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# Phase II - Environmental Site Assessment

180 Metcalfe Street
Ottawa, Ontario

Prepared For

Jadco Group

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Report: PE4280-2

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# EXECUTIVE SUMMARY

## Assessment

A Phase II-Environmental Site Assessment (ESA) was conducted on 180 Metcalfe Street, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address the Areas of Potential Environmental Concern identified during a historical review. The Phase II-ESA consisted of the drilling of four boreholes and one probe hole along with the installation of three groundwater monitoring wells to assess the soil and groundwater quality at the subject site.

Soil samples obtained from the boreholes were screened using visual observations. Site soils consist of fill material consisting of sand, gravel, and organics underlain by silty clay and glacial till. Shale bedrock was cored in 3 of the 4 boreholes, while auger refusal was identified in the remaining boreholes and the one probehole advanced on site for geotechnical purposes. Based on the screening results, fill samples were selected for testing of metals and/or PAH parameters. Based on the analytical results, the fill material is impacted with metals. Samples of the native silty clay and the glacial till material were selected for analysis of PHCs and BTEX. Based on the analytical results, the native silty clay and glacial till is not impacted by the former UST on the subject site.

Groundwater samples were collected from the monitoring wells installed in BH1-18, BH2-18, and BH3-18, and analyzed for BTEX and PHCs. Based on the analytical results, the groundwater on the subject site has not been impacted by the past use of the subject site and the adjacent properties.

## Recommendations

Soil

During redevelopment of the site a soil remediation program will need to be undertaken. At this time the soil does not present a concern to the occupants of the subject site. Further information can be provided with respect to soil disposal, if required.

Groundwater

No impacted groundwater was identified on the subject site. Prior to any excavation work and the decommissioning of the groundwater wells on site, the groundwater should be retested to assist in the filing of a Record of Site Condition.

Monitoring Wells

If the monitoring wells installed on the subject site are not going to be used in the future, or will be destroyed during site redevelopment, they should be abandoned according to Ontario Regulation 903. Otherwise, the wells will be registered with the MOECC under this regulation. It is recommended that the monitoring wells remain intact for future groundwater monitoring purposes.

# 1.0 INTRODUCTION

At the request of Jadco Group (Jadco), Paterson Group (Paterson) conducted a Phase II-Environmental Site Assessment (ESA) of the property addressed as 180 Metcalfe Street, Ottawa, Ontario. The purpose of this Phase II-ESA was to address concerns identified during a historical review.

## 1.1 Site Description

| | |
|---|---|
| Address: | 180 Metcalfe Street, Ottawa, Ontario |
| Legal Description: | Lots 47 to 49, Plan 2996, City of Ottawa. |
| Property Identification Numbers: | 04115-0258 |
| Location: | The subject site is located at the southwest corner of the intersection of Metcalfe Street and Nepean Street. The subject site is shown on Figure 1 - Key Plan following the body of this report. |
| Latitude and Longitude: | 45° 25' 06" N, 75° 41' 39" W |
| Configuration: | Rectangular |
| Site Area: | 0.18 ha (approximate) |

## 1.2 Property Ownership

Paterson was engaged to conduct this Phase II ESA by Mr. Andre Doudak of Jadco Group (Jadco). Jadco's offices are located at 345 Boulevard Samson, Laval, Quebec. Mr. Doudak can be reached at 450-689-5232.

## 1.3 Current and Proposed Future Uses

The property is currently used as a parking lot for an adjacent office tower. The parking lot is being considered for redevelopment.

## 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 (MOECC), April 2011. The MOECC Table 3 Standards are based on the following considerations:

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

# 2.0 BACKGROUND INFORMATION

## 2.1 Physical Setting

The subject site is the property municipally addressed as 180 Metcalfe Street. The site is located at the southwest corner of the Metcalfe Street and Nepean Street intersection. The property is currently used as an office tower and pay parking lot. The site and regional topography is generally flat, with slight slopes for grading purposes. A catch basin was observed on the subject site, along with several on the adjacent roadways.

No drinking water wells or private sewage systems were observed on the subject property, nor are any expected to be present, as the site is located in a fully municipally-serviced area. No water bodies or known areas of natural significance are present with the Phase I ESA Study Area.

## 2.2 Past Investigations

Based on a review of historical uses of the subject site, adjacent properties, and previous Paterson records, Paterson identified the following Areas of Potential Environmental Concern (APEC) for the subject property, as listed in Table 1.

**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) |
|---|---|---|---|---|---|
| Former Underground Fuel oil storage tank | On-site, on the west side of the existing building. | Item 28: Gasoline and associated products in fixed tanks | On-site | PHC F1-F4, BTEX | Soil, Groundwater |
| Fill Material of unknown quality | In the parking area of the subject site | Item 30: Importation of fill material of unknown quality | On-site | Metals, PAHs | Soil |

# 3.0 SCOPE OF INVESTIGATION

## 3.1 Overview of Site Investigation

The subsurface investigation conducted as a component of the Phase II ESA consisted of drilling four (4) boreholes and 1 probehole (BH5) at the subject site. Three of the boreholes were instrumented with a groundwater monitoring well. The probe hole was extended to the bedrock surface for geotechnical purposes.

## 3.2 Media Investigated

During the subsurface investigation, soil and groundwater samples were recovered and submitted for laboratory analytical testing. There are no water bodies on the Phase II-ESA Property and as such, sediment sampling was not part of the Phase II-ESA. The rationale for sampling and analyzing these media is based on the Contaminants of Potential Concern identified in the Phase I-ESA Conceptual Site Model, discussed in Subsection 3.3.

**Soil**

Soil samples were collected from the four boreholes on subject property. Soil samples were collected from the boreholes by means of split spoon sampling or auger sampling. All boreholes extended from the existing ground surface to bedrock. No soil samples were collected from the probehole.

**Groundwater**

Groundwater monitoring wells were developed upon completion using a dedicated inertial lift pump. A minimum of three well volumes were removed from the monitoring wells during development. Groundwater samples were obtained from each monitoring well, using dedicated sampling equipment. Standing water was purged from each monitoring 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.

**Sediment**

There is no water body present on the Phase II-ESA property. As such, there is no sediment on, in or under the Phase II-ESA property. No sediment sampling was completed

## 3.3 Phase I Conceptual Site Model

### Geological and Hydrogeological Setting

The Phase I property is located in an area of shale of the Billings Formation. Overburden soils consist of offshore marine sediments (silts and clays), with a drift thickness on the order to 10 to 15m. Based on information from the geotechnical investigation, the overburden depth ranges from 12.70m to 14.40m below the existing ground surface.

### Contaminants of Potential Concern

Contaminants of potential concern include BTEX and PHC F1-F4 in the soil and groundwater. Contaminants of potential concern relating to fill material on the subject site consist of Metals and PAHs.

### Existing Buildings and Structures

A multi-storey commercial/office building is present on the subject site, along with a small building associated with the pay parking lot. No other significant buildings or structures are present on the subject site

### Water Bodies

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

### Areas of Natural Significance

There are no areas of natural significance on the site or within the study area.

### Drinking Water Wells

There are no drinking water wells located on the subject site or within the study area.

### Neighbouring Land Use

Currently, neighbouring land use in the Phase I study area is commercial and residential.

### Potentially Contaminating Activities and Areas of Potential Environmental Concern

Two potentially contaminating activities identified within the study area are considered to represent an area of potential concern on the subject site. The former underground storage tank (UST) located at the rear of the building and fill

material of unknown quality beneath the existing parking structure are considered to represent areas of potential environmental concern. Other potentially contaminating activities in the area are not considered to have created areas of potential environmental concern on the subject site, based on their separation distances, downgradient location with respect to groundwater flow direction, and/or available documentation regarding those concerns.

**Assessment of Uncertainty and/or Absence of Information**

The information available for review as part of the preparation of this Phase I ESA is considered to be sufficient to conclude that there are areas of potential environmental concern on the subject site. The presence of potentially contaminating activities was confirmed by a variety of independent sources, and as such, the conclusions of 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. Two deviations from the sampling and analysis plan were noted and are as follows:

- Duplicate soil samples were not submitted for analytical testing.
- Trip Blank samples were not collected.

Based on the analytical test results the absence of duplicate and trip blank samples are not considered to significantly impact the results and conclusions of the Phase II ESA.

## 3.5 Impediments

No physical impediments or denial of access were encountered during the Phase II ESA.

# 4.0 INVESTIGATION METHOD

## 4.1 Subsurface Investigation

The subsurface investigation was conducted on April 17, 2018 and consisted four boreholes (BH1 to BH4). The boreholes were placed to address the APECs identified in the Phase I ESA. The boreholes were advanced using a truck-mounted CME 55 power auger drill rig. The drilling contractor was George Downing Estate Drilling of Hawkesbury, Ontario. Drilling occurred under full-time supervision of Paterson personnel. The borehole locations are indicated on the attached Drawing PE4280-3 - Test Hole Location Plan.

## 4.2 Soil Sampling

A total of 63 soil samples were obtained from the boreholes by means of split spoon sampling and grab sampling from auger flights. Split spoon samples were taken at approximate 0.76 m intervals. The depths at which split spoon, and grab 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 a pavement structure followed by a sand fill with gravel and organics underlain by native silty clay and glacial till. Bedrock was encountered in all boreholes between 12.70m to 14.40m below ground surface.

## 4.3 Field Screening Measurements

All soil samples collected were submitted to a preliminary screening procedure, which included visual screening for colour, evidence of metals, PAHs, PHCs and other potential environmental impacts.

## 4.4 Groundwater Monitoring Well Installation

Three (3) groundwater monitoring wells were installed by George Downing Estate Drilling of Hawkesbury, Ontario, under the full-time supervision of Paterson personnel. Monitoring wells in BH1-18, BH2-18, and BH3-18 consist of 32 mm diameter Schedule 40 threaded PVC risers and screens. A sand pack consisting of silica sand was placed around the screen, and a bentonite seal was placed above the screen to the ground surface to minimize cross-contamination. Monitoring well construction details are provided on the Soil Profile and Test

Data Sheets in Appendix 1. A summary of monitoring well construction details is provided below in Table 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 |
|---|---|---|---|---|---|---|
| BH1-18 | 99.51 | 20.98 | 17.98-20.98 | 17.68-20.98 | 0.61 – 17.68 | Flushmount |
| BH2-18 | 99.50 | 17.68 | 14.68-17.68 | 14.38-17.68 | 0.61 – 14.38 | Flushmount |
| BH3-18 | 99.60 | 17.68 | 14.68-17.68 | 14.38-17.68 | 0.61 – 14.38 | Flushmount |

## 4.5 Field Measurement of Water Quality Parameters

Field water quality parameters were considered consistent throughout the sampling program and in each monitoring well. The results of the field measurement of water quality parameters are considered to represent the groundwater at each sampling location.

## 4.6 Groundwater Sampling

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

## 4.7 Analytical Testing

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

**Table 3:**
**Soil Samples Submitted**

| Sample ID | Sample Depth/Stratigraphic Unit | Parameters Analyzed | | | Rationale |
|---|---|---|---|---|---|
| | | Metals | PAHs | PHCs BTEX | |
| **April 3, 2018** | | | | | |
| BH1-18-SS5 | 3.05m-3.66m bgs; Native Silty Clay | | | X | Assess quality of the soil at the bottom of the former UST excavation |
| **April 4, 2018** | | | | | |
| BH2-18-SS15 | 12.19m-12.90m bgs, native glacial till | | | X | Assess potential deep PHC impacts near the groundwater table |
| BH3-18-G | 0.25m-0.79m bgs, fill | X | X | | Assess quality of the fill material above the native soils |
| **April 5, 2018** | | | | | |
| BH4-18-G | 0.3m-0.61m bgs; fill | X | X | | Assess quality of the fill material above the native soils |

**Table 4:**
**Groundwater Samples Submitted**

| Sample ID | Sample Depth/ Stratigraphic Unit | Parameters Analyzed | | Rationale |
|---|---|---|---|---|
| | | PHC ($F_1$-$F_4$) | BTEX | |
| **April 23, 2018** | | | | |
| BH1-18-GW1 | 17.98m-20.98m – Shale bedrock | X | X | Assess the groundwater quality on the subject site. |
| BH2-18-GW1 | 14.68m-17.68m– Shale bedrock | X | X | |
| BH3-18-GW1 | 14.68m-17.68m– Shale bedrock | X | X | |
| DUP1 | 14.68m-17.68m– Shale bedrock | X | | Provide duplicate results from BH2-18-GW1 |

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

## 4.8 Residue Management

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

## 4.9 Elevation Surveying

Monitoring well/borehole locations were surveyed using a laser level. Elevations were surveyed relative to a benchmark (top spindle of the fire hydrant on the south side of Nepean Street, adjacent to 96 Nepean Street). The elevation of the benchmark was assumed to be 100m. The location of the site benchmark is shown on Drawing PE4280-3 – Test Hole Location Plan.

## 4.10 Quality Assurance and Quality Control Measures

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

# 5.0 REVIEW AND EVALUATION

## 5.1 Geology

Site geology details are provided in the Soil Profile and Test Data Sheets provided in Appendix 1. Site soils consist of a layer of fill material, which is underlain by native silty clay and glacial till. The bedrock was cored in three of the boreholes locations to facilitate the installation of groundwater monitoring wells and for geotechnical purposes. The fill material consisted primarily of sand mixed with gravel and trace organics. Groundwater was encountered near the soil and bedrock interface at depths ranging from 13.76m to 14.64 m below existing grade.

## 5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured using an electronic water level meter. Groundwater levels are summarized below in Table 5. All elevations are relative to the temporary benchmark. It should be noted that groundwater levels are expected to fluctuate throughout the year with seasonal variations.

**Table 5:**
**Groundwater Level Measurements**

| Borehole Location | Ground Surface Elevation (m) | Water Level Depth (m below grade) | Water Level Elevation (m) | Date of Measurement |
|---|---|---|---|---|
| BH1-18 | 99.51 | 13.76 | 85.75 | April 23, 2018 |
| BH2-18 | 99.50 | 14.64 | 84.86 | April 23, 2018 |
| BH3-18 | 99.60 | 14.04 | 85.56 | April 23, 2018 |

Based on the groundwater elevations from the April 2018 monitoring event, groundwater contour mapping was completed. Groundwater contours are shown on Drawing PE4280-4 - Groundwater Contour Plan. Based on the contour mapping, groundwater flow at the subject site appears to be in a northerly direction. A horizontal hydraulic gradient of approximately 0.032 m/m was calculated.

## 5.3 Fine-Medium Soil Texture

Coarse-grained soil standards have been used for the subject site. Grain size analysis was not completed.

## 5.4 Soil: Field Screening

Visual screening was completed for the limited soil samples collected from the subject site.

## 5.5 Soil Quality

Four soil samples were submitted to Paracel Laboratories for a combination of PHC, BTEX, PAH and metal parameters. A copy of the analytical test results are attached to this report. The results of the soil analysis are presented in the tables below. The laboratory certificate of analysis is provided in Appendix 1.

**Table 6:**
**Analytical Test Results – Soil**
**PHCs and BTEX**

| Parameter | MDL (µg/g) | Soil Samples (µg/g) | | MOECC Table 3 Residential Coarse (µg/g) |
|---|---|---|---|---|
| | | BH1-18-SS5 April 3, 2018 | BH2-18-SS15 April 4, 2018 | |
| Benzene | 0.02 | nd | nd | 0.21 |
| Ethylbenzene | 0.05 | nd | nd | 2 |
| Toluene | 0.05 | nd | nd | 2.3 |
| Xylenes | 0.05 | nd | nd | 3.1 |
| PHC F1 | 7 | nd | nd | 55 |
| PHC F2 | 4 | 5 | 77 | 98 |
| PHC F3 | 8 | 46 | 109 | 300 |
| PHC F4 | 6 | 40 | 38 | 2800 |

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold** – Value exceeds selected MOECC Standard

**Table 7:**
**Analytical Test Results – Soil**
**PAHs**

| Parameter | MDL (µg/g) | Soil Samples (µg/g) | | MOECC Table 3 Residential Coarse (µg/g) |
|---|---|---|---|---|
| | | BH3-18-G April 4, 2018 | BH4-18-G April 5, 2018 | |
| Acenaphthene | 0.02 | nd | nd | 7.9 |
| Acenaphthylene | 0.02 | nd | 0.03 | 0.15 |
| Anthracene | 0.02 | nd | 0.02 | 0.67 |
| Benzo[a]anthracene | 0.02 | 0.02 | 0.07 | 0.5 |
| Benzo[a]pyrene | 0.02 | 0.03 | 0.08 | 0.3 |
| Benzo[b]fluoranthene | 0.02 | 0.03 | 0.11 | 0.78 |
| Benzo[g,h,i]perylene | 0.02 | nd | 0.05 | 6.6 |
| Benzo[k]fluoranthene | 0.02 | nd | 0.06 | 0.78 |
| Chrysene | 0.02 | 0.03 | 0.09 | 7 |
| Dibenzo[a,h]anthracene | 0.02 | nd | nd | 0.1 |
| Fluoranthene | 0.02 | 0.07 | 0.16 | 0.69 |
| Fluorene | 0.02 | nd | nd | 62 |
| Indeno[1,2,3-cd]pyrene | 0.02 | nd | 0.04 | 0.38 |
| Methylnapthalene (1&2) | 0.04 | nd | nd | 0.99 |
| Napthalene | 0.01 | nd | 0.01 | 0.6 |
| Phenanthrene | 0.02 | 0.04 | 0.07 | 6.2 |
| Pyrene | 0.02 | 0.06 | 0.15 | 78 |

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold** – Value exceeds selected MOECC Standard

**Table 8:**
**Analytical Test Results – Soil**
**Metals**

| Parameter | MDL (µg/g) | Soil Samples (µg/g | | MOECC Table 3 Residential Coarse (µg/g) |
|---|---|---|---|---|
| | | BH3-18-G April 3, 2018 | BH4-18-G April 4, 2018 | |
| Antimony | 1.0 | nd | nd | 7.5 |
| Arsenic | 1.0 | 4 | 4 | 18 |
| Barium | 1.0 | 114 | 309 | 390 |
| Beryllium | 1.0 | nd | nd | 4 |
| Boron | 1.0 | nd | nd | 120 |
| Boron, available | 0.5 | nd | nd | 1.5 |
| Cadmium | 0.5 | nd | nd | 1.2 |
| Chromium | 1.0 | 17 | 17 | 160 |
| Chromium (VI) | 0.2 | nd | nd | 8 |
| Cobalt | 1.0 | 5 | 5 | 22 |
| Copper | 1.0 | 28 | 39 | 140 |
| Lead | 1.0 | **192** | **1020** | 120 |
| Mercury | 0.1 | **1.9** | **0.7** | 0.27 |
| Molybdenum | 1.0 | nd | nd | 6.9 |
| Nickel | 1.0 | 14 | 13 | 100 |
| Selenium | 1.0 | nd | nd | 2.4 |
| Silver | 0.5 | nd | nd | 20 |
| Thallium | 1.0 | nd | nd | 1 |
| Uranium | 1.0 | nd | nd | 23 |
| Vanadium | 1.0 | 23 | 26 | 86 |
| Zinc | 1.0 | 103 | 258 | 340 |

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold** – Value exceeds selected MOECC Standard

Lead and Mercury exceed the MOECC Table 3 Residential Standards in samples BH3-18-G and BH4-18-G. All other metals parameters are in compliance with the MOECC Standard.

**Table 9:**
**Maximum Concentrations – Soil**

| Parameter | Maximum Concentration (µg/g) | Borehole/ Test Pit | Depth Interval (m BGS) |
|---|---|---|---|
| Arsenic | 4 | BH3-18-G | 0.25m-0.79m bgs, fill |
| Arsenic | 4 | BH4-18-G | 0.3m-0.61m bgs; fill |
| Barium | 309 | BH4-18-G | 0.3m-0.61m bgs; fill |
| Chromium | 26 | BH4-18-G | 0.3m-0.61m bgs; fill |
| Cobalt | 5 | BH3-18-G | 0.25m-0.79m bgs, fill |
| Cobalt | 5 | BH4-18-G | 0.3m-0.61m bgs; fill |
| Copper | 39 | BH4-18-G | 0.3m-0.61m bgs; fill |
| Lead | **1020** | BH4-18-G | 0.3m-0.61m bgs; fill |
| Mercury | **1.9** | BH3-18-G | 0.25m-0.79m bgs, fill |
| Nickel | 14 | BH3-18-G | 0.25m-0.79m bgs, fill |
| Vanadium | 26 | BH4-18-G | 0.3m-0.61m bgs; fill |
| Zinc | 258 | BH4-18-G | 0.3m-0.61m bgs; fill |
| Acenaphthylene | 0.03 | BH4-18-G | 0.3m-0.61m bgs; fill |
| Anthracene | 0.02 | BH4-18-G | 0.3m-0.61m bgs; fill |
| Benzo[a]anthracene | 0.07 | BH4-18-G | 0.3m-0.61m bgs; fill |
| Benzo[a]pyrene | 0.08 | BH4-18-G | 0.3m-0.61m bgs; fill |
| Benzo[b]fluoranthene | 0.11 | BH4-18-G | 0.3m-0.61m bgs; fill |
| Benzo[g,h,i]perylene | 0.05 | BH4-18-G | 0.3m-0.61m bgs; fill |
| Benzo[k]fluoranthene | 0.06 | BH4-18-G | 0.3m-0.61m bgs; fill |
| Chrysene | 0.09 | BH4-18-G | 0.3m-0.61m bgs; fill |
| Fluoranthene | 0.16 | BH4-18-G | 0.3m-0.61m bgs; fill |
| Indeno[1,2,3-cd]pyrene | 0.04 | BH4-18-G | 0.3m-0.61m bgs; fill |
| Napthalene | 0.01 | BH4-18-G | 0.3m-0.61m bgs; fill |
| Phenanthrene | 0.07 | BH4-18-G | 0.3m-0.61m bgs; fill |
| Pyrene | 0.15 | BH4-18-G | 0.3m-0.61m bgs; fill |
| PHC F2 | 77 | BH2-18-SS15 | 12.19m-12.90m bgs, native glacial till |
| PHC F3 | 109 | BH1-18-SS5 | 3.05m-3.66m bgs; Native Silty Clay |
| PHC F4 | 40 | BH1-18-SS5 | 3.05m-3.66m bgs; Native Silty Clay |

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

All other parameter concentrations were below laboratory detection limits.

## 5.6 Groundwater Quality

Groundwater samples from the monitoring wells installed in BH1-18, BH2-18, and BH3-18 were submitted for laboratory analysis of BTEX and PHC ($F_1$-$F_4$) parameters. The groundwater samples were obtained from the screened intervals noted on Table 2. The results of the analytical testing are presented below in Table 10. The laboratory certificates of analysis are provided in Appendix 1.

**Table 10:**
**Analytical Test Results – Groundwater**
**BTEX and PHC ($F_1$ – $F_4$)**

| Parameter | MDL (µg/L) | Groundwater Samples (µg/L) | | | | MOECC Table 3 Standards Non-Potable Coarse (µg/L) |
|---|---|---|---|---|---|---|
| | | BH1-18 GW1 | BH2-18 GW1 | BH3-18 GW1 | DUP1 | |
| | | April 23, 2018 | | | | |
| Benzene | 0.5 | 0.9 | nd | 1.0 | nd | 44 |
| Ethylbenzne | 0.5 | nd | nd | nd | nd | 2300 |
| Toluene | 0.5 | 4.5 | nd | 3.3 | nd | 18000 |
| Xylene | 0.5 | 6.5 | nd | 2.5 | nd | 4200 |
| PHC $F_1$ | 25 | nd | nd | nd | NA | 750 |
| PHC $F_2$ | 100 | nd | nd | nd | NA | 150 |
| PHC $F_3$ | 100 | nd | nd | 347 | NA | 500 |
| PHC $F_4$ | 100 | nd | nd | 122 | NA | 500 |

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

BTEX parameters were identified in BH1-18-GW1 and BH3-18-GW1. PHC F3 and PHC F4 were identified in sample BH3-18-GW1. All detected parameters are in compliance with the selected MOECC Standards.

## 5.7 Quality Assurance and Quality Control Results

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

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

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. 153/04 as amended by O.Reg. 269/11 - Record of Site Condition regulation, made under the Environmental Protection Act. Conclusions and recommendations are discussed in a subsequent section.

## Site Description

### Potentially Contaminating Activities

Two PCA's representing APECs on the subject site were identified during the historical research.

- Former underground fuel oil storage tank.
- Fill material of unknown quality.

Other PCAs 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 downgradient or cross-gradient of the subject site.

### Areas of Potential Environmental Concern

The APECs with respect to the subject site are summarized below:

- APEC 1 – Former underground fuel oil storage tank
- APEC 2 – Fill material of unknown quality

Other PCAs 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 downgradient or cross-gradient of the subject site.

### Contaminants of Potential Concern

The contaminants of concern are considered to be PHCs and BTEX in the soil and groundwater in the area of the former UST. Contaminants of concern in the fill material are considered to be PAHs and Metals.

### Subsurface Structures and Utilities

The subject site is located in a municipally serviced area. Several underground services, including municipal water and sewer, natural gas, and hydro, were located as part of the field program for the Phase II ESA.

## Physical Setting

### Site Stratigraphy

Site stratigraphy is provided in the Soil Profile and Test Data Sheets provided in Appendix 1 and illustrated on Drawing PE4280-5 - Cross-Section A-A'. Stratigraphy consists of:

- Asphaltic concrete varying in thickness between 0.02m and 0.08m.
- Crushed stone beneath the asphalt surfaces.
- Fill material consisting of sand, brick, gravel and cobbles.
- Native Silty clay
- Native Glacial till
- Interbedded shale and limestone bedrock.

The shale and limestone bedrock is the deepest unit investigated as part of this Phase II ESA.

**Hydrogeological Characteristics**

The water table at the subject site was encountered in the limestone bedrock at the subject site. Groundwater levels were measured at the subject site on April 23, 2018. Groundwater was encountered at depths between 13.76m and 14.64 m below existing grade. It is noted that water levels fluctuate with seasonal variations.

Based on the groundwater elevations from the April 23, 2018 monitoring event, groundwater contour mapping was completed. Groundwater contours are shown on Drawing PE4280-2 - Groundwater Contour Plan. Based on the contour mapping, groundwater flow at the subject site appears to be in a northerly direction. A horizontal hydraulic gradient of approximately 0.032 m/m was calculated.

**Approximate Depth to Bedrock**

Bedrock was encountered in all boreholes at depths varying from 12.70m to 14.40m below the existing ground surface.

**Approximate Depth to Water Table**

Depth to water table at the subject site varies between approximately 13.76m and 14.64 m 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.

### Fill Placement

Fill placement has occurred at the subject site. The fill material is considered to have been a part of the original pavement structure in the parking area of the subject site and consists of silty sand with gravel and organics. Additional fill material, consisting of a brown silty sand was used to backfill the excavation for the former UST. The backfill material from the UST excavation is not considered to be an APEC on the subject site.

### Proposed Buildings and Other Structures

It is our understanding there is a proposed redevelopment of the subject site covering the entire parking area.

### Existing Buildings and Structures

The Phase II Property is occupied by a multi storey commercial/office building. A small structure associated with the pay parking operations is also present on the subject site, along Nepean Street. No other significant buildings or structures are present on the subject site.

### Water Bodies

There are no water bodies on the subject site. The nearest water body is the Rideau Canal which is located approximately 550 m northeast of the site.

### Areas of Natural Significance

No areas of natural significance were observed on the site or within a 250m radius of the subject site.

## Environmental Condition

### Areas Where Contaminants are Present

Based on analytical results, impacted fill material (consisting of sand, gravel and organics) is present above the native silty clay. No native impacted soil was identified on the subject site.

Based on the analytical results, the groundwater on the Phase II ESA property is not impacted with PHCs and BTEX. The metals exceedances identified in the fill material on the subject site are not considered to have impacted the groundwater based on the depth to the water table and the generally impermeable nature of the site soils and the low dissolution rate of metals.

Sample locations are illustrated with analytical results in the Analytical Testing Plans (Drawings PE4280-3 and PE4280-4) appended to this report.

**Types of Contaminants**

The fill material beneath the pavement structure on the subject site is impacted with lead and mercury.

**Contaminated Media**

Based on the analytical testing results from the Phase II-ESA, the fill material beneath the pavement structure throughout the Phase II ESA property exceeds the MOECC Table 3 Standards.

**What Is Known About Areas where Contaminants are Present**

The Phase II ESA property was originally developed prior to 1928 for residential purposes, until a redevelopment with the current Medical Arts Building. The property tenants have undergone many changes and no particular tenant is considered to be the direct source of the contaminants. The poor quality fill material is likely the result of the redevelopment of the site and demolition of the former residential buildings present.

**Distribution and Migration of Contaminants**

The fill material throughout the subject site is considered to be impacted. The impacted fill is not considered to have the potential to migrate unless disturbed by anthropogenic causes since the fill material is sealed beneath the asphalt surface of the parking areas.

**Discharge of Contaminants**

The discharge of contaminants at the Phase II-ESA Property is not considered to have been associated with the historical uses of the property and the surrounding area. No ongoing discharge of contaminants is expected on the Phase II-ESA Property.

**Migration of Contaminants**

Contaminant migration due to anthropogenic causes is expected to be limited on the Phase II-ESA Property. All parts of the property which are not developed are currently covered in asphalt concrete.

### Climatic and Meteorological Conditions

In general, climatic and meteorological conditions have the potential to affect contaminant distribution. Two 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.

Two APECs are currently present on the subject site, fill material of unknown quality and a former furnace oil UST. The fill material of unknown quality and the former furnace oil UST, while outdoors are entirely covered by asphaltic concrete and the effect of climactic and meteorological conditions are considered to be minimal.

### Potential for Vapour Intrusion

The impacted fill material is not expected to have the potential for vapour intrusion into the building, while there is a basement on the subject site the quantity and thickness of the fill material is expected to the relatively minimal and vapour intrusion is not considered to be a concern. The impacted material is also not considered to be a volatile contaminant. During redevelopment of the subject site, the entire property is expected to be excavated to accommodate an underground parking structure. Future vapour intrusion is expected to be negligible.

# 6.0 CONCLUSIONS

## Assessment

A Phase II-Environmental Site Assessment (ESA) was conducted on 180 Metcalfe Street, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address the Areas of Potential Environmental Concern identified during a historical review. The Phase II-ESA consisted of the drilling of four boreholes and one probe hole along with the installation of three groundwater monitoring wells to assess the soil and groundwater quality at the subject site.

Soil samples obtained from the boreholes were screened using visual observations. Site soils consist of fill material consisting of sand, gravel, and organics underlain by silty clay and glacial till. Shale bedrock was cored in 3 of the 4 boreholes, while auger refusal was identified in the remaining boreholes and the one probehole advanced on site for geotechnical purposes. Based on the screening results, fill samples were selected for testing of metals and/or PAH parameters. Based on the analytical results, the fill material is impacted with metals. Samples of the native silty clay and the glacial till material were selected for analysis of PHCs and BTEX. Based on the analytical results, the native silty clay and glacial till is not impacted by the former UST on the subject site.

Groundwater samples were collected from the monitoring wells installed in BH1-18, BH2-18, and BH3-18, and analyzed for BTEX and PHCs. Based on the analytical results, the groundwater on the subject site has not been impacted by the past use of the subject site and the adjacent properties.

## Recommendations

Soil

During redevelopment of the site a soil remediation program will need to be undertaken. At this time the soil does not present a concern to the occupants of the subject site. Further information can be provided with respect to soil disposal, if required.

Groundwater

No impacted groundwater was identified on the subject site. Prior to any excavation work and the decommissioning of the groundwater wells on site, the groundwater should be retested to assist in the filing of a Record of Site Condition.

Monitoring Wells

If the monitoring wells installed on the subject site are not going to be used in the future, or will be destroyed during site redevelopment, they should be abandoned according to Ontario Regulation 903. Otherwise, the wells will be registered with the MOECC under this regulation. It is recommended that the monitoring wells remain intact for future groundwater monitoring purposes.

# 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 Jadco Group. Permission and notification from Jadco Group and Paterson will be required to release this report to any other party.

**Paterson Group Inc.**

Michael Beaudoin, P.Eng.


Mark D'Arcy, P.Eng.

**Report Distribution:**

- ❑ Jadco Group
- ❑ Paterson Group

# FIGURES

**FIGURE 1 – KEY PLAN**

**DRAWING PE4280-1 – TEST HOLE LOCATION PLAN**

**DRAWING PE4280-2 - GROUNDWATER CONTOUR PLAN**

**DRAWING PE4280-3 – ANALYTICAL TESTING PLAN – SOIL**

**DRAWING PE4280-4 – ANALYTICAL TESTING PLAN - GROUNDWATER**

**DRAWING PE4280-5 – CROSS-SECTION A-A`**

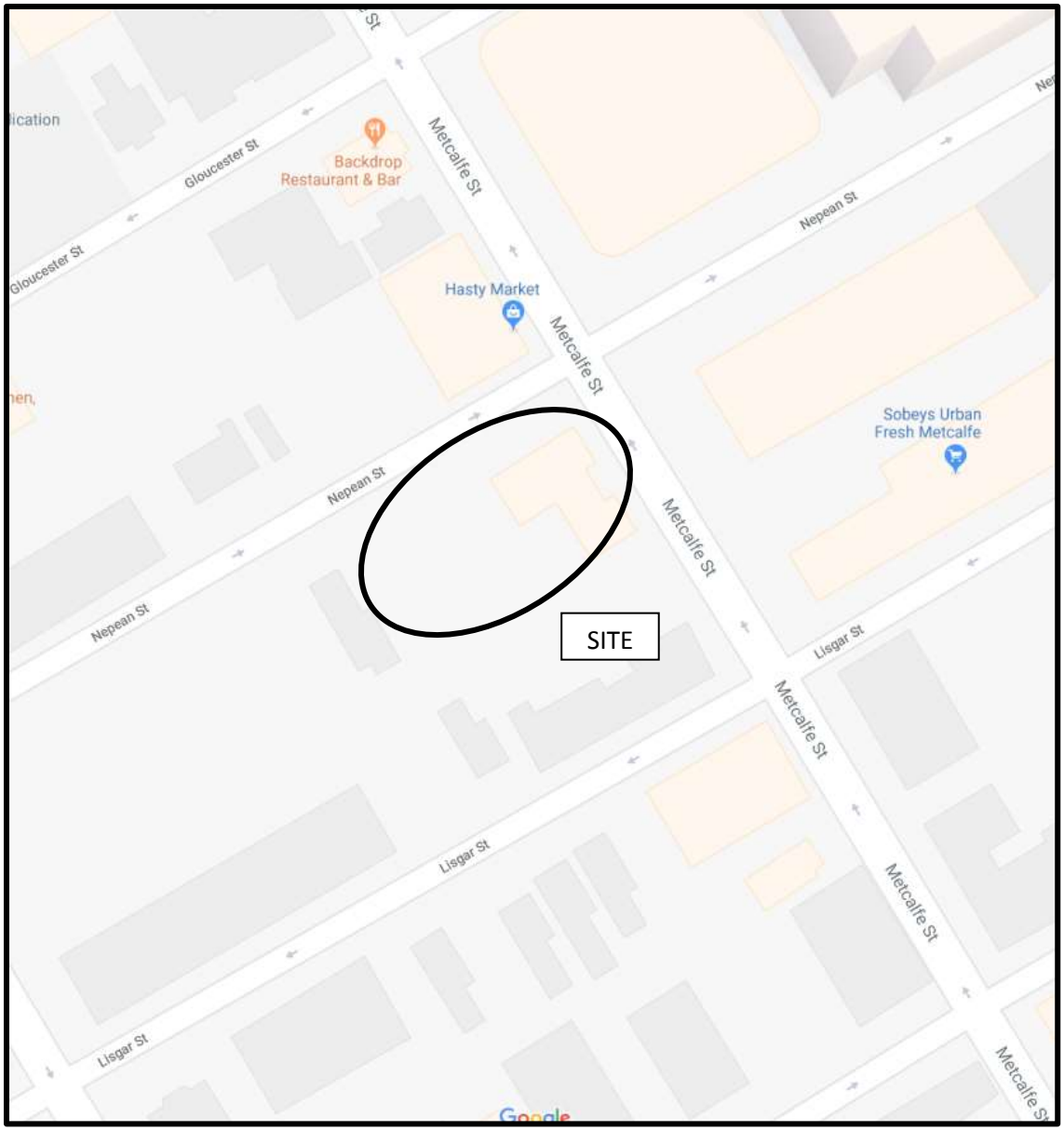


FIGURE 1

# KEY PLAN

NEPEAN STREET

SIDEWALK

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

BH 4-18
99.39
{86.69}

BH 2-18
99.50
[86.60]
(84.86)

PARKING BOOTH

#180 METCALFE STREET
COMMERCIAL BUILDING

METCALFE STREET

#96 NEPEAN STREET
VACANT

#88 NEPEAN STREET
RESIDENTIAL

ASPHALTIC CONCRETE
PARKING LOT

BH 5-18
99.64
[85.62]

APPROXIMATE EXTENT OF
PREVIOUS REMEDIATION
EXCAVATION (1998)

BH 1-18
99.51
[85.11]
(85.75)

BH 3-18
99.60
[85.71]
(85.56)

A

A'

PARKING LOT

#231 LISGAR STREET
OAKTREE CHIROPRACTIC

#225 LISGAR STREET
RESIDENTIAL APARMENT
BUILDING

LEGEND:

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- 99.51 GROUND SURFACE ELEVATION (m)
- [85.11] BEDROCK SURFACE ELEVATION (m)
- {86.69} PRACTICAL REFUSAL TO AUGERING ELEVATION (m)
- (85.75) GROUNDWATER SURFACE ELEVATION (m)
- A—A' CROSS-SECTION LOCATION


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|---|---|---|---|
| 0 | | | |

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
180 METCALFE STREET

OTTAWA, ONTARIO

Title:

# TEST HOLE LOCATION PLAN

| | |
|---|---|
| Scale: 1:250 | Date: 05/2018 |
| Drawn by: MPG | Report No.: PE4280-1 |
| Checked by: MB | Dwg. No.: PE4280-1 |
| Approved by: CDS | Revision No.: 0 |

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NEPEAN STREET

SIDEWALK

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

BH 4-18
99.39
{86.69}

BH 2-18
99.50
[86.60]
(84.86)

PARKING BOOTH

#180 METCALFE STREET
COMMERCIAL BUILDING

METCALFE STREET

#96 NEPEAN STREET
VACANT

#88 NEPEAN STREET
RESIDENTIAL

ASPHALTIC CONCRETE
PARKING LOT

85.0
85.1
85.2
85.3
85.4
85.5
85.6

(0.032m/m)

BH 5-18
99.64
[85.62]

BH 3-18
99.60
[85.71]
(85.56)

APPROXIMATE EXTENT OF
PREVIOUS REMEDIATION
EXCAVATION (1998)

BH 1-18
99.51
[85.11]
(85.75)

PARKING LOT

#231 LISGAR STREET
OAKTREE CHIROPRACTIC

#225 LISGAR STREET
RESIDENTIAL APARMENT
BUILDING

LEGEND:

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- 99.51 GROUND SURFACE ELEVATION (m)
- [85.11] BEDROCK SURFACE ELEVATION (m)
- {86.69} PRACTICAL REFUSAL TO AUGERING ELEVATION (m)
- (85.75) GROUNDWATER SURFACE ELEVATION (m)
- 85.3 GROUNDWATER CONTOUR
- (0.032m/m) APPROX. GROUNDWATER FLOW DIRECTION (HORIZONTAL HYDRAULIC GRADIENT)


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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
180 METCALFE STREET

OTTAWA, ONTARIO

Title:

# GROUNDWATER CONTOUR PLAN

| | |
|---|---|
| Scale: 1:250 | Date: 05/2018 |
| Drawn by: MPG | Report No.: PE4280-1 |
| Checked by: MB | Dwg. No.: PE4280-2 |
| Approved by: CDS | Revision No.: 0 |

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NEPEAN STREET

SIDEWALK

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

BH 2-18-SS15 (12.19-12.80m) - April 4, 2018
BTEX complies with MOECC Table 3 Standards
PHC complies with MOECC Table 3 Standards

BH 4-18
99.39
{86.69}

BH 2-18
99.50
[86.60]
(84.86)

PARKING BOOTH

#180 METCALFE STREET
COMMERCIAL BUILDING

METCALFE STREET

BH 4-18-G (0.30-0.61m) - April 5, 2018

| Parameter | Result | MOECC (ug/g) |
|---|---|---|
| Lead | 1020 | 120 |
| Mercury | 0.7 | 0.27 |

Other metals comply with MOECC Table 3 Standards
PAH complies with MOECC Table 3 Standards

ASPHALTIC CONCRETE PARKING LOT

BH 5-18
99.64
[85.62]

APPROXIMATE EXTENT OF PREVIOUS REMEDIATION EXCAVATION (1998)

BH 1-18
99.51
[85.11]
(85.75)

BH 3-18
99.60
[85.71]
(85.56)

BH 3-18-G (0.25-0.79m) - April 4, 2018

| Parameter | Result | MOECC (ug/g) |
|---|---|---|
| Lead | 192 | 120 |
| Mercury | 1.9 | 0.27 |

Other metals comply with MOECC Table 3 Standards
PAH complies with MOECC Table 3 Standards

BH 1-18-SS5 (3.05-3.66m) - April 3, 2018
BTEX complies with MOECC Table 3 Standards
PHC complies with MOECC Table 3 Standards

PARKING LOT

#231 LISGAR STREET
OAKTREE CHIROPRACTIC

#225 LISGAR STREET
RESIDENTIAL APARMENT BUILDING

SOIL RESULTS COMPLY WITH MOECC TABLE 3 STANDARDS

SOIL RESULTS EXCEED MOECC TABLE 3 STANDARDS

LEGEND:

| | |
|---|---|
| ⊕ | BOREHOLE LOCATION |
| ⊕ | BOREHOLE WITH MONITORING WELL LOCATION |
| 99.51 | GROUND SURFACE ELEVATION (m) |
| [85.11] | BEDROCK SURFACE ELEVATION (m) |
| {86.69} | PRACTICAL REFUSAL TO AUGERING ELEVATION (m) |
| (85.75) | GROUNDWATER SURFACE ELEVATION (m) |


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# PHASE II - ENVIRONMENTAL SITE ASSESSMENT
# 180 METCALFE STREET

OTTAWA, ONTARIO

Title:

# ANALYTICAL TESTING PLAN - SOIL

| | |
|---|---|
| Scale: 1:250 | Date: 05/2018 |
| Drawn by: MPG | Report No.: PE4280-1 |
| Checked by: MB | Dwg. No.: PE4280-3 |
| Approved by: CDS | Revision No.: 0 |

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NEPEAN STREET

SIDEWALK

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

**BH 4-18**
**99.39**
**{86.69}**

**BH 2-18**
**99.50**
**[86.60]**
**(84.86)**

PARKING BOOTH

BH 2-18-GW1 (14.64-17.68m) - April 23, 2018
BTEX complies with MOECC Table 3 Standards
PHC complies with MOECC Table 3 Standards

**#180 METCALFE STREET**
**COMMERCIAL BUILDING**

#96 NEPEAN STREET
VACANT

#88 NEPEAN STREET
RESIDENTIAL

ASPHALTIC CONCRETE
PARKING LOT

**BH 5-18**
**99.64**
**[85.62]**

APPROXIMATE EXTENT OF
PREVIOUS REMEDIATION
EXCAVATION (1998)

**BH 1-18**
**99.51**
**[85.11]**
**(85.75)**

**BH 3-18**
**99.60**
**[85.71]**
**(85.56)**

METCALFE STREET

BH 3-18-GW1 (14.04-17.68m) - April 23, 2018
BTEX complies with MOECC Table 3 Standards
PHC complies with MOECC Table 3 Standards

BH 1-18-GW1 (13.76-20.98m) - April 23, 2018
BTEX complies with MOECC Table 3 Standards
PHC complies with MOECC Table 3 Standards

PARKING LOT

#231 LISGAR STREET
OAKTREE CHIROPRACTIC

#225 LISGAR STREET
RESIDENTIAL APARMENT
BUILDING

GROUNDWATER RESULTS COMPLY WITH MOECC
TABLE 3 STANDARDS

LEGEND:

| | |
|---|---|
| ⊕ | BOREHOLE LOCATION |
| ⊕ | BOREHOLE WITH MONITORING WELL LOCATION |
| 99.51 | GROUND SURFACE ELEVATION (m) |
| [85.11] | BEDROCK SURFACE ELEVATION (m) |
| {86.69} | PRACTICAL REFUSAL TO AUGERING ELEVATION (m) |
| (85.75) | GROUNDWATER SURFACE ELEVATION (m) |


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JADCO GROUP

**PHASE II - ENVIRONMENTAL SITE ASSESSMENT**
**180 METCALFE STREET**

OTTAWA, ONTARIO

Title:

# ANALYTICAL TESTING PLAN - GROUNDWATER

| | |
|---|---|
| Scale: 1:250 | Date: 05/2018 |
| Drawn by: MPG | Report No.: PE4280-1 |
| Checked by: MB | Dwg. No.: PE4280-4 |
| Approved by: CDS | Revision No.: 0 |

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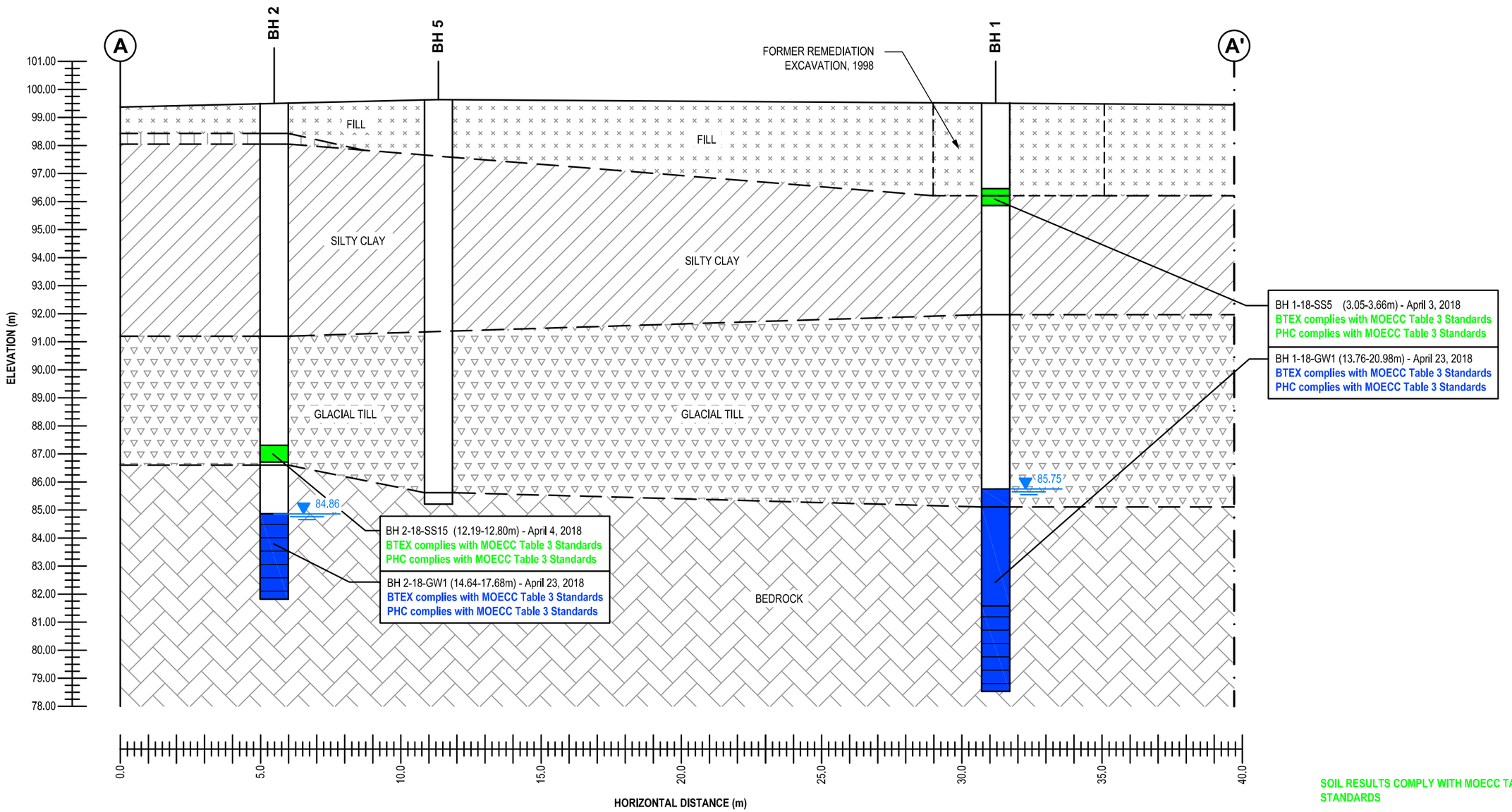


SOIL RESULTS COMPLY WITH MOECC TABLE 3 STANDARDS

GROUNDWATER RESULTS COMPLY WITH MOECC TABLE 3 STANDARDS


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**PHASE II - ENVIRONMENTAL SITE ASSESSMENT**
**180 METCALFE STREET**

OTTAWA, ONTARIO

Title:

# CROSS-SECTION A-A'

| | |
|---|---|
| Scale: AS SHOWN | Date: 05/2018 |
| Drawn by: MPG | Report No.: PE4280-1 |
| Checked by: MB | Dwg. No.: PE4280-5 |
| Approved by: CDS | Revision No.: 0 |

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# APPENDIX 1

## SAMPLING AND ANALYSIS PLAN

## SOIL PROFILE AND TEST DATA SHEETS

## SYMBOLS AND TERMS

## LABORATORY CERTIFICATES OF ANALYSIS

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Studies

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# Sampling and Analysis Plan

180 Metcalfe Street
Ottawa, Ontario

Prepared For

Jadco Group

April, 2018

Report: PE4280-SAP.01

## Table of Contents

# 1.0 Sampling Program

Paterson Group (Paterson) was commissioned by Jadco Group to conduct a Phase II ESA for a portion of the property addressed as 180 Metcalfe Street, in the City of Ottawa, Ontario.

The Phase II ESA was carried out to address the APECs identified in the Paterson Phase I ESA. The following subsurface investigation program was developed to identify and delineate the suspected contamination:

| Borehole | Location and Rationale | Proposed Depth and Rationale |
|---|---|---|
| BH1 | Address former underground storage tank associated with the building. | Boreholes to be advanced to intercept water table to facilitate installation of groundwater monitoring wells. |
| BH2 | Provide general coverage | |
| BH3 | Provide general coverage | |
| BH4 | Provide general coverage | Borehole advanced to collect soil samples for environmental and geotechnical evaluation and encounter bedrock |
| BH5 | Geotechnical borehole, soil conditions visually inspected for signs of environmental issues | Encounter bedrock |

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

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

If it is considered necessary to drill into bedrock to intercept the groundwater table, boreholes will be advanced into bedrock as required using diamond coring equipment. Rock core samples will be retained for review.

Following borehole drilling, monitoring wells will be installed in selected boreholes 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 borehole where there is visual or olfactory evidence of contamination, or where gas detector readings indicate the presence of contamination, the 'worst-case' sample from each test pit should be submitted for comparison with MOECC site condition standards.
- In boreholes with evidence of contamination as described above, a sample should be submitted from the stratigraphic unit below the 'worst-case' sample to determine whether the contaminant(s) have migrated vertically downward.
- At least one sample from each borehole should be submitted to delineate the horizontal extent of contamination across the site.
- Parameters analyzed should be consistent with the contaminants of potential concern identified in the Phase II-ESA.
- Samples will be submitted for analysis of PHC, PAH, and metals parameters.

# 3.0 Standard Operating Procedures

## 3.1 Environmental Drilling Procedure

### Purpose

The purpose of environmental boreholes is to assess the soil condition and facilitate the installation of groundwater monitoring wells to delineate the petroleum hydrocarbon impacted groundwater.

### Equipment

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

- Glass soil sample jars
- Plastic sample bags two buckets
- Cleaning brush (toilet brush works well)
- Dish detergent
- Methyl hydrate
- Water (if not available on site - water jugs available in trailer)

- Latex or nitrile gloves (depending on suspected contaminant)
- RKI Eagle organic vapour meter or MiniRae photoionization detector (depending on contamination suspected)

## Determining Borehole and Test Pit Locations

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

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

### Drilling Procedure

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

- Continuous split spoon samples (every 0.6 m or 2') or semi-continuous (every 0.76 m or 2'6") are required. Sleeve samples are to be collected when utilizing GeoProbe direct push drill.
- 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. Sleeves are disposable and will not require washing.
- 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, visual observations, 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.

The spoon-washing procedure may be bypassed if a GeoProbe direct-push drill rig with disposable plastic sampling tubes is used.

## 3.2 Monitoring Well Installation Procedure

### Equipment

- 1.5 m x 5 cm threaded sections of Schedule 40 PVC slotted well screen (1.5 m x 3.2 cm if installing in cored hole in bedrock)
- 1.5 m x 5 cm threaded sections of Schedule 40 PVC riser pipe (1.5 m x 3.2 cm 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

- Portable pH/Temperature/Conductivity analyzer
- 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.

## Instrument Washing Procedure

All sampling equipment (shovels, trowels, spatulas, 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 instrument with brush in soapy water, inside and out, including tip
- Rinse in clean water

- Apply a small amount of methyl hydrate to the exposed faces of the instrument. (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 equipment, 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.

# 4.0 Quality Assurance/Quality Control (QA/QC)

The QA/QC program for this subsurface investigation is as follows:

- All non-dedicated sampling equipment (shovels, split spoons, etc.) will be decontaminated according to the SOPs listed above.
- Approximately one field duplicate will be submitted for every ten samples submitted for laboratory analysis. A minimum of one field duplicate per project will be submitted. Field duplicates will be submitted for soil and groundwater samples where possible.
- Where multi-parameter analyzers are used to measure field chemistry, they will be calibrated on an approximately monthly basis, according to frequency of use.

# 5.0 Physical Impediments to Sampling and Analysis Plan

Physical impediments to the Sampling and Analysis plan may include:

- The location of underground utilities
- Shallow bedrock or limited presence of fill
- Insufficient groundwater volume for groundwater samples (if encountered)
- 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
- Mechanical Equipment breakdowns
- Winter conditions
- Other site-specific impediments

# patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

## SOIL PROFILE AND TEST DATA

**Phase II - Environmental Site Assessment**
**180 Metcalfe Street**
**Ottawa, Ontario**

**DATUM** TBM - Top spindle of fire hydrant . Assumed elevation = 100.00m.

**FILE NO.** PE4280

**REMARKS**

**HOLE NO.** BH 1

**BORINGS BY** CME 55 Power Auger **DATE** April 3, 2018

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|---|---|
| **GROUND SURFACE** | | | | | | 0 | 99.51 |
| Asphaltic concrete 0.05 | | | | | | | |
| **FILL:** Crushed stone with silt and sand 0.30 | | AU | 1 | | | | |
| **FILL:** Brown silty sand | | SS | 2 | 42 | 9 | 1 | 98.51 |
| - trace gravel and clay by 1.45m depth | | SS | 3 | 58 | 4 | 2 | 97.51 |
| | | SS | 4 | 8 | 2 | | |
| 3.30 | | SS | 5 | 58 | 27 | 3 | 96.51 |
| | | SS | 6 | 100 | W | 4 | 95.51 |
| Very stiff to soft, grey **SILTY CLAY,** trace sand | | SS | 7 | 100 | W | 5 | 94.51 |
| | | SS | 8 | 100 | W | | |
| | | SS | 9 | 100 | W | 6 | 93.51 |
| | | SS | 10 | 100 | W | 7 | 92.51 |
| 7.54 | | SS | 11 | 100 | W | 8 | 91.51 |
| | | SS | 12 | 75 | 9 | | |
| **GLACIAL TILL:** Grey silty clay, some sand, trace gravel, cobbles and boulders | | SS | 13 | 58 | 1 | 9 | 90.51 |
| | | SS | 14 | 33 | 50+ | 10 | 89.51 |
| | | | | | | 11 | 88.51 |

**Photo Ionization Detector**
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

**RKI Eagle Rdg. (ppm)**

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

# patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

## SOIL PROFILE AND TEST DATA

**Phase II - Environmental Site Assessment**
**180 Metcalfe Street**
**Ottawa, Ontario**

**DATUM** TBM - Top spindle of fire hydrant . Assumed elevation = 100.00m.

**FILE NO.** PE4280

**REMARKS**

**HOLE NO.** BH 1

**BORINGS BY** CME 55 Power Auger **DATE** April 3, 2018

| 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** | | | | | | | | | |
| **GLACIAL TILL:** Grey silty clay, some sand, trace gravel, cobbles and boulders | | SS | 15 | 42 | 3 | 11 | 88.51 | | |
| | | SS | 16 | 25 | 17 | 12 | 87.51 | | |
| | | SS | 17 | 62 | 21 | 13 | 86.51 | | |
| | | SS | 18 | 75 | 13 | | | | |
| | | SS | 19 | 42 | 16 | 14 | 85.51 | | |
| 14.40 | | | | | | | | | |
| Inferred weathered **BEDROCK** | | SS | 20 | 83 | 22 | 15 | 84.51 | | |
| 15.34 | | SS | 21 | 93 | 50+ | | | | |
| | | RC | 1 | 100 | 38 | 16 | 83.51 | | |
| | | RC | 2 | 97 | 88 | 17 | 82.51 | | |
| **BEDROCK:** Black shale | | RC | 3 | 100 | 100 | 18 | 81.51 | | |
| | | | | | | 19 | 80.51 | | |
| | | RC | 4 | 100 | 94 | 20 | 79.51 | | |
| | | RC | 5 | 95 | 95 | | | | |
| 20.98 | | | | | | | | | |
| End of Borehole | | | | | | | | | |
| (GWL @ 13.76m - April 23, 2018) | | | | | | | | | |

Photo Ionization Detector: ● Volatile Organic Rdg. (ppm)
○ Lower Explosive Limit %
20 40 60 80

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

# patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

# SOIL PROFILE AND TEST DATA

**Phase II - Environmental Site Assessment**
**180 Metcalfe Street**
**Ottawa, Ontario**

**DATUM** TBM - Top spindle of fire hydrant . Assumed elevation = 100.00m.

**FILE NO.** **PE4280**

**REMARKS**

**HOLE NO.** **BH 2**

**BORINGS BY** CME 55 Power Auger **DATE** April 4, 2018

| 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** | | | | | | | | | |
| Asphaltic concrete 0.05 | | | | | | | | | |
| **FILL:** Crushed stone with silt and sand 0.23 | | AU | 1 | | | | | | |
| **FILL:** Brown silty sand, trace gravel 1.07 | | SS | 2 | 100 | 12 | 1 | 98.50 | | |
| Compact, brown **SILTY SAND** 1.45 | | SS | 3 | 100 | 10 | 2 | 97.50 | | |
| | | SS | 4 | 100 | 5 | | | | |
| | | SS | 5 | 100 | P | 3 | 96.50 | | |
| | | SS | 6 | 100 | P | 4 | 95.50 | | |
| Stiff, brown to grey **SILTY CLAY,** trace sand | | SS | 7 | 100 | P | 5 | 94.50 | | |
| | | SS | 8 | 100 | P | 6 | 93.50 | | |
| | | SS | 9 | 54 | P | 7 | 92.50 | | |
| 8.30 | | | | | | 8 | 91.50 | | |
| | | SS | 10 | 58 | P | | | | |
| **GLACIAL TILL:** Brown silty clay, some sand, gravel, cobbles and boulders | | SS | 11 | 42 | 50 | 9 | 90.50 | | |
| | | SS | 12 | 67 | 12 | 10 | 89.50 | | |
| | | | | | | 11 | 88.50 | | |

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

RKI Eagle Rdg. (ppm) — 100 200 300 400 500

▲ Full Gas Resp. △ Methane Elim.

# patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

# SOIL PROFILE AND TEST DATA

**Phase II - Environmental Site Assessment**
**180 Metcalfe Street**
**Ottawa, Ontario**

**DATUM** TBM - Top spindle of fire hydrant . Assumed elevation = 100.00m.

**FILE NO.** PE4280

**REMARKS**

**HOLE NO.** BH 2

**BORINGS BY** CME 55 Power Auger **DATE** April 4, 2018

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|---|---|
| **GROUND SURFACE** | | | | | | | |
| **GLACIAL TILL:** Brown silty clay, some sand, gravel, cobbles and boulders | | SS | 13 | 67 | 14 | 11 | 88.50 |
| | | SS | 14 | 46 | 4 | 12 | 87.50 |
| | | SS | 15 | 42 | 8 | | |
| 12.90 | | | | | | | |
| | | RC | 1 | 100 | 50 | 13 | 86.50 |
| | | RC | 2 | 93 | 32 | 14 | 85.50 |
| **BEDROCK:** Black shale | | | | | | 15 | 84.50 |
| | | RC | 3 | 100 | 76 | 16 | 83.50 |
| | | RC | 4 | 98 | 76 | 17 | 82.50 |
| 17.68 | | | | | | | |
| End of Borehole | | | | | | | |
| (GWL @ 14.64m - April 23, 2018) | | | | | | | |

**Photo Ionization Detector**

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

Monitoring Well Construction

100 200 300 400 500

**RKI Eagle Rdg. (ppm)**

▲ Full Gas Resp. △ Methane Elim.

# patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

## SOIL PROFILE AND TEST DATA

**Phase II - Environmental Site Assessment**
**180 Metcalfe Street**
**Ottawa, Ontario**

**DATUM** TBM - Top spindle of fire hydrant . Assumed elevation = 100.00m.

**FILE NO.** PE4280

**REMARKS**

**HOLE NO.** BH 3

**BORINGS BY** CME 55 Power Auger **DATE** April 4, 2018

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|---|---|
| **GROUND SURFACE** | | | | | | 0 | 99.60 |
| 25mm Asphaltic concrete over crushed stone with silt and sand 0.25 | | AU | 1 | | | | |
| **FILL:** Brown silty sand, trace gravel and organics 0.79 | | SS | 2 | 100 | 10 | 1 | 98.60 |
| Compact, brown **SILTY SAND** 1.65 | | SS | 3 | 75 | 10 | 2 | 97.60 |
| | | SS | 4 | 100 | 5 | 3 | 96.60 |
| | | SS | 5 | 0 | P | | |
| | | SS | 6 | 100 | P | 4 | 95.60 |
| Stiff, brown to grey **SILTY CLAY,** trace sand | | SS | 7 | 100 | P | 5 | 94.60 |
| | | SS | 8 | 100 | P | 6 | 93.60 |
| 7.39 | | | | | | 7 | 92.60 |
| | | SS | 9 | 62 | 6 | 8 | 91.60 |
| **GLACIAL TILL:** Grey silty clay, some sand, trace gravel, cobbles and boulders | | SS | 10 | 58 | 2 | 9 | 90.60 |
| | | SS | 11 | 50 | 7 | 10 | 89.60 |
| | | SS | 12 | 0 | 18 | | |
| | | | | | | 11 | 88.60 |

**Photo Ionization Detector**
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

**RKI Eagle Rdg. (ppm)**

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

# patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

## SOIL PROFILE AND TEST DATA

**Phase II - Environmental Site Assessment**
**180 Metcalfe Street**
**Ottawa, Ontario**

**DATUM** TBM - Top spindle of fire hydrant . Assumed elevation = 100.00m.

**FILE NO.** PE4280

**REMARKS**

**HOLE NO.** BH 3

**BORINGS BY** CME 55 Power Auger **DATE** April 4, 2018

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|---|---|
| **GROUND SURFACE** | | | | | | | |
| | | SS | 13 | 67 | 8 | 11 | 88.60 |
| **GLACIAL TILL:** Grey silty clay, some sand, trace gravel, cobbles and boulders | | | | | | 12 | 87.60 |
| | | | | | | 13 | 86.60 |
| 13.89 | | | | | | | |
| | | RC | 1 | 100 | 84 | 14 | 85.60 |
| | | | | | | 15 | 84.60 |
| **BEDROCK:** Black shale | | RC | 2 | 100 | 81 | | |
| | | | | | | 16 | 83.60 |
| | | RC | 3 | 100 | 92 | 17 | 82.60 |
| 17.68 | | | | | | | |
| End of Borehole | | | | | | | |
| (GWL @ 14.04m - April 23, 2018) | | | | | | | |

**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**
**180 Metcalfe Street**
**Ottawa, Ontario**

**DATUM** TBM - Top spindle of fire hydrant . Assumed elevation = 100.00m.

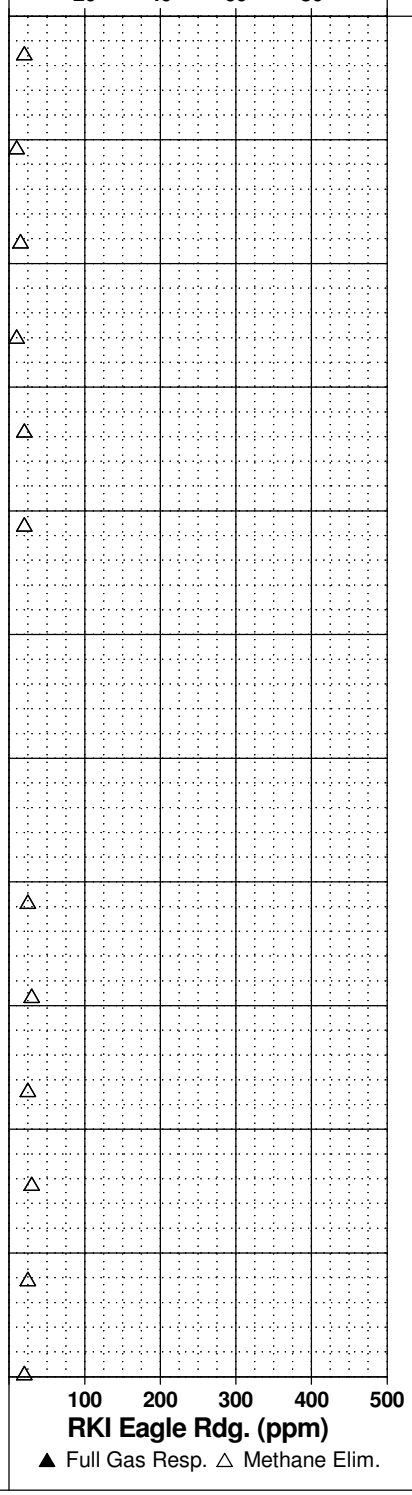
**FILE NO.** PE4280

**REMARKS**

**HOLE NO.** BH 4

**BORINGS BY** CME 55 Power Auger **DATE** April 5, 2018

| 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** | | | | | | | | | | |
| Asphaltic concrete | 0.05 | | | | | | | | | |
| **FILL:** Crushed stone with silt and sand | 0.20 / 0.69 | | AU | 1 | | | 0 | 99.39 | | |
| **FILL:** Brown silty sand, trace gravel and organics | | | SS | 2 | 83 | 27 | 1 | 98.39 | | |
| Compact, brown **SILTY SAND** | 1.62 | | SS | 3 | 100 | 12 | 2 | 97.39 | | |
| | | | SS | 4 | 100 | 5 | 3 | 96.39 | | |
| Stiff, brown to grey **SILTY CLAY,** trace sand | | | SS | 5 | 50 | P | 4 | 95.39 | | |
| | | | SS | 6 | 100 | P | 5 | 94.39 | | |
| | 6.63 | | | | | | 6 | 93.39 | | |
| **GLACIAL TILL:** Grey silty clay, some sand, trace gravel, cobbles and boulders | | | SS | 7 | 42 | P | 7 | 92.39 | | |
| | | | SS | 8 | 83 | 2 | 8 | 91.39 | | |
| | | | SS | 9 | 67 | 8 | 9 | 90.39 | | |
| | | | SS | 10 | 58 | 13 | 10 | 89.39 | | |
| | | | SS | 11 | 71 | 19 | 11 | 88.39 | | |



# patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

## SOIL PROFILE AND TEST DATA

**Phase II - Environmental Site Assessment**
**180 Metcalfe Street**
**Ottawa, Ontario**

**DATUM** TBM - Top spindle of fire hydrant . Assumed elevation = 100.00m.

**FILE NO.** PE4280

**REMARKS**

**HOLE NO.** BH 4

**BORINGS BY** CME 55 Power Auger **DATE** April 5, 2018

| 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** | | | | | | | | | |
| | | SS | 12 | 83 | 40 | 11 | 88.39 | | |
| **GLACIAL TILL:** Grey silty clay, some sand, trace gravel, cobbles and boulders | | SS | 13 | 79 | 34 | 12 | 87.39 | | |
| | | SS | 14 | 84 | 34 | | | | |
| 12.70 | | | | | | | | | |
| End of Borehole | | | | | | | | | |
| Practical refusal to augering at 12.70m depth | | | | | | | | | |

Photo Ionization Detector: ● Volatile Organic Rdg. (ppm)

○ Lower Explosive Limit %

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

# patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

## SOIL PROFILE AND TEST DATA

**Phase II - Environmental Site Assessment**
**180 Metcalfe Street**
**Ottawa, Ontario**

**DATUM** TBM - Top spindle of fire hydrant . Assumed elevation = 100.00m.

**FILE NO.** PE4280

**REMARKS**

**HOLE NO.** BH 5

**BORINGS BY** CME 55 Power Auger **DATE** April 5, 2018

| 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 | 99.64 | | |
| | | | | | | 1 | 98.64 | | |
| | | | | | | 2 | 97.64 | | |
| | | | | | | 3 | 96.64 | | |
| | | | | | | 4 | 95.64 | | |
| | | | | | | 5 | 94.64 | | |
| **OVERBURDEN** | | | | | | 6 | 93.64 | | |
| | | | | | | 7 | 92.64 | | |
| | | | | | | 8 | 91.64 | | |
| | | | | | | 9 | 90.64 | | |
| | | | | | | 10 | 89.64 | | |
| | | | | | | 11 | 88.64 | | |

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

RKI Eagle Rdg. (ppm) — 100 200 300 400 500

▲ Full Gas Resp. △ Methane Elim.

# patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

## SOIL PROFILE AND TEST DATA

**Phase II - Environmental Site Assessment**
**180 Metcalfe Street**
**Ottawa, Ontario**

**DATUM** TBM - Top spindle of fire hydrant . Assumed elevation = 100.00m.

**FILE NO.** PE4280

**REMARKS**

**HOLE NO.** BH 5

**BORINGS BY** CME 55 Power Auger **DATE** April 5, 2018

| 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** | | | | | | | | | |
| | | | | | | 11 | 88.64 | | |
| **OVERBURDEN** | | | | | | 12 | 87.64 | | |
| | | | | | | 13 | 86.64 | | |
| 14.02 | | | | | | 14 | 85.64 | | |
| Inferred weathered **BEDROCK** | | | | | | | | | |
| 14.43 | | SS | 1 | 100 | 50+ | | | | |
| End of Borehole | | | | | | | | | |

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

Monitoring Well Construction

# SYMBOLS AND TERMS

## SOIL DESCRIPTION

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

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

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

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

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

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

# SYMBOLS AND TERMS (continued)

## SOIL DESCRIPTION (continued)

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

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

## ROCK DESCRIPTION

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

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

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

## SAMPLE TYPES

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

## SYMBOLS AND TERMS (continued)

### GRAIN SIZE DISTRIBUTION

| | | |
|---|---|---|
| MC% | - | Natural moisture content or water content of sample, % |
| LL | - | Liquid Limit, % (water content above which soil behaves as a liquid) |
| PL | - | Plastic limit, % (water content above which soil behaves plastically) |
| PI | - | Plasticity index, % (difference between LL and PL) |
| Dxx | - | Grain size which xx% of the soil, by weight, is of finer grain sizes<br>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

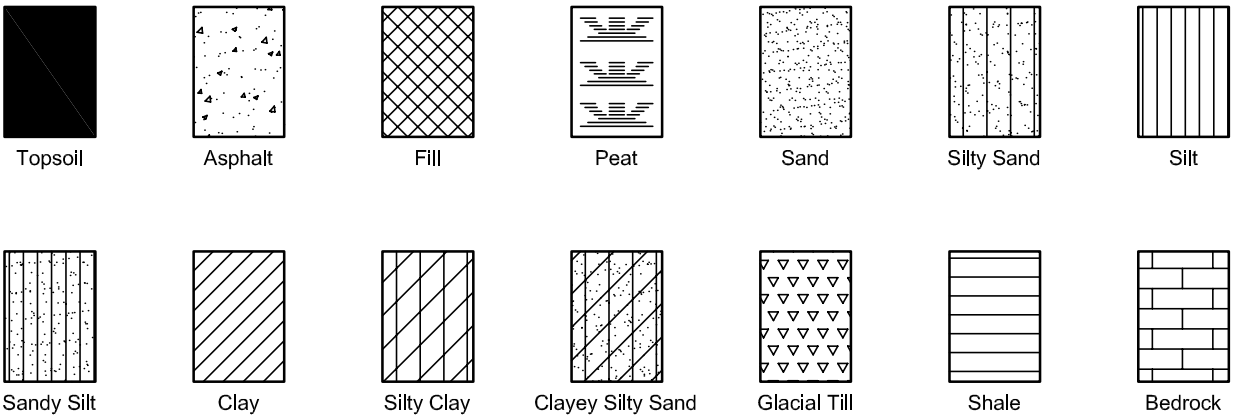
| | | |
|---|---|---|
| $p'_o$ | - | Present effective overburden pressure at sample depth |
| $p'_c$ | - | Preconsolidation pressure of (maximum past pressure on) sample |
| Ccr | - | Recompression index (in effect at pressures below $p'_c$) |
| Cc | - | Compression index (in effect at pressures above $p'_c$) |
| 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. |

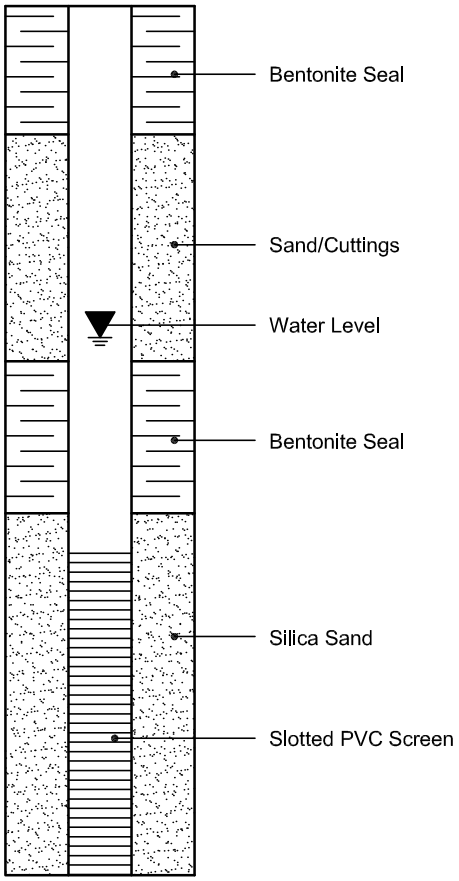
# SYMBOLS AND TERMS (continued)

## STRATA PLOT

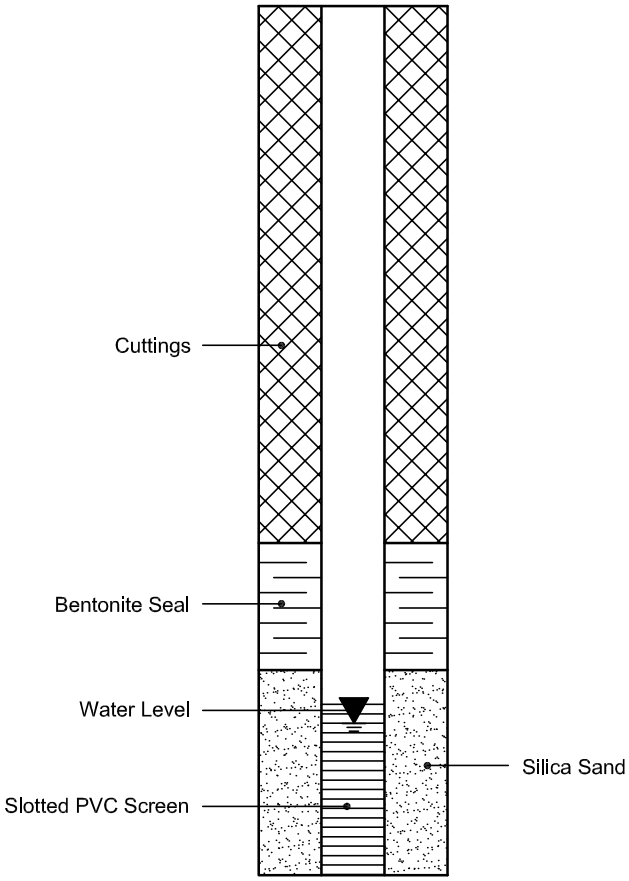



## MONITORING WELL AND PIEZOMETER CONSTRUCTION

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: Mike Beaudoin

Client PO: 23785
Project: PE4280
Custody: 116640

Report Date: 19-Apr-2018
Order Date: 13-Apr-2018

**Order #: 1815566**

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

| Paracel ID | Client ID |
|---|---|
| 1815566-01 | BH1-18-SS5 |
| 1815566-02 | BH2-18-SS15 |
| 1815566-03 | BH3-18-6 |
| 1815566-04 | BH4-18-6 |

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
**Client: Paterson Group Consulting Engineers**
**Client PO: 23785**

Report Date: 19-Apr-2018
Order Date: 13-Apr-2018
**Project Description: PE4280**

## Analysis Summary Table

| Analysis | Method Reference/Description | Extraction Date | Analysis Date |
|---|---|---|---|
| Boron, available | MOE (HWE), EPA 200.7 - ICP-OES | 19-Apr-18 | 19-Apr-18 |
| BTEX by P&T GC-MS | EPA 8260 - P&T GC-MS | 16-Apr-18 | 17-Apr-18 |
| Chromium, hexavalent - soil | MOE E3056 - Extraction, colourimetric | 13-Apr-18 | 17-Apr-18 |
| Mercury by CVAA | EPA 7471B - CVAA, digestion | 19-Apr-18 | 19-Apr-18 |
| Metals, ICP-MS | EPA 6020 - Digestion - ICP-MS | 19-Apr-18 | 19-Apr-18 |
| PHC F1 | CWS Tier 1 - P&T GC-FID | 16-Apr-18 | 17-Apr-18 |
| PHCs F2 to F4 | CWS Tier 1 - GC-FID, extraction | 13-Apr-18 | 15-Apr-18 |
| REG 153: PAHs by GC-MS | EPA 8270 - GC-MS, extraction | 13-Apr-18 | 15-Apr-18 |
| Solids, % | Gravimetric, calculation | 18-Apr-18 | 18-Apr-18 |

Certificate of Analysis

**Client: Paterson Group Consulting Engineers**

**Client PO: 23785**

Report Date: 19-Apr-2018

Order Date: 13-Apr-2018

**Project Description: PE4280**

| | Client ID: | BH1-18-SS5 | BH2-18-SS15 | BH3-18-6 | BH4-18-6 |
|---|---|---|---|---|---|
| | Sample Date: | 04/03/2018 09:00 | 04/04/2018 09:00 | 04/04/2018 09:00 | 04/05/2018 09:00 |
| | Sample ID: | 1815566-01 | 1815566-02 | 1815566-03 | 1815566-04 |
| | MDL/Units | Soil | Soil | Soil | Soil |
| **Physical Characteristics** | | | | | |
| % Solids | 0.1 % by Wt. | 57.2 | 91.6 | 80.1 | 82.3 |
| **Metals** | | | | | |
| Antimony | 1 ug/g dry | - | - | <1 | <1 |
| Arsenic | 1 ug/g dry | - | - | 4 | 4 |
| Barium | 1 ug/g dry | - | - | 114 | 309 |
| Beryllium | 0.5 ug/g dry | - | - | <0.5 | <0.5 |
| Boron | 5.0 ug/g dry | - | - | <5.0 | <5.0 |
| Boron, available | 0.5 ug/g dry | - | - | <0.5 | <0.5 |
| Cadmium | 0.5 ug/g dry | - | - | <0.5 | <0.5 |
| Chromium | 5 ug/g dry | - | - | 17 | 26 |
| Chromium (VI) | 0.2 ug/g dry | - | - | <0.2 | <0.2 |
| Cobalt | 1 ug/g dry | - | - | 5 | 5 |
| Copper | 5 ug/g dry | - | - | 28 | 39 |
| Lead | 1 ug/g dry | - | - | 192 | 1020 |
| Mercury | 0.1 ug/g dry | - | - | 1.9 | 0.7 |
| Molybdenum | 1 ug/g dry | - | - | <1 | <1 |
| Nickel | 5 ug/g dry | - | - | 14 | 13 |
| Selenium | 1 ug/g dry | - | - | <1 | <1 |
| Silver | 0.3 ug/g dry | - | - | <0.3 | <0.3 |
| Thallium | 1 ug/g dry | - | - | <1 | <1 |
| Uranium | 1 ug/g dry | - | - | <1 | <1 |
| Vanadium | 10 ug/g dry | - | - | 23 | 26 |
| Zinc | 20 ug/g dry | - | - | 103 | 258 |
| **Volatiles** | | | | | |
| Benzene | 0.02 ug/g dry | <0.02 | <0.02 | - | - |
| Ethylbenzene | 0.05 ug/g dry | <0.05 | <0.05 | - | - |
| Toluene | 0.05 ug/g dry | <0.05 | <0.05 | - | - |
| m,p-Xylenes | 0.05 ug/g dry | <0.05 | <0.05 | - | - |
| o-Xylene | 0.05 ug/g dry | <0.05 | <0.05 | - | - |
| Xylenes, total | 0.05 ug/g dry | <0.05 | <0.05 | - | - |
| Toluene-d8 | Surrogate | 93.0% | 92.5% | - | - |
| **Hydrocarbons** | | | | | |
| F1 PHCs (C6-C10) | 7 ug/g dry | <7 | <7 | - | - |
| F2 PHCs (C10-C16) | 4 ug/g dry | 5 | 77 | - | - |
| F3 PHCs (C16-C34) | 8 ug/g dry | 46 | 109 | - | - |

Certificate of Analysis

**Client: Paterson Group Consulting Engineers**

**Client PO: 23785**

Report Date: 19-Apr-2018

Order Date: 13-Apr-2018

**Project Description: PE4280**

| | Client ID: | BH1-18-SS5 | BH2-18-SS15 | BH3-18-6 | BH4-18-6 |
|---|---|---|---|---|---|
| | Sample Date: | 04/03/2018 09:00 | 04/04/2018 09:00 | 04/04/2018 09:00 | 04/05/2018 09:00 |
| | Sample ID: | 1815566-01 | 1815566-02 | 1815566-03 | 1815566-04 |
| | MDL/Units | Soil | Soil | Soil | Soil |
| F4 PHCs (C34-C50) | 6 ug/g dry | 40 | 38 | - | - |
| **Semi-Volatiles** | | | | | |
| Acenaphthene | 0.02 ug/g dry | - | - | <0.02 | <0.02 |
| Acenaphthylene | 0.02 ug/g dry | - | - | <0.02 | 0.03 |
| Anthracene | 0.02 ug/g dry | - | - | <0.02 | 0.02 |
| Benzo [a] anthracene | 0.02 ug/g dry | - | - | 0.02 | 0.07 |
| Benzo [a] pyrene | 0.02 ug/g dry | - | - | 0.03 | 0.08 |
| Benzo [b] fluoranthene | 0.02 ug/g dry | - | - | 0.03 | 0.11 |
| Benzo [g,h,i] perylene | 0.02 ug/g dry | - | - | <0.02 | 0.05 |
| Benzo [k] fluoranthene | 0.02 ug/g dry | - | - | <0.02 | 0.06 |
| Chrysene | 0.02 ug/g dry | - | - | 0.03 | 0.09 |
| Dibenzo [a,h] anthracene | 0.02 ug/g dry | - | - | <0.02 | <0.02 |
| Fluoranthene | 0.02 ug/g dry | - | - | 0.07 | 0.16 |
| Fluorene | 0.02 ug/g dry | - | - | <0.02 | <0.02 |
| Indeno [1,2,3-cd] pyrene | 0.02 ug/g dry | - | - | <0.02 | 0.04 |
| 1-Methylnaphthalene | 0.02 ug/g dry | - | - | <0.02 | <0.02 |
| 2-Methylnaphthalene | 0.02 ug/g dry | - | - | <0.02 | <0.02 |
| Methylnaphthalene (1&2) | 0.04 ug/g dry | - | - | <0.04 | <0.04 |
| Naphthalene | 0.01 ug/g dry | - | - | <0.01 | 0.01 |
| Phenanthrene | 0.02 ug/g dry | - | - | 0.04 | 0.07 |
| Pyrene | 0.02 ug/g dry | - | - | 0.06 | 0.15 |
| 2-Fluorobiphenyl | Surrogate | - | - | 75.6% | 95.8% |
| Terphenyl-d14 | Surrogate | - | - | 97.2% | 112% |

## *Method Quality Control: Blank*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 7 | ug/g | | | | | | |
| F2 PHCs (C10-C16) | ND | 4 | ug/g | | | | | | |
| F3 PHCs (C16-C34) | ND | 8 | ug/g | | | | | | |
| F4 PHCs (C34-C50) | ND | 6 | ug/g | | | | | | |
| **Metals** | | | | | | | | | |
| Antimony | ND | 1 | ug/g | | | | | | |
| Arsenic | ND | 1 | ug/g | | | | | | |
| Barium | ND | 1 | ug/g | | | | | | |
| Beryllium | ND | 0.5 | ug/g | | | | | | |
| Boron, available | ND | 0.5 | ug/g | | | | | | |
| Boron | ND | 5.0 | ug/g | | | | | | |
| Cadmium | ND | 0.5 | ug/g | | | | | | |
| Chromium (VI) | ND | 0.2 | ug/g | | | | | | |
| Chromium | ND | 5 | ug/g | | | | | | |
| Cobalt | ND | 1 | ug/g | | | | | | |
| Copper | ND | 5 | ug/g | | | | | | |
| Lead | ND | 1 | ug/g | | | | | | |
| Mercury | ND | 0.1 | ug/g | | | | | | |
| Molybdenum | ND | 1 | ug/g | | | | | | |
| Nickel | ND | 5 | ug/g | | | | | | |
| Selenium | ND | 1 | ug/g | | | | | | |
| Silver | ND | 0.3 | ug/g | | | | | | |
| Thallium | ND | 1 | ug/g | | | | | | |
| Uranium | ND | 1 | ug/g | | | | | | |
| Vanadium | ND | 10 | ug/g | | | | | | |
| Zinc | ND | 20 | ug/g | | | | | | |
| **Semi-Volatiles** | | | | | | | | | |
| Acenaphthene | ND | 0.02 | ug/g | | | | | | |
| Acenaphthylene | ND | 0.02 | ug/g | | | | | | |
| Anthracene | ND | 0.02 | ug/g | | | | | | |
| Benzo [a] anthracene | ND | 0.02 | ug/g | | | | | | |
| Benzo [a] pyrene | ND | 0.02 | ug/g | | | | | | |
| Benzo [b] fluoranthene | ND | 0.02 | ug/g | | | | | | |
| Benzo [g,h,i] perylene | ND | 0.02 | ug/g | | | | | | |
| Benzo [k] fluoranthene | ND | 0.02 | ug/g | | | | | | |
| Chrysene | ND | 0.02 | ug/g | | | | | | |
| Dibenzo [a,h] anthracene | ND | 0.02 | ug/g | | | | | | |
| Fluoranthene | ND | 0.02 | ug/g | | | | | | |
| Fluorene | ND | 0.02 | ug/g | | | | | | |
| Indeno [1,2,3-cd] pyrene | ND | 0.02 | ug/g | | | | | | |
| 1-Methylnaphthalene | ND | 0.02 | ug/g | | | | | | |
| 2-Methylnaphthalene | ND | 0.02 | ug/g | | | | | | |
| Methylnaphthalene (1&2) | ND | 0.04 | ug/g | | | | | | |
| Naphthalene | ND | 0.01 | ug/g | | | | | | |
| Phenanthrene | ND | 0.02 | ug/g | | | | | | |
| Pyrene | ND | 0.02 | ug/g | | | | | | |
| *Surrogate: 2-Fluorobiphenyl* | *1.26* | | *ug/g* | | *94.6* | *50-140* | | | |
| *Surrogate: Terphenyl-d14* | *1.12* | | *ug/g* | | *83.9* | *50-140* | | | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.02 | ug/g | | | | | | |
| Ethylbenzene | ND | 0.05 | ug/g | | | | | | |
| Toluene | ND | 0.05 | ug/g | | | | | | |
| m,p-Xylenes | ND | 0.05 | ug/g | | | | | | |
| o-Xylene | ND | 0.05 | ug/g | | | | | | |
| Xylenes, total | ND | 0.05 | ug/g | | | | | | |
| *Surrogate: Toluene-d8* | *7.87* | | *ug/g* | | *98.4* | *50-140* | | | |

## *Method Quality Control: Duplicate*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 7 | ug/g dry | ND | | | | 40 | |
| F2 PHCs (C10-C16) | 54 | 4 | ug/g dry | 77 | | | 34.2 | 30 | QR-04 |
| F3 PHCs (C16-C34) | 58 | 8 | ug/g dry | 75 | | | 27.0 | 30 | |
| F4 PHCs (C34-C50) | ND | 6 | ug/g dry | ND | | | | 30 | |
| **Metals** | | | | | | | | | |
| Antimony | ND | 1 | ug/g dry | ND | | | 0.0 | 30 | |
| Arsenic | 5.4 | 1 | ug/g dry | 5.5 | | | 1.4 | 30 | |
| Barium | 69.7 | 1 | ug/g dry | 72.8 | | | 4.3 | 30 | |
| Beryllium | ND | 0.5 | ug/g dry | ND | | | | 30 | |
| Boron, available | 0.58 | 0.5 | ug/g dry | 0.63 | | | 6.8 | 35 | |
| Boron | 15.7 | 5.0 | ug/g dry | 13.8 | | | 13.4 | 30 | |
| Cadmium | ND | 0.5 | ug/g dry | ND | | | 0.0 | 30 | |
| Chromium (VI) | ND | 0.2 | ug/g dry | ND | | | | 35 | |
| Chromium | 20.2 | 5 | ug/g dry | 21.2 | | | 5.2 | 30 | |
| Cobalt | 8.6 | 1 | ug/g dry | 9.2 | | | 7.1 | 30 | |
| Copper | 16.7 | 5 | ug/g dry | 17.7 | | | 6.0 | 30 | |
| Lead | 12.1 | 1 | ug/g dry | 12.7 | | | 5.0 | 30 | |
| Mercury | ND | 0.1 | ug/g dry | ND | | | 0.0 | 30 | |
| Molybdenum | 2.1 | 1 | ug/g dry | 2.0 | | | 5.5 | 30 | |
| Nickel | 23.5 | 5 | ug/g dry | 25.4 | | | 7.7 | 30 | |
| Selenium | ND | 1 | ug/g dry | ND | | | 0.0 | 30 | |
| Silver | ND | 0.3 | ug/g dry | ND | | | 0.0 | 30 | |
| Thallium | ND | 1 | ug/g dry | ND | | | 0.0 | 30 | |
| Uranium | 1.1 | 1 | ug/g dry | 1.2 | | | 3.9 | 30 | |
| Vanadium | 30.3 | 10 | ug/g dry | 31.6 | | | 4.3 | 30 | |
| Zinc | 44.5 | 20 | ug/g dry | 46.2 | | | 3.8 | 30 | |
| **Physical Characteristics** | | | | | | | | | |
| % Solids | 82.7 | 0.1 | % by Wt. | 79.2 | | | 4.3 | 25 | |
| **Semi-Volatiles** | | | | | | | | | |
| Acenaphthene | ND | 0.02 | ug/g dry | ND | | | | 40 | |
| Acenaphthylene | ND | 0.02 | ug/g dry | ND | | | | 40 | |
| Anthracene | ND | 0.02 | ug/g dry | ND | | | | 40 | |
| Benzo [a] anthracene | ND | 0.02 | ug/g dry | ND | | | 0.0 | 40 | |
| Benzo [a] pyrene | ND | 0.02 | ug/g dry | ND | | | | 40 | |
| Benzo [b] fluoranthene | ND | 0.02 | ug/g dry | ND | | | 0.0 | 40 | |
| Benzo [g,h,i] perylene | ND | 0.02 | ug/g dry | ND | | | 0.0 | 40 | |
| Benzo [k] fluoranthene | ND | 0.02 | ug/g dry | ND | | | | 40 | |
| Chrysene | ND | 0.02 | ug/g dry | ND | | | 0.0 | 40 | |
| Dibenzo [a,h] anthracene | ND | 0.02 | ug/g dry | ND | | | | 40 | |
| Fluoranthene | ND | 0.02 | ug/g dry | ND | | | 0.0 | 40 | |
| Fluorene | ND | 0.02 | ug/g dry | ND | | | | 40 | |
| Indeno [1,2,3-cd] pyrene | ND | 0.02 | ug/g dry | ND | | | | 40 | |
| 1-Methylnaphthalene | ND | 0.02 | ug/g dry | ND | | | | 40 | |
| 2-Methylnaphthalene | ND | 0.02 | ug/g dry | ND | | | | 40 | |
| Naphthalene | ND | 0.01 | ug/g dry | ND | | | | 40 | |
| Phenanthrene | ND | 0.02 | ug/g dry | ND | | | | 40 | |
| Pyrene | ND | 0.02 | ug/g dry | ND | | | 0.0 | 40 | |
| *Surrogate: 2-Fluorobiphenyl* | *1.35* | | *ug/g dry* | | *79.0* | *50-140* | | | |
| *Surrogate: Terphenyl-d14* | *1.11* | | *ug/g dry* | | *65.0* | *50-140* | | | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.02 | ug/g dry | ND | | | | 50 | |
| Ethylbenzene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| Toluene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| m,p-Xylenes | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| o-Xylene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| *Surrogate: Toluene-d8* | *8.48* | | *ug/g dry* | | *94.0* | *50-140* | | | |

## *Method Quality Control: Spike*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | 181 | 7 | ug/g | | 90.5 | 80-120 | | | |
| F2 PHCs (C10-C16) | 197 | 4 | ug/g | 77 | 113 | 60-140 | | | |
| F3 PHCs (C16-C34) | 345 | 8 | ug/g | 75 | 123 | 60-140 | | | |
| F4 PHCs (C34-C50) | 187 | 6 | ug/g | ND | 128 | 60-140 | | | |
| **Metals** | | | | | | | | | |
| Antimony | 39.1 | | ug/L | ND | 78.2 | 70-130 | | | |
| Arsenic | 41.2 | | ug/L | 2.2 | 78.0 | 70-130 | | | |
| Barium | 75.8 | | ug/L | 29.1 | 93.3 | 70-130 | | | |
| Beryllium | 47.1 | | ug/L | ND | 94.2 | 70-130 | | | |
| Boron, available | 3.49 | 0.5 | ug/g | 0.63 | 57.3 | 70-122 | | | QM-07 |
| Boron | 50.1 | | ug/L | 5.5 | 89.2 | 70-130 | | | |
| Cadmium | 38.0 | | ug/L | ND | 76.0 | 70-130 | | | |
| Chromium (VI) | 4.7 | 0.2 | ug/g | | 93.5 | 70-130 | | | |
| Chromium | 53.4 | | ug/L | 8.5 | 89.8 | 70-130 | | | |
| Cobalt | 48.8 | | ug/L | 3.7 | 90.2 | 70-130 | | | |
| Copper | 52.2 | | ug/L | 7.1 | 90.2 | 70-130 | | | |
| Lead | 54.8 | | ug/L | 5.1 | 99.5 | 70-130 | | | |
| Mercury | 1.43 | 0.1 | ug/g | ND | 95.1 | 70-130 | | | |
| Molybdenum | 39.1 | | ug/L | ND | 76.6 | 70-130 | | | |
| Nickel | 54.3 | | ug/L | 10.1 | 88.2 | 70-130 | | | |
| Selenium | 37.6 | | ug/L | ND | 75.2 | 70-130 | | | |
| Silver | 39.2 | | ug/L | ND | 78.5 | 70-130 | | | |
| Thallium | 50.0 | | ug/L | ND | 99.6 | 70-130 | | | |
| Uranium | 51.1 | | ug/L | ND | 101 | 70-130 | | | |
| Vanadium | 57.7 | | ug/L | 12.6 | 90.2 | 70-130 | | | |
| Zinc | 54.9 | | ug/L | ND | 72.9 | 70-130 | | | |
| **Semi-Volatiles** | | | | | | | | | |
| Acenaphthene | 0.207 | 0.02 | ug/g | ND | 97.2 | 50-140 | | | |
| Acenaphthylene | 0.159 | 0.02 | ug/g | ND | 74.6 | 50-140 | | | |
| Anthracene | 0.134 | 0.02 | ug/g | ND | 62.8 | 50-140 | | | |
| Benzo [a] anthracene | 0.132 | 0.02 | ug/g | ND | 61.7 | 50-140 | | | |
| Benzo [a] pyrene | 0.126 | 0.02 | ug/g | ND | 58.9 | 50-140 | | | |
| Benzo [b] fluoranthene | 0.150 | 0.02 | ug/g | ND | 70.4 | 50-140 | | | |
| Benzo [g,h,i] perylene | 0.124 | 0.02 | ug/g | ND | 58.1 | 50-140 | | | |
| Benzo [k] fluoranthene | 0.126 | 0.02 | ug/g | ND | 59.0 | 50-140 | | | |
| Chrysene | 0.172 | 0.02 | ug/g | ND | 80.7 | 50-140 | | | |
| Dibenzo [a,h] anthracene | 0.120 | 0.02 | ug/g | ND | 56.4 | 50-140 | | | |
| Fluoranthene | 0.290 | 0.02 | ug/g | ND | 136 | 50-140 | | | |
| Fluorene | 0.173 | 0.02 | ug/g | ND | 81.3 | 50-140 | | | |
| Indeno [1,2,3-cd] pyrene | 0.128 | 0.02 | ug/g | ND | 60.1 | 50-140 | | | |
| 1-Methylnaphthalene | 0.154 | 0.02 | ug/g | ND | 72.3 | 50-140 | | | |
| 2-Methylnaphthalene | 0.168 | 0.02 | ug/g | ND | 78.6 | 50-140 | | | |
| Naphthalene | 0.173 | 0.01 | ug/g | ND | 81.0 | 50-140 | | | |
| Phenanthrene | 0.155 | 0.02 | ug/g | ND | 72.7 | 50-140 | | | |
| Pyrene | 0.290 | 0.02 | ug/g | ND | 136 | 50-140 | | | |
| *Surrogate: 2-Fluorobiphenyl* | *1.29* | | *ug/g* | | *75.7* | *50-140* | | | |
| **Volatiles** | | | | | | | | | |
| Benzene | 4.97 | 0.02 | ug/g | | 124 | 60-130 | | | |
| Ethylbenzene | 3.56 | 0.05 | ug/g | | 89.1 | 60-130 | | | |
| Toluene | 3.28 | 0.05 | ug/g | | 82.0 | 60-130 | | | |

## *Method Quality Control: Spike*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| m,p-Xylenes | 6.87 | 0.05 | ug/g | | 85.8 | 60-130 | | | |
| o-Xylene | 3.44 | 0.05 | ug/g | | 86.0 | 60-130 | | | |

## Qualifier Notes:

***QC Qualifiers :***

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

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

## Sample Data Revisions

None

## Work Order Revisions / Comments:

None

## Other Report Notes:

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

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

*CCME PHC additional information:*

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

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**Paracel ID: 1815566**

**Chain of Custody**
(Lab Use Only)
№ 116640

Page 1 of 1

| | | | |
|---|---|---|---|
| Client Name: Paterson | Project Reference: PE4280 | **Turnaround Time:** | |
| Contact Name: Mike Bernardon | Quote # | ☐ 1 Day | ☐ 3 Day |
| Address: 154 Colonnade Rd | PO # 23785 | ☐ 2 Day | ~~☐~~ Regular |
| Telephone: 613-226-7381 | Email Address: mbernardon@patersongroup.ca | Date Required: | |

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

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

**Required Analyses**

| | Paracel Order Number: / 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 | BH1-16-SS5 | S | | 2 | APR 3/18 | | X | | | | | | | ↓ | 120mL+Vial | | | | | ~~✓~~ |
| 2 | BH2-16-SS15 | S | | 2 | APR4/18 | | X | | | | | | | ↓ | | | | | | ~~✓~~ |
| 3 | BH3-16-6 | S | | 1 | APR4/18 | | | | X | X | X | X | | ↓ | 250mL | | | | | ✓ |
| 4 | BH4-16-6 | S | | 1 | APR5/18 | | | | X | X | X | X | | ↓ | | | | | | ✓ |
| 5 | ~~BH4-16-SS5~~ | ~~S~~ | | ~~2~~ | ~~APR5/18~~ | | ~~X~~ | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | |

Comments:

Method of Delivery: Paracel

| | | | |
|---|---|---|---|
| Relinquished By (Sign): | Received by Driver/Depot: A Scause | Received at Lab: | Verified By: |
| Relinquished By (Print): Mike B. | Date/Time: 13/04/18 3:50 PM | Date/Time: APR 13,18 4:43 | Date/Time: 04/13/18 4:55 pm |
| Date/Time: APR 13/18 | Temperature: °C | Temperature: 18.5 °C | pH Verified [ ] By: |

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www.paracellabs.com

# Certificate of Analysis

**Paterson Group Consulting Engineers**

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

Client PO: 23814
Project: PE4280
Custody: 116681

Report Date: 2-May-2018
Order Date: 26-Apr-2018

**Order #: 1817518**

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

| Paracel ID | Client ID |
|---|---|
| 1817518-01 | BH1-GW1 |
| 1817518-02 | BH2-GW1 |
| 1817518-03 | BH3-GW1 |
| 1817518-04 | Dup1 |

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
**Client: Paterson Group Consulting Engineers**
**Client PO: 23814**

Report Date: 02-May-2018
Order Date: 26-Apr-2018
**Project Description: PE4280**

## Analysis Summary Table

| Analysis | Method Reference/Description | Extraction Date | Analysis Date |
|---|---|---|---|
| BTEX by P&T GC-MS | EPA 624 - P&T GC-MS | 30-Apr-18 | 30-Apr-18 |
| PHC F1 | CWS Tier 1 - P&T GC-FID | 27-Apr-18 | 30-Apr-18 |
| PHCs F2 to F4 | CWS Tier 1 - GC-FID, extraction | 30-Apr-18 | 30-Apr-18 |

Certificate of Analysis

**Client: Paterson Group Consulting Engineers**

**Client PO: 23814**

Report Date: 02-May-2018

Order Date: 26-Apr-2018

**Project Description: PE4280**

| | Client ID: | BH1-GW1 | BH2-GW1 | BH3-GW1 | Dup1 |
|---|---|---|---|---|---|
| | Sample Date: | 04/23/2018 09:00 | 04/23/2018 09:00 | 04/23/2018 09:00 | 04/23/2018 09:00 |
| | Sample ID: | 1817518-01 | 1817518-02 | 1817518-03 | 1817518-04 |
| | MDL/Units | Water | Water | Water | Water |
| **Volatiles** | | | | | |
| Benzene | 0.5 ug/L | 0.9 | <0.5 | 1.0 | <0.5 |
| Ethylbenzene | 0.5 ug/L | <0.5 | <0.5 | <0.5 | <0.5 |
| Toluene | 0.5 ug/L | 4.5 | <0.5 | 3.3 | <0.5 |
| m,p-Xylenes | 0.5 ug/L | 4.7 | <0.5 | 1.9 | <0.5 |
| o-Xylene | 0.5 ug/L | 1.9 | <0.5 | 0.6 | <0.5 |
| Xylenes, total | 0.5 ug/L | 6.5 | <0.5 | 2.5 | <0.5 |
| Toluene-d8 | Surrogate | 112% | 112% | 112% | 112% |
| **Hydrocarbons** | | | | | |
| F1 PHCs (C6-C10) | 25 ug/L | <25 | <25 | <25 | - |
| F2 PHCs (C10-C16) | 100 ug/L | <100 | <100 | <100 | - |
| F3 PHCs (C16-C34) | 100 ug/L | <100 | <100 | 347 | - |
| F4 PHCs (C34-C50) | 100 ug/L | <100 | <100 | 122 | - |

Certificate of Analysis
**Client: Paterson Group Consulting Engineers**
**Client PO: 23814**

Report Date: 02-May-2018
Order Date: 26-Apr-2018
**Project Description: PE4280**

## *Method Quality Control: Blank*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 25 | ug/L | | | | | | |
| F2 PHCs (C10-C16) | ND | 100 | ug/L | | | | | | |
| F3 PHCs (C16-C34) | ND | 100 | ug/L | | | | | | |
| F4 PHCs (C34-C50) | ND | 100 | ug/L | | | | | | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.5 | ug/L | | | | | | |
| Ethylbenzene | ND | 0.5 | ug/L | | | | | | |
| Toluene | ND | 0.5 | ug/L | | | | | | |
| m,p-Xylenes | ND | 0.5 | ug/L | | | | | | |
| o-Xylene | ND | 0.5 | ug/L | | | | | | |
| Xylenes, total | ND | 0.5 | ug/L | | | | | | |
| *Surrogate: Toluene-d8* | *88.7* | | *ug/L* | | *111* | *50-140* | | | |

Certificate of Analysis
**Client: Paterson Group Consulting Engineers**
**Client PO: 23814**

Report Date: 02-May-2018
Order Date: 26-Apr-2018
**Project Description: PE4280**

## *Method Quality Control: Duplicate*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 25 | ug/L | ND | | | | 30 | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.5 | ug/L | ND | | | | 30 | |
| Ethylbenzene | ND | 0.5 | ug/L | ND | | | | 30 | |
| Toluene | ND | 0.5 | ug/L | ND | | | | 30 | |
| m,p-Xylenes | ND | 0.5 | ug/L | ND | | | | 30 | |
| o-Xylene | ND | 0.5 | ug/L | ND | | | | 30 | |
| *Surrogate: Toluene-d8* | *88.0* | | *ug/L* | | *110* | *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) | 1960 | 25 | ug/L | | 97.8 | 68-117 | | | |
| F2 PHCs (C10-C16) | 1840 | 100 | ug/L | | 102 | 60-140 | | | |
| F3 PHCs (C16-C34) | 3420 | 100 | ug/L | | 92.0 | 60-140 | | | |
| F4 PHCs (C34-C50) | 2540 | 100 | ug/L | | 102 | 60-140 | | | |
| **Volatiles** | | | | | | | | | |
| Benzene | 39.6 | 0.5 | ug/L | | 98.9 | 60-130 | | | |
| Ethylbenzene | 39.8 | 0.5 | ug/L | | 99.6 | 60-130 | | | |
| Toluene | 39.2 | 0.5 | ug/L | | 98.0 | 60-130 | | | |
| m,p-Xylenes | 84.4 | 0.5 | ug/L | | 105 | 60-130 | | | |
| o-Xylene | 42.5 | 0.5 | ug/L | | 106 | 60-130 | | | |
| *Surrogate: Toluene-d8* | *77.7* | | *ug/L* | | *97.1* | *50-140* | | | |

## Qualifier Notes:

***Login Qualifiers :***

Container(s) - Bottle and COC sample ID don't match - VOC vial reads BH-1-18 GW1, DUP vial reads BH-3-18 GW1.

*Applies to samples: BH1-GW1*

## Sample Data Revisions

None

## Work Order Revisions / Comments:

None

## Other Report Notes:

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

*CCME PHC additional information:*

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

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**Paracel ID: 1817518**

**Chain of Custody**
(Lab Use Only)
**№ 116681**

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| | | | |
|---|---|---|---|
| Client Name: Paterson Group | Project Reference: PE4280 | **Turnaround Time:** | |
| Contact Name: Mike Beaudoin | Quote # | ☐ 1 Day | ☐ 3 Day |
| Address: 154 Colonnade Rd S. | PO # 23614 | ☐ 2 Day | ☒ Regular |
| Telephone: 613-226-7381 | Email Address: mbeaudoin@patersongroup.ca | Date Required: | |

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

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

**Paracel Order Number:** 1817518

| | 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) | BTEX | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | BH1-GW1 ✓ | GW | | 3 | APR 23/18 | | X | | | | | | | | | | | | | | ✓ |
| 2 | BH2-GW1 ✓ | GW | | 3 | ↓ | | X | | | | | | | | | | | | | | ✓ |
| 3 | BH3-GW1 ✓ | GW | | 3 | ↓ | | X | | | | | | | | | | | | | | ✓ |
| 4 | Dup1 | GW | | 2 | ↓ | | | | | | | | | X | | | | | | | ✓ |
| 5 | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | |

Comments: No. 1 - Sample ID on 1 VOC read = BH-3-18 6'W1. Use for exposure
1 VOC read = BH-1-18 6'W1

Method of Delivery: Paracel

| | | | |
|---|---|---|---|
| Relinquished By (Sign): | Received by Driver/Depot: A. Krause | Received at Lab: Summerland Dawn | Verified By: |
| Relinquished By (Print): Mike B | Date/Time: 26/04/18 3:50 | Date/Time: APR 26, 2018 05:00 | Date/Time: 04/26/18 5:23p |
| Date/Time: APR 26/18 | Temperature: °C | Temperature: 19.4 °C | pH Verified [ ] By: |