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Phase II-Environmental Site Assessment

Vacant Property
590 Rideau Street
Ottawa, Ontario

Prepared For

Richcraft Group of Companies

March 25, 2016

Report: PE2706-3

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EXECUTIVE SUMMARY

Assessment

A Phase II-ESA was conducted for the property at 590 Rideau Street, Ottawa, Ontario. The purpose of the Phase II-ESA was to address the areas of potential environmental concern identified during the Phase I-ESA. The subsurface investigation at the subject site consisted of drilling four (4) boreholes and installing three (3) groundwater monitoring wells.

Soil samples were obtained from the boreholes and screened using visual observations and organic vapour measurements. A total of seven (7) soil samples were submitted for laboratory analysis for a combination of PHC, BTEX, VOC and metal parameters. The four (4) native soil samples submitted were in compliance with the MOECC Table 3 standards. The three (3) fill samples submitted were found to exceed the MOECC Table 3 standards for several metal parameters.

Groundwater samples were obtained from two (2) monitoring wells (BH2 and BH3) and submitted for analysis of PHCs and VOCs. No parameters were detected above the method detection limit. The groundwater samples were in compliance with the selected MOECC Table 3 standards. A groundwater sample could not be obtained from BH1 due to a blockage encountered within the well which could not be removed at the time of the sampling event.

Conclusion

Based on the above results, fill exists at the subject property with thallium and lead concentrations which exceed the MOECC Table 3 standards. This fill typically also contains varying quantities of demolitions. It is our understanding that the subject site is to be redeveloped with a multi-storey mixed-use building with underground levels. It is our recommendation that an environmental site remediation program, involving the removal of all contaminated fill/demolition debris, be completed concurrently with the site redevelopment.

1.0 INTRODUCTION

At the request of Richcraft Group of Companies, Paterson Group (Paterson) conducted a Phase II Environmental Site Assessment of the property addressed 590 Rideau 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, dated March 9, 2016.

1.1 Site Description

Address:	590 Rideau Street, Ottawa, Ontario.
Legal Description:	Lots 49, 50 and the west half of lot 51, Plan 6, City of Ottawa.
Property Identification Number:	04207-0667.
Location:	The subject site is located on the southeast corner of the Rideau Street and Charlotte Street intersection, in the City of Ottawa, Ontario. The subject site is shown on Figure 1 - Key Plan following the body of this report.
Latitude and Longitude:	45° 25' 58" N, 75° 40' 57" W.
Configuration:	Rectangular.
Site Area:	1214 square meters (approximate).

1.2 Property Ownership

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

1.3 Current and Proposed Future Uses

The subject site is currently vacant and occupied by a park. It is our understanding that the subject site will be redeveloped with a seven (7) storey mixed-use building with underground levels. No further details are currently available.

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
- Residential land use

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The subject site is located to the southeast of the intersection of Rideau Street and Charlotte Street, in the City of Ottawa, Ontario. The site is currently occupied by a park which is primarily grass covered. Site topography slopes down towards the adjacent roadways. Site drainage consists of infiltration.

2.2 Past Investigations

Paterson previously completed a Phase I-ESA provided under separate cover. According to the historical research, the subject site was occupied by residential buildings between 1896 and 1933. The buildings were subsequently used for residential and commercial purposes, including dry cleaning establishments between 1933 and circa 1956, although it could not be confirmed whether dry cleaning was actually done on site or if they were drop off locations. Various tenants occupied the subject buildings until they were demolished circa 1980 and 2013. The subject site has been vacant since and used as a park.

The former presence of potential dry cleaning activities on site were Potentially Contaminating Activities (PCAs) representing Areas of Potential Environmental Concern (APEC).

The building formerly located at 592 Rideau Street was demolished between 1974 and 1984. It was considered possible that fill of questionable quality was used to backfill this building foundation. As a result, this former building foundation was also considered to represent an APEC on the subject site.

Vent and fill pipes were identified in a previous assessment prior to the demolition of the remaining structures circa 2013. The former on-site use of furnace oil represents an APEC on the subject site.

Various neighbouring properties in the Phase I study area were identified as PCAs, however, none of these were considered to represent an APEC on the subject site with the exception of the adjacent properties to the east which were historically occupied by an automobile service garage, a retail fuel outlet and a dry cleaner. Based on the information discovered during the historical research a Phase II ESA was recommended.

A geotechnical investigation was completed on the subject site by Paterson in 2012. Four (4) boreholes were drilled and one (1) groundwater monitoring well was installed. The fill was noted to contain demolition debris in the former building foundation of 592 Rideau Street. Practical refusal to DCPT was encountered at 21 and 22 meters below ground surface in BH1 and BH3, respectively. No apparent signs of petroleum hydrocarbon impact were noted in the soil samples collected.

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The subsurface investigation was conducted March 9, 2016, and consisted of drilling four (4) boreholes, three (3) of which were completed with groundwater monitoring wells. Boreholes were drilled to depths ranging from 3.7 and 8.2 meters below ground surface.

3.2 Media Investigated

During the subsurface investigation, soil samples and groundwater samples were obtained and submitted for laboratory analysis. The rationale for sampling and analyzing these media is based on the Contaminants of Potential Concern identified in the Phase I ESA. Contaminants of concern for soil and groundwater are Petroleum Hydrocarbons (PHCs), Volatile Organic Compounds (VOCs) or metals.

3.3 Phase I Conceptual Site Model

Geological and Hydrogeological Setting

Based on information from the Geological Survey of Canada mapping and the subsurface investigations, drift thickness in the area of the subject site is on the order of 15 to 25 m. Overburden soils consist of fill over loose to compact brown silty sand over grey silty clay. Groundwater was encountered within the silty clay at depths ranging from 3.75 to 7.60 meters below existing grade.

Contaminants of Potential Concern

The following CPCs were identified with respect to the subject site:

- Volatile Organic Compounds (VOCs) – this suite of parameters includes chlorinated solvents and gasoline related BTEX parameters (Benzene, Toluene, Ethylbenzene, and Xylenes). These parameters were selected as CPCs for the Phase I study area due to the potential former use of chemicals for dry cleaning and solvents at an automotive service garage. VOCs may be present in the soil matrix as well as in the dissolved phase in the groundwater system.

- Petroleum Hydrocarbons Fractions 1 through 4 (PHCs F1-F4) – this suite of parameters encompasses gasoline (Fraction 1), diesel and fuel oil (Fraction 2), and heavy oils (Fractions 3 and 4). PHCs F1-F4 was selected as a CPC for the Phase I property based on the presence of the former automotive service garage and former retail fuel outlet located adjacent to the east. The former site buildings were also historically heated with furnace oil. PHCs may be present in the soil matrix, sorbed to soil particles, as well as in free or dissolved phase in the groundwater system. PHCs are generally considered to be LNAPLs – light non-aqueous phase liquids, indicating that when present in sufficient concentrations above the solubility limit, they will partition into a separate phase above the water table, due to their lower density.

- Metals – this suite of parameters encompasses various metals for which MOECC standards exist. Metals may be present in the soil matrix or dissolved in site groundwater, although less likely in the latter case. Metals were selected as CPCs for the Phase II property based on the potential placement of fill of questionable quality to backfill the foundation of a former building (592 Rideau Street)

The mechanisms of contaminant transport within the site soils include physical transportation and leaching. Due to the impermeable nature of the neighbouring properties' ground cover, leaching is not considered to be a major issue for the subject site. The subject land was until recently (2013) paved and occupied by buildings.

The mechanisms of contaminant transport within the groundwater system include advection, dispersion, and diffusion. Advection and dispersion will be the dominant mechanisms of contaminant transport in soils with higher hydraulic conductivities, such as sands, gravels, silts, and some glacial till soils, whereas diffusion will dominate in soils with lower hydraulic conductivity, such as clays. Groundwater transport is not an issue since the groundwater is not contaminated.

Existing Buildings and Structures

The subject site is vacant and currently occupied by a park.

Water Bodies and Areas of Natural Significance

No water bodies or areas of natural significance were identified on the subject site or in the Phase I study area.

Drinking Water Wells

A search of the MOECC water well database returned one (1) record in 2013 located near the intersection of Besserer and Charlotte Street, 35 m south of the subject site. This is expected to be a monitoring well, although no other information regarding this well was available. Due to the availability of municipal water services in the area of the subject site, it is our opinion that there are no drinking water wells within the Phase I study area.

Neighbouring Land Use

Neighbouring land use in the Phase I study area is generally residential and commercial.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

The Areas of Potential Environmental Concern identified in the Phase I ESA are summarized below in Table 1. Other Potentially Contaminating Activities within the Phase I study area are not considered to pose an environmental concern to the subject site due to their separation distance and/or location down-gradient or cross-gradient of the subject site.

Table 1 – Areas 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)
590 Rideau Street (167 and 169 Charlotte Street and 594 Rideau Street)	Subject Property	Former dry cleaners (1933 to 1954); Item 37, Table 2, O.Reg. 153/04 (Operation of Dry Cleaning Equipment where chemicals are used)	On-site	VOCs	Soil, Groundwater
590-594 Rideau Street	Subject Property	Former on-site use of furnace oil; Item 28, Table 2, O.Reg. 153/04 (Gasoline and Associated Products Storage in Fixed Tanks)	On-Site	PHCs (F1-F4) and BTEX	Soil, Groundwater
592 Rideau Street	Subject Property	Backfilled building foundation (1974-1984); Item 30, Table 2, O.Reg. 153/04 (Importation of Fill Material of Unknown Quality)	On-Site	Metals	Soil
598 Rideau Street	Eastern Portion of Phase I Property	Former Automobile Garage (1960s-1970s); Item 52, Table 2, O.Reg. 153/04 (Storage, maintenance, fuelling and repair of vehicles)	Off-site	PHCs (F1-F4) and VOCs	Soil, Groundwater
600 Rideau Street	Eastern Portion of Phase I Property	Former Retail Fuel Outlet (1930s-1960s); Item 28, Table 2, O.Reg. 153/04 (Gasoline and Associated Products Storage in Fixed Tanks)	Off-site	PHCs (F1-F4) and BTEX	Soil, Groundwater
602 Rideau Street	Eastern Portion of Phase I Property	Former dry cleaners (1960 to 1980); Item 37, Table 2, O.Reg. 153/04 (Operation of Dry Cleaning Equipment where chemicals are used)	Off-Site	VOCs	Groundwater

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 potentially contaminating activities that have the potential to have impacted the subject site.

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

3.4 Deviations from Sampling and Analysis Plan

The Sampling and Analysis Plan for this project is included in Appendix 1 of this report. No deviations from the sampling and analysis plan were noted except the blockage encountered in the well in BH1, which had not allowed sampling of the groundwater at the time of issuance of this report.

3.5 Impediments

No physical impediments or denial of access were encountered during the Phase II Environmental Site Assessment.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation was conducted on March 9, 2016. The subsurface investigation consisted of the drilling of four (4) boreholes on the subject site, three (3) of which were completed with groundwater monitoring wells. The boreholes were placed to provide general coverage of the subject site and to address the aforementioned areas of potential environmental concern. The boreholes were drilled with a track mounted CME 55 power auger drill rig provided by George Downing Estate Drilling of Hawkesbury, Ontario. Borehole locations are shown on Drawing PE2706-4 – Test Hole Location Plan, appended to this report.

4.2 Soil Sampling

A total of thirty-four (34) soil samples were obtained from the boreholes by means of split spoon sampling and the sampling of shallow soils directly from auger flights. The depths at which split spoon and auger flight samples were obtained from the boreholes are shown as "**SS**" and "**AU**" respectively on the Soil Profile and Test Data Sheets, appended to this report.

Site soils consist of topsoil overlying sand and gravel fill containing pieces of brick and mortar. The fill layer varied in thickness from 1.98 to 2.14m and was underlain by brown silty sand followed by grey silty clay. The boreholes with monitoring wells were ended within the underlying silty clay at depths between 7.62 and 8.23 meters below ground surface.

4.3 Field Screening Measurements

All soil samples collected underwent a preliminary screening procedure, which included visual screening for colour and evidence of deleterious fill, as well as screening with a photo ionization detector (PID). The detection limit is 0.1ppm, with a precision of +/- 2ppm 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 1.7 to 62.1ppm. Vapour readings are noted on the Soil Profile and Test Data Sheets in Appendix 1.

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

4.4 Groundwater Monitoring Well Installation

Three (3) groundwater monitoring wells were installed on the subject site, during the subsurface investigation on March 9, 2016. Copies of the borehole logs for these wells are included in Appendix 1. The monitoring wells consisted of 50mm diameter Schedule 40 threaded PVC risers and screens. Monitoring well construction details are listed below in Table 2.

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
BH 1	71.15	8.23	5.18-8.23	4.88-8.23	0.3-4.88	Flushmount
BH 2	71.54	8.23	5.18-8.23	4.93-8.23	0.3-4.93	Flushmount
BH 3	71.51	7.62	5.49-7.62	5.03-7.62	0.3-5.03	Flushmount

4.5 Field Measurement of Water Quality Parameters

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

4.6 Groundwater Sampling

Groundwater sampling protocols were followed using the 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 soil and groundwater samples were submitted for analysis:

Table 3: Soil Samples Submitted

Sample ID	Sample Depth/ Stratigraphic Unit	Parameters Analyzed			Rationale
		PHCs/ BTEX	Metals	VOCs	
BH1-AU1	0.46-0.76 m; Fill		X		Assessment of metals in fill in the footprint of a former building
BH1-SS5	3.05-3.66 m; Silty Sand			X	Assessment of potential VOC impacts within the footprint of a former dry cleaner
BH2-SS2	1.52-2.13 m; Fill		X		Assessment of metals in fill adjacent to a former building
BH2-SS5	3.81-4.42 m; Silty Clay	X			Assessment of PHC/BTEX impacts (former oil tank)
BH3-SS5	3.81-4.42 m; Silty Clay			X	Assessment of VOC impacts within the footprint of a former dry cleaner
BH3-SS8	6.10-6.71 m; Silty Clay			X	Assessment of VOC impacts within the footprint of a former dry cleaner
BH4-SS1	0.61-1.22 m; Fill		X		Assessment of metals in fill in the footprint of a former building

Table 4: Groundwater Samples Submitted

Sample ID	Screened Interval/ Stratigraphic Unit	Parameters Analyzed		Rationale
		PHCs/BTEX	VOCs	
BH2-GW	5.18-8.23; Silty Clay	X		Assessment of potential PHC impacts in the groundwater
BH3-GW	5.49-7.62; Silty Clay	X	X	Assessment of potential PHC and VOC impacts in the eastern portion of the subject site.

BH1 had a blockage which could not be removed at the time of sampling. No groundwater sample could be obtained from BH1.

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 of a fire hydrant spindle located to the north, across Rideau Street. The top of the spindle has a Geodetic Elevation = 72.20 m.

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 consist of topsoil over fill which is underlain by silty sand and silty clay. The fill material consists of brown sand and gravel (with some brick and mortar debris in the vicinity of former building footprints) and varies in thickness from 1.98 to 2.14m. Boreholes were terminated in the silty sand or silty clay layers at depths ranging from 3.7 and 8.2 meters. According to geological maps reviewed, bedrock is considered to consist of interbedded limestone and shale from the Verulam Formation. Practical refusal to DCPT was encountered between 21 and 22 meters below ground surface during a previous geotechnical investigation. Site stratigraphy is shown on Drawing PE2706-7 – Cross-Section A-A'.

Groundwater was encountered within the silty clay at depths of 3.8 to and 7.6 m below existing grade, although the water levels may not have stabilized.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured during the groundwater sampling events on March 16, 2016, using an electronic water level meter. Groundwater levels are summarized below in Table 5. All measurements are relative to the top of the fire hydrant spindle located to the north, opposite Rideau Street.

Table 5: Groundwater Level Measurements

Borehole Location	Ground Surface Elevation (m)	Water Level Depth (m below grade)	Water Level Elevation (m ASL)	Date of Measurement
BH 1	71.15	well blocked	-	March 16, 2016
BH 2	71.54	3.75	67.79	March 16, 2016
BH 3	71.51	7.60	63.91	March 16, 2016

Due to a blockage encountered in BH1, no groundwater level could be obtained at the time of sampling. As such, groundwater contour mapping to establish groundwater flow direction and horizontal hydraulic gradient could not be completed. Groundwater is inferred to flow to the north based on previous investigations conducted by Paterson in this area.

No unusual odours or free product was observed in the monitoring wells sampled at the subject site.

5.3 Fine-Coarse Soil Texture

Coarse grained soil standards were chosen for the subject site, although fine-grained standards may be applied upon further analysis.

5.4 Soil: Field Screening

Field screening of the soil samples collected during drilling resulted in organic vapour readings of 1.7 to 62.1ppm. 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 higher-fraction hydrocarbons may not be as readily detectable by combustible gas or PID detectors.

5.5 Soil Quality

A total of seven (7) soil samples were submitted for analysis of a combination of PHCs (F1-F4), BTEX, VOC and metal parameters. The results of the analytical testing are presented below in Tables 6, 7 and 8. The laboratory certificates of analysis are provided in Appendix 1.

Table 6: Analytical Test Results – Soil – BTEX/PHCs F1-F4

Parameter	MDL (µg/g)	Soil Samples (µg/g)	MOECC Table 3 Residential Coarse Standards (µg/g)
		March 9, 2016	
		BH2-SS5	
Benzene	0.02	nd	0.21
Ethylbenzene	0.05	nd	2
Toluene	0.05	nd	2.3
Xylenes (Total)	0.05	nd	3.1
PHC F1	7	nd	55
PHC F2	4	nd	98
PHC F3	8	nd	300
PHC F4	6	nd	2800

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

All parameters were below the detection limits for PHCs and BTEX and are in compliance with the MOECC Table 3 residential standards.

Table 7: Analytical Test Results – Soil - Metals

Parameter	MDL (µg/g)	Soil Samples (µg/g)			MOECC Table 3 Residential Coarse Standards
		BH1-AU1	BH2-SS2	BH4-SS1	
Boron, available	0.5	nd	0.8	nd	1.5
Chromium (VI)	0.2	nd	nd	nd	8
Mercury	0.1	nd	nd	nd	0.27
Antimony	1.0	nd	nd	nd	7.5
Arsenic	1.0	5.5	2.2	2.4	18
Barium	1.0	125	179	57.8	390
Beryllium	1.0	nd	nd	nd	4
Boron	1.0	11.9	3.5	3.2	120
Cadmium	0.5	nd	nd	nd	1.2
Chromium	1.0	35.1	20.1	19.6	160
Cobalt	1.0	8.3	5.4	5.3	22
Copper	1.0	22.4	9.0	9.8	140
Lead	1.0	31.9	**176**	79.4	120
Molybdenum	1.0	1.8	nd	nd	6.9
Nickel	1.0	18.7	9.8	11.0	100
Selenium	1.0	nd	nd	nd	2.4
Silver	0.5	nd	nd	nd	20
Thallium	1.0	**3.5**	**1.9**	**1.7**	1
Uranium	1.0	nd	nd	nd	23
Vanadium	1.0	34.4	23.0	21.4	86
Zinc	1.0	70.2	52.2	57.4	340

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

Thallium concentrations indentified in all the fill samples analysed and the lead concentration identified in BH2-SS2 exceed the MOECC Table 3 residential standards.

Table 8: Analytical Test Results – Soil - VOCs					
Parameter	MDL (µg/g)	Soil Sample (µg/g)			MOE Table 3 Residential Coarse Standards
		March 9, 2016			
		BH1-SS5	BH3-SS5	BH3-SS8	
Acetone	0.50	nd	nd	nd	16
Benzene	0.02	nd	nd	nd	0.21
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
Chloroform	0.05	nd	nd	nd	0.05
Dibromochloromethane	0.05	nd	nd	nd	9.4
Dichlorodifluoromethane	0.20	nd	nd	nd	16
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
cis-1,3-Dichloropropylene	0.05	nd	nd	nd	nv
trans-1,3-Dichloropropylene	0.05	nd	nd	nd	nv
1,3-Dichloropropene, total	0.05	nd	nd	nd	0.05
Ethylbenzene	0.5	nd	nd	nd	2
Ethylene dibromide	0.5	nd	nd	nd	0.05
Hexane	0.05	nd	nd	nd	2.8
Methyl Ethyl Ketone	0.05	nd	nd	nd	16
Methyl Isobutyl Ketone	0.05	nd	nd	nd	1.7
Methyl tert-butyl ether	0.50	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
Toluene	0.05	nd	nd	nd	2.3
1,1,1-Trichloroethane	0.05	nd	nd	nd	0.38
1,1,2-Trichloroethane	0.05	nd	nd	nd	0.05
Trichloroethylene	0.02	nd	nd	nd	0.061
Trichlorofluoromethane	0.05	nd	nd	nd	4
Vinyl Chloride	0.02	nd	nd	nd	0.02
Xylenes, total	0.05	nd	nd	nd	3.1

No detectable VOC parameter concentrations were indentified in the soil samples analysed, as such, the soil is in compliance with the MOECC Table 3 residential standards.

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

Table 9: Maximum Concentrations – Soil

Parameter	Maximum Concentration (µg/g)	Borehole	Depth Interval (m BGS)
Boron, available	0.8	BH 2	1.52-2.13
Arsenic	5.5	BH 1	0.46-0.76
Barium	179	BH 2	1.52-2.13
Boron	11.9	BH 1	0.46-0.76
Chromium	35.9	BH 1	0.46-0.76
Cobalt	8.3	BH 1	0.46-0.76
Copper	22.4	BH 1	0.46-0.76
Lead	**176**	BH 2	1.52-2.13
Molybdenum	1.8	BH 1	0.46-0.76
Nickel	18.7	BH 1	0.46-0.76
Thallium	**3.5**	BH 1	0.46-0.76
Vanadium	34.4	BH 1	0.46-0.76
Zinc	70.2	BH 1	0.46-0.76

Notes:
- **Bold and Underlined** – 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 BH2 and BH3 were submitted for laboratory analysis of PHC and VOC parameters. The groundwater samples were obtained from the screened intervals noted on Table 2. BH1 had a blockage which could not be cleared and no groundwater sample could be obtained at the time of sampling. The results of the analytical testing are presented below in Tables 10 and 11. The laboratory certificates of analysis are provided in Appendix 1.

Table 10: Analytical Test Results – Groundwater - PHCs F1-F4				
Parameter	**MDL (µg/L)**	**Groundwater Samples (µg/L)**		**MOECC Table 3 Residential Coarse Standards (µg/L)**
		March 16, 2016		
		BH2-GW	**BH3-GW**	
PHC F1	25	nd	nd	750
PHC F2	100	nd	nd	150
PHC F3	100	nd	nd	500
PHC F4	100	nd	nd	500

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

No PHC concentrations were detected in the groundwater samples submitted for analysis.

Table 11: Analytical Test Results – Groundwater – VOCs				
Parameter	MDL (µg/L)	Groundwater Samples (µg/L)		MOECC Table 3 Residential Coarse Standards (µg/L)
		March 16, 2016		
		BH2-GW	BH3-GW	
Acetone	5.0	-	nd	130000
Benzene	0.5	nd	nd	44
Bromodichloromethane	0.5	-	nd	85000
Bromoform	0.5	-	nd	380
Bromomethane	0.5	-	nd	5.6
Carbon Tetrachloride	0.2	-	nd	0.79
Chlorobenzene	0.5	-	nd	630
Chloroform	0.5	-	nd	2.4
Dibromochloromethane	0.5	-	nd	82000
Dichlorodifluoromethane	1.0	-	nd	4400
1,2-Dichlorobenzene	0.5	-	nd	4600
1,3-Dichlorobenzene	0.5	-	nd	9600
1,4-Dichlorobenzene	0.5	-	nd	8
1,1-Dichloroethane	0.5	-	nd	320
1,2-Dichloroethane	0.5	-	nd	1.6
1,1-Dichloroethylene	0.5	-	nd	1.6
cis-1,2-Dichloroethylene	0.5	-	nd	1.6
trans-1,2-Dichloroethylene	0.5	-	nd	1.6
1,2-Dichloropropane	0.5	-	nd	16
cis-1,3-Dichloropropylene	0.5	-	nd	nv
trans-1,3-Dichloropropylene	0.5	-	nd	nv
1,3-Dichloropropene, total	0.5	-	nd	5.2
Ethylbenzene	0.5	nd	nd	2300
Ethylene dibromide	0.2	-	nd	0.25
Hexane	1.0	-	nd	51
Methyl Ethyl Ketone	5.0	-	nd	470000
Methyl Isobutyl Ketone	5.0	-	nd	140000
Methyl tert-butyl ether	2.0	-	nd	190
Methylene Chloride	5.0	-	nd	610
Styrene	0.5	-	nd	1300
1,1,1,2-Tetrachloroethane	0.5	-	nd	3.3
1,1,2,2-Tetrachloroethane	0.5	-	nd	3.2
Tetrachloroethylene	0.5	-	nd	1.6
Toluene	0.5	nd	nd	18000
1,1,1-Trichloroethane	0.5	-	nd	640
1,1,2-Trichloroethane	0.5	-	nd	4.7
Trichloroethylene	0.5	-	nd	1.6
Trichlorofluoromethane	1.0	-	nd	2500
Vinyl Chloride	0.5	-	nd	0.5
Xylenes, total	0.5	nd	nd	4200

No detectable VOC parameter concentrations were identified in the groundwater samples analysed, as such, they are in compliance with the MOECC Table 3 standards.

No groundwater parameter concentrations were detected above the laboratory detection limits, as such, there are no maximum concentrations.

It is our interpretation that the analyzed parameter concentrations do not indicate the potential presence of light non-aqueous phase liquids (LNAPLs) or dense non-aqueous phase liquids (DNAPLs). No free phase hydrocarbons were noted in the wells sampled at the time of sampling.

5.7 Quality Assurance and Quality Control Results

A duplicate groundwater sample was not obtained during the 2016 sampling event. The conclusions of the report are not considered to be affected by this, as all of the analyzed groundwater parameters are in compliance with the selected MOECC standards.

All samples submitted as part of the 2016 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 during the 2016 sampling event, and all Certificates of Analysis are appended to this report.

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

5.8 Phase II Conceptual Site Model

The following section has been prepared in 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 indicated in the Phase I-ESA report, no Potentially Contaminating Activities (PCAs) currently take place at the subject site. The PCAs that are considered to represent Areas of Potential Environmental Concern (APECs) on the subject site are the historical on-site presence of dry cleaning operations, former use of furnace oil and potential placement of fill of questionable quality. The former automotive service garage, dry cleaning operation and retail fuel outlet located adjacent to the east (596-602 Rideau Street) were also considered to represent APECs for the subject site.

PHCs, BTEX, VOCs and metals are identified as the Contaminants of Concern with respect to the subject site potentially resulting from these APECs.

Subsurface Structures and Utilities

Underground service locates were completed prior to the subsurface investigations. A bell conduit is located along the southern property line. Service locations were not provided and are therefore not shown on Drawing: PE2706-4 – Test Hole Location Plan.

Physical Setting

Site Stratigraphy

The site stratigraphy, from ground surface to the deepest aquifer or aquitard investigated, is illustrated on Drawings PE2706-7 - Cross-Section A-A'. Stratigraphy consists of:

- Fill – consisting of silty sand and gravel (with some brick and mortar debris in the vicinity of the former buildings). The fill varies in thickness from 1.98 to 2.14m. Groundwater was not observed in this stratigraphic unit.
- Silty sand – encountered at depths ranging from 2.13 to 2.29 m below grade. Groundwater was encountered in this stratigraphic unit (possibly a perched water level).

- Silty Clay – encountered at depths ranging from 3.48 to 3.73 m and extended to final borehole depths of between 7.62 and 8.23 m below grade. Groundwater was encountered in this Stratigraphic unit. This is the deepest unit investigated.

Hydrogeological Characteristics

Groundwater was encountered in the silty clay layer at the subject site. This unit is interpreted to function as a local aquifer at the subject site.

Water levels were measured at the subject site on March 16, 2016. Water levels are summarized above in Section 5.2 of this report and are shown on Drawing PE2706-5.

Due to a blockage encountered in BH1, no groundwater level could be obtained at the time of sampling. As such, groundwater contour mapping to establish groundwater flow direction and horizontal hydraulic gradient could not be completed. Groundwater is inferred to flow to the north/northeast.

Approximate Depth to Bedrock

Bedrock was not encountered in the recent boreholes advanced on the subject site, however, refusal on inferred bedrock was encountered between 21 and 22 meters below grade during a previous geotechnical investigation.

Approximate Depth to Water Table

Depth to water table at the subject site varies between approximately 3.75 and 7.60 m (not likely stabilized) below existing grade.

Sections 41 and 43.1 of the Regulation

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

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

Fill Placement

Fill material was identified at the subject site. This fill material is approximately 0.7 to 2.1m thick. The fill is suspected to have been placed on the subject for the purpose of grading, during site development and backfilling former building footprints. The fill was observed to contain demolition debris (brick and mortar) in the areas of the former buildings. The demolition debris is suspected to originate from the former buildings. The fill material did not exhibit any olfactory evidence of contamination. Selected fill samples were analyzed to assess its quality as detailed in preceding sections.

Proposed Buildings and Other Structures

It is our understanding that the site is to be redeveloped with a seven (7) storey mixed-use building with underground levels.

Existing Buildings and Structures

The subject site is currently vacant. No other structures are present on the subject site.

Water Bodies

There are no water bodies on the subject site. The Rideau River is located 250 m to the east on the edge of the Phase I study area.

Areas of Natural Significance

No areas of natural significance are present in the area of the subject site.

Environmental Condition

Areas Where Contaminants are Present

Based on screening and analytical results, lead and thallium concentrations in the fill in the vicinity of the former buildings exceed the MOECC Table 3 standards. The native soil and groundwater at the subject site was is in compliance with the selected MOECC Table 3 standards. Sample locations are illustrated on Drawings PE2706-6.

Types of Contaminants

The fill in the vicinity of the former buildings was found to contain brick and mortar debris. The fill samples submitted for analysis exceeded the MOECC Table 3 standards for metal parameters (thallium and lead).

Contaminated Media

Based on the results of the subsurface investigation some of the fill at the subject site is not in compliance with the selected MOECC Table 3 standards. The native soil and groundwater at the subject site was in compliance with the selected MOECC standards.

What Is Known About Areas Where Contaminants Are Present

The property addressed 590 Rideau Street is considered to have been occupied by four (4) individual building structures. One (1) structure was demolished between 1974 and 1984 while the remaining structures were demolished circa 2013. Impacted fill was identified in three (3) locations across the subject site and is suspected to have been placed after the demolition of the buildings.

Distribution and Migration of Contaminants

Thallium and lead impacted fill was identified in BH1, BH2 and BH4. Based on a visual inspection, the fill material located in BH3 contains identical brick and mortar debris and therefore may also be impacted with metal parameters. Metal impacts are considered to be restricted to the fill material due to the low migration potential of the contaminants and not expected in groundwater based on very low solubility.

Discharge of Contaminants

No discharge of contaminants was observed at the time of the site visit.

Climatic and Meteorological Conditions

In general, climatic and meteorological conditions have the potential to affect contaminant distribution. Two (2) ways by which climatic and meteorological conditions may affect contaminant distribution include the downward leaching of contaminants by means of the infiltration of precipitation, and the migration of contaminants via groundwater levels and/or flow, which may fluctuate seasonally. Leaching is not considered to be an issue since the property was until recently (circa 2013) covered by asphalt and buildings and the metal contaminants low migration potential. The fluctuation of groundwater levels is not considered an issue as the groundwater is not contaminated.

Potential for Vapour Intrusion

There is no vapour risk from metal parameters and as such no potential for vapour intrusion for the future development.

6.0 CONCLUSIONS

Assessment

A Phase II-ESA was conducted for the property at 590 Rideau Street, Ottawa, Ontario. The purpose of the Phase II-ESA was to address the areas of potential environmental concern identified during the Phase I-ESA. The subsurface investigation at the subject site consisted of drilling four (4) boreholes and installing three (3) groundwater monitoring wells.

Soil samples were obtained from the boreholes and screened using visual observations and organic vapour measurements. A total of seven (7) soil samples were submitted for laboratory analysis for a combination of PHC, BTEX, VOC and metal parameters. The four (4) native soil samples submitted were in compliance with the MOECC Table 3 standards. The three (3) fill samples submitted were found to exceed the MOECC Table 3 standards for several metal parameters.

Groundwater samples were obtained from two (2) monitoring wells (BH2 and BH3) and submitted for analysis of PHCs and VOCs. No parameters were detected above the method detection limit. The groundwater samples were in compliance with the selected MOECC Table 3 standards. A groundwater sample could not be obtained from BH1 due to a blockage encountered within the well which could not be removed at the time of the sampling event.

Conclusion

Based on the above results, fill exists at the subject property with thallium and lead concentrations which exceed the MOECC Table 3 standards. This fill typically also contains varying quantities of demolitions. It is our understanding that the subject site is to be redeveloped with a multi-storey mixed-use building with underground levels. It is our recommendation that an environmental site remediation program, involving the removal of all contaminated fill/demolition debris, be completed concurrently with the site redevelopment.

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 Group of Companies and notification from Richcraft and Paterson will be required to release this report to any other party.

Paterson Group Inc.

Xavier Redhead, B.Eng.

Mark S. D'Arcy, P.Eng.

Report Distribution:

- Richcraft Group of Companies (5 copies)
- Paterson Group (1 copy)

FIGURES

FIGURE 1 – KEY PLAN

DRAWING PE2706-4 – TEST HOLE LOCATION PLAN

DRAWING PE2706-5 - GROUNDWATER CONTOUR PLAN

DRAWING PE2706-6 – ANALYTICAL TESTING PLAN

DRAWING PE2706-7 - CROSS-SECTION A-A’

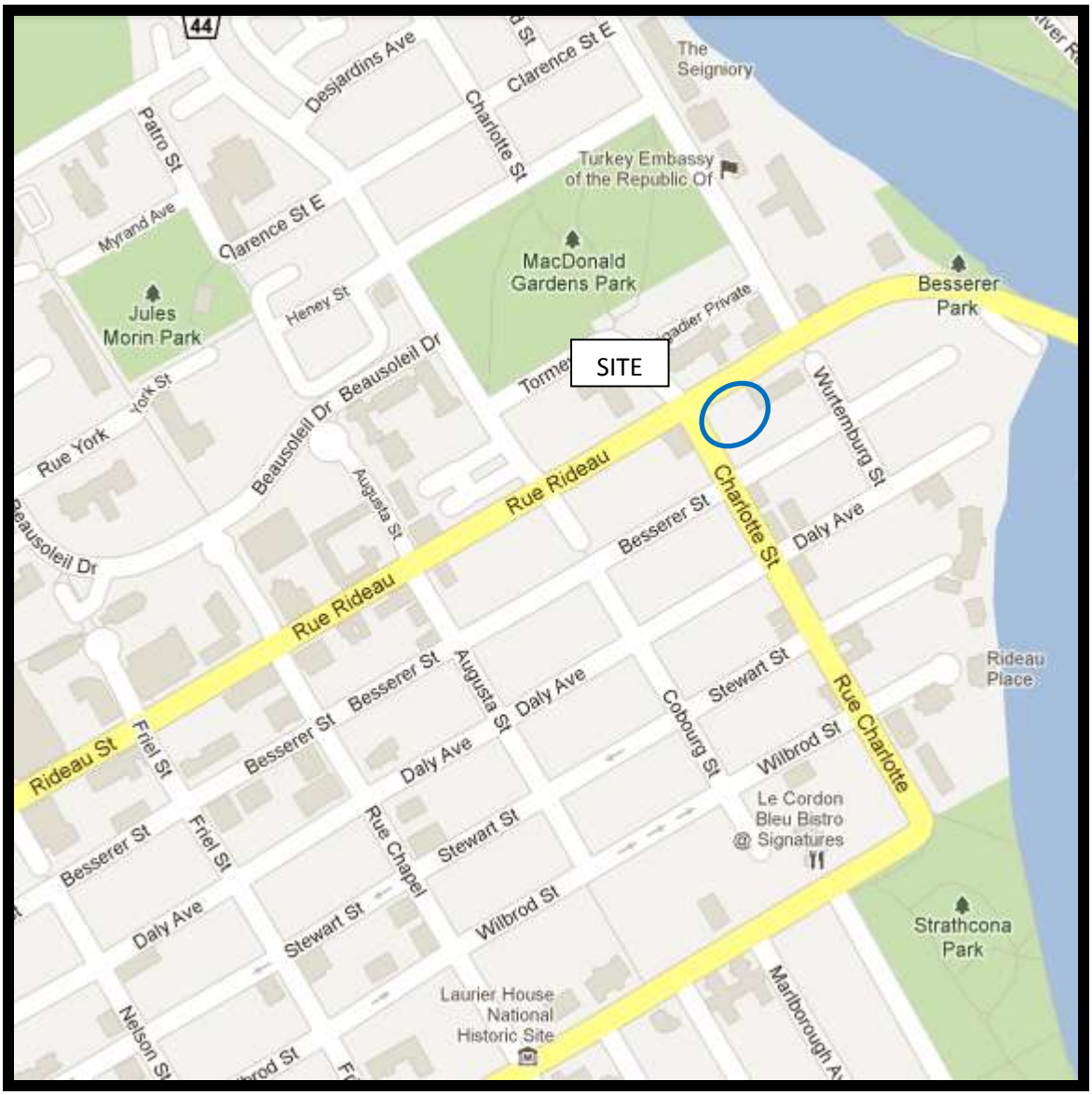


FIGURE 1

KEY PLAN

#160 CHARLOTTE STREET
HIGH-RISE RESIDENTIAL
APARTMENT BUILDING

LEGEND:

- BOREHOLE LOCATION (PATERSON, 2012)
- BOREHOLE WITH MONITORING WELL LOCATION - DESTROYED (PATERSON, 2012)
- BOREHOLE LOCATION (CURRENT INVESTIGATION)
- BOREHOLE WITH MONITORING WELL LOCATION (CURRENT INVESTIGATION)
- 71.14 GROUND SURFACE ELEVATION (m)
- (50.36) PRACTICAL DCPT REFUSAL ELEVATION (m)
- [67.79] GROUNDWATER ELEVATION (MARCH 16, 2016)
- A—A' CROSS-SECTION LOCATION

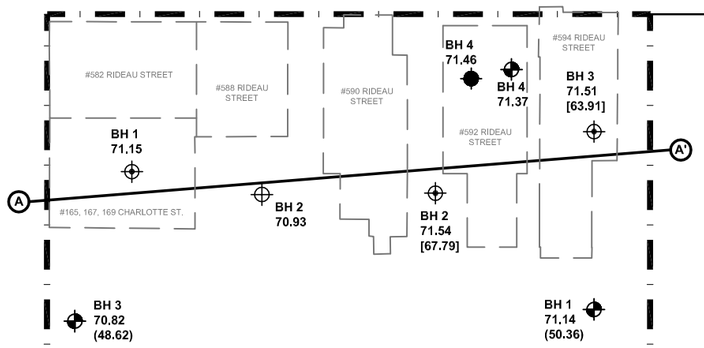
TBM - TOP SPINDLE OF FIRE HYDRANT.
GEODETIC ELEVATION = 72.20m.

#589 RIDEAU STREET
RESIDENTIAL
CONDOMINIUMS

#595 RIDEAU STREET
RESIDENTIAL
APARTMENT BUILDING

FH-TBM

RIDEAU STREET



#560 RIDEAU STREET
VACANT LAND

#574 RIDEAU STREET
COMMERCIAL AND
RESIDENTIAL BUILDING

#596 RIDEAU STREET
COMMERCIAL PLAZA

FORMERLY #600/602 RIDEAU STREET

PARKLAND

CHARLOTTE STREET

WURTEMBURG STREET

PRIVATE LANEWAY

#507 BESSERER STREET
VACANT

#517 BESSERER STREET
RESIDENTIAL

PARKING LOT

#205
CHARLOTTE STREET
RESIDENTIAL

#525
BESSERER STREET
RESIDENTIAL

#527
BESSERER STREET
RESIDENTIAL

#529
BESSERER STREET
RESIDENTIAL

#531
BESSERER STREET
RESIDENTIAL

#533
BESSERER STREET
RESIDENTIAL

#535
BESSERER STREET
RESIDENTIAL

#537
BESSERER STREET
RESIDENTIAL

#539
BESSERER STREET
RESIDENTIAL

#541
BESSERER STREET

#549
BESSERER STREET
RESIDENTIAL

#551
CHARLOTTE STREET
RESIDENTIAL

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NO.	REVISIONS	DATE	INITIAL

RICHCRAFT GROUP OF COMPANIES

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
590 RIDEAU STREET

OTTAWA, ONTARIO

Drawing Title:

TEST HOLE LOCATION PLAN

Drawn by:	Checked by:	Date:
XR	MSD	03/2016

Scale: 1:500

Report No.: PE2706-3

Drawing No.: **PE2706-4**

#160 CHARLOTTE STREET
HIGH-RISE RESIDENTIAL
APARTMENT BUILDING

LEGEND:

- BOREHOLE LOCATION (PATERSON, 2012)
- BOREHOLE WITH MONITORING WELL LOCATION - DESTROYED (PATERSON, 2012)
- BOREHOLE LOCATION (CURRENT INVESTIGATION)
- BOREHOLE WITH MONITORING WELL LOCATION (CURRENT INVESTIGATION)
- 71.14 GROUND SURFACE ELEVATION (m)
- (50.36) PRACTICAL DCPT REFUSAL ELEVATION (m)
- [67.79] GROUNDWATER ELEVATION (MARCH 16, 2016)
- [66.50*] DEPTH OF BLOCKAGE IN BH1
- INFERRED GROUNDWATER FLOW DIRECTION (BASED ON PREVIOUS WORK IN AREA)

TBM - TOP SPINDLE OF FIRE HYDRANT.
GEODETIC ELEVATION = 72.20m.

#589 RIDEAU STREET
RESIDENTIAL
CONDOMINIUMS

#595 RIDEAU STREET
RESIDENTIAL
APARTMENT BUILDING

FH-TBM

RIDEAU STREET

#582 RIDEAU STREET
#588 RIDEAU STREET
#590 RIDEAU STREET
#592 RIDEAU STREET
#594 RIDEAU STREET
#165, 167, 169 CHARLOTTE ST.

BH 1
71.15
[66.50*]

BH 2
70.93

BH 2
71.54
[67.79]

BH 4
71.46

BH 4
71.37

BH 3
71.51
[63.91]

#590 RIDEAU STREET
VACANT
(CHARLOTTE PARK)

BH 3
70.82
(48.62)

BH 1
71.14
(50.36)

PARKLAND

#560 RIDEAU STREET
VACANT LAND

#574 RIDEAU STREET
COMMERCIAL AND
RESIDENTIAL BUILDING

#596 RIDEAU STREET
COMMERCIAL PLAZA

FORMERLY #600/602 RIDEAU STREET

CHARLOTTE STREET

WURTEMBURG STREET

PRIVATE LANEWAY

#507 BESSERER STREET
VACANT

#517 BESSERER STREET
RESIDENTIAL

PARKING LOT

#205
CHARLOTTE STREET
RESIDENTIAL

#525
BESSERER STREET
RESIDENTIAL

#527
BESSERER STREET
RESIDENTIAL

#529
BESSERER STREET
RESIDENTIAL

#531
BESSERER STREET
RESIDENTIAL

#533
BESSERER STREET
RESIDENTIAL

#535
BESSERER STREET
RESIDENTIAL

#537
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RESIDENTIAL

#539
BESSERER STREET
RESIDENTIAL

#541
BESSERER STREET

#549
BESSERER STREET
RESIDENTIAL

#551
CHARLOTTE STREET
RESIDENTIAL

paterson group
consulting engineers

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NO.	REVISIONS	DATE	INITIAL

RICHCRAFT GROUP OF COMPANIES

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
590 RIDEAU STREET
OTTAWA, ONTARIO

Drawing Title:

GROUNDWATER CONTOUR PLAN

Drawn by:	Checked by:	Date:
XR	MSD	03/2016

Scale: 1:500

Report No.: PE2706-3

Drawing No.: **PE2706-5**

#160 CHARLOTTE STREET
HIGH-RISE RESIDENTIAL
APARTMENT BUILDING

LEGEND:

- BOREHOLE LOCATION (PATERSON, 2012)
- BOREHOLE WITH MONITORING WELL LOCATION - DESTROYED (PATERSON, 2012)
- BOREHOLE LOCATION (CURRENT INVESTIGATION)
- BOREHOLE WITH MONITORING WELL LOCATION (CURRENT INVESTIGATION)
- 71.14 GROUND SURFACE ELEVATION (m)
- (50.36) PRACTICAL DCPT REFUSAL ELEVATION (m)
- [67.79] GROUNDWATER ELEVATION

TBM - TOP SPINDLE OF FIRE HYDRANT.
GEODETIC ELEVATION = 72.20m.

Soil Results in Compliance with MOECC Standards
Soil Results Exceed MOECC Standards
Groundwater Results In Compliance with MOECC Standards
Groundwater Results Exceed MOECC Standards

#589 RIDEAU STREET
RESIDENTIAL
CONDOMINIUMS

BH2-SS2	Result	MOECC
FILL (1.52-2.13 m) - 09/03/2016		
METALS	ug/g	
Thallium	1.9	1.0
Lead	176	120
BH2-SS5	Result	MOECC
SILTY CLAY (3.81-4.42 m) - 09/03/2016		
PHCs/BTEX comply with MOECC Table 3		
BH2-GW	Result	MOECC
GROUNDWATER (5.18-8.23 m) - 16/03/2016		
PHCs/BTEX comply with MOECC Table 3		

#595 RIDEAU STREET
RESIDENTIAL
APARTMENT BUILDING

FH-TBM

BH4-SS11	Result	MOECC
FILL (0.61-1.22 m) - 09/03/2016		
METALS	ug/g	
Thallium	1.7	1.0

R I D E A U S T R E E T

#560 RIDEAU STREET
VACANT LAND

#574 RIDEAU STREET
COMMERCIAL AND
RESIDENTIAL BUILDING

BH1-AU1	Result	MOECC
FILL (0.46-0.76 m) - 09/03/2016		
METALS	ug/g	
Thallium	3.5	1.0
BH1-SS5	Result	MOECC
SOIL (3.05-3.66 m) - 09/03/2016		
VOCs comply with MOECC Table 3		

#582 RIDEAU STREET
#588 RIDEAU STREET
#590 RIDEAU STREET
#592 RIDEAU STREET
#594 RIDEAU STREET
#165, 167, 169 CHARLOTTE ST.

BH 1 71.15
BH 2 70.93
BH 2 71.54 [67.79]
BH 3 70.82 (48.62)
BH 4 71.46
BH 4 71.37
BH 3 71.51 [63.91]
BH 1 71.14 (50.36)

#590 RIDEAU STREET
VACANT
(CHARLOTTE PARK)

BH3-SS5	Result	MOECC
SILTY CLAY (3.81-4.42 m) - 09/03/2016		
VOCs comply with MOECC Table 3		
BH3-SS8	Result	MOECC
SILTY CLAY (6.10-6.71 m) - 09/03/2016		
VOCs comply with MOECC Table 3		
BH3-GW	Result	MOECC
GROUNDWATER (5.49-7.62 m) - 16/03/2016		
PHCs/VOCs comply with MOECC Table 3		

#596 RIDEAU STREET
COMMERCIAL PLAZA

FORMERLY #600/602 RIDEAU STREET

PARKLAND

C H A R L O T T E S T R E E T

W U R T E M B U R G S T R E E T

P R I V A T E L A N E W A Y

#507 BESSERER STREET
VACANT

#517 BESSERER STREET
RESIDENTIAL

PARKING LOT

#205 CHARLOTTE STREET RESIDENTIAL

#525 BESSERER STREET RESIDENTIAL

#527 BESSERER STREET RESIDENTIAL

#529 BESSERER STREET RESIDENTIAL

#531 BESSERER STREET RESIDENTIAL

#533 BESSERER STREET RESIDENTIAL

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#541 BESSERER STREET

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#551 CHARLOTTE STREET RESIDENTIAL

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NO.	REVISIONS	DATE	INITIAL

RICHCRAFT GROUP OF COMPANIES

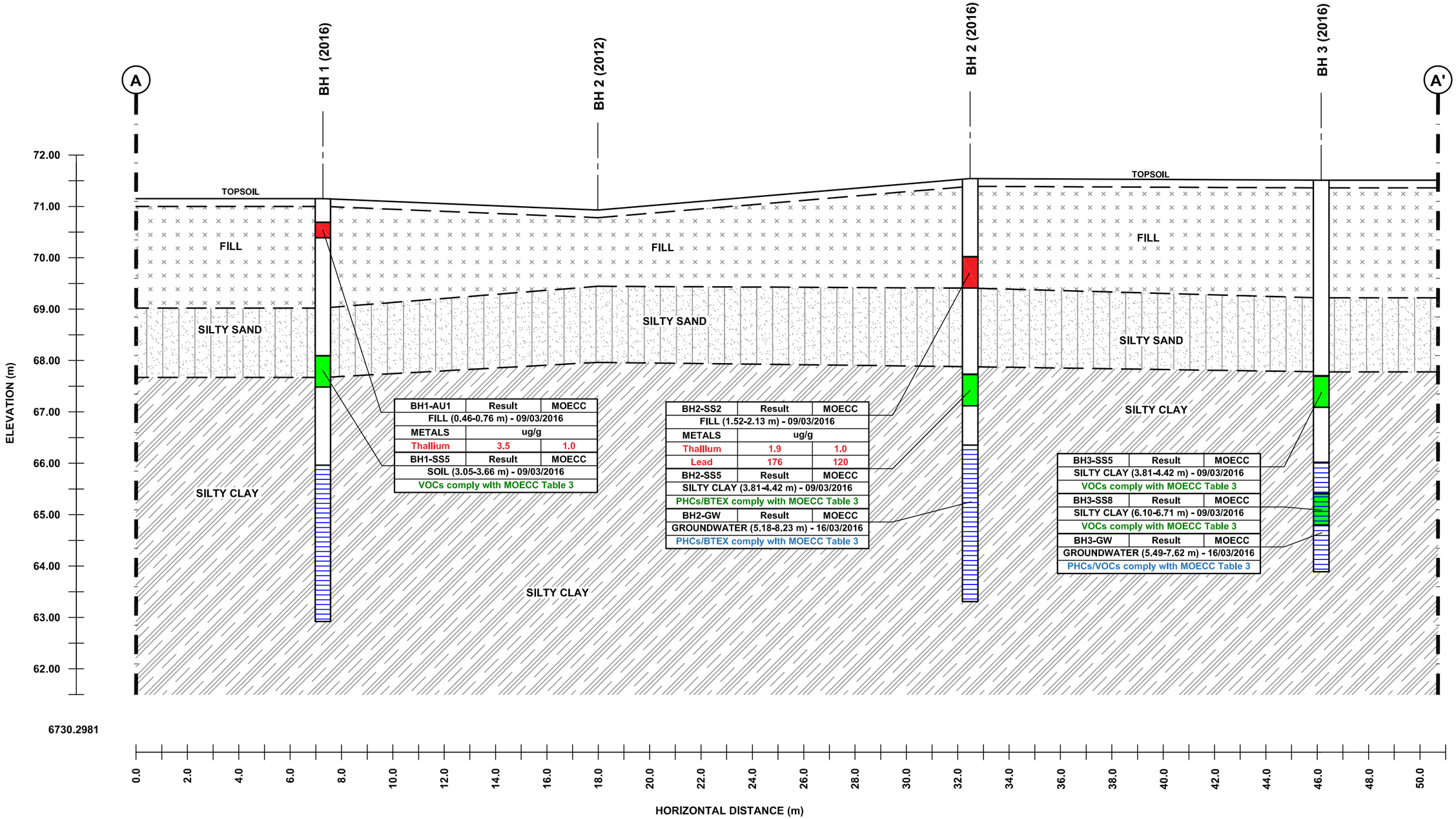
PHASE II - ENVIRONMENTAL SITE ASSESSMENT
590 RIDEAU STREET

OTTAWA, ONTARIO

Drawing Title:

ANALYTICAL TESTING PLAN

Drawn by:	Checked by:	Date:
XR	MSD	03/2016
Scale: 1:500		Drawing No.: PE2706-6
Report No.: PE2706-3		



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Scale:	AS SHOWN
Des.:	XR
Dwn:	MPG
Chkd:	MSD

RICHCRAFT GROUP OF COMPANIES

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
590 RIDEAU STREET
OTTAWA, ONTARIO

CROSS-SECTION A-A'

Dwg. No. PE2706-7
Report No.: PE2706-3
Date: 03/2016

11x17

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

patersongroup

Sampling & Analysis Plan

Phase II-Environmental Site Assessment
590 Rideau Street
Ottawa

Prepared For

Richcraft Group of Companies

March 9, 2016

Report: PE2706-SAP

Paterson Group Inc.

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Table of Contents

1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by Richcraft Group of Companies to conduct a Phase II-Environmental Site Assessment (ESA) for the property located at 590 Rideau Street, in the City of Ottawa. Based on a Phase I-ESA completed by Paterson for the subject property, the following subsurface investigation program, consisting of borehole drilling, was developed:

Borehole	Location & Rationale	Proposed Depth & Rationale
BH1	Located within the footprint of the former building addressed 165-169 Charlotte Street to address potential soil or groundwater impacts from the former dry cleaner	Drilled to intercept water table within the native soil for installation of a monitoring well.
BH2	Located adjacent to the footprint of the former building addressed 590 Rideau Street to address potential soil or groundwater impacts from the former use of furnace oil	Drilled to intercept water table within the native soil for installation of a monitoring well.
BH3	Located within the footprint of the former building addressed 594 Rideau Street to address potential soil or groundwater impacts from the former dry cleaner, former use of furnace oil and from adjacent properties to the east.	Drilled to intercept water table within the native soil for installation of a monitoring well.
BH4	Located within the footprint of the former building addressed 592 Rideau Street to address potential placement of fill of unknown quality	Drilled within the fill layer.

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 intervals until at least 1.5 m below the groundwater table. 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 the boreholes (as above) for the measurement of water levels and the collection of groundwater samples.

2.0 ANALYTICAL TESTING PROGRAM

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

- 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, at least one sample should be submitted to delineate the horizontal extent of contamination across the site and at least one sample from each stratigraphic unit should be submitted to delineate the vertical extent of contamination at the site.
- 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.
- If contamination is encountered or suspected, 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 combustible vapour meter or MiniRae photoionization detector (depending on contamination suspected)

Determining Borehole Locations

If conditions on site are not as expected 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 (QP).

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 0.6m) or semi-continuous (every 0.76 m) 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

- 1.52m x 0.05m threaded sections of Schedule 40 PVC slotted well screen (1.52m x 0.03m if installing in cored hole in bedrock)
- 1.52m x 0.05m threaded sections of Schedule 40 PVC riser pipe (1.52m x 0.05m 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.
- 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/or 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) multiplied by the laboratory detection limit.

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

These considerations are discussed in the body of the report.

6.0 PHYSICAL IMPEDIMENTS TO SAMPLING & ANALYSIS PLAN

Physical impediments to the Sampling and Analysis plan may include:

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

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
590 Rideau Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the north side of Rideau Street, near the northeast corner of subject site. Geodetic elevation = 72.20m.

FILE NO. PE2706

REMARKS

HOLE NO. BH 1

BORINGS BY CME-55 Low Clearance Drill **DATE** March 9, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	71.15
TOPSOIL 0.15		AU	1				
FILL: Sand and gravel with occasional brick and asphalt pieces		SS	2	67	30	1	70.15
		SS	3	33	12	2	69.15
2.13							
Loose, brown **SILTY SAND,** trace clay		SS	4	83	8	3	68.15
3.48		SS	5	100	9		
		SS	6	100	1	4	67.15
		SS	7	100	1	5	66.15
Grey **SILTY CLAY,** trace sand		SS	8	100	1	6	65.15
		SS	9	100	W		
		SS	10	100	W	7	64.15
		SS	11	100	1	8	63.15
8.23							
End of Borehole							
(Well blocked at 4.65m depth - March 16, 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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
590 Rideau Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the north side of Rideau Street, near the northeast corner of subject site. Geodetic elevation = 72.20m.

FILE NO. PE2706

REMARKS

HOLE NO. BH 2

BORINGS BY CME-55 Low Clearance Drill **DATE** March 9, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	71.54
TOPSOIL 0.15							
FILL: Sand and gravel with occasional brick and mortar		SS	1	42	14	1	70.54
		SS	2	50	7	2	69.54
2.13							
Compact, brown **SILTY SAND**		SS	3	83	11	3	68.54
		SS	4	100	16		
3.66						4	67.54
		SS	5	100	1		
		SS	6	100	1	5	66.54
Grey **SILTY CLAY,** trace sand		SS	7	100	W		
		SS	8	100	W	6	65.54
		SS	9	100	W	7	64.54
		SS	10	100	W		
8.23						8	63.54
End of Borehole							
(GWL @ 3.75m-March 16, 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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
590 Rideau Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the north side of Rideau Street, near the northeast corner of subject site. Geodetic elevation = 72.20m.

FILE NO. PE2706

REMARKS

HOLE NO. BH 3

BORINGS BY CME-55 Low Clearance Drill **DATE** March 9, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	71.51
TOPSOIL 0.15							
FILL: Sand and gravel 0.76							
FILL: Sand and gravel with some brick and mortar		SS	1	50	14	1	70.51
		SS	2	33	15	2	69.51
2.29							
Inferred **SILTY SAND**		SS	3	17	18	3	68.51
		SS	4	0	17		
3.73						4	67.51
Grey **SILTY CLAY**		SS	5	100	W		
		SS	6	100	W	5	66.51
		SS	7	100	W		
		SS	8	100	W	6	65.51
		SS	9	100	W	7	64.51
7.62							
End of Borehole							
(GWL @ 7.60m-March 16, 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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
590 Rideau Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the north side of Rideau Street, near the northeast corner of subject site. Geodetic elevation = 72.20m.

FILE NO. PE2706

REMARKS

HOLE NO. BH 4

BORINGS BY CME-55 Low Clearance Drill **DATE** March 9, 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	71.46		
TOPSOIL 0.15									
FILL: Sand and gravel 0.76									
FILL: Sand and gravel, some brick, mortar, wood/organic matter		SS	1	50	19	1	70.46		
		SS	2	100	2	2	69.46		
Compact, brown **SILTY SAND**		SS	3	100	11	3	68.46		
		SS	4	100	15				
3.66 End of Borehole									

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

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Multi-Storey Building - 590-594 Rideau St.
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant, north side of Rideau Street, across from subject site. Geodetic elevation = 72.20m.

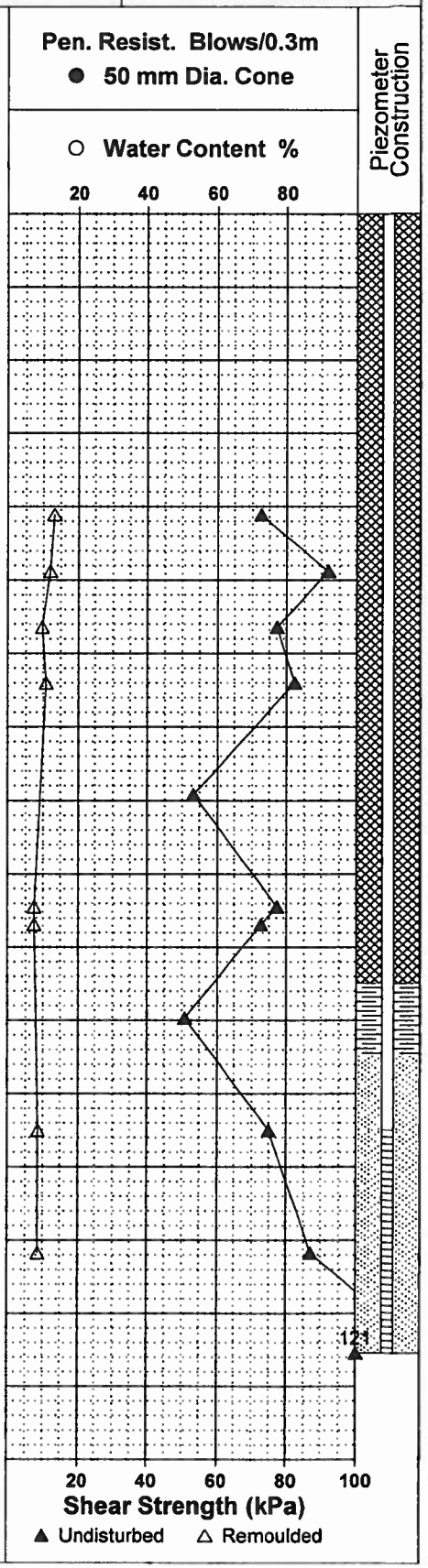
FILE NO. PG2730

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger DATE July 18, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	71.14
FILL: Sand and gravel		AU	1				
0.69		AU	2				
		SS	3	58	10	1	70.14
Compact, brown SILTY SAND		SS	4	67	15	2	69.14
		SS	5	62	15		
2.97		SS	6	100	2	3	68.14
						4	67.14
						5	66.14
						6	65.14
						7	64.14
						8	63.14
Stiff to very stiff, grey SILTY CLAY						9	62.14
						10	61.14
						11	60.14
						12	59.14
						13	58.14
						14	57.14
						15	56.14
15.54							
Dynamic Cone Penetration Test commenced at 15.54m depth. Cone pushed to 17.1m depth.						16	55.14
						17	54.14



Piezometer Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Multi-Storey Building - 590-594 Rideau St.
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant, north side of Rideau Street, across from subject site. Geodetic elevation = 72.20m.

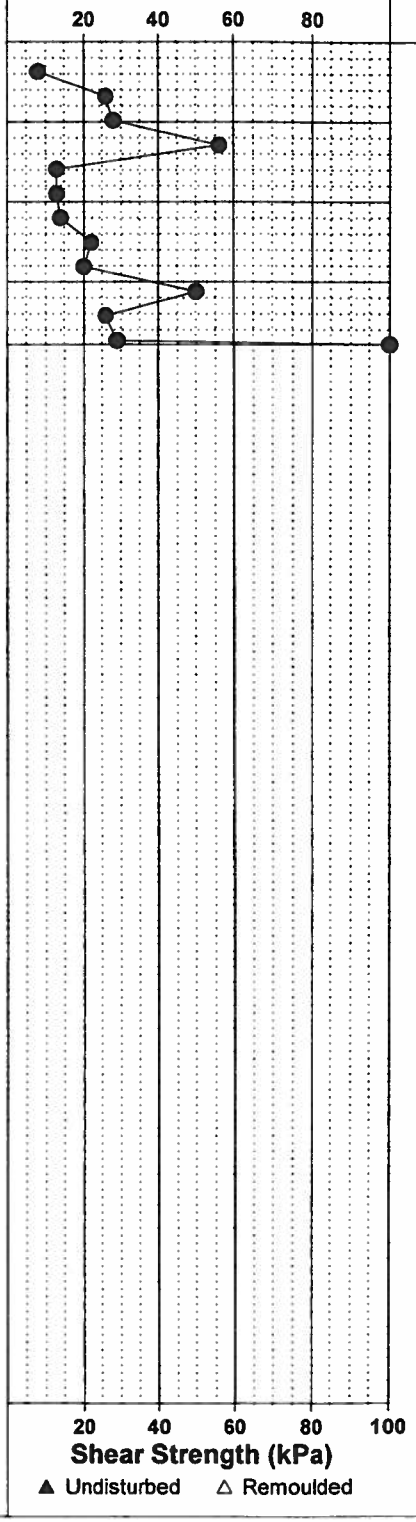
FILE NO. PG2730

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger DATE July 18, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
						17	54.14		
						18	53.14		
						19	52.14		
						20	51.14		
20.78									
End of Borehole Practical DCPT refusal at 20.78m depth.									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Multi-Storey Building - 590-594 Rideau St.
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant, north side of Rideau Street, across from subject site. Geodetic elevation = 72.20m.

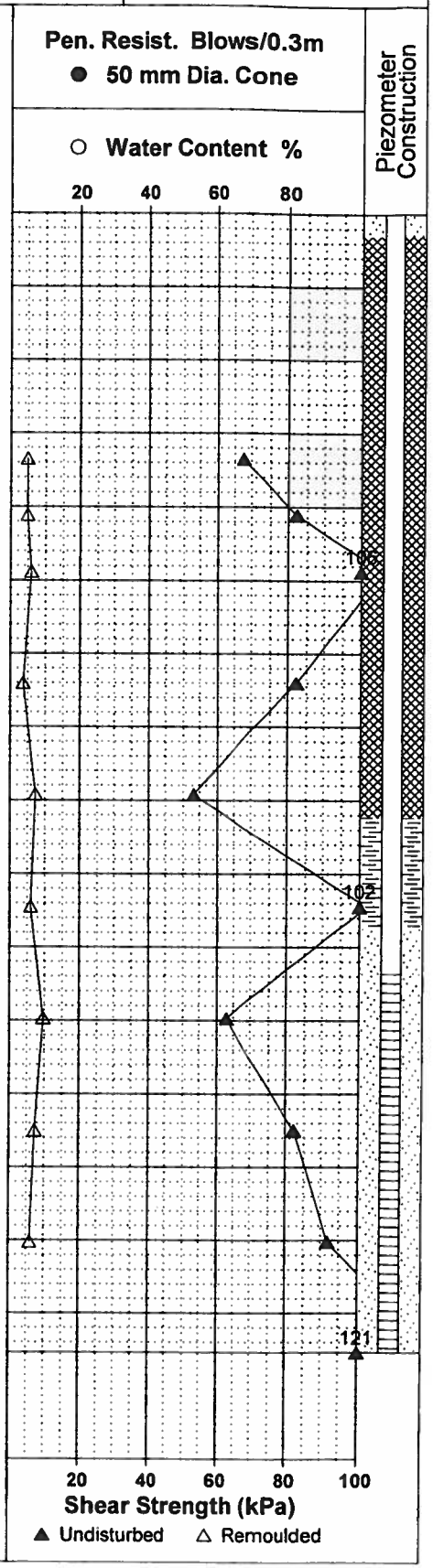
FILE NO. **PG2730**

REMARKS

HOLE NO. **BH 2**

BORINGS BY CME 55 Power Auger DATE July 19, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	70.93
25mm Asphaltic concrete over silty sand with gravel		AU	1				
		AU	2				
		SS	3	0	50+	1	69.93
- trace brick and asphalt by 0.3m depth							
1.45							
Compact, brown **SILTY SAND**		SS	4	71	11	2	68.93
		SS	5	75	14		
2.97						3	67.93
						4	66.93
						5	65.93
						6	64.93
						7	63.93
						8	62.93
Stiff to very stiff, grey **SILTY CLAY**						9	61.93
						10	60.93
						11	59.93
						12	58.93
						13	57.93
						14	56.93
						15	55.93
15.54							
End of Borehole							



Piezometer Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Multi-Storey Building - 590-594 Rideau St.
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant, north side of Rideau Street, across from subject site. Geodetic elevation = 72.20m.

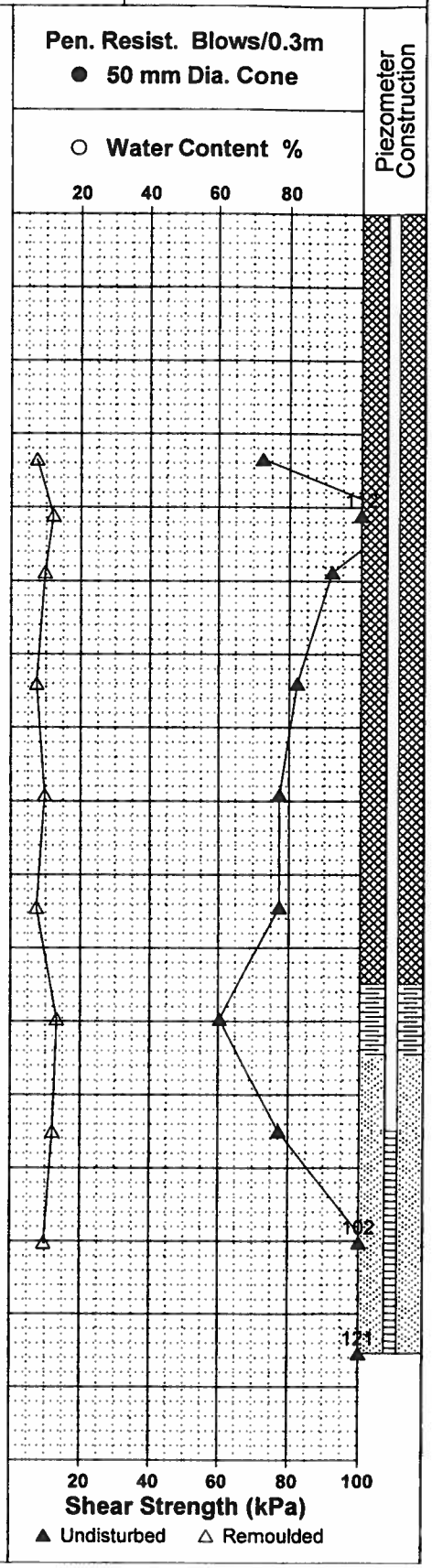
FILE NO. **PG2730**

REMARKS

HOLE NO. **BH 3**

BORINGS BY CME 55 Power Auger DATE July 18, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	70.82
25mm Asphaltic concrete over crushed stone 0.30		AU	1				
		AU	2				
FILL: Brown silty sand with gravel, trace clay 1.45		SS	3	12	5	1	69.82
Compact, brown **SILTY SAND**		SS	4	83	14	2	68.82
2.97		SS	5	50	10	3	67.82
						4	66.82
						5	65.82
						6	64.82
						7	63.82
						8	62.82
Stiff to very stiff, grey **SILTY CLAY**						9	61.82
						10	60.82
						11	59.82
						12	58.82
						13	57.82
						14	56.82
						15	55.82
15.54							
Dynamic Cone Penetration Test commenced at 15.54m depth. Cone pushed to 16.8m depth.						16	54.82
						17	53.82



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Multi-Storey Building - 590-594 Rideau St.
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant, north side of Rideau Street, across from subject site. Geodetic elevation = 72.20m.

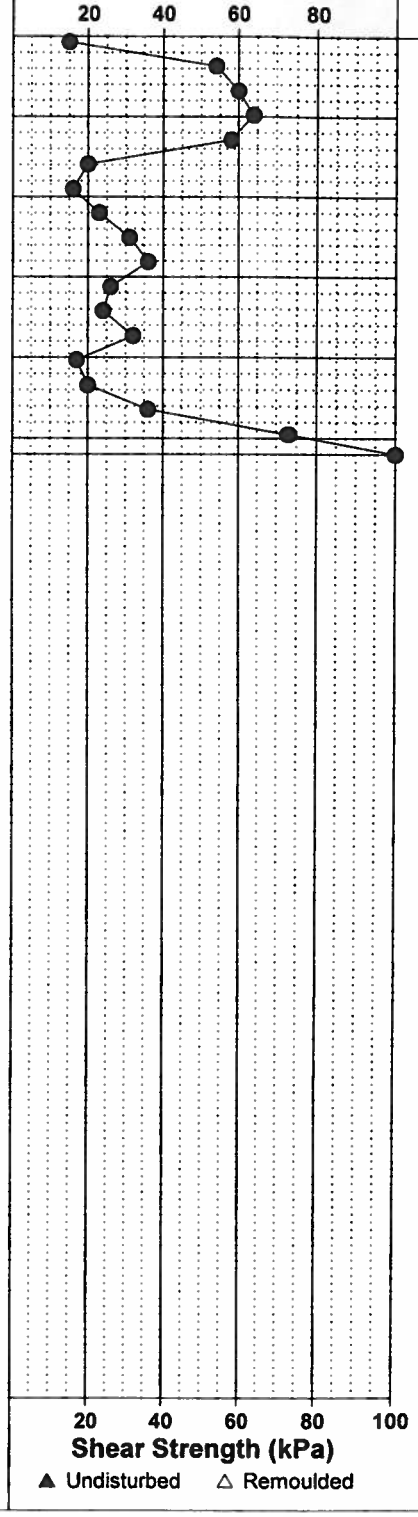
FILE NO. **PG2730**

REMARKS

HOLE NO. **BH 3**

BORINGS BY CME 55 Power Auger DATE July 18, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						17	53.82		
						18	52.82		
						19	51.82		
						20	50.82		
						21	49.82		
22.20						22	48.82		
End of Borehole Practical DCPT refusal at 22.20m depth									



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Multi-Storey Building - 590-594 Rideau St.
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant, north side of Rideau Street, across from subject site. Geodetic elevation = 72.20m.

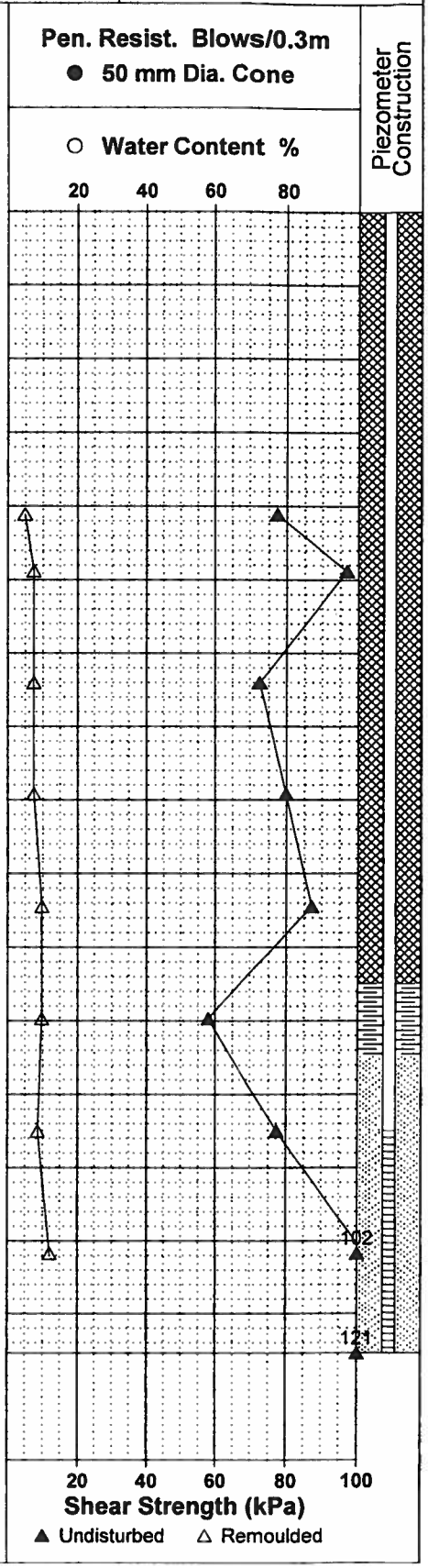
FILE NO. **PG2730**

REMARKS

HOLE NO. **BH 4**

BORINGS BY CME 55 Power Auger DATE July 19, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	71.37
FILL: Brown silty sand with gravel, cobbles, brick, concrete		SS	1	54		1	70.37
1.83		SS	2	33	12	2	69.37
Compact, brown **SILTY SAND**		SS	3	62	14	3	68.37
3.73		SS	4		14	4	67.37
						5	66.37
						6	65.37
						7	64.37
						8	63.37
Stiff to very stiff, grey **SILTY CLAY**						9	62.37
						10	61.37
						11	60.37
						12	59.37
						13	58.37
						14	57.37
						15	56.37
15.54							
End of Borehole							



Piezometer Construction

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

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

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

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

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

CONSOLIDATION TEST

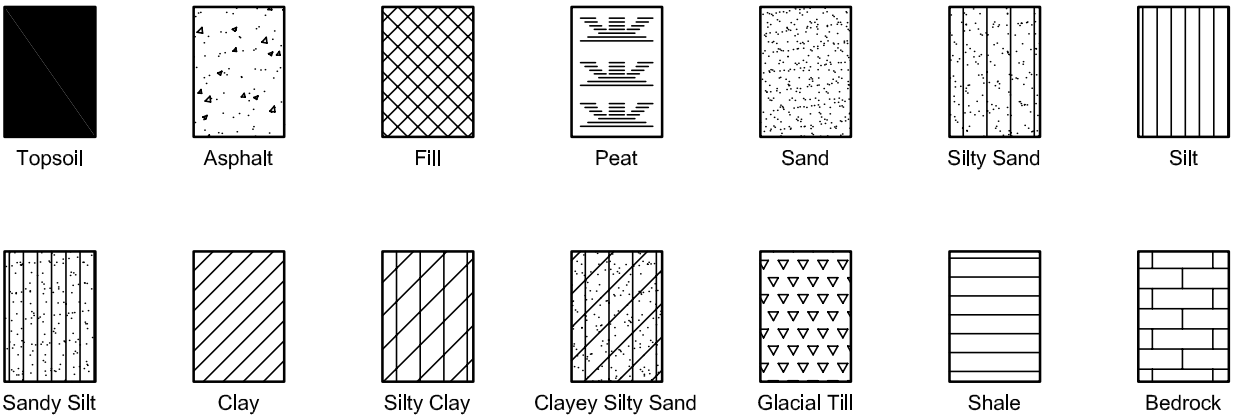
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

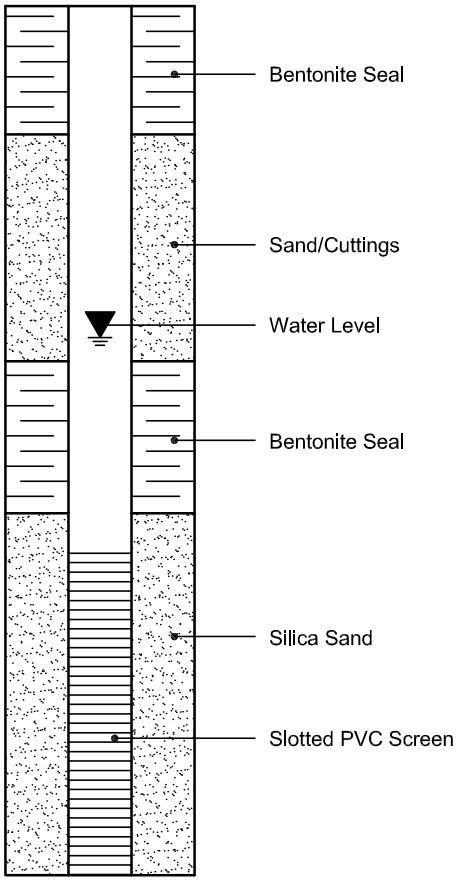
SYMBOLS AND TERMS (continued)

STRATA PLOT

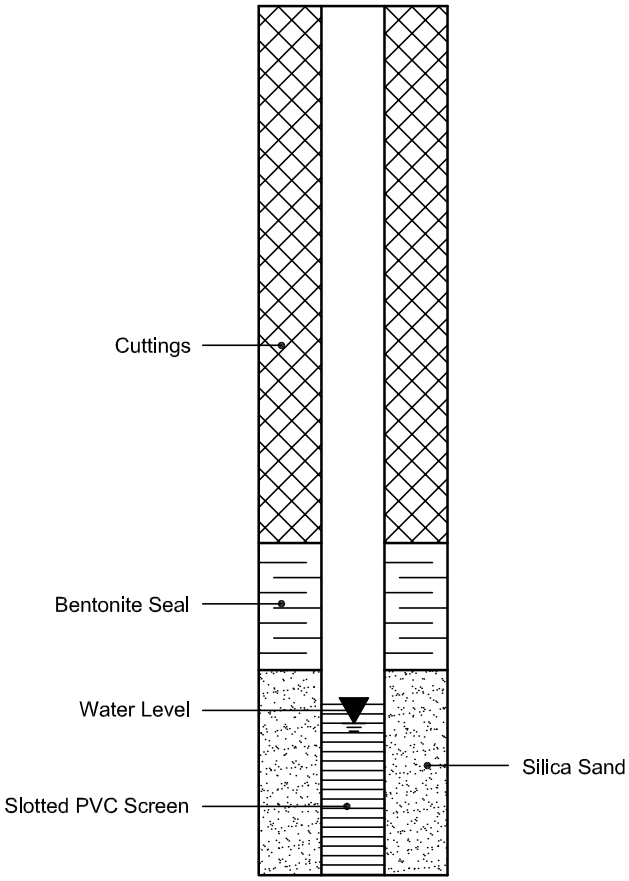


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 19212
Project: PE2706
Custody: 107009

Report Date: 16-Mar-2016
Order Date: 10-Mar-2016

Order #: 1611328

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

Paracel ID	Client ID
1611328-01	BH1-SS5
1611328-02	BH2-SS5
1611328-03	BH3-SS5
1611328-04	BH3-SS8

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 16-Mar-2016

Client: **Paterson Group Consulting Engineers**

Order Date:10-Mar-2016

Client PO: 19212

Project Description: PE2706

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	11-Mar-16	12-Mar-16
PHC F1	CWS Tier 1 - P&T GC-FID	11-Mar-16	12-Mar-16
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	12-Mar-16	12-Mar-16
REG 153: VOCs by P&T GC/MS	EPA 8260 - P&T GC-MS	11-Mar-16	13-Mar-16
Solids, %	Gravimetric, calculation	12-Mar-16	12-Mar-16

Certificate of Analysis

Report Date: 16-Mar-2016

Client: **Paterson Group Consulting Engineers**

Order Date:10-Mar-2016

Client PO: 19212

Project Description: PE2706

	Client ID:	BH1-SS5	BH2-SS5	BH3-SS5	BH3-SS8
	Sample Date:	09-Mar-16	09-Mar-16	09-Mar-16	09-Mar-16
	Sample ID:	1611328-01	1611328-02	1611328-03	1611328-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	82.6	58.2	59.6	57.1
Volatiles					
Acetone	0.50 ug/g dry	<0.50	-	<0.50	<0.50
Benzene	0.02 ug/g dry	<0.02	-	<0.02	<0.02
Bromodichloromethane	0.05 ug/g dry	<0.05	-	<0.05	<0.05
Bromoform	0.05 ug/g dry	<0.05	-	<0.05	<0.05
Bromomethane	0.05 ug/g dry	<0.05	-	<0.05	<0.05
Carbon Tetrachloride	0.05 ug/g dry	<0.05	-	<0.05	<0.05
Chlorobenzene	0.05 ug/g dry	<0.05	-	<0.05	<0.05
Chloroform	0.05 ug/g dry	<0.05	-	<0.05	<0.05
Dibromochloromethane	0.05 ug/g dry	<0.05	-	<0.05	<0.05
Dichlorodifluoromethane	0.05 ug/g dry	<0.05	-	<0.05	<0.05
1,2-Dichlorobenzene	0.05 ug/g dry	<0.05	-	<0.05	<0.05
1,3-Dichlorobenzene	0.05 ug/g dry	<0.05	-	<0.05	<0.05
1,4-Dichlorobenzene	0.05 ug/g dry	<0.05	-	<0.05	<0.05
1,1-Dichloroethane	0.05 ug/g dry	<0.05	-	<0.05	<0.05
1,2-Dichloroethane	0.05 ug/g dry	<0.05	-	<0.05	<0.05
1,1-Dichloroethylene	0.05 ug/g dry	<0.05	-	<0.05	<0.05
cis-1,2-Dichloroethylene	0.05 ug/g dry	<0.05	-	<0.05	<0.05
trans-1,2-Dichloroethylene	0.05 ug/g dry	<0.05	-	<0.05	<0.05
1,2-Dichloropropane	0.05 ug/g dry	<0.05	-	<0.05	<0.05
cis-1,3-Dichloropropylene	0.05 ug/g dry	<0.05	-	<0.05	<0.05
trans-1,3-Dichloropropylene	0.05 ug/g dry	<0.05	-	<0.05	<0.05
1,3-Dichloropropene, total	0.05 ug/g dry	<0.05	-	<0.05	<0.05
Ethylbenzene	0.05 ug/g dry	<0.05	-	<0.05	<0.05
Ethylene dibromide (dibromoethan	0.05 ug/g dry	<0.05	-	<0.05	<0.05
Hexane	0.05 ug/g dry	<0.05	-	<0.05	<0.05
Methyl Ethyl Ketone (2-Butanone)	0.50 ug/g dry	<0.50	-	<0.50	<0.50
Methyl Isobutyl Ketone	0.50 ug/g dry	<0.50	-	<0.50	<0.50
Methyl tert-butyl ether	0.05 ug/g dry	<0.05	-	<0.05	<0.05
Methylene Chloride	0.05 ug/g dry	<0.05	-	<0.05	<0.05
Styrene	0.05 ug/g dry	<0.05	-	<0.05	<0.05
1,1,1,2-Tetrachloroethane	0.05 ug/g dry	<0.05	-	<0.05	<0.05
1,1,2,2-Tetrachloroethane	0.05 ug/g dry	<0.05	-	<0.05	<0.05
Tetrachloroethylene	0.05 ug/g dry	<0.05	-	<0.05	<0.05

Certificate of Analysis

Report Date: 16-Mar-2016

Client: **Paterson Group Consulting Engineers**

Order Date:10-Mar-2016

Client PO: 19212

Project Description: PE2706

	Client ID:	BH1-SS5	BH2-SS5	BH3-SS5	BH3-SS8
	Sample Date:	09-Mar-16	09-Mar-16	09-Mar-16	09-Mar-16
	Sample ID:	1611328-01	1611328-02	1611328-03	1611328-04
	MDL/Units	Soil	Soil	Soil	Soil
Toluene	0.05 ug/g dry	<0.05	-	<0.05	<0.05
1,1,1-Trichloroethane	0.05 ug/g dry	<0.05	-	<0.05	<0.05
1,1,2-Trichloroethane	0.05 ug/g dry	<0.05	-	<0.05	<0.05
Trichloroethylene	0.05 ug/g dry	<0.05	-	<0.05	<0.05
Trichlorofluoromethane	0.05 ug/g dry	<0.05	-	<0.05	<0.05
Vinyl chloride	0.02 ug/g dry	<0.02	-	<0.02	<0.02
m,p-Xylenes	0.05 ug/g dry	<0.05	-	<0.05	<0.05
o-Xylene	0.05 ug/g dry	<0.05	-	<0.05	<0.05
Xylenes, total	0.05 ug/g dry	<0.05	-	<0.05	<0.05
4-Bromofluorobenzene	Surrogate	93.7%	-	93.6%	93.4%
Dibromofluoromethane	Surrogate	87.7%	-	96.2%	91.4%
Toluene-d8	Surrogate	110%	-	109%	109%
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	-	<8	-	-
F4 PHCs (C34-C50)	6 ug/g dry	-	<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						
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						
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	*7.55*		*ug/g*		*94.4*	*50-140*			
Surrogate: Dibromofluoromethane	*7.20*		*ug/g*		*90.0*	*50-140*			
Surrogate: Toluene-d8	*8.82*		*ug/g*		*110*	*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	*8.82*		*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	
Physical Characteristics									
% Solids	91.8	0.1	% by Wt.	92.4			0.6	25	
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	
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	*6.85*		*ug/g dry*	*ND*	*93.6*	*50-140*			
Surrogate: Dibromofluoromethane	*6.94*		*ug/g dry*	*ND*	*94.8*	*50-140*			
Surrogate: Toluene-d8	*8.22*		*ug/g dry*	*ND*	*112*	*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	*8.22*		*ug/g dry*	*ND*	*112*	*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)	178	7	ug/g	ND	88.9	80-120			
F2 PHCs (C10-C16)	92	4	ug/g	ND	102	80-120			
F3 PHCs (C16-C34)	216	8	ug/g	ND	116	80-120			
F4 PHCs (C34-C50)	126	6	ug/g	ND	102	80-120			
Volatiles									
Acetone	9.81	0.50	ug/g	ND	98.1	50-140			
Benzene	4.69	0.02	ug/g	ND	117	60-130			
Bromodichloromethane	4.47	0.05	ug/g	ND	112	60-130			
Bromoform	3.99	0.05	ug/g	ND	99.8	60-130			
Bromomethane	3.94	0.05	ug/g	ND	98.6	50-140			
Carbon Tetrachloride	4.54	0.05	ug/g	ND	113	60-130			
Chlorobenzene	3.76	0.05	ug/g	ND	94.0	60-130			
Chloroform	4.43	0.05	ug/g	ND	111	60-130			
Dibromochloromethane	3.91	0.05	ug/g	ND	97.8	60-130			
Dichlorodifluoromethane	3.51	0.05	ug/g	ND	87.8	50-140			
1,2-Dichlorobenzene	3.88	0.05	ug/g	ND	96.9	60-130			
1,3-Dichlorobenzene	4.05	0.05	ug/g	ND	101	60-130			
1,4-Dichlorobenzene	4.01	0.05	ug/g	ND	100	60-130			
1,1-Dichloroethane	4.52	0.05	ug/g	ND	113	60-130			
1,2-Dichloroethane	4.60	0.05	ug/g	ND	115	60-130			
1,1-Dichloroethylene	4.42	0.05	ug/g	ND	110	60-130			
cis-1,2-Dichloroethylene	3.76	0.05	ug/g	ND	94.1	60-130			
trans-1,2-Dichloroethylene	4.70	0.05	ug/g	ND	118	60-130			
1,2-Dichloropropane	4.60	0.05	ug/g	ND	115	60-130			
cis-1,3-Dichloropropylene	3.40	0.05	ug/g	ND	84.9	60-130			
trans-1,3-Dichloropropylene	3.47	0.05	ug/g	ND	86.8	60-130			
Ethylbenzene	3.51	0.05	ug/g	ND	87.8	60-130			
Ethylene dibromide (dibromoethane	4.03	0.05	ug/g	ND	101	60-130			
Hexane	3.96	0.05	ug/g	ND	99.0	60-130			
Methyl Ethyl Ketone (2-Butanone)	9.78	0.50	ug/g	ND	97.8	50-140			
Methyl Isobutyl Ketone	10.3	0.50	ug/g	ND	103	50-140			
Methyl tert-butyl ether	11.1	0.05	ug/g	ND	111	50-140			
Methylene Chloride	3.67	0.05	ug/g	ND	91.7	60-130			
Styrene	3.82	0.05	ug/g	ND	95.6	60-130			
1,1,1,2-Tetrachloroethane	3.96	0.05	ug/g	ND	98.9	60-130			
1,1,2,2-Tetrachloroethane	3.63	0.05	ug/g	ND	90.7	60-130			
Tetrachloroethylene	3.72	0.05	ug/g	ND	93.1	60-130			
Toluene	3.85	0.05	ug/g	ND	96.3	60-130			
1,1,1-Trichloroethane	4.65	0.05	ug/g	ND	116	60-130			
1,1,2-Trichloroethane	3.62	0.05	ug/g	ND	90.6	60-130			
Trichloroethylene	4.20	0.05	ug/g	ND	105	60-130			
Trichlorofluoromethane	3.91	0.05	ug/g	ND	97.7	50-140			
Vinyl chloride	3.95	0.02	ug/g	ND	98.8	50-140			
m,p-Xylenes	7.33	0.05	ug/g	ND	91.6	60-130			
o-Xylene	3.62	0.05	ug/g	ND	90.5	60-130			
Surrogate: 4-Bromofluorobenzene	*7.88*		*ug/g*		*98.6*	*50-140*			
Benzene	4.69	0.02	ug/g	ND	117	60-130			
Ethylbenzene	3.51	0.05	ug/g	ND	87.8	60-130			
Toluene	3.85	0.05	ug/g	ND	96.3	60-130			
m,p-Xylenes	7.33	0.05	ug/g	ND	91.6	60-130			
o-Xylene	3.62	0.05	ug/g	ND	90.5	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.

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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Chain of Custody
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№ 107009

Page 1 of 1

Client Name: Paterson Group	Project Reference: PE 2706	TAT: [X] Regular [ ] 3 Day
Contact Name: Mark D'Arcy	Quote #	[ ] 2 Day [ ] 1 Day
Address: 154 Colonnade Rd	PO # 19212	Date Required:
Telephone: 613-226-7381	Email Address: mdarcy@patersongroup.ca	

Criteria: [X] 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: 1611328

	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-SS5	S		2	Mar 9/16			X									120 + val.			
2	BH2-SS5	S		2	↓		X										↓			
3	BH3-SS5	S		2				X												
4	BH3-SS8	S		2				X												
5																				
6																				
7																				
8																				
9																				
10																				

Comments:

Method of Delivery: Paracel

Relinquished By (Sign): Mike B	Received by Driver/Depot: A. Deluse	Received at Lab:	Verified By:
Relinquished By (Print):	Date/Time: 10/03/16 3:40pm	Date/Time: Mar 10/16 5:15	Date/Time: Mar 10/16 5:24
Date/Time:	Temperature: ___ °C	Temperature: 14.6 °C	pH Verified [X] By: NA

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 19507
Project: PE2706
Custody: 107564

Report Date: 21-Mar-2016
Order Date: 15-Mar-2016

Order #: 1612177

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

Paracel ID	Client ID
1612177-01	BH1-AU1
1612177-02	BH2-SS2
1612177-03	BH4-SS1

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Report Date: 21-Mar-2016
Client: **Paterson Group Consulting Engineers**
Order Date:15-Mar-2016
Client PO: 19507
Project Description: PE2706

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Boron, available	MOE (HWE), EPA 200.7 - ICP-OES	16-Mar-16	16-Mar-16
Chromium, hexavalent - soil	MOE E3056 - Extraction, colourimetric	15-Mar-16	17-Mar-16
Mercury by CVAA	EPA 7471B - CVAA, digestion	16-Mar-16	16-Mar-16
REG 153: Metals by ICP/OES, soil	based on MOE E3470, ICP-OES	17-Mar-16	17-Mar-16
Solids, %	Gravimetric, calculation	17-Mar-16	17-Mar-16

Certificate of Analysis

Report Date: 21-Mar-2016

Client: **Paterson Group Consulting Engineers**

Order Date:15-Mar-2016

Client PO: 19507

Project Description: PE2706

	Client ID:	BH1-AU1	BH2-SS2	BH4-SS1	-
	Sample Date:	09-Mar-16	09-Mar-16	09-Mar-16	-
	Sample ID:	1612177-01	1612177-02	1612177-03	-
	MDL/Units	Soil	Soil	Soil	-
Physical Characteristics					
% Solids	0.1 % by Wt.	88.3	87.3	92.0	-
Metals					
Antimony	1.0 ug/g dry	<1.0	<1.0	<1.0	-
Arsenic	1.0 ug/g dry	5.5	2.2	2.4	-
Barium	1.0 ug/g dry	125	179	57.8	-
Beryllium	1.0 ug/g dry	<1.0	<1.0	<1.0	-
Boron	1.0 ug/g dry	11.9	3.5	3.2	-
Boron, available	0.5 ug/g dry	<0.5	0.8	<0.5	-
Cadmium	0.5 ug/g dry	<0.5	<0.5	<0.5	-
Chromium	1.0 ug/g dry	35.1	20.1	19.6	-
Chromium (VI)	0.2 ug/g dry	<0.2	<0.2	<0.2	-
Cobalt	1.0 ug/g dry	8.3	5.4	5.3	-
Copper	1.0 ug/g dry	22.4	9.0	9.8	-
Lead	1.0 ug/g dry	31.9	176	79.4	-
Mercury	0.1 ug/g dry	<0.1	<0.1	<0.1	-
Molybdenum	1.0 ug/g dry	1.8	<1.0	<1.0	-
Nickel	1.0 ug/g dry	18.7	9.8	11.0	-
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	3.5	1.9	1.7	-
Uranium	1.0 ug/g dry	<1.0	<1.0	<1.0	-
Vanadium	1.0 ug/g dry	34.4	23.0	21.4	-
Zinc	1.0 ug/g dry	70.2	52.2	57.4	-

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, 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						

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	6.07	1.0	ug/g dry	5.51			9.7	30	
Barium	126	1.0	ug/g dry	125			1.0	30	
Beryllium	ND	1.0	ug/g dry	ND			0.0	30	
Boron, available	0.84	0.5	ug/g dry	0.76			9.2	35	
Boron	12.1	1.0	ug/g dry	11.9			1.8	30	
Cadmium	ND	0.5	ug/g dry	ND			0.0	30	
Chromium (VI)	ND	0.2	ug/g dry	ND				35	
Chromium	35.8	1.0	ug/g dry	35.1			1.9	30	
Cobalt	8.37	1.0	ug/g dry	8.29			1.0	30	
Copper	22.6	1.0	ug/g dry	22.4			0.9	30	
Lead	31.5	1.0	ug/g dry	31.9			1.2	30	
Mercury	0.602	0.1	ug/g dry	0.619			2.9	35	
Molybdenum	2.03	1.0	ug/g dry	1.80			12.0	30	
Nickel	18.9	1.0	ug/g dry	18.7			0.6	30	
Selenium	ND	1.0	ug/g dry	ND			0.0	30	
Silver	ND	0.5	ug/g dry	ND			0.0	30	
Thallium	3.48	1.0	ug/g dry	3.54			1.9	30	
Uranium	ND	1.0	ug/g dry	ND				30	
Vanadium	34.9	1.0	ug/g dry	34.4			1.4	30	
Zinc	71.1	1.0	ug/g dry	70.2			1.2	30	
Physical Characteristics									
% Solids	86.5	0.1	% by Wt.	88.3			2.2	25	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Antimony	172		ug/L	ND	72.6	70-130			
Arsenic	331		ug/L	110	88.4	70-130			
Barium	239		ug/L	ND	95.7	70-130			
Beryllium	202		ug/L	1.05	80.5	70-130			
Boron, available	5.21	0.5	ug/g	0.76	89.0	70-122			
Boron	429		ug/L	237	76.6	70-130			
Cadmium	203		ug/L	ND	82.2	70-130			
Chromium (VI)	4.6	0.2	ug/g	ND	91.5	70-130			
Chromium	886		ug/L	703	73.2	70-130			
Cobalt	378		ug/L	166	85.0	70-130			
Copper	646		ug/L	449	78.7	70-130			
Lead	819		ug/L	638	72.4	70-130			
Mercury	2.10	0.1	ug/g	0.619	98.7	72-128			
Molybdenum	243		ug/L	36.1	82.6	70-130			
Nickel	570		ug/L	375	78.0	70-130			
Selenium	147		ug/L	ND	84.8	70-130			
Silver	195		ug/L	0.53	77.8	70-130			
Thallium	279		ug/L	70.8	83.2	70-130			
Uranium	248		ug/L	ND	99.2	70-130			
Vanadium	899		ug/L	687	84.6	70-130			
Zinc	1610		ug/L	1400	81.8	70-130			

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.

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.

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Page __ of __

Client Name: PATERSON
Contact Name: MARK D'ARCY
Address: 154 COLONNADE ROAD
Telephone: 613-226-7381

Project Reference: PE2706
Quote #
PO # 19507
Email Address: mdarcy@patersongroup.ca

TAT: [X] Regular [ ] 3 Day [ ] 2 Day [ ] 1 Day
Date Required: _____

Criteria: [X] 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: 1612177

	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-AU1	S		1	March9					X	X	X	X				250mL			
2	BH2-SS2	S		1	March9					X	X	X	X				↓			
3	BH4-SS1	S		1	March9					X	X	X	X				↓			
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Comments:

Method of Delivery: Swift

Relinquished By (Sign): Xavier Redlord	Received by Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): Xavier Redlord	Date/Time:	Date/Time: Mar 15/16 3:30	Date/Time: Mar 15/16 4:25
Date/Time: March 15, 2016	Temperature: ____ °C	Temperature: 13.6 °C	pH Verified [X] By: N/A

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 19235
Project: PE2706
Custody: 106985

Report Date: 18-Mar-2016
Order Date: 16-Mar-2016

Order #: 1612267

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

Paracel ID	Client ID
1612267-01	BH2-GW
1612267-02	BH3-GW

Approved By:

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 18-Mar-2016

Client: **Paterson Group Consulting Engineers**

Order Date:16-Mar-2016

Client PO: 19235

Project Description: PE2706

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	16-Mar-16	17-Mar-16
PHC F1	CWS Tier 1 - P&T GC-FID	16-Mar-16	17-Mar-16
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	17-Mar-16	17-Mar-16
REG 153: VOCs by P&T GC/MS	EPA 624 - P&T GC-MS	16-Mar-16	17-Mar-16

Certificate of Analysis

Report Date: 18-Mar-2016

Client: **Paterson Group Consulting Engineers**

Order Date:16-Mar-2016

Client PO: 19235

Project Description: PE2706

	Client ID:	BH2-GW	BH3-GW	-	-
	Sample Date:	16-Mar-16	16-Mar-16	-	-
	Sample ID:	1612267-01	1612267-02	-	-
	MDL/Units	Water	Water	-	-
Volatiles					
Acetone	5.0 ug/L	-	<5.0	-	-
Benzene	0.5 ug/L	-	<0.5	-	-
Bromodichloromethane	0.5 ug/L	-	<0.5	-	-
Bromoform	0.5 ug/L	-	<0.5	-	-
Bromomethane	0.5 ug/L	-	<0.5	-	-
Carbon Tetrachloride	0.2 ug/L	-	<0.2	-	-
Chlorobenzene	0.5 ug/L	-	<0.5	-	-
Chloroform	0.5 ug/L	-	<0.5	-	-
Dibromochloromethane	0.5 ug/L	-	<0.5	-	-
Dichlorodifluoromethane	1.0 ug/L	-	<1.0	-	-
1,2-Dichlorobenzene	0.5 ug/L	-	<0.5	-	-
1,3-Dichlorobenzene	0.5 ug/L	-	<0.5	-	-
1,4-Dichlorobenzene	0.5 ug/L	-	<0.5	-	-
1,1-Dichloroethane	0.5 ug/L	-	<0.5	-	-
1,2-Dichloroethane	0.5 ug/L	-	<0.5	-	-
1,1-Dichloroethylene	0.5 ug/L	-	<0.5	-	-
cis-1,2-Dichloroethylene	0.5 ug/L	-	<0.5	-	-
trans-1,2-Dichloroethylene	0.5 ug/L	-	<0.5	-	-
1,2-Dichloropropane	0.5 ug/L	-	<0.5	-	-
cis-1,3-Dichloropropylene	0.5 ug/L	-	<0.5	-	-
trans-1,3-Dichloropropylene	0.5 ug/L	-	<0.5	-	-
1,3-Dichloropropene, total	0.5 ug/L	-	<0.5	-	-
Ethylbenzene	0.5 ug/L	-	<0.5	-	-
Ethylene dibromide (dibromoethan	0.2 ug/L	-	<0.2	-	-
Hexane	1.0 ug/L	-	<1.0	-	-
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	-	<5.0	-	-
Methyl Isobutyl Ketone	5.0 ug/L	-	<5.0	-	-
Methyl tert-butyl ether	2.0 ug/L	-	<2.0	-	-
Methylene Chloride	5.0 ug/L	-	<5.0	-	-
Styrene	0.5 ug/L	-	<0.5	-	-
1,1,1,2-Tetrachloroethane	0.5 ug/L	-	<0.5	-	-
1,1,2,2-Tetrachloroethane	0.5 ug/L	-	<0.5	-	-
Tetrachloroethylene	0.5 ug/L	-	<0.5	-	-
Toluene	0.5 ug/L	-	<0.5	-	-
1,1,1-Trichloroethane	0.5 ug/L	-	<0.5	-	-

Certificate of Analysis

Report Date: 18-Mar-2016

Client: **Paterson Group Consulting Engineers**

Order Date:16-Mar-2016

Client PO: 19235

Project Description: PE2706

	Client ID:	BH2-GW	BH3-GW	-	-
	Sample Date:	16-Mar-16	16-Mar-16	-	-
	Sample ID:	1612267-01	1612267-02	-	-
	MDL/Units	Water	Water	-	-
1,1,2-Trichloroethane	0.5 ug/L	-	<0.5	-	-
Trichloroethylene	0.5 ug/L	-	<0.5	-	-
Trichlorofluoromethane	1.0 ug/L	-	<1.0	-	-
Vinyl chloride	0.5 ug/L	-	<0.5	-	-
m,p-Xylenes	0.5 ug/L	-	<0.5	-	-
o-Xylene	0.5 ug/L	-	<0.5	-	-
Xylenes, total	0.5 ug/L	-	<0.5	-	-
4-Bromofluorobenzene	Surrogate	-	102%	-	-
Dibromofluoromethane	Surrogate	-	96.9%	-	-
Toluene-d8	Surrogate	-	87.1%	-	-
Benzene	0.5 ug/L	<0.5	-	-	-
Ethylbenzene	0.5 ug/L	<0.5	-	-	-
Toluene	0.5 ug/L	<0.5	-	-	-
m,p-Xylenes	0.5 ug/L	<0.5	-	-	-
o-Xylene	0.5 ug/L	<0.5	-	-	-
Xylenes, total	0.5 ug/L	<0.5	-	-	-
Toluene-d8	Surrogate	85.3%	-	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	<25	-	-
F2 PHCs (C10-C16)	100 ug/L	<100	<100	-	-
F3 PHCs (C16-C34)	100 ug/L	<100	<100	-	-
F4 PHCs (C34-C50)	100 ug/L	<100	<100	-	-
F1 + F2 PHCs	125 ug/L	<125	-	-	-
F1 + F2 PHCs	125 ug/L	-	<125	-	-
F3 + F4 PHCs	200 ug/L	<200	-	-	-
F3 + F4 PHCs	200 ug/L	-	<200	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
Volatiles									
Acetone	ND	5.0	ug/L						
Benzene	ND	0.5	ug/L						
Bromodichloromethane	ND	0.5	ug/L						
Bromoform	ND	0.5	ug/L						
Bromomethane	ND	0.5	ug/L						
Carbon Tetrachloride	ND	0.2	ug/L						
Chlorobenzene	ND	0.5	ug/L						
Chloroform	ND	0.5	ug/L						
Dibromochloromethane	ND	0.5	ug/L						
Dichlorodifluoromethane	ND	1.0	ug/L						
1,2-Dichlorobenzene	ND	0.5	ug/L						
1,3-Dichlorobenzene	ND	0.5	ug/L						
1,4-Dichlorobenzene	ND	0.5	ug/L						
1,1-Dichloroethane	ND	0.5	ug/L						
1,2-Dichloroethane	ND	0.5	ug/L						
1,1-Dichloroethylene	ND	0.5	ug/L						
cis-1,2-Dichloroethylene	ND	0.5	ug/L						
trans-1,2-Dichloroethylene	ND	0.5	ug/L						
1,2-Dichloropropane	ND	0.5	ug/L						
cis-1,3-Dichloropropylene	ND	0.5	ug/L						
trans-1,3-Dichloropropylene	ND	0.5	ug/L						
1,3-Dichloropropene, total	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Ethylene dibromide (dibromoethane	ND	0.2	ug/L						
Hexane	ND	1.0	ug/L						
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L						
Methyl Isobutyl Ketone	ND	5.0	ug/L						
Methyl tert-butyl ether	ND	2.0	ug/L						
Methylene Chloride	ND	5.0	ug/L						
Styrene	ND	0.5	ug/L						
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L						
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L						
Tetrachloroethylene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
1,1,1-Trichloroethane	ND	0.5	ug/L						
1,1,2-Trichloroethane	ND	0.5	ug/L						
Trichloroethylene	ND	0.5	ug/L						
Trichlorofluoromethane	ND	1.0	ug/L						
Vinyl chloride	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: 4-Bromofluorobenzene	*82.4*		*ug/L*		*103*	*50-140*			
Surrogate: Dibromofluoromethane	*73.1*		*ug/L*		*91.4*	*50-140*			
Surrogate: Toluene-d8	*82.8*		*ug/L*		*103*	*50-140*			
Benzene	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: Toluene-d8	*82.8*		*ug/L*		*103*	*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	3.10	0.5	ug/L	1.76			55.1	30	QR-05
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	7.05	0.5	ug/L	4.42			45.9	30	QR-05
Dibromochloromethane	1.45	0.5	ug/L	ND			0.0	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	*84.7*		*ug/L*	*ND*	*106*	*50-140*			
Surrogate: Dibromofluoromethane	*72.6*		*ug/L*	*ND*	*90.8*	*50-140*			
Surrogate: Toluene-d8	*70.5*		*ug/L*	*ND*	*88.1*	*50-140*			
Benzene	ND	0.5	ug/L	ND				30	
Ethylbenzene	ND	0.5	ug/L	ND				30	
Toluene	ND	0.5	ug/L	ND				30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: Toluene-d8	*70.5*		*ug/L*	*ND*	*88.1*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	1830	25	ug/L	ND	91.3	68-117			
F2 PHCs (C10-C16)	1200	100	ug/L	ND	66.8	60-140			
F3 PHCs (C16-C34)	3570	100	ug/L	ND	95.9	60-140			
F4 PHCs (C34-C50)	2210	100	ug/L	ND	89.1	60-140			
Volatiles									
Acetone	83.8	5.0	ug/L	ND	83.8	50-140			
Benzene	34.7	0.5	ug/L	ND	86.8	50-140			
Bromodichloromethane	45.5	0.5	ug/L	1.76	109	50-140			
Bromoform	41.9	0.5	ug/L	ND	105	50-140			
Bromomethane	38.4	0.5	ug/L	ND	95.9	50-140			
Carbon Tetrachloride	40.5	0.2	ug/L	ND	101	50-140			
Chlorobenzene	37.1	0.5	ug/L	ND	92.8	50-140			
Chloroform	48.4	0.5	ug/L	4.42	110	50-140			
Dibromochloromethane	47.3	0.5	ug/L	ND	118	50-140			
Dichlorodifluoromethane	33.4	1.0	ug/L	ND	83.6	50-140			
1,2-Dichlorobenzene	43.3	0.5	ug/L	ND	108	50-140			
1,3-Dichlorobenzene	42.1	0.5	ug/L	ND	105	50-140			
1,4-Dichlorobenzene	42.0	0.5	ug/L	ND	105	50-140			
1,1-Dichloroethane	36.9	0.5	ug/L	ND	92.2	50-140			
1,2-Dichloroethane	36.6	0.5	ug/L	ND	91.6	50-140			
1,1-Dichloroethylene	40.2	0.5	ug/L	ND	100	50-140			
cis-1,2-Dichloroethylene	35.7	0.5	ug/L	ND	89.2	50-140			
trans-1,2-Dichloroethylene	39.9	0.5	ug/L	ND	99.8	50-140			
1,2-Dichloropropane	30.9	0.5	ug/L	ND	77.3	50-140			
cis-1,3-Dichloropropylene	32.5	0.5	ug/L	ND	81.2	50-140			
trans-1,3-Dichloropropylene	29.4	0.5	ug/L	ND	73.6	50-140			
Ethylbenzene	37.4	0.5	ug/L	ND	93.5	50-140			
Ethylene dibromide (dibromoethane	38.6	0.2	ug/L	ND	96.4	50-140			
Hexane	21.6	1.0	ug/L	ND	53.9	50-140			
Methyl Ethyl Ketone (2-Butanone)	61.9	5.0	ug/L	ND	61.9	50-140			
Methyl Isobutyl Ketone	63.8	5.0	ug/L	ND	63.8	50-140			
Methyl tert-butyl ether	86.4	2.0	ug/L	ND	86.4	50-140			
Methylene Chloride	37.0	5.0	ug/L	ND	92.6	50-140			
Styrene	40.1	0.5	ug/L	ND	100	50-140			
1,1,1,2-Tetrachloroethane	42.0	0.5	ug/L	ND	105	50-140			
1,1,2,2-Tetrachloroethane	35.2	0.5	ug/L	ND	88.1	50-140			
Tetrachloroethylene	39.5	0.5	ug/L	ND	98.7	50-140			
Toluene	35.6	0.5	ug/L	ND	89.1	50-140			
1,1,1-Trichloroethane	37.6	0.5	ug/L	ND	93.9	50-140			
1,1,2-Trichloroethane	35.4	0.5	ug/L	ND	88.6	50-140			
Trichloroethylene	32.6	0.5	ug/L	ND	81.4	50-140			
Trichlorofluoromethane	46.6	1.0	ug/L	ND	116	50-140			
Vinyl chloride	46.4	0.5	ug/L	ND	116	50-140			
m,p-Xylenes	77.8	0.5	ug/L	ND	97.2	50-140			
o-Xylene	39.0	0.5	ug/L	ND	97.4	50-140			
Surrogate: 4-Bromofluorobenzene	*80.5*		*ug/L*		*101*	*50-140*			
Benzene	34.7	0.5	ug/L	ND	86.8	50-140			
Ethylbenzene	37.4	0.5	ug/L	ND	93.5	50-140			
Toluene	35.6	0.5	ug/L	ND	89.1	50-140			
m,p-Xylenes	77.8	0.5	ug/L	ND	97.2	50-140			
o-Xylene	39.0	0.5	ug/L	ND	97.4	50-140			

Qualifier Notes:

QC Qualifiers :

QR-05 : Duplicate RPDs higher than normally accepted. Remaing batch QA\QC was acceptable. May be sample effect.

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.

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Chain of Custody
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№ 106985

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Client Name: PATERSON	Project Reference: PE2706	TAT: [X] Regular [ ] 3 Day
Contact Name: MARK D'ARCY	Quote #	[ ] 2 Day [ ] 1 Day
Address: 154 COLONNADE ROAD	PO # 19235	Date Required:
Telephone: 613-226-7301	Email Address: mdarcy@patersongroup.ca	

Criteria: [X] 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: 1612267

	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-GW	GW		3	March 16	AM	X						
2	BH3-GW	GW		3	↓	↓	X	X					
3													
4													
5													
6													
7													
8													
9													
10													

Comments:

Method of Delivery: Walk-in

Relinquished By (Sign): Xavier Redhead	Received by Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): Xavier Redhead	Date/Time:	Date/Time: MAR 16/16 5:30	Date/Time: MAR 16/16 5:54
Date/Time: March 16, 2016	Temperature: ___ °C	Temperature: 9.3 °C	pH Verified [X] By: N/A