (Metals)

Drawing PE4597-4C – Analytical Testing Plan – Soil (PAHs)

Drawing PE4597-5 – Analytical Testing Plan – Groundwater

Drawing PE4597-6A - Cross-Section A-A' – Soil (Metals)

Drawing PE4597-6B – Cross-Section A-A' – Soil (PAHs)

Drawing PE4597-7 – Cross-Section A-A' – Groundwater

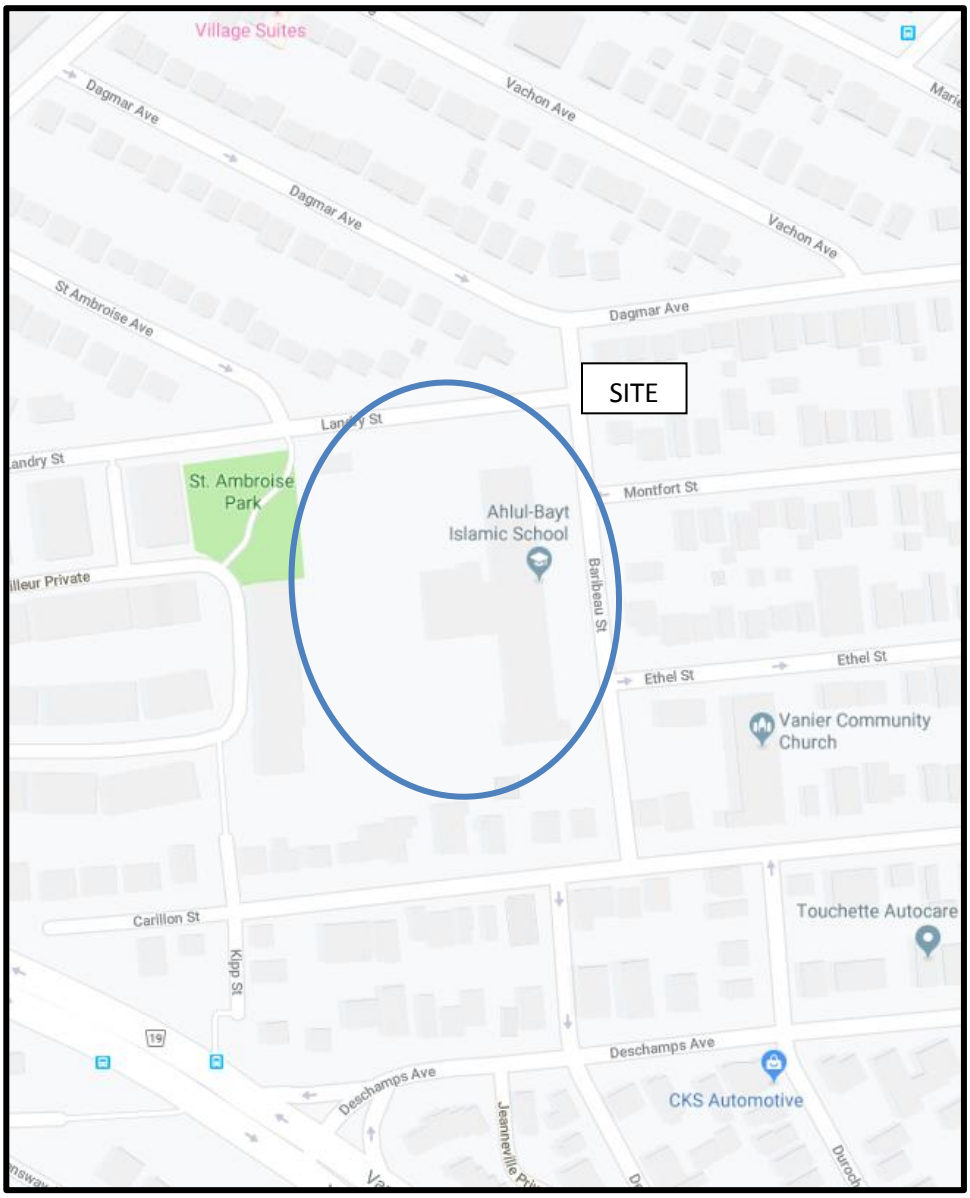
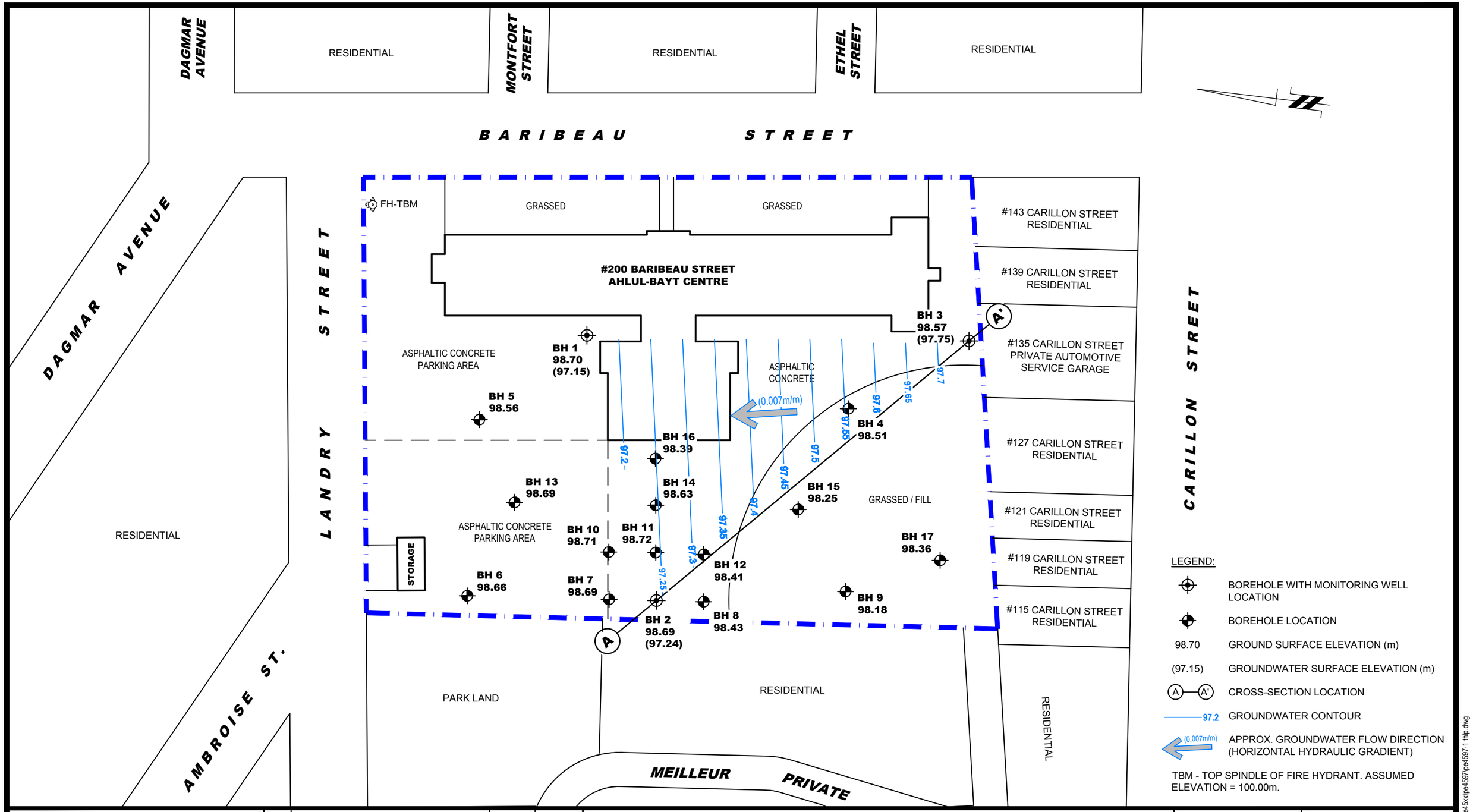


FIGURE 1

KEY PLAN



LEGEND:

- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION
- 98.70 GROUND SURFACE ELEVATION (m)
- (97.15) GROUNDWATER SURFACE ELEVATION (m)
- A — A' CROSS-SECTION LOCATION
- 97.2 GROUNDWATER CONTOUR
- (0.007m/m) APPROX. GROUNDWATER FLOW DIRECTION (HORIZONTAL HYDRAULIC GRADIENT)

TBM - TOP SPINDLE OF FIRE HYDRANT. ASSUMED ELEVATION = 100.00m.

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NO.	REVISIONS	DATE	INITIAL

BOULET CONSTRUCTION c/o URBAN LOGIC RESEARCH & ADVISORY

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
200 BARIBEAU STREET

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:750	Date: 06/2019
Drawn by: MPG	Report No.: PE4597-2
Checked by: MB	PE4597-3
Approved by: MSD	Revision No.:

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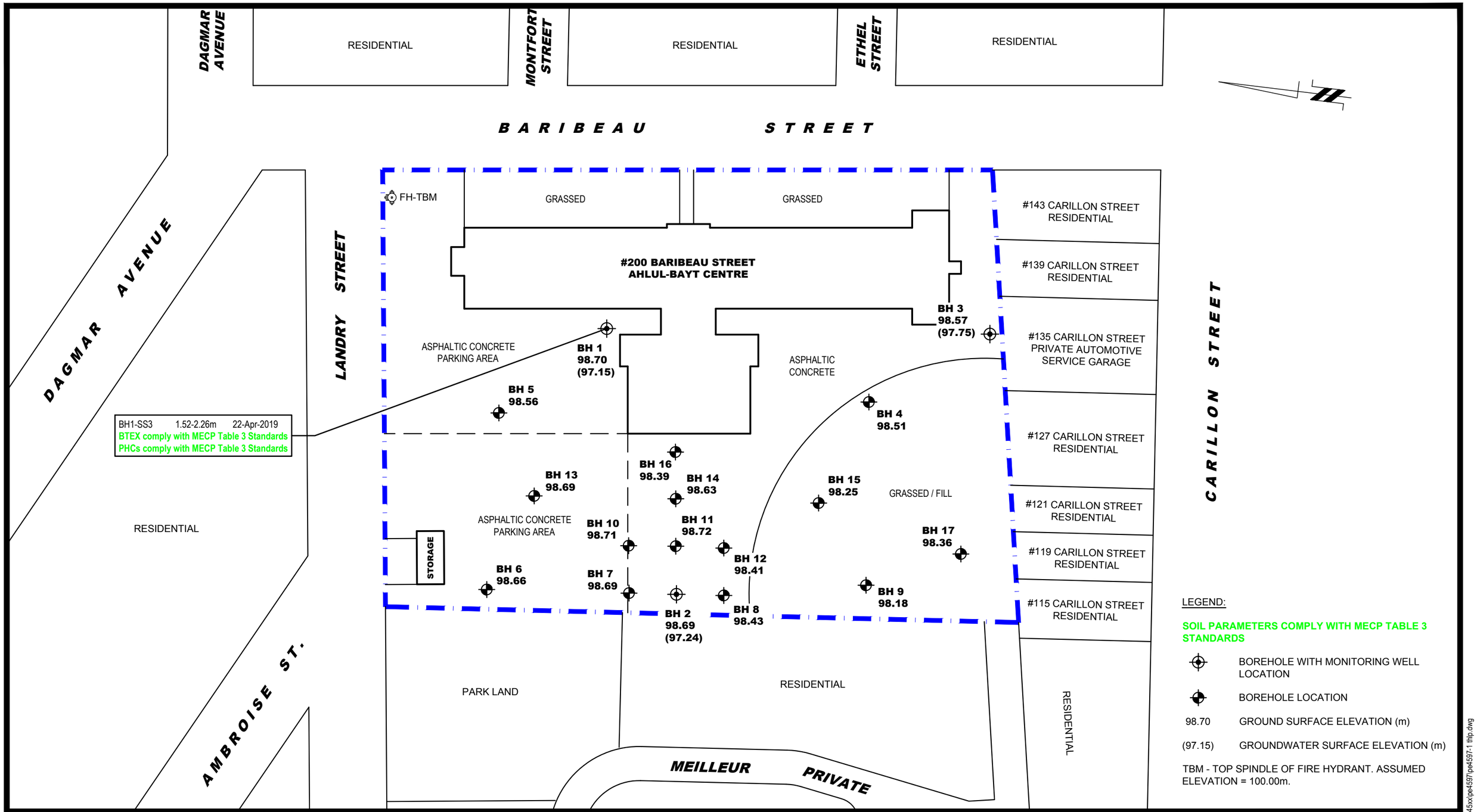

LEGEND:

SOIL PARAMETERS COMPLY WITH MECP TABLE 3 STANDARDS

- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION
- 98.70 GROUND SURFACE ELEVATION (m)
- (97.15) GROUNDWATER SURFACE ELEVATION (m)

TBM - TOP SPINDLE OF FIRE HYDRANT. ASSUMED ELEVATION = 100.00m.

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BOULET CONSTRUCTION c/o URBAN LOGIC RESEARCH & ADVISORY

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
200 BARIBEAU STREET

OTTAWA, ONTARIO

Title:
ANALYTICAL TESTING PLAN - SOIL (BTEX & PHCs)

Scale: 1:750	Date: 06/2019
Drawn by: MPG	Report No.: PE4597-2
Checked by: MB	PE4597-4A
Approved by: MSD	Revision No.:

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DAGMAR AVENUE

RESIDENTIAL

MONTFORT STREET

RESIDENTIAL

ETHEL STREET

RESIDENTIAL

BARIBEAU STREET

DAGMAR AVENUE

LANDRY STREET

CARILLON STREET

AMBROISE ST.

MEILLEUR PRIVATE

FH-TBM

GRASSED

GRASSED

#200 BARIBEAU STREET
AHLUL-BAYT CENTRE

ASPHALTIC CONCRETE
PARKING AREA

ASPHALTIC
CONCRETE

ASPHALTIC CONCRETE
PARKING AREA

GRASSED / FILL

STORAGE

BH 1
98.70
(97.15)

BH 2
98.69
(97.24)

BH 3
98.57
(97.75)

BH 4
98.51

BH 5
98.56

BH 6
98.66

BH 7
98.69

BH 8
98.43

BH 9
98.18

BH 10
98.71

BH 11
98.72

BH 12
98.41

BH 13
98.69

BH 14
98.63

BH 15
98.25

BH 16
98.39

BH 17
98.36

BH16-SS2	0.61-1.22m	19-June-2019
Parameter	Result (ug/g)	Standard (ug/g)
Mercury	1.3	0.27
Antimony	52.4	7.5
Arsenic	60.5	18
Barium	3000	390
Cadmium	3.0	1.2
Copper	290	140
Lead	5660	120
Molybdenum	8.3	6.9
Selenium	10.5	2.4
Zinc	1540	340

BH5-SS2	0.76-1.37m	22-Apr-2019
Metals comply with MECP Table 3 Standards		

BH13-SS3	1.22-1.83m	19-June-2019
Parameter	Result (ug/g)	Standard (ug/g)
Mercury	1.9	0.27
Antimony	23.7	7.5
Arsenic	112	18
Barium	1100	390
Cadmium	3.2	1.2
Copper	627	140
Lead	4230	120
Molybdenum	8.0	6.9
Selenium	25.5	2.4
Tahllium	1.2	1.0
Zinc	1580	340

BH6-SS3	1.22-1.83m	19-June-2019
Parameter	Result (ug/g)	Standard (ug/g)
Mercury	5.2	0.27
Antimony	11.2	7.5
Arsenic	28.6	18
Barium	1070	390
Cadmium	2.9	1.2
Copper	161	140
Lead	1420	120
Molybdenum	7.4	6.9
Selenium	2.9	2.4
Zinc	1340	340

BH7-SS3	1.22-1.83m	19-June-2019
Parameter	Result (ug/g)	Standard (ug/g)
Mercury	10.6	0.27
Antimony	55.6	7.5
Arsenic	28.7	18
Barium	1420	390
Cadmium	2.6	1.2
Cobalt	36.0	22
Copper	284	140
Lead	5290	120
Molybdenum	9.4	6.9
Selenium	3.4	2.4
Zinc	1100	340

BH10-SS2	0.61-1.22m	19-June-2019
Parameter	Result (ug/g)	Standard (ug/g)
Mercury	0.7	0.27
Antimony	7.6	7.5
Barium	957	390
Cadmium	1.8	1.2
Lead	957	120
Selenium	4.8	2.4
Zinc	699	340

BH2-SS2	0.76-1.37m	22-Apr-2019
Parameter	Result (ug/g)	Standard (ug/g)
Mercury	3	0.27
Antimony	23.5	7.5
Arsenic	23.5	18
Barium	1020	390
Cadmium	2.1	1.2
Copper	195	140
Lead	1480	120
Selenium	3.7	2.4
Zinc	1120	340

BH12-SS2	1.22-1.42m	19-June-2019
Parameter	Result (ug/g)	Standard (ug/g)
Mercury	0.7	0.27
Antimony	21.1	7.5
Arsenic	40.2	18
Barium	528	390
Cadmium	3.4	1.2
Cobalt	39.1	22
Copper	957	140
Lead	907	120
Selenium	4.8	2.4
Zinc	1960	340

BH14-SS2	0.61-1.22m	19-June-2019
Parameter	Results (ug/g)	Standard (ug/g)
Mercury	1.3	0.27
Antimony	9.6	7.5
Arsenic	275	18
Barium	1020	390
Cadmium	2.0	1.2
Copper	172	140
Lead	1150	120
Molybdenum	16.9	6.9
Selenium	31.3	2.4
Thallium	2.8	1.0
Zinc	563	340

BH3-SS2	0.76-1.37m	22-Apr-2019
Metals comply with MECP Table 3 Standards		

BH4-SS3	1.52-2.13m	22-Apr-2019
Metals comply with MECP Table 3 Standards		

BH15-SS2	0.61-1.22m	19-June-2019
Metals comply with MECP Table 3 Standards		

BH17-SS2	0.61-1.22m	19-June-2019
Parameter	Result (ug/g)	Standard (ug/g)
Mercury	0.67	0.27
Barium	1710	390
Copper	178	140
Lead	1520	120
Selenium	2.5	2.4
Zinc	833	340

BH9-SS2	0.61-1.22m	19-June-2019
Parameter	Result (ug/g)	Standard (ug/g)
Mercury	1.1	0.27
Antimony	76.5	7.5
Arsenic	20	18
Barium	1010	390
Cadmium	1.5	1.2
Copper	155	140
Lead	1010	120
Zinc	983	340

LEGEND:

SOIL PARAMETERS COMPLY WITH MECP TABLE 3 STANDARDS

SOIL PARAMETERS EXCEED MECP TABLE 3 STANDARDS

BOREHOLE WITH MONITORING WELL LOCATION

BOREHOLE LOCATION

98.70 GROUND SURFACE ELEVATION (m)

(97.15) GROUNDWATER SURFACE ELEVATION (m)

TBM - TOP SPINDLE OF FIRE HYDRANT. ASSUMED ELEVATION = 100.00m.

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NO.	REVISIONS	DATE	INITIAL

BOULET CONSTRUCTION c/o URBAN LOGIC RESEARCH & ADVISORY

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
200 BARIBEAU STREET

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL (METALS)

Scale: 1:750	Date: 06/2019
Drawn by: MPG	Report No.: PE4597-2
Checked by: MB	PE4597-4B
Approved by: MSD	Revision No.:

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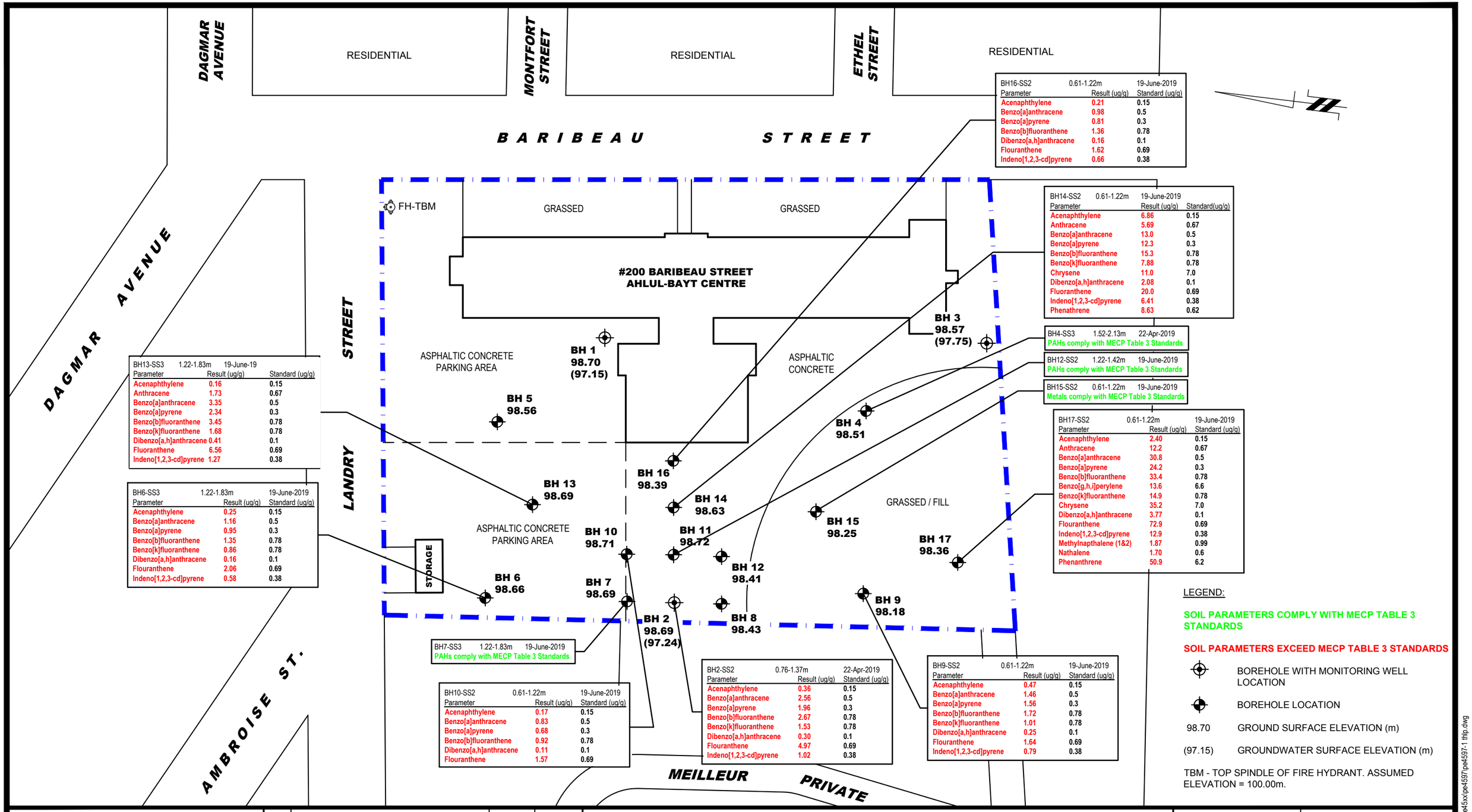

BH16-SS2 0.61-1.22m 19-June-2019

Parameter	Result (ug/g)	Standard (ug/g)
Acenaphthylene	0.21	0.15
Benzo[a]anthracene	0.98	0.5
Benzo[a]pyrene	0.81	0.3
Benzo[b]fluoranthene	1.36	0.78
Dibenzo[a,h]anthracene	0.16	0.1
Flouranthene	1.62	0.69
Indeno[1,2,3-cd]pyrene	0.66	0.38

BH14-SS2 0.61-1.22m 19-June-2019

Parameter	Result (ug/g)	Standard(ug/g)
Acenaphthylene	6.86	0.15
Anthracene	5.69	0.67
Benzo[a]anthracene	13.0	0.5
Benzo[a]pyrene	12.3	0.3
Benzo[b]fluoranthene	15.3	0.78
Benzo[k]fluoranthene	7.88	0.78
Chrysene	11.0	7.0
Dibenzo[a,h]anthracene	2.08	0.1
Fluoranthene	20.0	0.69
Indeno[1,2,3-cd]pyrene	6.41	0.38
Phenathrene	8.63	0.62

BH4-SS3 1.52-2.13m 22-Apr-2019
PAHs comply with MECP Table 3 Standards

BH12-SS2 1.22-1.42m 19-June-2019
PAHs comply with MECP Table 3 Standards

BH15-SS2 0.61-1.22m 19-June-2019
Metals comply with MECP Table 3 Standards

BH17-SS2 0.61-1.22m 19-June-2019

Parameter	Result (ug/g)	Standard (ug/g)
Acenaphthylene	2.40	0.15
Anthracene	12.2	0.67
Benzo[a]anthracene	30.8	0.5
Benzo[a]pyrene	24.2	0.3
Benzo[b]fluoranthene	33.4	0.78
Benzo[g,h,i]perylene	13.6	6.6
Benzo[k]fluoranthene	14.9	0.78
Chrysene	35.2	7.0
Dibenzo[a,h]anthracene	3.77	0.1
Flouranthene	72.9	0.69
Indeno[1,2,3-cd]pyrene	12.9	0.38
Methylnapthalene (1&2)	1.87	0.99
Nathalene	1.70	0.6
Phenanthrene	50.9	6.2

BH13-SS3 1.22-1.83m 19-June-19

Parameter	Result (ug/g)	Standard (ug/g)
Acenaphthylene	0.16	0.15
Anthracene	1.73	0.67
Benzo[a]anthracene	3.35	0.5
Benzo[a]pyrene	2.34	0.3
Benzo[b]fluoranthene	3.45	0.78
Benzo[k]fluoranthene	1.68	0.78
Dibenzo[a,h]anthracene	0.41	0.1
Fluoranthene	6.56	0.69
Indeno[1,2,3-cd]pyrene	1.27	0.38

BH6-SS3 1.22-1.83m 19-June-2019

Parameter	Result (ug/g)	Standard (ug/g)
Acenaphthylene	0.25	0.15
Benzo[a]anthracene	1.16	0.5
Benzo[a]pyrene	0.95	0.3
Benzo[b]fluoranthene	1.35	0.78
Benzo[k]fluoranthene	0.86	0.78
Dibenzo[a,h]anthracene	0.16	0.1
Flouranthene	2.06	0.69
Indeno[1,2,3-cd]pyrene	0.58	0.38

BH7-SS3 1.22-1.83m 19-June-2019
PAHs comply with MECP Table 3 Standards

BH10-SS2 0.61-1.22m 19-June-2019

Parameter	Result (ug/g)	Standard (ug/g)
Acenaphthylene	0.17	0.15
Benzo[a]anthracene	0.83	0.5
Benzo[a]pyrene	0.68	0.3
Benzo[b]fluoranthene	0.92	0.78
Dibenzo[a,h]anthracene	0.11	0.1
Flouranthene	1.57	0.69

BH2-SS2 0.76-1.37m 22-Apr-2019

Parameter	Result (ug/g)	Standard (ug/g)
Acenaphthylene	0.36	0.15
Benzo[a]anthracene	2.56	0.5
Benzo[a]pyrene	1.96	0.3
Benzo[b]fluoranthene	2.67	0.78
Benzo[k]fluoranthene	1.53	0.78
Dibenzo[a,h]anthracene	0.30	0.1
Flouranthene	4.97	0.69
Indeno[1,2,3-cd]pyrene	1.02	0.38

BH9-SS2 0.61-1.22m 19-June-2019

Parameter	Result (ug/g)	Standard (ug/g)
Acenaphthylene	0.47	0.15
Benzo[a]anthracene	1.46	0.5
Benzo[a]pyrene	1.56	0.3
Benzo[b]fluoranthene	1.72	0.78
Benzo[k]fluoranthene	1.01	0.78
Dibenzo[a,h]anthracene	0.25	0.1
Flouranthene	1.64	0.69
Indeno[1,2,3-cd]pyrene	0.79	0.38

LEGEND:

SOIL PARAMETERS COMPLY WITH MECP TABLE 3 STANDARDS

SOIL PARAMETERS EXCEED MECP TABLE 3 STANDARDS

BOREHOLE WITH MONITORING WELL LOCATION

BOREHOLE LOCATION

98.70 GROUND SURFACE ELEVATION (m)

(97.15) GROUNDWATER SURFACE ELEVATION (m)

TBM - TOP SPINDLE OF FIRE HYDRANT. ASSUMED ELEVATION = 100.00m.

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NO.	REVISIONS	DATE	INITIAL

BOULET CONSTRUCTION c/o URBAN LOGIC RESEARCH & ADVISORY

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
200 BARIBEAU STREET

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL (PAHs)

Scale: 1:750	Date: 06/2019
Drawn by: MPG	Report No.: PE4597-2
Checked by: MB	PE4597-4C
Approved by: MSD	Revision No.:

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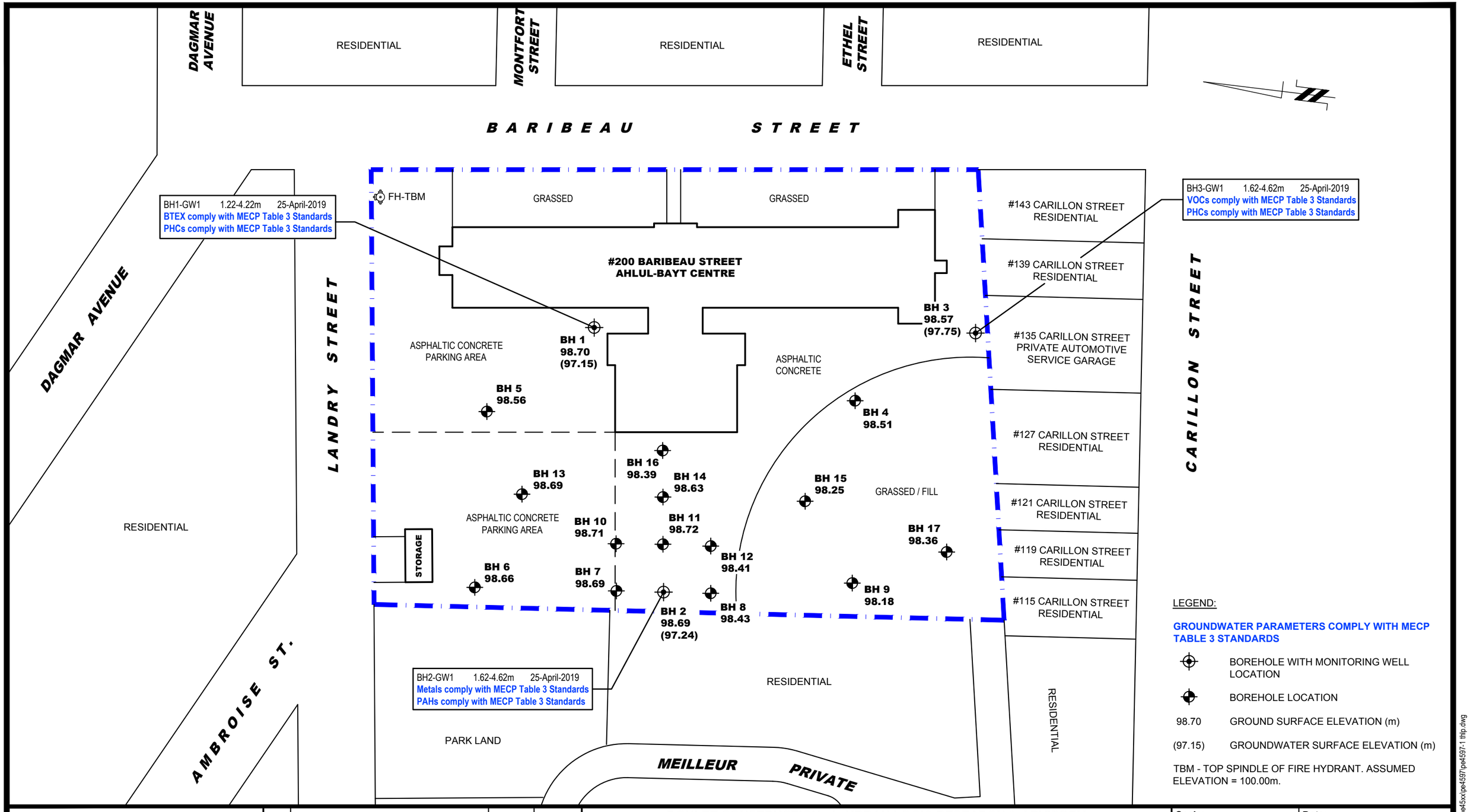

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BOULET CONSTRUCTION c/o URBAN LOGIC RESEARCH & ADVISORY

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
200 BARIBEAU STREET

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - GROUNDWATER

Scale: 1:750	Date: 06/2019
Drawn by: MPG	Report No.: PE4597
Checked by: MB	PE4597-5
Approved by: MSD	Revision No.:

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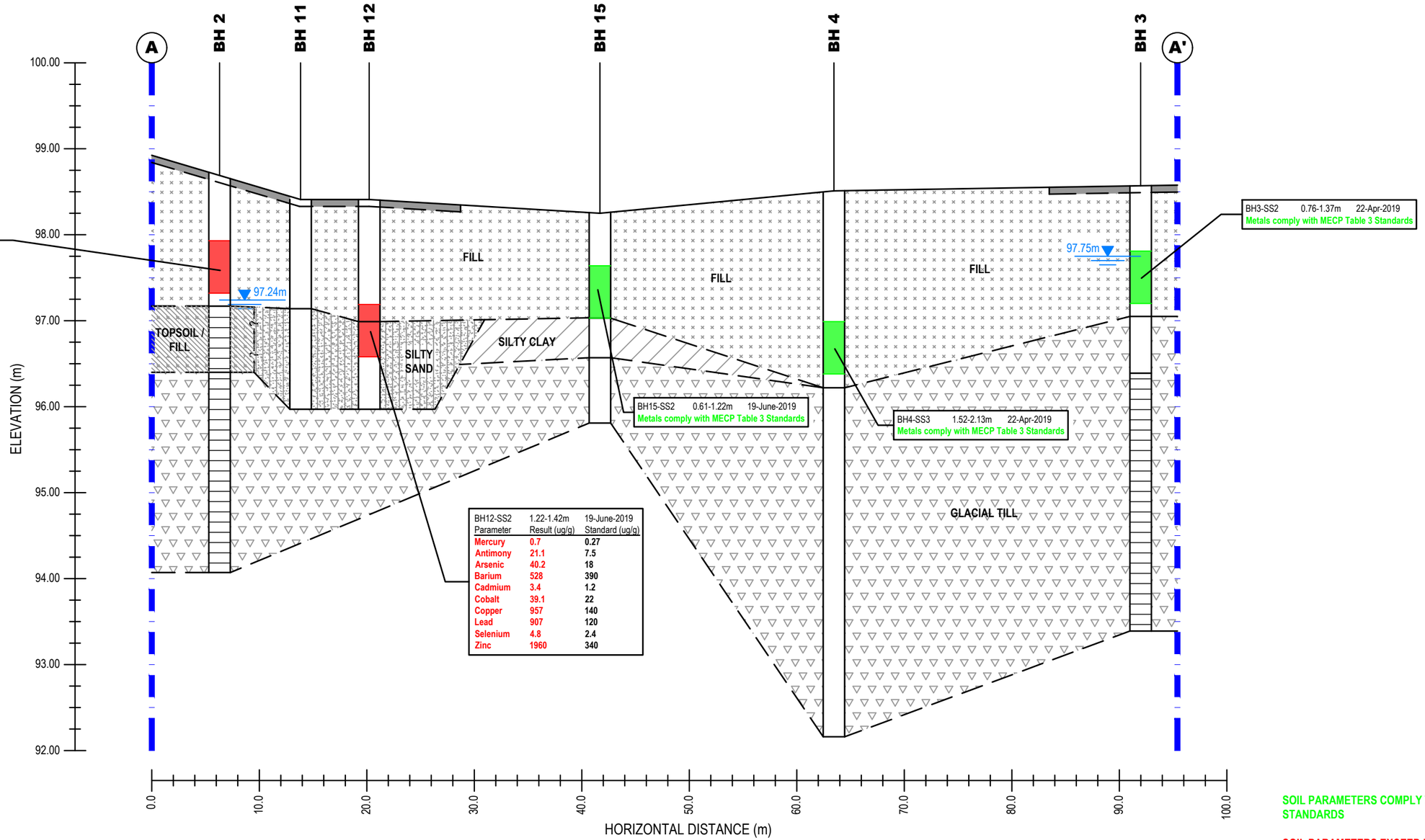

SOIL PARAMETERS COMPLY WITH MECP TABLE 3 STANDARDS

SOIL PARAMETERS EXCEED MECP TABLE 3 STANDARDS

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BOULET CONSTRUCTION c/o URBAN LOGIC RESEARCH & ADVISORY

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
200 BARIBEAU STREET

OTTAWA, ONTARIO

Title:

CROSS-SECTION A-A' - SOIL (METALS)

Scale: AS SHOWN	Date: 06/2019
Drawn by: MPG	Report No.: PE4597-2
Checked by: MB	PE4597-6A
Approved by: MSD	Revision No.:

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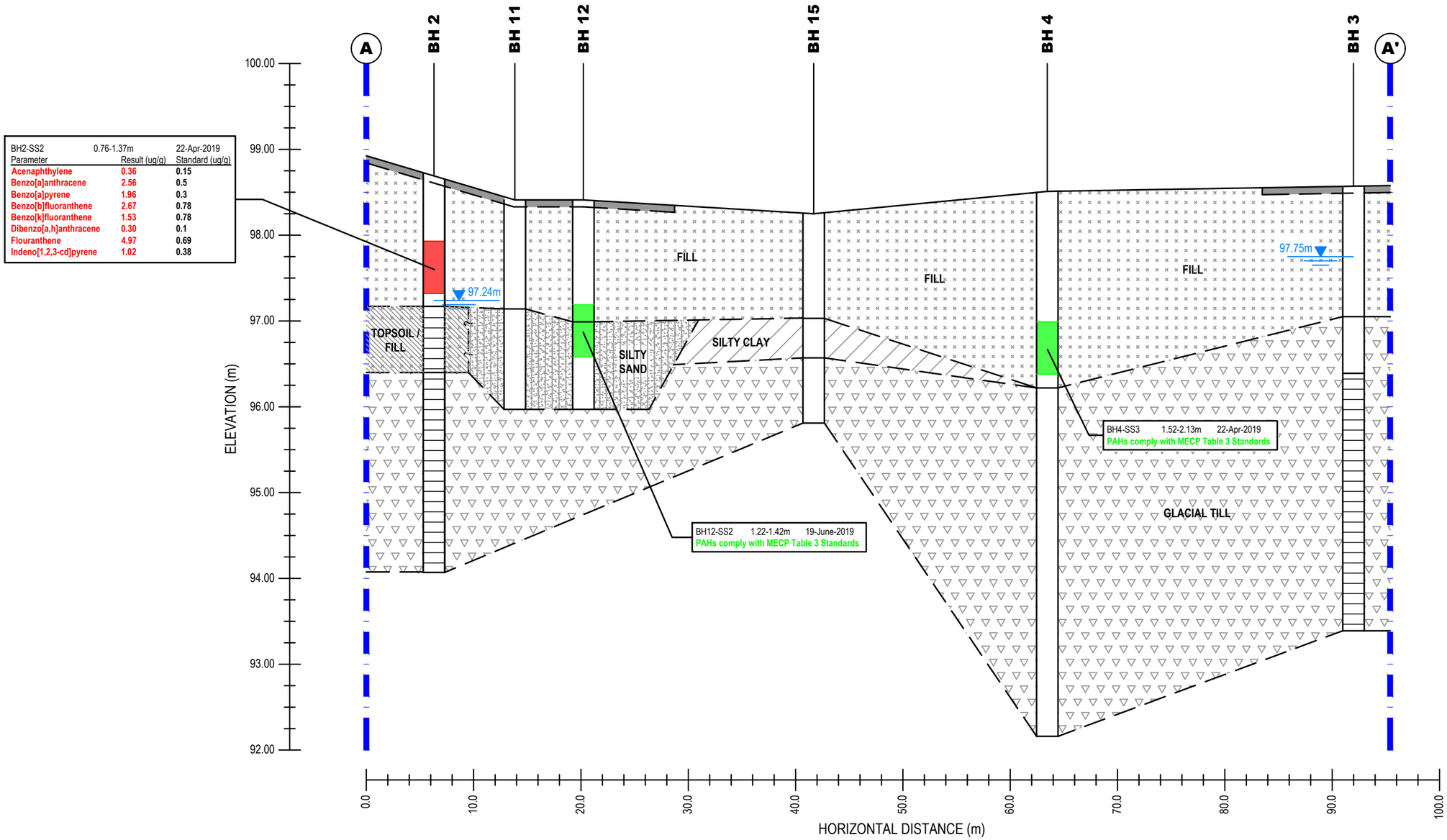

SOIL PARAMETERS COMPLY WITH MECP TABLE 3 STANDARDS

SOIL PARAMETERS EXCEED MECP TABLE 3 STANDARDS

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Ottawa, Ontario K2E 7J5
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BOULET CONSTRUCTION c/o URBAN LOGIC RESEARCH & ADVISORY

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
200 BARIBEAU STREET

OTTAWA, ONTARIO

Title:

CROSS-SECTION A-A' - SOIL (PAHs)

Scale: AS SHOWN	Date: 06/2019
Drawn by: MPG	Report No.: PE4597-2
Checked by: MB	PE4597-6B
Approved by: MSD	Revision No.:

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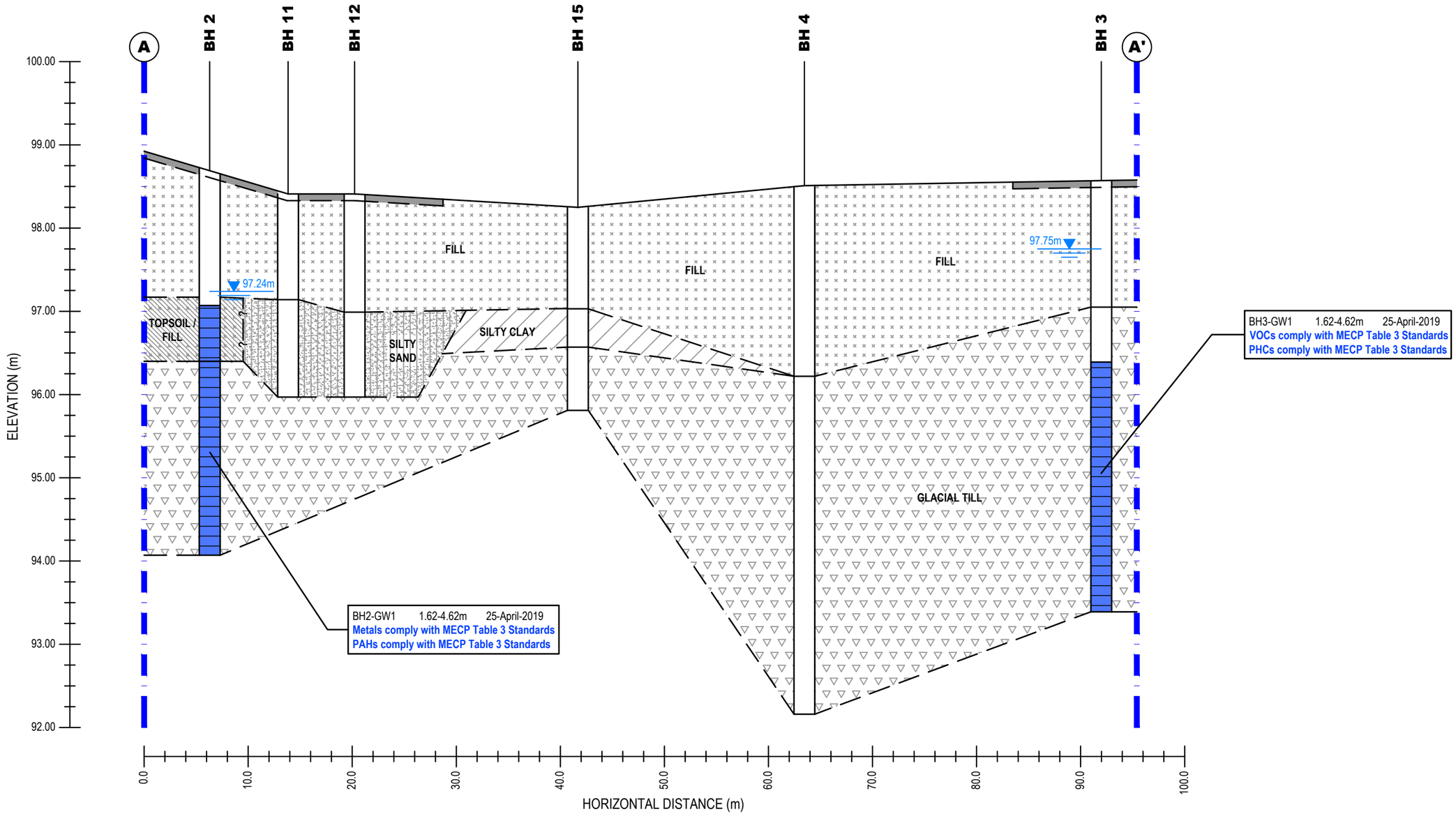

GROUNDWATER PARAMETERS COMPLY WITH MECP TABLE 3 STANDARDS

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BOULET CONSTRUCTION c/o URBAN LOGIC RESEARCH & ADVISORY

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
200 BARIBEAU STREET

OTTAWA, ONTARIO

Title:

CROSS-SECTION A-A' - GROUNDWATER

Scale: AS SHOWN	Date: 06/2019
Drawn by: MPG	Report No.: PE4597-2
Checked by: MB	PE4597-7
Approved by: MSD	Revision No.:

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APPENDIX 1

SAMPLING AND ANALYSIS PLAN

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

LABORATORY CERTIFICATES OF ANALYSIS

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

Paterson Group Inc.

Consulting Engineers
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Sampling & Analysis Plan

Phase II Environmental Site Assessment
200 Baribeau Street
Ottawa, Ontario

Prepared For

Boulet Constuction
c/o Urban Logic Research and Advisory

April 2019

Report: PE4597-SAP

Table of Contents

1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by Boulet Construction c/o Urban Logic research and Advisory to conduct a Phase II Environmental Site Assessment (ESA) at 200 Baribeau Street, in the City of Ottawa, Ontario. Based on historical research completed by Paterson for the subject property, a subsurface investigation program, consisting of borehole drilling, was developed. A geotechnical investigation was conducted concurrently with the environmental subsurface investigation.

Borehole	Location & Rationale	Proposed Depth & Rationale
BH1	Near the furnace room to address the existing furnace oil tanks.	Borehole sampled through the groundwater table to facilitate groundwater monitoring well installation.
BH2	West side of property to address former industrial operations and landfill on adjacent property.	Borehole sampled through the groundwater table to facilitate groundwater monitoring well installation.
BH3	South side of property to address existing private automotive service garage on adjacent property.	Borehole sampled through the groundwater table to facilitate groundwater monitoring well installation.
BH4	General coverage for geotechnical purposes.	Through fill material to native soils, advance a DCPT to refusal for seismic purposes.
BH5	General coverage for geotechnical purposes.	Through fill material to native soils.
BH6-BH17	Delineate impacted fill material from BH2	Through fill material to native soils.

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

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

2.0 ANALYTICAL TESTING PROGRAM

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

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

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

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

3.0 STANDARD OPERATING PROCEDURES

3.1 Environmental Drilling Procedure

Purpose

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

Equipment

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

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

Determining Borehole Locations

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

After drilling is completed a plan with the borehole locations must be provided. Distances 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 fire hydrant located or another benchmark.

Drilling Procedure

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

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

Spoon Washing Procedure

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

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

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

Screening Procedure

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

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

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

3.2 Monitoring Well Installation Procedure

Equipment

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

- ❒ Bentonite chips (Holeplug)
- ❒ Steel flushmount casing

Procedure

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

3.3 Monitoring Well Sampling Procedure

Equipment

- ❒ Water level metre or interface probe on hydrocarbon/LNAPL sites
- ❒ Spray bottles containing water and methanol to clean water level tape or interface probe
- ❒ Peristaltic pump
- ❒ Polyethylene tubing for peristaltic pump
- ❒ Flexible tubing for peristaltic pump
- ❒ Latex or nitrile gloves (depending on suspected contaminant)

- ❒ Allen keys and/or 9/16” socket wrench to remove well caps
- ❒ Graduated bucket with volume measurements
- ❒ pH/Temperature/Conductivity combo pen
- ❒ Laboratory-supplied sample bottles

Sampling Procedure

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

4.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

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

- ❒ All non-dedicated sampling equipment (split spoons) will be decontaminated according to the SOPs listed above.

- ❒ All groundwater sampling equipment is dedicated (polyethylene and flexible peristaltic tubing is replaced for each well).

- ❒ Where groundwater samples are to be analyzed for VOCs, one laboratory-provided trip blank will be submitted for analysis with every laboratory submission.
- ❒ Approximately one (1) field duplicate will be submitted for every ten (10) samples submitted for laboratory analysis. A minimum of one (1) field duplicate per project will be submitted. Field duplicates will be submitted for soil and groundwater samples
- ❒ Where combo pens are used to measure field chemistry, they will be calibrated on an approximately monthly basis, according to frequency of use.

5.0 DATA QUALITY OBJECTIVES

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

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

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

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

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

It is also important to consider data quality in the overall context of the project. For example, if the DQOs are not met for a given sample, yet the concentrations of contaminants in both the sample and the duplicate exceed the 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 TO SAMPLING & ANALYSIS PLAN

Physical impediments to the Sampling and Analysis plan may include:

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

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
200 Baribeau Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located near the southwest corner of Landry Street and Baribeau Street. Assumed elevation = 100.00m.

FILE NO. PE4597

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** 2019 April 22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
Asphaltic concrete 0.08		AU	1			0	98.70
FILL: Brown silty sand, trace clay and construction debris		SS	2	58	5	1	97.70
2.29		SS	3	21	2	2	96.70
TOPSOIL 3.05		SS	4	71	1	3	95.70
Very loose, brown **SANDY SILT** 3.81		SS	5	58	1	4	94.70
GLACIAL TILL: Compact to dense, brown silty sand, some gravel		SS	6	79	18	5	93.70
5.94		SS	7	75	36		
End of Borehole		SS	8	83	41		
(GWL @ 1.55m - April 25, 2019)							

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

20 40 60 80

Monitoring Well Construction

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
200 Baribeau Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located near the southwest corner of Landry Street and Baribeau Street. Assumed elevation = 100.00m.

FILE NO. PE4597

REMARKS

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger **DATE** 2019 April 22

SOIL DESCRIPTION		STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE								
Asphaltic concrete	0.08		AU	1			0	98.69
FILL: Crushed stone	0.23							
FILL: Brown silty sand	1.52		SS	2	62	7	1	97.69
- trace clay and glass by 0.6m depth	2.29		SS	3	67	2	2	96.69
TOPSOIL			SS	4	50	35		
GLACIAL TILL: Dense to compact, brown silty sand, some gravel, occasional cobbles and boulders, trace clay	3.80		SS	5	58	12	3	95.69
			SS	6	62	13	4	94.69
GLACIAL TILL: Brown silty clay, some sand, trace gravel	5.18		SS	7	54	13	5	93.69
End of Borehole								
(GWL @ 1.45m - April 25, 2019)								

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

Monitoring Well Construction

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
200 Baribeau Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located near the southwest corner of Landry Street and Baribeau Street. Assumed elevation = 100.00m.

FILE NO. PE4597

REMARKS

HOLE NO. BH 3

BORINGS BY CME 55 Power Auger **DATE** 2019 April 22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
Asphaltic concrete 0.05		AU	1			0	98.57
FILL: Brown silty sand, some clay, trace gravel 1.52		SS	2	50	4	1	97.57
		SS	3	42	11	2	96.57
		SS	4	88	10		
GLACIAL TILL: Brown silty clay, some sand, trace gravel		SS	5	83	20	3	95.57
		SS	6	83	22	4	94.57
5.18		SS	6	100	50+	5	93.57
End of Borehole							
(GWL @ 0.82m - April 25, 2019)							

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

20 40 60 80

100 200 300 400 500
RKI Eagle Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
200 Baribeau Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located near the southwest corner of Landry Street and Baribeau Street. Assumed elevation = 100.00m.

FILE NO. PE4597

REMARKS

HOLE NO. BH 4

BORINGS BY CME 55 Power Auger **DATE** 2019 April 22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	98.51
FILL: Brown silty sand, trace clay and gravel 0.28		AU	1				
FILL: Brown silty sand, some gravel, trace clay and construction debris 2.29		SS	2	62	3	1	97.51
		SS	3	58	19	2	96.51
GLACIAL TILL: Brown silty clay, some sand, trace gravel 3.66		SS	4	42	5		
		SS	5	88	14	3	95.51
Dynamic Cone Penetration Test commenced at 3.66m depth.						4	94.51
Inferred **GLACIAL TILL**						5	93.51
6.35						6	92.51
End of Borehole							
Practical DCPT refusal at 6.35m depth							

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

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
200 Baribeau Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located near the southwest corner of Landry Street and Baribeau Street. Assumed elevation = 100.00m.

FILE NO. PE4597

REMARKS

HOLE NO. BH 5

BORINGS BY CME 55 Power Auger **DATE** 2019 April 22

SOIL DESCRIPTION		STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE								
Asphaltic concrete	0.08		AU	1			0	98.56
FILL: Brown silty sand, some crushed stone, trace clay	0.30		SS	2	42	6	1	97.56
FILL: Brown silty clay, some sand and gravel	1.83		SS	3	62	4	2	96.56
TOPSOIL	2.29		SS	4	79	3		
Loose, brown **SANDY SILT**	3.05		SS	5	38	15	3	95.56
GLACIAL TILL: Brown silty clay, some sand, trace gravel	3.66							
End of Borehole								

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

20 40 60 80

100 200 300 400 500
RKI Eagle Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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

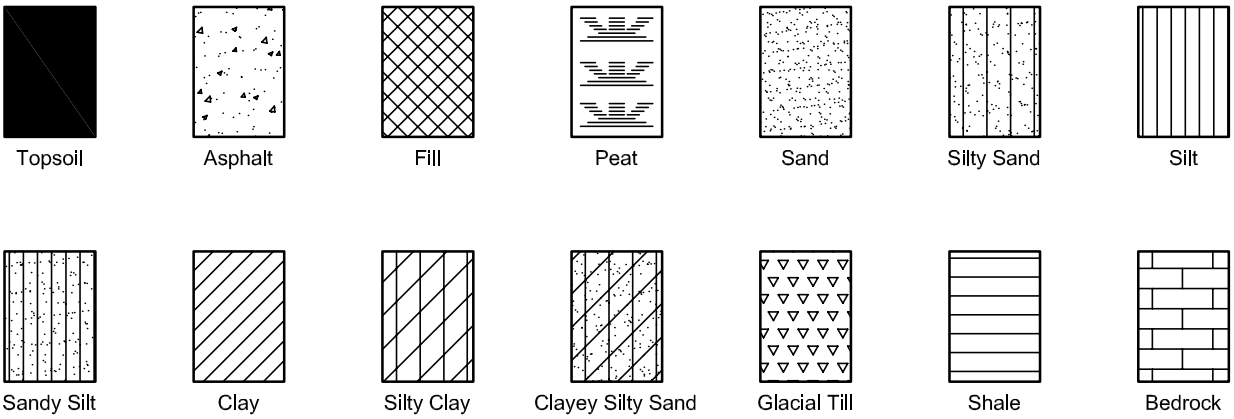
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void 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.

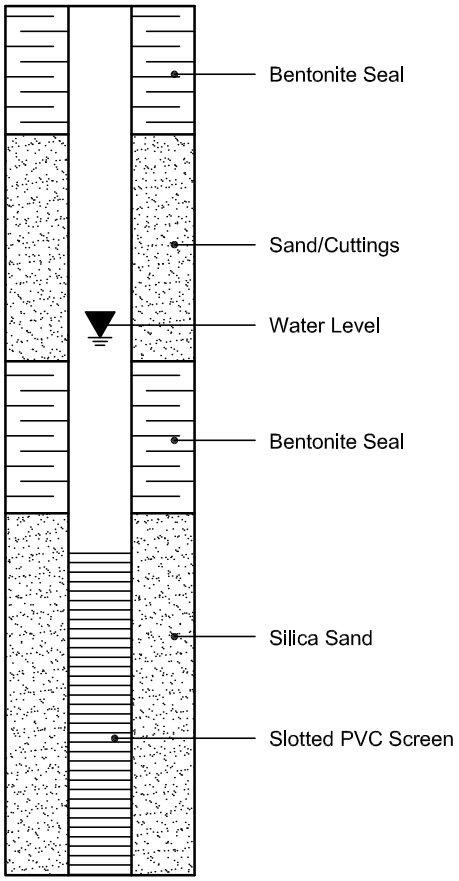
SYMBOLS AND TERMS (continued)

STRATA PLOT

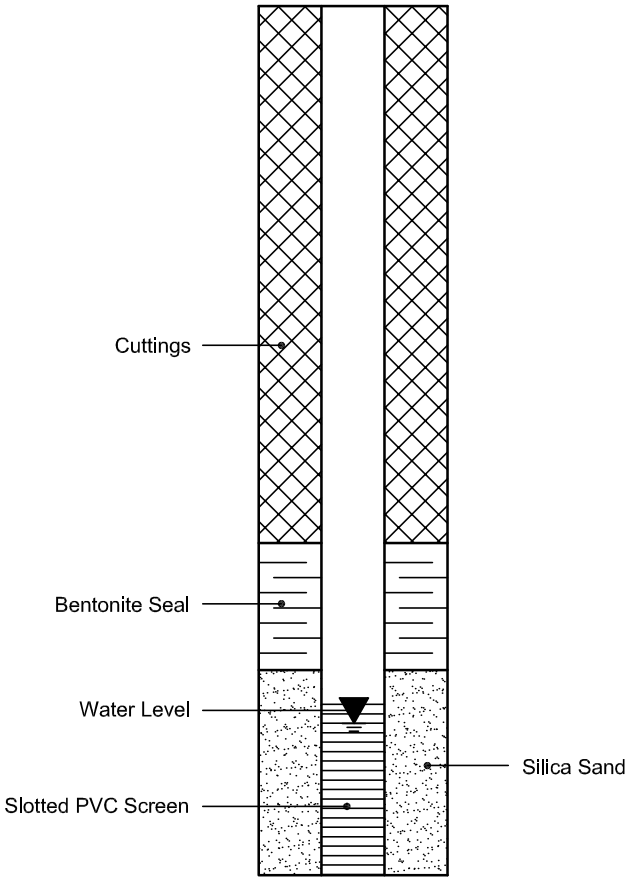


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Rd South
Nepean, ON K2E 7J5
Attn: Mark St. Pierre

Client PO: 26463
Project: PE4597
Custody: 121670

Report Date: 2-May-2019
Order Date: 25-Apr-2019

Order #: 1917553

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

Paracel ID	Client ID
1917553-01	BH1-GW1
1917553-02	BH2-GW1
1917553-03	BH3-GW1

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 26463

Report Date: 02-May-2019
Order Date: 25-Apr-2019
Project Description: PE4597

Analysis Summary Table

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

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26463

Report Date: 02-May-2019

Order Date: 25-Apr-2019

Project Description: PE4597

	Client ID:	BH1-GW1	BH2-GW1	BH3-GW1	-
	Sample Date:	04/25/2019 07:24	04/25/2019 07:24	04/25/2019 07:24	-
	Sample ID:	1917553-01	1917553-02	1917553-03	-
	MDL/Units	Water	Water	Water	-
Metals					
Mercury	0.1 ug/L	-	<0.1	-	-
Antimony	0.5 ug/L	-	5.0	-	-
Arsenic	1 ug/L	-	<1	-	-
Barium	1 ug/L	-	303	-	-
Beryllium	0.5 ug/L	-	<0.5	-	-
Boron	10 ug/L	-	65	-	-
Cadmium	0.1 ug/L	-	1.1	-	-
Chromium	1 ug/L	-	<1	-	-
Chromium (VI)	10 ug/L	-	<10	-	-
Cobalt	0.5 ug/L	-	0.8	-	-
Copper	0.5 ug/L	-	7.8	-	-
Lead	0.1 ug/L	-	0.8	-	-
Molybdenum	0.5 ug/L	-	0.8	-	-
Nickel	1 ug/L	-	7	-	-
Selenium	1 ug/L	-	6	-	-
Silver	0.1 ug/L	-	<0.1	-	-
Sodium	200 ug/L	-	360000	-	-
Thallium	0.1 ug/L	-	<0.1	-	-
Uranium	0.1 ug/L	-	1.3	-	-
Vanadium	0.5 ug/L	-	0.6	-	-
Zinc	5 ug/L	-	453	-	-
Volatiles					
Acetone	5.0 ug/L	-	-	<5.0	-
Benzene	0.5 ug/L	-	-	<0.5	-
Bromodichloromethane	0.5 ug/L	-	-	<0.5	-
Bromoform	0.5 ug/L	-	-	<0.5	-
Bromomethane	0.5 ug/L	-	-	<0.5	-
Carbon Tetrachloride	0.2 ug/L	-	-	<0.2	-
Chlorobenzene	0.5 ug/L	-	-	<0.5	-
Chloroform	0.5 ug/L	-	-	<0.5	-
Dibromochloromethane	0.5 ug/L	-	-	<0.5	-
Dichlorodifluoromethane	1.0 ug/L	-	-	<1.0	-
1,2-Dichlorobenzene	0.5 ug/L	-	-	<0.5	-
1,3-Dichlorobenzene	0.5 ug/L	-	-	<0.5	-
1,4-Dichlorobenzene	0.5 ug/L	-	-	<0.5	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26463

Report Date: 02-May-2019

Order Date: 25-Apr-2019

Project Description: PE4597

	Client ID:	BH1-GW1	BH2-GW1	BH3-GW1	-
	Sample Date:	04/25/2019 07:24	04/25/2019 07:24	04/25/2019 07:24	-
	Sample ID:	1917553-01	1917553-02	1917553-03	-
	MDL/Units	Water	Water	Water	-
1,1-Dichloroethane	0.5 ug/L	-	-	<0.5	-
1,2-Dichloroethane	0.5 ug/L	-	-	<0.5	-
1,1-Dichloroethylene	0.5 ug/L	-	-	<0.5	-
cis-1,2-Dichloroethylene	0.5 ug/L	-	-	<0.5	-
trans-1,2-Dichloroethylene	0.5 ug/L	-	-	<0.5	-
1,2-Dichloropropane	0.5 ug/L	-	-	<0.5	-
cis-1,3-Dichloropropylene	0.5 ug/L	-	-	<0.5	-
trans-1,3-Dichloropropylene	0.5 ug/L	-	-	<0.5	-
1,3-Dichloropropene, total	0.5 ug/L	-	-	<0.5	-
Ethylbenzene	0.5 ug/L	-	-	4.4	-
Ethylene dibromide (dibromoethan	0.2 ug/L	-	-	<0.2	-
Hexane	1.0 ug/L	-	-	<1.0	-
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	-	-	<5.0	-
Methyl Isobutyl Ketone	5.0 ug/L	-	-	<5.0	-
Methyl tert-butyl ether	2.0 ug/L	-	-	<2.0	-
Methylene Chloride	5.0 ug/L	-	-	<5.0	-
Styrene	0.5 ug/L	-	-	<0.5	-
1,1,1,2-Tetrachloroethane	0.5 ug/L	-	-	<0.5	-
1,1,2,2-Tetrachloroethane	0.5 ug/L	-	-	<0.5	-
Tetrachloroethylene	0.5 ug/L	-	-	<0.5	-
Toluene	0.5 ug/L	-	-	5.0	-
1,1,1-Trichloroethane	0.5 ug/L	-	-	<0.5	-
1,1,2-Trichloroethane	0.5 ug/L	-	-	<0.5	-
Trichloroethylene	0.5 ug/L	-	-	<0.5	-
Trichlorofluoromethane	1.0 ug/L	-	-	<1.0	-
Vinyl chloride	0.5 ug/L	-	-	<0.5	-
m,p-Xylenes	0.5 ug/L	-	-	5.0	-
o-Xylene	0.5 ug/L	-	-	<0.5	-
Xylenes, total	0.5 ug/L	-	-	5.0	-
4-Bromofluorobenzene	Surrogate	-	-	90.8%	-
Dibromofluoromethane	Surrogate	-	-	108%	-
Toluene-d8	Surrogate	-	-	100%	-
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	-	-	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26463

Report Date: 02-May-2019

Order Date: 25-Apr-2019

Project Description: PE4597

	Client ID:	BH1-GW1	BH2-GW1	BH3-GW1	-
	Sample Date:	04/25/2019 07:24	04/25/2019 07:24	04/25/2019 07:24	-
	Sample ID:	1917553-01	1917553-02	1917553-03	-
	MDL/Units	Water	Water	Water	-
o-Xylene	0.5 ug/L	<0.5	-	-	-
Xylenes, total	0.5 ug/L	<0.5	-	-	-
Toluene-d8	Surrogate	103%	-	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	-	<25	-
F2 PHCs (C10-C16)	100 ug/L	<100	-	<100	-
F3 PHCs (C16-C34)	100 ug/L	<100	-	<100	-
F4 PHCs (C34-C50)	100 ug/L	<100	-	<100	-
Semi-Volatiles					
Acenaphthene	0.05 ug/L	-	<0.05	-	-
Acenaphthylene	0.05 ug/L	-	<0.05	-	-
Anthracene	0.01 ug/L	-	<0.01	-	-
Benzo [a] anthracene	0.01 ug/L	-	<0.01	-	-
Benzo [a] pyrene	0.01 ug/L	-	<0.01	-	-
Benzo [b] fluoranthene	0.05 ug/L	-	<0.05	-	-
Benzo [g,h,i] perylene	0.05 ug/L	-	<0.05	-	-
Benzo [k] fluoranthene	0.05 ug/L	-	<0.05	-	-
Chrysene	0.05 ug/L	-	<0.05	-	-
Dibenzo [a,h] anthracene	0.05 ug/L	-	<0.05	-	-
Fluoranthene	0.01 ug/L	-	0.04	-	-
Fluorene	0.05 ug/L	-	<0.05	-	-
Indeno [1,2,3-cd] pyrene	0.05 ug/L	-	<0.05	-	-
1-Methylnaphthalene	0.05 ug/L	-	<0.05	-	-
2-Methylnaphthalene	0.05 ug/L	-	<0.05	-	-
Methylnaphthalene (1&2)	0.10 ug/L	-	<0.10	-	-
Naphthalene	0.05 ug/L	-	<0.05	-	-
Phenanthrene	0.05 ug/L	-	<0.05	-	-
Pyrene	0.01 ug/L	-	0.04	-	-
2-Fluorobiphenyl	Surrogate	-	76.3%	-	-
Terphenyl-d14	Surrogate	-	118%	-	-

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	*25.5*		*ug/L*		*127*	*50-140*			
Surrogate: Terphenyl-d14	*23.7*		*ug/L*		*119*	*50-140*			
Volatiles									
Acetone	ND	5.0	ug/L						
Benzene	ND	0.5	ug/L						
Bromodichloromethane	ND	0.5	ug/L						
Bromoform	ND	0.5	ug/L						
Bromomethane	ND	0.5	ug/L						
Carbon Tetrachloride	ND	0.2	ug/L						
Chlorobenzene	ND	0.5	ug/L						
Chloroform	ND	0.5	ug/L						
Dibromochloromethane	ND	0.5	ug/L						

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Dichlorodifluoromethane	ND	1.0	ug/L						
1,2-Dichlorobenzene	ND	0.5	ug/L						
1,3-Dichlorobenzene	ND	0.5	ug/L						
1,4-Dichlorobenzene	ND	0.5	ug/L						
1,1-Dichloroethane	ND	0.5	ug/L						
1,2-Dichloroethane	ND	0.5	ug/L						
1,1-Dichloroethylene	ND	0.5	ug/L						
cis-1,2-Dichloroethylene	ND	0.5	ug/L						
trans-1,2-Dichloroethylene	ND	0.5	ug/L						
1,2-Dichloropropane	ND	0.5	ug/L						
cis-1,3-Dichloropropylene	ND	0.5	ug/L						
trans-1,3-Dichloropropylene	ND	0.5	ug/L						
1,3-Dichloropropene, total	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Ethylene dibromide (dibromoethane	ND	0.2	ug/L						
Hexane	ND	1.0	ug/L						
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L						
Methyl Isobutyl Ketone	ND	5.0	ug/L						
Methyl tert-butyl ether	ND	2.0	ug/L						
Methylene Chloride	ND	5.0	ug/L						
Styrene	ND	0.5	ug/L						
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L						
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L						
Tetrachloroethylene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
1,1,1-Trichloroethane	ND	0.5	ug/L						
1,1,2-Trichloroethane	ND	0.5	ug/L						
Trichloroethylene	ND	0.5	ug/L						
Trichlorofluoromethane	ND	1.0	ug/L						
Vinyl chloride	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: 4-Bromofluorobenzene	*91.0*		*ug/L*		*114*	*50-140*			
Surrogate: Dibromofluoromethane	*78.0*		*ug/L*		*97.5*	*50-140*			
Surrogate: Toluene-d8	*78.2*		*ug/L*		*97.8*	*50-140*			
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	*78.2*		*ug/L*		*97.8*	*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	0.61	0.5	ug/L	ND			0.0	20	
Arsenic	ND	1	ug/L	ND			0.0	20	
Barium	20.9	1	ug/L	21.3			1.9	20	
Beryllium	ND	0.5	ug/L	ND			0.0	20	
Boron	20	10	ug/L	19			5.0	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	ND	0.5	ug/L	ND			0.0	20	
Copper	0.85	0.5	ug/L	0.85			0.6	20	
Lead	ND	0.1	ug/L	ND			0.0	20	
Molybdenum	1.15	0.5	ug/L	1.05			9.3	20	
Nickel	ND	1	ug/L	ND			0.0	20	
Selenium	ND	1	ug/L	ND			0.0	20	
Silver	ND	0.1	ug/L	ND			0.0	20	
Sodium	16000	200	ug/L	16500			3.3	20	
Thallium	ND	0.1	ug/L	ND			0.0	20	
Uranium	ND	0.1	ug/L	ND			0.0	20	
Vanadium	ND	0.5	ug/L	ND			0.0	20	
Zinc	6	5	ug/L	8			20.4	20	QR-01
Volatiles									
Acetone	ND	5.0	ug/L	ND				30	
Benzene	ND	0.5	ug/L	ND				30	
Bromodichloromethane	ND	0.5	ug/L	ND				30	
Bromoform	ND	0.5	ug/L	ND				30	
Bromomethane	ND	0.5	ug/L	ND				30	
Carbon Tetrachloride	ND	0.2	ug/L	ND				30	
Chlorobenzene	ND	0.5	ug/L	ND				30	
Chloroform	ND	0.5	ug/L	ND				30	
Dibromochloromethane	ND	0.5	ug/L	ND				30	
Dichlorodifluoromethane	ND	1.0	ug/L	ND				30	
1,2-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,3-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,4-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,1-Dichloroethane	ND	0.5	ug/L	ND				30	
1,2-Dichloroethane	ND	0.5	ug/L	ND				30	
1,1-Dichloroethylene	ND	0.5	ug/L	ND				30	
cis-1,2-Dichloroethylene	ND	0.5	ug/L	ND				30	
trans-1,2-Dichloroethylene	ND	0.5	ug/L	ND				30	
1,2-Dichloropropane	ND	0.5	ug/L	ND				30	
cis-1,3-Dichloropropylene	ND	0.5	ug/L	ND				30	
trans-1,3-Dichloropropylene	ND	0.5	ug/L	ND				30	
Ethylbenzene	ND	0.5	ug/L	ND				30	
Ethylene dibromide (dibromoethane,	ND	0.2	ug/L	ND				30	
Hexane	ND	1.0	ug/L	ND				30	
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L	ND				30	
Methyl Isobutyl Ketone	ND	5.0	ug/L	ND				30	
Methyl tert-butyl ether	ND	2.0	ug/L	ND				30	
Methylene Chloride	ND	5.0	ug/L	ND				30	
Styrene	ND	0.5	ug/L	ND				30	
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L	ND				30	
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L	ND				30	
Tetrachloroethylene	ND	0.5	ug/L	ND				30	
Toluene	ND	0.5	ug/L	ND				30	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
1,1,1-Trichloroethane	ND	0.5	ug/L	ND				30	
1,1,2-Trichloroethane	ND	0.5	ug/L	ND				30	
Trichloroethylene	ND	0.5	ug/L	ND				30	
Trichlorofluoromethane	ND	1.0	ug/L	ND				30	
Vinyl chloride	ND	0.5	ug/L	ND				30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: 4-Bromofluorobenzene	*89.2*		*ug/L*		*111*	*50-140*			
Surrogate: Dibromofluoromethane	*81.9*		*ug/L*		*102*	*50-140*			
Surrogate: Toluene-d8	*77.7*		*ug/L*		*97.1*	*50-140*			
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	*77.7*		*ug/L*		*97.1*	*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)	1860	25	ug/L		93.0	68-117			
F2 PHCs (C10-C16)	1480	100	ug/L		92.3	60-140			
F3 PHCs (C16-C34)	3820	100	ug/L		97.4	60-140			
F4 PHCs (C34-C50)	1960	100	ug/L		78.8	60-140			
Metals									
Mercury	3.24	0.1	ug/L	ND	108	70-130			
Antimony	37.1	0.5	ug/L	ND	74.2	80-120			QM-07
Arsenic	44.4	1	ug/L	ND	88.8	80-120			
Barium	58.8	1	ug/L	21.3	74.9	80-120			QM-07
Beryllium	43.3	0.5	ug/L	ND	86.5	80-120			
Boron	57	10	ug/L	19	76.2	80-120			QM-07
Cadmium	41.4	0.1	ug/L	ND	82.7	80-120			
Chromium (VI)	200	10	ug/L	ND	100	70-130			
Chromium	43.7	1	ug/L	ND	87.4	80-120			
Cobalt	41.0	0.5	ug/L	ND	82.1	80-120			
Copper	42.2	0.5	ug/L	0.85	82.8	80-120			
Lead	42.8	0.1	ug/L	ND	85.5	80-120			
Molybdenum	44.3	0.5	ug/L	ND	88.6	80-120			
Nickel	42.5	1	ug/L	ND	85.0	80-120			
Selenium	45.4	1	ug/L	ND	90.7	80-120			
Silver	42.9	0.1	ug/L	ND	85.8	80-120			
Sodium	23400	200	ug/L	16500	69.2	80-120			QM-07
Thallium	39.6	0.1	ug/L	ND	79.2	80-120			QM-07
Uranium	43.9	0.1	ug/L	ND	87.7	80-120			
Vanadium	43.2	0.5	ug/L	ND	86.4	80-120			
Zinc	48	5	ug/L	8	80.5	80-120			
Semi-Volatiles									
Acenaphthene	3.77	0.05	ug/L		75.5	50-140			
Acenaphthylene	3.56	0.05	ug/L		71.2	50-140			
Anthracene	3.55	0.01	ug/L		70.9	50-140			
Benzo [a] anthracene	3.68	0.01	ug/L		73.6	50-140			
Benzo [a] pyrene	3.58	0.01	ug/L		71.5	50-140			
Benzo [b] fluoranthene	5.28	0.05	ug/L		106	50-140			
Benzo [g,h,i] perylene	3.74	0.05	ug/L		74.9	50-140			
Benzo [k] fluoranthene	5.10	0.05	ug/L		102	50-140			
Chrysene	4.25	0.05	ug/L		85.0	50-140			
Dibenzo [a,h] anthracene	4.25	0.05	ug/L		84.9	50-140			
Fluoranthene	3.86	0.01	ug/L		77.3	50-140			
Fluorene	3.62	0.05	ug/L		72.3	50-140			
Indeno [1,2,3-cd] pyrene	4.20	0.05	ug/L		84.0	50-140			
1-Methylnaphthalene	3.44	0.05	ug/L		68.8	50-140			
2-Methylnaphthalene	3.84	0.05	ug/L		76.7	50-140			
Naphthalene	3.89	0.05	ug/L		77.9	50-140			
Phenanthrene	3.52	0.05	ug/L		70.3	50-140			
Pyrene	3.86	0.01	ug/L		77.2	50-140			
Surrogate: 2-Fluorobiphenyl	*13.9*		*ug/L*		*69.6*	*50-140*			
Volatiles									
Acetone	134	5.0	ug/L		134	50-140			
Benzene	37.9	0.5	ug/L		94.8	60-130			
Bromodichloromethane	35.4	0.5	ug/L		88.4	60-130			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Bromoform	41.4	0.5	ug/L		103	60-130			
Bromomethane	30.0	0.5	ug/L		74.9	50-140			
Carbon Tetrachloride	32.4	0.2	ug/L		81.1	60-130			
Chlorobenzene	42.7	0.5	ug/L		107	60-130			
Chloroform	39.4	0.5	ug/L		98.6	60-130			
Dibromochloromethane	38.4	0.5	ug/L		95.9	60-130			
Dichlorodifluoromethane	44.7	1.0	ug/L		112	50-140			
1,2-Dichlorobenzene	40.4	0.5	ug/L		101	60-130			
1,3-Dichlorobenzene	41.1	0.5	ug/L		103	60-130			
1,4-Dichlorobenzene	40.0	0.5	ug/L		100	60-130			
1,1-Dichloroethane	35.0	0.5	ug/L		87.4	60-130			
1,2-Dichloroethane	38.1	0.5	ug/L		95.4	60-130			
1,1-Dichloroethylene	35.2	0.5	ug/L		88.1	60-130			
cis-1,2-Dichloroethylene	38.6	0.5	ug/L		96.4	60-130			
trans-1,2-Dichloroethylene	35.8	0.5	ug/L		89.4	60-130			
1,2-Dichloropropane	38.6	0.5	ug/L		96.6	60-130			
cis-1,3-Dichloropropylene	43.3	0.5	ug/L		108	60-130			
trans-1,3-Dichloropropylene	41.0	0.5	ug/L		103	60-130			
Ethylbenzene	39.3	0.5	ug/L		98.3	60-130			
Ethylene dibromide (dibromoethane	39.0	0.2	ug/L		97.5	60-130			
Hexane	41.0	1.0	ug/L		102	60-130			
Methyl Ethyl Ketone (2-Butanone)	107	5.0	ug/L		107	50-140			
Methyl Isobutyl Ketone	110	5.0	ug/L		110	50-140			
Methyl tert-butyl ether	88.5	2.0	ug/L		88.5	50-140			
Methylene Chloride	35.0	5.0	ug/L		87.6	60-130			
Styrene	36.1	0.5	ug/L		90.2	60-130			
1,1,1,2-Tetrachloroethane	37.1	0.5	ug/L		92.8	60-130			
1,1,2,2-Tetrachloroethane	43.1	0.5	ug/L		108	60-130			
Tetrachloroethylene	41.8	0.5	ug/L		104	60-130			
Toluene	41.5	0.5	ug/L		104	60-130			
1,1,1-Trichloroethane	35.3	0.5	ug/L		88.2	60-130			
1,1,2-Trichloroethane	39.4	0.5	ug/L		98.6	60-130			
Trichloroethylene	41.0	0.5	ug/L		103	60-130			
Trichlorofluoromethane	38.2	1.0	ug/L		95.5	60-130			
Vinyl chloride	29.5	0.5	ug/L		73.8	50-140			
m,p-Xylenes	82.9	0.5	ug/L		104	60-130			
o-Xylene	43.0	0.5	ug/L		107	60-130			
Benzene	37.9	0.5	ug/L		94.8	60-130			
Ethylbenzene	39.3	0.5	ug/L		98.3	60-130			
Toluene	41.5	0.5	ug/L		104	60-130			
m,p-Xylenes	82.9	0.5	ug/L		104	60-130			
o-Xylene	43.0	0.5	ug/L		107	60-130			

Qualifier Notes:

QC Qualifiers :

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

QR-01 : Duplicate RPD is high, however, the sample result is less than 10x the MDL.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

CCME PHC additional information:

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

PARACEL LABORATORIES LTD.

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Chain of Custody
(Lab Use Only)
№ 121670

Page 1 of 1

Client Name: Paterson Group	Project Reference: PE4597
Contact Name: Mark St Pierre / MIKE BEAUDOIN	Quote #
Address: 154 Colonnade Road South	PO # 26463
Telephone: 613-226-7381	Email Address: mbeaudoin@patersongroup.ca mstpierre@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)

Paracel Order Number: 1917553

Required Analyses

	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	BH1-GW1	GW		3	Apr. 25, 2019	7:24	✓						
2	BH2-GW1	GW		4	↓	8:10			✓	✓	✓	✓	
3	BH3-GW1	GW		3	↓	9:05	X	X		[illegible]	[illegible]	[illegible]	
4													
5													
6													
7													
8													
9													
10													

Comments:

Method of Delivery: Paracel

Relinquished By (Sign): [signature]	Received by Driver/Depot: M. Drouse	Received at Lab: [illegible]	Verified By: [illegible]
Relinquished By (Print): MIKE B.	Date/Time: 25/04/19 4:00	Date/Time: Apr 25, 2019 05:04	Date/Time: 04-25-19 17:38
Date/Time:	Temperature: °C	Temperature: 15.9	pH Verified ☒ By: [illegible]

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Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Mike Beaudoin

Client PO: 26411
Project: PE4597
Custody: 121668

Report Date: 26-Apr-2019
Order Date: 23-Apr-2019

Order #: 1917260

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

Paracel ID	Client ID
1917260-01	BH1-SS3
1917260-02	BH2-SS2
1917260-03	BH3-SS2
1917260-04	BH4-SS3
1917260-05	BH5-SS2

Approved By:

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 26411

Report Date: 26-Apr-2019
Order Date: 23-Apr-2019
Project Description: PE4597

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	24-Apr-19	25-Apr-19
Chromium, hexavalent - soil	MOE E3056 - Extraction, colourimetric	24-Apr-19	24-Apr-19
Mercury by CVAA	EPA 7471B - CVAA, digestion	25-Apr-19	25-Apr-19
PHC F1	CWS Tier 1 - P&T GC-FID	24-Apr-19	25-Apr-19
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	24-Apr-19	25-Apr-19
REG 153: Metals by ICP/MS, soil	EPA 6020 - Digestion - ICP-MS	25-Apr-19	25-Apr-19
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	22-Apr-19	25-Apr-19
Solids, %	Gravimetric, calculation	25-Apr-19	25-Apr-19

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26411

Report Date: 26-Apr-2019

Order Date: 23-Apr-2019

Project Description: PE4597

	Client ID:	BH1-SS3	BH2-SS2	BH3-SS2	BH4-SS3
	Sample Date:	04/22/2019 09:00	04/22/2019 09:00	04/22/2019 09:00	04/22/2019 09:00
	Sample ID:	1917260-01	1917260-02	1917260-03	1917260-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	75.2	77.6	80.4	87.1
Metals					
Antimony	1.0 ug/g dry	-	20.1	<1.0	<1.0
Arsenic	1.0 ug/g dry	-	23.5	4.9	3.4
Barium	1.0 ug/g dry	-	1030	76.1	65.1
Beryllium	0.5 ug/g dry	-	0.9	0.5	0.5
Boron	5.0 ug/g dry	-	16.5	<5.0	7.0
Cadmium	0.5 ug/g dry	-	2.1	<0.5	<0.5
Chromium	5.0 ug/g dry	-	40.5	26.8	25.7
Chromium (VI)	0.2 ug/g dry	-	<0.2	<0.2	<0.2
Cobalt	1.0 ug/g dry	-	10.6	8.7	8.3
Copper	5.0 ug/g dry	-	195	22.0	25.9
Lead	1.0 ug/g dry	-	1480	20.0	10.4
Mercury	0.1 ug/g dry	-	3.0	<0.1	<0.1
Molybdenum	1.0 ug/g dry	-	3.8	2.2	1.1
Nickel	5.0 ug/g dry	-	37.5	26.7	27.1
Selenium	1.0 ug/g dry	-	3.7	<1.0	<1.0
Silver	0.3 ug/g dry	-	1.5	<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	1.1
Vanadium	10.0 ug/g dry	-	28.5	41.5	42.1
Zinc	20.0 ug/g dry	-	1120	55.6	48.4
Volatiles					
Benzene	0.02 ug/g dry	<0.02	-	-	-
Ethylbenzene	0.05 ug/g dry	<0.05	-	-	-
Toluene	0.05 ug/g dry	<0.05	-	-	-
m,p-Xylenes	0.05 ug/g dry	<0.05	-	-	-
o-Xylene	0.05 ug/g dry	<0.05	-	-	-
Xylenes, total	0.05 ug/g dry	<0.05	-	-	-
Toluene-d8	Surrogate	99.7%	-	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	-	-	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	-	-	-
F3 PHCs (C16-C34)	8 ug/g dry	146	-	-	-
F4 PHCs (C34-C50)	6 ug/g dry	79	-	-	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26411

Report Date: 26-Apr-2019

Order Date: 23-Apr-2019

Project Description: PE4597

	Client ID:	BH1-SS3	BH2-SS2	BH3-SS2	BH4-SS3
	Sample Date:	04/22/2019 09:00	04/22/2019 09:00	04/22/2019 09:00	04/22/2019 09:00
	Sample ID:	1917260-01	1917260-02	1917260-03	1917260-04
	MDL/Units	Soil	Soil	Soil	Soil
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	-	0.26	-	<0.02
Acenaphthylene	0.02 ug/g dry	-	0.36	-	<0.02
Anthracene	0.02 ug/g dry	-	1.22	-	<0.02
Benzo [a] anthracene	0.02 ug/g dry	-	2.56	-	<0.02
Benzo [a] pyrene	0.02 ug/g dry	-	1.96	-	<0.02
Benzo [b] fluoranthene	0.02 ug/g dry	-	2.67	-	<0.02
Benzo [g,h,i] perylene	0.02 ug/g dry	-	0.96	-	<0.02
Benzo [k] fluoranthene	0.02 ug/g dry	-	1.53	-	<0.02
Chrysene	0.02 ug/g dry	-	2.79	-	<0.02
Dibenzo [a,h] anthracene	0.02 ug/g dry	-	0.30	-	<0.02
Fluoranthene	0.02 ug/g dry	-	4.97	-	<0.02
Fluorene	0.02 ug/g dry	-	0.34	-	<0.02
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	-	1.02	-	<0.02
1-Methylnaphthalene	0.02 ug/g dry	-	0.13	-	<0.02
2-Methylnaphthalene	0.02 ug/g dry	-	0.18	-	<0.02
Methylnaphthalene (1&2)	0.04 ug/g dry	-	0.30	-	<0.04
Naphthalene	0.01 ug/g dry	-	0.57	-	<0.01
Phenanthrene	0.02 ug/g dry	-	3.48	-	<0.02
Pyrene	0.02 ug/g dry	-	4.15	-	<0.02
2-Fluorobiphenyl	Surrogate	-	84.8%	-	107%
Terphenyl-d14	Surrogate	-	75.5%	-	98.4%

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26411

Report Date: 26-Apr-2019

Order Date: 23-Apr-2019

Project Description: PE4597

	Client ID:	BH5-SS2	-	-	-
	Sample Date:	04/22/2019 09:00	-	-	-
	Sample ID:	1917260-05	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	90.5	-	-	-
Metals					
Antimony	1.0 ug/g dry	1.3	-	-	-
Arsenic	1.0 ug/g dry	5.3	-	-	-
Barium	1.0 ug/g dry	126	-	-	-
Beryllium	0.5 ug/g dry	0.5	-	-	-
Boron	5.0 ug/g dry	8.1	-	-	-
Cadmium	0.5 ug/g dry	<0.5	-	-	-
Chromium	5.0 ug/g dry	17.9	-	-	-
Chromium (VI)	0.2 ug/g dry	<0.2	-	-	-
Cobalt	1.0 ug/g dry	8.1	-	-	-
Copper	5.0 ug/g dry	29.8	-	-	-
Lead	1.0 ug/g dry	46.5	-	-	-
Mercury	0.1 ug/g dry	<0.1	-	-	-
Molybdenum	1.0 ug/g dry	3.2	-	-	-
Nickel	5.0 ug/g dry	26.5	-	-	-
Selenium	1.0 ug/g dry	<1.0	-	-	-
Silver	0.3 ug/g dry	<0.3	-	-	-
Thallium	1.0 ug/g dry	<1.0	-	-	-
Uranium	1.0 ug/g dry	1.2	-	-	-
Vanadium	10.0 ug/g dry	24.1	-	-	-
Zinc	20.0 ug/g dry	66.8	-	-	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 26411

Report Date: 26-Apr-2019
Order Date: 23-Apr-2019
Project Description: PE4597

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	*1.41*		*ug/g*		*105*	*50-140*			
Surrogate: Terphenyl-d14	*1.41*		*ug/g*		*106*	*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	*8.89*		*ug/g*		*111*	*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	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND				30	
F3 PHCs (C16-C34)	14	8	ug/g dry	18			25.2	30	
F4 PHCs (C34-C50)	11	6	ug/g dry	18			46.8	30	QR-01
Metals									
Antimony	1.1	1.0	ug/g dry	1.2			7.2	30	
Arsenic	3.5	1.0	ug/g dry	3.9			12.2	30	
Barium	120	1.0	ug/g dry	131			8.3	30	
Beryllium	ND	0.5	ug/g dry	ND			0.0	30	
Boron	7.6	5.0	ug/g dry	8.6			11.5	30	
Cadmium	ND	0.5	ug/g dry	ND			0.0	30	
Chromium (VI)	ND	0.2	ug/g dry	ND				35	
Chromium	16.7	5.0	ug/g dry	19.1			13.8	30	
Cobalt	2.0	1.0	ug/g dry	2.2			8.7	30	
Copper	10.6	5.0	ug/g dry	11.7			9.8	30	
Lead	7.7	1.0	ug/g dry	8.0			3.5	30	
Mercury	ND	0.1	ug/g dry	ND			0.0	30	
Molybdenum	1.5	1.0	ug/g dry	1.7			15.0	30	
Nickel	43.4	5.0	ug/g dry	50.4			15.0	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	1.7	1.0	ug/g dry	1.9			10.5	30	
Vanadium	18.8	10.0	ug/g dry	22.9			19.4	30	
Zinc	38.0	20.0	ug/g dry	42.6			11.6	30	
Physical Characteristics									
% Solids	91.2	0.1	% by Wt.	90.7			0.5	25	
Semi-Volatiles									
Acenaphthene	0.095	0.02	ug/g dry	0.129			30.8	40	
Acenaphthylene	0.030	0.02	ug/g dry	0.040			27.4	40	
Anthracene	0.342	0.02	ug/g dry	0.470			31.6	40	
Benzo [a] anthracene	0.641	0.02	ug/g dry	0.866			30.0	40	
Benzo [a] pyrene	0.486	0.02	ug/g dry	0.642			27.6	40	
Benzo [b] fluoranthene	0.680	0.02	ug/g dry	0.897			27.5	40	
Benzo [g,h,i] perylene	0.290	0.02	ug/g dry	0.369			23.8	40	
Benzo [k] fluoranthene	0.364	0.02	ug/g dry	0.487			28.9	40	
Chrysene	0.704	0.02	ug/g dry	0.944			29.1	40	
Dibenzo [a,h] anthracene	0.072	0.02	ug/g dry	0.089			20.5	40	
Fluoranthene	1.65	0.02	ug/g dry	2.30			32.7	40	
Fluorene	0.129	0.02	ug/g dry	0.191			38.5	40	
Indeno [1,2,3-cd] pyrene	0.272	0.02	ug/g dry	0.352			25.6	40	
1-Methylnaphthalene	0.113	0.02	ug/g dry	0.115			1.3	40	
2-Methylnaphthalene	0.123	0.02	ug/g dry	0.115			6.8	40	
Naphthalene	0.039	0.01	ug/g dry	0.041			4.7	40	
Phenanthrene	1.11	0.02	ug/g dry	1.54			32.7	40	
Pyrene	1.33	0.02	ug/g dry	1.82			31.3	40	
Surrogate: 2-Fluorobiphenyl	*1.49*		*ug/g dry*		*97.6*	*50-140*			
Surrogate: Terphenyl-d14	*1.34*		*ug/g dry*		*87.8*	*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	
Surrogate: Toluene-d8	*8.55*		*ug/g dry*		*93.2*	*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)	199	7	ug/g		99.7	80-120			
F2 PHCs (C10-C16)	79	4	ug/g	ND	90.0	60-140			
F3 PHCs (C16-C34)	220	8	ug/g	18	93.8	60-140			
F4 PHCs (C34-C50)	159	6	ug/g	18	103	60-140			
Metals									
Antimony	39.5		ug/L	ND	78.0	70-130			
Arsenic	49.1		ug/L	1.6	95.0	70-130			
Barium	88.5		ug/L	52.4	72.2	70-130			
Beryllium	46.0		ug/L	ND	91.7	70-130			
Boron	43.1		ug/L	ND	79.3	70-130			
Cadmium	43.0		ug/L	ND	85.8	70-130			
Chromium (VI)	5.0	0.2	ug/g		100	70-130			
Chromium	56.2		ug/L	7.7	97.2	70-130			
Cobalt	46.1		ug/L	ND	90.5	70-130			
Copper	49.2		ug/L	ND	89.0	70-130			
Lead	44.4		ug/L	3.2	82.3	70-130			
Mercury	1.54	0.1	ug/g	ND	102	70-130			
Molybdenum	45.2		ug/L	ND	89.1	70-130			
Nickel	62.8		ug/L	20.2	85.2	70-130			
Selenium	45.0		ug/L	ND	89.4	70-130			
Silver	42.3		ug/L	ND	84.5	70-130			
Thallium	42.6		ug/L	ND	85.1	70-130			
Uranium	44.6		ug/L	ND	87.8	70-130			
Vanadium	57.0		ug/L	ND	95.7	70-130			
Zinc	58.3		ug/L	ND	82.5	70-130			
Semi-Volatiles									
Acenaphthene	0.153	0.02	ug/g	ND	76.7	50-140			
Acenaphthylene	0.144	0.02	ug/g	ND	72.2	50-140			
Anthracene	0.164	0.02	ug/g	ND	82.3	50-140			
Benzo [a] anthracene	0.175	0.02	ug/g	ND	87.5	50-140			
Benzo [a] pyrene	0.152	0.02	ug/g	ND	76.1	50-140			
Benzo [b] fluoranthene	0.256	0.02	ug/g	ND	128	50-140			
Benzo [g,h,i] perylene	0.143	0.02	ug/g	ND	71.7	50-140			
Benzo [k] fluoranthene	0.223	0.02	ug/g	ND	112	50-140			
Chrysene	0.212	0.02	ug/g	ND	106	50-140			
Dibenzo [a,h] anthracene	0.138	0.02	ug/g	ND	69.4	50-140			
Fluoranthene	0.184	0.02	ug/g	0.021	81.7	50-140			
Fluorene	0.163	0.02	ug/g	ND	81.6	50-140			
Indeno [1,2,3-cd] pyrene	0.149	0.02	ug/g	ND	74.8	50-140			
1-Methylnaphthalene	0.185	0.02	ug/g	ND	92.6	50-140			
2-Methylnaphthalene	0.200	0.02	ug/g	ND	100	50-140			
Naphthalene	0.176	0.01	ug/g	ND	88.4	50-140			
Phenanthrene	0.174	0.02	ug/g	ND	87.4	50-140			
Pyrene	0.188	0.02	ug/g	0.020	84.2	50-140			
Surrogate: 2-Fluorobiphenyl	*1.64*		*ug/g*		*103*	*50-140*			
Volatiles									
Benzene	3.60	0.02	ug/g		90.1	60-130			
Ethylbenzene	3.29	0.05	ug/g		82.2	60-130			
Toluene	3.44	0.05	ug/g		85.9	60-130			
m,p-Xylenes	6.97	0.05	ug/g		87.2	60-130			

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 26411

Report Date: 26-Apr-2019
Order Date: 23-Apr-2019
Project Description: PE4597

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
o-Xylene	3.52	0.05	ug/g		87.9	60-130			

Qualifier Notes:

QC Qualifiers :

QR-01 : Duplicate RPD is high, however, the sample result is less than 10x the MDL.

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.

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Chain of Custody
(Lab Use Only)
Nº 121668

Page 1 of 1

Client Name: PATERSON	Project Reference: PE4597
Contact Name: MIKE BEAUDOIN	Quote #
Address: 154 Colonnade Rd S.	PO # 26411
Telephone: 613-226-7381	Email Address: mbeaudoin@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: 1917260

	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	BH1-SS3	S		2	Apr 22/19		X											250mL+1L		
2	BH2-SS2	S		1	Apr 22/19				X	X	X	X						250mL		
3	BH3-SS2	S		1	Apr 22/19					X	X	X						↓		
4	BH4-SS3	S		#1	Apr 22/19				X	X	X	X						↓		
5	BH5-SS2	~~S~~		1	Apr 22/19					X	X	X						250mL		
6																				
7																				
8																				
9																				
10																				

Comments:

Method of Delivery: Paracel

Relinquished By (Sign):	Received by Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): MIKE B.	Date/Time: 23/04/19 3:50 PM	Date/Time: Apr 23 2019 05:00	Date/Time: 04-23-19 17:36
Date/Time:	Temperature: °C	Temperature: 19.6 °C	pH Verified [ ] By:

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Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Mike Beaudoin

Client PO: 26801
Project: PE4597
Custody: 122409

Report Date: 26-Jun-2019
Order Date: 20-Jun-2019

Order #: 1925512

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

Paracel ID	Client ID
1925512-01	BH6-SS3
1925512-02	BH7-SS3
1925512-03	BH9-SS2
1925512-04	BH10-SS2
1925512-05	BH12-SS2
1925512-06	BH13-SS3
1925512-07	BH14-SS2
1925512-08	BH15-SS2
1925512-09	BH16-SS2
1925512-10	BH17-SS2

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 26801

Report Date: 26-Jun-2019
Order Date: 20-Jun-2019
Project Description: PE4597

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Mercury by CVAA	EPA 7471B - CVAA, digestion	24-Jun-19	25-Jun-19
REG 153: Metals by ICP/MS, soil	EPA 6020 - Digestion - ICP-MS	24-Jun-19	25-Jun-19
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	24-Jun-19	25-Jun-19
Solids, %	Gravimetric, calculation	24-Jun-19	24-Jun-19

PARACEL LABORATORIES LTD.

Order #: 1925512

Certificate of Analysis

Report Date: 26-Jun-2019

Client: Paterson Group Consulting Engineers

Order Date: 20-Jun-2019

Client PO: 26801

Project Description: PE4597

	Client ID:	BH6-SS3	BH7-SS3	BH9-SS2	BH10-SS2
	Sample Date:	19-Jun-19 09:00	19-Jun-19 09:00	19-Jun-19 09:00	19-Jun-19 09:00
	Sample ID:	1925512-01	1925512-02	1925512-03	1925512-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	70.8	51.1	74.9	85.5
Metals					
Antimony	1.0 ug/g dry	11.2	55.6	76.5	7.6
Arsenic	1.0 ug/g dry	28.6	28.7	20.0	16.2
Barium	1.0 ug/g dry	1070	1420	1010	957
Beryllium	0.5 ug/g dry	0.7	3.1	0.9	0.7
Boron	5.0 ug/g dry	13.2	51.0	7.4	13.6
Cadmium	0.5 ug/g dry	2.9	2.6	1.5	1.8
Chromium	5.0 ug/g dry	158	57.3	37.3	55.5
Cobalt	1.0 ug/g dry	9.8	36.0	10.7	14.2
Copper	5.0 ug/g dry	161	284	188	129
Lead	1.0 ug/g dry	1420	5290	1010	957
Mercury	0.1 ug/g dry	5.2	10.6	1.1	0.7
Molybdenum	1.0 ug/g dry	7.4	9.4	3.4	6.1
Nickel	5.0 ug/g dry	36.3	88.3	34.4	47.2
Selenium	1.0 ug/g dry	2.9	3.4	1.7	4.8
Silver	0.3 ug/g dry	1.4	1.0	0.8	0.8
Thallium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Uranium	1.0 ug/g dry	<1.0	5.9	<1.0	1.8
Vanadium	10.0 ug/g dry	26.5	66.8	30.4	31.3
Zinc	20.0 ug/g dry	1340	1100	983	699
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	0.07	0.03	0.05	0.05
Acenaphthylene	0.02 ug/g dry	0.25	0.06	0.47	0.17
Anthracene	0.02 ug/g dry	0.36	0.09	0.31	0.28
Benzo [a] anthracene	0.02 ug/g dry	1.16	0.23	1.46	0.83
Benzo [a] pyrene	0.02 ug/g dry	0.95	0.22	1.56	0.68
Benzo [b] fluoranthene	0.02 ug/g dry	1.35	0.31	1.72	0.92
Benzo [g,h,i] perylene	0.02 ug/g dry	0.65	0.16	0.81	0.40
Benzo [k] fluoranthene	0.02 ug/g dry	0.86	0.16	1.01	0.44
Chrysene	0.02 ug/g dry	1.31	0.31	1.62	0.95
Dibenzo [a,h] anthracene	0.02 ug/g dry	0.16	0.04	0.25	0.11
Fluoranthene	0.02 ug/g dry	2.06	0.46	1.64	1.57
Fluorene	0.02 ug/g dry	0.09	<0.02	0.04	0.06
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	0.58	0.14	0.79	0.38

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26801

Report Date: 26-Jun-2019

Order Date: 20-Jun-2019

Project Description: PE4597

	Client ID:	BH6-SS3	BH7-SS3	BH9-SS2	BH10-SS2
	Sample Date:	19-Jun-19 09:00	19-Jun-19 09:00	19-Jun-19 09:00	19-Jun-19 09:00
	Sample ID:	1925512-01	1925512-02	1925512-03	1925512-04
	MDL/Units	Soil	Soil	Soil	Soil
1-Methylnaphthalene	0.02 ug/g dry	0.04	<0.02	<0.02	0.02
2-Methylnaphthalene	0.02 ug/g dry	0.06	<0.02	0.04	0.03
Methylnaphthalene (1&2)	0.04 ug/g dry	0.10	<0.04	0.06	0.05
Naphthalene	0.01 ug/g dry	0.12	0.04	0.09	0.03
Phenanthrene	0.02 ug/g dry	0.93	0.25	0.61	0.80
Pyrene	0.02 ug/g dry	1.84	0.40	1.56	1.36
2-Fluorobiphenyl	Surrogate	90.3%	84.9%	101%	112%
Terphenyl-d14	Surrogate	97.4%	86.2%	107%	116%

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26801

Report Date: 26-Jun-2019

Order Date: 20-Jun-2019

Project Description: PE4597

	Client ID:	BH12-SS2	BH13-SS3	BH14-SS2	BH15-SS2
	Sample Date:	19-Jun-19 09:00	19-Jun-19 09:00	19-Jun-19 09:00	19-Jun-19 09:00
	Sample ID:	1925512-05	1925512-06	1925512-07	1925512-08
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	66.4	63.8	80.6	90.8
Metals					
Antimony	1.0 ug/g dry	21.1	23.7	9.6	<1.0
Arsenic	1.0 ug/g dry	40.2	112	275	6.5
Barium	1.0 ug/g dry	528	1100	1020	74.9
Beryllium	0.5 ug/g dry	1.2	1.5	1.4	0.6
Boron	5.0 ug/g dry	67.3	34.3	15.3	11.0
Cadmium	0.5 ug/g dry	3.4	3.2	2.0	<0.5
Chromium	5.0 ug/g dry	52.6	77.8	41.9	18.0
Cobalt	1.0 ug/g dry	39.1	18.2	13.3	9.2
Copper	5.0 ug/g dry	957	627	172	25.9
Lead	1.0 ug/g dry	907	4230	1150	17.9
Mercury	0.1 ug/g dry	0.7	1.9	1.3	<0.1
Molybdenum	1.0 ug/g dry	6.3	8.0	16.9	3.1
Nickel	5.0 ug/g dry	72.9	51.8	72.4	30.8
Selenium	1.0 ug/g dry	4.8	25.5	31.3	<1.0
Silver	0.3 ug/g dry	1.0	2.4	1.1	<0.3
Thallium	1.0 ug/g dry	<1.0	1.2	2.8	<1.0
Uranium	1.0 ug/g dry	1.6	<1.0	<1.0	1.5
Vanadium	10.0 ug/g dry	32.1	38.4	33.6	28.9
Zinc	20.0 ug/g dry	1960	1580	563	36.4
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	<0.02	0.53	0.57	<0.02
Acenaphthylene	0.02 ug/g dry	<0.02	0.16	6.86	<0.02
Anthracene	0.02 ug/g dry	<0.02	1.73	5.69	<0.02
Benzo [a] anthracene	0.02 ug/g dry	0.04	3.38	13.0	<0.02
Benzo [a] pyrene	0.02 ug/g dry	0.04	2.34	12.6	<0.02
Benzo [b] fluoranthene	0.02 ug/g dry	0.05	3.45	15.3	<0.02
Benzo [g,h,i] perylene	0.02 ug/g dry	0.02	1.50	6.33	<0.02
Benzo [k] fluoranthene	0.02 ug/g dry	0.02	1.68	7.88	<0.02
Chrysene	0.02 ug/g dry	0.05	3.74	11.0	<0.02
Dibenzo [a,h] anthracene	0.02 ug/g dry	<0.02	0.41	2.08	<0.02
Fluoranthene	0.02 ug/g dry	0.09	6.56	20.0	<0.02
Fluorene	0.02 ug/g dry	<0.02	0.72	0.99	<0.02
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	0.02	1.27	6.41	<0.02

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26801

Report Date: 26-Jun-2019

Order Date: 20-Jun-2019

Project Description: PE4597

	Client ID:	BH12-SS2	BH13-SS3	BH14-SS2	BH15-SS2
	Sample Date:	19-Jun-19 09:00	19-Jun-19 09:00	19-Jun-19 09:00	19-Jun-19 09:00
	Sample ID:	1925512-05	1925512-06	1925512-07	1925512-08
	MDL/Units	Soil	Soil	Soil	Soil
1-Methylnaphthalene	0.02 ug/g dry	<0.02	0.08	<0.40 [1]	<0.02
2-Methylnaphthalene	0.02 ug/g dry	<0.02	0.13	<0.40 [1]	<0.02
Methylnaphthalene (1&2)	0.04 ug/g dry	<0.04	0.21	<0.80 [1]	<0.04
Naphthalene	0.01 ug/g dry	0.01	0.17	0.24	<0.01
Phenanthrene	0.02 ug/g dry	0.06	5.77	8.63	<0.02
Pyrene	0.02 ug/g dry	0.08	4.90	19.5	<0.02
2-Fluorobiphenyl	Surrogate	85.4%	86.8%	109%	97.4%
Terphenyl-d14	Surrogate	96.2%	89.7%	109%	105%

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26801

Report Date: 26-Jun-2019

Order Date: 20-Jun-2019

Project Description: PE4597

	Client ID:	BH16-SS2	BH17-SS2	-	-
	Sample Date:	19-Jun-19 09:00	19-Jun-19 09:00	-	-
	Sample ID:	1925512-09	1925512-10	-	-
	MDL/Units	Soil	Soil	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	73.9	79.3	-	-
Metals					
Antimony	1.0 ug/g dry	52.4	7.4	-	-
Arsenic	1.0 ug/g dry	60.5	15.6	-	-
Barium	1.0 ug/g dry	3000	1710	-	-
Beryllium	0.5 ug/g dry	1.5	0.8	-	-
Boron	5.0 ug/g dry	24.5	10.7	-	-
Cadmium	0.5 ug/g dry	3.0	1.0	-	-
Chromium	5.0 ug/g dry	61.3	69.2	-	-
Cobalt	1.0 ug/g dry	16.7	11.0	-	-
Copper	5.0 ug/g dry	290	178	-	-
Lead	1.0 ug/g dry	5660	1520	-	-
Mercury	0.1 ug/g dry	1.3	0.6	-	-
Molybdenum	1.0 ug/g dry	8.3	3.0	-	-
Nickel	5.0 ug/g dry	53.7	36.7	-	-
Selenium	1.0 ug/g dry	10.5	2.5	-	-
Silver	0.3 ug/g dry	2.8	1.9	-	-
Thallium	1.0 ug/g dry	<1.0	<1.0	-	-
Uranium	1.0 ug/g dry	<1.0	<1.0	-	-
Vanadium	10.0 ug/g dry	40.0	34.3	-	-
Zinc	20.0 ug/g dry	1540	833	-	-
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	0.06	4.33	-	-
Acenaphthylene	0.02 ug/g dry	0.21	2.40	-	-
Anthracene	0.02 ug/g dry	0.52	12.2	-	-
Benzo [a] anthracene	0.02 ug/g dry	0.98	30.8	-	-
Benzo [a] pyrene	0.02 ug/g dry	0.81	24.2	-	-
Benzo [b] fluoranthene	0.02 ug/g dry	1.36	33.4	-	-
Benzo [g,h,i] perylene	0.02 ug/g dry	0.75	13.6	-	-
Benzo [k] fluoranthene	0.02 ug/g dry	0.71	14.9	-	-
Chrysene	0.02 ug/g dry	1.21	35.2	-	-
Dibenzo [a,h] anthracene	0.02 ug/g dry	0.16	3.77	-	-
Fluoranthene	0.02 ug/g dry	1.62	72.9	-	-
Fluorene	0.02 ug/g dry	0.06	3.90	-	-
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	0.66	12.9	-	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26801

Report Date: 26-Jun-2019

Order Date: 20-Jun-2019

Project Description: PE4597

	Client ID:	BH16-SS2	BH17-SS2	-	-
	Sample Date:	19-Jun-19 09:00	19-Jun-19 09:00	-	-
	Sample ID:	1925512-09	1925512-10	-	-
	MDL/Units	Soil	Soil	-	-
1-Methylnaphthalene	0.02 ug/g dry	0.02	0.89	-	-
2-Methylnaphthalene	0.02 ug/g dry	0.08	0.98	-	-
Methylnaphthalene (1&2)	0.04 ug/g dry	0.10	1.87	-	-
Naphthalene	0.01 ug/g dry	0.06	1.70	-	-
Phenanthrene	0.02 ug/g dry	0.77	50.9	-	-
Pyrene	0.02 ug/g dry	1.54	57.7	-	-
2-Fluorobiphenyl	Surrogate	106%	102%	-	-
Terphenyl-d14	Surrogate	108%	103%	-	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 26801

Report Date: 26-Jun-2019
Order Date: 20-Jun-2019
Project Description: PE4597

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Antimony	ND	1.0	ug/g						
Arsenic	ND	1.0	ug/g						
Barium	ND	1.0	ug/g						
Beryllium	ND	0.5	ug/g						
Boron	ND	5.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium	ND	5.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	5.0	ug/g						
Lead	ND	1.0	ug/g						
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	*0.906*		*ug/g*		*68.0*	*50-140*			
Surrogate: Terphenyl-d14	*0.942*		*ug/g*		*70.6*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Mercury	0.309	0.1	ug/g dry	0.337			8.6	30	
Physical Characteristics									
% Solids	70.8	0.1	% by Wt.	70.8			0.1	25	
Semi-Volatiles									
Acenaphthene	0.468	0.02	ug/g dry	0.070			148.0	40	QR-04
Acenaphthylene	0.342	0.02	ug/g dry	0.249			31.3	40	QR-04
Anthracene	1.49	0.02	ug/g dry	0.360			122.0	40	QR-04
Benzo [a] anthracene	3.26	0.02	ug/g dry	1.16			95.2	40	QR-04
Benzo [a] pyrene	2.46	0.02	ug/g dry	0.954			88.2	40	QR-04
Benzo [b] fluoranthene	3.24	0.02	ug/g dry	1.35			82.5	40	QR-04
Benzo [g,h,i] perylene	1.40	0.02	ug/g dry	0.646			73.5	40	QR-04
Benzo [k] fluoranthene	1.61	0.02	ug/g dry	0.859			61.0	40	QR-04
Chrysene	3.49	0.02	ug/g dry	1.31			91.1	40	QR-04
Dibenzo [a,h] anthracene	0.349	0.02	ug/g dry	0.156			76.4	40	QR-04
Fluoranthene	7.10	0.02	ug/g dry	2.06			110.0	40	QR-04
Fluorene	0.472	0.02	ug/g dry	0.088			137.0	40	QR-04
Indeno [1,2,3-cd] pyrene	1.28	0.02	ug/g dry	0.576			75.5	40	QR-04
1-Methylnaphthalene	0.087	0.02	ug/g dry	0.040			74.4	40	QR-04
2-Methylnaphthalene	0.134	0.02	ug/g dry	0.059			77.2	40	QR-04
Naphthalene	0.293	0.01	ug/g dry	0.119			84.5	40	QR-04
Phenanthrene	5.27	0.02	ug/g dry	0.934			140.0	40	QR-04
Pyrene	6.19	0.02	ug/g dry	1.84			108.0	40	QR-04
Surrogate: 2-Fluorobiphenyl	*1.85*		*ug/g dry*		*98.1*	*50-140*			
Surrogate: Terphenyl-d14	*1.94*		*ug/g dry*		*103*	*50-140*			

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 26801

Report Date: 26-Jun-2019
Order Date: 20-Jun-2019
Project Description: PE4597

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Antimony	38.0		ug/L		76.0	70-130			
Arsenic	48.7		ug/L		97.5	70-130			
Barium	47.1		ug/L		94.2	70-130			
Beryllium	48.7		ug/L		97.5	70-130			
Boron	43.8		ug/L		87.6	70-130			
Cadmium	48.5		ug/L		97.0	70-130			
Chromium	49.0		ug/L		98.0	70-130			
Cobalt	49.0		ug/L		97.9	70-130			
Copper	47.7		ug/L		95.5	70-130			
Lead	49.5		ug/L		99.0	70-130			
Mercury	1.83	0.1	ug/g	0.337	99.3	70-130			
Molybdenum	48.2		ug/L		96.3	70-130			
Nickel	48.4		ug/L		96.8	70-130			
Selenium	49.9		ug/L		99.8	70-130			
Silver	46.8		ug/L		93.5	70-130			
Thallium	47.1		ug/L		94.2	70-130			
Uranium	47.2		ug/L		94.4	70-130			
Vanadium	48.5		ug/L		96.9	70-130			
Zinc	49.7		ug/L		99.4	70-130			
Semi-Volatiles									
Acenaphthene	0.144	0.02	ug/g		86.2	50-140			
Acenaphthylene	0.131	0.02	ug/g		78.5	50-140			
Anthracene	0.130	0.02	ug/g		78.2	50-140			
Benzo [a] anthracene	0.129	0.02	ug/g		77.7	50-140			
Benzo [a] pyrene	0.109	0.02	ug/g		65.1	50-140			
Benzo [b] fluoranthene	0.174	0.02	ug/g		104	50-140			
Benzo [g,h,i] perylene	0.113	0.02	ug/g		68.0	50-140			
Benzo [k] fluoranthene	0.133	0.02	ug/g		79.7	50-140			
Chrysene	0.150	0.02	ug/g		90.1	50-140			
Dibenzo [a,h] anthracene	0.111	0.02	ug/g		66.9	50-140			
Fluoranthene	0.135	0.02	ug/g		81.3	50-140			
Fluorene	0.139	0.02	ug/g		83.5	50-140			
Indeno [1,2,3-cd] pyrene	0.116	0.02	ug/g		69.4	50-140			
1-Methylnaphthalene	0.152	0.02	ug/g		91.4	50-140			
2-Methylnaphthalene	0.168	0.02	ug/g		101	50-140			
Naphthalene	0.143	0.01	ug/g		85.9	50-140			
Phenanthrene	0.137	0.02	ug/g		82.2	50-140			
Pyrene	0.136	0.02	ug/g		81.6	50-140			
Surrogate: 2-Fluorobiphenyl	*1.37*		*ug/g*		*103*	*50-140*			

Qualifier Notes:

Sample Qualifiers :

1 : Elevated detection limit due to dilution required because of high target analyte concentration.

QC Qualifiers :

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

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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

PARACEL LABORATORIES LTD.

TRUSTEI RESPON RELIABL

PARACEL WO: 1925512

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Chain of Custody
(Lab Use Only)
№ 122409

Page 1 of 1

Client Name: Paterson	Project Reference: PE4597	**Turnaround Time:**
Contact Name: Mike Beaudoin	Quote #	☐ 1 Day ☐ 3 Day
Address: 154 Colonnade Rd S.	PO # 26801	☐ 2 Day ☒ Regular
Telephone: 613-226-7381	Email Address: mbeaudoin@patersongroup.ca	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: 1925512

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)							
1	BH6-SS3	S		1	June 19/19				X	X	X						250mL			✓
2	BH7-SS3								X	X	X									✓
3	BH9-SS2								X	X	X									✓
4	BH10-SS2								X	X	X									✓
5	BH12-SS2								X	X	X									✓
6	BH13-SS3								X	X	X									✓
7	BH14-SS2								X	X	X									✓
8	BH15-SS2								X	X	X									✓
9	BH16-SS2								X	X	X									✓
10	BH17-SS2								X	X	X									✓

Comments:

Method of Delivery: Paracel

Relinquished By (Sign):	Received by Driver/Depot: T Teodie	Received at Lab: Shreeparn Bahmai	Verified By: DGauvin
Relinquished By (Print):	Date/Time: 20/06/19 3:10 PM	Date/Time: June 20, 2019 09:28	Date/Time: 21 June 2019 10:10
Date/Time:	Temperature: °C	Temperature: 20.8	pH Verified ☐ By: