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Phase II Environmental Site Assessment

373 Princeton Avenue
Ottawa, Ontario

Prepared For

Mr. Barry Hobin

October 17, 2016

Report: PE3876-2

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EXECUTIVE SUMMARY

Assessment

Paterson Group was retained Mr. Barry Hobin, to prepare a Phase II Environmental Site Assessment for the property addressed 373 Princeton Avenue (also includes 530, 534 and 540 Edison Avenue), in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address the Areas of Potential Environmental Concern (APECs) for the subject site identified during the Phase I ESA conducted in September of 2016.

The Phase II ESA consisted of drilling three (3) interior boreholes which were cored into the bedrock and instrumented with groundwater monitoring wells, to assess soil and groundwater quality at the subject site. An additional corehole was conducted at 530 Edison Avenue.

Soil samples obtained from the boreholes were screened using visual observations and vapour measurements. Soils on site generally consist of Glacial Till over limestone bedrock interbedded with dolomite. Some crushed stone was present beneath the floor slabs of 534 and 540 Edison Avenue. The crushed stone was mixed with what appeared to be occasional remnants of partially burned coal, ash and/or occasional fragments of brick and concrete. The remnant coal and ash is considered to have resulted from the historical burning of coal as heating fuel and is not considered to have had the potential to impact the underlying soils and groundwater. Based on the location of this material beneath the floor slab and well above the groundwater table, leaching is not considered to have occurred.

Based on the screening results in combination with field observations, soil samples from BH1, BH2 and CH1 were submitted for analytical testing of benzene, ethylbenzene, toluene and xylenes (BTEX) and petroleum hydrocarbons (fractions F_1-F_4). BTEX and PHC parameters were not detected above method detection limits in any of the samples, with the exception of PHC F_3 and F_4 in Sample CH4-G1, which were identified at concentrations below the MOECC Table 3 standards.

Groundwater samples were collected from the monitoring wells installed in BH1, BH2 and BH3 on September 28, 2016 and submitted for analysis of BTEX and PHC (F_1-F_4) parameters. Parameters were not detected above the method detection limits in any of the groundwater samples submitted for testing. The results are therefore in compliance with the MOECC Table 3 standards.

Recommendations

Based on the findings of the Phase II-ESA, some partially burned coal and ashes were observed beneath the basement floor slabs at 534 and 540 Edison Avenue. The material is considered to be associated with the historical use of coal as a heating source, prior to conversion to fuel oil-fired equipment. This material should be removed from the property during the redevelopment of the site, for disposal at a registered waste disposal facility.

It is recommended that Paterson personnel be on site at the time of the excavation activities in order to supervise segregation of this material. Prior to off-site disposal of impacted material at a waste disposal facility, a leachate analysis of a representative sample will be required in accordance with Ontario Regulation 347/558.

If not longer required, the monitoring wells should be decommissioned by a licenced contractor in accordance with Ontario Regulation 903.

1.0 INTRODUCTION

At the request of Mr. Barry Hobin, Paterson Group (Paterson) conducted a Phase II Environmental Site Assessment (ESA) for the property addressed 373 Princeton Avenue, in the City of Ottawa, Ontario. It should be noted that this property also includes 530, 534 and 540 Edison Avenue. The purpose of this Phase II ESA was to address potential environmental concerns identified in a Phase I ESA prepared by Paterson in September of 2016.

1.1 Site Description

Address:	373 Princeton Avenue, as well as 530, 534 and 540 Edison Avenue, Ottawa, Ontario.
Legal Description:	Part Lot 22, Lots 23-26 East Melbourne, Part Lot 22, Lots 23-26 West Edison, Plan 204, being Part 2 on 4R21744,in the City of Ottawa.
Property Identification Number:	04016-0141
Location:	The subject property encompasses the southern half of the block bounded by Princeton Avenue, Edison Avenue, Melbourne Avenue and Kenwood Avenue. The subject site is shown on Figure 1 - Key Plan following the body of this report.
Latitude and Longitude:	45° 23' 14" N, 75° 45' 09" W
Configuration:	Rectangular
Site Area:	0.59 hectares (approximate)

1.2 Property Ownership

Property ownership is in the process of being transferred from l'Institut Jeanne D'Arc to Mr. Barry Hobin. Paterson was engaged to complete the Phase II ESA at the subject site by Mr. Barry Hobin, the beneficial owner at the time. Mr. Hobin can be reached by telephone at (613) 238-7200.

1.3 Current and Proposed Future Uses

The Phase II Property is currently occupied by l'Institut Jeanne D'Arc (a boarding house and infirmary with associated parking, private garage and storage structures) addressed 373 Princeton Avenue, as well as three residential dwellings addressed 530, 534 and 540 Edison Avenue. It is our understanding that the entire property, with the possible exception of the building addressed 373 Princeton, with be redeveloped with residential dwellings.

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 Table 3 Standards are based on the following considerations:

- ❒ Coarse-grained soil conditions.
- ❒ Surface soil and groundwater conditions.
- ❒ Non-potable groundwater conditions.
- ❒ Residential land use.

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

At the time of the Phase II ESA, the southwestern portion of the Phase II Property was occupied by a two storey residence (boarding house and infirmary) with a basement level, while the southeastern portion of the Phase II Property was occupied by three (3) two-storey residential dwellings with basement levels. The northern portion of the property was occupied by parking and landscaped areas as well as a private garage and two (2) storage sheds.

The Phase II Property is at grade with the adjacent roadways. The site topography slopes slightly down to the south.

2.2 Past Investigations

A Phase I ESA, in general accordance with Ontario Regulation (O.Reg.) 153/04, amended by O.Reg. 269/11, was conducted by Paterson in September of 2016.

Based on the findings of the Phase I-ESA, three (3) areas of potential environmental concern (APECs) were identified on the subject property. The APECs are discussed below in Section 3.3 Phase I Conceptual Site Model.

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The Phase II-ESA was carried outon September 21 and 23, 2016, and consisted of drilling three boreholes and one core hole in the basements of the dwellings addressed 530, 534 and 540 Edison Avenue. As per the Sampling and Analysis Plan appended to this report, the test holes were placed to address potential concerns with the existing and former fuel oil heating equipment.

The boreholes and core hole were advanced with portable drilling equipment under the full time supervision of Paterson personnel. The boreholes were drilled through overburden soils and cored into bedrock to depths ranging from approximately 4.9 to 5.5 m below the basement floor slabs (or approximately 6.1 to 7m below grade), and instrumented with groundwater monitoring wells.

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 (CPCs) identified in the Phase I-ESA, in conjunction with the findings of the field program.

The CPCs for the soil and/or groundwater within the APECs identified on the Phase II Property, include benzene, toluene, ethylbenzene, and xylenes (BTEX) as well as petroleum hydrocarbons, fractions 1 through 4 (PHCs F_1-F_4).

3.3 Phase I Conceptual Site Model

Existing Buildings and Structures

Buildings on site include the Institut Jeanne D'Arc building addressed 373 Princeton Avenue, an associated three-car private garage and two metal storage structures, as well as three residential dwellings addressed 530, 534 and 540 Edison Avenue and a private, single-car garage at 540 Edison Avenue.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

As per Section 7.1 of this report, PCAs identified on the subject site include the existing ASTs and associated fuel lines at each of the residential dwellings addressed 530, 534 and 540 Edison Avenue. These PCAs represent APECs on the Phase I Property, as shown on Drawing PE3876-1 – Site Plan. No other PCAs were identified on the Phase I Property or within the Phase I ESA Study Area.

Contaminants of Potential Concern

As discussed in the previous section CPCs include BTEX and PHCs in the soil and groundwater.

Underground Utilities

Buried services situated in the immediate vicinity of the aforementioned APECs, include municipal water and sewer services. Based on standard practice for subsurface utility installation, service trenches are expected to be present approximately 1 to 2 m below existing grade. In general, trench backfill may provide a preferential pathway for contaminant transport if the water table is at or above the base of the trenches. Based on the expected depth of groundwater, these service trenches are not considered to affect contaminant transport.

Geological and Hydrogeological Setting

Geological Survey of Canada mapping indicates the drift thickness in the area of the subject site is on the order of 1 to 5 m and overburden soils consist of Glacial Till. Bedrock reportedly consists of interbedded limestone and dolomite of the Gull River Formation.

The inferred direction of regional groundwater flow is in a north-northwest direction toward the Ottawa River.

Assessment of Uncertainty and/or Absence of Information

The presence of potentially contaminating activities was confirmed by a variety of independent sources. As such, the conclusions of this report are not affected by uncertainty which may be present with respect to the individual sources.

3.4 Deviations from Sampling and Analysis Plan

The Sampling and Analysis Plan for this project is included in Appendix 1 of this report. Duplicate samples were not submitted as part of the analytical testing program. Otherwise, there were no deviations from the Sampling and Analysis Plan.

3.5 Impediments

No denial of access was encountered during the Phase II-ESA. In order to fit the drilling equipment in the basement of 530 Edison Avenue, it was necessary to saw-cut the concrete floor slab (approximately 1.5 m^2 area). Due to the presence of the AST at 534 Edison Avenue, it was not possible to place a core hole in the immediate vicinity of a capped pipe in the floor slab. Otherwise, no physical impediments were identified.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation was conducted on September 21 and 23, 2016 and consisted of drilling 3 boreholes (BH1 to BH3) in the basements of the residential dwellings along Edison Avenue. In addition to the boreholes, a corehole was also placed in the basement of 530 Edison Avenue to further investigate the subsurface beneath the concrete floor slab in an area of staining. The boreholes were placed to address the existing and former fuel oil heating equipment. The drilling contractor was Capital Cutting and Coring Ltd. (CCC) of Ottawa, Ontario. The boreholes (BH1 through BH3) and corehole (CH1) were advanced using portable drilling equipment under the full-time supervision of Paterson personnel. The testhole locations are identified on the attached Drawing PE3876-3 - Test Hole Location Plan.

The boreholes BH1 through BH3 were drilled through the overburden and cored into the bedrock to depths ranging from approximately 4.9 to 5.5 m below the basement floor slabs (or approximately 6.1 to 7 m below the existing surface grade). Each borehole was instrumented with a groundwater monitoring well upon completion. The core hole (CH1) was completed through the slab only and a grab sample was collected from the surface of the underlying soil at an approximate depth of 0.2 m below the floor slab.

In addition to the drilling program, a capped pipe identified at 534 Edison Avenue during the Phase I ESA, was opened for further inspection. However it was not possible to determine the use of the pipe at the time.

4.2 Soil Sampling

A total of nine (9) soil samples were obtained from the boreholes by means of split spoon sampling with shallow grab samples collected directly from the test holes. Continuous split spoon samples were taken at approximate 0.6 m intervals. It should be noted that practical spoon refusal was encountered on cobbles and boulders within the native till material and coring through the overburden was required. The depths at which split spoon, grab samples and rock cores were obtained from the boreholes are shown as "**SS**", "**G**" and "**RC**" respectively on the Soil Profile and Test Data Sheets, appended to this report.

Site soils beneath the concrete floor slab generally consist of a sandy silt to silty sand Glacial Till, over grey limestone bedrock. At the locations of BH1 and BH2, approximately 0.45 to 0.76 m of apparent fill material was identified. This material consisted of crushed stone mixed with occasional pieces of residual coal and ash, as well as occasional brick and concrete fragments. Based on the age of the buildings (1920's), it is considered likely that they were originally heated with coal. Specific details of the soil profile at each testhole location are presented on the Soil Profile and Test Data sheets appended to this report.

4.3 Field Screening Measurements

All soil samples collected were submitted to a preliminary screening procedure, which included visual screening for colour and evidence of metals, as well as a soil vapour screening with an RKI Eagle gas detector with methane elimination and calibrated to hexane.

The soil vapours were measured by inserting the analyzer probe into the nominal headspace above the soil sample. Samples were then agitated/manipulated gently as the measurements were taken. The peak reading registered within the first 15 seconds was recorded as the vapour measurement.

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

The combustible vapour readings were found to range from 0 ppm to 15 ppm. These readings are not indicative of volatile substances such as gasoline. It should be noted however that combustible vapours cannot be relied upon when screening for heavier hydrocarbon fractions (such as engine oil) or weathered petroleum products.

Please refer to the Soil Profile and Test Data sheets provided in Appendix 1 for soil sample headspace results.

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

4.4 Groundwater Monitoring Well Installation

Three (3) groundwater monitoring wells were installed by CCC under full-time supervision by Paterson personnel. The monitoring wells consisted of 32 mm diameter Schedule 40 threaded PVC risers and screens. A sand pack consisting of silica sand was placed around the screen, and a bentonite seal was placed above the screen to minimize cross-contamination. Monitoring well construction details are provided on the Soil Profile and Test Data Sheets in Appendix 1. A summary of monitoring well construction details is provided below in Table 1.

Table 1: Monitoring Well Construction Details

Well ID	Ground Surface Elevation*	Total Depth (m BGS*)	Screened Interval (m BGS*)	Sand Pack (m BGS*)	Bentonite Seal (m BGS*)	Casing Type
BH1	98.02	5.54	2.5-5.5	2.2-5.5	0.3-2.2	PVC riser
BH2	97.46	5.33	2.3-5.3	2.0-5.3	0.3-2.0	PVC riser
BH3	99.33	4.88	1.9-4.9	1.6-4.9	0.3-1.6	PVC riser

Notes:
- * - ground surface refers to the basement floor slab

4.5 Field Measurement of Water Quality Parameters

Prior to groundwater sampling, water quality parameters were measured in the field using a multi-parameter analyzer. Parameters measured in the field include temperature, electrical conductivity, pH, and total dissolved solids. Wells were purged prior to sampling until at least three well volumes had been removed or until the well was purged dry. Field parameter values prior to sampling are summarized below in Table 2.

Table 2:
Field Measurement of Water Quality Parameters

Borehole Location	Temperature (°C)	pH	Conductivity (µS/cm)	Total Dissolved Solids (ppm)	Date
BH1	14.2	7.06	1,700	850	Sept.28, 2016
BH2	15.0	7.1	1,865	932	
BH3	16.0	7.09	1,616	808	

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 each monitoring well, using dedicated sampling equipment. Standing water was purged from each well prior to sampling. Samples were stored in coolers to reduce analyte volatilization during transportation. Details of our standard operating procedure for groundwater sampling are provided in the Sampling and Analysis Plan in Appendix 1.

4.7 Analytical Testing

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

Table 3: Soil Samples Submitted				
Sample ID	Sample Depth/ Stratigraphic Unit	Parameters Analyzed		Rationale
		BTEX	PHC (F_1-F_4)	
BH1-SS4	1.3-1.5 m bgs; glacial till	X	X	Petroleum hydrocarbon odour; closest sample to water table.
BH2-SS2	0.3-0.9m bgs; glacial till	X	X	Highest vapour reading.
CH4-G1	0.1-0.2 m bgs; glacial till	X	X	Petroleum hydrocarbon odour.

Table 4: Groundwater Samples Submitted				
Sample ID	Sample Depth/ Stratigraphic Unit	Parameters Analyzed		Rationale
		BTEX	PHC (F_1-F_4)	
BH1-GW1	2.49-5.54 m bgs; bedrock	X	X	Assessment of groundwater quality at the subject site based on potential contaminants of concern.
BH2-GW1	2.28-5.33 m bgs; bedrock	X	X	
BH3-GW1	1.83-4.88 m bgs; bedrock	X	X	

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

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

4.9 Elevation Surveying

Boreholes elevations were surveyed using a laser level relative to a temporary benchmark (TBM), consisting of the top spindle of a fire hydrant located at the southeast corner of Princeton Avenue and Edison Avenue. An assumed elevation of 100.00 metres above sea level (m ASL) was used. The location of the site benchmark is shown on Drawing PE3876-3 – Test Hole Location Plan.

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, chain of custody, equipment cleaning procedures, and field quality control measurements are provided in the Sampling and Analysis Plan in Appendix 1.

5.0 REVIEW AND EVALUATION

5.1 Geology

Site geology details are provided in the Soil Profile and Test Data Sheets provided in Appendix 1. The borehole profiles generally consist of concrete floor slab over sandy silt to silty sand Glacial Till, underlain by limestone bedrock interbedded with dolomite. Fill material consisting of crushed stone mixed with some residual coal and ash as well as occasional brick and concrete fragments was identified beneath the floor slabs at BH1 (540 Edison Avenue) and BH2 (534 Edison Avenue). Bedrock was encountered at depths ranging from approximately 1.4 to 2.1 m below the floor slab (2.6 to 2.9 m below ground surface).

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured using an electronic water level meter and are summarized below in Table 5. All elevations are relative to a temporary benchmark with assumed elevation of 100.00 m ASL, as discussed above. It should be noted that groundwater levels are expected to fluctuate throughout the year with seasonal variations.

Table 5: Groundwater Level Measurements				
Borehole Location	**Ground Surface Elevation (m ASL)**	**Water Level Depth (m below grade)**	**Water Level Elevation (m ASL)**	**Date of Measurement**
BH1	98.02	2.82	95.2	September 28, 2016
BH2	97.46	2.11	95.35	
BH3	99.33	1.90	95.43	
Notes: ❒ * - ground surface refers to the basement floor slab				

Based on the groundwater elevations recorded during the monitoring event, groundwater contour mapping was completed. Groundwater contours are shown on Drawing PE3876-5 - Groundwater Contour Plan. Based on the contour mapping, groundwater flow at the subject site appears to be in a southerly direction. An average horizontal hydraulic gradient of approximately 0.046 m/m was calculated.

5.3 Fine-Medium Soil Texture

Based on observed soil conditions, it is our opinion that fine- to medium-grained soil standards are not applicable at the subject site. Coarse-grained soil standards have been used for the subject site. Grain size analysis was not completed.

5.4 Soil: Field Screening

Field screening of the soil samples collected during drilling resulted in soil vapour readings of 0 ppm to 15 ppm. Field screening results of each individual soil sample are provided on the Soil Profile and Test Data Sheets appended to this report.

5.5 Soil Quality

Three soil samples were submitted to Paracel Laboratories for analysis of BTEX and PHC (F_1-F4) parameters. The results of the soil testing are presented in Table 6. The laboratory certificates of analysis are provided in Appendix 1.

Table 6: Analytical Test Results – Soil
BTEX and PHCs (F_1-F_4)

Parameter	MDL (µg/g)	Soil Samples (µg/g)			MOECC Table 3 Standards Residential Coarse (µg/g)
		BH1-SS4	BH2-SS2	*CH1-G1	
		Sept.21, 2016		Sept.23,2016	
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 F_1	7	nd	nd	nd	55
PHC F_2	4	nd	nd	nd	98
PHC F_3	8	nd	nd	126	300
PHC F_4	6	nd	nd	26	2,800

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- note that Sample CH1-G1 was mislabelled as BH4-G1 and is referred to as such on the CofA

No BTEX or PHC parameters were detected above the method detection limits in any of the soil samples submitted for analysis, with the exception of PHC F_3 (126 µg/g) and F_4 (26 µg/g) parameters in sample CH1-G1. The PHC concentrations identified were in compliance with the MOECC Table 3 standards. It should be noted that these concentrations are also in compliance with the MOECC Table 1 standards which are typically referenced for off-site disposal purposes.

5.6 Groundwater Quality

Groundwater samples from the monitoring wells installed in BH1, BH2 and BH3 were submitted for laboratory analysis of BTEX and PHC (F_1-F_4) parameters. The groundwater samples were obtained from the screened intervals noted in Tables 1 and 4, above. The results of the analytical testing are presented below in Table 7. The laboratory certificates of analysis are provided in Appendix 1.

Table 7: Analytical Test Results – Groundwater
BTEX/PHC (F_1 – F_4)

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)			MOECC Table 3 Residential Standards (µg/L)
		BH1-GW1	BH2-GW1	BH3-GW1	
		September 28, 2016			
Benzene	0.5	nd	nd	nd	44
Ethylbenzene	0.5	nd	nd	nd	2,300
Toluene	0.5	nd	nd	nd	18,000
Xylenes (total)	0.5	nd	nd	nd	4,200
PHC F_1	25	nd	nd	nd	750
PHC F_2	100	nd	nd	nd	150
PHC F_3	100	nd	nd	nd	500
PHC F_4	100	nd	nd	nd	500

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

No BTEX or PHC parameters were identified above the method detection limits in any of the samples submitted for analytical testing. The results are in compliance with MOECC Table 3 standards.

5.7 Quality Assurance and Quality Control Results

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

As per Subsection 47(3) of O.Reg. 153/04 as amended by 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.

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. 153/04 as amended by O.Reg. 269/11 made under the Environmental Protection Act. Conclusions and recommendations are discussed in a subsequent section.

Site Description

The Phase II Property is situated on the north side of Princeton Avenue, between Edison Avenue and Melbourne Avenue, in the City of Ottawa, Ontario. The Phase II Property has an area of approximately 0.59 hectares. At the time of the Phase II Environmental Site Assessment (ESA), the Phase II Property was occupied by a two-storey residence and infirmary situated along Melbourne Avenue, as well as three two-storey residential buildings along Edison Avenue. The remainder of the property was occupied by paved access lanes and parking areas, landscaped areas, two private garages and storage sheds.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

As per Column A of Table 2 outlined in Ontario Regulation 153/04 and amended by O.Reg. 269/11, the following potentially contaminating activity (PCA) was identified on the subject property: Item 28 - "Gasoline and Associated Products Storage in Fixed Tanks". Based on staining observed in combination with partially buried fuel lines, areas of potential environmental concern (APECs) are considered to be present within the basements of each of the residential dwellings along Edison Avenue.

No other PCAs were identified on the subject property or within the Phase I study area.

At the time of the Phase II ESA, what appeared to be occasional pieces of residual coal and ash, as well as occasional fragments of building debris, were observed beneath the floor slabs of 534 and 540 Edison Avenue. The remnant coal and ash is considered to have resulted from the historical burning of coal as heating fuel and is not considered to have had the potential to impact the underlying soils and groundwater. Based on its presence beneath the floor slab above the groundwater table, leaching is not considered to have occurred.

Contaminants of Concern

Based on the findings of the Phase II ESA BTEX and PHCs and not considered to be contaminants of concern.

Subsurface Structures and Utilities

The Phase II Property is situated in a municipally serviced area and is occupied by four building structures with basement levels. No other subsurface structures are present on the property.

Buried services situated in the immediate vicinity of the aforementioned APECs, include municipal water and sewer services. Based on standard practice for subsurface utility installation, service trenches are expected to be present approximately 1 to 2 m below existing grade. In general, trench backfill may provide a preferential pathway for contaminant transport if the water table is at or above the base of the trenches. Based on the depth of groundwater, these service trenches are not considered to affect contaminant transport.

Physical Setting

Site Stratigraphy

Site stratigraphy is provided in the Soil Profile and Test Data Sheets provided in Appendix 1 and illustrated on Drawing PE3876-6 - Cross-Sections A-A'. Stratigraphy consists of:

- **Basement floor slab** consisting of 0.07 to 0.15 m of concrete.
- **Fill Material** crushed stone was encountered beneath the floor slab at BH1 and BH2; occasional pieces of partially burned coal and ash and/or occasional fragments of brick and concrete were mixed with the crushed stone. This material was present to depths of approximately 0.51 to 0.91 m below the top of the floor slab.
- **Glacial Till** was encountered beneath the fill or the floor slab. The till consisted of brown sandy silty to silty sand with gravel and cobbles.
- **Limestone Bedrock** was encountered beneath the till at depths ranging from 1.4 to 2.1 m below the top of the floor slab.

Hydrogeological Characteristics

Groundwater levels were measured at the subject site on September 28, 2016. The water table at the subject site was encountered in the bedrock.

Groundwater levels were measured at depths between approximately 1.9 and 2.8 m below the top of the basement floor slab. It is noted that water levels fluctuate with seasonal variations.

Based on the groundwater elevations recorded during the monitoring event, groundwater contour mapping was completed. Groundwater contours are shown on Drawing PE3786-5 - Groundwater Contour Plan. Based on the contour mapping, groundwater flow at the subject site appears to be towards the south. An average horizontal hydraulic gradient of approximately 0.007 m/m was calculated.

Approximate Depth to Bedrock

At the time of the Phase II ESA, grey, limestone bedrock was encountered at depths ranging from approximately 1.4 to 2.1 m below the top of the basement floor slab or 2.6 to 2.9 m below the exterior grade.

Approximate Depth to Water Table

Depth to water table at the subject site varies between approximately 1.9 and 2.8 m below the basement floor slab or 3.1 to 3.6 m below the exterior ground surface.

Sections 41 and 43.1 of the Regulation

Section 41 of the Regulation (Site Condition Standards, Environmentally Sensitive Areas) and Section 43.1 do not apply to the subject site. The Phase II Property is not a shallow soil property and is not within 30 m of a body of water.

Fill Placement

As noted above, fill material onsite consists of granular material beneath the floor slabs of 534 and 540 Edison Avenue. Some remnant coal and ash with occasional fragments of brick and concrete were mixed with the granular material overlying the native soil. It is considered likely however that this material is a result of historical heating with coal. This material ranged in thickness from 0.46 to 0.76 m.

Proposed Buildings and Other Structures

It is our understanding that a portion of the Phase II Property will be redeveloped with residential dwellings.

Existing Buildings and Structures

The subject property is currently occupied by a two-storey residence and infirmary with a full basement level, as well three two-storey residential dwellings, each with a full basement level. Two concrete slab-on-grade private garage structures and two temporary metal sheds are also present on the Phase II Property. The locations of the existing buildings and structures are shown on Drawing PE3876-3 – Test Hole Location Plan.

Water Bodies

No bodies of water are present on the subject property or within the Phase I study area.

Areas of Natural Significance

No areas of natural significance were observed on the Phase I Property or within the Phase I study area.

Environmental Condition

Areas Where Contaminants are Present

Based on the findings of the Phase II ESA, there are no BTEX and PHC parameters exceeding the MOECC Table 3 standards, in the soil or groundwater beneath the Phase II Property. Although analyses were not conducted for PAHs, based on the presence of coal fragments identified at 540 Edison Avenue, this material should be considered as impacted. As stated previously, underlying soils and groundwater are not considered to have been impacted by this material; based on its presence beneath a building and above the water table, leaching is not considered to have occurred. Analytical test results for soil and groundwater are shown on Drawings PE3876-4 – Analytical Testing Plan.

6.0 CONCLUSIONS

Assessment

Paterson Group was retained Mr. Barry Hobin, to prepare a Phase II Environmental Site Assessment for the property addressed 373 Princeton Avenue (also includes 530, 534 and 540 Edison Avenue), in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address the Areas of Potential Environmental Concern (APECs) for the subject site identified during the Phase I ESA conducted in September of 2016.

The Phase II ESA consisted of drilling three (3) interior boreholes which were cored into the bedrock and instrumented with groundwater monitoring wells, to assess soil and groundwater quality at the subject site. An additional corehole was conducted at 530 Edison Avenue.

Soil samples obtained from the boreholes were screened using visual observations and vapour measurements. Soils on site generally consist of Glacial Till over limestone bedrock interbedded with dolomite. Some crushed stone was present beneath the floor slabs of 534 and 540 Edison Avenue. The crushed stone was mixed with what appeared to be occasional remnants of partially burned coal, ash and/or occasional fragments of brick and concrete. The remnant coal and ash is considered to have resulted from the historical burning of coal as heating fuel and is not considered to have had the potential to impact the underlying soils and groundwater. Based on the location of this material beneath the floor slab and well above the groundwater table, leaching is not considered to have occurred.

Based on the screening results in combination with field observations, soil samples from BH1, BH2 and CH1 were submitted for analytical testing of benzene, ethylbenzene, toluene and xylenes (BTEX) and petroleum hydrocarbons (fractions F_1-F_4). BTEX and PHC parameters were not detected above method detection limits in any of the samples, with the exception of PHC F_3 and F_4 in Sample CH4-G1, which were identified at concentrations below the MOECC Table 3 standards.

Groundwater samples were collected from the monitoring wells installed in BH1, BH2 and BH3 on September 28, 2016 and submitted for analysis of BTEX and PHC (F_1-F_4) parameters. Parameters were not detected above the method detection limits in any of the groundwater samples submitted for testing. The results are therefore in compliance with the MOECC Table 3 standards.

Recommendations

Based on the findings of the Phase II-ESA, some partially burned coal and ashes were observed beneath the basement floor slabs at 534 and 540 Edison Avenue. The material is considered to be associated with the historical use of coal as a heating source, prior to conversion to fuel oil-fired equipment. This material should be removed from the property during the redevelopment of the site, for disposal at a registered waste disposal facility.

It is recommended that Paterson personnel be on site at the time of the excavation activities in order to supervise segregation of this material. Prior to off-site disposal of impacted material at a waste disposal facility, a leachate analysis of a representative sample will be required in accordance with Ontario Regulation 347/558.

Once the monitoring wells are no longer required for sampling purposes, they should be decommissioned by a licenced contractor in accordance with Ontario Regulation 903.

7.0 STATEMENT OF LIMITATIONS

This Phase II - Environmental Site Assessment report has been prepared in general accordance with O.Reg. 153/04 as amended 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 Mr. Barry Hobin. Permission and notification from Mr. Hobin 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:

- Mr. Barry Hobin (2 copies)
- Paterson Group (1 copy)

FIGURES

FIGURE 1 – KEY PLAN

DRAWING PE3876-3 – TEST HOLE LOCATION PLAN

DRAWING PE3876-4 – ANALYTICAL TESTING PLAN

DRAWING PE3837-5 – CROSS-SECTION A-A`

DRAWING PE3837-6– GROUNDWATER FLOW CONTOURS

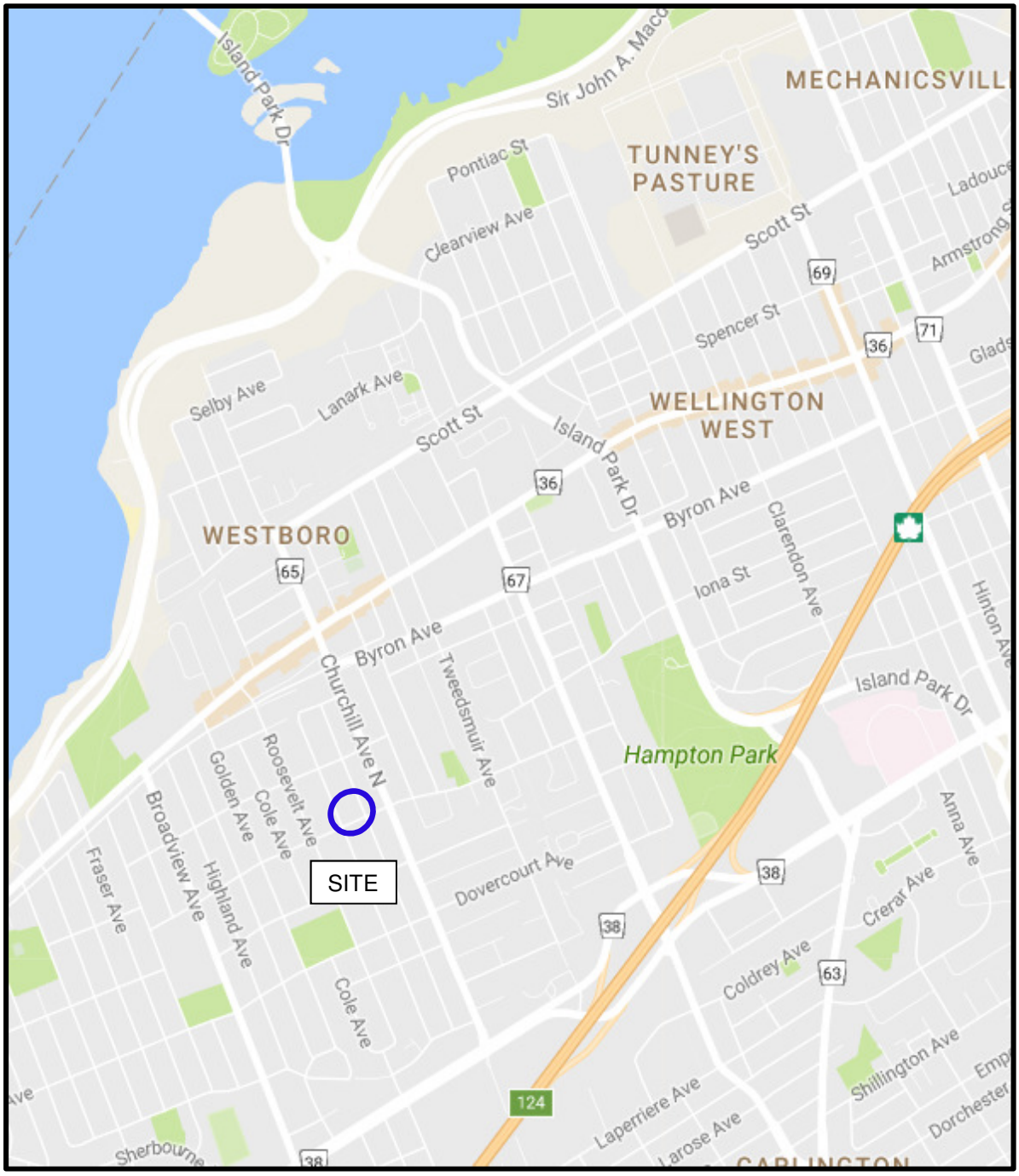

FIGURE 1

KEY PLAN

#521 EDISON AVENUE
RESIDENTIAL

#525 EDISON AVENUE
RESIDENTIAL

#529 EDISON AVENUE
RESIDENTIAL

#531 EDISON AVENUE
RESIDENTIAL

#349 PRINCETON AVENUE
RESIDENTIAL

FH - BM

EDISON AVENUE

TREED

TREED

TREED

DRIVEWAY

#534 EDISON AVE.

BH 2
97.46
[96.06]
(95.35)

#540 EDISON AVE.

BH 1
98.02
[95.94]
(95.20)

PRIVATE GARAGE
(2006)

#530
EDISON
AVENUE

CH 1
97.33

BH 3
97.33
[95.96]
(95.43)

A

A'

STORAGE
SHED

TREED

#373 PRINCETON AVE.
INSTITUT JEANNE D'ARC

PRINCETON AVENUE

#552 EDISON AVENUE
RESIDENTIAL

#370 PRINCETON AVENUE
RESIDENTIAL

LEGEND:

- BOREHOLE WITH MONITORING WELL LOCATION
- COREHOLE LOCATION
- 98.02 — GROUND SURFACE ELEVATION (m)
- [95.94] — BEDROCK SURFACE ELEVATION (m)
- (95.20) — GROUNDWATER SURFACE ELEVATION (m)
- A—A' — CROSS-SECTION LOCATION

BENCHMARK (BM) - TOP SPINDLE OF FIRE HYDRANT LOCATED ON THE SOUTHEAST CORNER OF PRINCETON AVENUE AND EDISON AVENUE. ASSUMED ELEVATION = 100.00m.

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NO.	REVISIONS	DATE	INITIAL
0			

MR. BARRY HOBIN

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
530, 534 & 540 EDISON AVENUE AND 373 PRINCETON AVENUE
OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:250	Date: 10/2016
Drawn by: MPG	Report No.: PE3876-2
Checked by: KM	Dwg. No.: PE3876-3
Approved by: MSD	Revision No.: 0

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#521 EDISON AVENUE
RESIDENTIAL

#525 EDISON AVENUE
RESIDENTIAL

#529 EDISON AVENUE
RESIDENTIAL

#531 EDISON AVENUE
RESIDENTIAL

#349 PRINCETON AVENUE
RESIDENTIAL

FH - BM

E D I S O N A V E N U E

BH1-SS4 (1.3-1.5m) - Sept.21, 2016
BTEX and PHCs comply with MOECC Table 3
BH1-GW1 (2.5-5.5m) - Sept.28, 2016
BTEX and PHCs comply with MOECC Table 3

CH1-G1 (0.1-0.2 m) - Sept.23, 2016
BTEX and PHCs comply with MOECC Table 3

BH3-GW1 (1.8-4.8m) - Sept.28, 2016
BTEX and PHCs comply with MOECC Table 3

TREED

#534 EDISON AVE.

BH 2
97.46
[96.06]
(95.35)

#540 EDISON AVE.

TREED

#530
EDISON
AVENUE

CH 1
97.33

BH 3
97.33
[95.96]
(95.43)

DRIVEWAY

BH 1
98.02
[95.94]
(95.20)

PRIVATE GARAGE
(2006)

STORAGE
SHED

P R I N C E T O N A V E N U E

#552 EDISON AVENUE
RESIDENTIAL

BH2-SS2 (0.3-0.9m) - Sept.21, 2016
BTEX and PHCs comply with MOECC Table 3
BH2-GW1 (2.3-5.3m) - Sept.28, 2016
BTEX and PHCs comply with MOECC Table 3

TREED

#373 PRINCETON AVE.
INSTITUT JEANNE D'ARC

LEGEND:

- BOREHOLE WITH MONITORING WELL LOCATION
- COREHOLE LOCATION
- 98.02 GROUND SURFACE ELEVATION (m)
- [95.94] BEDROCK SURFACE ELEVATION (m)
- (95.20) GROUNDWATER SURFACE ELEVATION (m)

BENCHMARK (BM) - TOP SPINDLE OF FIRE HYDRANT LOCATED ON THE SOUTHEAST CORNER OF PRINCETON AVENUE AND EDISON AVENUE. ASSUMED ELEVATION = 100.00m.

SOIL: Analysed parameters comply with MOECC Table 3
SOIL: Analysed parameters exceed MOECC Table 3
GROUNDWATER: Analysed parameters comply with MOECC Table 3
GROUNDWATER: Analysed parameters exceed MOECC Table 3
Depths provided are with respect to top of basement floor slab

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NO.	REVISIONS	DATE	INITIAL
0			

MR. BARRY HOBIN

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
530, 534 & 540 EDISON AVENUE AND 373 PRINCETON AVENUE
OTTAWA, ONTARIO

Title:
ANALYTICAL TESTING PLAN

Scale: 1:250	Date: 10/2016
Drawn by: MPG	Report No.: PE3876-2
Checked by: KM	Dwg. No.: PE3876-4
Approved by: MSD	Revision No.: 0

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#521 EDISON AVENUE
RESIDENTIAL

#525 EDISON AVENUE
RESIDENTIAL

#529 EDISON AVENUE
RESIDENTIAL

#531 EDISON AVENUE
RESIDENTIAL

#349 PRINCETON AVENUE
RESIDENTIAL

FH - BM

EDISON AVENUE

PRINCETON AVENUE

TREED

TREED

TREED

DRIVEWAY

#530
EDISON
AVENUE

CH 1
97.33

BH 3
97.33
[95.96]
(95.43)

#534 EDISON AVE.

BH 2
97.46
[96.06]
(95.35)

#540 EDISON AVE.

BH 1
98.02
[95.94]
(95.20)

PRIVATE GARAGE
(2006)

(0.007m/m)

95.40
95.35
95.30
95.25
95.20

STORAGE
SHED

TREED

#373 PRINCETON AVE.
INSTITUT JEANNE D'ARC

#552 EDISON AVENUE
RESIDENTIAL

#370 PRINCETON AVENUE
RESIDENTIAL

LEGEND:

- BOREHOLE WITH MONITORING WELL LOCATION
- COREHOLE LOCATION
- 98.02 — GROUND SURFACE ELEVATION (m)
- [95.94] — BEDROCK SURFACE ELEVATION (m)
- (95.20) — GROUNDWATER SURFACE ELEVATION (m)
- 95.0 — GROUNDWATER CONTOUR
- (0.007m/m) — APPROX. GROUNDWATER FLOW DIRECTION (HORIZONTAL HYDRAULIC GRADIENT)

BENCHMARK (BM) - TOP SPINDLE OF FIRE HYDRANT LOCATED ON THE SOUTHEAST CORNER OF PRINCETON AVENUE AND EDISON AVENUE. ASSUMED ELEVATION = 100.00m.

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NO.	REVISIONS	DATE	INITIAL
0			

MR. BARRY HOBIN

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
530, 534 & 540 EDISON AVENUE AND 373 PRINCETON AVENUE
OTTAWA, ONTARIO

Title:

GROUNDWATER CONTOUR PLAN

Scale: 1:250	Date: 10/2016
Drawn by: MPG	Report No.: PE3876-2
Checked by: KM	Dwg. No.: PE3876-5
Approved by: MSD	Revision No.: 0

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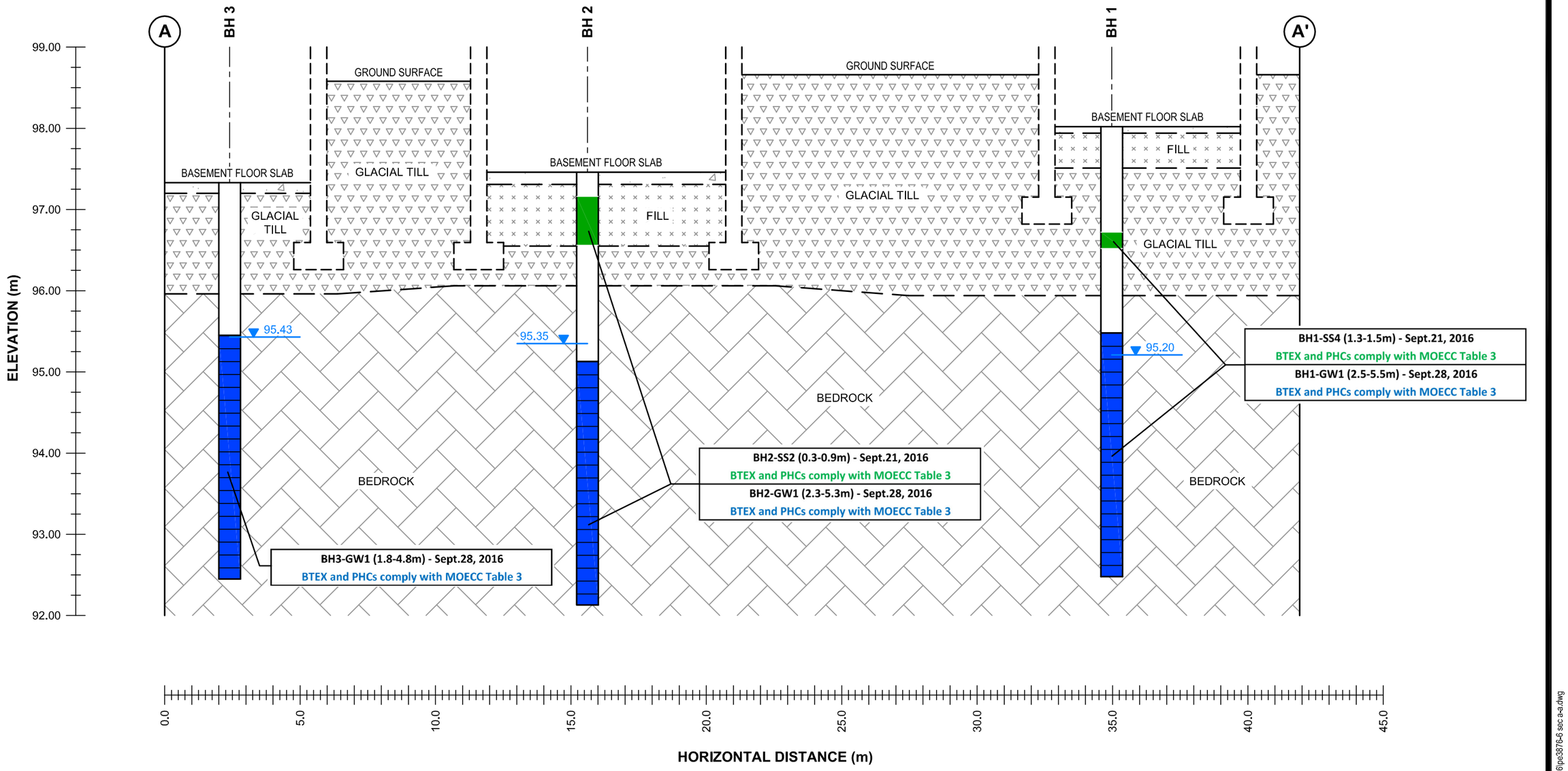

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NO.	REVISIONS	DATE	INITIAL
0			

MR. BARRY HOBIN

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
530, 534 & 540 EDISON AVENUE AND 373 PRINCETON AVENUE
OTTAWA, ONTARIO

Title:

CROSS-SECTION A-A'

Scale: AS SHOWN	Date: 10/2016
Drawn by: MPG	Report No.: PE3876-2
Checked by: KM	Dwg. No.: PE3876-6
Approved by: MSD	Revision No.: 0

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APPENDIX 1

SAMPLING AND ANALYSIS PLAN

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

LABORATORY CERTIFICATES OF ANALYSIS

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

Paterson Group Inc.

Consulting Engineers
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patersongroup

Sampling & Analysis Plan

Phase II Environmental Site Assessment,
373 Princeton Avenue
Ottawa, Ontario

Prepared For

Mr. Barry Hobin

September 19, 2016

Report: PE3876-SAP

Table of Contents

1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by Mr. Barry Hobin to conduct a Phase II-Environmental Site Assessment (ESA) for the property addressed 373 Princeton Avenue, Ottawa, Ontario. The subject property also includes residential dwellings addressed 530, 534 and 540 Edison Avenue. Based on the findings of the Phase I-ESA conducted by Paterson, a subsurface investigation program, consisting of borehole drilling, was developed.

Borehole	Location & Rationale	Proposed Depth & Rationale
BH1	540 Edison Avenue; borehole located adjacent to former fuel oil heating equipment in the basement, to address potential hydrocarbon impacts in soil and groundwater.	Intercept groundwater table for monitoring well installation at proposed depth of 5 to 6 m below basement floor slab.
BH2	534 Edison Avenue; borehole located adjacent to former fuel oil heating equipment in basement to address potential hydrocarbon impacts in soil and groundwater beneath concrete floor slab.	Intercept groundwater table for installation of monitoring well 5 to 6 m below basement floor slab.
BH3	530 Edison Avenue; borehole located in area of staining adjacent fuel oil heating equipment in the basement, to address potential hydrocarbon impacts in soil and groundwater.	Intercept groundwater table for installation of monitoring well 5 to 6 m below basement floor slab.
CH1	530 Edison Avenue; corehole located in area of staining adjacent fuel oil heating equipment located in the basement, to address soil beneath concrete floor slab.	Core through concrete slab to collect grab sample from upper portion of underlying soil (0.2 m below basement floor slab).

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

At each borehole, continuous split-spoon samples of overburden soils will be obtained (every 0.6 m or 2') until practical refusal to augering. All soil samples will be retained, and samples will be selected for submission following a preliminary screening analysis.

Following borehole drilling, monitoring wells will be installed in each borehole (as above).

2.0 ANALYTICAL TESTING PROGRAM

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

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

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

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

3.0 STANDARD OPERATING PROCEDURES

3.1 Environmental Drilling Procedure

Purpose

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

Equipment

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

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

Determining Borehole Locations

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

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

Drilling Procedure

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

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

Spoon Washing Procedure

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

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

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

Screening Procedure

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

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

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

3.2 Monitoring Well Installation Procedure

Equipment

- ❒ 1.5 m x 50 mm threaded sections of Schedule 40 PVC slotted well screen (1.5 m x 31 mm if installing in cored hole in bedrock)
- ❒ 1.5 m x 50 mm threaded sections of Schedule 40 PVC riser pipe (1.5 m x 31 mm if installing in cored hole in bedrock)
- ❒ Threaded end-cap
- ❒ Slip-cap or J-plug
- ❒ Asphalt cold patch or concrete
- ❒ Silica Sand
- ❒ Bentonite chips (Holeplug)
- ❒ Steel flushmount casing

Procedure

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

- ❒ Install flushmount casing. Seal space between flushmount and borehole annulus with concrete, cold patch, or holeplug to match surrounding ground surface.

3.3 Monitoring Well Sampling Procedure

Equipment

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

Sampling Procedure

- ❒ Locate well and use socket wrench or Allan key to open metal flush mount protector cap. Remove plastic well cap.
- ❒ Measure water level, with respect to existing ground surface, using water level meter or interface probe. If using interface probe on suspected NAPL site, measure the thickness of free product.
- ❒ Measure total depth of well.
- ❒ Clean water level tape or interface probe using methanol and water. Change gloves between wells.
- ❒ Calculate volume of standing water within well and record.
- ❒ Insert polyethylene tubing into well and attach to peristaltic pump. Turn on peristaltic pump and purge into graduated bucket. Purge at least three well volumes of water from the well. Measure and record field chemistry. Continue to purge, measuring field chemistry after every well volume purged, until appearance or field chemistry stabilizes.

- ❒ Note appearance of purge water, including colour, opacity (clear, cloudy, silty), sheen, presence of LNAPL, and odour. Note any other unusual features (particulate matter, effervescence (bubbling) of dissolved gas, etc.).
- ❒ Fill required sample bottles. If sampling for metals, attach 75-micron filter to discharge tube and filter metals sample. If sampling for VOCs, use low flow rate to ensure continuous stream of non-turbulent flow into sample bottles. Ensure no headspace is present in VOC vials.
- ❒ Replace well cap and flushmount casing cap.

4.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

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

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

5.0 DATA QUALITY OBJECTIVES

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

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

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

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

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

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

These considerations are discussed in the body of the report.

6.0 PHYSICAL IMPEDIMENTS TO SAMPLING & ANALYSIS PLAN

Physical impediments to the Sampling and Analysis plan may include:

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

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
530, 534 & 540 Edison Avenue and 373 Princeton Ave.
Ottawa, Ontario

DATUM Benchmark (BM) - Top spindle of fire hydrant located on the southeast corner of Princeton Ave. and Edison Ave. Assumed elevation = 100.00m

REMARKS 540 Edison Avenue

FILE NO. PE3876

HOLE NO. BH 1

BORINGS BY Portable Drill **DATE** September 21, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	98.02
Concrete slab 0.08		G	1				
FILL: Crushed stone mixed with occasional pieces of residual coal, as well as occasional brick and concrete fragments 0.51		SS	2	75			
		SS	3	100		1	97.02
GLACIAL TILL: Brown sandy silt to silty sand, trace gravel to 0.9m depth		SS	4	67			
2.08						2	96.02
		RC	1	100	42		
						3	95.02
BEDROCK: Grey limestone interbedded with shale							
		RC	2	96	44	4	94.02
		RC	3	100	75	5	93.02
5.54							
End of Borehole							
(GWL @ 2.82m-Sept. 28, 2016)							

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
530, 534 & 540 Edison Avenue and 373 Princeton Ave.
Ottawa, Ontario

DATUM Benchmark (BM) - Top spindle of fire hydrant located on the southeast corner of Princeton Ave. and Edison Ave. Assumed elevation = 100.00m

REMARKS 534 Edison Avenue

FILE NO. PE3876

HOLE NO. BH 2

BORINGS BY Portable Drill **DATE** September 21, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	97.46
Concrete slab 0.15		G	1				
FILL: Crushed stone mixed with some ash, as well as occasional brick and concrete fragments		SS	2	67	14		
0.91						1	96.46
GLACIAL TILL: Brown sandy silt to silty sand, trace gravel to 0.9m depth							
1.40		RC	1	92	0		
		RC	2	88	48	2	95.46
BEDROCK: Grey limestone interbedded with shale						3	94.46
		RC	3	97	72		
						4	93.46
		RC	4	100	81		
						5	92.46
5.33							
End of Borehole							
(GWL @ 2.11m-Sept. 28, 2016)							

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
530, 534 & 540 Edison Avenue and 373 Princeton Ave.
Ottawa, Ontario

DATUM Benchmark (BM) - Top spindle of fire hydrant located on the southeast corner of Princeton Ave. and Edison Ave. Assumed elevation = 100.00m

REMARKS 530 Edison Avenue

FILE NO. PE3876

HOLE NO. BH 3

BORINGS BY Portable Drill **DATE** September 23, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	97.33
Concrete slab 0.13							
GLACIAL TILL: Brown silty sand to sandy silt, trace gravel, cobbles, boulders and clay		SS	1	75	11		
		G	2			1	96.33
1.37		RC	1	75	0		
		RC	2	92	39	2	95.33
BEDROCK: Grey shale interbedded with shale						3	94.33
		RC	3	100	73		
						4	93.33
		RC	4	98	70		
4.88							
End of Borehole							
(GWL @ 1.90m-Sept. 28, 2016)							

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
530, 534 & 540 Edison Avenue and 373 Princeton Ave.
Ottawa, Ontario

DATUM Benchmark (BM) - Top spindle of fire hydrant located on the southeast corner of Princeton Ave. and Edison Ave. Assumed elevation = 100.00m

REMARKS 530 Edison Avenue

FILE NO. PE3876

HOLE NO. CH 1

BORINGS BY Portable Drill **DATE** September 23, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Photo Ionization Detector: ● Volatile Organic Rdg. (ppm) / ○ Lower Explosive Limit %	Monitoring Well Construction
GROUND SURFACE						0	97.33		
Concrete slab 0.13		G	1						
GLACIAL TILL: Brown sandy silt, trace clay, gravel, cobbles, boulders 0.20									
End of Corehole									

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

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

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

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

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

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

CONSOLIDATION TEST

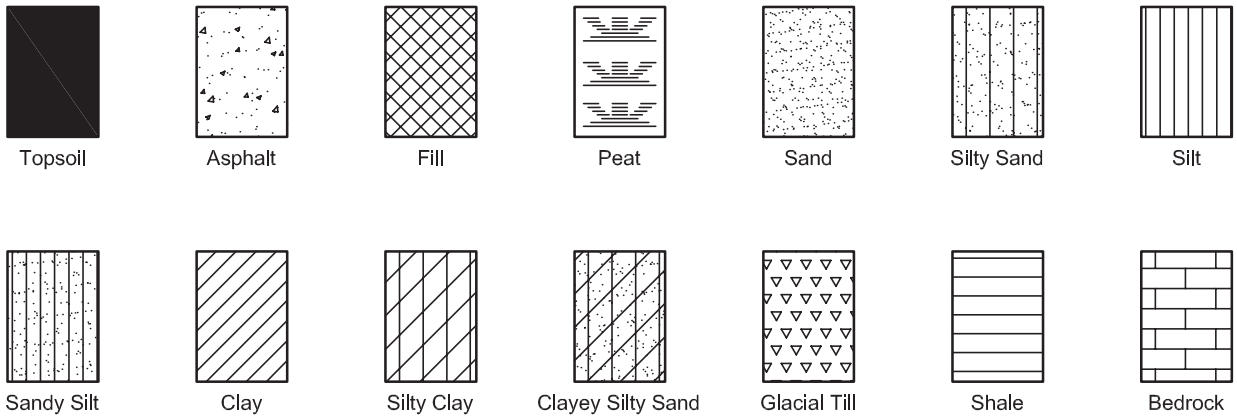
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

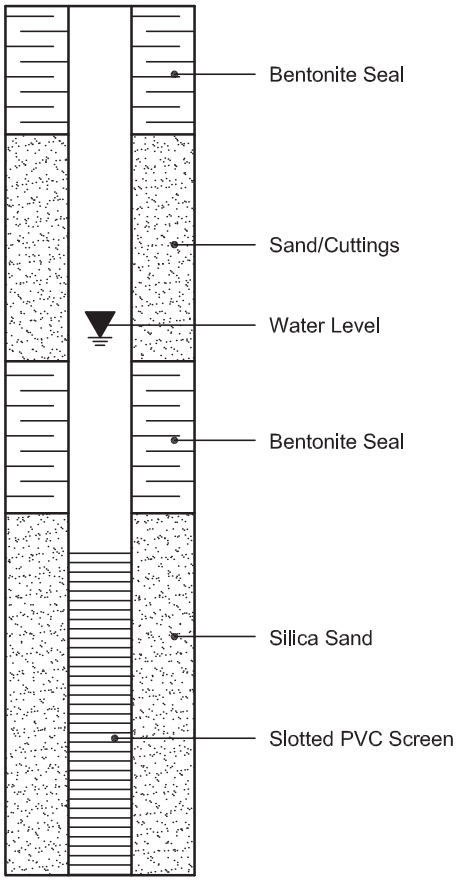
SYMBOLS AND TERMS (continued)

STRATA PLOT

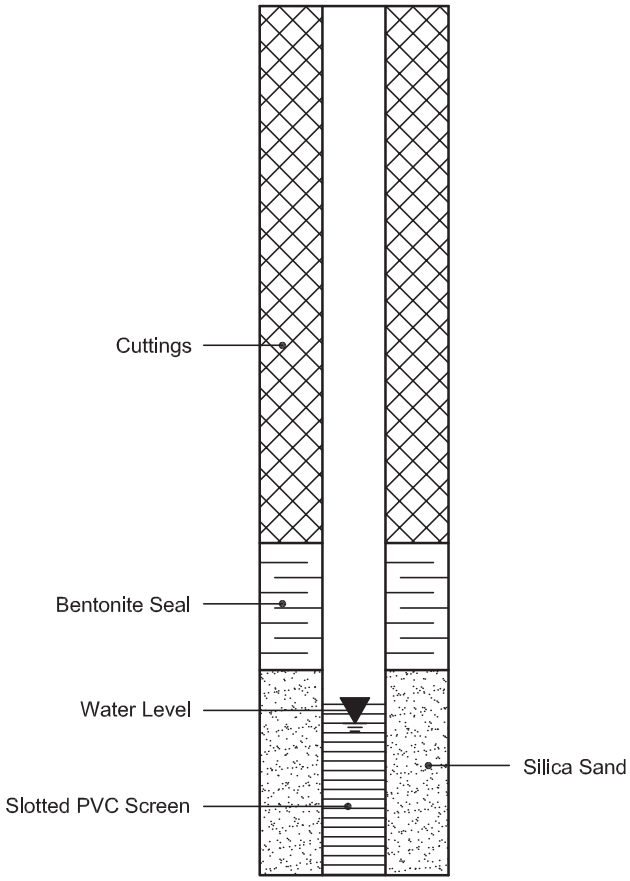


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 20150
Project: PE3876
Custody: 108924

Report Date: 28-Sep-2016
Order Date: 22-Sep-2016

Order #: 1639383

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

Paracel ID	Client ID
1639383-01	BH1-SS4
1639383-02	BH2-SS2

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 20150

Report Date: 28-Sep-2016
Order Date: 22-Sep-2016
Project Description: PE3876

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	24-Sep-16	27-Sep-16
PHC F1	CWS Tier 1 - P&T GC-FID	24-Sep-16	27-Sep-16
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	24-Sep-16	26-Sep-16
Solids, %	Gravimetric, calculation	24-Sep-16	24-Sep-16

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 20150

Report Date: 28-Sep-2016
Order Date: 22-Sep-2016
Project Description: PE3876

	Client ID:	BH1-SS4	BH2-SS2	-	-
	Sample Date:	21-Sep-16	21-Sep-16	-	-
	Sample ID:	1639383-01	1639383-02	-	-
	MDL/Units	Soil	Soil	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	86.1	91.2	-	-
Volatiles					
Benzene	0.02 ug/g dry	<0.02	<0.02	-	-
Ethylbenzene	0.05 ug/g dry	<0.05	<0.05	-	-
Toluene	0.05 ug/g dry	<0.05	<0.05	-	-
m,p-Xylenes	0.05 ug/g dry	<0.05	<0.05	-	-
o-Xylene	0.05 ug/g dry	<0.05	<0.05	-	-
Xylenes, total	0.05 ug/g dry	<0.05	<0.05	-	-
Toluene-d8	Surrogate	110%	111%	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	-	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	-	-
F3 PHCs (C16-C34)	8 ug/g dry	<8	<8	-	-
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	-	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 20150

Report Date: 28-Sep-2016
Order Date: 22-Sep-2016
Project Description: PE3876

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Volatiles									
Benzene	ND	0.02	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: Toluene-d8	*8.80*		*ug/g*		*110*	*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)	57	4	ug/g dry	55			4.1	30	
F3 PHCs (C16-C34)	1940	8	ug/g dry	1990			2.5	30	
F4 PHCs (C34-C50)	421	6	ug/g dry	396			6.2	30	
Physical Characteristics									
% Solids	87.5	0.1	% by Wt.	87.3			0.2	25	
Volatiles									
Benzene	ND	0.02	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	
Surrogate: Toluene-d8	*6.01*		*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)	193	7	ug/g		96.6	80-120			
F2 PHCs (C10-C16)	80	4	ug/g		88.9	80-120			
F3 PHCs (C16-C34)	166	8	ug/g		89.2	80-120			
F4 PHCs (C34-C50)	110	6	ug/g		88.7	80-120			
Volatiles									
Benzene	3.92	0.02	ug/g		98.1	60-130			
Ethylbenzene	3.60	0.05	ug/g		90.0	60-130			
Toluene	3.68	0.05	ug/g		92.0	60-130			
m,p-Xylenes	7.20	0.05	ug/g		90.0	60-130			
o-Xylene	3.67	0.05	ug/g		91.7	60-130			
Surrogate: Toluene-d8	*7.82*		*ug/g*		*97.8*	*50-140*			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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

CCME PHC additional information:

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

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№ 108924

Page __ of __

Client Name: Paterson Group Inc.	Project Reference: PE3876	**Turnaround Time:**	
Contact Name: Kanya Munch	Quote #	☐ 1 Day	☐ 3 Day
Address: 154 Colonnade Rd. S.	PO # 20150	☐ 2 Day	☒ Regular
Telephone: 613-226-7381	Email Address: kmunch@patersongroup.ca	Date Required:	

Criteria: ☒ O. Reg. 153/04 (As Amended) Table 7 ☐ 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: 1639383

	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-SS4	S		2	Sept. 21/16	am	✓						
2	BH2-SS2	S		2	↓	pm	✓						
3													
4													
5													
6													
7													
8													
9													
10													

Comments:

Method of Delivery: Paracel

Relinquished By (Sign): KMunch	Received by Driver/Depot: T. Trouse	Received at Lab:	Verified By:
Relinquished By (Print): K Munch	Date/Time: 22/09/16 3:00 PM	Date/Time: 22/09/16 17:42	Date/Time: 22/09/16 17:47
Date/Time: Sept. 22/16.	Temperature: ___ °C	Temperature: 20.3 °C	pH Verified [ ] By: -

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO:
Project: PE3876
Custody: 108926

Report Date: 30-Sep-2016
Order Date: 26-Sep-2016

Order #: 1640062

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

Paracel ID	Client ID
1640062-01	BH4-G1

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

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

Report Date: 30-Sep-2016
Order Date: 26-Sep-2016
Project Description: PE3876

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	29-Sep-16	30-Sep-16
PHC F1	CWS Tier 1 - P&T GC-FID	29-Sep-16	30-Sep-16
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	27-Sep-16	27-Sep-16
Solids, %	Gravimetric, calculation	30-Sep-16	30-Sep-16

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

Report Date: 30-Sep-2016
Order Date: 26-Sep-2016
Project Description: PE3876

	Client ID:	BH4-G1	-	-	-
	Sample Date:	23-Sep-16	-	-	-
	Sample ID:	1640062-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	85.5	-	-	-
Volatiles					
Benzene	0.02 ug/g dry	<0.02	-	-	-
Ethylbenzene	0.05 ug/g dry	<0.05	-	-	-
Toluene	0.05 ug/g dry	<0.05	-	-	-
m,p-Xylenes	0.05 ug/g dry	<0.05	-	-	-
o-Xylene	0.05 ug/g dry	<0.05	-	-	-
Xylenes, total	0.05 ug/g dry	<0.05	-	-	-
Toluene-d8	Surrogate	109%	-	-	-
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	126	-	-	-
F4 PHCs (C34-C50)	6 ug/g dry	26	-	-	-

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

Report Date: 30-Sep-2016
Order Date: 26-Sep-2016
Project Description: PE3876

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Volatiles									
Benzene	ND	0.02	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: Toluene-d8	*3.63*		*ug/g*		*114*	*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	
Physical Characteristics									
% Solids	90.9	0.1	% by Wt.	88.9			2.2	25	
Volatiles									
Benzene	ND	0.02	ug/g dry					50	
Ethylbenzene	ND	0.05	ug/g dry					50	
Toluene	ND	0.05	ug/g dry					50	
m,p-Xylenes	ND	0.05	ug/g dry					50	
o-Xylene	ND	0.05	ug/g dry					50	
Surrogate: Toluene-d8	*3.81*		*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)	199	7	ug/g		99.7	80-120			
F2 PHCs (C10-C16)	72	4	ug/g		80.0	80-120			
F3 PHCs (C16-C34)	176	8	ug/g		94.6	80-120			
F4 PHCs (C34-C50)	104	6	ug/g		83.9	80-120			
Volatiles									
Benzene	3.27	0.02	ug/g		81.8	60-130			
Ethylbenzene	4.20	0.05	ug/g		105	60-130			
Toluene	3.95	0.05	ug/g		98.8	60-130			
m,p-Xylenes	7.86	0.05	ug/g		98.2	60-130			
o-Xylene	4.07	0.05	ug/g		102	60-130			
Surrogate: Toluene-d8	*3.11*		*ug/g*		*97.1*	*50-140*			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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

CCME PHC additional information:

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

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№ 108926

Page __ of __

Client Name: Paterson Group	Project Reference: ~~PE3873~~ PE3876.	**Turnaround Time:**
Contact Name: Kaya Munch	Quote #	☐ 1 Day ☐ 3 Day
Address: 154 Colonnade Rd S.	PO #	☐ 2 Day ☒ Regular
Telephone: 613-226-7381	Email Address: kmunch@patersongroup.ca	Date Required: Mon. Oct. 3

Criteria: ☑ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: _____ ☐ Other: before 4:00 if possible.

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: 1640062.

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)							
1	BH4-G1	S		2	Sept. 23/16	am.	✓							- 120ml + 1 vial -						✓
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Comments:

Method of Delivery: Swift

Relinquished By (Sign):	Received by Driver/Depot:	Received at Lab:	Verified By:
K Munch		SUNEPGRN DOC MAI	Rachel Subject
Relinquished By (Print): K. Munch.	Date/Time:	Date/Time: SEP 26, 2016 08:21	Date/Time: Sep 26/16
Date/Time: Sept. 26, 2016.	Temperature: ____ °C	Temperature: 16.0 °C	pH Verified ☒ By: DA 4:44

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 19275
Project: PE3876
Custody: 28923

Report Date: 3-Oct-2016
Order Date: 28-Sep-2016

Order #: 1640267

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

Paracel ID	Client ID
1640267-01	BH1-GW1
1640267-02	BH2-GW1
1640267-03	BH3-GW1

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	30-Sep-16	3-Oct-16
PHC F1	CWS Tier 1 - P&T GC-FID	30-Sep-16	3-Oct-16
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	30-Sep-16	1-Oct-16

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 19275

Report Date: 03-Oct-2016
Order Date: 28-Sep-2016
Project Description: PE3876

	Client ID:	BH1-GW1	BH2-GW1	BH3-GW1	-
	Sample Date:	28-Sep-16	28-Sep-16	28-Sep-16	-
	Sample ID:	1640267-01	1640267-02	1640267-03	-
	MDL/Units	Water	Water	Water	-
Volatiles					
Benzene	0.5 ug/L	<0.5	<0.5	<0.5	-
Ethylbenzene	0.5 ug/L	<0.5	<0.5	<0.5	-
Toluene	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	-
Toluene-d8	Surrogate	91.6%	90.9%	92.0%	-
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	-
F1 + F2 PHCs	125 ug/L	<125	<125	<125	-
F3 + F4 PHCs	200 ug/L	<200	<200	<200	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 19275

Report Date: 03-Oct-2016
Order Date: 28-Sep-2016
Project Description: PE3876

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
Volatiles									
Benzene	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: Toluene-d8	*34.4*		*ug/L*		*107*	*50-140*			

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 19275

Report Date: 03-Oct-2016
Order Date: 28-Sep-2016
Project Description: PE3876

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND				30	
Volatiles									
Benzene	ND	0.5	ug/L	ND				30	
Ethylbenzene	ND	0.5	ug/L	ND				30	
Toluene	ND	0.5	ug/L	ND				30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: Toluene-d8	*34.0*		*ug/L*		*106*	*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)	1700	25	ug/L		85.1	68-117			
F2 PHCs (C10-C16)	1780	100	ug/L		98.9	60-140			
F3 PHCs (C16-C34)	3460	100	ug/L		93.1	60-140			
F4 PHCs (C34-C50)	2210	100	ug/L		89.2	60-140			
Volatiles									
Benzene	24.7	0.5	ug/L		61.7	60-130			
Ethylbenzene	36.0	0.5	ug/L		89.9	60-130			
Toluene	46.1	0.5	ug/L		115	60-130			
m,p-Xylenes	84.0	0.5	ug/L		105	60-130			
o-Xylene	44.8	0.5	ug/L		112	60-130			
Surrogate: Toluene-d8	*27.7*		*ug/L*		*86.5*	*50-140*			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

CCME PHC additional information:

- 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.
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- 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.

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Page 1 of 1

Client Name: Paterson Group	Project Reference: PE3876
Contact Name: Karyn Munch	Quote #
Address: 154 Colonnade Rd S.	PO # 19275
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 _ ☐ 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: 1640267

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	BTEX	PHC (F1-F4)									
1	BH1-GW1	GW		3	Sep 28/2016		✓	✓									
2	BH2-GW1	GW		3	↓		✓	✓									
3	BH3-GW1	GW		3			✓	✓									
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Comments: Please Return Results by 4pm on Monday Oct. 3 2016. Thanks!

Method of Delivery: Paracel

Relinquished By (Sign):	Received by Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): ERIK ARDLEY	Date/Time: 28/09/16 3:10PM	Date/Time: SEP 28, 2016 05:12	Date/Time: 28/09/16 17:17
Date/Time: Sep 28 2016	Temperature: ___°C	Temperature: 16 °C	pH Verified ☐ By: