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Paterson Group Inc.

Consulting Engineers
154 Colonnade Road South
Ottawa (Nepean), Ontario
Canada K2E 7J5

Tel: (613) 226-7381
Fax: (613) 226-6344
www.patersongroup.ca

patersongroup

Phase II Environmental Site Assessment

147 Langstaff Drive
Ottawa, Ontario

Prepared For

Inverness Homes

July 31, 2019

Report: PE4666-2

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EXECUTIVE SUMMARY

Assessment

A Phase II ESA was conducted for the property addressed 147 Langstaff Drive, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address the a potentially contaminating activity (PCA) that resulted in an area of environmental concern (APEC) on the northwestern portion of the Phase II Property.

The Phase II ESA was carried out in conjunction with a Geotechnical Investigation and consisted of drilling seven (7) boreholes across the Phase II Property, three (3) of which were constructed with groundwater monitoring well installations.

The soil profile generally consisted of a topsoil, followed by a deep silty clay layer. Boreholes were terminated at a maximum depth of 6.7 m below the existing grade. No obvious visual or olfactory indications of potential contamination were identified during the field program.

Soil samples were obtained from the boreholes and screened using combustible vapour measurements (BH1-19 to BH3-19) along with visual and olfactory observations. Based on the screening results in combination with sample depth and location, five (5) soil samples were submitted for laboratory analysis of benzene, toluene, ethylbenzene, and xylenes (BTEX) and petroleum hydrocarbons (PHCs, F_1-F_4). Based on the analytical test results, no BTEX or PHC parameters were identified in any of the samples with the exception of PHC F_3 and F_4 fractions identified in Sample BH3-19-SS8. While the detected concentrations were in compliance with the MECP Table 2 standards selected for the site, the results were considered to be anomalous based on field observations. For confirmatory purposes, three (3) additional soil samples BH3-19-SS7, BH3-19-SS9 and BH3-19-SS10 were subsequently tested for PHC fractions F_2-F_4. No PHC parameters were identified in any of the additional samples analysed from BH3-19. All of the soil results are in compliance with the MECP Table 2 residential standards for fine-grained soils.

Groundwater samples from monitoring wells installed in BH1-19, BH2-19 and BH3-19 were recovered and analysed for BTEX, PHCs, VOCs and PAHs. No free-phase product was observed on the groundwater at any of the monitoring well locations during the groundwater sampling event.

Based on analytical test results, no BTEX, PHC, VOC or PAH parameters were identified above the laboratory method detection limits in the groundwater samples analysed. The groundwater results are in compliance with the MECP Table 2 standards.

Conclusion

Based on the findings of the Phase II ESA, **no further environmental investigation is required.**

Monitoring Wells

If the monitoring wells installed on the subject site are not going to be used in the future, or will be destroyed during site redevelopment, they should be abandoned according to Ontario Regulation 903.

1.0 INTRODUCTION

At the request of Inverness Homes, Paterson Group (Paterson) conducted a Phase II Environmental Site Assessment for the property addressed 147 Langstaff Drive, in the City of Ottawa, Ontario, herein referred to as the Phase II Property. The purpose of this Phase II ESA was to address an area of potential environmental concern (APEC) identified on the northwestern portion of Phase II Property, during the Phase I ESA conducted by Paterson in July 2019.

1.1 Site Description

Address:	147 Langstaff Drive, Ottawa, Ontario
Legal Description:	Part of Lots 3 and 4 of Part 1 of Registered Plan 4R6094, Concession 2 (Ottawa Front), Township of Gloucester, now in the City of Ottawa, Ontario.
Property Identification Number (PIN):	04533-1980
Location:	The site is located on the southwest side of Langstaff Drive, 185 m northwest of the Langstaff Drive and Donald B. Munro intersection, in the Village of Carp; Township of West Carleton, (now City of Ottawa), Ontario. Refer to Figure 1 - Key Plan in the Figures section following the text.
Latitude and Longitude:	45° 20’ 43.96" N, 75° 02’ 54.26" W
Zoning:	V3B – Village Residential Third Density Zone
Configuration:	Irregular
Area:	7.3 hectares (approximately)

1.2 Property Ownership

Paterson was retained to complete this Phase II ESA by Ms. Alison Stirling of Stirling Group, acting on behalf of Inverness Homes, the current property owner. Ms. Stirling can be reached by telephone at (613) 299-5654.

1.3 Current and Proposed Future Uses

The Phase II Property is currently vacant, undeveloped land. It is our understanding that the proposed site development for the Phase II Property includes several blocks of attached residential dwellings and/or low-rise condo buildings with associated parking and parkland. The footprint of the development will cover the majority of the site.

1.4 Applicable Site Condition Standard

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

- ❑ Fine-grained soil conditions
- ❑ Full depth generic site conditions
- ❑ Potable groundwater conditions
- ❑ Residential land use

Residential standards were selected based on the future land use of the subject site. Fine-grained soil standards were chosen to represent the current site conditions due to the presence of native silty clay underlying the Phase II Property.

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The Phase II Property is situated in a rural setting within the village of Carp. Adjacent and neighbouring properties consist of low-rise residential, commercial and institutional buildings.

Phase II Property consists of vacant land covered in grass and low brush with some trees along the property boundaries. A small ravine passes through the central part of the site, running in a north to south direction. A partially gravel covered laneway provides access to the site, fronting Langstaff Drive. Site drainage consists primarily of infiltration with some runoff into the aforementioned ravine.

The site topography appears to be at grade with Langstaff Drive and slopes down in a southerly direction. The regional topography slopes down in a south-westerly direction towards the Carp River.

No permanent water bodies or areas of natural or scientific (ANSIs) are present on the Phase II Property or within the 250m study area.

2.2 Past Investigations

Paterson completed a Phase I ESA in July 2019 for the Phase II Property. Based on the findings of the Phase I ESA, one Potentially Contaminating Activity (PCA) was identified. A former landfill (waste site Wc-05) operated on the adjacent property to the northwest of the site and is considered to represent an area of potential environmental concern (APEC) on the subject land.

The aforementioned PCA resulting in an APEC on the Phase I and II Property is presented in Table 1, along with the associated contaminants of potential concern.

TABLE 1: Areas of Potential Environmental Concern

Area of Potential Environmental Concern	Potentially Contaminating Activity, as per Table 2 of O.Reg 153/04, as amended by, O.Reg 269/11	Location of PCA with respect to the Phase I Property	Contaminants of Potential Concern	Media Potentially Impacted (Soil and/or Groundwater)
APEC 1: resulting on the northwestern portion of the Phase I Property, from a former off-site landfill	Item 58: Waste disposal and waste management, including thermal treatment, landfilling and transfer of waste, other than use of biosoils as soil conditioners	Off-site (on the adjacent property to the northwest)	PHC, BTEX VOC, PAH	Soil and groundwater Groundwater

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

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The subsurface investigation was conducted on July 11 and 12, 2019, in conjunction with a Geotechnical Investigation. The field program consisted of drilling seven (7) boreholes, three (3) of which were instrumented with groundwater monitoring wells for environmental purposes. Boreholes were drilled to depths ranging from approximately 6.70 to 9.14 m below the ground surface (m BGS).

3.2 Media Investigated

During the subsurface investigation, soil samples and groundwater samples were obtained and submitted for laboratory analysis. The rationale for sampling and analyzing this media is based on the Contaminants of Potential Concern (CPCs) identified in the Phase I ESA. These CPCs include benzene, toluene, ethylbenzene, xylenes (BTEX), petroleum hydrocarbons (PHC, F_1-F_4), polycyclic aromatic hydrocarbons (PAH) and volatile organic compounds (VOCs) in soil and/or groundwater.

3.3 Phase I Conceptual Site Model

Geological and Hydrogeological Setting

Based on the information from the Geological Survey of Canada, the overburden thickness in the area of the subject site is estimated to be on the order of 50 to 100 m. The overburden consists of both nearshore and offshore marine sediments (sand, reworked glaciofluvial, clay and silt). Bedrock in the southern and northern portions of the property consists of interbedded limestone and shale of the Verulam Formation and intrusive rocks of Syenite, respectively.

The regional topography slopes down in a southernly direction. The local groundwater flow beneath the Phase II Property is inferred to be in a north-westerly direction.

Contaminants of Potential Concern

The contaminants of potential concern identified on the Phase II Property includes: BTEX and PHC (F_1-F_4), in soil and groundwater, as well as PAHs and VOCs in groundwater.

Existing Buildings and Structures

There are no buildings or structures on the Phase I Property.

Water Bodies and Areas of Natural Significance

No water bodies or areas of natural significance were identified on the Phase II Property or within the study area.

Drinking Water Wells

Based on the MECP well records search, no potable water wells were identified on the Phase II Property. Several potable wells within the Phase I Study Area were identified through the MECP well record database. It is expected that local residences may still be using some of these potable wells.

Neighbouring Land Use

Neighbouring land use in the Phase I Study Area consists of a combination of residential, institutional, commercial (retailers and restaurants) and recreational. Railway tracks are present 100 m south of the subject south.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

Several off-site potentially contaminating activities (PCAs) were identified within the study area. With the exception of one, these PCAs do not represent areas of potential environmental concern (APECs) on the Phase II Property. One PCA located on the adjacent property to the northwest, is considered to have created an APEC on the Phase II Property. This APEC is defined by Table 2 of O.Reg. 153/04, amended by, O.Reg. 269/11:

- PCA, Item 58: “Waste disposal and waste management, including thermal treatment, landfilling and transfer of waste, other than use of biosolids as soil conditioners.”

The above PCA was determined to generate an APEC on the Phase II Property. The rationale for identifying several off-site PCAs was based on a review of aerial photographs, city directories and previous reports, along with field observations.

Assessment of Uncertainty and/or Absence of Information

The information available for review as part of the preparation of this Phase I-ESA is considered to be sufficient to conclude that there is one APEC on the Phase II Property. A variety of independent sources were consulted as part of this assessment, and as such, the conclusions of this report are not affected by uncertainty which may be present with respect to the individual sources.

3.4 Deviations from Sampling and Analysis Plan

The Sampling and Analysis Plan for this project is included in Appendix 1 of this report. Duplicate samples and a trip blank were not recovered or carried out as part of the Phase II ESA, which is further discussed in Section 4.10.

3.5 Impediments

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

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation, completed in conjunction with a Geotechnical Investigation, was conducted on July 11 and July 12, 2019. The field program consisted of drilling seven (7) boreholes on the Phase II Property. The boreholes were drilled to a maximum depth of 9.14 m below the existing grade. Three (3) of the seven (7) boreholes were completed as groundwater monitoring wells to access the groundwater table.

The boreholes (BH1-19 through BH3-19) were placed to address the aforementioned APEC, as presented in Table 1, while the remaining four (4) boreholes (BH4-19 through BH7-19) were completed for geotechnical purposes. The boreholes were drilled using a track-mounted drill rig provided by George Downing Estate Drilling of Hawkesbury, Ontario, under the full-time supervision of Paterson personnel. The borehole locations are indicated on the attached Drawing PE4666-3 - Test Hole Location Plan, appended to this report.

4.2 Soil Sampling

A total of fifty-one (51) soil samples were obtained from the boreholes by means of grab sampling from auger flights and split spoon sampling. Split spoon samples were taken at approximate 0.76 m intervals. The depths at which auger samples and split spoon samples were obtained from the boreholes are shown as "**AU**" and "**SS**" on the Soil Profile and Test Data Sheets appended to this report.

The soil stratigraphy at the borehole locations generally consisted of topsoil underlain by silty clay.

4.3 Field Screening Measurements

An RKI Eagle gastech with methane elimination and calibrated to hexane was used to measure the combustible vapour concentrations in the headspace of the soil samples recovered from BH1-19, BH2-19 and BH3-19. The results of the vapour survey are discussed in Subsection 5.4 and are available on the Soil Profile & Test Data sheets in Appendix 1.

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

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

To measure the soil vapours, the analyser probe is inserted into the nominal headspace above the soil sample. A gastech calibrated to hexane was used for this purpose. The sample is agitated/manipulated gently as the measurement is taken. The peak reading registered within the first 15 seconds is recorded as the vapour measurement.

The parts per million (ppm) scale is used to measure concentrations of hydrocarbon vapours that are too low to register on the Lower Explosive Limit (LEL) scale. The explosive point, 100% LEL, represents the leanest mixture which will burn (or explode) if ignited.

The combustible vapour readings ranged from less than 20 to 60ppm and were not considered to be indicative of lighter fraction petroleum hydrocarbon compounds. Vapour readings are noted on the Soil Profile and Test Data Sheets in Appendix 1.

No visual or olfactory indications of potential hydrocarbons, or visual indications of deleterious fill material, were identified in the soil samples. Soil samples were selected based on a combination of the results of the vapour screening, visual screening, sample depth and/or sample location.

4.4 Groundwater Monitoring Well Installation

Three (3) groundwater monitoring wells were installed on the Phase II Property as part of the subsurface investigation. The monitoring wells consisted of 50 mm diameter, Schedule 40 threaded PVC risers and screens. Monitoring well construction details are listed below in Table 2 and are also presented on the Soil Profile and Test Data Sheets provided in Appendix 1.

A summary of the monitoring well construction details is provided below in Table 2. Boreholes were surveyed by Robinson Land Development.

TABLE 2: Monitoring Well Construction Details

Well ID	Ground Surface Elevation	Total Depth (m BGS)	Screened Interval (m BGS)	Sand Pack (m BGS)	Bentonite Seal (m BGS)	Casing Type
BH1-19	106.71	9.14	6.14-9.14	5.81-9.14	0.16-5.81	None
BH2-19	106.86	9.14	6.14-9.14	5.81-9.14	0.16-5.81	None
BH3-19	105.94	9.14	6.14-9.14	5.81-9.14	0.16-5.81	None

4.5 Field Measurement of Water Quality Parameters

Groundwater samples were collected on July 18, 2019. Parameters measured in the field included water levels, temperature, pH and electrical conductivity.

Field parameters were measured after each well volume purged. Wells were purged prior to sampling until at least three well volumes had been removed or the field parameters were relatively stable. Stabilized field parameter values are summarized in Table 3.

TABLE 3: Field Measurement of Water Quality Parameters			
Parameter	**BH1**	**BH2**	**BH3**
Temperature (°C)	17.9	19.9	14.6
pH	9.28	9.17	9.97
Electrical Conductivity (µS/cm)	7.81	7.32	7.46

4.6 Groundwater Sampling

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

4.7 Analytical Testing

Based on the guidelines outlined in the Sampling and Analysis Plan in Appendix 1, the soil and groundwater samples submitted for analytical testing are presented in Tables 4 and 5.

TABLE 4: Soil Samples Submitted and Analyzed Parameters				
Sample ID	**Sample Depth or Stratigraphic Unit**	**Parameters Analyzed**		**Rationale**
		PHCs (F1-F4 or F3-F4)	**BTEX**	
July 11, 2019				
BH2-19-SS10	6.86-7.47m Silty clay	X	X	Assess potential impact in the overburden soil due to the former landfill; based on the highest combustible vapour readings.
BH3-19-SS7	4.72-5.33m Silty clay	X		Assess F_3 and F_4 impact for quality control and confirmatory purposes.
BH3-19-SS8	5.33-5.94m Silty clay	X	X	Assess potential impact in the overburden soil due to the former landfill; based on the highest combustible vapour readings.
BH3-19-SS9	5.94-6.55m Silty clay	X		Assess F_3 and F_4 impact for quality control and confirmatory purposes.
BH3-19-SS10	6.55-7.16m Silty clay	X		Assess F_3 and F_4 impact for quality control and confirmatory purposes.

TABLE 5: Groundwater Samples Submitted and Analyzed Parameters					
Sample ID	Screened Interval (m)	Parameters Analyzed			Rationale
		PHCs + BTEX	PAHs	VOCs	
July 18, 2019					
BH1-19-GW1	6.14-9.14 m	X	X	X	Assess potential groundwater impact due to the former landfill
BH2-19-GW1	6.14-9.14 m	X	X	X	Assess potential groundwater impact due to the former landfill
BH3-19-GW1	6.14-9.14 m	X		X	Assess potential groundwater impact due to the former landfill

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

4.8 Residue Management

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

4.9 Elevation Surveying

The borehole locations were selected by Paterson for both environmental and geotechnical purposes. Boreholes were located and surveyed in the field by Robinson Land Development. The locations and elevations are presented on Drawing PE4666-3 – Test Hole Location Plan, appended to this report.

4.10 Quality Assurance and Quality Control Measures

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

It should be noted that duplicate samples and a trip blank were not recovered or carried out as part of the Phase II ESA; however, the findings of the Phase II ESA are not considered to have been affected.

Additional soil samples were submitted as part of this investigation for confirmatory purposes.

5.0 REVIEW AND EVALUATION

5.1 Geology

Site soils generally consist of topsoil followed by native silty clay. A layer of silty sand was identified beneath the topsoil at BH1-19 and BH3-19, to depths ranging from approximately 1.5 to 2.3 m BGS. The boreholes were terminated at depths ranging from 6.70 to 9.14 m BGS.

Groundwater was encountered within the overburden at depths ranging from approximately 5.30 to 6.91 m BGS. Site geology details are provided in the Soil Profile and Test Data Sheets provided in Appendix 1.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured during the groundwater sampling event on July 18, 2019, using an electronic water level meter. Groundwater levels are summarized below in Table 6.

TABLE 6: Groundwater Level Measurements

Borehole Location	Ground Surface Elevation (m)	Water Level Depth (m below grade)	Water Level Elevation (m ASL)	Date of Measurement
BH1-19	106.71	6.17	100.54	July 18, 2019
BH2-19	106.86	5.30	101.56	July 18, 2019
BH3-19	105.94	6.91	99.03	July 18, 2019

Based on the groundwater elevations measured during the sampling event, groundwater contour mapping was completed. Groundwater contours are shown on Drawing PE4666-3 – Test Hole Location Plan. Based on the contour mapping, groundwater flow at the Phase II Property is in a southerly direction. A horizontal hydraulic gradient of approximately 0.06 m/m was calculated.

5.3 Fine-Course Soil Texture

Based on the silty clay deposit present beneath the subject land, fine-grained soil conditions have been selected for the Phase II Property.

5.4 Soil: Field Screening

Field screening of the soil samples collected from BH1-19 through BH3-19, resulted in vapour readings ranging from 20 to 60 ppm.

Boreholes BH4-19 through BH7-19 were not screened for combustible vapours, as they were drilled for geotechnical purposes.

No obvious visual or olfactory indications of potential contamination were identified in any of the soil samples recovered. The field screening results of each individual soil sample (BH1-19 to BH3-19) are provided on the Soil Profile and Test Data Sheets, appended to this report.

5.5 Soil Quality

Two (2) soil samples from BH2-19 and BH3-19 were initially submitted for BTEX and PHC (F_1-F_4) analyses. Based on the results, three (3) additional samples from BH3-19 were submitted for PHC (F_2-F_4) analysis.

The results of the analytical testing are presented in Tables 7 and 8. The laboratory certificate of analysis is provided in Appendix 1.

TABLE 7: Analytical Test Results – Soil – BTEX and PHC (F_1-F_4)

Parameter	MDL (µg/g)	Soil Samples (µg/g) July 11, 2019		MECP Table 2 Residential Standards (µg/g)
		BH2-19-SS10	BH3-19-SS8	
Benzene	0.02	nd	nd	0.17
Ethylbenzene	0.05	nd	nd	1.6
Toluene	0.05	nd	nd	6
Xylenes (total)	0.05	nd	nd	25
PHC F_1	7	nd	nd	65
PHC F_2	4	nd	nd	150
PHC F_3	8	nd	669	1,300
PHC F_4	6	nd	119	5,600

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

No detectable BTEX concentrations were identified in any of the soil samples analyzed. With the exception of PHC, F_3 and F_4 in soil sample BH3-19-SS8, no detectable PHC concentrations were identified in the soil samples analyzed. All test results are in compliance with the MECP Table 2 Residential Standards.

TABLE 8: Analytical Test Results – Soil – PHC (F_2-F_4)					
Parameter	MDL (µg/g)	Soil Samples (µg/g) July 11, 2019			MECP Table 2 Residential Standards (µg/g)
		BH3-19-SS7	BH3-19-SS9	BH3-SS10	
PHC F_2	4	nd	nd	nd	150
PHC F_3	8	nd	nd	nd	1,300
PHC F_4	6	nd	nd	nd	5,600

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

The PHC F_3 and F_4 concentrations identified in sample BH3-19-SS8 were considered to be anomalous, based on the absence of visual and olfactory evidence of potential petroleum hydrocarbon contamination during the subsurface investigation.

For confirmatory purposes, additional soil samples from above (sample BH3-19-SS7) and below (samples BH3-19-SS9 and SS10) were subsequently submitted for analytical testing of PHC fractions 2 through 4 parameters. No detectable PHC fractions were identified in any of the three (3) soil samples. All test results are in compliance with the MECT Table 2 Standards for fine-grained soils.

The analytical results for BTEX and PHC parameters tested in soil are shown on Drawing PE4666-4 – Analytical Testing Plan – Soil.

The maximum concentrations of analyzed parameters in the soil at the site are summarized in Table 9.

TABLE 9: Maximum Concentrations – Soil			
Parameter	Maximum Parameter Concentration (µg/g)	Borehole	Depth Interval (m BGS)
PHC F_3	669	BH3-19-SS8	5.33-5.94 m; silty clay
PHC F_4	119	BH3-19-SS8	5.33-5.94 m; silty clay

The maximum parameter concentrations comply with the selected MECP Table 2 Standards. The remaining parameters were not detected above the laboratory method detection limits.

5.6 Groundwater Quality

Groundwater samples from monitoring wells installed in BH1-19, BH2 and BH3 were submitted for laboratory analysis of VOC (including BTEX), PHC (F_1-F_4), and PAH parameters. The groundwater samples were obtained from the screened intervals noted on Table 2.

The results of the analytical testing are presented in Tables 10, 11 and 112. The laboratory certificates of analysis are provided in Appendix 1.

TABLE 10: Analytical Test Results – Groundwater – PHCs

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)			MECP Table 2 Standards (µg/L)
		July 18, 2019			
		BH1-19-GW1	BH2-19-GW1	BH3-19-GW1	
PHC F_1	25	nd	nd	nd	750
PHC F_2	100	nd	nd	nd	150
PHC F_3	100	nd	nd	nd	500
PHC F_4	100	nd	nd	nd	500

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

No detectable PHC concentrations were identified in the groundwater samples analyzed. All test results are in compliance with the MECP Table 2 standards.

TABLE 11: Analytical Test Results – Groundwater – PAH

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)		MECP Table 2 Standards (µg/L)
		July 18, 2019		
		BH1-19-GW1	BH2-19-GW1	
Acenaphthene	0.05	nd	nd	4.1
Acenaphthylene	0.05	nd	nd	1
Anthracene	0.01	nd	nd	2.4
Benzo[a]anthracene	0.01	nd	nd	1
Benzo[a]pyrene	0.01	nd	nd	0.01
Benzo[b]fluoranthene	0.05	nd	nd	0.1
Benzo[g,h,i]perylene	0.05	nd	nd	0.2
Benzo[k]fluoranthene	0.05	nd	nd	0.1
Chrysene	0.05	nd	nd	0.1
Dibenzo[a,h]anthracene	0.05	nd	nd	0.2
Fluoranthene	0.01	nd	nd	0.41
Fluorene	0.05	nd	nd	120
Indeno[1,2,3-cd]pyrene	0.05	nd	nd	0.2
1-Methylnaphthalene	0.05	nd	nd	3.2
2-Methylnaphthalene	0.05	nd	nd	3.2
Methylnaphthalene (1&2)	0.1	nd	nd	3.2
Naphthalene	0.05	nd	nd	11
Phenathrene	0.05	nd	nd	1
Pyrene	0.01	nd	nd	4.1

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

No detectable PAH concentrations were identified in the groundwater samples analyzed. All test results are in compliance with the MECP Table 2 standards.

TABLE 12: Analytical Test Results – Groundwater – VOC					
Parameter	MDL (µg/L)	Groundwater Samples (µg/L)			MECP Table 2 Standards (µg/L)
		July 18, 2019			
		BH1-19-GW1	BH2-19-GW1	BH3-19-GW1	
Acetone	5	nd	nd	nd	2,700
Benzene	0.5	nd	nd	nd	5
Bromodichloromethane	0.5	nd	nd	nd	16
Bromoform	0.5	nd	nd	nd	25
Bromomethane	0.5	nd	nd	nd	0.89
Carbon Tetrachloride	0.2	nd	nd	nd	0.79
Chlorobenzene	0.5	nd	nd	nd	30
Chloroform	0.5	nd	nd	nd	2.4
Dibromochloromethane	0.5	nd	nd	nd	25
Dichlorodifluoromethane	1	nd	nd	nd	590
1,2-Dichlorobenzene	0.5	nd	nd	nd	3
1,3-Dichlorobenzene	0.5	nd	nd	nd	59
1,4-Dichlorobenzene	0.5	nd	nd	nd	1
1,1-Dichloroethane	0.5	nd	nd	nd	5
1,2-Dichloroethane	0.5	nd	nd	nd	1.6
1,1-Dichloroethylene	0.5	nd	nd	nd	1.6
cis-1,2-Dichloroethylene	0.5	nd	nd	nd	1.6
trans-1,2-Dichloroethylene	0.5	nd	nd	nd	1.6
1,2-Dichloropropane	0.5	nd	nd	nd	5
1,3-Dichloropropene, total	0.5	nd	nd	nd	0.5
Ethylbenzene	0.5	nd	nd	nd	2.4
Ethylene dibromide	0.2	nd	nd	nd	0.2
Hexane	1	nd	nd	nd	51
Methyl Ethyl Ketone	5	nd	nd	nd	1,800
Methyl Isobutyl Ketone	5	nd	nd	nd	640
Methyl tert-butyl ether	2	nd	nd	nd	15
Methylene Chloride	5	nd	nd	nd	50
Styrene	0.5	nd	nd	nd	5.4
1,1,1,2-Tetrachloroethane	0.5	nd	nd	nd	1.1
1,1,2,2-Tetrachloroethane	0.5	nd	nd	nd	1
Tetrachloroethylene	0.5	nd	nd	nd	1.6
Toluene	0.5	nd	nd	nd	24
1,1,1-Trichloroethane	0.5	nd	nd	nd	200
1,1,2-Trichloroethane	0.5	nd	nd	nd	4.7
Trichloroethylene	0.5	nd	nd	nd	1.6
Trichlorofluoromethane	1	nd	nd	nd	150
Vinyl Chloride	0.5	nd	nd	nd	0.5
Xylenes, total	0.5	nd	nd	nd	300

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

No detectable VOC concentrations were identified in the groundwater samples analyzed. All test results are in compliance with the MECP Table 2 standards.

5.7 Quality Assurance and Quality Control Results

All samples submitted as part of the Phase II ESA were handled in accordance with the Analytical Protocol with respect to preservation method, storage requirement, and container type. As per Subsection 47(3) of O.Reg. 153/04, as amended, under the Environmental Protection Act, a Certificate of Analysis has been received for each sample submitted for analysis and all Certificates of Analysis are appended to this report.

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

5.8 Phase II Conceptual Site Model

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

Site Description

Potentially Contaminating Activity and Areas of Potential Environmental Concern

As indicated in Section 2.2 of this report, the following PCA has been identified to result in an APEC on the Phase II Property:

- Former landfill located on the adjacent property to the northwest of the subject land.

The rationale for identifying the above PCA is based on aerial photographs, city directories, previous reports and field observations.

Contaminants of Potential Concern

Contaminants of Potential Concern (CPCs) on the Phase II Property include benzene, toluene ethylbenzene, and xylenes (BTEXs), petroleum hydrocarbons (PHCs), polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs) in soil and/or groundwater.

Subsurface Structures and Utilities

There are no utilities or subsurface structures present on the Phase II Property.

Physical Setting

Site Stratigraphy

The site stratigraphy, from ground surface to the deepest aquifer or aquitard investigated, is illustrated on Drawings PE4666-6 – Cross-section A-A' – Soil and Groundwater. The site stratigraphy consists of:

- Topsoil, ranging from 0.18 to 0.20m thick. Groundwater was not encountered in this layer.
- Silty clay was identified beneath the topsoil in at all borehole locations. At BH2-19, a layer of silty sand and clay was identified from approximately 5.30 to 6.70m below grade. Boreholes were terminated in the silty clay layer. Groundwater was encountered in this layer.

Hydrogeological Characteristics

Groundwater at the Phase II Property was encountered in the native silty clay layer. During the most recent groundwater monitoring event, groundwater flow was measured in a southerly direction, towards the Carp River, with a hydraulic gradient of 0.06 m/m. Groundwater contours are shown on Drawing PE4666-3– Test Hole Location Plan and Groundwater Contour Plan.

Approximate Depth to Water Table

Depth to the water table at the subject site varies between approximately 5.30 to 6.91 m below existing grade.

Approximate Depth to Bedrock

Bedrock was not confirmed during the drilling program. All boreholes were completed in the native soil and did not reach refusal, as the drift thickness is estimated to be on the order of 50 to 100 m

Well records for the immediate area of the Phase II Property did not provide any information regarding the local stratigraphy or bedrock depth.

Sections 41 and 43.1 of the Regulation

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

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

Fill Placement

Based on the findings of the subsurface investigation, no fill material was encountered at any of the borehole locations.

Existing Buildings and Structures

There are no buildings or structures on the Phase II Property.

Proposed Buildings and Other Structures

The proposed development for the Phase II Property includes several blocks of attached residential dwellings and/or low-rise condominium buildings with associated parking and parkland. The footprint of the development will cover the majority of the subject land.

Areas of Natural Significance

No areas of natural significance are present on the Phase II Property or within the 250 m study area.

Environmental Condition

Areas Where Contaminants are Present

Based on the analytical results, soil and groundwater are in compliance with the MECP Table 2 Residential Standards.

Types of Contaminants

Based on the analytical results for soil and groundwater, there are no contaminants present on or beneath the Phase II Property.

Contaminated Media

Based on the findings of the Phase II ESA, no contaminated media is present on or beneath the Phase II Property.

What Is Known About Areas Where Contaminants Are Present

No contaminants exceeding MECP Table 2 Standards are present in the soil or groundwater on or beneath the Phase II Property.

Distribution and Migration of Contaminants

Based on the findings of the Phase II ESA, the distribution and migration of contaminants is not considered to have occurred on the Phase II Property.

Discharge of Contaminants

Based on the findings of the Phase II ESA, no contaminants have been discharged on the Phase II Property.

Climatic and Meteorological Conditions

No contaminants are present in the soil or groundwater beneath the Phase II Property and therefore climatic and meteorological conditions are not considered to have contributed to contaminant transport.

Potential for Vapour Intrusion

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

6.0 CONCLUSIONS

Assessment

A Phase II ESA was conducted for the property addressed 147 Langstaff Drive, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address the a potentially contaminating activity (PCA) that resulted in an area of environmental concern (APEC) on the northwestern portion of the Phase II Property.

The Phase II ESA was carried out in conjunction with a Geotechnical Investigation and consisted of drilling seven (7) boreholes across the Phase II Property, three (3) of which were constructed with groundwater monitoring well installations.

The soil profile generally consisted of a topsoil, followed by a deep silty clay layer. Boreholes were terminated at a maximum depth of 6.7 m below the existing grade. No obvious visual or olfactory indications of potential contamination were identified during the field program.

Soil samples were obtained from the boreholes and screened using combustible vapour measurements (BH1-19 to BH3-19) along with visual and olfactory observations. Based on the screening results in combination with sample depth and location, five (5) soil samples were submitted for laboratory analysis of benzene, toluene, ethylbenzene, and xylenes (BTEX) and petroleum hydrocarbons (PHCs, F_1-F_4). Based on the analytical test results, no BTEX or PHC parameters were identified in any of the samples with the exception of PHC F_3 and F_4 fractions identified in Sample BH3-19-SS8. While the detected concentrations were in compliance with the MECP Table 2 standards selected for the site, the results were considered to be anomalous based on field observations. For confirmatory purposes, three (3) additional soil samples BH3-19-SS7, BH3-19-SS9 and BH3-19-SS10 were subsequently tested for PHC fractions F_2-F_4. No PHC parameters were identified in any of the additional samples analysed from BH3-19. All of the soil results are in compliance with the MECP Table 2 residential standards for fine-grained soils.

Groundwater samples from monitoring wells installed in BH1-19, BH2-19 and BH3-19 were recovered and analysed for BTEX, PHCs, VOCs and PAHs. No free-phase product was observed on the groundwater at any of the monitoring well locations during the groundwater sampling event.

Based on analytical test results, no BTEX, PHC, VOC or PAH parameters were identified above the laboratory method detection limits in the groundwater samples analysed. The groundwater results are in compliance with the MECP Table 2 standards.

Conclusion

Based on the findings of the Phase II ESA, **no further environmental investigation is required.**

Monitoring Wells

If the monitoring wells installed on the subject site are not going to be used in the future, or will be destroyed during site redevelopment, they should be abandoned according to Ontario Regulation 903.

7.0 STATEMENT OF LIMITATIONS

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

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

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

This report was prepared for the sole use of Inverness Homes. Notification from Inverness Homes and Paterson Group will be required to release this report to any other party.

Paterson Group Inc.

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

Karyn Munch, P.Eng., QP_{ESA}

Report Distribution:

- Inverness Homes
- Paterson Group

FIGURES

FIGURE 1 – KEY PLAN

DRAWING PE4666-3 – TEST HOLE LOCATION PLAN AND GROUNDWATER CONTOUR PLAN

DRAWING PE4666-4– ANALYTICAL TESTING PLAN – SOIL

DRAWING PE4666-5 – ANALYTICAL TESTING PLAN – GROUNDWATER

DRAWING PE4666-6 – CROSS-SECTION A – A' – SOIL

DRAWING PE4666-7 – CROSS-SECTION A – A' – GROUNDWATER

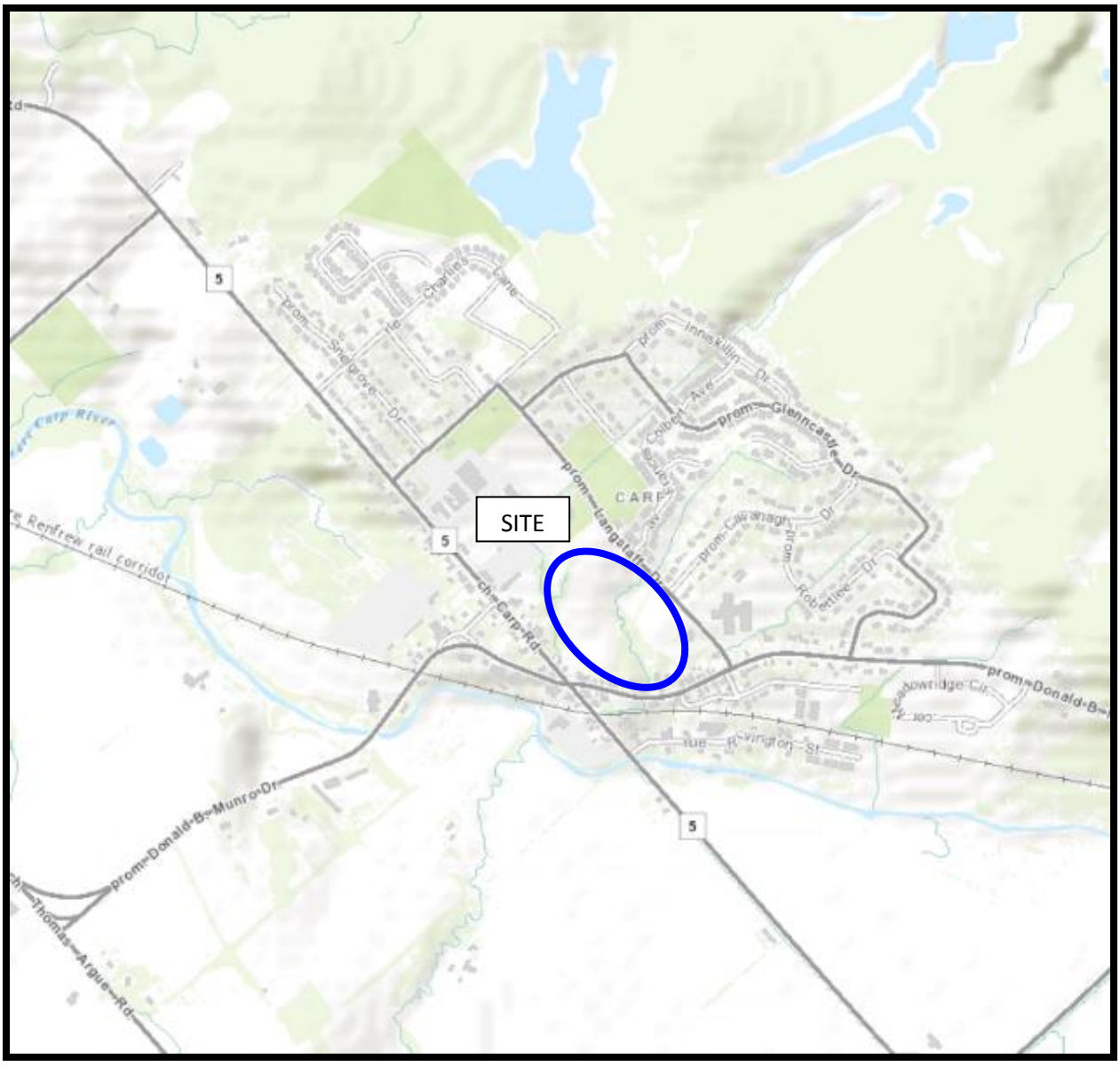
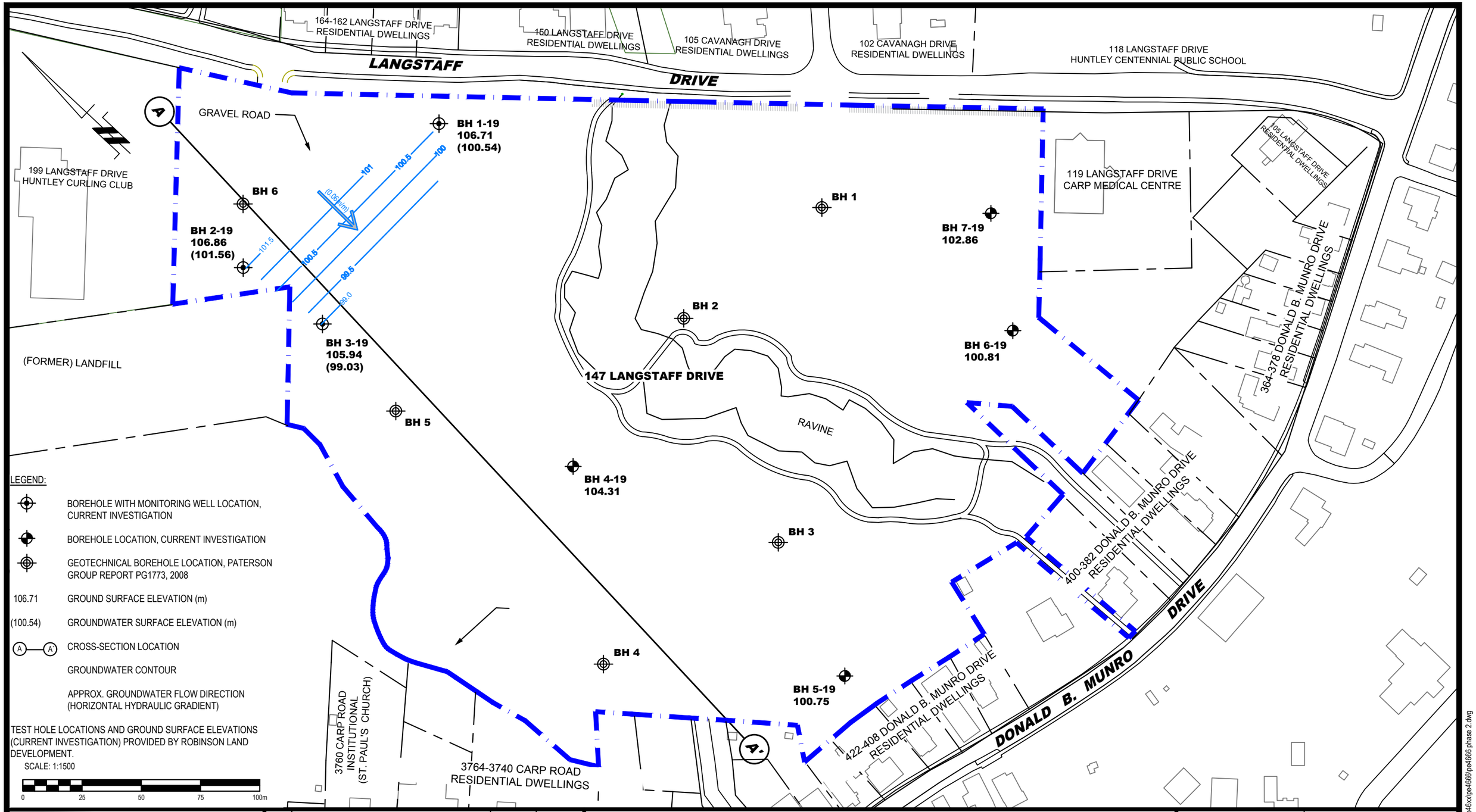


FIGURE 1

KEY PLAN



LEGEND:

- BOREHOLE WITH MONITORING WELL LOCATION, CURRENT INVESTIGATION
- BOREHOLE LOCATION, CURRENT INVESTIGATION
- GEOTECHNICAL BOREHOLE LOCATION, PATERSON GROUP REPORT PG1773, 2008
- 106.71 GROUND SURFACE ELEVATION (m)
- (100.54) GROUNDWATER SURFACE ELEVATION (m)
- A — A' CROSS-SECTION LOCATION
- GROUNDWATER CONTOUR
- APPROX. GROUNDWATER FLOW DIRECTION (HORIZONTAL HYDRAULIC GRADIENT)

TEST HOLE LOCATIONS AND GROUND SURFACE ELEVATIONS (CURRENT INVESTIGATION) PROVIDED BY ROBINSON LAND DEVELOPMENT.

SCALE: 1:1500

0 25 50 75 100m

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL

INVERNESS HOMES

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
147 LANGSTAFF DRIVE

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:1500	Date: 07/2019
Drawn by: MPG	Report No.: PE4666-2
Checked by: MW	Dwg. No.: PE4666-3
Approved by: MSD	Revision No.:

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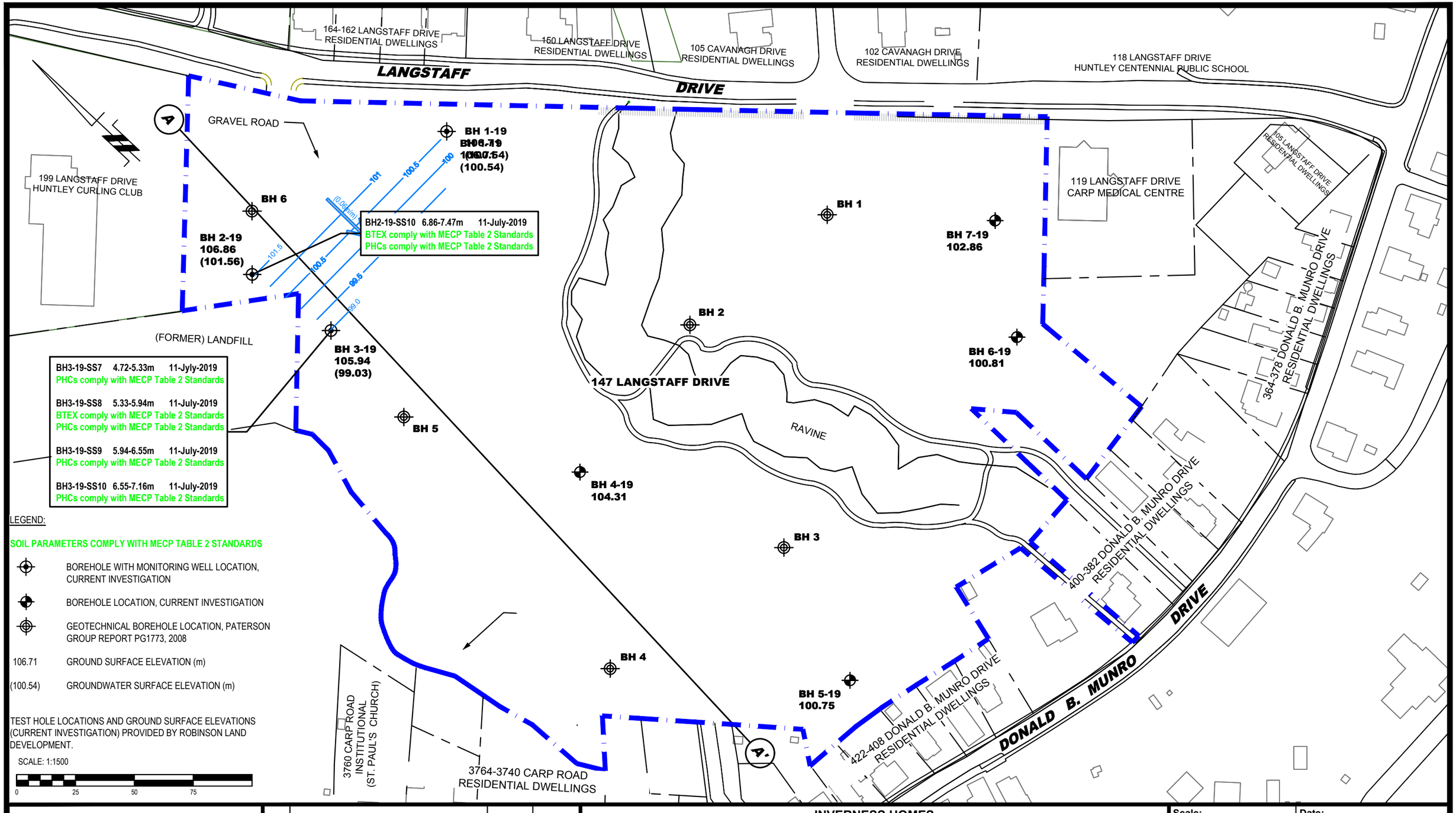

LEGEND:

SOIL PARAMETERS COMPLY WITH MECP TABLE 2 STANDARDS

- BOREHOLE WITH MONITORING WELL LOCATION, CURRENT INVESTIGATION
- BOREHOLE LOCATION, CURRENT INVESTIGATION
- GEOTECHNICAL BOREHOLE LOCATION, PATERSON GROUP REPORT PG1773, 2008
- 106.71 GROUND SURFACE ELEVATION (m)
- (100.54) GROUNDWATER SURFACE ELEVATION (m)

TEST HOLE LOCATIONS AND GROUND SURFACE ELEVATIONS (CURRENT INVESTIGATION) PROVIDED BY ROBINSON LAND DEVELOPMENT.

SCALE: 1:1500

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patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
147 LANGSTAFF DRIVE

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL

Scale: 1:1500	Date: 07/2019
Drawn by: MPG	Report No.: PE4666-2
Checked by: MW	**PE4666-4**
Approved by: MSD	Revision No.:

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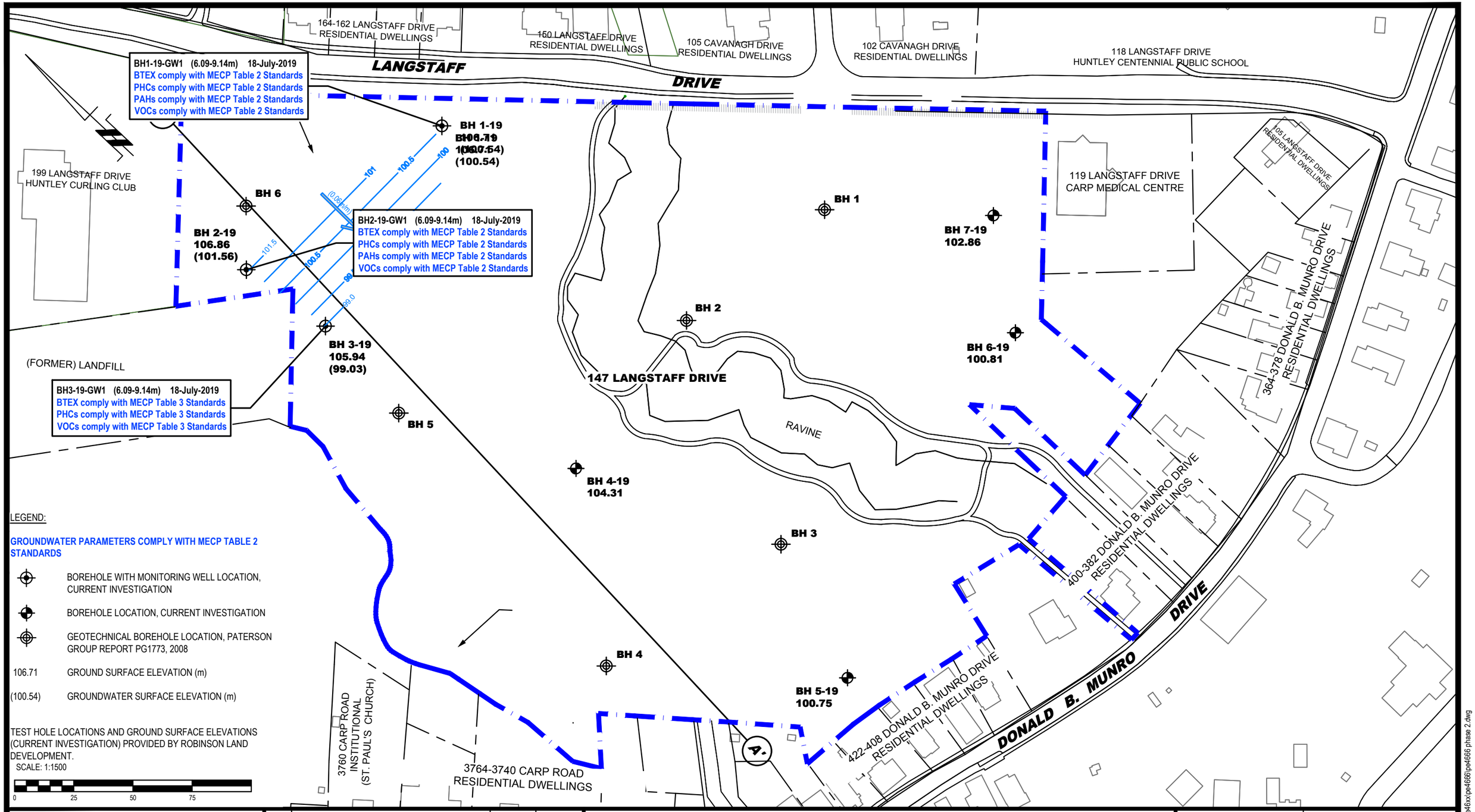

LEGEND:

GROUNDWATER PARAMETERS COMPLY WITH MECP TABLE 2 STANDARDS

- BOREHOLE WITH MONITORING WELL LOCATION, CURRENT INVESTIGATION
- BOREHOLE LOCATION, CURRENT INVESTIGATION
- GEOTECHNICAL BOREHOLE LOCATION, PATERSON GROUP REPORT PG1773, 2008
- 106.71 GROUND SURFACE ELEVATION (m)
- (100.54) GROUNDWATER SURFACE ELEVATION (m)

TEST HOLE LOCATIONS AND GROUND SURFACE ELEVATIONS (CURRENT INVESTIGATION) PROVIDED BY ROBINSON LAND DEVELOPMENT.

SCALE: 1:1500

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patersongroup
consulting engineers
154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
147 LANGSTAFF DRIVE
OTTAWA, ONTARIO

Title:
ANALYTICAL TESTING PLAN - GROUNDWATER

Scale: 1:1500	Date: 07/2019
Drawn by: MPG	Report No.: PE4666-2
Checked by: MW	PE4666-5
Approved by: MSD	Revision No.:

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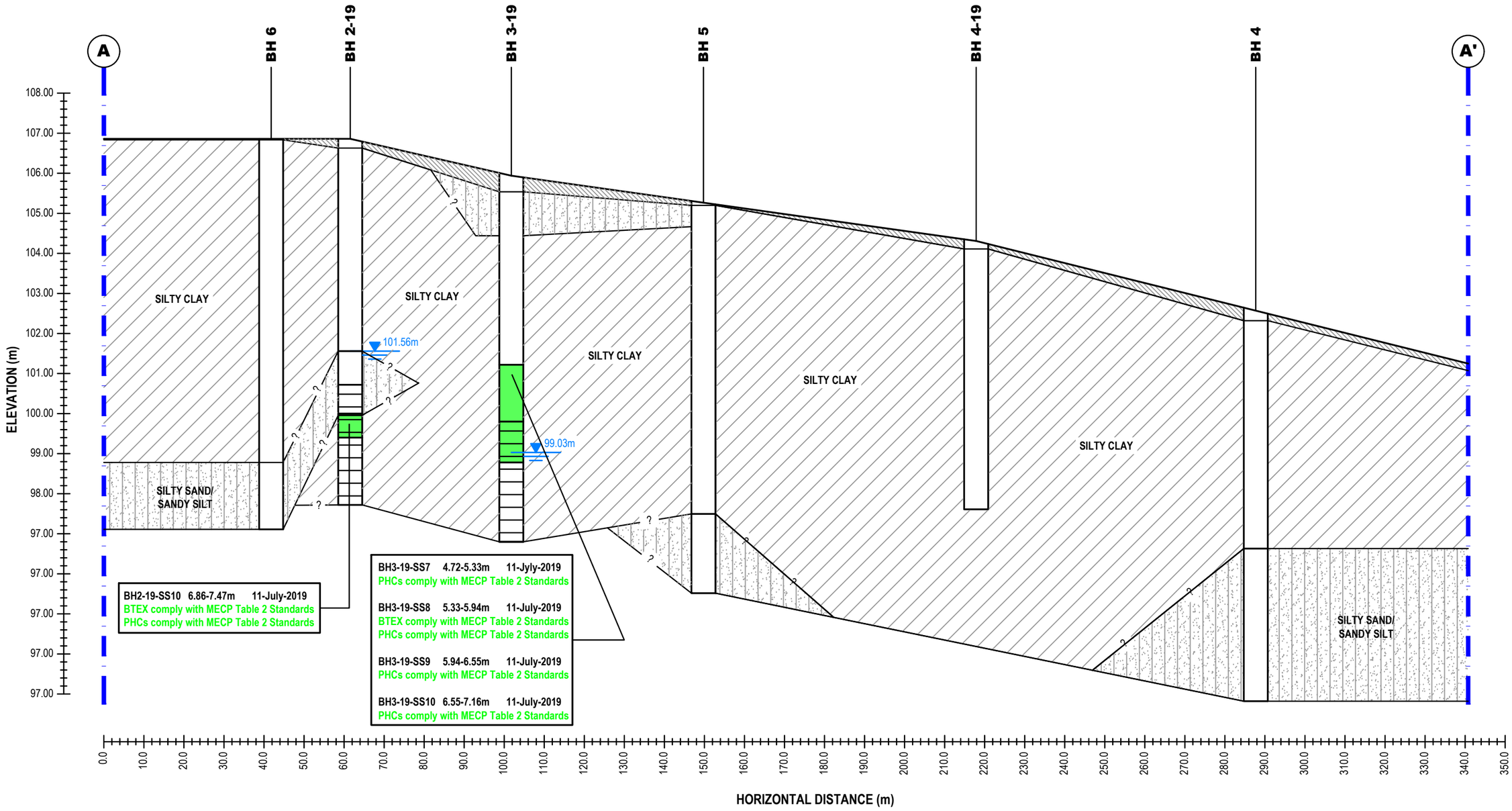

SOIL PARAMETERS COMPLY WITH MECP TABLE 2 STANDARDS

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

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INVERNESS HOMES

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
147 LANGSTAFF DRIVE
OTTAWA, ONTARIO

Title:
CROSS-SECTION A-A' - SOIL

Scale: AS SHOWN	Date: 07/2019
Drawn by: MPG	Report No.: PE4666-2
Checked by: MW	PE4666-6
Approved by: MSD	Revision No.:

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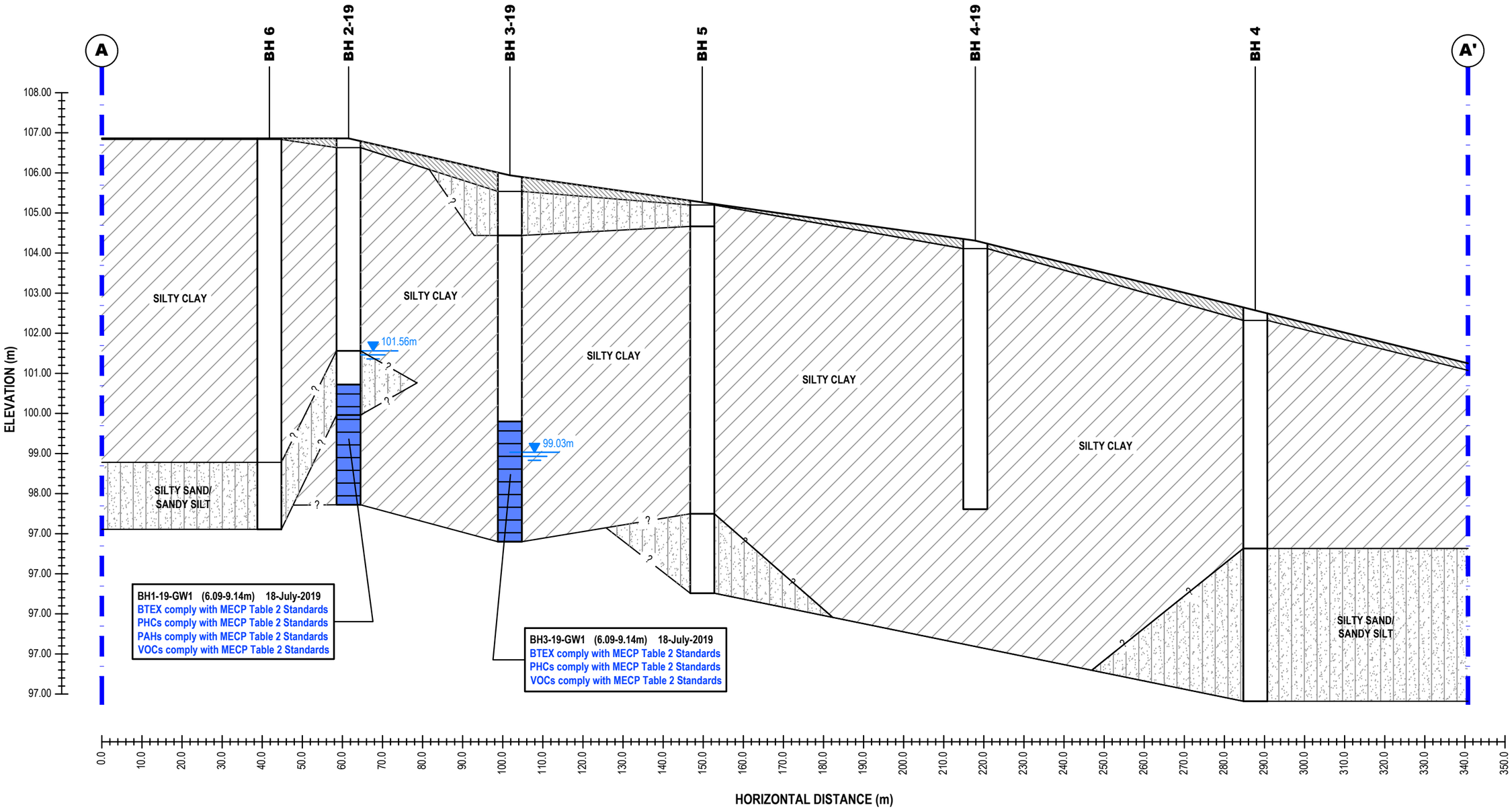

GROUNDWATER PARAMETERS COMPLY WITH MECP TABLE 2 STANDARDS

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
147 LANGSTAFF DRIVE

OTTAWA, ONTARIO

Title:
CROSS-SECTION A-A' - GROUNDDWATER

Scale: AS SHOWN	Date: 07/2019
Drawn by: MPG	Report No.: PE4666-2
Checked by: MW	PE4666-7
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
154 Colonnade Road South
Ottawa (Nepean), Ontario
Canada K2E 7J5

Tel: (613) 226-7381
Fax: (613) 226-6344
www.patersongroup.ca

patersongroup

Sampling & Analysis Plan

Phase II Environmental Site Assessment
147 Langstaff Drive
Ottawa, Ontario

Prepared For

Inverness Homes

July 2019

Report: PE4666-SAP

Table of Contents

1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by Ms. Alison Stirling of the Stirling Group, acting on behalf of Inverness Homes, to conduct a Phase II Environmental Site Assessment (ESA) for the property addressed 147 Langstaff Drive, in the City of Ottawa, Ontario

The Phase II ESA was carried out to address an area of potential environmental concern on the northwestern portion of the property, resulting form a former landfill on the adjacent property to the west, as identical to the Phase I ESA conducted by Paterson in July 2019. The following subsurface investigation program was developed to identify and delineate potential concerns. A Geotechnical Investigation was conducted concurrently with the environmental subsurface investigation.

Borehole	Location & Rationale	Proposed Depth & Rationale
BH1-19	Place on the northeastern portion of the Phase II Property to triangulate groundwater flow and to address the potential impacts from the former off-site landfill.	Boreholes to be advanced to at least 1.5 m within the groundwater table to facilitate installation of groundwater monitoring wells.
BH2-19	Place along the northwestern property boundary to assess potential impacts subsurface impacts resulting from the former landfill off-site.	Boreholes to be advanced to at least 1.5 m within the groundwater table to facilitate installation of groundwater monitoring wells.
BH3-19	Place along the northwestern property boundary to assess potential impacts subsurface impacts resulting from the former landfill off-site.	Boreholes to be advanced to at least 1.5 m within the groundwater table to facilitate installation of groundwater monitoring wells.
BH4-19	Placed on the central portion of the site for geotechnical purposes.	Advance borehole to depth of approximately 6 m or more for the geotechnical investigation.
BH5-19	Placed on the southwestern portion of the site for geotechnical purposes.	Borehole advanced to approximately 6 m for the geotechnical investigation.
BH6-19	Placed on the southeastern portion for geotechnical purposes.	Borehole advanced to approximately 6 m for the geotechnical investigation.
BH7-19	Placed on the eastern portion of the site for geotechnical purposes.	Borehole advanced to approximately 6 m for the geotechnical investigation.

At each borehole, split-spoon samples of overburden soils will be obtained at 0.76 m (2'6") intervals until practical refusal to augering. All soil samples will be

retained, and samples will be selected for submission following a preliminary screening analysis.

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

2.0 ANALYTICAL TESTING PROGRAM

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

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

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

- ❒ Groundwater monitoring wells should be installed in all boreholes with visual or olfactory evidence of soil contamination, in stratigraphic units where soil contamination was encountered, where those stratigraphic units are at or below the water table (i.e. a water sample can be obtained).
- ❒ Groundwater monitoring well screens should straddle the water table at sites where the contaminants of concern are suspected to be LNAPLs.

- ❒ At least one groundwater monitoring well should be installed in a stratigraphic unit below the suspected contamination, where said stratigraphic unit is water-bearing.
- ❒ Parameters analyzed should be consistent with the Contaminants of Concern identified in the Phase I ESA and with the contaminants identified in the soil samples.

3.0 STANDARD OPERATING PROCEDURES

3.1 Environmental Drilling Procedure

Purpose

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

Equipment

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

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

Determining Borehole Locations

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

After drilling is completed a plan with the borehole locations must be provided. Distances should be measured using a measuring tape or wheel rather than paced off. Elevations and boreholes were surveyed by Robinson Land Developers.

Drilling Procedure

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

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

Spoon Washing Procedure

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

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

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

Screening Procedure

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

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

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

3.2 Monitoring Well Installation Procedure

Equipment

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

Procedure

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

3.3 Monitoring Well Sampling Procedure

Equipment

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

Sampling Procedure

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

4.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

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

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

5.0 DATA QUALITY OBJECTIVES

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

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

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

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

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

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

These considerations are discussed in the body of the report.

6.0 PHYSICAL IMPEDIMENTS TO SAMPLING & ANALYSIS PLAN

Physical impediments to the Sampling and Analysis plan may include:

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

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
147 Langstaff Drive
Ottawa, Ontario

DATUM Ground surface elevations provided by Robinson Land Development.

FILE NO. PE4666

REMARKS

HOLE NO. BH 1-19

BORINGS BY CME 55 Power Auger **DATE** 2019 July 11

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	106.71
TOPSOIL 0.20		AU	1				
		SS	2	58	13	1	105.71
		SS	3	100	10	2	104.71
		SS	4	100	8		
		SS	5	100	5	3	103.71
Very stiff to stiff, brown **SILTY CLAY**		SS	6	100	4	4	102.71
		SS	6	100	4	5	101.71
		SS	7	100	4		
- firm to very stiff and grey by 6.1m depth		SS	8	100	W	6	100.71
		SS	9	100	W	7	99.71
		SS	10	100	W	8	98.71
		SS	11	100	2		
9.14						9	97.71
End of Borehole							
(GWL @ 6.17m - July 18, 2019)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**
20 40 60 80

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

Monitoring Well Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
147 Langstaff Drive
Ottawa, Ontario

DATUM Ground surface elevations provided by Robinson Land Development.

FILE NO. PE4666

REMARKS

HOLE NO. BH 2-19

BORINGS BY CME 55 Power Auger **DATE** 2019 July 11

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	106.86
TOPSOIL 0.23		AU	1				
		SS	2	100	15	1	105.86
		SS	3	100	14	2	104.86
Very stiff to stiff, brown **SILTY CLAY**		SS	4	100	11		
- grey by 3.0m depth		SS	5	100	8	3	103.86
		SS	6	79	6	4	102.86
		SS	7	100	5	5	101.86
5.30		SS	8	100	8		
Brown **SILTY SAND** with clay		SS	7	62	9	6	100.86
6.90		SS	8	100	2	7	99.86
Stiff, grey **SILTY CLAY** with sand		SS	9		W	8	98.86
		SS	10		W		
9.14						9	97.86
End of Borehole							
(GWL @ 5.30m - July 18, 2019)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)
○ **Lower Explosive Limit %**
20 40 60 80
100 200 300 400 500
RKI Eagle Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
147 Langstaff Drive
Ottawa, Ontario

DATUM Ground surface elevations provided by Robinson Land Development.

FILE NO. PE4666

REMARKS

HOLE NO. BH 3-19

BORINGS BY CME 55 Power Auger **DATE** 2019 July 11

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	105.94
TOPSOIL 0.18		AU	1				
		SS	2	12	11	1	104.94
		SS	3	79	7	2	103.94
		SS	4	83	5		
Very stiff to stiff, brown **SILTY CLAY**		SS	5	100	4	3	102.94
		SS	6	100	5	4	101.94
		SS	7	100	4	5	100.94
		SS	8	100	2	6	99.94
- firm to stiff and grey by 6.1m depth		SS	9	100	W		
		SS	10	100	W	7	98.94
		SS	11	100	W	8	97.94
		SS	12	0	W	9	96.94
9.14							
End of Borehole							
(GWL @ 6.91m - July 18, 2019)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
147 Langstaff Drive
Ottawa, Ontario

DATUM Ground surface elevations provided by Robinson Land Development.

FILE NO. PE4666

REMARKS

HOLE NO. BH 4-19

BORINGS BY CME 55 Power Auger **DATE** 2019 July 11

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Photo Ionization Detector: ● Volatile Organic Rdg. (ppm) / ○ Lower Explosive Limit %	Monitoring Well Construction
GROUND SURFACE						0	104.31	20 40 60 80	
TOPSOIL 0.20		AU	1						
		SS	2	100	14	1	103.31		
		SS	3	100	9	2	102.31		
		SS	4	100	6				
Very stiff, brown **SILTY CLAY,** trace sand						3	101.31		
						4	100.31		
- grey by 4.6m depth		SS	5	100	4	5	99.31		
						6	98.31		
6.70									
End of Borehole								100 200 300 400 500 RKI Eagle Rdg. (ppm) ▲ Full Gas Resp. △ Methane Elim.	

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SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
147 Langstaff Drive
Ottawa, Ontario

DATUM Ground surface elevations provided by Robinson Land Development.

FILE NO. PE4666

REMARKS

HOLE NO. BH 5-19

BORINGS BY CME 55 Power Auger **DATE** 2019 July 12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Photo Ionization Detector: ● Volatile Organic Rdg. (ppm) / ○ Lower Explosive Limit %	Monitoring Well Construction
GROUND SURFACE									
TOPSOIL 0.20		AU	1			0	100.75		
		SS	2	88	11	1	99.75		
		SS	3	100	10	2	98.75		
		SS	4	100	9	3	97.75		
Very stiff, brown **SILTY CLAY**						4	96.75		
- grey by 4.6m depth		SS	5	100	7	5	95.75		
6.70						6	94.75		
End of Borehole									

Photo Ionization Detector: ○ Lower Explosive Limit % — 20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
147 Langstaff Drive
Ottawa, Ontario

DATUM Ground surface elevations provided by Robinson Land Development.

FILE NO. PE4666

REMARKS

HOLE NO. BH 6-19

BORINGS BY CME 55 Power Auger **DATE** 2019 July 12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Photo Ionization Detector: Volatile Organic Rdg. (ppm) / Lower Explosive Limit %	Monitoring Well Construction
GROUND SURFACE						0	100.81		
TOPSOIL 0.15		AU	1						
		SS	2	58	8	1	99.81		
		SS	3	75	9	2	98.81		
Hard to stiff, brown **SILTY CLAY**						3	97.81		
						4	96.81		
- grey by 4.6m depth		SS	4	100	2	5	95.81		
						6	94.81		
6.70									
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.

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SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
147 Langstaff Drive
Ottawa, Ontario

DATUM Ground surface elevations provided by Robinson Land Development.

FILE NO. PE4666

REMARKS

HOLE NO. BH 7-19

BORINGS BY CME 55 Power Auger **DATE** 2019 July 12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Photo Ionization Detector: ● Volatile Organic Rdg. (ppm) / ○ Lower Explosive Limit %	Monitoring Well Construction
GROUND SURFACE						0	102.86	20 40 60 80	
TOPSOIL 0.18		AU	1						
		SS	2	100	13	1	101.86		
		SS	3	100	13	2	100.86		
Very stiff to stiff, brown **SILTY CLAY**						3	99.86		
						4	98.86		
- grey by 4.6m depth		SS	4	88	5	5	97.86		
						6	96.86		
6.70									
Dynamic Cone Penetration Test commenced at 6.70m depth. Practical DCPT refusal at 24.87m depth.								100 200 300 400 500 **RKI Eagle Rdg. (ppm)** ▲ Full Gas Resp. △ Methane Elim.	

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

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

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

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

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

CONSOLIDATION TEST

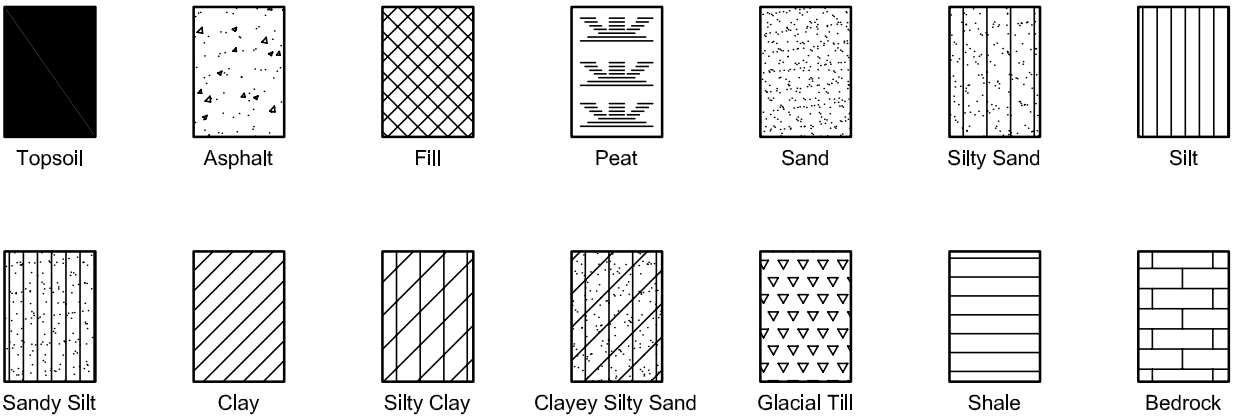
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

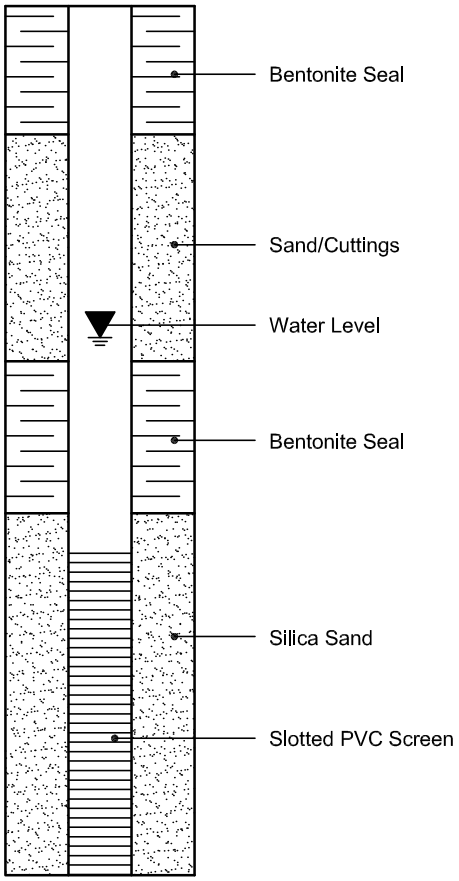
SYMBOLS AND TERMS (continued)

STRATA PLOT

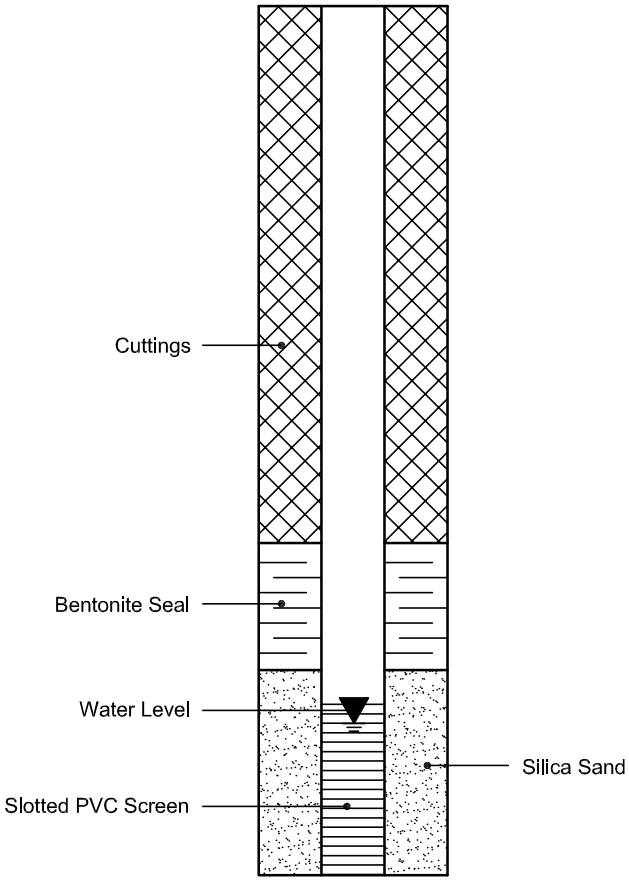


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 26977
Project: PE4666
Custody: 122830

Report Date: 22-Jul-2019
Order Date: 16-Jul-2019

Order #: 1929241

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

Paracel ID	Client ID
1929241-01	BH2-19-SS10
1929241-02	BH3-19-SS8

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 26977

Report Date: 22-Jul-2019
Order Date: 16-Jul-2019
Project Description: PE4666

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	18-Jul-19	19-Jul-19
PHC F1	CWS Tier 1 - P&T GC-FID	18-Jul-19	19-Jul-19
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	17-Jul-19	19-Jul-19
Solids, %	Gravimetric, calculation	20-Jul-19	20-Jul-19

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26977

Report Date: 22-Jul-2019

Order Date: 16-Jul-2019

Project Description: PE4666

	Client ID:	BH2-19-SS10	BH3-19-SS8	-	-
	Sample Date:	11-Jul-19 11:00	11-Jul-19 13:00	-	-
	Sample ID:	1929241-01	1929241-02	-	-
	MDL/Units	Soil	Soil	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	92.0	94.6	-	-
Volatiles					
Benzene	0.02 ug/g dry	<0.02	<0.02	-	-
Ethylbenzene	0.05 ug/g dry	<0.05	<0.05	-	-
Toluene	0.05 ug/g dry	<0.05	<0.05	-	-
m,p-Xylenes	0.05 ug/g dry	<0.05	<0.05	-	-
o-Xylene	0.05 ug/g dry	<0.05	<0.05	-	-
Xylenes, total	0.05 ug/g dry	<0.05	<0.05	-	-
Toluene-d8	Surrogate	85.6%	88.2%	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	-	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	-	-
F3 PHCs (C16-C34)	8 ug/g dry	<8	669	-	-
F4 PHCs (C34-C50)	6 ug/g dry	<6	119	-	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 26977

Report Date: 22-Jul-2019
Order Date: 16-Jul-2019
Project Description: PE4666

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						
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	*2.47*		*ug/g*		*77.1*	*50-140*			

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 26977

Report Date: 22-Jul-2019
Order Date: 16-Jul-2019
Project Description: PE4666

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)	ND	8	ug/g dry	ND				30	
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND				30	
Physical Characteristics									
% Solids	83.6	0.1	% by Wt.	85.0			1.6	25	
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	*2.98*		*ug/g dry*		*84.6*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	196	7	ug/g		97.9	80-120			
F2 PHCs (C10-C16)	96	4	ug/g	ND	111	60-140			
F3 PHCs (C16-C34)	282	8	ug/g	ND	133	60-140			
F4 PHCs (C34-C50)	164	6	ug/g	ND	122	60-140			
Volatiles									
Benzene	4.13	0.02	ug/g		103	60-130			
Ethylbenzene	4.19	0.05	ug/g		105	60-130			
Toluene	3.99	0.05	ug/g		99.7	60-130			
m,p-Xylenes	7.76	0.05	ug/g		97.1	60-130			
o-Xylene	4.48	0.05	ug/g		112	60-130			
Surrogate: Toluene-d8	*2.33*		*ug/g*		*72.7*	*50-140*			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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.

PARACE LABORATORIES

Paracel ID: 1929241

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Ottawa, Ontario K1G 4J8
p: 1-800-749-1947
e: paracel@paracellabs.com

Chain of Custody
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№ 122830

Page 1 of 1

Client Name: Paterson	Project Reference: PE4666
Contact Name: Mark D'Arcy	Quote #
Address:	PO # 26977
Telephone: 226-7381	Email Address:

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

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

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

Required Analyses

Paracel Order Number: 192924

	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	BH2-19-SS#10	S		3	Jul 11/19	11 am	✓							250ml jar x 2 vials						
2	BH3-19-SS8	S		3	Jul 11/19	1 pm	✓										11			
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Comments:

Method of Delivery: Paracel

Relinquished By (Sign):	Received by Driver/Depot: A. Seguin	Received at Lab: Samuel
Relinquished By (Print): Mark St Pierre	Date/Time: 16/07/19 2:40 pm	Date/Time: 07/16/19 15:27
Date/Time:	Temperature: °C	Temperature: 9.5 °C
		Verified By: D Gamey
		Date/Time: 16 July 19 1600
		pH Verified [ ] By:

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 27046 & 27047
Project: PE4666
Custody: 122865

Report Date: 30-Jul-2019
Order Date: 26-Jul-2019

Order #: 1930742

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

Paracel ID	Client ID
1930742-01	BH3-19-SS7
1930742-02	BH3-19-SS9
1930742-03	BH3-19-SS10

Approved By:

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 27046 & 27047

Report Date: 30-Jul-2019
Order Date: 26-Jul-2019
Project Description: PE4666

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	28-Jul-19	30-Jul-19
Solids, %	Gravimetric, calculation	29-Jul-19	29-Jul-19

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 27046 & 27047

Report Date: 30-Jul-2019

Order Date: 26-Jul-2019

Project Description: PE4666

	Client ID:	BH3-19-SS7	BH3-19-SS9	BH3-19-SS10	-
	Sample Date:	11-Jul-19 09:00	11-Jul-19 09:00	11-Jul-19 09:00	-
	Sample ID:	1930742-01	1930742-02	1930742-03	-
	MDL/Units	Soil	Soil	Soil	-
Physical Characteristics					
% Solids	0.1 % by Wt.	88.4	87.8	88.0	-
Hydrocarbons					
F2 PHCs (C10-C16)	4 ug/g dry	<4 [1]	<4 [1]	<4 [1]	-
F3 PHCs (C16-C34)	8 ug/g dry	<8 [1]	<8 [1]	<8 [1]	-
F4 PHCs (C34-C50)	6 ug/g dry	<6 [1]	<6 [1]	<6 [1]	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND				30	
F3 PHCs (C16-C34)	ND	8	ug/g dry	ND				30	
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND				30	
Physical Characteristics									
% Solids	89.2	0.1	% by Wt.	88.7			0.5	25	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F2 PHCs (C10-C16)	113	4	ug/g	ND	128	60-140			
F3 PHCs (C16-C34)	246	8	ug/g	ND	114	60-140			
F4 PHCs (C34-C50)	137	6	ug/g	ND	101	60-140			

Qualifier Notes:

Login Qualifiers :

Container(s) - Bottle and COC sample ID don't match -
Applies to samples: BH3-19-SS9, BH3-19-SS10

Sample - One or more parameter received past hold time -
Applies to samples: BH3-19-SS7, BH3-19-SS9, BH3-19-SS10

Sample Qualifiers :

1 : This analysis was conducted after the accepted holding time had been exceeded.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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

CCME PHC additional information:

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

PARACEL LABORATORIES LTD.

Paracel ID: 1930742

Head Office
300-2319 St. Laurent Blvd.
Ottawa, Ontario K1G 4J8
p: 1-800-749-1947
e: paracel@paracellabs.com

Chain of Custody
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№ 122865

Page ___ of ___

Client Name: Paterson Group (Mark Darcy)
Contact Name: mdarcy@patersongroup.ca
Address: 154 Colonnade Rd S. Ottawa
Telephone:

Project Reference: PE4666
Quote #
PO # 27046 + 27047
Email Address: mdarcy@patersongroup.ca

Turnaround Time:
☐ 1 Day ☐ 3 Day
☒ 2 Day ☐ Regular
Date Required: ___

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

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

Paracel Order Number:
1930728 = Water.
1930742 = Soil.

	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)	PHCs (F2 - F4)	Required Analyses
1	BH3-19-GW1	GW		3	July 18/19		X	X	X						
2	BH3-19-SS7	S		1	July 11/19									X	-120mL-
3	BH3-19-SS9	S		1	↓									X	↓
4	BH3-19-SS10	S		1	↓									X	↓
5															
6															
7															
8															
9	Cancel PAHs on sample #1. Report EXO														
10	Analysis for PHC + Modify date to hard time.														

Comments: ~~-~~ No.3 Sample ID on LID Read = BH3-19-SS9, on Jar read = BH3-SS9
No. 4 " " LID " = BH3-19-SS10, ON Jar " = BH3-SS10.

Method of Delivery: Paracel

Relinquished By (Sign):	Received by Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): Eric Levesque	Date/Time: 26/07/19 12:15	Date/Time: July 26, 2019 12:55	Date/Time: 26 July 19 13:13
Date/Time: July 26/19 Noon	Temperature: °C	Temperature: 3.9 °C	pH Verified [ ] By:

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 27076
Project: PE4666
Custody: 122843

Report Date: 25-Jul-2019
Order Date: 19-Jul-2019

Order #: 1930038

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

Paracel ID	Client ID
1930038-01	BH1-19-GW1
1930038-02	BH2-19-GW1

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
PHC F1	CWS Tier 1 - P&T GC-FID	23-Jul-19	24-Jul-19
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	24-Jul-19	25-Jul-19
REG 153: PAHs by GC-MS	EPA 625 - GC-MS, extraction	24-Jul-19	24-Jul-19
REG 153: VOCs by P&T GC/MS	EPA 624 - P&T GC-MS	23-Jul-19	24-Jul-19

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 27076

Report Date: 25-Jul-2019

Order Date: 19-Jul-2019

Project Description: PE4666

	Client ID:	BH1-19-GW1	BH2-19-GW1	-	-
	Sample Date:	18-Jul-19 09:00	18-Jul-19 09:00	-	-
	Sample ID:	1930038-01	1930038-02	-	-
	MDL/Units	Water	Water	-	-
Volatiles					
Acetone	5.0 ug/L	<5.0	<5.0	-	-
Benzene	0.5 ug/L	<0.5	<0.5	-	-
Bromodichloromethane	0.5 ug/L	<0.5	<0.5	-	-
Bromoform	0.5 ug/L	<0.5	<0.5	-	-
Bromomethane	0.5 ug/L	<0.5	<0.5	-	-
Carbon Tetrachloride	0.2 ug/L	<0.2	<0.2	-	-
Chlorobenzene	0.5 ug/L	<0.5	<0.5	-	-
Chloroform	0.5 ug/L	<0.5	<0.5	-	-
Dibromochloromethane	0.5 ug/L	<0.5	<0.5	-	-
Dichlorodifluoromethane	1.0 ug/L	<1.0	<1.0	-	-
1,2-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	-	-
1,3-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	-	-
1,4-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	-	-
1,1-Dichloroethane	0.5 ug/L	<0.5	<0.5	-	-
1,2-Dichloroethane	0.5 ug/L	<0.5	<0.5	-	-
1,1-Dichloroethylene	0.5 ug/L	<0.5	<0.5	-	-
cis-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	-	-
trans-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	-	-
1,2-Dichloropropane	0.5 ug/L	<0.5	<0.5	-	-
cis-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	-	-
trans-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	-	-
1,3-Dichloropropene, total	0.5 ug/L	<0.5	<0.5	-	-
Ethylbenzene	0.5 ug/L	<0.5	<0.5	-	-
Ethylene dibromide (dibromoethan	0.2 ug/L	<0.2	<0.2	-	-
Hexane	1.0 ug/L	<1.0	<1.0	-	-
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	<5.0	<5.0	-	-
Methyl Isobutyl Ketone	5.0 ug/L	<5.0	<5.0	-	-
Methyl tert-butyl ether	2.0 ug/L	<2.0	<2.0	-	-
Methylene Chloride	5.0 ug/L	<5.0	<5.0	-	-
Styrene	0.5 ug/L	<0.5	<0.5	-	-
1,1,1,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	-	-
1,1,2,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	-	-
Tetrachloroethylene	0.5 ug/L	<0.5	<0.5	-	-
Toluene	0.5 ug/L	<0.5	<0.5	-	-
1,1,1-Trichloroethane	0.5 ug/L	<0.5	<0.5	-	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 27076

Report Date: 25-Jul-2019

Order Date: 19-Jul-2019

Project Description: PE4666

	Client ID:	BH1-19-GW1	BH2-19-GW1	-	-
	Sample Date:	18-Jul-19 09:00	18-Jul-19 09:00	-	-
	Sample ID:	1930038-01	1930038-02	-	-
	MDL/Units	Water	Water	-	-
1,1,2-Trichloroethane	0.5 ug/L	<0.5	<0.5	-	-
Trichloroethylene	0.5 ug/L	<0.5	<0.5	-	-
Trichlorofluoromethane	1.0 ug/L	<1.0	<1.0	-	-
Vinyl chloride	0.5 ug/L	<0.5	<0.5	-	-
m,p-Xylenes	0.5 ug/L	<0.5	<0.5	-	-
o-Xylene	0.5 ug/L	<0.5	<0.5	-	-
Xylenes, total	0.5 ug/L	<0.5	<0.5	-	-
4-Bromofluorobenzene	Surrogate	118%	128%	-	-
Dibromofluoromethane	Surrogate	71.3%	80.8%	-	-
Toluene-d8	Surrogate	119%	113%	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	<25	-	-
F2 PHCs (C10-C16)	100 ug/L	<100	<100	-	-
F3 PHCs (C16-C34)	100 ug/L	<100	<100	-	-
F4 PHCs (C34-C50)	100 ug/L	<100	<100	-	-
Semi-Volatiles					
Acenaphthene	0.05 ug/L	<0.05	<0.05	-	-
Acenaphthylene	0.05 ug/L	<0.05	<0.05	-	-
Anthracene	0.01 ug/L	<0.01	<0.01	-	-
Benzo [a] anthracene	0.01 ug/L	<0.01	<0.01	-	-
Benzo [a] pyrene	0.01 ug/L	<0.01	<0.01	-	-
Benzo [b] fluoranthene	0.05 ug/L	<0.05	<0.05	-	-
Benzo [g,h,i] perylene	0.05 ug/L	<0.05	<0.05	-	-
Benzo [k] fluoranthene	0.05 ug/L	<0.05	<0.05	-	-
Chrysene	0.05 ug/L	<0.05	<0.05	-	-
Dibenzo [a,h] anthracene	0.05 ug/L	<0.05	<0.05	-	-
Fluoranthene	0.01 ug/L	<0.01	<0.01	-	-
Fluorene	0.05 ug/L	<0.05	<0.05	-	-
Indeno [1,2,3-cd] pyrene	0.05 ug/L	<0.05	<0.05	-	-
1-Methylnaphthalene	0.05 ug/L	<0.05	<0.05	-	-
2-Methylnaphthalene	0.05 ug/L	<0.05	<0.05	-	-
Methylnaphthalene (1&2)	0.10 ug/L	<0.10	<0.10	-	-
Naphthalene	0.05 ug/L	<0.05	<0.05	-	-
Phenanthrene	0.05 ug/L	<0.05	<0.05	-	-
Pyrene	0.01 ug/L	<0.01	<0.01	-	-
2-Fluorobiphenyl	Surrogate	88.6%	93.7%	-	-
Terphenyl-d14	Surrogate	92.1%	95.3%	-	-

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						
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	*20.0*		*ug/L*		*100*	*50-140*			
Surrogate: Terphenyl-d14	*19.4*		*ug/L*		*97.1*	*50-140*			
Volatiles									
Acetone	ND	5.0	ug/L						
Benzene	ND	0.5	ug/L						
Bromodichloromethane	ND	0.5	ug/L						
Bromoform	ND	0.5	ug/L						
Bromomethane	ND	0.5	ug/L						
Carbon Tetrachloride	ND	0.2	ug/L						
Chlorobenzene	ND	0.5	ug/L						
Chloroform	ND	0.5	ug/L						
Dibromochloromethane	ND	0.5	ug/L						
Dichlorodifluoromethane	ND	1.0	ug/L						
1,2-Dichlorobenzene	ND	0.5	ug/L						
1,3-Dichlorobenzene	ND	0.5	ug/L						
1,4-Dichlorobenzene	ND	0.5	ug/L						
1,1-Dichloroethane	ND	0.5	ug/L						
1,2-Dichloroethane	ND	0.5	ug/L						
1,1-Dichloroethylene	ND	0.5	ug/L						
cis-1,2-Dichloroethylene	ND	0.5	ug/L						
trans-1,2-Dichloroethylene	ND	0.5	ug/L						
1,2-Dichloropropane	ND	0.5	ug/L						
cis-1,3-Dichloropropylene	ND	0.5	ug/L						
trans-1,3-Dichloropropylene	ND	0.5	ug/L						
1,3-Dichloropropene, total	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Ethylene dibromide (dibromoethane	ND	0.2	ug/L						
Hexane	ND	1.0	ug/L						
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L						
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						

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 27076

Report Date: 25-Jul-2019
Order Date: 19-Jul-2019
Project Description: PE4666

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
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	*96.4*		*ug/L*		*120*	*50-140*			
Surrogate: Dibromofluoromethane	*61.4*		*ug/L*		*76.7*	*50-140*			
Surrogate: Toluene-d8	*92.0*		*ug/L*		*115*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND				30	
Volatiles									
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	
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	*91.8*		*ug/L*		*115*	*50-140*			
Surrogate: Dibromofluoromethane	*61.6*		*ug/L*		*77.0*	*50-140*			
Surrogate: Toluene-d8	*91.0*		*ug/L*		*114*	*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)	2060	25	ug/L		103	68-117			
F2 PHCs (C10-C16)	1720	100	ug/L		108	60-140			
F3 PHCs (C16-C34)	3890	100	ug/L		99.3	60-140			
F4 PHCs (C34-C50)	2600	100	ug/L		105	60-140			
Semi-Volatiles									
Acenaphthene	4.75	0.05	ug/L		95.0	50-140			
Acenaphthylene	4.40	0.05	ug/L		88.1	50-140			
Anthracene	4.49	0.01	ug/L		89.8	50-140			
Benzo [a] anthracene	4.83	0.01	ug/L		96.5	50-140			
Benzo [a] pyrene	3.91	0.01	ug/L		78.2	50-140			
Benzo [b] fluoranthene	5.24	0.05	ug/L		105	50-140			
Benzo [g,h,i] perylene	3.99	0.05	ug/L		79.8	50-140			
Benzo [k] fluoranthene	5.29	0.05	ug/L		106	50-140			
Chrysene	5.32	0.05	ug/L		106	50-140			
Dibenzo [a,h] anthracene	3.94	0.05	ug/L		78.8	50-140			
Fluoranthene	4.42	0.01	ug/L		88.4	50-140			
Fluorene	4.24	0.05	ug/L		84.9	50-140			
Indeno [1,2,3-cd] pyrene	4.17	0.05	ug/L		83.3	50-140			
1-Methylnaphthalene	5.14	0.05	ug/L		103	50-140			
2-Methylnaphthalene	5.55	0.05	ug/L		111	50-140			
Naphthalene	4.69	0.05	ug/L		93.9	50-140			
Phenanthrene	4.35	0.05	ug/L		86.9	50-140			
Pyrene	4.60	0.01	ug/L		92.1	50-140			
Surrogate: 2-Fluorobiphenyl	*20.6*		*ug/L*		*103*	*50-140*			
Volatiles									
Acetone	68.5	5.0	ug/L		68.5	50-140			
Benzene	31.4	0.5	ug/L		78.5	60-130			
Bromodichloromethane	24.3	0.5	ug/L		60.7	60-130			
Bromoform	34.6	0.5	ug/L		86.5	60-130			
Bromomethane	32.0	0.5	ug/L		80.1	50-140			
Carbon Tetrachloride	28.4	0.2	ug/L		71.0	60-130			
Chlorobenzene	37.2	0.5	ug/L		92.9	60-130			
Chloroform	26.6	0.5	ug/L		66.4	60-130			
Dibromochloromethane	39.6	0.5	ug/L		99.0	60-130			
Dichlorodifluoromethane	30.0	1.0	ug/L		74.9	50-140			
1,2-Dichlorobenzene	43.8	0.5	ug/L		110	60-130			
1,3-Dichlorobenzene	48.1	0.5	ug/L		120	60-130			
1,4-Dichlorobenzene	39.4	0.5	ug/L		98.5	60-130			
1,1-Dichloroethane	32.8	0.5	ug/L		82.0	60-130			
1,2-Dichloroethane	27.4	0.5	ug/L		68.6	60-130			
1,1-Dichloroethylene	33.2	0.5	ug/L		83.0	60-130			
cis-1,2-Dichloroethylene	28.0	0.5	ug/L		70.0	60-130			
trans-1,2-Dichloroethylene	30.7	0.5	ug/L		76.8	60-130			
1,2-Dichloropropane	26.9	0.5	ug/L		67.2	60-130			
cis-1,3-Dichloropropylene	26.8	0.5	ug/L		66.9	60-130			
trans-1,3-Dichloropropylene	28.4	0.5	ug/L		70.9	60-130			
Ethylbenzene	43.0	0.5	ug/L		107	60-130			
Ethylene dibromide (dibromoethane	40.2	0.2	ug/L		100	60-130			
Hexane	31.7	1.0	ug/L		79.3	60-130			
Methyl Ethyl Ketone (2-Butanone)	78.0	5.0	ug/L		78.0	50-140			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Methyl Isobutyl Ketone	62.8	5.0	ug/L		62.8	50-140			
Methyl tert-butyl ether	90.0	2.0	ug/L		90.0	50-140			
Methylene Chloride	32.7	5.0	ug/L		81.8	60-130			
Styrene	39.8	0.5	ug/L		99.6	60-130			
1,1,1,2-Tetrachloroethane	47.0	0.5	ug/L		117	60-130			
1,1,2,2-Tetrachloroethane	44.5	0.5	ug/L		111	60-130			
Tetrachloroethylene	43.6	0.5	ug/L		109	60-130			
Toluene	44.5	0.5	ug/L		111	60-130			
1,1,1-Trichloroethane	26.6	0.5	ug/L		66.6	60-130			
1,1,2-Trichloroethane	29.4	0.5	ug/L		73.4	60-130			
Trichloroethylene	38.0	0.5	ug/L		94.9	60-130			
Trichlorofluoromethane	29.6	1.0	ug/L		74.0	60-130			
Vinyl chloride	45.3	0.5	ug/L		113	50-140			
m,p-Xylenes	74.0	0.5	ug/L		92.4	60-130			
o-Xylene	39.1	0.5	ug/L		97.8	60-130			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

CCME PHC additional information:

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

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№ 122843

Page 1 of 1

Client Name: Paterson	Project Reference: PE4666	**Turnaround Time:**	
Contact Name: Mark D'Arcy	Quote #	☐ 1 Day	☐ 3 Day
Address: 154 Colonnade Rd South	PO # 27076	☐ 2 Day	☑ ~~Regular~~
Telephone: 613-226-7381	Email Address: m.darcy@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: 1930038

	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	BH1-19-GW1	GW		4	July 18/19		✓	✓	✓				
2	BH2-19-GW1	GW		4	July 18/19		✓	✓	✓				
3													
4													
5													
6													
7													
8													
9													
10													

Comments: Received Extra Sample, Sample ID on Plic Bottle read = BH3-19-GW1 (PE4666.) Jul 19, 2019 Hold -

Method of Delivery: Swift

Relinquished By (Sign):	Received by Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): Nicole Sullivan	Date/Time: July 19/19 1413	Date/Time: July 19/19	Date/Time: 7-22-19 11:42
Date/Time: July 19/19	Temperature: °C	Temperature: 16.9 °C 4:00p	pH Verified [ ] By:

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 27046 & 27047
Project: PE4666
Custody: 122865

Report Date: 30-Jul-2019
Order Date: 26-Jul-2019

Order #: 1930728

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

Paracel ID	Client ID
1930728-01	BH3-19-GW1

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 27046 & 27047

Report Date: 30-Jul-2019
Order Date: 26-Jul-2019
Project Description: PE4666

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
PHC F1	CWS Tier 1 - P&T GC-FID	29-Jul-19	30-Jul-19
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	30-Jul-19	30-Jul-19
REG 153: VOCs by P&T GC/MS	EPA 624 - P&T GC-MS	29-Jul-19	30-Jul-19

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 27046 & 27047

Report Date: 30-Jul-2019

Order Date: 26-Jul-2019

Project Description: PE4666

Client ID:		BH3-19-GW1	-	-	-
Sample Date:		18-Jul-19 09:00	-	-	-
Sample ID:		1930728-01	-	-	-
	MDL/Units	Water	-	-	-
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	-	-	-
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	<0.5	-	-	-
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	<0.5	-	-	-
1,1,1-Trichloroethane	0.5 ug/L	<0.5	-	-	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 27046 & 27047

Report Date: 30-Jul-2019

Order Date: 26-Jul-2019

Project Description: PE4666

	Client ID:	BH3-19-GW1	-	-	-
	Sample Date:	18-Jul-19 09:00	-	-	-
	Sample ID:	1930728-01	-	-	-
	MDL/Units	Water	-	-	-
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	<0.5	-	-	-
o-Xylene	0.5 ug/L	<0.5	-	-	-
Xylenes, total	0.5 ug/L	<0.5	-	-	-
4-Bromofluorobenzene	Surrogate	90.1%	-	-	-
Dibromofluoromethane	Surrogate	107%	-	-	-
Toluene-d8	Surrogate	91.6%	-	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	-	-	-
F2 PHCs (C10-C16)	100 ug/L	<100	-	-	-
F3 PHCs (C16-C34)	100 ug/L	<100	-	-	-
F4 PHCs (C34-C50)	100 ug/L	<100	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
Volatiles									
Acetone	ND	5.0	ug/L						
Benzene	ND	0.5	ug/L						
Bromodichloromethane	ND	0.5	ug/L						
Bromoform	ND	0.5	ug/L						
Bromomethane	ND	0.5	ug/L						
Carbon Tetrachloride	ND	0.2	ug/L						
Chlorobenzene	ND	0.5	ug/L						
Chloroform	ND	0.5	ug/L						
Dibromochloromethane	ND	0.5	ug/L						
Dichlorodifluoromethane	ND	1.0	ug/L						
1,2-Dichlorobenzene	ND	0.5	ug/L						
1,3-Dichlorobenzene	ND	0.5	ug/L						
1,4-Dichlorobenzene	ND	0.5	ug/L						
1,1-Dichloroethane	ND	0.5	ug/L						
1,2-Dichloroethane	ND	0.5	ug/L						
1,1-Dichloroethylene	ND	0.5	ug/L						
cis-1,2-Dichloroethylene	ND	0.5	ug/L						
trans-1,2-Dichloroethylene	ND	0.5	ug/L						
1,2-Dichloropropane	ND	0.5	ug/L						
cis-1,3-Dichloropropylene	ND	0.5	ug/L						
trans-1,3-Dichloropropylene	ND	0.5	ug/L						
1,3-Dichloropropene, total	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Ethylene dibromide (dibromoethane	ND	0.2	ug/L						
Hexane	ND	1.0	ug/L						
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L						
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	*85.7*		*ug/L*		*107*	*50-140*			
Surrogate: Dibromofluoromethane	*79.2*		*ug/L*		*99.0*	*50-140*			
Surrogate: Toluene-d8	*76.8*		*ug/L*		*96.0*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND				30	
Volatiles									
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	
1,1,1-Trichloroethane	ND	0.5	ug/L	ND				30	
1,1,2-Trichloroethane	ND	0.5	ug/L	ND				30	
Trichloroethylene	ND	0.5	ug/L	ND				30	
Trichlorofluoromethane	ND	1.0	ug/L	ND				30	
Vinyl chloride	ND	0.5	ug/L	ND				30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: 4-Bromofluorobenzene	*87.4*		*ug/L*		*109*	*50-140*			
Surrogate: Dibromofluoromethane	*79.6*		*ug/L*		*99.4*	*50-140*			
Surrogate: Toluene-d8	*80.3*		*ug/L*		*100*	*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)	2070	25	ug/L		104	68-117			
F2 PHCs (C10-C16)	1850	100	ug/L		116	60-140			
F3 PHCs (C16-C34)	5020	100	ug/L		128	60-140			
F4 PHCs (C34-C50)	2880	100	ug/L		116	60-140			
Volatiles									
Acetone	87.6	5.0	ug/L		87.6	50-140			
Benzene	41.4	0.5	ug/L		103	60-130			
Bromodichloromethane	29.6	0.5	ug/L		73.9	60-130			
Bromoform	28.3	0.5	ug/L		70.8	60-130			
Bromomethane	32.2	0.5	ug/L		80.6	50-140			
Carbon Tetrachloride	28.7	0.2	ug/L		71.8	60-130			
Chlorobenzene	28.6	0.5	ug/L		71.6	60-130			
Chloroform	29.5	0.5	ug/L		73.7	60-130			
Dibromochloromethane	31.2	0.5	ug/L		78.0	60-130			
Dichlorodifluoromethane	29.0	1.0	ug/L		72.6	50-140			
1,2-Dichlorobenzene	43.4	0.5	ug/L		108	60-130			
1,3-Dichlorobenzene	47.3	0.5	ug/L		118	60-130			
1,4-Dichlorobenzene	39.6	0.5	ug/L		99.1	60-130			
1,1-Dichloroethane	35.3	0.5	ug/L		88.4	60-130			
1,2-Dichloroethane	33.7	0.5	ug/L		84.2	60-130			
1,1-Dichloroethylene	37.6	0.5	ug/L		94.0	60-130			
cis-1,2-Dichloroethylene	41.7	0.5	ug/L		104	60-130			
trans-1,2-Dichloroethylene	38.7	0.5	ug/L		96.6	60-130			
1,2-Dichloropropane	33.2	0.5	ug/L		83.0	60-130			
cis-1,3-Dichloropropylene	29.7	0.5	ug/L		74.2	60-130			
trans-1,3-Dichloropropylene	32.5	0.5	ug/L		81.3	60-130			
Ethylbenzene	29.1	0.5	ug/L		72.7	60-130			
Ethylene dibromide (dibromoethane	30.4	0.2	ug/L		76.0	60-130			
Hexane	42.8	1.0	ug/L		107	60-130			
Methyl Ethyl Ketone (2-Butanone)	121	5.0	ug/L		121	50-140			
Methyl Isobutyl Ketone	84.5	5.0	ug/L		84.5	50-140			
Methyl tert-butyl ether	97.3	2.0	ug/L		97.3	50-140			
Methylene Chloride	40.2	5.0	ug/L		101	60-130			
Styrene	30.8	0.5	ug/L		77.1	60-130			
1,1,1,2-Tetrachloroethane	38.2	0.5	ug/L		95.4	60-130			
1,1,2,2-Tetrachloroethane	32.1	0.5	ug/L		80.2	60-130			
Tetrachloroethylene	29.2	0.5	ug/L		73.0	60-130			
Toluene	46.6	0.5	ug/L		116	60-130			
1,1,1-Trichloroethane	30.7	0.5	ug/L		76.8	60-130			
1,1,2-Trichloroethane	28.8	0.5	ug/L		71.9	60-130			
Trichloroethylene	29.5	0.5	ug/L		73.8	60-130			
Trichlorofluoromethane	28.0	1.0	ug/L		70.0	60-130			
Vinyl chloride	50.6	0.5	ug/L		127	50-140			
m,p-Xylenes	59.8	0.5	ug/L		74.8	60-130			
o-Xylene	33.8	0.5	ug/L		84.4	60-130			
Surrogate: 4-Bromofluorobenzene	*63.7*		*ug/L*		*79.6*	*50-140*			

Qualifier Notes:

Login Qualifiers :

Sample - One or more parameter received past hold time - unpreserved bottle for PHC
Applies to samples: BH3-19-GW1

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

CCME PHC additional information:

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

PARACEL LABORATORIES LTD.

Paracel ID: 1930728

Head Office
300-2319 St. Laurent Blvd.
Ottawa, Ontario K1G 4J8
p: 1-800-749-1947
e: paracel@paracellabs.com

Chain of Custody (Lab Use Only)
Nº 122865

Page __ of __

Client Name: Paterson Group (Mark Darcy)	Project Reference: PE4666
Contact Name: mdarcy@patersongroup.ca	Quote #
Address: 154 Colonnade Rd S. Ottawa	PO # 27046 + 27047
Telephone:	Email Address: mdarcy@patersongroup.ca

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

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

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

Paracel Order Number: 1930728 = Water. 1930742 = Soil

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Date	Time	PHCs F1-F4 ~~+BTEX~~	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	PHCs (F2 - F4)						
1	BH3-19-GW1	GW		3	July 18/19		X	X	X											
2	BH3-19-SS7	S		1	July 11/19									X			-120ml-			
3	BH3-19-SS9	S		1	↓									X						
4	BH3-19-SS10	S		1	↓									X			↓			
5																				
6																				
7																				
8																				
9	Cancel PAH's on sample #1. Report F2 as F2 to F4																			
10	[illegible]																			

Comments: :- No. 3 Sample ID on LID Read = BH3-19-SS9, on Jar read = BH3-SS9
No. 4 ⟶ LID " = BH3-19-SS10, ON Jar " = BH3-SS10.

Method of Delivery: Paracel

Relinquished By (Sign): [signature]	Received by Driver/Depot: [signature] Rouse	Received at Lab: Junepform Dokmai	Verified By: [signature]
Relinquished By (Print): Eric Leveque	Date/Time: 26/07/19 12:15	Date/Time: Jul 26, 2019 12:55	Date/Time: 26 July 19 [illegible]
Date/Time: July 26/19 Noon	Temperature: °C	Temperature: 13.9 °C	pH Verified [ ] By:

Chain of Custody (Env) - Rev 0.7 Feb. 2016