Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

patersongroup

Phase II Environmental Site Assessment

176 Nepean Street and 293 to 307 Lisgar Street
Ottawa, Ontario

Prepared For

Richcraft (Lisgar) Ltd.

February 5, 2018

Report: PE3651-2

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

TABLE OF CONTENTS

List of Figures

List of Appendices

EXECUTIVE SUMMARY

Assessment

A Phase II ESA was conducted for the property at 176 Nepean Street and 293 to 307 Lisgar Street in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address potentially contaminating activities (PCAs) that were identified during the Phase I ESA and considered to result in areas of potential environmental concern (APEC) on the Phase II Property. The subsurface investigation was carried out in conjunction with a Geotechnical Investigation and consisted of the drilling seven (7) boreholes, five (5) of which were constructed with groundwater monitoring well installations. It should be noted that the monitoring wells installed in BH1 and BH2 were installed deeper and for geotechnical purposes only.

Soil samples were obtained from the boreholes and screened using visual observations and organic vapour measurements. A total of 12 soil samples were submitted for laboratory analysis of a combination of volatile organic compounds (VOCs), petroleum hydrocarbons (PHCs, F_1-F_4), polycyclic aromatic hydrocarbons (PAHs) and metals. Several PAH and metal parameters exceeding MOECC Table 3 standards were identified in the fill material on the northern and southeastern portions of the Phase II Property.

To confirm whether or not the contaminants had migrated to the underlying native silty clay, additional sampling for PAH and metal parameters was conducted. No PAH parameters were detected in the native silty clay. Metal parameters were identified with cobalt and vanadium present at concentrations exceeding the MOECC Table 3 standard.

Based on our experience, these parameters are naturally occurring at elevated concentrations in silty clays within the Ottawa region. They were not present at elevated concentrations in the overlying impacted fill material and are not considered to represent contaminants of concern in the native material.

Groundwater samples obtained from three (3) monitoring wells, BH1A, BH3 and BH5, were analysed for VOCs, PHC, and/or PAHs. Based on the results of the analytical testing, parameter concentrations were not identified above the method detection limits with one exception. A concentration of chloroform (2.7µg/L) marginally exceeding the MOECC Table 3 standard of 2.4µg/L was identified in the groundwater recovered from BH2. The chloroform is considered to be the result of using municipal groundwater during the rock coring process, for the installation of the groundwater monitoring wells. The chloroform is expected to dissipate over time and is not considered to be contaminant of concern. The groundwater is considered to be in compliance with MOECC Table 3 standards.

Conclusion

Based on the findings of the Phase II ESA, fill material impacted with PAH and metal concentrations exceeding MOECC Table 3 standards, is present on the Phase II Property. It is our understanding that the subject site is to be redeveloped with two multi-storey apartment towers with 4 levels of underground parking.

It is our recommendation that an environmental site remediation program, involving the removal of all impacted fill material, be completed concurrently with the site redevelopment. Prior to offsite disposal at a licenced landfill site, a leachate analysis of a representative sample of contaminated soil must be conducted in accordance with Ontario Regulation 347/558.

It is also recommended that Paterson personnel be onsite during construction activities to direct the excavation and segregation of impacted soil and to conduct confirmatory sampling as required.

It is expected that groundwater monitoring wells will be abandoned in accordance with O.Reg.903, at the time of construction excavation.

1.0 INTRODUCTION

At the request of Richcraft (Lisgar) Ltd., Paterson Group (Paterson) conducted a Phase II Environmental Site Assessment for the property addressed 176 Nepean Street and 293 to 307 Lisgar Street, in the City of Ottawa, Ontario. The purpose of this Phase II ESA was to address concerns identified in the Phase I ESA prepared by Paterson in August, 2017.

1.1 Site Description

Address:	176 Nepean Street, 293 and 307 Lisgar Street, Ottawa, Ontario. Note that the parcel addressed 307 Lisgar Street also includes civic address 309 Lisgar Street.
Legal Description:	Lot 37, Part of Lots 36 and 38 (South Nepean Street) and Lots 37, 38 and Part of Lot 39 (North Lisgar Street) RP 2996, City of Ottawa, Ontario.
Property Identification Numbers:	041150239, 041150242 and 041150249
Location:	The Phase II Property is situated between Nepean and Lisgar Streets, approximately 45m east of Bank Street. The subject site is shown on Figure 1 - Key Plan following the body of this report.
Latitude and Longitude:	45° 25' 02" N, 75° 41' 49" W
Configuration:	Irregular
Site Area:	0.27 hectares (approximate)

1.2 Property Ownership

The subject property is currently owned by Richcraft (Lisgar) Ltd. Paterson was retained to complete this Phase II ESA by Ms. Fairouz Wahab, with Richcraft Group of Companies (Richcraft). The offices of Richcraft are located at 2280 St. Laurent Boulevard, Suite 201, Ottawa, Ontario. Ms. Wahab can be reached by telephone at (613) 739-7111.

1.3 Current and Proposed Future Uses

The Phase II Property is currently occupied by a community garden (176 Nepean Street), a 3-storey residential dwelling (309 Lisgar Street) and a parking lot (307 Lisgar Street). The southeastern portion of the Phase II Property (part of 307 Lisgar Street and 293 Lisgar Street) are currently used as a storage area by Claridge Homes in conjunction with their residential development under construction at 287 Lisgar Street, immediately east of the Phase II Property.

It is our understanding that the proposed development will consist of two residential towers with ground-floor commercial space, linked by a common elevator lobby. The towers will be connected below-grade, through an underground parking garage consisting of 4 levels.

1.4 Applicable Site Condition Standard

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

- ❒ Coarse-grained soil conditions;
- ❒ Full depth generic site conditions;
- ❒ Non-potable groundwater conditions; and
- ❒ Residential land use.

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The Phase II Property is located in an urban area surrounded by various sized commercial and residential structures. Site topography slopes slightly down towards the north and east. The Phase II Property is at a similar grade as the adjacent properties, with the exception of the adjacent property to the east which is currently under construction. Site drainage consists primarily of sheet flow to a catch basins both on site and along Lisgar and Nepean Streets. The Phase II Property is situated with a municipally serviced area.

2.2 Past Investigations

A Phase I ESA was conducted by Paterson in August of 2017. Based on the findings of the Phase I ESA, several historical on- and off-site potentially contaminating activities (PCAs) were considered to result in areas of potential environmental concern (APECs) on the Phase I and Phase II Property, as presented in Table 1.

Table 1
Area of Potential Environmental Concern

Area of Potential Environmental Concern	Location of Area of Potential Environmental Concern with respect to Phase I Property	Potentially Contaminating Activity	Location of PCA (on-site or off-site)	Contaminants of Potential Concern	Media Potentially Impacted (Groundwater, Soil, and/or Sediment)
APEC 1	At locations of former building foundations.	30 – Importation of Fill Material of Unknown Quality	On-site	BTEX/PHCs (F_1-F_4) and PAHs	Soil, Groundwater
				Metals	Soil (fill material)
APEC 2	Southwestern portion of Phase I Property	28 – Gasoline and Associated Products Storage in Fixed Tanks	On-site	BTEX/PHCs (F_1-F_4)	Soil, Groundwater
APEC 3	Northwestern portion of Phase I Property	37 – Operation of Dry Cleaning Equipment (where chemicals are used)	Off-site	VOCs	Soil, Groundwater

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

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The subsurface investigation conducted as a component of this Phase II ESA, consisted of drilling seven (7) boreholes, five (5) of which were completed with groundwater monitoring wells. Boreholes were drilled to depths ranging from approximately 7.3 to 19.3m below grade.

3.2 Media Investigated

During the subsurface investigation, soil samples and groundwater samples were obtained and submitted for laboratory analysis. The rationale for sampling and analyzing these media is based on the Contaminants of Potential Concern identified in the Phase I ESA and observations made during the sampling program.

Contaminants of potential concern for soil include benzene, ethylbenzene, toluene and xylene (BTEX), petroleum hydrocarbons (PHCs, F_1-F_4), volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PAHs) and metals (including hydride forming compounds as well as CrIV, Hg and B_{HWS}). Contaminants of potential concern for groundwater include BTEX/PHCs, VOCs and PAHs.

3.3 Phase I Conceptual Site Model

The Geological Survey of Canada website on the Urban Geology of the National Capital Area was consulted as part of this assessment. Based on this information, bedrock in the area of the site consists of Paleozoic shale of the Billings Formation. Overburden soils are shown as off-shore marine sediments, with a drift thickness on the order of 5 to 15 m. During the concurrent Geotechnical Investigation, weathered shale bedrock was encountered at depths ranging from 6.2 to 7.5 m below grade.

Based on site and regional topography, the groundwater flow in the immediate vicinity of the Phase I Property was expected to be in a northerly direction, towards the Ottawa River.

Existing Buildings and Structures

The subject site is currently occupied by a two-storey residential dwelling with a full basement situated on the southwestern portion of the Phase I Property. A parking kiosk is present immediately northeast of the dwelling, while a community garden is situated on the lot addressed 176 Nepean Street, immediately north-northwest of the residential dwelling. At the time of the site visit, the southeastern portion of the Phase I Property (293 Lisgar Street) was being used as a storage area in association with the ongoing residential construction at 287 Nepean Street, immediately east of the Phase I Property; on-site structures include two site trailers, a waste bin and a portable toilet.

Water Bodies

There are no water bodies on the Phase I Property or within the Phase I Study Area. The closest water bodies are the Ottawa River and the Rideau Canal, located approximately 800 m to the northwest and 900m to the northeast, respectively.

Areas of Natural Significance

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

Drinking Water Wells

According to the MOECC well mapping database, there are no domestic well records for the Phase I Property. One 1948 domestic well record was identified for a property along the north side of Nepean Street, just west of Bank Street, within the Phase I ESA Study Area. Based on the age of the well record and the current municipal services throughout the Phase I ESA Study Area, this domestic well is considered to no longer be in use.

Monitoring Wells

According to the MOECC well mapping database, monitoring well and abandonment records exist for several properties within the Phase I ESA Study Area. These properties are not considered to represent environmental concerns to the Phase I Property based on their separation distances and/or orientations with respect to the subject land.

Neighbouring Land Use

Neighbouring land use in the Phase I Study Area is currently residential and commercial.

Potential Contaminating Activities and Areas of Potential Environmental Concern

As presented in Table 4 in Section 7.1 of the Phase I ESA, two on-site PCAs and one off-site PCA are considered to have resulted in three APECs on the Phase I Property.

Contaminants of Potential Concern

As noted in Table 4, CPCs associated with the APECs identified in the Phase I ESA include BTEX, PHCs (F_1-F_4), PAHs, VOCs and metals in the soil and/or groundwater beneath the Phase I Property.

Assessment of Uncertainty and/or Absence of Information

The information available for review as part of the preparation of the Phase I ESA is considered to be sufficient to conclude that there are areas of potential environmental concern on the subject site.

The presence of potentially contaminating activities was confirmed by a variety of independent sources, and as such, the conclusions of the 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. There were no deviations from the Sampling and Analysis Plan.

3.5 Impediments

Borehole locations were limited due to the community garden on the northwestern portion of the property, the construction site trailers, material and equipment on the southwestern portion of the Phase II Property and the open excavation adjacent to the east. An interior borehole location was not possible within the dwelling due to the interior condition of the structure. No other impediments were encountered during the Phase II ESA.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation was conducted in conjunction with a Geotechnical Investigation, during the interim of August 21 through August 24, 2017. The subsurface investigation consisted of the drilling seven (7) boreholes across the Phase II Property, five (5) of which were completed with groundwater monitoring well installations. The boreholes were placed address the aforementioned areas of potential environmental concern and to provide coverage of the proposed building foundations. The boreholes were drilled under full-time supervision of Paterson personnel, with a truck mounted CME 55 power auger drill rig provided by George Downing Estate Drilling of Hawkesbury, Ontario. Borehole locations are shown on Drawing PE3651-3 – Test Hole Location Plan, appended to this report.

4.2 Soil Sampling

A total of 67 soil samples were obtained from the boreholes by means of split spoon sampling and the sampling of shallow soils directly from auger flights. Bedrock was cored at five (5) borehole locations to intercept the groundwater table. Rock core samples were collected with the use of coring equipment. The depths at which split spoon, auger flight and rock core samples were obtained from the boreholes are shown as "**SS**", "**AU**" and "**RC**" respectively on the Soil Profile and Test Data Sheets, appended to this report.

Site soils consist of a pavement structure overlying fill material, underlain by silty clay, glacial till and shale bedrock. The fill material extends to depths ranging from approximately 1.0 to 1.5 m below grade. Fill material generally consisted of brown silty sand with gravel. Construction debris (brick and concrete fragments), suspected ash and/or coal fragments were noted at all borehole locations, with the exception of BH5.

The layer of silty clay underlying the fill material extended to depths ranging from approximately 3.7 to 5.3m below grade. Glacial till, consisting of silty clay with some sand and gravel was identified to depths ranging from approximately 6.3 to 7.5 m below grade, where shale bedrock was encountered. With the exception of BH4 and BH6, the bedrock was cored at all borehole locations. Further details regarding the soil profile are provided on Soil Profile and Test Data Sheets in Appendix 1.

4.3 Field Screening Measurements

All soil samples collected underwent a preliminary screening procedure, which included visual screening for colour and evidence of deleterious fill, as well as screening with a photo ionization detector (PID). The detection limit is 0.1 ppm, with a precision of +/- 2 ppm or 10% of the reading.

The soil vapours were measured by inserting the analyzer probe into the nominal headspace above the soil sample. Samples were then agitated and the peak readings recorded. The vapour readings ranged from 0.1 ppm to 14.3 ppm. Vapour readings are noted on the Soil Profile and Test Data Sheets in Appendix 1.

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

4.4 Groundwater Monitoring Well Installation

Five (5) groundwater monitoring wells were installed on the Phase II Property; the monitoring wells installed in BH1A, BH3 and BH5 were installed for environmental purposes, while the monitoring wells installed in BH1 and BH2 were installed deeper and for geotechnical purposes. The monitoring wells consisted of 32 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.

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	71.84	19.2	16.1-19.2	15.8-19.2	0.6-15.8	Flushmount
BH1A	71.82	12.2	9.1-12.2	8.8-12.2	0.6-8.8	Flushmount
BH2	71.76	19.3	16.2-19.3	15.9-19.3	0.6-15.9	Flushmount
BH3	71.51	13.2	10.1-13.2	9.8-13.2	0.6-9.8	Flushmount
BH5	72.00	12.4	9.3-12.4	9.0-12.4	0.6-9.0	Flushmount

4.5 Field Measurement of Water Quality Parameters

Groundwater sampling was conducted at BH1A, BH3 and BH5 on August 31, 2017. At this time, water quality parameters were measured in the field using a multi-parameter analyzer. Parameters measured in the field included temperature, pH, electrical conductivity, and total dissolved solids.

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 – Aug.31, 2017

Parameter	BH1A	BH3	BH5
Temperature (°C)	14.3	13.9	14.4
pH	7.87	8.37	7.66
Electrical Conductivity (µS/cm)	2,270	2,890	1,280

4.6 Groundwater Sampling

Groundwater sampling protocols were followed using the MOECC document entitled "Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario", dated May 1996. Groundwater samples were obtained from monitoring wells BH1A, BH3 and BH5 using dedicated sampling equipment. Standing water was purged from each well prior to sampling. Samples were stored in coolers to reduce analyte volatilization during transportation. Details of our standard operating procedure for groundwater sampling are provided in the Sampling and Analysis Plan in Appendix 1.

4.7 Analytical Testing

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

Table 4
Soil Samples Analysed

Sample ID	Sample Depth / Stratigraphic Unit	Parameters Analysed					Rationale
		Metals	PAHS	BTEX	PHC s	VOCs	
BH1-SS2	0.8-1.4m; Fill	X	X	X	X		To assess visually impacted fill material.
BH1-SS3	1.5-2.1m; Native silty clay	X	X				Vertical delineation of metal and PAH impacts in fill.
BH1-SS6	3.8-4.4m; Native glacial till					X	To assess potential VOC impacts in soil from historical off-site PCA.
BH2-G1/SS2	0.3-1.4m; Fill		X				To assess visually impacted fill material.
BH2-SS3	1.5-2.1m; Native silty clay	X	X				Vertical delineation of PAH impacts and potential metal impacts in fill.
BH2-SS8	3.8-4.4m; Native glacial till	X				X	To assess potential VOC impacts in soil from historical off-site PCA.
BH3-SS2	0.8-1.4m; Fill		X				To assess visually impacted fill material.
BH3-SS3	1.5-2.1m; Native silty clay		X				Vertical delineation of PAH impacts in fill.
BH3-SS6	3.8-4.4m; Native glacial till					X	To assess potential VOC impacts in soil from historical off-site PCA.
BH5-SS5	3.0-3.6m; Native glacial till			X	X		To assess potential hydrocarbon impacts in soil from historical use of furnace oil (interior AST).
BH6-SS2	0.8-1.4m; Fill	X		X	X		To assess visually impacted fill material
BH6-SS3	1.5-2.1m; Native silty clay	X	X				Vertical delineation of metal impacts and potential PAH impacts.

Table 5
Groundwater Samples Analysed

Sample ID	Screened Interval/ Stratigraphic Unit	Parameters Analysed				Rationale
		PAHs	BTEX	PHCs	VOCs	
BH1A-GW1	9.1-12.2m; Shale bedrock	X	X	X	X	To assess potential impacts from impacted fill material and historical off-site PCA.
BH3-GW1	10.1-13.2m; Shale bedrock	X	X	X	X	To assess potential impacts from impacted fill material and historical off-site PCA.
BH5-GW1	11.79-13.31; Shale		X	X	X	To assess potential impacts from historical use of furnace oil (interior AST).

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

4.8 Residue Management

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

4.9 Elevation Surveying

An elevation survey of all borehole locations was completed by Paterson at the time of the subsurface investigation. All borehole elevations are relative to the top spindle of a fire hydrant located on the south side of Lisgar Street, south of the Phase II Property. The geodetic elevation is 72.57m above sea level (asl).

4.10 Quality Assurance and Quality Control Measures

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

5.0 REVIEW AND EVALUATION

5.1 Geology

Site soils generally consist of a pavement structure over fill material, underlain by native silty clay, glacial till and shale bedrock. The fill material primarily consists of brown silty sand with gravel and ranges in depth from approximately 1 to 1.5 m below grade. With the exception of the fill identified at BH5, fill material was observed to contain fragments of construction debris (brick and concrete) coal and/or ash at the remaining borehole locations. Shale bedrock was identified at depths ranging from approximately 6.3 to 7.5 m below grade. Site stratigraphy is shown on Drawings PE3651-7 - Cross-Section A-A' and PE3651-8 – Cross-Section B-B'.

Groundwater was encountered within the shale at depths ranging from 10.2 to 10.7m below existing grade.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured during the groundwater sampling event on August 31, 2017, using an electronic water level meter. Groundwater levels are summarized in Table 6. All measurements are relative to the fire hydrant located on the south side of Lisgar Street, to the south of the Phase II Property.

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
BH1A	71.8	10.3	61.5	August 31, 2017
BH3	71.5	10.7	58.3	
BH5	72.0	11.3	60.7	

Based on the groundwater elevations from sampling events, groundwater contour mapping was completed. Groundwater contours are shown on Drawing PE3651-6 - Groundwater Contour Plan. Based on the contour mapping, groundwater flow at the subject site appears to be in an easterly direction. A horizontal hydraulic gradient of approximately 0.026 m/m was calculated.

It should be noted that the groundwater flow direction is considered to have been influenced by the deep construction excavation immediately to the east of the Phase II Property. The historical groundwater flow beneath the Phase II Property is considered to have been similar to the regional groundwater flow, in a northerly direction.

5.3 Fine-Coarse Soil Texture

Based on field soil observations, fine-grained soil standards may be applicable to the subject site, however grain-size analyses have not been conducted for the Phase II Property. The more stringent standards for coarse-grained soil have therefore been selected.

5.4 Soil: Field Screening

Field screening of the soil samples collected during drilling resulted in organic vapour readings of 0.2ppm to 14.3ppm. Field screening results of each individual soil sample are provided on the Soil Profile and Test Data Sheets appended to this report. It is noted that these readings are not indicative of significant levels of organic compounds, although higher-fraction hydrocarbons may not be as readily detectable by PID detectors.

5.5 Soil Quality

A total of 12 soil samples were submitted for analytical testing of a combination of metals, polycyclic aromatic hydrocarbons (PAHs), benzene, toluene, ethylbenzene and xylene (BTEX), petroleum hydrocarbons (PHC, F_1-F_4) and volatile organic compounds (VOCs). The results of the analytical testing are presented below in Tables 7, 8, 9 and 10. The laboratory certificates of analysis are provided in Appendix 1.

Table 7
Analytical Test Results
Soil – BTEX, Petroleum Hydrocarbons (PHCs, F_1-F_4)

Parameter	MDL (µg/g)	Soil Samples (µg/g)			MOECC Table 3 Residential Coarse Standards
		Aug.21, 2017	Aug.22, 2017	Aug.24, 2017	
		BH1-SS2 (0.8-1.4m)	BH5-SS5 (3.0-3.6m)	BH6-SS2 (0.8-1.4m)	
Benzene	0.02	nd	nd	nd	0.21
Toluene	0.05	nd	nd	nd	2.3
Ethylbenzene	0.05	nd	nd	nd	2
Xylenes	0.05	nd	nd	nd	3.1
PHC F1	7	nd	nd	nd	55
PHC F2	4	nd	nd	nd	98
PHC F3	8	111	nd	nd	300
PHC F4	6	447	nd	nd	2,800

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

With the exception of PHC fractions F3 and F4 detected at concentrations below the MOECC Table 3 standards, BTEX and PHC concentrations were not detected above the method detection limits for the samples submitted for analysis. The results are in compliance with the MOECC Table 3 standards.

Table 8
Analytical Test Results
Soil – Volatile Organic Compounds (VOCs)

Parameter	MDL (µg/g)	Soil Samples (µg/g)			MOECC Table 3 Residential Coarse Standards
		Aug.21, 2017	Aug.24, 2017	Aug.22, 2017	
		BH1-SS6 (3.8-4.4m)	BH2-SS8 (5.3-5.9m)	BH3-SS6 (3.8-4.4m)	
Acetone	0.50	nd	nd	nd	16
Bromodichloromethane	0.05	nd	nd	nd	13
Bromoform	0.05	nd	nd	nd	0.27
Bromomethane	0.05	nd	nd	nd	0.05
Carbon Tetrachloride	0.05	nd	nd	nd	0.05
Chlorobenzene	0.05	nd	nd	nd	2.4
Chloroethane	0.05	nd	nd	nd	nv
Chloroform	0.05	nd	nd	nd	0.05
Chloromethane	0.20	nd	nd	nd	nv
Dibromochloromethane	0.05	nd	nd	nd	9.4
Dichlorodifluoromethane	0.05	nd	nd	nd	16
1,2-Dibromoethane	0.05	nd	nd	nd	0.05
1,2-Dichlorobenzene	0.05	nd	nd	nd	3.4
1,3-Dichlorobenzene	0.05	nd	nd	nd	4.8
1,4-Dichlorobenzene	0.05	nd	nd	nd	0.083
1,1-Dichloroethane	0.05	nd	nd	nd	3.5
1,2-Dichloroethane	0.05	nd	nd	nd	0.05
1,1-Dichloroethylene	0.05	nd	nd	nd	0.05
cis-1,2-Dichloroethylene	0.05	nd	nd	nd	3.4
trans-1,2-Dichloroethylene	0.05	nd	nd	nd	0.084
1,2-Dichloropropane	0.05	nd	nd	nd	0.05
1,3-Dichloropropene	0.05	nd	nd	nd	0.05
Hexane	0.05	nd	nd	nd	2.8
Methyl Ethyl Ketone	0.50	nd	nd	nd	16
Methyl Butyl Ketone	2.00	nd	nd	nd	nv
Methyl Isobutyl Ketone	0.50	nd	nd	nd	1.7
Methyl tert-butyl Ether	0.05	nd	nd	nd	0.75
Methylene Chloride	0.05	nd	nd	nd	0.1
Styrene	0.05	nd	nd	nd	0.7
1,1,1,2-Tetrachloroethane	0.05	nd	nd	nd	0.058
1,1,2,2-Tetrachloroethane	0.05	nd	nd	nd	0.05
Tetrachloroethylene	0.05	nd	nd	nd	0.28
1,1,1-Trichloroethane	0.05	nd	nd	nd	0.38
1,1,2-Trichloroethane	0.05	nd	nd	nd	0.05
Trichloroethylene	0.05	nd	nd	nd	0.061
Trichlorofluoromethane	0.05	nd	nd	nd	4
1,3,5-Trimethylbenzene	0.05	nd	nd	nd	nv
Vinyl Chloride	0.02	nd	nd	nd	0.02

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- BTEX values included in Table 7
- nv – No value for MOECC standards

No VOC parameters were detected above the method detection limits, in any of the soil samples submitted for analytical testing. The results are in compliance with MOECC Table 3 standards.

Table 9
Analytical Test Results
Soil – Polycyclic Aromatic Hydrocarbons (PAHs)

Parameter	MDL (µg/g)	Soil Samples (µg/g)			MOECC Table 3 Residential Coarse Standards
		Aug.21, 2017		Aug.24, 2017	
		BH1-SS2 (0.8-1.4m)	BH1-SS3 (1.5-2.1m)	BH2-G1/SS2 (0.3-1.4m)	
Acenaphthene	0.02	0.18	nd	0.43	7.9
Acenaphthylene	0.02	0.13	nd	**0.74**	0.15
Anthracene	0.02	**0.95**	nd	**2.01**	0.67
Benzo[a]anthracene	0.02	**2.47**	nd	**3.16**	0.5
Benzo[a]pyrene	0.02	**3.29**	nd	**2.82**	0.3
Benzo[b]fluoranthene	0.02	**3.68**	nd	**2.77**	0.78
Benzo[g,h,i]perylene	0.02	2.24	nd	1.35	6.6
Benzo[k]fluoranthene	0.02	**2.16**	nd	**1.82**	0.78
Chrysene	0.02	2.65	nd	3.07	7
Dibenzo[a,h]anthracene	0.02	**0.69**	nd	**0.50**	0.1
Flouranthene	0.02	**5.38**	nd	**8.52**	0.69
Fluorene	0.02	0.36	nd	0.68	62
Indeno[1,2,3-cd]pyrene	0.02	**2.20**	nd	**1.48**	0.38
1-Methylnaphthalene	0.02	0.04	nd	0.18	0.99
2-Methylnaphthalene	0.02	0.06	nd	0.26	0.99
Methylnaphthalene (1&2)	0.04	0.10	nd	0.44	0.99
Naphthalene	0.01	0.15	nd	**0.66**	0.6
Phenanthrene	0.02	2.85	nd	**6.47**	6.2
Pyrene	0.02	4.49	nd	6.79	78

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

Based on the analytical test results, PAH parameters at concentrations exceeding MOECC Table 3 standards were identified in the fill material at BH1 and BH2. No PAH parameters were detected above the method detection limits in Sample BH1-SS3, collected from the native silty clay beneath the fill.

Table 9 Continued
Analytical Test Results
Soil – Polycyclic Aromatic Hydrocarbons (PAHs)

Parameter	MDL (µg/g)	Soil Samples (µg/g)				MOECC Table 3 Residential Coarse Standards
		Aug.24, 2017	Aug.22, 2017		Aug.24, 2017	
		BH2-SS3 (1.5-2.1m)	BH3-SS2 (0.8-1.4m)	BH3-SS3 (1.5-2.1m)	BH6-SS3 (1.5-2.1m)	
Acenaphthene	0.02	nd	0.15	nd	nd	7.9
Acenaphthylene	0.02	nd	0.03	nd	nd	0.15
Anthracene	0.02	nd	0.32	nd	nd	0.67
Benzo[a]anthracene	0.02	nd	**0.66**	nd	nd	0.5
Benzo[a]pyrene	0.02	nd	**0.59**	nd	nd	0.3
Benzo[b]fluoranthene	0.02	nd	0.67	nd	nd	0.78
Benzo[g,h,i]perylene	0.02	nd	0.32	nd	nd	6.6
Benzo[k]fluoranthene	0.02	nd	0.40	nd	nd	0.78
Chrysene	0.02	nd	0.72	nd	nd	7
Dibenzo[a,h]anthracene	0.02	nd	**0.11**	nd	nd	0.1
Flouranthene	0.02	nd	**1.71**	nd	nd	0.69
Fluorene	0.02	nd	0.15	nd	nd	62
Indeno[1,2,3-cd]pyrene	0.02	nd	0.32	nd	nd	0.38
1-Methylnaphthalene	0.02	nd	0.04	nd	nd	0.99
2-Methylnaphthalene	0.02	nd	0.04	nd	nd	0.99
Methylnaphthalene (1&2)	0.04	nd	0.08	nd	nd	0.99
Naphthalene	0.01	nd	0.09	nd	nd	0.6
Phenanthrene	0.02	nd	1.48	nd	nd	6.2
Pyrene	0.02	nd	1.36	nd	nd	78

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

Concentrations of several PAH parameters exceeding MOECC Table 3 standards were also identified in the fill material at BH3. Parameters were not identified above the method detection limits in the native silty clay samples beneath the fill material at BH2, BH3 and BH6. Although PAH impacts were not confirmed in the fill material at BH6 with analytical testing, exceedances were anticipated based on visual assessment in combination with test results of similar fill at other locations.

Table 10
Analytical Test Results
Soil - Metals

Parameter	MDL (µg/g)	Soil Samples (µg/g)			MOECC Table 3 Residential Coarse Standards
		Aug.21, 2017		Aug.24, 2017	
		BH1-SS2 (0.8-1.4m)	BH1-SS3 (1.5-2.1m)	BH2-SS3 (1.5-2.1m)	
Antimony	1.0	nd	nd	nd	7.5
Arsenic	1.0	8.7	nd	nd	18
Barium	1.0	**418**	383	344	390
Beryllium	1.0	nd	nd	nd	4
Boron	1.0	18.5	6.7	8.0	120
Boron, available	0.5	0.9	nt	nt	1.5
Cadmium	0.5	nd	nd	nd	1.2
Chromium	1.0	19.4	117	124	160
Chromium (IV)	0.2	nd	nt	nt	8
Cobalt	1.0	6.9	**22.2**	21.1	22
Copper	1.0	27.3	55.5	54.9	140
Lead	1.0	**247**	11.5	11.2	120
Mercury	0.1	**0.4**	nd	nd	0.27
Molybdenum	1.0	nd	nd	nd	6.9
Nickel	1.0	**120**	61.3	62.7	100
Selenium	1.0	nd	nd	nd	2.4
Silver	0.5	nd	nd	nd	20
Thallium	1.0	nd	nd	nd	1
Uranium	1.0	nd	nd	nd	23
Vanadium	1.0	22.7	**93.7**	**101**	86
Zinc	1.0	**341**	105	109	340

Notes:
- MDL – Method Detection Limit
- nt – not tested for this parameter
- nd – not detected above the MDL
- **Bold** – Value exceeds selected MOECC standards

Concentrations of barium, lead, mercury, nickel and zinc were identified in the fill material collected from BH1, at concentrations exceeding the MOECC Table 3 standards. To confirm that the metal impacts identified were contained to the fill material, samples of the underlying native silty clay were analysed for metal parameters.

Concentrations of cobalt and vanadium exceeding the MOECC Table 3 standards were identified at BH1 and BH2. Based on previous experience, cobalt and vanadium parameters are present at naturally elevated concentrations in clay soils in the Ottawa region.

Paterson has very similar data for many other silty clay soils sampled at various locations throughout Ottawa: concentrations of up to 30 µg/g have been identified for cobalt, compared to the MOECC standard of 22 µg/g, and up to 120 µg/g for vanadium, compared to the MOECC standard of 86 µg/g. Furthermore, the native silty clay results are consistent across the property and the naturally occurring exceedances identified are for different parameters than those identified in the fill material.

Table 10 Continued
Analytical Test Results
Soil - Metals

Parameter	MDL (µg/g)	Soil Samples (µg/g)			MOECC Table 3 Residential Coarse Standards
		Aug.22, 2017			
		BH3-SS2 (0.8-1.4m)	BH6-SS2 (0.8-1.4m)	BH6-SS3 (1.5-2.1m)	
Antimony	1.0	nd	**97.9**	nd	7.5
Arsenic	1.0	4.2	4.2	nd	18
Barium	1.0	135	181	376	390
Beryllium	1.0	nd	nd	nd	4
Boron	1.0	6.1	5.9	6.9	120
Boron, available	0.5	nd	0.8	nt	1.5
Cadmium	0.5	nd	nd	nd	1.2
Chromium	1.0	36.4	41.3	135	160
Chromium (IV)	0.2	nd	nd	nt	8
Cobalt	1.0	7.9	8.4	**23.5**	22
Copper	1.0	28.5	49.3	63.5	140
Lead	1.0	87.5	**551**	10.7	120
Mercury	0.1	0.2	**1.1**	nd	0.27
Molybdenum	1.0	nd	nd	nd	6.9
Nickel	1.0	21.8	19.4	69.2	100
Selenium	1.0	nd	nd	nd	2.4
Silver	0.5	nd	nd	nd	20
Thallium	1.0	nd	nd	nd	1
Uranium	1.0	nd	nd	nd	23
Vanadium	1.0	46.4	44.8	**113**	86
Zinc	1.0	63.6	86.1	116	340

Notes:
- MDL – Method Detection Limit
- nt – not tested for this parameter
- nd – not detected above the MDL
- **Bold** – Value exceeds selected MOECC standards

Metal concentrations identified in the fill material at BH3 were in compliance with the MOECC Table 3 standards. Concentrations of antimony, lead and mercury exceeding MOECC standards were identified in the fill material recovered from BH6.

Similar to native silty clay samples underlying the fill material at BH1 and BH2, concentrations of cobalt and vanadium exceeding MOECC Table 3 standards were identified at BH6 in the native silty clay Sample BH6-SS3. As noted above, these concentrations are considered to be naturally occurring in the clay.

The maximum concentrations of analyzed parameters in the soil at the site are summarized below in Table 11.

Table 11
Maximum Concentrations – Soil

Parameter	Maximum Concentration (µg/g)	Borehole	Depth Interval (m BGS)
PHC F3	111	BH1-SS2	0.8-1.4
PHC F4	447	BH1-SS2	0.8-1.4
Acenaphthene	0.43	BH2-G1/SS2	0.3-1.4
Acenaphthylene	**0.74**		
Anthracene	**2.01**		
Benzo[a]anthracene	**3.16**		
Benzo[a]pyrene	**3.29**	BH1-SS2	0.8-1.4
Benzo[b]fluoranthene	**3.68**		
Benzo[g,h,i]perylene	2.24		
Benzo[k]fluoranthene	**2.16**		
Chrysene	3.07	BH2-G1/SS2	0.3-1.4
Dibenzo[a,h]anthracene	**0.69**	BH1-SS2	0.8-1.4
Flouranthene	**8.52**	BH2-G1/SS2	0.3-1.4
Fluorene	0.68		
Indeno[1,2,3-cd]pyrene	**2.20**	BH1-SS2	0.8-1.4
1-Methylnaphthalene	0.06	BH2-G1/SS2	0.3-1.4
2-Methylnaphthalene	0.26		
Methylnaphthalene (1&2)	0.44		
Naphthalene	**0.66**		
Phenanthrene	**6.47**		
Pyrene	6.79		
Antimony	**97.9**	BH6-SS2	0.8-1.4
Arsenic	8.7	BH1-SS2	0.8-1.4
Barium	**418**		
Boron	18.5		
Boron, available	0.9		
Chromium	135	BH6-SS3	1.5-2.1
Cobalt	**23.5**		
Copper	63.5		
Lead	**551**	BH6-SS2	0.8-1.4
Mercury	**1.1**		
Nickel	**120**	BH1-SS2	0.8-1.4
Vanadium	**113**	BH6-SS3	1.5-2.1
Zinc	116		

Notes:
- **Bold** – Value exceeds MOECC Table 3 standards

All other parameter concentrations were below laboratory detection limits.

5.6 Groundwater Quality

Groundwater samples from monitoring wells installed in BH1A, BH3 and BH5 were submitted for laboratory analysis of VOC, PHC and/or PAH parameters. The results of the analytical testing are presented below in Tables 12, 13 and 14. The laboratory certificates of analysis are provided in Appendix 1. No free product was observed in the monitoring wells at the time of the sampling event. No hydrocarbon sheen or odours were noted on the purge water at the time of the sampling event.

Table 12
Analytical Test Results
Groundwater - PHCs

Parameter	MDL (µg/L)	Groundwater Samples (µg/L) August 31, 2017			MOECC Table 3 Residential Coarse Standards
		BH1A-GW1 (9.1-12.2m)	BH3-GW1 (10.1-13.2m)	BH5-GW1 (9.3-12.4m)	
PHCs F1	25	nd	nd	nd	750
PHCs F2	100	nd	nd	nd	150
PHCs F3	100	nd	nd	nd	500
PHCs F4	100	nd	nd	nd	500

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

There were no PHC parameters detected above method detection limits, in any of the three groundwater samples submitted for analysis. The results are in compliance with the MOECC Table 3 standards.

Table 13
Analytical Test Results
Groundwater – VOCs

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)			MOECC Table 3 Residential Coarse Standards
		August 31, 2017			
		BH1A-GW1 (9.1-12.2m)	BH3-GW1 (10.1-13.2m)	BH5-GW1 (9.3-12.4m)	
Acetone	5.0	nd	nd	nd	130,000
Benzene	0.5	nd	nd	nd	44
Bromodichloromethane	0.5	nd	nd	nd	85,000
Bromoform	0.5	nd	nd	nd	380
Bromomethane	0.5	nd	nd	nd	5.6
Carbon Tetrachloride	0.2	nd	nd	nd	0.79
Chlorobenzene	0.5	nd	nd	nd	630
Chloroethane	1.0	nd	nd	nd	nv
Chloroform	0.5	nd	**2.7**	nd	2.4
Chloromethane	3.0	nd	nd	nd	nv
Dibromochloromethane	0.5	nd	nd	nd	82,000
Dichlorodifluoromethane	1.0	nd	nd	nd	4,400
1,2-Dibromoethane	0.2	nd	nd	nd	0.25
1,2-Dichlorobenzene	0.5	nd	nd	nd	4,600
1,3-Dichlorobenzene	0.5	nd	nd	nd	9,600
1,4-Dichlorobenzene	0.5	nd	nd	nd	8
1,1-Dichloroethane	0.5	nd	nd	nd	320
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	16
1,3-Dichloropropene	0.5	nd	nd	nd	5.2
Ethylbenzene	0.5	nd	nd	nd	2,300
Hexane	1.0	nd	nd	nd	51
Methyl Ethyl Ketone	5.0	nd	nd	nd	470,000
Methyl Butyl Ketone	10.0	nd	nd	nd	nv
Methyl Isobutyl Ketone	5.0	nd	nd	nd	140,000
Methyl tert-butyl Ether	2.0	nd	nd	nd	1900
Methylene Chloride	5.0	nd	nd	nd	610
Styrene	0.5	nd	nd	nd	1,300
1,1,1,2-Tetrachloroethane	0.5	nd	nd	nd	3.4
1,1,2,2-Tetrachloroethane	0.5	nd	nd	nd	3.2
Tetrachloroethylene	0.5	nd	nd	nd	1.6
Toluene	0.5	nd	nd	nd	18,000
1,1,1-Trichloroethane	0.5	nd	nd	nd	640
1,1,2-Trichloroethane	0.5	nd	nd	nd	4.7
Trichloroethylene	0.5	nd	nd	nd	1.6
Trichlorofluoromethane	1.0	nd	nd	nd	2,500
1,3,5-Trimethylbenzene	0.5	nd	nd	nd	nv
Vinyl Chloride	0.5	nd	nd	nd	0.5
Xylenes	0.5	nd	nd	nd	4,200

Notes:
- MDL – Method Detection Limit;
- nd – not detected above the MDL
- **Bold** – Value exceeds selected MOE standards
- nv – No value for MOECC standards

With the exception of chloroform in groundwater sample BH3-GW1, there were no VOC parameters detected above method detection limits in any of the groundwater samples submitted for analytical testing. The chloroform concentration (2.7 µg/L) identified in the groundwater recovered from BH3, is marginally above the MOECC Table 3 standard of 2.4 µg/L. The chloroform concentration is considered to have resulted from the use of municipal water during the rock coring process and is not considered to represent a concern to the Phase II Property. The concentration is expected to dissipate in the near future.

Table 14
Analytical Test Results
Groundwater – Polycyclic Aromatic Hydrocarbons (PAHs)

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)		MOECC Table 3 Residential Coarse Standards
		August 31, 2017		
		BH1A-GW1 (9.1-12.2m)	BH3-GW1 (10.1-13.2m)	
Acenaphthene	0.05	nd	nd	600
Acenaphthylene	0.05	nd	nd	1.8
Anthracene	0.01	nd	nd	2.4
Benzo[a]anthracene	0.01	nd	nd	4.7
Benzo[a]pyrene	0.01	nd	nd	0.81
Benzo[b]fluoranthene	0.05	nd	nd	0.75
Benzo[g,h,i]perylene	0.05	nd	nd	0.2
Benzo[k]fluoranthene	0.05	nd	nd	0.4
Chrysene	0.05	nd	nd	1
Dibenzo[a,h]anthracene	0.05	nd	nd	0.52
Flouranthene	0.01	nd	nd	130
Fluorene	0.05	nd	nd	400
Indeno[1,2,3-cd]pyrene	0.05	nd	nd	0.2
1-Methylnaphthalene	0.05	nd	nd	1800
2-Methylnaphthalene	0.05	nd	nd	
Naphthalene	0.05	nd	nd	1400
Phenanthrene	0.05	nd	nd	580
Pyrene	0.01	nd	nd	68

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

No PAH parameters were detected above the method detection limits in Samples BH1A-GW1 and BH3-GW1. The results are in compliance with MOECC Table 3 standards.

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

Table 15: Maximum Concentrations – Groundwater

Parameter	Maximum Concentration (µg/L)	Borehole	Depth Interval (m BGS)
Chloroform	**2.7**	BH3-GW1	10.1-13.2

Notes:
- **Bold** – Value exceeds MOECC Table 3 standards

All other parameter concentrations were not detected above the laboratory detection limits. With the exception of the chloroform concentration noted above, all of the groundwater results comply with the MOECC Table 3 standards. As discussed previously, the chloroform is considered to have resulted from the use of municipal water during the rock coring process. The concentration is expected to dissipate in the near future and is not considered to represent a concern to the Phase II Property.

5.7 Quality Assurance and Quality Control Results

All samples submitted as part of the 2014 sampling event were handled in accordance with the Analytical Protocol with respect to holding time, preservation method, storage requirement, and container type.

As per Subsection 47(3) of O.Reg. 153/04 as amended by O.Reg. 269/11, a Certificate of Analysis has been received for each sample submitted for analysis and all Certificates of Analysis are appended to this report.

As noted on laboratory certificate of analysis (Order #1734326) the GC-FID signal did not return to baseline by C50 for soil Sample BH1-SS2. The F4G (gravimetric) concentration was therefore reported. A laboratory QC qualifier for this sample indicated that the duplicate results exceed the RPD limits due to the non-homogeneous matrix. Other QC qualifiers include high duplicates for VOC parameters in the soil and spike recoveries outside the range for semi-volatile parameters in the soil.

The qualifiers were not considered to be concerns based on other QC data and/or the sample results were less than 10 times the MDL. 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 accordance with the requirements of O.Reg. 269/11 amending O.Reg. 153/04 - Record of Site Condition regulation, made under the Environmental Protection Act. Conclusions and recommendations are discussed in a subsequent section.

Site Description

Potentially Contaminating Activity and Areas of Potential Environmental Concern

As per Table 1 in Section 2.2, PCA's considered to result in APECs on the Phase II Property include:

- Item 30: Importation of Fill Material of Unknown Quality, resulting in APEC 1 across the northern and southeastern portions of the Phase I Property in vicinity of historical building foundations;
- Item 28: Gasoline and Associated Products Storage in Fixed Tanks, resulting in APEC 2 on the southwestern portion of the Phase II Property in the vicinity of an interior aboveground storage tank (AST) which is no longer in use; and
- Item 37: Operation of Dry Cleaning Equipment (where chemicals are used), an off-site PCA (former dry cleaners at 211 Bank Street) resulting in APEC 3 on the northern portion of the Phase II Property.

Chemicals of potential concern identified in association with the aforementioned APECs include BTEX, VOCs, PHCs, PAHs and metals in the soil and/or groundwater.

Subsurface Structures and Utilities

Based on underground service locates completed prior to the subsurface investigation, buried telephone and electrical services are present on the Phase II Property. Their approximate locations are shown on Drawing: PE3651-3 – Test Hole Location Plan. A buried natural gas service previously extended from Lisgar Avenue to the residential dwelling. Buried water and sewer services are also considered to be present on site, however their locations could not be confirmed.

Physical Setting

Site Stratigraphy

The site stratigraphy, from ground surface to the deepest aquifer or aquitard investigated, is illustrated on Drawings PE3651-6 - Cross-Section A-A' and PE3651-7 – Cross-Section B-B'. Stratigraphy consists of:

- Pavement structure ranging from 25 to 50mm in depth and consisting of asphaltic concrete underlain by a granular base (sand and gravel).
- Fill ranging in depth from approximately 1 to 1.5 m below ground surface and generally consisting of brown silty sand with gravel. Construction debris (brick and concrete fragments) suspected ash and/or coal fragments were noted at all borehole locations with the exception of BH5.
- Native silty clay extending to depths ranging from approximately 3.7 to 5.3 m below grade.
- Glacial till consisting of silty clay with some sand and shale fragments was encountered below the silty clay to depths ranging from 6.3 to 7.5 m below grade.
- Shale bedrock was encountered at depths ranging from 6.3 to 7.5 m below grade. This is the deepest unit investigated. Groundwater was encountered in this stratigraphic unit.

Hydrogeological Characteristics

Groundwater was encountered in the shale bedrock beneath the Phase II Property. This unit is interpreted to function as a local aquifer at the subject site.

Water levels were measured at the subject site on August 31, 2017. Water levels are summarized above in Section 5.2 of this report and are shown on Drawings PE3651-7 and 8 – Cross Sections A-A` and B-B`.

Based on the groundwater elevations measured during the August 31, 2017 monitoring event, groundwater contour mapping was completed and the horizontal hydraulic gradient for the subject site was calculated. Groundwater flow at the subject site was determined to be in an easterly direction with a hydraulic gradient of approximately 0.026 m/m was calculated.

Approximate Depth to Bedrock

Bedrock was identified in all boreholes at depths ranging from 6.3 to 7.5m below grade.

Approximate Depth to Water Table

Depth to water table at the subject site varies between approximately 10.3 and 10.7m below existing grade.

Sections 41 and 43.1 of the Regulation

Section 41 of the Regulation (Site Condition Standards, Environmentally Sensitive Areas) does not apply to the Phase II Property.

Section 43.1 of the Regulation does apply to the Phase II Property in that it is not within 30m of a body of water and there is more than 2m of overburden across the site.

Fill Placement

Fill material was identified across the Phase II Property and generally consisted of silty sand and gravel to depths ranging from approximately 1 to 1.5m below grade. Fill material in the immediate vicinity of former building foundations was noted to contain fragments of construction debris (including brick and concrete) as well as possible ash and coal fragments.

Proposed Buildings and Other Structures

It is our understanding that the site is to be redeveloped with two multi-storey residential towers with ground floor commercial space. The towers will be connected below grade through 4 levels of underground parking.

Existing Buildings and Structures

A two storey residential dwelling, with a full basement, is currently situated on the southwester portion of the subject land. A parking kiosk is present to the northeast of the dwelling. No other buildings or structures are present on the subject site.

Water Bodies

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

Areas of Natural Significance

No areas of natural significance are present on the subject site or within the Phase I study area.

Environmental Condition

Areas Where Contaminants are Present

Based on screening and analytical results PAH and metal concentrations exceeding MOECC Table 3 standards were identified in the fill material. Cobalt and vanadium concentrations exceeding MOECC Table 3 standards were identified in the underlying native silty clay; these concentrations are considered to be naturally occurring in clay soils within the Ottawa region and are not considered to be contaminants of concern. A chloroform concentration marginally exceeding the MOECC Table 3 standards was identified in the groundwater recovered from BH2; the chloroform concentration is considered to have resulted from the use of municipal groundwater during the rock coring process and is not considered to be a contaminant of concern. Otherwise the groundwater was in compliance with MOECC Table 3 standards. Analytical test results are present in plan view on Drawings PE3651-4 and 5 – Analytical Testing Plans.

Types of Contaminants

The following parameters were identified in the fill material at concentrations exceeding the MOECC Table 3 standards:

- PAHs - acenapthylene, anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluroanthene, benzo[k]fluoranthene, dibenzo[a,h]anthracene, fluoranthene, Indeno[1,2,3-cd]pyrene, naphthalene and phenanthrene.
- Metals – antimony, barium, lead, nickel, zinc and mercury.

All other PAH and metal parameters detected in the fill material were in compliance with the MOECC Table 3 standards.

Contaminated Media

Based on the results of the Phase II ESA, some of the fill material is impacted with PAH and metal concentrations exceeding MOECC Table 3 standards. Groundwater on the subject site is considered to be in compliance with the MOECC Table 3 standards.

What Is Known About Areas Where Contaminants Are Present

Impacted fill is present on the northern portion of the property east of the community garden and on the southeastern portion of the property, in the vicinity of BH1, BH2, BH3 and BH6. Analytical test results exceeding the MOECC Table 3 standards are presented on Drawings PE3651-4B,C, PE3651-7B,C and PE3651-8B,C.

Distribution and Migration of Contaminants

As previously noted, the PAH and metal impacts are considered to be limited to the fill material. Based on their low solubility in combination with the depth of the water table in the bedrock, well beneath the fill material, the potential for migration is considered to be negligible. Furthermore groundwater beneath the Phase II Property is in compliance with MOECC Table 3 standards.

Contaminant distribution is presented in both plan view and cross-section, on Drawings PE3651-4B,C, PE3651-7B,C and PE3651-8B,C.

Discharge of Contaminants

Metal and PAH concentrations are considered to have been directly discharged to the soil through historical infilling of former building foundations or historical storage/management of coal (and resulting ash) for heating purposes.

Climatic and Meteorological Conditions

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

Due to the Phase II Property having been covered largely by asphaltic concrete and building structures and the low solubilities of PAHs and metals, precipitation and infiltration are not considered to have contributed to the migration of the identified parameters. Based on analytical testing of the underlying native soils and groundwater, which is present well below the fill material, impacts are considered to be confined to the fill material.

Potential for Vapour Intrusion

Given the low organic vapour readings, the potential for vapour intrusion within the existing dwelling is considered to be negligible.

6.0 CONCLUSIONS

Assessment

A Phase II ESA was conducted for the property at 176 Nepean Street and 293 to 307 Lisgar Street in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address potentially contaminating activities (PCAs) that were identified during the Phase I ESA and considered to result in areas of potential environmental concern (APEC) on the Phase II Property. The subsurface investigation was carried out in conjunction with a Geotechnical Investigation and consisted of the drilling seven (7) boreholes, five (5) of which were constructed with groundwater monitoring well installations. It should be noted that the monitoring wells installed in BH1 and BH2 were installed deeper and for geotechnical purposes only.

Soil samples were obtained from the boreholes and screened using visual observations and organic vapour measurements. A total of 12 soil samples were submitted for laboratory analysis of a combination of volatile organic compounds (VOCs), petroleum hydrocarbons (PHCs, F_1-F_4), polycyclic aromatic hydrocarbons (PAHs) and metals. Several PAH and metal parameters exceeding MOECC Table 3 standards were identified in the fill material on the northern and southeastern portions of the Phase II Property.

To confirm whether or not the contaminants had migrated to the underlying native silty clay, additional sampling for PAH and metal parameters was conducted. No PAH parameters were detected in the native silty clay. Metal parameters were identified with cobalt and vanadium present at concentrations exceeding the MOECC Table 3 standard.

Based on our experience, these parameters are naturally occurring at elevated concentrations in silty clays within the Ottawa region. They were not present at elevated concentrations in the overlying impacted fill material and are not considered to represent contaminants of concern in the native material.

Groundwater samples obtained from three (3) monitoring wells, BH1A, BH3 and BH5, were analysed for VOCs, PHC, and/or PAHs. Based on the results of the analytical testing, parameter concentrations were not identified above the method detection limits with one exception. A concentration of chloroform (2.7µg/L) marginally exceeding the MOECC Table 3 standard of 2.4µg/L was identified in the groundwater recovered from BH2. The chloroform is considered to be the result of using municipal groundwater during the rock coring process, for the installation of the groundwater monitoring wells. The chloroform is expected to dissipate over time and is not considered to be contaminant of concern. The groundwater is considered to be in compliance with MOECC Table 3 standards.

Conclusion

Based on the findings of the Phase II ESA, fill material impacted with PAH and metal concentrations exceeding MOECC Table 3 standards, is present on the Phase II Property. It is our understanding that the subject site is to be redeveloped with two multi-storey apartment towers with 4 levels of underground parking.

It is our recommendation that an environmental site remediation program, involving the removal of all impacted fill material, be completed concurrently with the site redevelopment. Prior to offsite disposal at a licenced landfill site, a leachate analysis of a representative sample of contaminated soil must be conducted in accordance with Ontario Regulation 347/558.

It is also recommended that Paterson personnel be onsite during construction activities to direct the excavation and segregation of impacted soil and to conduct confirmatory sampling as required.

It is expected that groundwater monitoring wells will be abandoned in accordance with O.Reg.903, at the time of construction excavation.

7.0 STATEMENT OF LIMITATIONS

This Phase II - Environmental Site Assessment report has been prepared in general accordance with O.Reg. 153/04 as amended by O.Reg. 269/11, and meets the requirements of CSA Z769-00. The conclusions presented herein are based on information gathered from a limited sampling and testing program. The test results represent conditions at specific test locations at the time of the field program.

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

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

This report was prepared for the sole use of Richcraft (Lisgar) Ltd. and notification from Richcraft (Lisgar) Ltd. and Paterson will be required to release this report to any other party.

Paterson Group Inc.

Karyn Munch, P.Eng., QP$_{ESA}$

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

Report Distribution:

- Richcraft (Lisgar) Ltd.
- Paterson Group

FIGURES

FIGURE 1 – KEY PLAN

DRAWING PE3651-3 – TEST HOLE LOCATION PLAN

DRAWING PE3651-4A – ANALYTICAL TESTING PLAN – SOIL (BTEX/PHCs and VOCs)

DRAWING PE3651-4B – ANALYTICAL TESTING PLAN – SOIL (PAHS)

DRAWING PE3651-4C – ANALYTICAL TESTING PLAN - SOIL (METALS)

DRAWING PE3651-5 – ANALYTICAL TESTING PLAN – GROUNDWATER (BTEX/PHCS,VOCS AND PAHS)

DRAWING PE3651-6 - GROUNDWATER CONTOUR PLAN

DRAWING PE3651-7A – CROSS SECTION A-A` – SOIL (BTEX/PHCs and VOCs)

DRAWING PE3651-7B – CROSS SECTION A-A` – SOIL (PAHS)

DRAWING PE3651-7C – CROSS SECTION A-A`- SOIL (METALS)

DRAWING PE3651-7D – CROSS SECTION A-A`- GROUNDWATER

DRAWING PE3651-8A – CROSS SECTION A-A` – SOIL (BTEX/PHCs and VOCs)

DRAWING PE3651-8B – CROSS SECTION A-A` – SOIL (PAHS)

DRAWING PE3651-8C – CROSS SECTION A-A`- SOIL (METALS)

DRAWING PE3651-8D – CROSS SECTION A-A`- GROUNDWATER

DRAWING PE3651-9 – CONTAMINANT TRANSPORT DIAGRAM

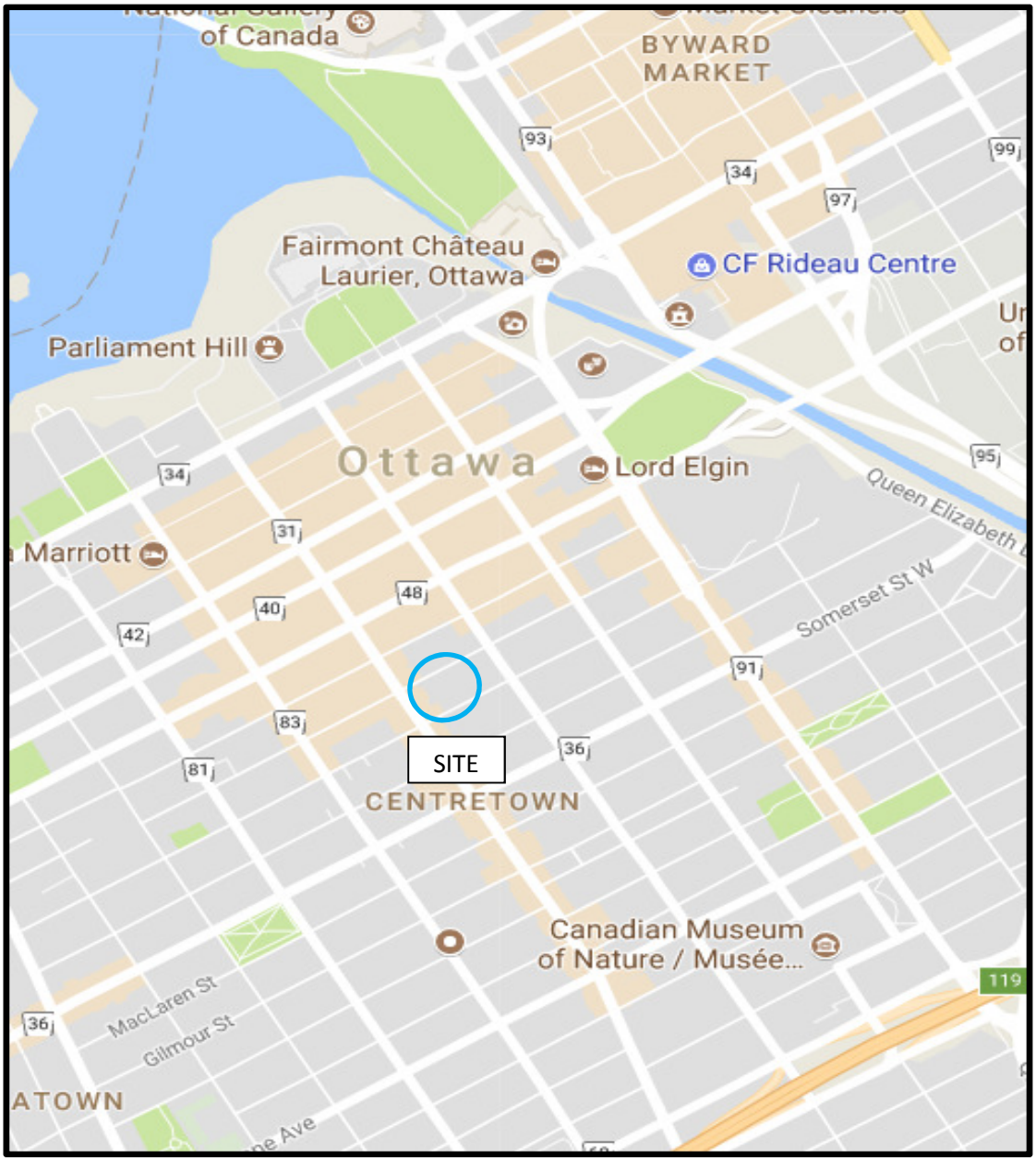


FIGURE 1

KEY PLAN

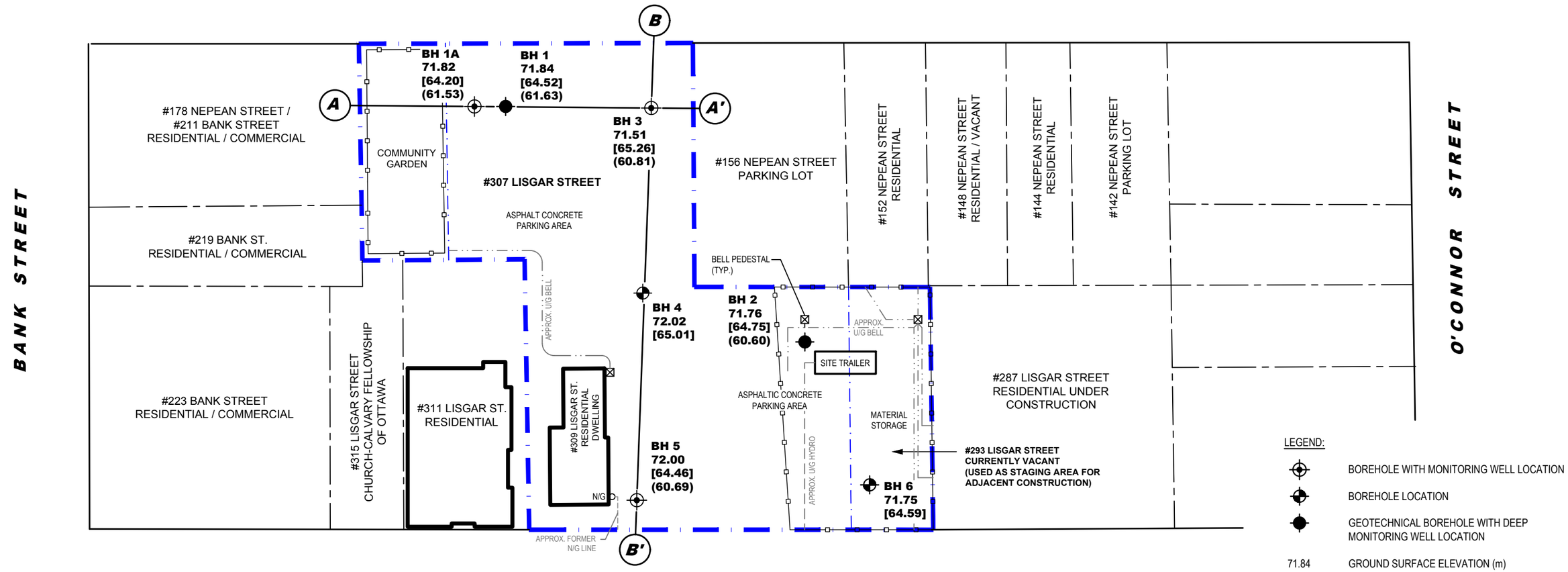
#203 BANK STREET
RESIDENTIAL/COMMERCIAL

#171 NEPEAN STREET
RESIDENTIAL /
COMMERCIAL

#153 NEPEAN STREET
RESIDENTIAL APPARTMENT

#143 NEPEAN STREET
PARKING LOT

NEPEAN STREET



LEGEND:

- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION
- GEOTECHNICAL BOREHOLE WITH DEEP MONITORING WELL LOCATION
- 71.84 GROUND SURFACE ELEVATION (m)
- [64.52] BEDROCK SURFACE ELEVATION (m)
- (61.63) GROUNDWATER SURFACE ELEVATION (m)
- A — A' CROSS-SECTION LOCATION

BM - TOP SPINDLE OF FIRE HYDRANT. GEODETIC ELEVATION = 72.57m.

#318 LISGAR STREET
VACANT

#312
LISGAR ST.
VACANT

FH - BM

#300 LISGAR STREET
RESIDENTIAL APPARTMENTS

#355 COOPER STREET
DOMINION CHALMERS UNITED CHURCH PARKING LOT

patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
0			

RICHCRAFT HOMES
PHASE II - ENVIRONMENTAL SITE ASSESSMENT
176 NEPEAN STREET AND 293 LISGAR STREET
OTTAWA, ONTARIO

Title:
TEST HOLE LOCATION PLAN

Scale: 1:500	Date: 09/2017
Drawn by: MPG	Report No.: PE3651-2
Checked by: KM	Dwg. No.: PE3651-3
Approved by: MSD	Revision No.: 0

p:\autocad drawings\environmental\pe36xx\pe3651 - lisgar at nepean\pe3651-1 site plan.dwg

#203 BANK STREET
RESIDENTIAL/COMMERCIAL

#171 NEPEAN STREET
RESIDENTIAL /
COMMERCIAL

#153 NEPEAN STREET
RESIDENTIAL APPARTMENT

#143 NEPEAN STREET
PARKING LOT

BH1-SS2 (0.8-1.4m) - 21-August-2017
BTEX/PHCs comply with MOECC Table 3 Standards

BH1-SS6 (3.8-4.4m) - 21-August-2017
VOCs comply with MOECC Table 3 Standards

NEPEAN STREET

BH 1A
71.82
[64.20]
(61.53)

BH 1
71.84
[64.52]
(61.63)

BH3-SS6 (3.8-4.4m) - 22-August-2017
VOCs comply with MOECC Table 3 Standards

BH 3
71.51
[65.26]
(60.81)

#178 NEPEAN STREET /
#211 BANK STREET
RESIDENTIAL / COMMERCIAL

COMMUNITY
GARDEN

#156 NEPEAN STREET
PARKING LOT

#152 NEPEAN STREET
RESIDENTIAL

#148 NEPEAN STREET
RESIDENTIAL / VACANT

#144 NEPEAN STREET
RESIDENTIAL

#142 NEPEAN STREET
PARKING LOT

#307 LISGAR STREET

ASPHALT CONCRETE
PARKING AREA

#219 BANK ST.
RESIDENTIAL / COMMERCIAL

BELL PEDESTAL
(TYP.)

BH2-SS8 (5.3-5.9m) - 24-August-2017
VOCs comply with MOECC Table 3 Standards

BH 4
72.02
[65.01]

BH 2
71.76
[64.75]
(60.60)

APPROX. U/G BELL

APPROX.
U/G BELL

SITE TRAILER

#315 LISGAR STREET
CHURCH-CALVARY FELLOWSHIP
OF OTTAWA

#223 BANK STREET
RESIDENTIAL / COMMERCIAL

#311 LISGAR ST.
RESIDENTIAL

#309 LISGAR ST.
RESIDENTIAL
DWELLING

N/G

ASPHALTIC CONCRETE
PARKING AREA

#287 LISGAR STREET
RESIDENTIAL UNDER
CONSTRUCTION

MATERIAL
STORAGE

APPROX. U/G HYDRO

#293 LISGAR STREET
CURRENTLY VACANT
(USED AS STAGING AREA FOR
ADJACENT CONSTRUCTION)

BH 5
72.00
[64.46]
(60.69)

BH 6
71.75
[64.59]

APPROX. FORMER
N/G LINE

BH5-SS5 (3.0-3.6m) - 22-August-2017
BTEX/PHCs comply with MOECC Table 3 Standards

BH6-SS2 (0.8-1.4m) - 24-August-2017
BTEX/PHCs comply with MOECC Table 3 Standards

LISGAR STREET

BANK STREET

O'CONNOR STREET

#318 LISGAR STREET
VACANT

#312
LISGAR ST.
VACANT

FH - BM

#300 LISGAR STREET
RESIDENTIAL APPARTMENTS

#355 COOPER STREET
DOMINION CHALMERS UNITED CHURCH PARKING LOT

LEGEND:

SOIL PARAMETERS MEET MOECC TABLE 3 STANDARDS

- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION
- GEOTECHNICAL BOREHOLE WITH DEEP MONITORING WELL LOCATION
- 71.84 GROUND SURFACE ELEVATION (m)
- [64.52] BEDROCK SURFACE ELEVATION (m)
- (61.63) GROUNDWATER SURFACE ELEVATION (m)

BM - TOP SPINDLE OF FIRE HYDRANT. GEODETIC ELEVATION = 72.57m.

patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
0			

RICHCRAFT HOMES

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
176 NEPEAN STREET AND 293 LISGAR STREET

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL
BTEX / PHC / VOC

Scale: 1:500	Date: 09/2017
Drawn by: MPG	Report No.: PE3651-2
Checked by: KM	Dwg. No.: PE3651-4A
Approved by: MSD	Revision No.: 0

p:\autocad drawings\environmental\pe36xx\pe3651 - lisgar at nepean\pe3651-1 site plan.dwg

BH1-SS2 (0.8-1.4m) - 21-August-2017

Parameter	Result	MOECC
Mercury	0.4	0.27
Barium	418	390
Lead	247	120
Nickel	120	100
Zinc	341	340

Other metals comply with MOECC Table 3 Standards

BH1-SS3 (1.5-2.1m) - 21-August-2017

Parameter	Result	MOECC
Cobalt	22.2*	22
Vanadium	93.7*	86

*Parameters considered to be naturally occuring at elevated levels in native silty clay

Other metals comply with MOECC Table 3 Standards

#171 NEPEAN STREET
RESIDENTIAL / COMMERCIAL

#153 NEPEAN STREET
RESIDENTIAL APPARTMENT

#143 NEPEAN STREET
PARKING LOT

NEPEAN STREET

BH3-SS2 (0.8-1.4m) - 24-August-2017
Metals comply with MOECC Table 3 Standards

BH 1A
71.82
[64.20]
(61.53)

BH 1
71.84
[64.52]
(61.63)

BH 3
71.51
[65.26]
(60.81)

#178 NEPEAN STREET /
#211 BANK STREET
RESIDENTIAL / COMMERCIAL

COMMUNITY GARDEN

#307 LISGAR STREET

ASPHALT CONCRETE PARKING AREA

#156 NEPEAN STREET
PARKING LOT

#152 NEPEAN STREET
RESIDENTIAL

#148 NEPEAN STREET
RESIDENTIAL / VACANT

#144 NEPEAN STREET
RESIDENTIAL

#142 NEPEAN STREET
PARKING LOT

BH2-SS3 (1.5-2.1m) - 21-August-2017

Parameter	Result	MOECC
Vanadium	93.7*	86

*Parameters considered to be naturally occuring at elevated levels in native silty clay

Other metals comply with MOECC Table 3 Standards

BELL PEDESTAL (TYP.)

BANK STREET

#219 BANK ST.
RESIDENTIAL / COMMERCIAL

APPROX. U/G BELL

BH 4
72.02
[65.01]

BH 2
71.76
[64.75]
(60.60)

APPROX. U/G BELL

SITE TRAILER

#223 BANK STREET
RESIDENTIAL / COMMERCIAL

#315 LISGAR STREET
CHURCH-CALVARY FELLOWSHIP
OF OTTAWA

#311 LISGAR ST.
RESIDENTIAL

#309 LISGAR ST.
RESIDENTIAL
DWELLING

ASPHALTIC CONCRETE PARKING AREA

MATERIAL STORAGE

#287 LISGAR STREET
RESIDENTIAL UNDER
CONSTRUCTION

BH 5
72.00
[64.46]
(60.69)

N/G

APPROX. U/G HYDRO

BH 6
71.75
[64.59]

#293 LISGAR STREET
CURRENTLY VACANT
(USED AS STAGING AREA FOR
ADJACENT CONSTRUCTION)

APPROX. FORMER N/G LINE

LISGAR STREET

O'CONNOR STREET

BH6-SS2 (0.8-1.4m) - 24-August-2017

Parameter	Result	MOECC
Mercury	1.1	0.27
Antimony	97.9	7.5
Lead	551	120

Other metals comply with MOECC Table 3 Standards

BH6-SS3 (1.5-2.1m) - 24-August-2017

Parameter	Result	MOECC
Cobalt	23.5*	22
Vanadium	113*	86

*Parameters considered to be naturally occuring at elevated levels in native silty clay

Other metals comply with MOECC Table 3 Standards

#318 LISGAR STREET
VACANT

#312
LISGAR ST.
VACANT

FH - BM

#300 LISGAR STREET
RESIDENTIAL APPARTMENTS

LEGEND:

SOIL PARAMETERS MEET MOECC TABLE 3 STANDARDS

SOIL PARAMETERS EXCEED MOECC TABLE 3 STANDARDS

APPROX. AREA OF SOIL IMPACTED WITH METALS EXCEEDING MOECC TABLE 3 STANDARDS

BOREHOLE WITH MONITORING WELL LOCATION

BOREHOLE LOCATION

GEOTECHNICAL BOREHOLE WITH DEEP MONITORING WELL LOCATION

71.84 GROUND SURFACE ELEVATION (m)

[64.52] BEDROCK SURFACE ELEVATION (m)

(61.63) GROUNDWATER SURFACE ELEVATION (m)

BM - TOP SPINDLE OF FIRE HYDRANT. GEODETIC ELEVATION = 72.57m.

patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
0			

RICHCRAFT HOMES

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
176 NEPEAN STREET AND 293 LISGAR STREET

OTTAWA, ONTARIO

Title: ANALYTICAL TESTING PLAN - SOIL METALS

Scale: 1:500	Date: 09/2017
Drawn by: MPG	Report No.: PE3651-2
Checked by: KM	Dwg. No.: PE3651-4B
Approved by: MSD	Revision No.: 0

p:\autocad drawings\environmental\pe36xx\pe3651 - lisgar at nepean\pe3651-1 site plan.dwg

BH1-SS2 (0.8-1.4m) - 21-August-2017

Parameter	Result	MOECC
Anthracene	0.95	0.67
Benzo[a]anthracene	2.47	0.5
Benzo[a]pyrene	3.29	0.3
Benzo[b]fluoranthene	3.68	0.78
Benzo[k]flouranthene	2.16	0.78
Dibenzo[a,h]anthracene	0.69	0.1
Fluoranthene	5.38	0.69
Indeno[1,2,3-cd]pyrene	2.2	0.38

Other PAHs comply with MOECC Table 3 Standards

BH1-SS3 (1.5-2.1m) - 21-August-2017
PAHs were not detected in sample; results in compliance with MOECC Table 3 Standards

BH3-SS2 (0.8-1.4m) - 22-August-2017

Parameter	Result	MOECC
Benzo[a]anthracene	0.66	0.5
Benzo[a]pyrene	0.59	0.3
Dibenzo[a,h]anthracene	0.11	0.1
Fluoranthene	1.71	0.69

Other PAHs comply with MOECC Table 3 Standards

BH3-SS3 (1.5-2.1m) - 22-August-2017
PAHs were not detected in sample; results in compliance with MOECC Table 3 Standards

BH2-G1/SS2 (0.3-1.4m) - 24-August-2017

Parameter	Result	MOECC
Acenapthylene	0.74	0.15
Anthracene	2.01	0.67
Benzo[a]anthracene	3.16	0.5
Benzo[a]pyrene	2.82	0.3
Benzo[b]fluoranthene	2.77	0.78
Benzo[k]flouranthene	1.82	0.78
Dibenzo[a,h]anthracene	0.5	0.1
Fluoranthene	8.52	0.69
Indeno[1,2,3-cd]pyrene	1.48	0.38
Naphthalene	0.66	0.6
Phenanthrene	6.47	6.2

Other PAHs comply with MOECC Table 3 Standards

BH2-SS3 (1.5-2.1m) - 24-August-2017
PAHs were not detected in sample; results in compliance with MOECC Table 3 Standards

BH6-SS3 (1.5-2.1m) - 24-August-2017
PAHs were not detected in sample; results in compliance with MOECC Table 3 Standards

#171 NEPEAN STREET
RESIDENTIAL / COMMERCIAL

#153 NEPEAN STREET
RESIDENTIAL APPARTMENT

#143 NEPEAN STREET
PARKING LOT

NEPEAN STREET

BH 1A
71.82
[64.20]
(61.53)

BH 1
71.84
[64.52]
(61.63)

BH 3
71.51
[65.26]
(60.81)

#178 NEPEAN STREET /
#211 BANK STREET
RESIDENTIAL / COMMERCIAL

COMMUNITY
GARDEN

#307 LISGAR STREET

ASPHALT CONCRETE
PARKING AREA

#156 NEPEAN STREET
PARKING LOT

BELL PEDESTAL
(TYP.)

BH 2
71.76
[64.75]
(60.60)

BH 4
72.02
[65.01]

APPROX. U/G BELL

APPROX. U/G BELL

SITE TRAILER

#219 BANK ST.
RESIDENTIAL / COMMERCIAL

#315 LISGAR STREET
CHURCH-CALVARY FELLOWSHIP
OF OTTAWA

#311 LISGAR ST.
RESIDENTIAL

#309 LISGAR ST.
RESIDENTIAL
DWELLING

ASPHALTIC CONCRETE
PARKING AREA

MATERIAL
STORAGE

#287 LISGAR STREET
RESIDENTIAL UNDER
CONSTRUCTION

#293 LISGAR STREET
CURRENTLY VACANT
(USED AS STAGING AREA FOR
ADJACENT CONSTRUCTION)

BH 5
72.00
[64.46]
(60.69)

BH 6
71.75
[64.59]

N/G

APPROX. FORMER
N/G LINE

APPROX. U/G HYDRO

#223 BANK STREET
RESIDENTIAL / COMMERCIAL

BANK STREET

O'CONNOR STREET

LISGAR STREET

#318 LISGAR STREET
VACANT

#312
LISGAR ST.
VACANT

FH - BM

#300 LISGAR STREET
RESIDENTIAL APPARTMENTS

#355 COOPER STREET
DOMINION CHALMERS UNITED CHURCH PARKING LOT

LEGEND:

SOIL PARAMETERS MEET MOECC TABLE 3 STANDARDS

SOIL PARAMETERS EXCEED MOECC TABLE 3 STANDARDS

APPROX. AREA OF SOIL IMPACTED WITH PAHs EXCEEDING MOECC TABLE 3 STANDARDS

BOREHOLE WITH MONITORING WELL LOCATION

BOREHOLE LOCATION

GEOTECHNICAL BOREHOLE WITH DEEP MONITORING WELL LOCATION

71.84 GROUND SURFACE ELEVATION (m)

[64.52] BEDROCK SURFACE ELEVATION (m)

(61.63) GROUNDWATER SURFACE ELEVATION (m)

BM - TOP SPINDLE OF FIRE HYDRANT. GEODETIC ELEVATION = 72.57m.

patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
0			

RICHCRAFT HOMES

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
176 NEPEAN STREET AND 293 LISGAR STREET

OTTAWA, ONTARIO

Title: ANALYTICAL TESTING PLAN - SOIL PAHs

Scale: 1:500	Date: 09/2017
Drawn by: MPG	Report No.: PE3651-2
Checked by: KM	Dwg. No.: PE3651-4C
Approved by: MSD	Revision No.: 0

p:\autocad drawings\environmental\pe36xx\pe3651 - lisgar at nepean\pe3651-1 site plan.dwg

#203 BANK STREET
RESIDENTIAL/COMMERCIAL

#171 NEPEAN STREET
RESIDENTIAL /
COMMERCIAL

#153 NEPEAN STREET
RESIDENTIAL APPARTMENT

#143 NEPEAN STREET
PARKING LOT

NEPEAN STREET

BH1A-GW1 (9.1-12.2m) - 31-August-2014
BTEX/PHC, VOCs, PAHs comply with MOECC Table 3 Standards

BH3-GW1 (10.1-13.2m) - 31-August-2014
BTEX/PHC, VOCs, PAHs comply with MOECC Table 3 Standards

BANK STREET

O'CONNOR STREET

BH 1A
71.82
[64.20]
(61.53)

BH 1
71.84
[64.52]
(61.63)

BH 3
71.51
[65.26]
(60.81)

#178 NEPEAN STREET /
#211 BANK STREET
RESIDENTIAL / COMMERCIAL

COMMUNITY
GARDEN

#307 LISGAR STREET

ASPHALT CONCRETE
PARKING AREA

#156 NEPEAN STREET
PARKING LOT

#152 NEPEAN STREET
RESIDENTIAL

#148 NEPEAN STREET
RESIDENTIAL / VACANT

#144 NEPEAN STREET
RESIDENTIAL

#142 NEPEAN STREET
PARKING LOT

#219 BANK ST.
RESIDENTIAL / COMMERCIAL

BELL PEDESTAL
(TYP.)

BH 4
72.02
[65.01]

BH 2
71.76
[64.75]
(60.60)

APPROX. U/G BELL

SITE TRAILER

#223 BANK STREET
RESIDENTIAL / COMMERCIAL

#315 LISGAR STREET
CHURCH-CALVARY FELLOWSHIP
OF OTTAWA

#311 LISGAR ST.
RESIDENTIAL

#309 LISGAR ST.
RESIDENTIAL
DWELLING

N/G

APPROX. U/G BELL

ASPHALTIC CONCRETE
PARKING AREA

MATERIAL
STORAGE

APPROX. U/G HYDRO

#287 LISGAR STREET
RESIDENTIAL UNDER
CONSTRUCTION

#293 LISGAR STREET
CURRENTLY VACANT
(USED AS STAGING AREA FOR
ADJACENT CONSTRUCTION)

BH 5
72.00
[64.46]
(60.69)

BH 6
71.75
[64.59]

APPROX. FORMER
N/G LINE

BH5-GW1 (9.1-12.2m) - 31-August-2014
BTEX/PHC and VOCs comply with MOECC Table 3 Standards

LISGAR STREET

#318 LISGAR STREET
VACANT

#312
LISGAR ST.
VACANT

FH - BM

#300 LISGAR STREET
RESIDENTIAL APPARTMENTS

#355 COOPER STREET
DOMINION CHALMERS UNITED CHURCH PARKING LOT

LEGEND:

GROUNDWATER PARAMETERS MEET MOECC TABLE 3 STANDARDS

- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION
- GEOTECHNICAL BOREHOLE WITH DEEP MONITORING WELL LOCATION
- 71.84 GROUND SURFACE ELEVATION (m)
- [64.52] BEDROCK SURFACE ELEVATION (m)
- (61.63) GROUNDWATER SURFACE ELEVATION (m)

BM - TOP SPINDLE OF FIRE HYDRANT. GEODETIC ELEVATION = 72.57m.

patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
0			

RICHCRAFT HOMES

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
176 NEPEAN STREET AND 293 LISGAR STREET

OTTAWA, ONTARIO

Title: ANALYTICAL TESTING PLAN - GROUNDWATER
BTEX / PHC / VOC / PAH

Scale: 1:500	Date: 09/2017
Drawn by: MPG	Report No.: PE3651-2
Checked by: KM	Dwg. No.: PE3651-5
Approved by: MSD	Revision No.: 0

p:\autocad drawings\environmental\pe36xx\pe3651 - lisgar at nepean\pe3651-1 site plan.dwg

#203 BANK STREET
RESIDENTIAL/COMMERCIAL

#171 NEPEAN STREET
RESIDENTIAL /
COMMERCIAL

#153 NEPEAN STREET
RESIDENTIAL APPARTMENT

#143 NEPEAN STREET
PARKING LOT

NEPEAN STREET

BANK STREET

O'CONNOR STREET

#178 NEPEAN STREET /
#211 BANK STREET
RESIDENTIAL / COMMERCIAL

#219 BANK ST.
RESIDENTIAL / COMMERCIAL

#223 BANK STREET
RESIDENTIAL / COMMERCIAL

#315 LISGAR STREET
CHURCH-CALVARY FELLOWSHIP
OF OTTAWA

#311 LISGAR ST.
RESIDENTIAL

#309 LISGAR ST.
RESIDENTIAL
DWELLING

COMMUNITY
GARDEN

BH 1A
71.82
[64.20]
(61.53)

BH 1
71.84
[64.52]
(61.63)

BH 3
71.51
[65.26]
(60.81)

61.5
61.4
61.3
61.2
61.1
61.0
60.9
60.8

(0.026m/m)

#307 LISGAR STREET
ASPHALT CONCRETE
PARKING AREA

APPROX. U/G BELL

BH 4
72.02
[65.01]

N/G

BH 5
72.00
[64.46]
(60.69)

APPROX. FORMER
N/G LINE

#156 NEPEAN STREET
PARKING LOT

BELL PEDESTAL
(TYP.)

BH 2
71.76
[64.75]
(60.60)

APPROX.
U/G BELL

SITE TRAILER

ASPHALTIC CONCRETE
PARKING AREA

MATERIAL
STORAGE

APPROX. U/G HYDRO

BH 6
71.75
[64.59]

#152 NEPEAN STREET
RESIDENTIAL

#148 NEPEAN STREET
RESIDENTIAL / VACANT

#144 NEPEAN STREET
RESIDENTIAL

#142 NEPEAN STREET
PARKING LOT

#287 LISGAR STREET
RESIDENTIAL UNDER
CONSTRUCTION

#293 LISGAR STREET
CURRENTLY VACANT
(USED AS STAGING AREA FOR
ADJACENT CONSTRUCTION)

LISGAR STREET

#318 LISGAR STREET
VACANT

#312
LISGAR ST.
VACANT

FH - BM

#300 LISGAR STREET
RESIDENTIAL APPARTMENTS

LEGEND:

- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION
- GEOTECHNICAL BOREHOLE WITH DEEP MONITORING WELL LOCATION
- 71.84 GROUND SURFACE ELEVATION (m)
- [64.52] BEDROCK SURFACE ELEVATION (m)
- (61.63) GROUNDWATER SURFACE ELEVATION (m)
- 61.0 GROUNDWATER CONTOUR
- APPROX. GROUNDWATER FLOW DIRECTION (HORIZONTAL HYDRAULIC GRADIENT)

BM - TOP SPINDLE OF FIRE HYDRANT. GEODETIC ELEVATION = 72.57m.

patersongroup
consulting engineers

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

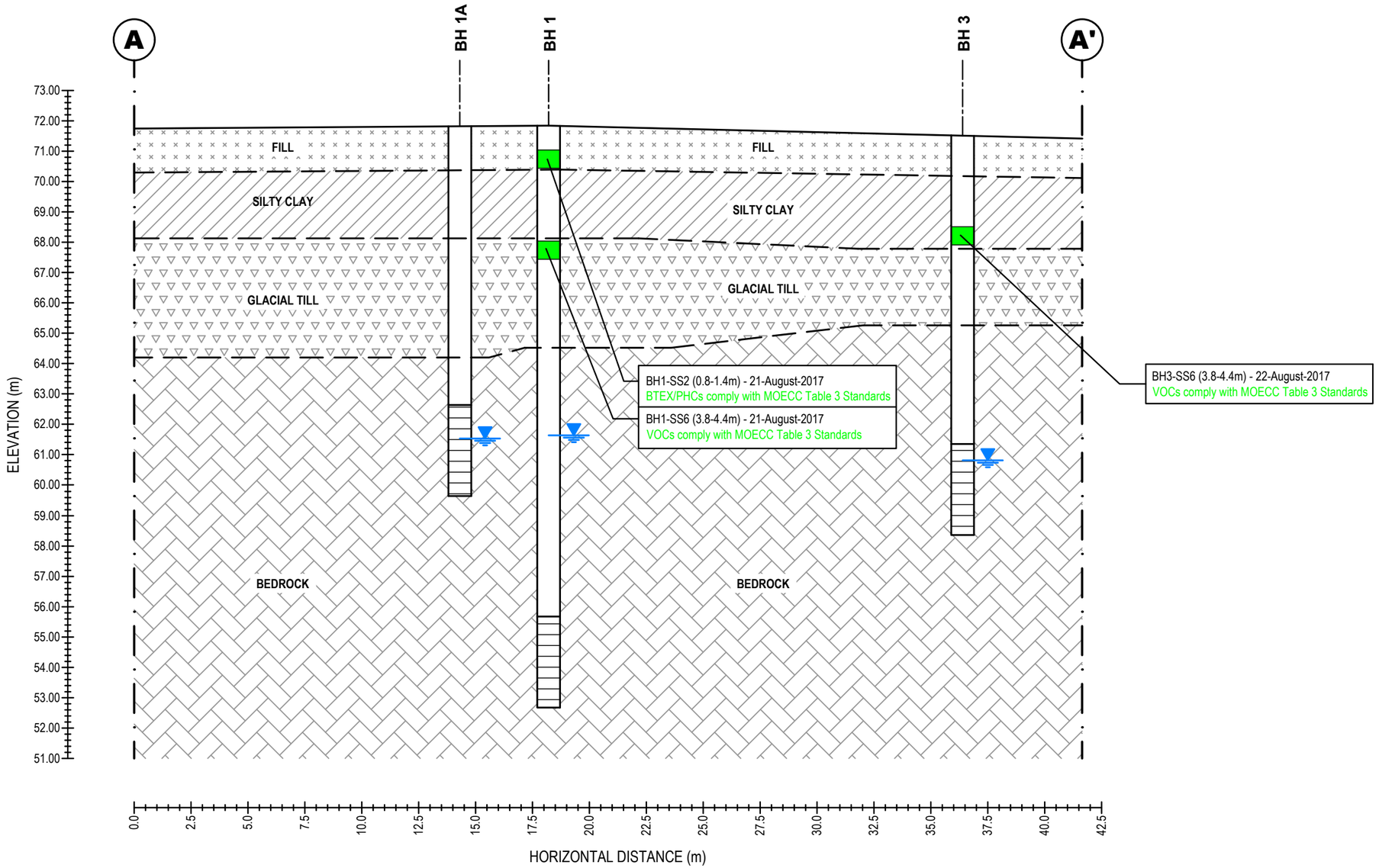
NO.	REVISIONS	DATE	INITIAL
0			

RICHCRAFT HOMES
PHASE II - ENVIRONMENTAL SITE ASSESSMENT
176 NEPEAN STREET AND 293 LISGAR STREET
OTTAWA, ONTARIO

Title:
GROUNDWATER CONTOUR PLAN

Scale: 1:500	Date: 09/2017
Drawn by: MPG	Report No.: PE3651-2
Checked by: KM	Dwg. No.: PE3651-6
Approved by: MSD	Revision No.: 0

p:\autocad drawings\environmental\pe36xx\pe3651 - lisgar at nepean\pe3651-6 gw contour.dwg



LEGEND:

SOIL PARAMETERS IN COMPLIANCE WITH MOECC TABLE 3 STANDARDS

patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
0			

RICHCRAFT HOMES

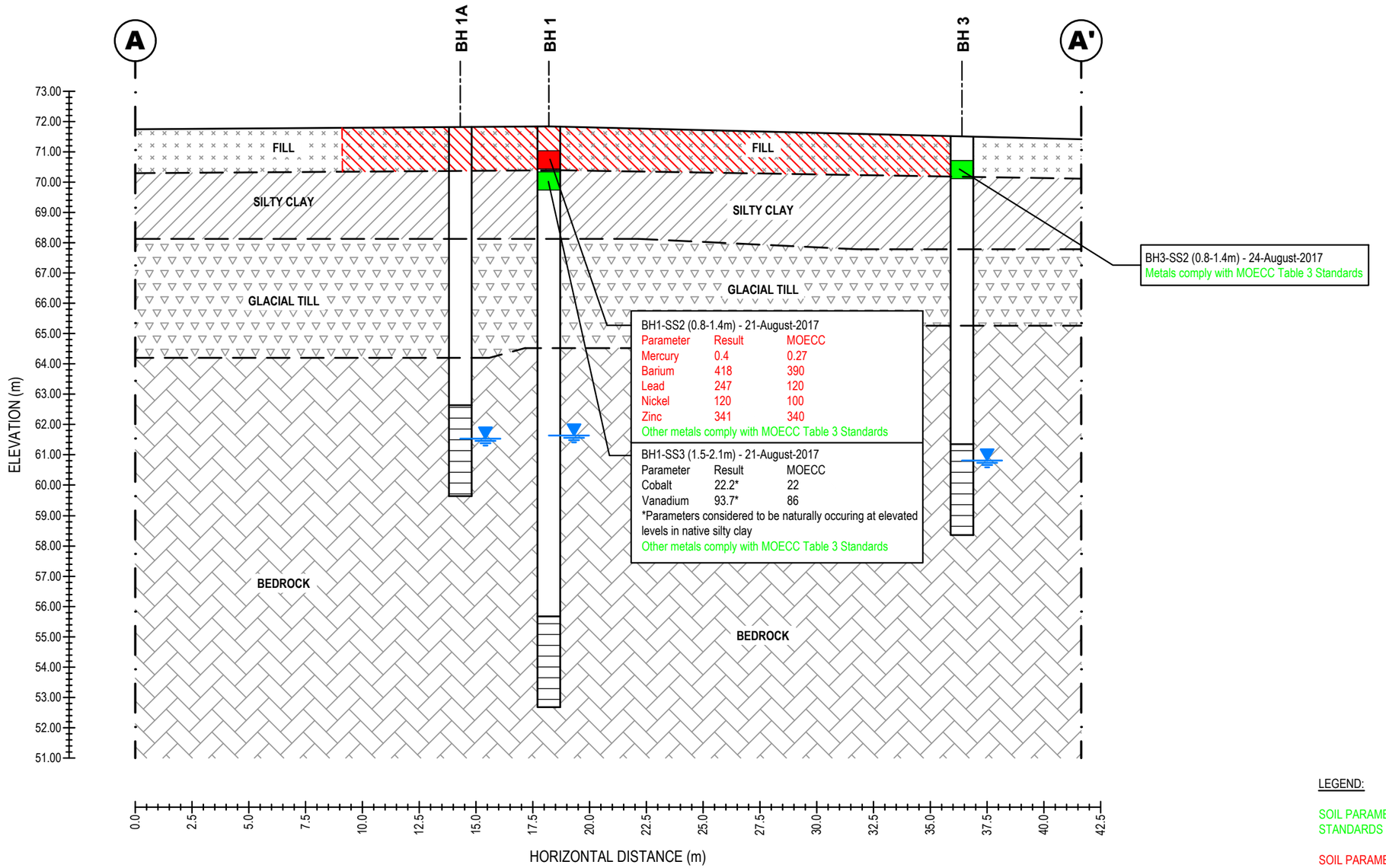
PHASE II - ENVIRONMENTAL SITE ASSESSMENT
176 NEPEAN STREET AND 293 LISGAR STREET

OTTAWA, ONTARIO

Title: CROSS-SECTION A-A' - SOIL BTEX / PHC / VOC

Scale: AS SHOWN	Date: 09/2017
Drawn by: MPG	Report No.: PE3651-2
Checked by: KM	Dwg. No.: PE3651-7A
Approved by: MSD	Revision No.: 0

p:\autocad drawings\environmental\pe36xx\pe3651 - lisgar at nepean\pe3651-7 seca.dwg



LEGEND:

SOIL PARAMETERS IN COMPLIANCE WITH MOECC TABLE 3 STANDARDS

SOIL PARAMETERS EXCEED MOECC TABLE 3 STANDARDS

APPROX. AREA OF SOIL IMPACTED WITH METALS EXCEEDING MOECC TABLE 3 STANDARDS

patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
0			

RICHCRAFT HOMES

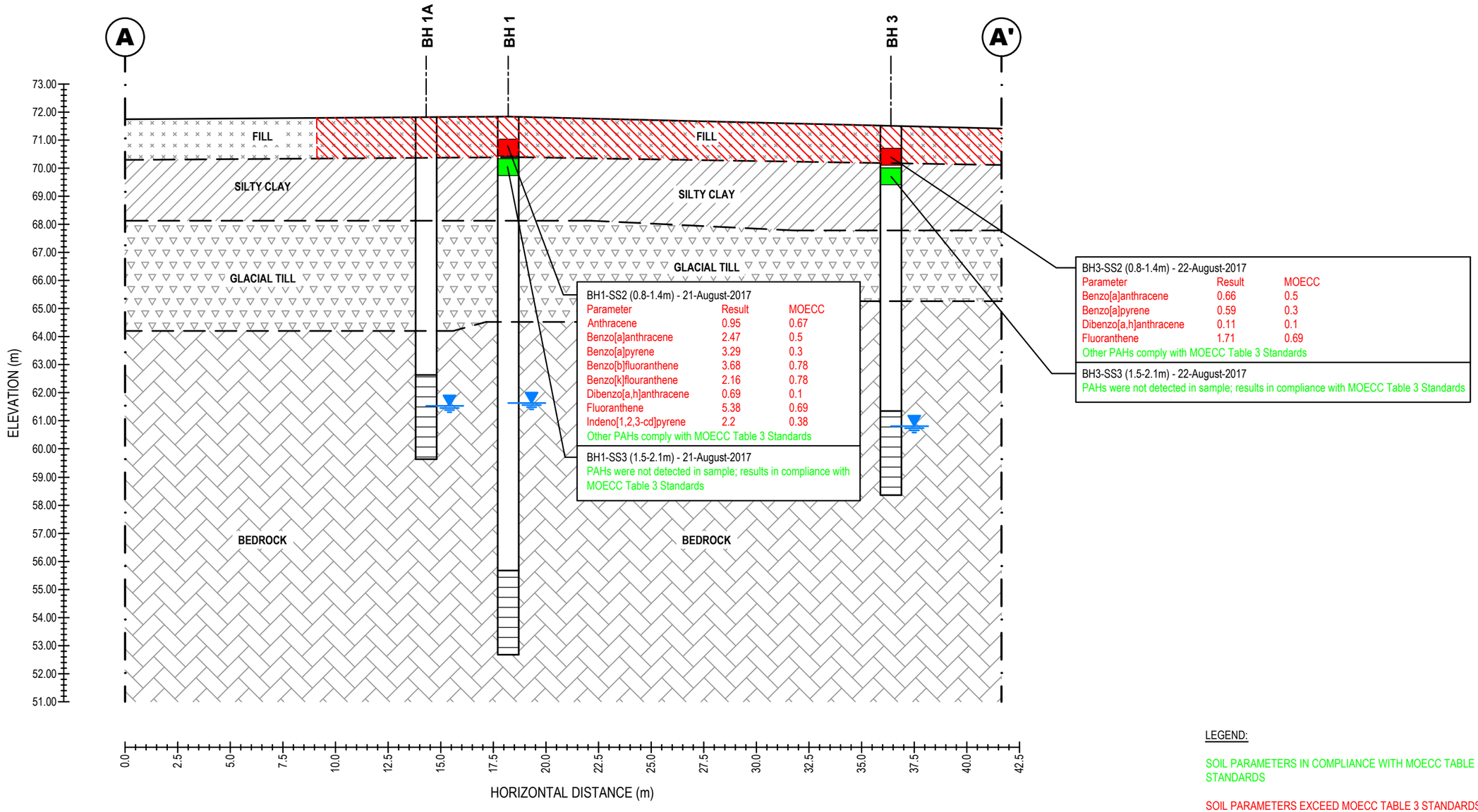
PHASE II - ENVIRONMENTAL SITE ASSESSMENT
176 NEPEAN STREET AND 293 LISGAR STREET

OTTAWA, ONTARIO

Title: CROSS-SECTION A-A' - SOIL METALS

Scale: AS SHOWN	Date: 09/2017
Drawn by: MPG	Report No.: PE3651-2
Checked by: KM	Dwg. No.: PE3651-7B
Approved by: MSD	Revision No.: 0

p:\autocad drawings\environmental\pe36xx\pe3651 - lisgar at nepean\pe3651-7 seca.dwg



BH1-SS2 (0.8-1.4m) - 21-August-2017

Parameter	Result	MOECC
Anthracene	0.95	0.67
Benzo[a]anthracene	2.47	0.5
Benzo[a]pyrene	3.29	0.3
Benzo[b]fluoranthene	3.68	0.78
Benzo[k]fluoranthene	2.16	0.78
Dibenzo[a,h]anthracene	0.69	0.1
Fluoranthene	5.38	0.69
Indeno[1,2,3-cd]pyrene	2.2	0.38

Other PAHs comply with MOECC Table 3 Standards

BH1-SS3 (1.5-2.1m) - 21-August-2017
PAHs were not detected in sample; results in compliance with MOECC Table 3 Standards

BH3-SS2 (0.8-1.4m) - 22-August-2017

Parameter	Result	MOECC
Benzo[a]anthracene	0.66	0.5
Benzo[a]pyrene	0.59	0.3
Dibenzo[a,h]anthracene	0.11	0.1
Fluoranthene	1.71	0.69

Other PAHs comply with MOECC Table 3 Standards

BH3-SS3 (1.5-2.1m) - 22-August-2017
PAHs were not detected in sample; results in compliance with MOECC Table 3 Standards

LEGEND:

SOIL PARAMETERS IN COMPLIANCE WITH MOECC TABLE 3 STANDARDS

SOIL PARAMETERS EXCEED MOECC TABLE 3 STANDARDS

APPROX. AREA OF SOIL IMPACTED WITH PAHs EXCEEDING MOECC TABLE 3 STANDARDS

patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
0			

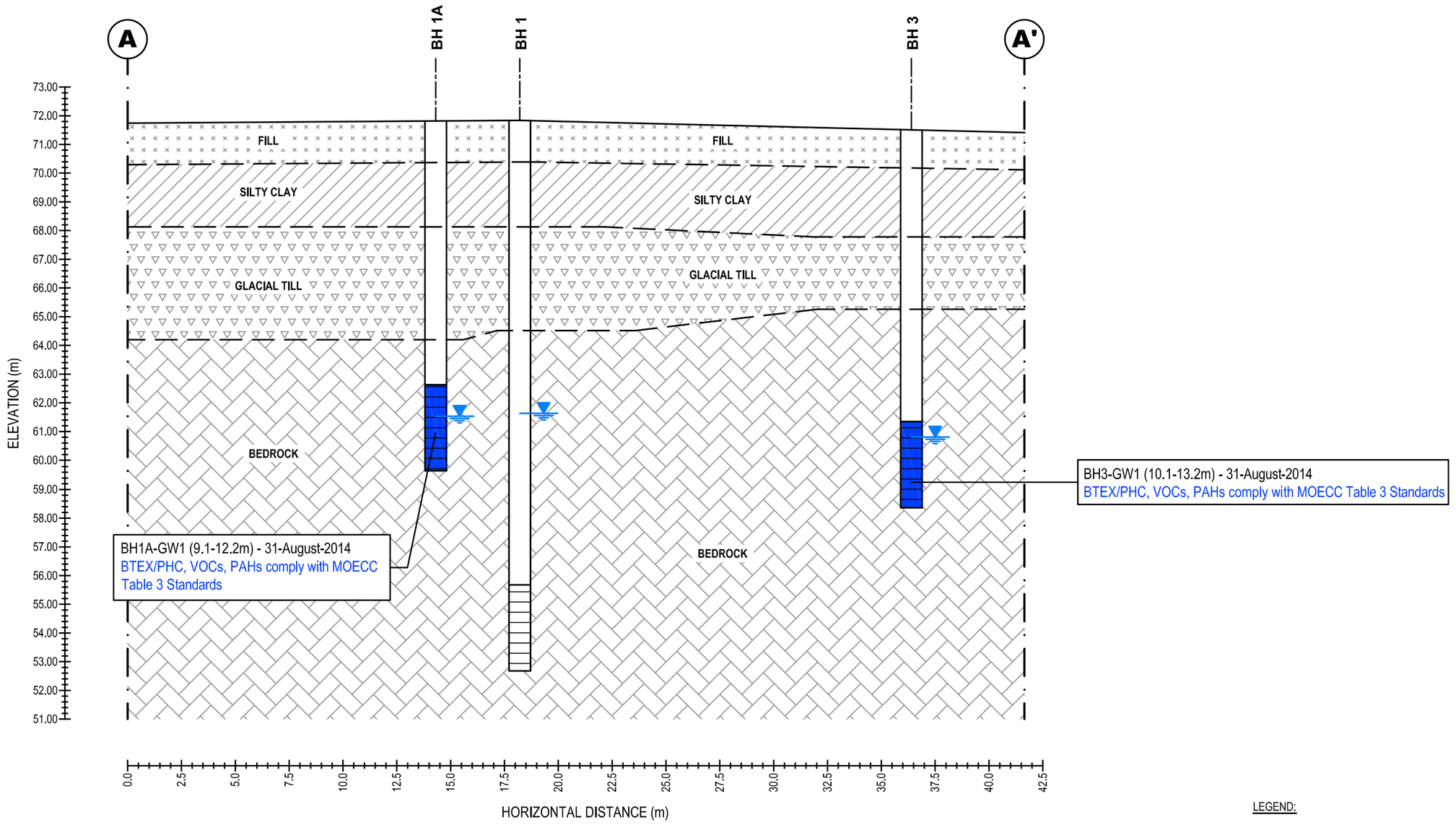
RICHCRAFT HOMES

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
176 NEPEAN STREET AND 293 LISGAR STREET
OTTAWA, ONTARIO

Title: CROSS-SECTION A-A' - SOIL PAHs

Scale: AS SHOWN	Date: 09/2017
Drawn by: MPG	Report No.: PE3651-2
Checked by: KM	Dwg. No.: PE3651-7C
Approved by: MSD	Revision No.: 0

p:\autocad drawings\environmental\pe36xx\pe3651 - lisgar at nepean\pe3651-7 seca.dwg



LEGEND:

GROUNDWATER PARAMETERS IN COMPLIANCE WITH MOECC TABLE 3 STANDARDS

patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
0			

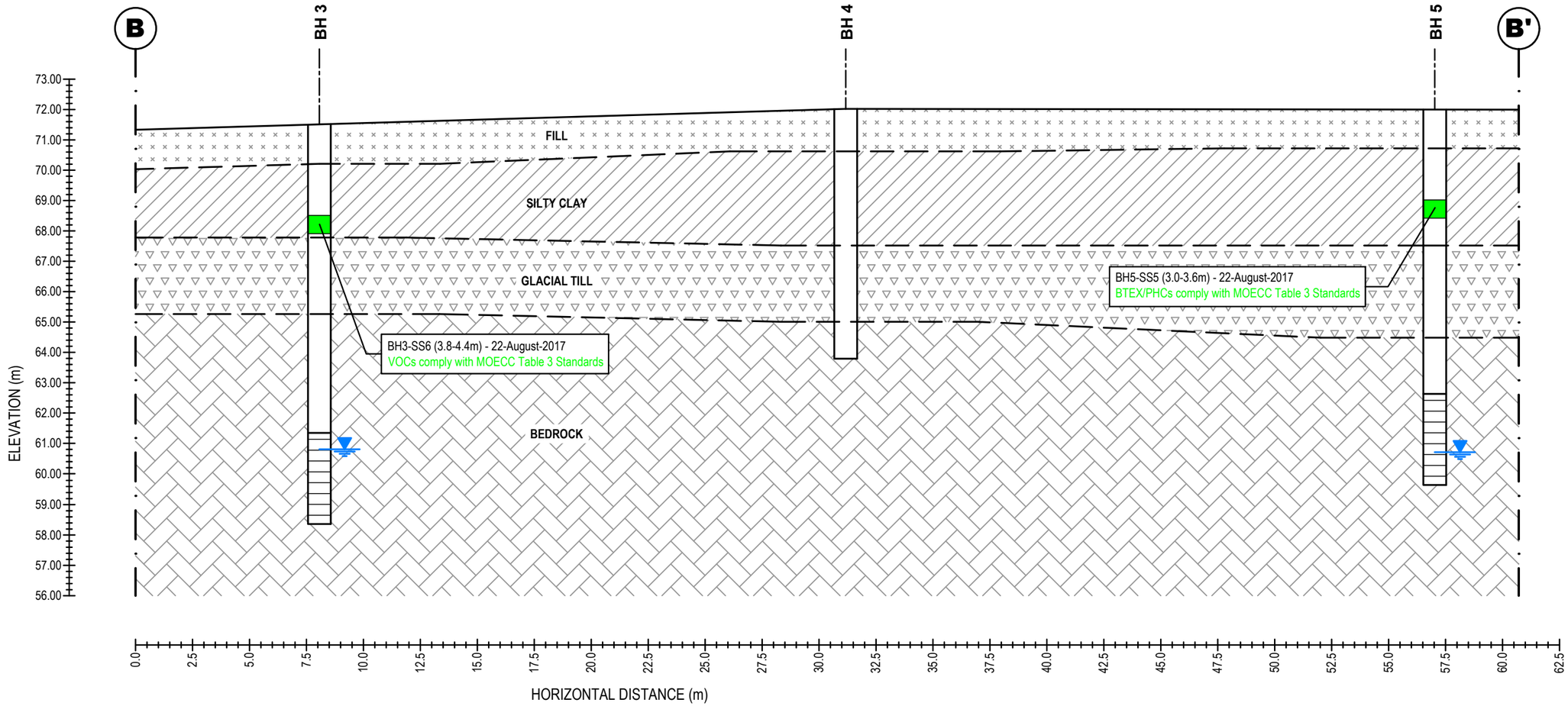
RICHCRAFT HOMES

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
176 NEPEAN STREET AND 293 LISGAR STREET
OTTAWA, ONTARIO

Title: CROSS-SECTION A-A' - GROUNDWATER BTEX / PHC / VOC / PAH

Scale: AS SHOWN	Date: 09/2017
Drawn by: MPG	Report No.: PE3651-2
Checked by: KM	Dwg. No.: PE3651-7D
Approved by: MSD	Revision No.: 0

p:\autocad drawings\environmental\pe36xx\pe3651 - lisgar at nepean\pe3651-7 secA.dwg



LEGEND:

SOIL PARAMETERS IN COMPLIANCE WITH MOECC TABLE 3 STANDARDS

patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
0			

RICHCRAFT HOMES

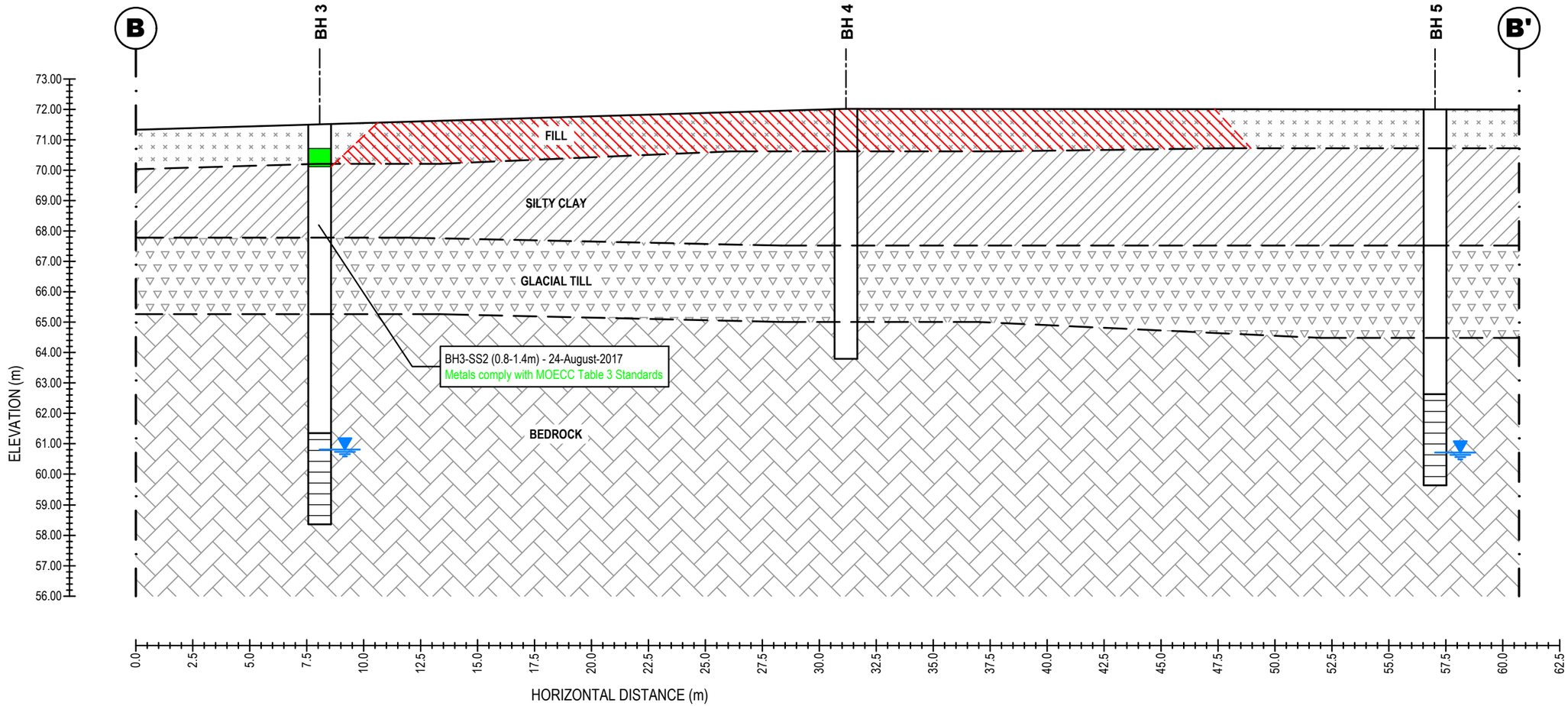
PHASE II - ENVIRONMENTAL SITE ASSESSMENT
176 NEPEAN STREET AND 293 LISGAR STREET

OTTAWA, ONTARIO

Title: CROSS-SECTION B-B' - SOIL BTEX / PHC / VOC

Scale: AS SHOWN	Date: 09/2017
Drawn by: MPG	Report No.: PE3651-2
Checked by: KM	Dwg. No.: PE3651-8A
Approved by: MSD	Revision No.: 0

p:\autocad drawings\environmental\pe36xx\pe3651 - lisgar at nepean\pe3651-7 seca.dwg



LEGEND:

SOIL PARAMETERS IN COMPLIANCE WITH MOECC TABLE 3 STANDARDS

APPROX. AREA OF SOIL IMPACTED WITH METALS EXCEEDING MOECC TABLE 3 STANDARDS

patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
0			

RICHCRAFT HOMES

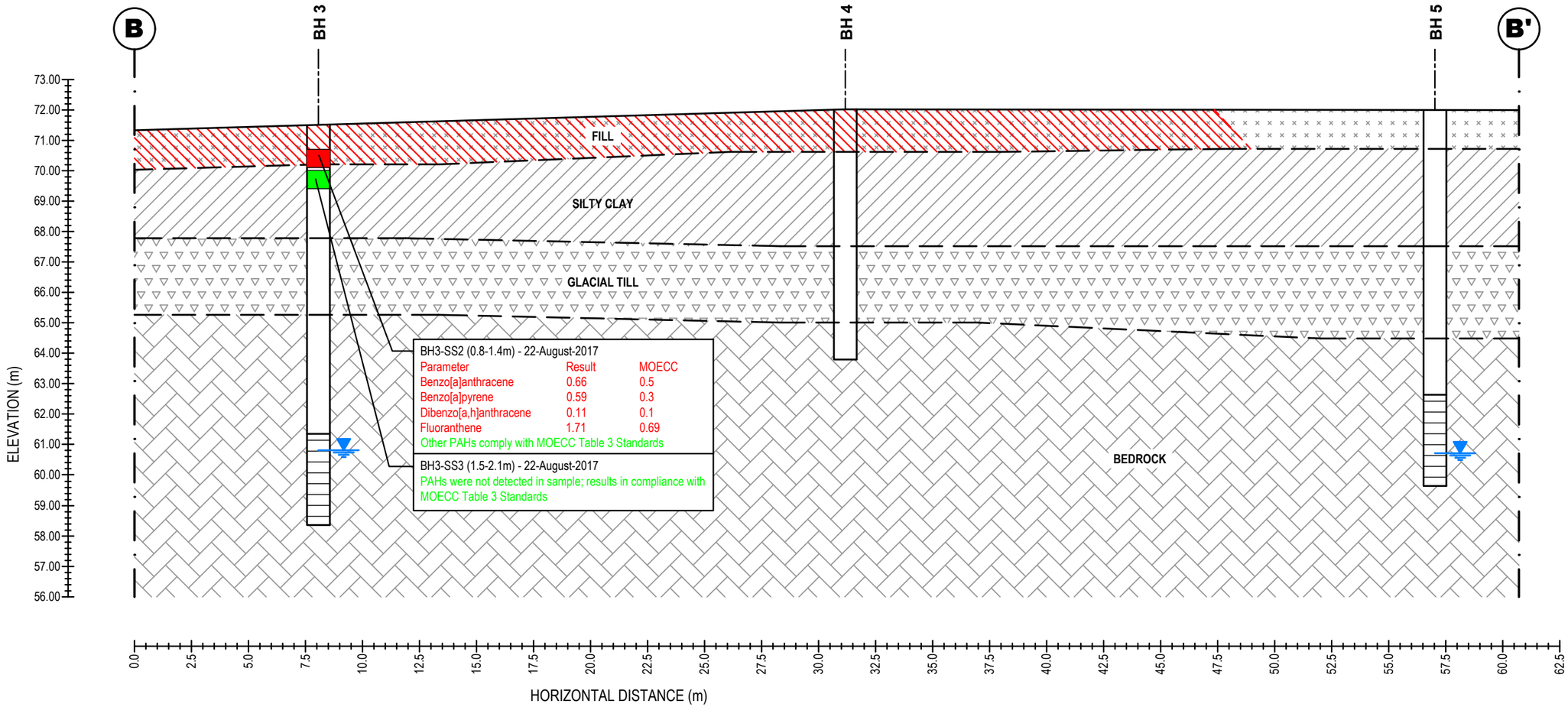
PHASE II - ENVIRONMENTAL SITE ASSESSMENT
176 NEPEAN STREET AND 293 LISGAR STREET

OTTAWA, ONTARIO

Title: CROSS-SECTION B-B' - SOIL METALS

Scale: AS SHOWN	Date: 09/2017
Drawn by: MPG	Report No.: PE3651-2
Checked by: KM	Dwg. No.: PE3651-8B
Approved by: MSD	Revision No.: 0

p:\autocad drawings\environmental\pe36xx\pe3651 - lisgar at nepean\pe3651-7 seca.dwg



LEGEND:

SOIL PARAMETERS IN COMPLIANCE WITH MOECC TABLE 3 STANDARDS

SOIL PARAMETERS EXCEED MOECC TABLE 3 STANDARDS

APPROX. AREA OF SOIL IMPACTED WITH PAHs EXCEEDING MOECC TABLE 3 STANDARDS

patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
0			

RICHCRAFT HOMES

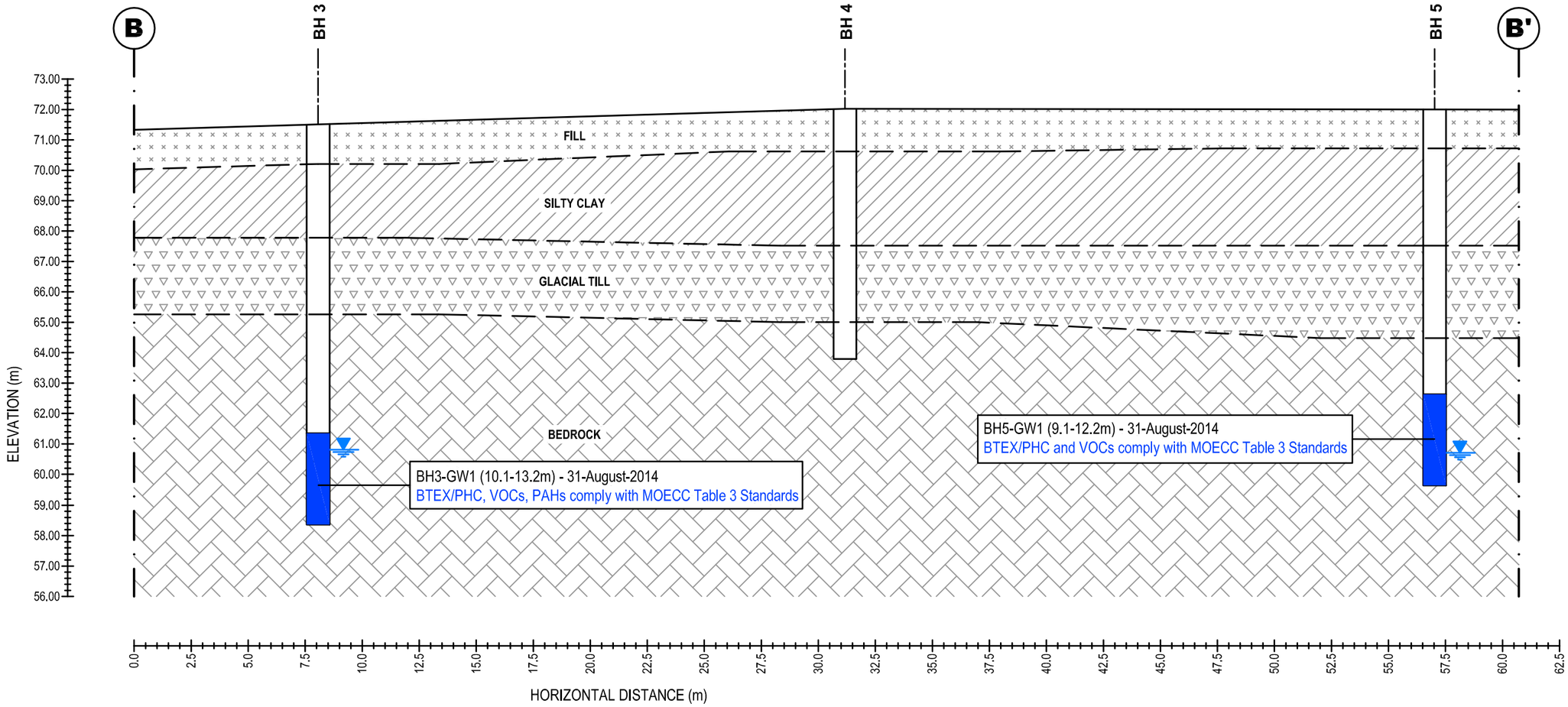
PHASE II - ENVIRONMENTAL SITE ASSESSMENT
176 NEPEAN STREET AND 293 LISGAR STREET

OTTAWA, ONTARIO

Title: CROSS-SECTION B-B' - SOIL PAHs

Scale: AS SHOWN	Date: 09/2017
Drawn by: MPG	Report No.: PE3651-2
Checked by: KM	Dwg. No.: PE3651-8C
Approved by: MSD	Revision No.: 0

p:\autocad drawings\environmental\pe36xx\pe3651 - lisgar at nepean\pe3651-7 seca.dwg



LEGEND:

GROUNDWATER PARAMETERS IN COMPLIANCE WITH MOECC TABLE 3 STANDARDS

patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
0			

RICHCRAFT HOMES

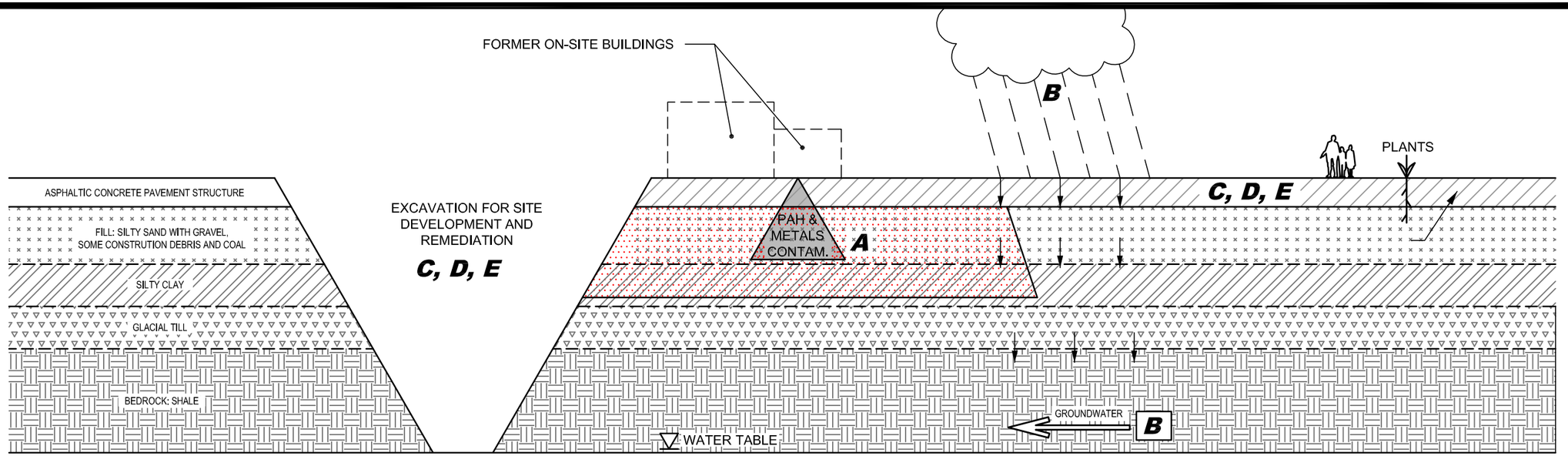
PHASE II - ENVIRONMENTAL SITE ASSESSMENT
176 NEPEAN STREET AND 293 LISGAR STREET

OTTAWA, ONTARIO

Title: CROSS-SECTION B-B' - GROUNDWATER BTEX / PHC / VOC / PAH

Scale: AS SHOWN	Date: 09/2017
Drawn by: MPG	Report No.: PE3651-2
Checked by: KM	Dwg. No.: PE3651-8D
Approved by: MSD	Revision No.: 0

p:\autocad drawings\environmental\pe36xx\pe3651 - lisgar at nepean\pe3651-7 secta.dwg



CONTAMINANT RELEASE MECHANISMS

A Fill material impacted with PAH and metal parameters exceeding MOECC Table 3 standards, was identifed on the northern and southeastern portions of the Phase II Property. Both metal and PAH impacts are considered to have been directly discharged to the subsurface through historical infilling of former building foundations or historical storage/management of coal (and resulting ash) for heating purposes.

CONTAMINANT TRANSPORT PATHWAYS

B PHYSICAL TRANSPORT - A potential contaminant transport pathway is the physical transport from one location to another of contamined soil, either intentionally or unintentionally, by earth moving equipment, vehicle traffic, or pedestrian traffic. Based on observations during the Phase I and Phase II ESA, physical transport of contaminants on the Phase II Property is considered to be negligible.
PRECIPITATION/INFILTRATION/LEACHING - Due to the Phase II Property having been covered largely by asphlatic concrete and building structures, precipitation and infiltration are no considered to have significantly contributed to the migration of the identified parameters beneath the subject land. Furthermore, metals and PAHs typically have low solubilities in water. Based on the findings of the Phase II ESA, the impacts are not considered to have migrated beyond the fill material.
DIFFUSION AND DISPERSION - Upon entering the groundwater table, contaminants will move from an area of greater concentration toward an area where it is less concentration as long as a concentration gradient exists (diffusion). When groundwater travels through bedrock it moves at differenct velocities resulting in mixing and dilution of the contmainion at the advancing edge of flow (dispersion). These processes are not considered to have contributed to contaminant migration, as the groundwater beneath the Phase II Property was determined to be in compliance with the MOECC Table 3 standards.

HUMAN AND ECOLOGICAL RECEPTORS

C HUMAN RECEPTORS - Although the majority of the subjet site is open to the general public, it is covered in asphalt, which greatly reduces the chances for humans to act as recptors. Potential human receptors are limited to construction works and enviromental professionals who may contact the soil during site remediation or redevelopment.
ECOLOGICAL RECEPTORS - Traditionally ecological receptors include plants and wildlife which may come into contact with the contaminated soil. While the site is largely paved, a community garden is present on the northwestern portion of the Phase II Property. The garden was implemented upon the removal of the former apartment building at 176 Nepean Street; it is considered unlikely that impact fill material is present at this location and the potential for migration of contaminant concentrations present to the east, is considered negligible for the reasons noted above.

RECEPTOR EXPOSURE POINTS

D HUMAN RECEPTORS - Exposure points for humans consist of remedial excavation or excavation for redevelopment.
ECOLOGICAL RECEPTORS - Given the location of the subject site in a built-up area, there are limited ecological receptor points in the general vicinity of the site. The aforementioned community garden on the northwestern portion of the Phase II Property will be discontinued upon site redevelopment.

E ROUTES OF EXPOSURE
HUMAN RECEPTORS - Routes of exposure for human receptors (construction workers and environmental professionals) include dermal contact and accidental ingestion.
ECOLOGICAL RECEPTORS - Routes of exposure for ecological receptors include ingestion and dermal contact.

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

NO.	REVISIONS	DATE	INITIAL
0			

RICHCRAFT HOMES
PHASE II - ENVIRONMENTAL SITE ASSESSMENT
176 NEPEAN STREET AND 293 LISGAR STREET
OTTAWA, ONTARIO
Title:
CONTAMINANT DISTRIBUTION DIAGRAM

Scale: N.T.S.	Date: 09/2017
Drawn by: RCG	Report No.: PE3651-2
Checked by: KM	Dwg. No.: PE3651-9
Approved by: MSD	Revision No.:

p:\autocad drawings\environmental\pe36xx\pe3651 - lisgar at nepean\pe3651-contaminant distribution diagram.dwg

APPENDIX 1

SAMPLING AND ANALYSIS PLAN

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

LABORATORY CERTIFICATES OF ANALYSIS

1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by Richcraft (Lisgar) Inc. to conduct a Phase II Environmental Site Assessment (ESA) for the properties addressed 176 Nepean Street and 293 to 309 Lisgar Street in the City of Ottawa, Ontario. Based on a Phase I ESA previously completed by Paterson for the subject property, a subsurface investigation program, consisting of borehole drilling, was developed. A geotechnical investigation was conducted concurrently with the environmental subsurface investigation.

Borehole	Location & Rationale	Proposed Depth & Rationale
BH1/BH1A	Place boreholes as close as possible to existing community garden to assess of potential soil and groundwater impacts resulting from a former drycleaner on the adjacent property to the west. Also placed to assess the potential for poor quality fill material in vicinity of former building foundations.	Drill to intercept water table for monitoring well installation. Install deep well in BH1 for geotechnical purposes. Auger BH1A to bedrock surface and core bedrock such that well screen will straddle the water table.
BH2, BH3	Place boreholes as close as possible to eastern property limit to assess potential soil and groundwater impacts resulting from former drycleaner to the northeast. Also placed to assess the potential for poor quality fill material in vicinity of former building foundations.	Drill to intercept water table for monitoring well installation.
BH4	Place borehole on central portion of site to provide general coverage and to assess potential for poor quality fill material in vicinity of former building foundations.	Drill to auger refusal on inferred bedrock surface.
BH5	Place borehole as close to 309 Lisgar Street as possible to assess potential for soil and groundwater impacts resulting from an interior aboveground fuel storage tank.	Drill to intercept water table for monitoring well installation.
BH6	Placed borehole on southeastern portion of site to assess potential for poor quality fill material in vicinity of former building foundations.	Drill to auger refusal on inferred bedrock surface.

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

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.

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
176 Nepean Street and 293-307 Lisgar Street
Ottawa, Ontario

DATUM BM - Top spindle of fire hydrant located on the south side of Lisgar Street, opposite subject site. Geodetic elevation = 72.57m.

FILE NO. PE3651

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** August 21, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	71.84
FILL: Crushed stone with silty sand 0.13		AU	1				
FILL: Brown silty sand, trace gravel, cobbles and construction debris 1.45		SS	2	54	17	1	70.84
Very stiff to stiff, brown **SILTY CLAY,** trace sand		SS	3	83	16	2	69.84
		SS	4	50	11	3	68.84
3.71		SS	5	100	5		
		SS	6	33	7	4	67.84
GLACIAL TILL: Brown to grey silty clay, some sand, trace gravel		SS	7	42	12	5	66.84
		SS	8	29	15	6	65.84
		SS	9	46	19		
7.32		SS	10	67	12	7	64.84
		SS	11	83	33	8	63.84
		SS	12	60	50+		
		RC	1	35	0	9	62.84
		RC	2	100	58	10	61.84
		RC	3	98	85	11	60.84
BEDROCK: Black shale		RC	4	100	94	12	59.84
		RC	5	99	73	13	58.84
		RC	6	100	61	14	57.84
		RC	7	98	71	15	56.84
19.18						16	55.84
End of Borehole (GWL @ 10.21m-August 31, 2017)						17	54.84
						18	53.84
						19	52.84

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

Monitoring Well Construction

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
176 Nepean Street and 293-307 Lisgar Street
Ottawa, Ontario

DATUM BM - Top spindle of fire hydrant located on the south side of Lisgar Street, opposite subject site. Geodetic elevation = 72.57m.

FILE NO. PE3651

REMARKS

HOLE NO. BH 1A

BORINGS BY CME 55 Power Auger **DATE** August 23, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	71.82
						1	70.82
						2	69.82
						3	68.82
OVERBURDEN						4	67.82
						5	66.82
						6	65.82
						7	64.82
7.62							
		RC	1	28	0	8	63.82
		RC	2	18	0	9	62.82
BEDROCK: Black shale						10	61.82
		RC	3	93	42	11	60.82
12.19		RC	4	100	66	12	59.82
End of Borehole							
(GWL @ 10.29m-August 31, 2017)							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

Monitoring Well Construction

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
176 Nepean Street and 293-307 Lisgar Street
Ottawa, Ontario

DATUM BM - Top spindle of fire hydrant located on the south side of Lisgar Street, opposite subject site. Geodetic elevation = 72.57m.

FILE NO. PE3651

REMARKS

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger **DATE** August 24, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	71.76
25mm Asphaltic concrete over crushed stone with silty sand 0.23		AU	1				
1.04		SS	2	67	4	1	70.76
FILL: Brown silty sand, trace gravel, cobbles, boulders, clay and construction debris		SS	3	75	5	2	69.76
		SS	4	100	4		
Very stiff to stiff, brown **SILTY CLAY,** trace sand		SS	5	100	P	3	68.76
4.40		SS	6	42	P	4	67.76
		SS	7	42	7		
GLACIAL TILL: Grey silty clay, some sand, trace gravel, cobbles and boulders		SS	8	58	15	5	66.76
		SS	9	71	7	6	65.76
7.01		SS	10	50	30	7	64.76
		RC	1	89	0	8	63.76
		RC	2	94	30	9	62.76
						10	61.76
		RC	3	91	24	11	60.76
BEDROCK: Black shale		RC	4	100	66	12	59.76
						13	58.76
		RC	5	100	79	14	57.76
		RC	6	97	75	15	56.76
						16	55.76
		RC	7	100	83	17	54.76
						18	53.76
		RC	8	100	82	19	52.76
19.25							
End of Borehole							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

Monitoring Well Construction

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
176 Nepean Street and 293-307 Lisgar Street
Ottawa, Ontario

DATUM BM - Top spindle of fire hydrant located on the south side of Lisgar Street, opposite subject site. Geodetic elevation = 72.57m.

FILE NO. PE3651

REMARKS

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger **DATE** August 24, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Photo Ionization Detector / Lower Explosive Limit %	Monitoring Well Construction
GROUND SURFACE									
(GWL @ 11.16m-August 31, 2017)									

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
176 Nepean Street and 293-307 Lisgar Street
Ottawa, Ontario

DATUM BM - Top spindle of fire hydrant located on the south side of Lisgar Street, opposite subject site. Geodetic elevation = 72.57m.

FILE NO. PE3651

REMARKS

HOLE NO. BH 3

BORINGS BY CME 55 Power Auger **DATE** August 22, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	71.51
FILL: 38mm Asphaltic concrete over crushed stone with silty sand (0.20)		AU	1				
FILL: Brown silty sand, some brick, trace gravel, cobbles, boulders, clay (1.30)		SS	2	50	12	1	70.51
		SS	3	83	7	2	69.51
Very stiff to firm, brown to grey **SILTY CLAY,** trace sand		SS	4		P		
(3.73)		SS	5	100	P	3	68.51
		SS	6	71	2	4	67.51
GLACIAL TILL: Grey silty clay, some sand, gravel and cobbles		SS	7	42	37	5	66.51
		SS	8	50	4		
(6.25)		SS	9	79	24	6	65.51
		SS	10	50	50+	7	64.51
		RC	1	45	0	8	63.51
		RC	2	92	12	9	62.51
BEDROCK: Black shale						10	61.51
		RC	3	45	0	11	60.51
		RC	4	95	62	12	59.51
(13.16)						13	58.51
End of Borehole							
(GWL @ 10.70m-August 31, 2017)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

Monitoring Well Construction

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
176 Nepean Street and 293-307 Lisgar Street
Ottawa, Ontario

DATUM BM - Top spindle of fire hydrant located on the south side of Lisgar Street, opposite subject site. Geodetic elevation = 72.57m.

FILE NO. PE3651

REMARKS

HOLE NO. BH 4

BORINGS BY CME 55 Power Auger **DATE** August 21, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	72.02
FILL: 50mm Asphaltic concrete over crushed stone with silty sand (0.36)		AU	1				
FILL: Brown silty sand, trace gravel and cobbles (1.45)		SS	2	17	3	1	71.02
		SS	3	83	10	2	70.02
Very stiff to stiff, brown to grey **SILTY CLAY,** trace sand		SS	4	100	7		
		SS	5	100	P	3	69.02
(4.50)		SS	6	100	P	4	68.02
GLACIAL TILL: Grey silty clay, some sand, trace gravel and cobbles		SS	7	50	1	5	67.02
		SS	8	46	1		
		SS	9	58	15	6	66.02
(7.01)		SS	10	56	24	7	65.02
BEDROCK: Black shale		SS	11	71	50+		
(8.23)						8	64.02
End of Borehole							
(BH dry - August 31, 2017)							

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
176 Nepean Street and 293-307 Lisgar Street
Ottawa, Ontario

DATUM BM - Top spindle of fire hydrant located on the south side of Lisgar Street, opposite subject site. Geodetic elevation = 72.57m.

FILE NO. PE3651

REMARKS

HOLE NO. BH 5

BORINGS BY CME 55 Power Auger **DATE** August 23, 2017

SOIL DESCRIPTION		STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							0	72.00
FILL: Asphaltic concrete over crushed stone with silty sand	0.25		AU	1				
FILL: Brown silty sand, trace gravel	1.30		SS	2	58	9	1	71.00
			SS	3	83	10	2	70.00
Very stiff to stiff, brown to grey **SILTY CLAY,** trace sand			SS	4	83	6	3	69.00
			SS	5	100	P		
	4.50		SS	6	100	P	4	68.00
GLACIAL TILL: Grey silty clay, some sand, trace gravel and cobbles			SS	7	100	3	5	67.00
			SS	8	100	3	6	66.00
			SS	9	83	5		
	7.54		SS	10	58	9	7	65.00
			SS	11	83	26	8	64.00
			SS	12	81	50+		
BEDROCK: Black shale			RC	1	55	10	9	63.00
			RC	2	100	28	10	62.00
			RC	3	100	20	11	61.00
	12.37						12	60.00
End of Borehole								
(GWL @ 11.31m-August 31, 2017)								

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

20 40 60 80

Monitoring Well Construction

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
176 Nepean Street and 293-307 Lisgar Street
Ottawa, Ontario

DATUM BM - Top spindle of fire hydrant located on the south side of Lisgar Street, opposite subject site. Geodetic elevation = 72.57m.

FILE NO. PE3651

REMARKS

HOLE NO. BH 6

BORINGS BY CME 55 Power Auger **DATE** August 24, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	71.75
FILL: Crushed stone with silt and sand		AU	1				
0.18							
FILL: Brown silty clay, some sand, trace gravel and cobbles		SS	2	50	7	1	70.75
1.27		SS	3	83	8	2	69.75
		SS	4	83	7		
Very stiff to stiff, brown to grey **SILTY CLAY,** trace sand		SS	5	100	P	3	68.75
		SS	6	100	P	4	67.75
		SS	7	100	P	5	66.75
5.26							
GLACIAL TILL: Grey silty clay, some sand, trace gravel, cobbles and boulders		SS	8	50	24	6	65.75
		SS	9	58	2		
7.16		SS	10	67	16	7	64.75
BEDROCK: Black shale		SS	11	32	51	8	63.75
8.18							
End of Borehole							
(BH dry - August 31, 2017)							

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

20 40 60 80

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

Monitoring Well Construction

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

The standard terminology to describe the strength of cohesionless soils is the relative density, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm.

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

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

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

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

CONSOLIDATION TEST

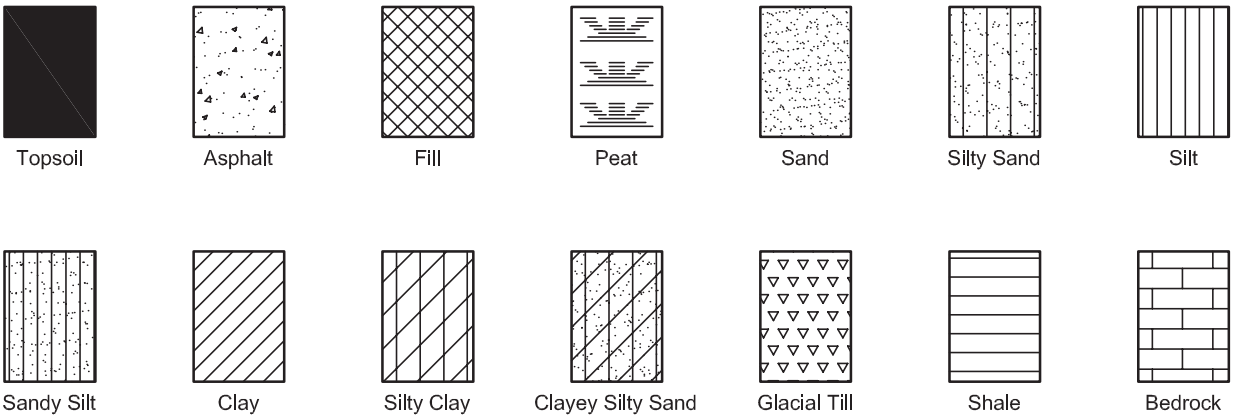
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

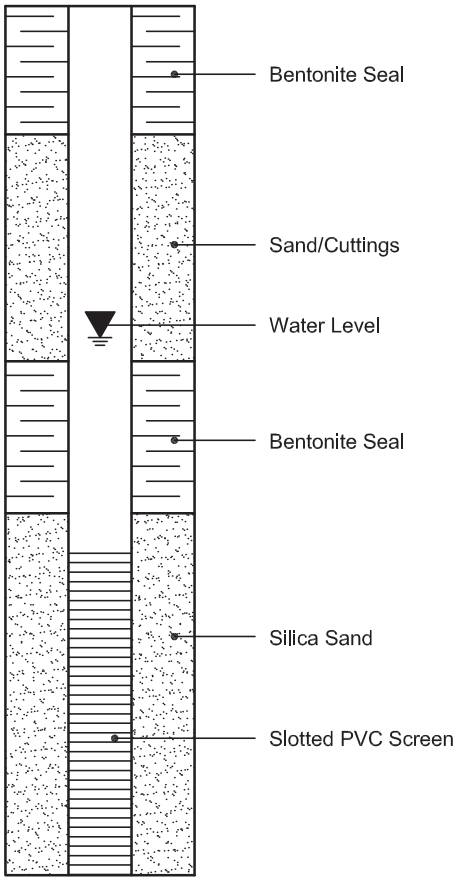
SYMBOLS AND TERMS (continued)

STRATA PLOT

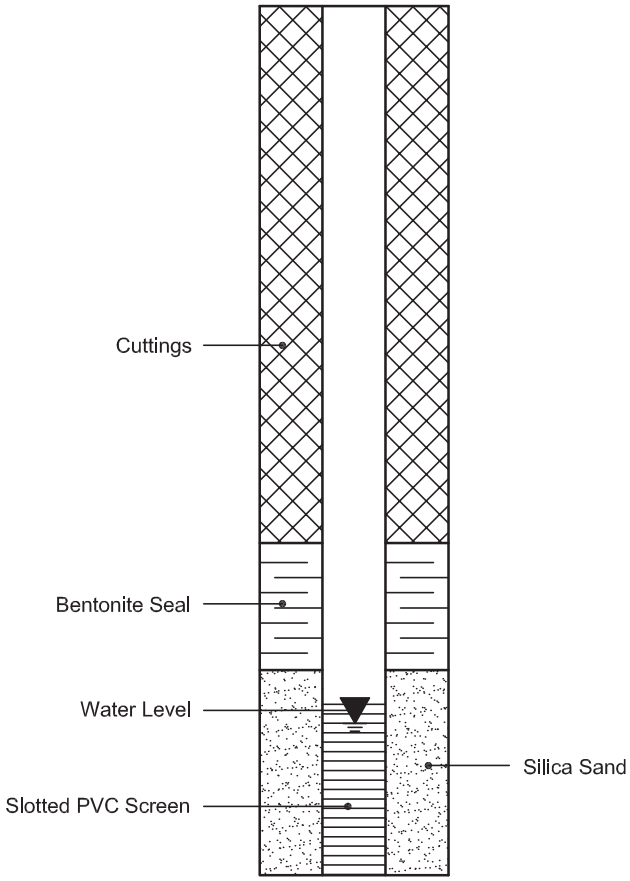


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



PARACEL LABORATORIES LTD.
TRUSTED. RESPONSIVE. RELIABLE.

300 - 2319 St. Laurent Blvd
Ottawa, ON, K1G 4J8
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Karyn Munch

Client PO: 21713
Project: PE3651
Custody: 111849

Report Date: 29-Aug-2017
Order Date: 23-Aug-2017

Order #: 1734326

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

Paracel ID	Client ID
1734326-01	BH1-SS2
1734326-02	BH1-SS6
1734326-03	BH3-SS2
1734326-04	BH5-SS5

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 21713

Report Date: 29-Aug-2017
Order Date: 23-Aug-2017
Project Description: PE3651

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Boron, available	MOE (HWE), EPA 200.7 - ICP-OES	28-Aug-17	28-Aug-17
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	28-Aug-17	29-Aug-17
Chromium, hexavalent - soil	MOE E3056 - Extraction, colourimetric	24-Aug-17	28-Aug-17
Mercury by CVAA	EPA 7471B - CVAA, digestion	29-Aug-17	29-Aug-17
PHC F1	CWS Tier 1 - P&T GC-FID	28-Aug-17	29-Aug-17
PHC F4G (gravimetric)	CWS Tier 1 - Extraction Gravimetric	29-Aug-17	29-Aug-17
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	24-Aug-17	25-Aug-17
REG 153: Metals by ICP/OES, soil	based on MOE E3470, ICP-OES	29-Aug-17	29-Aug-17
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	22-Aug-17	25-Aug-17
REG 153: VOCs by P&T GC/MS	EPA 8260 - P&T GC-MS	28-Aug-17	29-Aug-17
Solids, %	Gravimetric, calculation	28-Aug-17	28-Aug-17

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 21713

Report Date: 29-Aug-2017
Order Date: 23-Aug-2017
Project Description: PE3651

	Client ID:	BH1-SS2	BH1-SS6	BH3-SS2	BH5-SS5
	Sample Date:	21-Aug-17	21-Aug-17	22-Aug-17	22-Aug-17
	Sample ID:	1734326-01	1734326-02	1734326-03	1734326-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	85.0	89.2	87.3	65.7
Metals					
Antimony	1.0 ug/g dry	<1.0	-	<1.0	-
Arsenic	1.0 ug/g dry	8.7	-	4.2	-
Barium	1.0 ug/g dry	418	-	135	-
Beryllium	1.0 ug/g dry	<1.0	-	<1.0	-
Boron	1.0 ug/g dry	18.5	-	6.1	-
Boron, available	0.5 ug/g dry	0.9	-	<0.5	-
Cadmium	0.5 ug/g dry	<0.5	-	<0.5	-
Chromium	1.0 ug/g dry	19.4	-	36.4	-
Chromium (VI)	0.2 ug/g dry	<0.2	-	<0.2	-
Cobalt	1.0 ug/g dry	6.9	-	7.9	-
Copper	1.0 ug/g dry	27.3	-	28.5	-
Lead	1.0 ug/g dry	247	-	87.5	-
Mercury	0.1 ug/g dry	0.4	-	0.2	-
Molybdenum	1.0 ug/g dry	<1.0	-	<1.0	-
Nickel	1.0 ug/g dry	120	-	21.8	-
Selenium	1.0 ug/g dry	<1.0	-	<1.0	-
Silver	0.5 ug/g dry	<0.5	-	<0.5	-
Thallium	1.0 ug/g dry	<1.0	-	<1.0	-
Uranium	1.0 ug/g dry	<1.0	-	<1.0	-
Vanadium	1.0 ug/g dry	22.7	-	46.4	-
Zinc	1.0 ug/g dry	341	-	63.6	-
Volatiles					
Acetone	0.50 ug/g dry	-	<0.50	-	-
Benzene	0.02 ug/g dry	-	<0.02	-	-
Bromodichloromethane	0.05 ug/g dry	-	<0.05	-	-
Bromoform	0.05 ug/g dry	-	<0.05	-	-
Bromomethane	0.05 ug/g dry	-	<0.05	-	-
Carbon Tetrachloride	0.05 ug/g dry	-	<0.05	-	-
Chlorobenzene	0.05 ug/g dry	-	<0.05	-	-
Chloroform	0.05 ug/g dry	-	<0.05	-	-
Dibromochloromethane	0.05 ug/g dry	-	<0.05	-	-
Dichlorodifluoromethane	0.05 ug/g dry	-	<0.05	-	-
1,2-Dichlorobenzene	0.05 ug/g dry	-	<0.05	-	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 21713

Report Date: 29-Aug-2017
Order Date: 23-Aug-2017
Project Description: PE3651

	Client ID:	BH1-SS2	BH1-SS6	BH3-SS2	BH5-SS5
	Sample Date:	21-Aug-17	21-Aug-17	22-Aug-17	22-Aug-17
	Sample ID:	1734326-01	1734326-02	1734326-03	1734326-04
	MDL/Units	Soil	Soil	Soil	Soil
1,3-Dichlorobenzene	0.05 ug/g dry	-	<0.05	-	-
1,4-Dichlorobenzene	0.05 ug/g dry	-	<0.05	-	-
1,1-Dichloroethane	0.05 ug/g dry	-	<0.05	-	-
1,2-Dichloroethane	0.05 ug/g dry	-	<0.05	-	-
1,1-Dichloroethylene	0.05 ug/g dry	-	<0.05	-	-
cis-1,2-Dichloroethylene	0.05 ug/g dry	-	<0.05	-	-
trans-1,2-Dichloroethylene	0.05 ug/g dry	-	<0.05	-	-
1,2-Dichloropropane	0.05 ug/g dry	-	<0.05	-	-
cis-1,3-Dichloropropylene	0.05 ug/g dry	-	<0.05	-	-
trans-1,3-Dichloropropylene	0.05 ug/g dry	-	<0.05	-	-
1,3-Dichloropropene, total	0.05 ug/g dry	-	<0.05	-	-
Ethylbenzene	0.05 ug/g dry	-	<0.05	-	-
Ethylene dibromide (dibromoethan	0.05 ug/g dry	-	<0.05	-	-
Hexane	0.05 ug/g dry	-	<0.05	-	-
Methyl Ethyl Ketone (2-Butanone)	0.50 ug/g dry	-	<0.50	-	-
Methyl Isobutyl Ketone	0.50 ug/g dry	-	<0.50	-	-
Methyl tert-butyl ether	0.05 ug/g dry	-	<0.05	-	-
Methylene Chloride	0.05 ug/g dry	-	<0.05	-	-
Styrene	0.05 ug/g dry	-	<0.05	-	-
1,1,1,2-Tetrachloroethane	0.05 ug/g dry	-	<0.05	-	-
1,1,2,2-Tetrachloroethane	0.05 ug/g dry	-	<0.05	-	-
Tetrachloroethylene	0.05 ug/g dry	-	<0.05	-	-
Toluene	0.05 ug/g dry	-	<0.05	-	-
1,1,1-Trichloroethane	0.05 ug/g dry	-	<0.05	-	-
1,1,2-Trichloroethane	0.05 ug/g dry	-	<0.05	-	-
Trichloroethylene	0.05 ug/g dry	-	<0.05	-	-
Trichlorofluoromethane	0.05 ug/g dry	-	<0.05	-	-
Vinyl chloride	0.02 ug/g dry	-	<0.02	-	-
m,p-Xylenes	0.05 ug/g dry	-	<0.05	-	-
o-Xylene	0.05 ug/g dry	-	<0.05	-	-
Xylenes, total	0.05 ug/g dry	-	<0.05	-	-
4-Bromofluorobenzene	Surrogate	-	107%	-	-
Dibromofluoromethane	Surrogate	-	112%	-	-
Toluene-d8	Surrogate	-	92.7%	-	-
Benzene	0.02 ug/g dry	<0.02	-	-	<0.02
Ethylbenzene	0.05 ug/g dry	<0.05	-	-	<0.05

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 21713

Report Date: 29-Aug-2017

Order Date: 23-Aug-2017

Project Description: PE3651

	Client ID:	BH1-SS2	BH1-SS6	BH3-SS2	BH5-SS5
	Sample Date:	21-Aug-17	21-Aug-17	22-Aug-17	22-Aug-17
	Sample ID:	1734326-01	1734326-02	1734326-03	1734326-04
	MDL/Units	Soil	Soil	Soil	Soil
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	91.4%	-	-	90.7%
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	111	-	-	<8
F4 PHCs (C34-C50)	6 ug/g dry	268 [1]	-	-	<6
F4G PHCs (gravimetric)	50 ug/g dry	447	-	-	-
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	0.18	-	0.15	-
Acenaphthylene	0.02 ug/g dry	0.13	-	0.03	-
Anthracene	0.02 ug/g dry	0.95	-	0.32	-
Benzo [a] anthracene	0.02 ug/g dry	2.47	-	0.66	-
Benzo [a] pyrene	0.02 ug/g dry	3.29	-	0.59	-
Benzo [b] fluoranthene	0.02 ug/g dry	3.68	-	0.67	-
Benzo [g,h,i] perylene	0.02 ug/g dry	2.24	-	0.32	-
Benzo [k] fluoranthene	0.02 ug/g dry	2.16	-	0.40	-
Chrysene	0.02 ug/g dry	2.65	-	0.72	-
Dibenzo [a,h] anthracene	0.02 ug/g dry	0.69	-	0.11	-
Fluoranthene	0.02 ug/g dry	5.38	-	1.71	-
Fluorene	0.02 ug/g dry	0.36	-	0.15	-
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	2.20	-	0.32	-
1-Methylnaphthalene	0.02 ug/g dry	0.04	-	0.04	-
2-Methylnaphthalene	0.02 ug/g dry	0.06	-	0.04	-
Methylnaphthalene (1&2)	0.04 ug/g dry	0.10	-	0.08	-
Naphthalene	0.01 ug/g dry	0.15	-	0.09	-
Phenanthrene	0.02 ug/g dry	2.85	-	1.48	-
Pyrene	0.02 ug/g dry	4.49	-	1.36	-
2-Fluorobiphenyl	Surrogate	77.8%	-	72.2%	-
Terphenyl-d14	Surrogate	94.1%	-	91.6%	-

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						
F4G PHCs (gravimetric)	ND	50	ug/g						
Metals									
Antimony	ND	1.0	ug/g						
Arsenic	ND	1.0	ug/g						
Barium	ND	1.0	ug/g						
Beryllium	ND	1.0	ug/g						
Boron, available	ND	0.5	ug/g						
Boron	ND	1.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium (VI)	ND	0.2	ug/g						
Chromium	ND	1.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	1.0	ug/g						
Lead	ND	1.0	ug/g						
Mercury	ND	0.1	ug/g						
Molybdenum	ND	1.0	ug/g						
Nickel	ND	1.0	ug/g						
Selenium	ND	1.0	ug/g						
Silver	ND	0.5	ug/g						
Thallium	ND	1.0	ug/g						
Uranium	ND	1.0	ug/g						
Vanadium	ND	1.0	ug/g						
Zinc	ND	1.0	ug/g						
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g						
Acenaphthylene	ND	0.02	ug/g						
Anthracene	ND	0.02	ug/g						
Benzo [a] anthracene	ND	0.02	ug/g						
Benzo [a] pyrene	ND	0.02	ug/g						
Benzo [b] fluoranthene	ND	0.02	ug/g						
Benzo [g,h,i] perylene	ND	0.02	ug/g						
Benzo [k] fluoranthene	ND	0.02	ug/g						
Chrysene	ND	0.02	ug/g						
Dibenzo [a,h] anthracene	ND	0.02	ug/g						
Fluoranthene	ND	0.02	ug/g						
Fluorene	ND	0.02	ug/g						
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g						
1-Methylnaphthalene	ND	0.02	ug/g						
2-Methylnaphthalene	ND	0.02	ug/g						
Methylnaphthalene (1&2)	ND	0.04	ug/g						
Naphthalene	ND	0.01	ug/g						
Phenanthrene	ND	0.02	ug/g						
Pyrene	ND	0.02	ug/g						
Surrogate: 2-Fluorobiphenyl	*1.20*		*ug/g*		*89.9*	*50-140*			
Surrogate: Terphenyl-d14	*1.16*		*ug/g*		*87.2*	*50-140*			
Volatiles									
Acetone	ND	0.50	ug/g						
Benzene	ND	0.02	ug/g						
Bromodichloromethane	ND	0.05	ug/g						
Bromoform	ND	0.05	ug/g						
Bromomethane	ND	0.05	ug/g						
Carbon Tetrachloride	ND	0.05	ug/g						
Chlorobenzene	ND	0.05	ug/g						
Chloroform	ND	0.05	ug/g						
Dibromochloromethane	ND	0.05	ug/g						

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Dichlorodifluoromethane	ND	0.05	ug/g						
1,2-Dichlorobenzene	ND	0.05	ug/g						
1,3-Dichlorobenzene	ND	0.05	ug/g						
1,4-Dichlorobenzene	ND	0.05	ug/g						
1,1-Dichloroethane	ND	0.05	ug/g						
1,2-Dichloroethane	ND	0.05	ug/g						
1,1-Dichloroethylene	ND	0.05	ug/g						
cis-1,2-Dichloroethylene	ND	0.05	ug/g						
trans-1,2-Dichloroethylene	ND	0.05	ug/g						
1,2-Dichloropropane	ND	0.05	ug/g						
cis-1,3-Dichloropropylene	ND	0.05	ug/g						
trans-1,3-Dichloropropylene	ND	0.05	ug/g						
1,3-Dichloropropene, total	ND	0.05	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Ethylene dibromide (dibromoethane	ND	0.05	ug/g						
Hexane	ND	0.05	ug/g						
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g						
Methyl Isobutyl Ketone	ND	0.50	ug/g						
Methyl tert-butyl ether	ND	0.05	ug/g						
Methylene Chloride	ND	0.05	ug/g						
Styrene	ND	0.05	ug/g						
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g						
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g						
Tetrachloroethylene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
1,1,1-Trichloroethane	ND	0.05	ug/g						
1,1,2-Trichloroethane	ND	0.05	ug/g						
Trichloroethylene	ND	0.05	ug/g						
Trichlorofluoromethane	ND	0.05	ug/g						
Vinyl chloride	ND	0.02	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: 4-Bromofluorobenzene	*3.34*		*ug/g*		*104*	*50-140*			
Surrogate: Dibromofluoromethane	*3.30*		*ug/g*		*103*	*50-140*			
Surrogate: Toluene-d8	*3.07*		*ug/g*		*96.0*	*50-140*			
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	*3.07*		*ug/g*		*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	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND				30	
F3 PHCs (C16-C34)	143	8	ug/g dry	131			8.4	30	
F4 PHCs (C34-C50)	148	6	ug/g dry	108			31.4	30	QR-04
Metals									
Antimony	ND	1.0	ug/g dry	ND			0.0	30	
Arsenic	ND	1.0	ug/g dry	ND				30	
Barium	55.0	1.0	ug/g dry	55.5			1.0	30	
Beryllium	ND	1.0	ug/g dry	ND			0.0	30	
Boron, available	ND	0.5	ug/g dry	ND			0.0	35	
Boron	7.34	1.0	ug/g dry	8.15			10.4	30	
Cadmium	ND	0.5	ug/g dry	ND			0.0	30	
Chromium (VI)	ND	0.2	ug/g dry	ND				35	
Chromium	13.5	1.0	ug/g dry	13.8			2.0	30	
Cobalt	7.83	1.0	ug/g dry	7.49			4.5	30	
Copper	19.6	1.0	ug/g dry	19.2			2.0	30	
Lead	9.81	1.0	ug/g dry	8.58			13.3	30	
Mercury	ND	0.1	ug/g dry	ND			0.0	30	
Molybdenum	ND	1.0	ug/g dry	ND			0.0	30	
Nickel	18.3	1.0	ug/g dry	18.0			1.8	30	
Selenium	ND	1.0	ug/g dry	ND			0.0	30	
Silver	ND	0.5	ug/g dry	ND			0.0	30	
Thallium	ND	1.0	ug/g dry	ND			0.0	30	
Uranium	ND	1.0	ug/g dry	ND				30	
Vanadium	21.0	1.0	ug/g dry	21.6			2.5	30	
Zinc	40.3	1.0	ug/g dry	39.1			3.1	30	
Physical Characteristics									
% Solids	89.1	0.1	% by Wt.	87.4			1.9	25	
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g dry	ND				40	
Acenaphthylene	0.047	0.02	ug/g dry	0.033			35.5	40	
Anthracene	0.027	0.02	ug/g dry	0.022			22.6	40	
Benzo [a] anthracene	0.074	0.02	ug/g dry	0.044			50.5	40	QR-01
Benzo [a] pyrene	0.096	0.02	ug/g dry	0.063			41.0	40	QR-01
Benzo [b] fluoranthene	0.103	0.02	ug/g dry	0.084			20.4	40	
Benzo [g,h,i] perylene	0.075	0.02	ug/g dry	0.050			38.9	40	
Benzo [k] fluoranthene	0.050	0.02	ug/g dry	0.037			28.3	40	
Chrysene	0.084	0.02	ug/g dry	0.062			29.3	40	
Dibenzo [a,h] anthracene	ND	0.02	ug/g dry	ND			0.0	40	
Fluoranthene	0.199	0.02	ug/g dry	0.115			54.1	40	QR-01
Fluorene	ND	0.02	ug/g dry	ND				40	
Indeno [1,2,3-cd] pyrene	0.072	0.02	ug/g dry	0.044			47.6	40	QR-01
1-Methylnaphthalene	ND	0.02	ug/g dry	ND				40	
2-Methylnaphthalene	ND	0.02	ug/g dry	ND			0.0	40	
Naphthalene	ND	0.01	ug/g dry	ND			0.0	40	
Phenanthrene	0.080	0.02	ug/g dry	0.060			28.8	40	
Pyrene	0.183	0.02	ug/g dry	0.103			56.0	40	QR-01
Surrogate: 2-Fluorobiphenyl	*1.67*		*ug/g dry*		*113*	*50-140*			
Surrogate: Terphenyl-d14	*1.37*		*ug/g dry*		*92.2*	*50-140*			
Volatiles									
Acetone	ND	0.50	ug/g dry	ND				50	
Benzene	ND	0.02	ug/g dry	ND				50	
Bromodichloromethane	ND	0.05	ug/g dry	ND				50	
Bromoform	ND	0.05	ug/g dry	ND				50	
Bromomethane	ND	0.05	ug/g dry	ND				50	
Carbon Tetrachloride	ND	0.05	ug/g dry	ND				50	
Chlorobenzene	ND	0.05	ug/g dry	ND				50	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Chloroform	ND	0.05	ug/g dry	ND				50	
Dibromochloromethane	ND	0.05	ug/g dry	ND				50	
Dichlorodifluoromethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,3-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,4-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
cis-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
trans-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
1,2-Dichloropropane	ND	0.05	ug/g dry	ND				50	
cis-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
trans-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Ethylene dibromide (dibromoethane	ND	0.05	ug/g dry	ND				50	
Hexane	ND	0.05	ug/g dry	ND				50	
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g dry	ND				50	
Methyl Isobutyl Ketone	ND	0.50	ug/g dry	ND				50	
Methyl tert-butyl ether	ND	0.05	ug/g dry	ND				50	
Methylene Chloride	ND	0.05	ug/g dry	ND				50	
Styrene	ND	0.05	ug/g dry	ND				50	
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
Tetrachloroethylene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
1,1,1-Trichloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2-Trichloroethane	ND	0.05	ug/g dry	ND				50	
Trichloroethylene	ND	0.05	ug/g dry	ND				50	
Trichlorofluoromethane	ND	0.05	ug/g dry	ND				50	
Vinyl chloride	ND	0.02	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: 4-Bromofluorobenzene	*2.03*		*ug/g dry*		*107*	*50-140*			
Surrogate: Dibromofluoromethane	*2.03*		*ug/g dry*		*107*	*50-140*			
Surrogate: Toluene-d8	*1.83*		*ug/g dry*		*97.0*	*50-140*			
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	*1.83*		*ug/g dry*		*97.0*	*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)	218	7	ug/g		109	80-120			
F2 PHCs (C10-C16)	99	4	ug/g	ND	102	60-140			
F3 PHCs (C16-C34)	336	8	ug/g	131	102	60-140			
F4 PHCs (C34-C50)	264	6	ug/g	108	117	60-140			
F4G PHCs (gravimetric)	820	50	ug/g		82.0	80-120			
Metals									
Antimony	262		ug/L	18.7	97.5	70-130			
Arsenic	321		ug/L	ND	128	70-130			
Barium	1310		ug/L	1110	80.5	70-130			
Beryllium	234		ug/L	4.09	92.1	70-130			
Boron, available	4.53	0.5	ug/g	ND	90.6	70-122			
Boron	388		ug/L	163	89.9	70-130			
Cadmium	225		ug/L	3.17	88.9	70-130			
Chromium (VI)	4.4	0.2	ug/g		87.0	70-130			
Chromium	473		ug/L	276	79.1	70-130			
Cobalt	346		ug/L	150	78.5	70-130			
Copper	613		ug/L	385	91.4	70-130			
Lead	387		ug/L	172	86.1	70-130			
Mercury	1.44	0.1	ug/g	ND	95.7	70-130			
Molybdenum	206		ug/L	7.15	79.4	70-130			
Nickel	554		ug/L	360	77.4	70-130			
Selenium	221		ug/L	11.3	84.1	70-130			
Silver	229		ug/L	ND	91.3	70-130			
Thallium	202		ug/L	11.4	76.1	70-130			
Uranium	267		ug/L	ND	107	70-130			
Vanadium	647		ug/L	431	86.1	70-130			
Zinc	971		ug/L	782	75.9	70-130			
Semi-Volatiles									
Acenaphthene	0.147	0.02	ug/g	ND	79.3	50-140			
Acenaphthylene	0.161	0.02	ug/g	0.033	68.8	50-140			
Anthracene	0.112	0.02	ug/g	0.022	48.5	50-140			QM-06
Benzo [a] anthracene	0.167	0.02	ug/g	0.044	66.1	50-140			
Benzo [a] pyrene	0.194	0.02	ug/g	0.063	70.4	50-140			
Benzo [b] fluoranthene	0.292	0.02	ug/g	0.084	112	50-140			
Benzo [g,h,i] perylene	0.215	0.02	ug/g	0.050	88.6	50-140			
Benzo [k] fluoranthene	0.204	0.02	ug/g	0.037	90.0	50-140			
Chrysene	0.225	0.02	ug/g	0.062	87.8	50-140			
Dibenzo [a,h] anthracene	0.172	0.02	ug/g	ND	92.5	50-140			
Fluoranthene	0.274	0.02	ug/g	0.115	86.1	50-140			
Fluorene	0.148	0.02	ug/g	ND	80.0	50-140			
Indeno [1,2,3-cd] pyrene	0.214	0.02	ug/g	0.044	91.8	50-140			
1-Methylnaphthalene	0.149	0.02	ug/g	ND	80.1	50-140			
2-Methylnaphthalene	0.152	0.02	ug/g	ND	82.2	50-140			
Naphthalene	0.144	0.01	ug/g	ND	77.9	50-140			
Phenanthrene	0.141	0.02	ug/g	0.060	43.4	50-140			QM-06
Pyrene	0.267	0.02	ug/g	0.103	88.9	50-140			
Surrogate: 2-Fluorobiphenyl	*1.37*		*ug/g*		*92.3*	*50-140*			
Volatiles									
Acetone	6.89	0.50	ug/g		68.9	50-140			
Benzene	4.14	0.02	ug/g		104	60-130			
Bromodichloromethane	4.35	0.05	ug/g		109	60-130			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Bromoform	4.35	0.05	ug/g		109	60-130			
Bromomethane	5.15	0.05	ug/g		129	50-140			
Carbon Tetrachloride	4.01	0.05	ug/g		100	60-130			
Chlorobenzene	3.63	0.05	ug/g		90.8	60-130			
Chloroform	4.05	0.05	ug/g		101	60-130			
Dibromochloromethane	4.06	0.05	ug/g		102	60-130			
Dichlorodifluoromethane	3.21	0.05	ug/g		80.1	50-140			
1,2-Dichlorobenzene	3.67	0.05	ug/g		91.8	60-130			
1,3-Dichlorobenzene	3.59	0.05	ug/g		89.8	60-130			
1,4-Dichlorobenzene	3.45	0.05	ug/g		86.2	60-130			
1,1-Dichloroethane	3.77	0.05	ug/g		94.2	60-130			
1,2-Dichloroethane	3.81	0.05	ug/g		95.3	60-130			
1,1-Dichloroethylene	4.22	0.05	ug/g		106	60-130			
cis-1,2-Dichloroethylene	3.96	0.05	ug/g		99.1	60-130			
trans-1,2-Dichloroethylene	3.57	0.05	ug/g		89.3	60-130			
1,2-Dichloropropane	4.06	0.05	ug/g		102	60-130			
cis-1,3-Dichloropropylene	4.54	0.05	ug/g		114	60-130			
trans-1,3-Dichloropropylene	4.28	0.05	ug/g		107	60-130			
Ethylbenzene	4.17	0.05	ug/g		104	60-130			
Ethylene dibromide (dibromoethane	3.71	0.05	ug/g		92.7	60-130			
Hexane	4.43	0.05	ug/g		111	60-130			
Methyl Ethyl Ketone (2-Butanone)	7.54	0.50	ug/g		75.4	50-140			
Methyl Isobutyl Ketone	11.3	0.50	ug/g		113	50-140			
Methyl tert-butyl ether	10.6	0.05	ug/g		106	50-140			
Methylene Chloride	3.99	0.05	ug/g		99.8	60-130			
Styrene	4.24	0.05	ug/g		106	60-130			
1,1,1,2-Tetrachloroethane	4.19	0.05	ug/g		105	60-130			
1,1,2,2-Tetrachloroethane	4.48	0.05	ug/g		112	60-130			
Tetrachloroethylene	3.66	0.05	ug/g		91.4	60-130			
Toluene	3.72	0.05	ug/g		93.0	60-130			
1,1,1-Trichloroethane	4.24	0.05	ug/g		106	60-130			
1,1,2-Trichloroethane	3.95	0.05	ug/g		98.8	60-130			
Trichloroethylene	4.23	0.05	ug/g		106	60-130			
Trichlorofluoromethane	4.52	0.05	ug/g		113	50-140			
Vinyl chloride	2.87	0.02	ug/g		71.7	50-140			
m,p-Xylenes	8.08	0.05	ug/g		101	60-130			
o-Xylene	4.09	0.05	ug/g		102	60-130			
Benzene	4.14	0.02	ug/g		104	60-130			
Ethylbenzene	4.17	0.05	ug/g		104	60-130			
Toluene	3.72	0.05	ug/g		93.0	60-130			
m,p-Xylenes	8.08	0.05	ug/g		101	60-130			
o-Xylene	4.09	0.05	ug/g		102	60-130			

Qualifier Notes:

Sample Qualifiers :

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

QC Qualifiers :

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

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

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

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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

CCME PHC additional information:

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

Paracel ID: 1734326

PARACEL | TRUSTED . RESPONSIVE . RELIABLE .

LABORATORIES LTD.

e: paracel@paracellabs.com

Chain of Custody (Lab Use Only) № 111849

Page 1 of 1

Client Name: Paterson Group Inc.	Project Reference: PE3651	**Turnaround Time:**
Contact Name: Karyn Munch	Quote #	☐ 1 Day ☐ 3 Day
Address: 154 Colonnade Rd S	PO # 21713	☐ 2 Day ☒ Regular
Telephone: 613-226-7381	Email Address: kmunch@patersongroup.ca	Date Required:

Criteria: ☒ O. Reg. 153/04 (As Amended) Table 3 ✓ 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:

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)							
1	BH1-SS2 ✓	S		(2) X ✓	Aug.21/17	am	✓		✓	✓	✓	✓	✓			250ml +1 vial				✓
2	BH1-SS6 *	S		2	Aug.21/17	am		✓								120ml + 1 vial				✓
3	BH3-SS2	S		1	Aug.22/17	am			✓	✓	✓	✓	✓			250ml				✓
4	BH4-SS2 **	S		1	Aug.21/17	pm			✓	✓	✓	✓	✓			120ml				✓
5	BH5-SS5	S		2	Aug.22/17	am	✓									120ml + 1 vial				✓
6																				
7																				
8																				
9																				
10																				

Comments: * 2 jars provided, although VOC testing only ** please hold BH4 analyses for now

Method of Delivery: Paracel

Relinquished By (Sign): KMunch	Received by Driver/Depot: M. Rouse	Received at Lab: Sumetporn Dokmai	Verified By: [signature]
Relinquished By (Print): Karyn Munch	Date/Time: 23/08/17 4:00 PM	Date/Time: Aug 23 2017 05.37	Date/Time: 08/24/17 10:43
Date/Time: Aug.23, 11:00 2017	Temperature: °C	Temperature: 20.6 °C	pH Verified [ ] By:

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

PARACEL LABORATORIES LTD.
TRUSTED. RESPONSIVE. RELIABLE.

300 - 2319 St. Laurent Blvd
Ottawa, ON, K1G 4J8
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Karyn Munch

Client PO: 21714
Project: PE3651
Custody: 111850

Report Date: 1-Sep-2017
Order Date: 25-Aug-2017

Order #: 1735033

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

Paracel ID	Client ID
1735033-01	BH2-G1/SS2
1735033-02	BH2-SS8
1735033-03	BH3-SS6
1735033-04	BH6-SS2

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 21714

Report Date: 01-Sep-2017
Order Date: 25-Aug-2017
Project Description: PE3651

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Boron, available	MOE (HWE), EPA 200.7 - ICP-OES	30-Aug-17	30-Aug-17
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	30-Aug-17	1-Sep-17
Chromium, hexavalent - soil	MOE E3056 - Extraction, colourimetric	26-Aug-17	30-Aug-17
Mercury by CVAA	EPA 7471B - CVAA, digestion	31-Aug-17	31-Aug-17
PHC F1	CWS Tier 1 - P&T GC-FID	30-Aug-17	1-Sep-17
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	26-Aug-17	29-Aug-17
REG 153: Metals by ICP/OES, soil	based on MOE E3470, ICP-OES	31-Aug-17	31-Aug-17
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	25-Aug-17	30-Aug-17
REG 153: VOCs by P&T GC/MS	EPA 8260 - P&T GC-MS	30-Aug-17	1-Sep-17
Solids, %	Gravimetric, calculation	29-Aug-17	29-Aug-17

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 21714

Report Date: 01-Sep-2017
Order Date: 25-Aug-2017
Project Description: PE3651

	Client ID:	BH2-G1/SS2	BH2-SS8	BH3-SS6	BH6-SS2
	Sample Date:	24-Aug-17	24-Aug-17	22-Aug-17	24-Aug-17
	Sample ID:	1735033-01	1735033-02	1735033-03	1735033-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	72.5	89.1	81.4	82.2
Metals					
Antimony	1.0 ug/g dry	-	-	-	97.9
Arsenic	1.0 ug/g dry	-	-	-	4.2
Barium	1.0 ug/g dry	-	-	-	181
Beryllium	1.0 ug/g dry	-	-	-	<1.0
Boron	1.0 ug/g dry	-	-	-	5.9
Boron, available	0.5 ug/g dry	-	-	-	0.8
Cadmium	0.5 ug/g dry	-	-	-	<0.5
Chromium	1.0 ug/g dry	-	-	-	41.3
Chromium (VI)	0.2 ug/g dry	-	-	-	<0.2
Cobalt	1.0 ug/g dry	-	-	-	8.4
Copper	1.0 ug/g dry	-	-	-	49.3
Lead	1.0 ug/g dry	-	-	-	551
Mercury	0.1 ug/g dry	-	-	-	1.1
Molybdenum	1.0 ug/g dry	-	-	-	<1.0
Nickel	1.0 ug/g dry	-	-	-	19.4
Selenium	1.0 ug/g dry	-	-	-	<1.0
Silver	0.5 ug/g dry	-	-	-	<0.5
Thallium	1.0 ug/g dry	-	-	-	<1.0
Uranium	1.0 ug/g dry	-	-	-	<1.0
Vanadium	1.0 ug/g dry	-	-	-	44.8
Zinc	1.0 ug/g dry	-	-	-	86.1
Volatiles					
Acetone	0.50 ug/g dry	-	<0.50	<0.50	-
Benzene	0.02 ug/g dry	-	<0.02	<0.02	-
Bromodichloromethane	0.05 ug/g dry	-	<0.05	<0.05	-
Bromoform	0.05 ug/g dry	-	<0.05	<0.05	-
Bromomethane	0.05 ug/g dry	-	<0.05	<0.05	-
Carbon Tetrachloride	0.05 ug/g dry	-	<0.05	<0.05	-
Chlorobenzene	0.05 ug/g dry	-	<0.05	<0.05	-
Chloroform	0.05 ug/g dry	-	<0.05	<0.05	-
Dibromochloromethane	0.05 ug/g dry	-	<0.05	<0.05	-
Dichlorodifluoromethane	0.05 ug/g dry	-	<0.05	<0.05	-
1,2-Dichlorobenzene	0.05 ug/g dry	-	<0.05	<0.05	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 21714

Report Date: 01-Sep-2017
Order Date: 25-Aug-2017
Project Description: PE3651

	Client ID:	BH2-G1/SS2	BH2-SS8	BH3-SS6	BH6-SS2
	Sample Date:	24-Aug-17	24-Aug-17	22-Aug-17	24-Aug-17
	Sample ID:	1735033-01	1735033-02	1735033-03	1735033-04
	MDL/Units	Soil	Soil	Soil	Soil
1,3-Dichlorobenzene	0.05 ug/g dry	-	<0.05	<0.05	-
1,4-Dichlorobenzene	0.05 ug/g dry	-	<0.05	<0.05	-
1,1-Dichloroethane	0.05 ug/g dry	-	<0.05	<0.05	-
1,2-Dichloroethane	0.05 ug/g dry	-	<0.05	<0.05	-
1,1-Dichloroethylene	0.05 ug/g dry	-	<0.05	<0.05	-
cis-1,2-Dichloroethylene	0.05 ug/g dry	-	<0.05	<0.05	-
trans-1,2-Dichloroethylene	0.05 ug/g dry	-	<0.05	<0.05	-
1,2-Dichloropropane	0.05 ug/g dry	-	<0.05	<0.05	-
cis-1,3-Dichloropropylene	0.05 ug/g dry	-	<0.05	<0.05	-
trans-1,3-Dichloropropylene	0.05 ug/g dry	-	<0.05	<0.05	-
1,3-Dichloropropene, total	0.05 ug/g dry	-	<0.05	<0.05	-
Ethylbenzene	0.05 ug/g dry	-	<0.05	<0.05	-
Ethylene dibromide (dibromoethan	0.05 ug/g dry	-	<0.05	<0.05	-
Hexane	0.05 ug/g dry	-	<0.05	<0.05	-
Methyl Ethyl Ketone (2-Butanone)	0.50 ug/g dry	-	<0.50	<0.50	-
Methyl Isobutyl Ketone	0.50 ug/g dry	-	<0.50	<0.50	-
Methyl tert-butyl ether	0.05 ug/g dry	-	<0.05	<0.05	-
Methylene Chloride	0.05 ug/g dry	-	<0.05	<0.05	-
Styrene	0.05 ug/g dry	-	<0.05	<0.05	-
1,1,1,2-Tetrachloroethane	0.05 ug/g dry	-	<0.05	<0.05	-
1,1,2,2-Tetrachloroethane	0.05 ug/g dry	-	<0.05	<0.05	-
Tetrachloroethylene	0.05 ug/g dry	-	<0.05	<0.05	-
Toluene	0.05 ug/g dry	-	<0.05	<0.05	-
1,1,1-Trichloroethane	0.05 ug/g dry	-	<0.05	<0.05	-
1,1,2-Trichloroethane	0.05 ug/g dry	-	<0.05	<0.05	-
Trichloroethylene	0.05 ug/g dry	-	<0.05	<0.05	-
Trichlorofluoromethane	0.05 ug/g dry	-	<0.05	<0.05	-
Vinyl chloride	0.02 ug/g dry	-	<0.02	<0.02	-
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	-
4-Bromofluorobenzene	Surrogate	-	108%	109%	-
Dibromofluoromethane	Surrogate	-	107%	70.4%	-
Toluene-d8	Surrogate	-	113%	109%	-
Benzene	0.02 ug/g dry	-	-	-	<0.02
Ethylbenzene	0.05 ug/g dry	-	-	-	<0.05

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 21714

Report Date: 01-Sep-2017
Order Date: 25-Aug-2017
Project Description: PE3651

	Client ID:	BH2-G1/SS2	BH2-SS8	BH3-SS6	BH6-SS2
	Sample Date:	24-Aug-17	24-Aug-17	22-Aug-17	24-Aug-17
	Sample ID:	1735033-01	1735033-02	1735033-03	1735033-04
	MDL/Units	Soil	Soil	Soil	Soil
Toluene	0.05 ug/g dry	-	-	-	<0.05
m,p-Xylenes	0.05 ug/g dry	-	-	-	<0.05
o-Xylene	0.05 ug/g dry	-	-	-	<0.05
Xylenes, total	0.05 ug/g dry	-	-	-	<0.05
Toluene-d8	Surrogate	-	-	-	108%
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	-	-	-	<7
F2 PHCs (C10-C16)	4 ug/g dry	-	-	-	<4
F3 PHCs (C16-C34)	8 ug/g dry	-	-	-	<8
F4 PHCs (C34-C50)	6 ug/g dry	-	-	-	<6
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	0.43	-	-	-
Acenaphthylene	0.02 ug/g dry	0.74	-	-	-
Anthracene	0.02 ug/g dry	2.01	-	-	-
Benzo [a] anthracene	0.02 ug/g dry	3.16	-	-	-
Benzo [a] pyrene	0.02 ug/g dry	2.82	-	-	-
Benzo [b] fluoranthene	0.02 ug/g dry	2.77	-	-	-
Benzo [g,h,i] perylene	0.02 ug/g dry	1.35	-	-	-
Benzo [k] fluoranthene	0.02 ug/g dry	1.82	-	-	-
Chrysene	0.02 ug/g dry	3.07	-	-	-
Dibenzo [a,h] anthracene	0.02 ug/g dry	0.50	-	-	-
Fluoranthene	0.02 ug/g dry	8.52	-	-	-
Fluorene	0.02 ug/g dry	0.68	-	-	-
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	1.48	-	-	-
1-Methylnaphthalene	0.02 ug/g dry	0.18	-	-	-
2-Methylnaphthalene	0.02 ug/g dry	0.26	-	-	-
Methylnaphthalene (1&2)	0.04 ug/g dry	0.44	-	-	-
Naphthalene	0.01 ug/g dry	0.66	-	-	-
Phenanthrene	0.02 ug/g dry	6.47	-	-	-
Pyrene	0.02 ug/g dry	6.79	-	-	-
2-Fluorobiphenyl	Surrogate	90.0%	-	-	-
Terphenyl-d14	Surrogate	96.2%	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Metals									
Antimony	ND	1.0	ug/g						
Arsenic	ND	1.0	ug/g						
Barium	ND	1.0	ug/g						
Beryllium	ND	1.0	ug/g						
Boron, available	ND	0.5	ug/g						
Boron	ND	1.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium (VI)	ND	0.2	ug/g						
Chromium	ND	1.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	1.0	ug/g						
Lead	ND	1.0	ug/g						
Mercury	ND	0.1	ug/g						
Molybdenum	ND	1.0	ug/g						
Nickel	ND	1.0	ug/g						
Selenium	ND	1.0	ug/g						
Silver	ND	0.5	ug/g						
Thallium	ND	1.0	ug/g						
Uranium	ND	1.0	ug/g						
Vanadium	ND	1.0	ug/g						
Zinc	ND	1.0	ug/g						
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g						
Acenaphthylene	ND	0.02	ug/g						
Anthracene	ND	0.02	ug/g						
Benzo [a] anthracene	ND	0.02	ug/g						
Benzo [a] pyrene	ND	0.02	ug/g						
Benzo [b] fluoranthene	ND	0.02	ug/g						
Benzo [g,h,i] perylene	ND	0.02	ug/g						
Benzo [k] fluoranthene	ND	0.02	ug/g						
Chrysene	ND	0.02	ug/g						
Dibenzo [a,h] anthracene	ND	0.02	ug/g						
Fluoranthene	ND	0.02	ug/g						
Fluorene	ND	0.02	ug/g						
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g						
1-Methylnaphthalene	ND	0.02	ug/g						
2-Methylnaphthalene	ND	0.02	ug/g						
Methylnaphthalene (1&2)	ND	0.04	ug/g						
Naphthalene	ND	0.01	ug/g						
Phenanthrene	ND	0.02	ug/g						
Pyrene	ND	0.02	ug/g						
Surrogate: 2-Fluorobiphenyl	*1.15*		*ug/g*		*86.3*	*50-140*			
Surrogate: Terphenyl-d14	*1.50*		*ug/g*		*113*	*50-140*			
Volatiles									
Acetone	ND	0.50	ug/g						
Benzene	ND	0.02	ug/g						
Bromodichloromethane	ND	0.05	ug/g						
Bromoform	ND	0.05	ug/g						
Bromomethane	ND	0.05	ug/g						
Carbon Tetrachloride	ND	0.05	ug/g						
Chlorobenzene	ND	0.05	ug/g						
Chloroform	ND	0.05	ug/g						
Dibromochloromethane	ND	0.05	ug/g						
Dichlorodifluoromethane	ND	0.05	ug/g						

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
1,2-Dichlorobenzene	ND	0.05	ug/g						
1,3-Dichlorobenzene	ND	0.05	ug/g						
1,4-Dichlorobenzene	ND	0.05	ug/g						
1,1-Dichloroethane	ND	0.05	ug/g						
1,2-Dichloroethane	ND	0.05	ug/g						
1,1-Dichloroethylene	ND	0.05	ug/g						
cis-1,2-Dichloroethylene	ND	0.05	ug/g						
trans-1,2-Dichloroethylene	ND	0.05	ug/g						
1,2-Dichloropropane	ND	0.05	ug/g						
cis-1,3-Dichloropropylene	ND	0.05	ug/g						
trans-1,3-Dichloropropylene	ND	0.05	ug/g						
1,3-Dichloropropene, total	ND	0.05	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Ethylene dibromide (dibromoethane	ND	0.05	ug/g						
Hexane	ND	0.05	ug/g						
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g						
Methyl Isobutyl Ketone	ND	0.50	ug/g						
Methyl tert-butyl ether	ND	0.05	ug/g						
Methylene Chloride	ND	0.05	ug/g						
Styrene	ND	0.05	ug/g						
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g						
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g						
Tetrachloroethylene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
1,1,1-Trichloroethane	ND	0.05	ug/g						
1,1,2-Trichloroethane	ND	0.05	ug/g						
Trichloroethylene	ND	0.05	ug/g						
Trichlorofluoromethane	ND	0.05	ug/g						
Vinyl chloride	ND	0.02	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: 4-Bromofluorobenzene	*2.96*		*ug/g*		*92.4*	*50-140*			
Surrogate: Dibromofluoromethane	*2.49*		*ug/g*		*77.9*	*50-140*			
Surrogate: Toluene-d8	*3.44*		*ug/g*		*108*	*50-140*			
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	*3.44*		*ug/g*		*108*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND				30	
F3 PHCs (C16-C34)	ND	8	ug/g dry	ND				30	
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND				30	
Metals									
Antimony	ND	1.0	ug/g dry	ND				30	
Arsenic	ND	1.0	ug/g dry	ND				30	
Barium	124	1.0	ug/g dry	133			7.2	30	
Beryllium	ND	1.0	ug/g dry	ND			0.0	30	
Boron, available	1.12	0.5	ug/g dry	1.25			10.9	35	
Boron	6.11	1.0	ug/g dry	6.09			0.4	30	
Cadmium	ND	0.5	ug/g dry	ND			0.0	30	
Chromium (VI)	ND	0.2	ug/g dry	ND				35	
Chromium	29.9	1.0	ug/g dry	34.9			15.4	30	
Cobalt	8.87	1.0	ug/g dry	9.92			11.1	30	
Copper	25.2	1.0	ug/g dry	28.6			12.6	30	
Lead	24.6	1.0	ug/g dry	27.1			9.9	30	
Mercury	ND	0.1	ug/g dry	ND			0.0	30	
Molybdenum	ND	1.0	ug/g dry	ND			0.0	30	
Nickel	19.3	1.0	ug/g dry	20.7			7.0	30	
Selenium	ND	1.0	ug/g dry	ND			0.0	30	
Silver	ND	0.5	ug/g dry	ND			0.0	30	
Thallium	ND	1.0	ug/g dry	ND			0.0	30	
Uranium	ND	1.0	ug/g dry	ND				30	
Vanadium	40.2	1.0	ug/g dry	43.9			8.9	30	
Zinc	74.0	1.0	ug/g dry	81.6			9.8	30	
Physical Characteristics									
% Solids	82.9	0.1	% by Wt.	83.1			0.3	25	
Semi-Volatiles									
Acenaphthene	0.034	0.02	ug/g dry	0.036			6.3	40	
Acenaphthylene	0.051	0.02	ug/g dry	0.082			45.8	40	QR-04
Anthracene	0.121	0.02	ug/g dry	0.162			28.9	40	
Benzo [a] anthracene	0.231	0.02	ug/g dry	0.500			73.4	40	QR-04
Benzo [a] pyrene	0.253	0.02	ug/g dry	0.502			66.0	40	QR-04
Benzo [b] fluoranthene	0.294	0.02	ug/g dry	0.634			73.3	40	QR-04
Benzo [g,h,i] perylene	0.194	0.02	ug/g dry	0.350			57.6	40	QR-04
Benzo [k] fluoranthene	0.151	0.02	ug/g dry	0.332			75.1	40	QR-04
Chrysene	0.266	0.02	ug/g dry	0.481			57.4	40	QR-04
Dibenzo [a,h] anthracene	0.043	0.02	ug/g dry	0.082			61.5	40	QR-04
Fluoranthene	0.595	0.02	ug/g dry	1.56			89.7	40	QR-04
Fluorene	0.042	0.02	ug/g dry	0.038			10.2	40	
Indeno [1,2,3-cd] pyrene	0.159	0.02	ug/g dry	0.307			63.4	40	QR-04
1-Methylnaphthalene	0.061	0.02	ug/g dry	0.058			5.1	40	
2-Methylnaphthalene	0.079	0.02	ug/g dry	0.073			7.7	40	
Naphthalene	0.088	0.01	ug/g dry	0.081			8.1	40	
Phenanthrene	0.440	0.02	ug/g dry	0.389			12.2	40	
Pyrene	0.537	0.02	ug/g dry	1.50			94.3	40	QR-04
Surrogate: 2-Fluorobiphenyl	*1.02*		*ug/g dry*		*70.9*	*50-140*			
Surrogate: Terphenyl-d14	*1.31*		*ug/g dry*		*91.4*	*50-140*			
Volatiles									
Acetone	ND	0.50	ug/g dry	ND				50	
Benzene	ND	0.02	ug/g dry	ND				50	
Bromodichloromethane	ND	0.05	ug/g dry	ND				50	
Bromoform	ND	0.05	ug/g dry	ND				50	
Bromomethane	ND	0.05	ug/g dry	ND				50	
Carbon Tetrachloride	ND	0.05	ug/g dry	ND				50	
Chlorobenzene	ND	0.05	ug/g dry	ND				50	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Chloroform	ND	0.05	ug/g dry	ND				50	
Dibromochloromethane	ND	0.05	ug/g dry	ND				50	
Dichlorodifluoromethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,3-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,4-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
cis-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
trans-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
1,2-Dichloropropane	ND	0.05	ug/g dry	ND				50	
cis-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
trans-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Ethylene dibromide (dibromoethane	ND	0.05	ug/g dry	ND				50	
Hexane	ND	0.05	ug/g dry	ND				50	
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g dry	ND				50	
Methyl Isobutyl Ketone	ND	0.50	ug/g dry	ND				50	
Methyl tert-butyl ether	ND	0.05	ug/g dry	ND				50	
Methylene Chloride	ND	0.05	ug/g dry	ND				50	
Styrene	ND	0.05	ug/g dry	ND				50	
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
Tetrachloroethylene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
1,1,1-Trichloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2-Trichloroethane	ND	0.05	ug/g dry	ND				50	
Trichloroethylene	ND	0.05	ug/g dry	ND				50	
Trichlorofluoromethane	ND	0.05	ug/g dry	ND				50	
Vinyl chloride	ND	0.02	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: 4-Bromofluorobenzene	*2.78*		*ug/g dry*		*105*	*50-140*			
Surrogate: Dibromofluoromethane	*1.69*		*ug/g dry*		*63.8*	*50-140*			
Surrogate: Toluene-d8	*2.88*		*ug/g dry*		*109*	*50-140*			
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	*2.88*		*ug/g dry*		*109*	*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)	200	7	ug/g		99.9	80-120			
F2 PHCs (C10-C16)	97	4	ug/g	ND	89.9	60-140			
F3 PHCs (C16-C34)	228	8	ug/g	ND	102	60-140			
F4 PHCs (C34-C50)	165	6	ug/g	ND	110	60-140			
Metals									
Antimony	284		ug/L	ND	114	70-130			
Arsenic	400		ug/L	125	110	70-130			
Barium	2940		ug/L	2670	108	70-130			
Beryllium	264		ug/L	ND	105	70-130			
Boron, available	4.77	0.5	ug/g	1.25	70.5	70-122			
Boron	386		ug/L	122	106	70-130			
Cadmium	258		ug/L	2.26	102	70-130			
Chromium (VI)	0.1		mg/L	ND	74.0	70-130			
Chromium	896		ug/L	698	79.2	70-130			
Cobalt	443		ug/L	198	97.8	70-130			
Copper	835		ug/L	572	105	70-130			
Lead	755		ug/L	542	85.1	70-130			
Mercury	1.50	0.1	ug/g	ND	100	70-130			
Molybdenum	253		ug/L	14.6	95.5	70-130			
Nickel	656		ug/L	414	96.6	70-130			
Selenium	250		ug/L	ND	99.9	70-130			
Silver	261		ug/L	6.20	102	70-130			
Thallium	219		ug/L	15.0	81.8	70-130			
Uranium	323		ug/L	ND	129	70-130			
Vanadium	1140		ug/L	878	104	70-130			
Zinc	1840		ug/L	1630	81.4	70-130			
Semi-Volatiles									
Acenaphthene	0.147	0.02	ug/g		88.4	50-140			
Acenaphthylene	0.132	0.02	ug/g		78.9	50-140			
Anthracene	0.119	0.02	ug/g		71.7	50-140			
Benzo [a] anthracene	0.102	0.02	ug/g		60.9	50-140			
Benzo [a] pyrene	0.108	0.02	ug/g		65.0	50-140			
Benzo [b] fluoranthene	0.139	0.02	ug/g		83.5	50-140			
Benzo [g,h,i] perylene	0.116	0.02	ug/g		69.9	50-140			
Benzo [k] fluoranthene	0.128	0.02	ug/g		76.5	50-140			
Chrysene	0.125	0.02	ug/g		75.0	50-140			
Dibenzo [a,h] anthracene	0.120	0.02	ug/g		72.2	50-140			
Fluoranthene	0.122	0.02	ug/g		73.3	50-140			
Fluorene	0.137	0.02	ug/g		82.2	50-140			
Indeno [1,2,3-cd] pyrene	0.123	0.02	ug/g		73.7	50-140			
1-Methylnaphthalene	0.137	0.02	ug/g		82.0	50-140			
2-Methylnaphthalene	0.145	0.02	ug/g		86.7	50-140			
Naphthalene	0.136	0.01	ug/g		81.6	50-140			
Phenanthrene	0.131	0.02	ug/g		78.6	50-140			
Pyrene	0.124	0.02	ug/g		74.3	50-140			
Surrogate: 2-Fluorobiphenyl	*1.14*		*ug/g*		*85.3*	*50-140*			
Volatiles									
Acetone	7.71	0.50	ug/g		77.1	50-140			
Benzene	2.52	0.02	ug/g		63.1	60-130			
Bromodichloromethane	2.58	0.05	ug/g		64.4	60-130			
Bromoform	5.09	0.05	ug/g		127	60-130			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Bromomethane	2.67	0.05	ug/g		66.7	50-140			
Carbon Tetrachloride	2.69	0.05	ug/g		67.3	60-130			
Chlorobenzene	4.27	0.05	ug/g		107	60-130			
Chloroform	2.41	0.05	ug/g		60.3	60-130			
Dibromochloromethane	4.72	0.05	ug/g		118	60-130			
Dichlorodifluoromethane	3.64	0.05	ug/g		91.0	50-140			
1,2-Dichlorobenzene	4.33	0.05	ug/g		108	60-130			
1,3-Dichlorobenzene	4.17	0.05	ug/g		104	60-130			
1,4-Dichlorobenzene	4.06	0.05	ug/g		102	60-130			
1,1-Dichloroethane	2.70	0.05	ug/g		67.6	60-130			
1,2-Dichloroethane	2.45	0.05	ug/g		61.3	60-130			
1,1-Dichloroethylene	2.67	0.05	ug/g		66.7	60-130			
cis-1,2-Dichloroethylene	3.05	0.05	ug/g		76.2	60-130			
trans-1,2-Dichloroethylene	2.89	0.05	ug/g		72.2	60-130			
1,2-Dichloropropane	2.44	0.05	ug/g		61.0	60-130			
cis-1,3-Dichloropropylene	2.49	0.05	ug/g		62.2	60-130			
trans-1,3-Dichloropropylene	2.46	0.05	ug/g		61.5	60-130			
Ethylbenzene	4.35	0.05	ug/g		109	60-130			
Ethylene dibromide (dibromoethane	4.42	0.05	ug/g		111	60-130			
Hexane	2.99	0.05	ug/g		74.8	60-130			
Methyl Ethyl Ketone (2-Butanone)	7.61	0.50	ug/g		76.1	50-140			
Methyl Isobutyl Ketone	6.59	0.50	ug/g		65.9	50-140			
Methyl tert-butyl ether	6.29	0.05	ug/g		62.9	50-140			
Methylene Chloride	2.51	0.05	ug/g		62.7	60-130			
Styrene	4.52	0.05	ug/g		113	60-130			
1,1,1,2-Tetrachloroethane	5.02	0.05	ug/g		125	60-130			
1,1,2,2-Tetrachloroethane	4.20	0.05	ug/g		105	60-130			
Tetrachloroethylene	3.66	0.05	ug/g		91.5	60-130			
Toluene	4.26	0.05	ug/g		106	60-130			
1,1,1-Trichloroethane	2.99	0.05	ug/g		74.7	60-130			
1,1,2-Trichloroethane	2.52	0.05	ug/g		63.0	60-130			
Trichloroethylene	2.84	0.05	ug/g		71.0	60-130			
Trichlorofluoromethane	2.49	0.05	ug/g		62.2	50-140			
Vinyl chloride	3.83	0.02	ug/g		95.7	50-140			
m,p-Xylenes	8.96	0.05	ug/g		112	60-130			
o-Xylene	4.77	0.05	ug/g		119	60-130			
Benzene	2.52	0.02	ug/g		63.1	60-130			
Ethylbenzene	4.35	0.05	ug/g		109	60-130			
Toluene	4.26	0.05	ug/g		106	60-130			
m,p-Xylenes	8.96	0.05	ug/g		112	60-130			
o-Xylene	4.77	0.05	ug/g		119	60-130			

Qualifier Notes:

QC Qualifiers :

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

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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

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.

Paracel ID: 1735033

PARACEL LABORATORIES LTD.

TRUS
RESP
RELIABLE.

lice
9 St. Laurent Blvd.
Ontario K1G 4J8
p. 1-800-749-1947
e: paracel@paracellabs.com

Chain of Custody
(Lab Use Only)
№ 111850

Page ___ of ___

Client Name: Paterson Group Inc.	Project Reference: PE3651
Contact Name: Karyn Munch	Quote #
Address: 154 Colonnade Road S	PO # 21714
Telephone: 613-226-7381	Email Address: kmunch@patersongroup.ca

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

Criteria: ☒ O. Reg. 153/04 (As Amended) Table 3 ☑ 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: 1735033

	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-G1/SS2	S		1	Aug.24/17	am			✓								- 250mL			✓
2	BH2-SS8	S		2	Aug.24/17	am		✓									- 120mL+2vial-			✓
3	BH3-SS6	S		2	Aug.22/17	am		✓									↓			✓
4	BH6-SS2	S		2	Aug.24/17	pm	✓			✓	✓	✓	✓				250mL+2vial-			✓
5																				
6																				
7																				
8																				
9																				
10																				

Comments:

Method of Delivery: Paracel

Relinquished By (Sign): KMunch	Received by Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): KMunch	Date/Time: 25/08/17 3:50	Date/Time: AUG 25 2017 04.46	Date/Time: Aug 28 17.
Date/Time: Aug.25,2017	Temperature: °C	Temperature: 10.1.4 °C	pH Verified ☒ By: N/A 11:00

PARACEL LABORATORIES LTD.
TRUSTED. RESPONSIVE. RELIABLE.

300 - 2319 St. Laurent Blvd
Ottawa, ON, K1G 4J8
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Karyn Munch

Client PO: 21717
Project: PE3651
Custody: 111848

Report Date: 19-Sep-2017
Order Date: 13-Sep-2017

Order #: 1737342

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

Paracel ID	Client ID
1737342-01	BH1-SS3
1737342-02	BH2-SS3
1737342-03	BH3-SS3
1737342-04	BH6-SS3

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 21717

Report Date: 19-Sep-2017
Order Date: 13-Sep-2017
Project Description: PE3651

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Mercury by CVAA	EPA 7471B - CVAA, digestion	16-Sep-17	16-Sep-17
REG 153: Metals by ICP/OES, soil	based on MOE E3470, ICP-OES	15-Sep-17	15-Sep-17
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	14-Sep-17	15-Sep-17
Solids, %	Gravimetric, calculation	14-Sep-17	19-Sep-17

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 21717

Report Date: 19-Sep-2017
Order Date: 13-Sep-2017
Project Description: PE3651

	Client ID:	BH1-SS3	BH2-SS3	BH3-SS3	BH6-SS3
	Sample Date:	21-Aug-17	24-Aug-17	22-Aug-17	24-Aug-17
	Sample ID:	1737342-01	1737342-02	1737342-03	1737342-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	74.9	70.4	67.0	72.8
Metals					
Antimony	1.0 ug/g dry	<1.0	<1.0	-	<1.0
Arsenic	1.0 ug/g dry	<1.0	<1.0	-	<1.0
Barium	1.0 ug/g dry	383	344	-	376
Beryllium	1.0 ug/g dry	<1.0	<1.0	-	<1.0
Boron	1.0 ug/g dry	6.7	8.0	-	6.9
Cadmium	0.5 ug/g dry	<0.5	<0.5	-	<0.5
Chromium	1.0 ug/g dry	117	124	-	135
Cobalt	1.0 ug/g dry	22.2	21.1	-	23.5
Copper	1.0 ug/g dry	55.5	54.9	-	63.5
Lead	1.0 ug/g dry	11.5	11.2	-	10.7
Mercury	0.1 ug/g dry	<0.1	<0.1	-	<0.1
Molybdenum	1.0 ug/g dry	<1.0	<1.0	-	<1.0
Nickel	1.0 ug/g dry	61.3	62.7	-	69.2
Selenium	1.0 ug/g dry	<1.0	<1.0	-	<1.0
Silver	0.5 ug/g dry	<0.5	<0.5	-	<0.5
Thallium	1.0 ug/g dry	<1.0	<1.0	-	<1.0
Uranium	1.0 ug/g dry	<1.0	<1.0	-	<1.0
Vanadium	1.0 ug/g dry	93.7	101	-	113
Zinc	1.0 ug/g dry	105	109	-	116
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Acenaphthylene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Anthracene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Benzo [a] anthracene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Benzo [a] pyrene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Benzo [b] fluoranthene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Benzo [g,h,i] perylene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Benzo [k] fluoranthene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Chrysene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Dibenzo [a,h] anthracene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Fluoranthene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Fluorene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 21717

Report Date: 19-Sep-2017
Order Date: 13-Sep-2017
Project Description: PE3651

	Client ID:	BH1-SS3	BH2-SS3	BH3-SS3	BH6-SS3
	Sample Date:	21-Aug-17	24-Aug-17	22-Aug-17	24-Aug-17
	Sample ID:	1737342-01	1737342-02	1737342-03	1737342-04
	MDL/Units	Soil	Soil	Soil	Soil
1-Methylnaphthalene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Methylnaphthalene (1&2)	0.04 ug/g dry	<0.04	<0.04	<0.04	<0.04
Naphthalene	0.01 ug/g dry	<0.01	<0.01	<0.01	<0.01
Phenanthrene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Pyrene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
2-Fluorobiphenyl	Surrogate	83.9%	82.7%	74.8%	74.8%
Terphenyl-d14	Surrogate	101%	97.7%	93.8%	95.5%

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Antimony	ND	1.0	ug/g						
Arsenic	ND	1.0	ug/g						
Barium	ND	1.0	ug/g						
Beryllium	ND	1.0	ug/g						
Boron	ND	1.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium	ND	1.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	1.0	ug/g						
Lead	ND	1.0	ug/g						
Mercury	ND	0.1	ug/g						
Molybdenum	ND	1.0	ug/g						
Nickel	ND	1.0	ug/g						
Selenium	ND	1.0	ug/g						
Silver	ND	0.5	ug/g						
Thallium	ND	1.0	ug/g						
Uranium	ND	1.0	ug/g						
Vanadium	ND	1.0	ug/g						
Zinc	ND	1.0	ug/g						
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g						
Acenaphthylene	ND	0.02	ug/g						
Anthracene	ND	0.02	ug/g						
Benzo [a] anthracene	ND	0.02	ug/g						
Benzo [a] pyrene	ND	0.02	ug/g						
Benzo [b] fluoranthene	ND	0.02	ug/g						
Benzo [g,h,i] perylene	ND	0.02	ug/g						
Benzo [k] fluoranthene	ND	0.02	ug/g						
Chrysene	ND	0.02	ug/g						
Dibenzo [a,h] anthracene	ND	0.02	ug/g						
Fluoranthene	ND	0.02	ug/g						
Fluorene	ND	0.02	ug/g						
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g						
1-Methylnaphthalene	ND	0.02	ug/g						
2-Methylnaphthalene	ND	0.02	ug/g						
Methylnaphthalene (1&2)	ND	0.04	ug/g						
Naphthalene	ND	0.01	ug/g						
Phenanthrene	ND	0.02	ug/g						
Pyrene	ND	0.02	ug/g						
Surrogate: 2-Fluorobiphenyl	*1.09*		*ug/g*		*81.7*	*50-140*			
Surrogate: Terphenyl-d14	*1.37*		*ug/g*		*103*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Antimony	ND	1.0	ug/g dry	ND			0.0	30	
Arsenic	ND	1.0	ug/g dry	ND				30	
Barium	342	1.0	ug/g dry	383			11.3	30	
Beryllium	ND	1.0	ug/g dry	ND			0.0	30	
Boron	7.04	1.0	ug/g dry	6.66			5.6	30	
Cadmium	ND	0.5	ug/g dry	ND			0.0	30	
Chromium	109	1.0	ug/g dry	117			7.1	30	
Cobalt	21.8	1.0	ug/g dry	22.2			1.9	30	
Copper	53.5	1.0	ug/g dry	55.5			3.7	30	
Lead	10.8	1.0	ug/g dry	11.5			6.4	30	
Mercury	ND	0.1	ug/g dry	ND			0.0	30	
Molybdenum	ND	1.0	ug/g dry	ND			0.0	30	
Nickel	60.9	1.0	ug/g dry	61.3			0.7	30	
Selenium	ND	1.0	ug/g dry	ND			0.0	30	
Silver	ND	0.5	ug/g dry	ND			0.0	30	
Thallium	2.86	1.0	ug/g dry	ND			0.0	30	
Uranium	ND	1.0	ug/g dry	ND				30	
Vanadium	93.8	1.0	ug/g dry	93.7			0.1	30	
Zinc	105	1.0	ug/g dry	105			0.4	30	
Physical Characteristics									
% Solids	95.1	0.1	% by Wt.	94.6			0.5	25	
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g dry	ND				40	
Acenaphthylene	ND	0.02	ug/g dry	ND				40	
Anthracene	ND	0.02	ug/g dry	ND				40	
Benzo [a] anthracene	ND	0.02	ug/g dry	ND				40	
Benzo [a] pyrene	ND	0.02	ug/g dry	ND				40	
Benzo [b] fluoranthene	ND	0.02	ug/g dry	ND				40	
Benzo [g,h,i] perylene	ND	0.02	ug/g dry	ND				40	
Benzo [k] fluoranthene	ND	0.02	ug/g dry	ND				40	
Chrysene	ND	0.02	ug/g dry	ND				40	
Dibenzo [a,h] anthracene	ND	0.02	ug/g dry	ND				40	
Fluoranthene	ND	0.02	ug/g dry	ND			0.0	40	
Fluorene	ND	0.02	ug/g dry	ND				40	
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g dry	ND				40	
1-Methylnaphthalene	ND	0.02	ug/g dry	ND				40	
2-Methylnaphthalene	ND	0.02	ug/g dry	ND				40	
Naphthalene	ND	0.01	ug/g dry	ND				40	
Phenanthrene	ND	0.02	ug/g dry	ND				40	
Pyrene	ND	0.02	ug/g dry	ND			0.0	40	
Surrogate: 2-Fluorobiphenyl	*1.53*		*ug/g dry*		*86.0*	*50-140*			
Surrogate: Terphenyl-d14	*1.81*		*ug/g dry*		*102*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Antimony	295		ug/L	16.1	112	70-130			
Arsenic	310		ug/L	ND	124	70-130			
Barium	253		ug/L		101	70-130			
Beryllium	228		ug/L	ND	91.2	70-130			
Boron	368		ug/L	133	93.8	70-130			
Cadmium	239		ug/L	3.29	94.4	70-130			
Chromium	249		ug/L		99.8	70-130			
Cobalt	652		ug/L	443	83.5	70-130			
Copper	1330		ug/L	1110	88.0	70-130			
Lead	457		ug/L	231	90.4	70-130			
Mercury	1.37	0.1	ug/g	ND	91.4	70-130			
Molybdenum	219		ug/L	5.95	85.4	70-130			
Nickel	1440		ug/L	1230	87.1	70-130			
Selenium	189		ug/L	ND	75.6	70-130			
Silver	231		ug/L	8.44	89.1	70-130			
Thallium	218		ug/L	ND	87.0	70-130			
Uranium	304		ug/L	ND	122	70-130			
Vanadium	2100		ug/L	1870	92.0	70-130			
Zinc	2310		ug/L	2090	85.2	70-130			
Semi-Volatiles									
Acenaphthene	0.177	0.02	ug/g	ND	79.5	50-140			
Acenaphthylene	0.153	0.02	ug/g	ND	68.6	50-140			
Anthracene	0.175	0.02	ug/g	ND	78.7	50-140			
Benzo [a] anthracene	0.131	0.02	ug/g	ND	58.7	50-140			
Benzo [a] pyrene	0.164	0.02	ug/g	ND	73.7	50-140			
Benzo [b] fluoranthene	0.174	0.02	ug/g	ND	78.2	50-140			
Benzo [g,h,i] perylene	0.164	0.02	ug/g	ND	73.5	50-140			
Benzo [k] fluoranthene	0.150	0.02	ug/g	ND	67.2	50-140			
Chrysene	0.178	0.02	ug/g	ND	79.9	50-140			
Dibenzo [a,h] anthracene	0.166	0.02	ug/g	ND	74.6	50-140			
Fluoranthene	0.168	0.02	ug/g	ND	75.5	50-140			
Fluorene	0.180	0.02	ug/g	ND	80.7	50-140			
Indeno [1,2,3-cd] pyrene	0.160	0.02	ug/g	ND	71.9	50-140			
1-Methylnaphthalene	0.187	0.02	ug/g	ND	83.8	50-140			
2-Methylnaphthalene	0.204	0.02	ug/g	ND	91.6	50-140			
Naphthalene	0.195	0.01	ug/g	ND	87.7	50-140			
Phenanthrene	0.183	0.02	ug/g	ND	82.0	50-140			
Pyrene	0.174	0.02	ug/g	ND	78.1	50-140			
Surrogate: 2-Fluorobiphenyl	*1.55*		*ug/g*		*86.9*	*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.

Paracel ID: 1737342

PARACEL LABORATORIES LTD.

TRUS[T] RESP[ONSIVE] RELIABLE.

[Head O]ffice
[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 111848

Page __ of __

Client Name: Paterson Group Inc.	Project Reference: PE3051
Contact Name: Karyn Munch	Quote #
Address: 154 Colonnade Rd S.	PO # 21717
	Email Address: kmunch@patersongroup.ca
Telephone: 613-226-7381	

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

Date Required: ________

Criteria: ☒ O. Reg. 153/04 (As Amended) Table 3 ☐ 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: 1737342

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)					
1	BH1-SS3			1	Aug.21/17	am			✓	✓	✓					- 250mL -		
2	BH2-SS3			1	Aug.24/17	am			✓	✓	✓					↓		
3	BH3-SS3			1	Aug.22/17	am			✓									
4																		
5	BH6-SS3			1	Aug.24/17	pm			✓	✓	✓					250mL -		
6																		
7																		
8																		
9																		
10																		

Comments:

Method of Delivery: Paracel

Relinquished By (Sign): KMunch	Received by Driver/Depot: [signature]	Received at Lab: Sunnyparn Dohmat	Verified By: Rachel subject
Relinquished By (Print): KMunch	Date/Time: 13/09/17 3:40 PM	Date/Time: Sep 13, 2017 04:24	Date/Time: Sep 13/17 4:35
Date/Time: Sept.13,2017	Temperature: °C	Temperature: 18.4 °C	pH Verified ☒ By: N/A

PARACEL LABORATORIES LTD.
TRUSTED. RESPONSIVE. RELIABLE.

300 - 2319 St. Laurent Blvd
Ottawa, ON, K1G 4J8
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Karyn Munch

Client PO: 21715
Project: PE3651
Custody: 111847

Report Date: 8-Sep-2017
Order Date: 1-Sep-2017

Order #: 1735534

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

Paracel ID	Client ID
1735534-01	BH1A-GW1
1735534-02	BH3-GW1
1735534-03	BH5-GW1

Approved By:

Dale Robertson, BSc
Laboratory Director

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
PHC F1	CWS Tier 1 - P&T GC-FID	2-Sep-17	5-Sep-17
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	5-Sep-17	6-Sep-17
REG 153: PAHs by GC-MS	EPA 625 - GC-MS, extraction	7-Sep-17	8-Sep-17
REG 153: VOCs by P&T GC/MS	EPA 624 - P&T GC-MS	2-Sep-17	5-Sep-17

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 21715

Report Date: 08-Sep-2017
Order Date: 1-Sep-2017
Project Description: PE3651

	Client ID:	BH1A-GW1	BH3-GW1	BH5-GW1	-
	Sample Date:	31-Aug-17	31-Aug-17	31-Aug-17	-
	Sample ID:	1735534-01	1735534-02	1735534-03	-
	MDL/Units	Water	Water	Water	-
Volatiles					
Acetone	5.0 ug/L	<5.0	<5.0	<5.0	-
Benzene	0.5 ug/L	<0.5	<0.5	<0.5	-
Bromodichloromethane	0.5 ug/L	<0.5	<0.5	<0.5	-
Bromoform	0.5 ug/L	<0.5	<0.5	<0.5	-
Bromomethane	0.5 ug/L	<0.5	<0.5	<0.5	-
Carbon Tetrachloride	0.2 ug/L	<0.2	<0.2	<0.2	-
Chlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	-
Chloroform	0.5 ug/L	<0.5	2.7	<0.5	-
Dibromochloromethane	0.5 ug/L	<0.5	<0.5	<0.5	-
Dichlorodifluoromethane	1.0 ug/L	<1.0	<1.0	<1.0	-
1,2-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	-
1,3-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	-
1,4-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	-
1,1-Dichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	-
1,2-Dichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	-
1,1-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	-
cis-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	-
trans-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	-
1,2-Dichloropropane	0.5 ug/L	<0.5	<0.5	<0.5	-
cis-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	<0.5	-
trans-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	<0.5	-
1,3-Dichloropropene, total	0.5 ug/L	<0.5	<0.5	<0.5	-
Ethylbenzene	0.5 ug/L	<0.5	<0.5	<0.5	-
Ethylene dibromide (dibromoethan	0.2 ug/L	<0.2	<0.2	<0.2	-
Hexane	1.0 ug/L	<1.0	<1.0	<1.0	-
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	<5.0	<5.0	<5.0	-
Methyl Isobutyl Ketone	5.0 ug/L	<5.0	<5.0	<5.0	-
Methyl tert-butyl ether	2.0 ug/L	<2.0	<2.0	<2.0	-
Methylene Chloride	5.0 ug/L	<5.0	<5.0	<5.0	-
Styrene	0.5 ug/L	<0.5	<0.5	<0.5	-
1,1,1,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	<0.5	-
1,1,2,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	<0.5	-
Tetrachloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	-
Toluene	0.5 ug/L	<0.5	<0.5	<0.5	-
1,1,1-Trichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 21715

Report Date: 08-Sep-2017
Order Date: 1-Sep-2017
Project Description: PE3651

	Client ID:	BH1A-GW1	BH3-GW1	BH5-GW1	-
	Sample Date:	31-Aug-17	31-Aug-17	31-Aug-17	-
	Sample ID:	1735534-01	1735534-02	1735534-03	-
	MDL/Units	Water	Water	Water	-
1,1,2-Trichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	-
Trichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	-
Trichlorofluoromethane	1.0 ug/L	<1.0	<1.0	<1.0	-
Vinyl chloride	0.5 ug/L	<0.5	<0.5	<0.5	-
m,p-Xylenes	0.5 ug/L	<0.5	<0.5	<0.5	-
o-Xylene	0.5 ug/L	<0.5	<0.5	<0.5	-
Xylenes, total	0.5 ug/L	<0.5	<0.5	<0.5	-
4-Bromofluorobenzene	Surrogate	96.6%	93.6%	100%	-
Dibromofluoromethane	Surrogate	105%	105%	104%	-
Toluene-d8	Surrogate	87.9%	88.8%	91.0%	-
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	<25	<25	-
F2 PHCs (C10-C16)	100 ug/L	<100	<100	<100	-
F3 PHCs (C16-C34)	100 ug/L	<100	<100	<100	-
F4 PHCs (C34-C50)	100 ug/L	<100	<100	<100	-
Semi-Volatiles					
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	122%	106%	-	-
Terphenyl-d14	Surrogate	99.9%	121%	-	-

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	*17.5*		*ug/L*		*87.3*	*50-140*			
Surrogate: Terphenyl-d14	*18.3*		*ug/L*		*91.4*	*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						
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L						

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
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	*78.2*		*ug/L*		*97.8*	*50-140*			
Surrogate: Dibromofluoromethane	*78.3*		*ug/L*		*97.9*	*50-140*			
Surrogate: Toluene-d8	*75.3*		*ug/L*		*94.2*	*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	*76.5*		*ug/L*		*95.6*	*50-140*			
Surrogate: Dibromofluoromethane	*82.8*		*ug/L*		*103*	*50-140*			
Surrogate: Toluene-d8	*72.6*		*ug/L*		*90.7*	*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)	2100	25	ug/L		105	68-117			
F2 PHCs (C10-C16)	1480	100	ug/L		82.1	60-140			
F3 PHCs (C16-C34)	3350	100	ug/L		90.0	60-140			
F4 PHCs (C34-C50)	2650	100	ug/L		107	60-140			
Semi-Volatiles									
Acenaphthene	5.12	0.05	ug/L		102	50-140			
Acenaphthylene	4.77	0.05	ug/L		95.3	50-140			
Anthracene	5.24	0.01	ug/L		105	50-140			
Benzo [a] anthracene	4.53	0.01	ug/L		90.6	50-140			
Benzo [a] pyrene	5.30	0.01	ug/L		106	50-140			
Benzo [b] fluoranthene	6.07	0.05	ug/L		121	50-140			
Benzo [g,h,i] perylene	4.77	0.05	ug/L		95.4	50-140			
Benzo [k] fluoranthene	5.23	0.05	ug/L		105	50-140			
Chrysene	5.51	0.05	ug/L		110	50-140			
Dibenzo [a,h] anthracene	5.36	0.05	ug/L		107	50-140			
Fluoranthene	5.06	0.01	ug/L		101	50-140			
Fluorene	5.37	0.05	ug/L		107	50-140			
Indeno [1,2,3-cd] pyrene	5.39	0.05	ug/L		108	50-140			
1-Methylnaphthalene	6.18	0.05	ug/L		124	50-140			
2-Methylnaphthalene	4.88	0.05	ug/L		97.5	50-140			
Naphthalene	5.49	0.05	ug/L		110	50-140			
Phenanthrene	5.00	0.05	ug/L		100	50-140			
Pyrene	5.35	0.01	ug/L		107	50-140			
Surrogate: 2-Fluorobiphenyl	*21.9*		*ug/L*		*110*	*50-140*			
Volatiles									
Acetone	81.0	5.0	ug/L		81.0	50-140			
Benzene	38.4	0.5	ug/L		95.9	60-130			
Bromodichloromethane	47.4	0.5	ug/L		119	60-130			
Bromoform	51.6	0.5	ug/L		129	60-130			
Bromomethane	51.3	0.5	ug/L		128	50-140			
Carbon Tetrachloride	49.8	0.2	ug/L		125	60-130			
Chlorobenzene	39.8	0.5	ug/L		99.5	60-130			
Chloroform	45.4	0.5	ug/L		114	60-130			
Dibromochloromethane	51.5	0.5	ug/L		129	60-130			
Dichlorodifluoromethane	39.3	1.0	ug/L		98.3	50-140			
1,2-Dichlorobenzene	36.6	0.5	ug/L		91.5	60-130			
1,3-Dichlorobenzene	35.8	0.5	ug/L		89.6	60-130			
1,4-Dichlorobenzene	36.0	0.5	ug/L		90.0	60-130			
1,1-Dichloroethane	44.1	0.5	ug/L		110	60-130			
1,2-Dichloroethane	46.9	0.5	ug/L		117	60-130			
1,1-Dichloroethylene	42.6	0.5	ug/L		107	60-130			
cis-1,2-Dichloroethylene	45.7	0.5	ug/L		114	60-130			
trans-1,2-Dichloroethylene	40.0	0.5	ug/L		100	60-130			
1,2-Dichloropropane	38.9	0.5	ug/L		97.3	60-130			
cis-1,3-Dichloropropylene	30.5	0.5	ug/L		76.2	60-130			
trans-1,3-Dichloropropylene	31.4	0.5	ug/L		78.4	60-130			
Ethylbenzene	50.6	0.5	ug/L		126	60-130			
Ethylene dibromide (dibromoethane	42.6	0.2	ug/L		106	60-130			
Hexane	27.7	1.0	ug/L		69.4	60-130			
Methyl Ethyl Ketone (2-Butanone)	101	5.0	ug/L		101	50-140			
Methyl Isobutyl Ketone	115	5.0	ug/L		115	50-140			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Methyl tert-butyl ether	99.4	2.0	ug/L		99.4	50-140			
Methylene Chloride	33.0	5.0	ug/L		82.6	60-130			
Styrene	51.2	0.5	ug/L		128	60-130			
1,1,1,2-Tetrachloroethane	45.1	0.5	ug/L		113	60-130			
1,1,2,2-Tetrachloroethane	38.8	0.5	ug/L		96.9	60-130			
Tetrachloroethylene	39.8	0.5	ug/L		99.6	60-130			
Toluene	42.6	0.5	ug/L		106	60-130			
1,1,1-Trichloroethane	44.8	0.5	ug/L		112	60-130			
1,1,2-Trichloroethane	39.8	0.5	ug/L		99.5	60-130			
Trichloroethylene	32.6	0.5	ug/L		81.6	60-130			
Trichlorofluoromethane	50.6	1.0	ug/L		126	60-130			
Vinyl chloride	50.8	0.5	ug/L		127	50-140			
m,p-Xylenes	91.8	0.5	ug/L		115	60-130			
o-Xylene	49.2	0.5	ug/L		123	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.

PARACEL LABORATORIES LTD.

TRUSTED . RESPONSIV RELIABLE .

Paracel ID: 1735534

t Blvd.
G 4J8
abs.com

Chain of Custody
(Lab Use Only)
№ 111847

Page __ of __

Client Name: Paterson Group Inc.	Project Reference: PE3651
Contact Name: Karyn Munch	Quote #
Address: 154 Colonnade Rd. S.	PO # 21715
Telephone:	Email Address: kmunch@patersongroup.ca

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

Criteria: ☒ O. Reg. 153/04 (As Amended) Table 3 ☐ 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: 1735534

	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	BH1A-GW1	GW		4	Aug.31/17	am	✓	✓	✓											
2	BH3-GW1	GW		4	Aug.31/17	am	✓	✓	✓											
3	BH5-GW1	GW		3	Aug.31/17	am	✓													
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Comments:

Method of Delivery: Paracel

Relinquished By (Sign): KMunch	Received by Driver/Depot: [signature]	Received at Lab: Sumitporn Dehmai	Verified By: [signature]
Relinquished By (Print): KMunch.	Date/Time: 01/09/17 3:15 PM.	Date/Time: SEP 01, 2017 05:15	Date/Time: 01/01/17 5:25
Date/Time: Aug.31, 2017 2:00	Temperature: / °C	Temperature: 21.9 °C	pH Verified [ ] By: