Phase Two Environmental Site Assessment

229-231, 241-247 Beechwood Avenue, Ottawa, ON

Type of Document:
Final

Client:
Takyan Developments
100 Argyle Avenue, Suite 200
Ottawa, Ontario K2P 1B6

Project Number:
OTT-00238207-A0

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Date Submitted:
August 21, 2017

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Date Submitted:
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Legal Notification

This report was prepared by **exp** Services Inc. for the account of Takyan Developments**.**

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Executive Summary

Exp Services Inc. (**exp**) was retained by Takyan Developments to conduct a Phase Two Environmental Site Assessment (ESA) of the property located at 229-231 Beechwood Avenue (Parcel A), and 241-247 Beechwood Avenue (Parcel B) in Ottawa, Ontario hereinafter referred to as the 'Site'. The objective of the Phase Two ESA was to address areas of potential environmental concern (APEC) identified in a Phase I ESA conducted at the Site by **exp** in May 2017. It is understood that this report is required as part of the permitting process with the City of Ottawa. We understand that a Record of Site Condition (RSC) is not required.

The findings of the Phase I ESA were presented in a report entitled *Phase I Environmental Site Assessment, 229-231, 241-247 Beechwood Avenue, Ottawa, Ontario,* **exp** Services Inc., dated May 11, 2017. The Phase I ESA identified the following APECs:

Table EX.1: Areas of Potential Environmental Concern

Area of Potential Environmental Concern (APEC)	Potentially Contaminating Activity (PCA)	Location of PCA (On-Site or Off-Site)	Contaminants of Concern	Media Potentially Impacted (Groundwater, Soil and/or Sediment)
1. Furnace oil spill at 241 Beechwood Ave. (1991)	Not applicable	On-site (Parcel B)	petroleum hydrocarbons (PHC)	Soil and groundwater:
2. Former Off-Site Retail Fuel Outlet (222 Beechwood Ave.) present between the 1950s and 2000s. Also operated as an automotive garage.	#27 – Garages and Maintenance #28 – Gasoline and Associated Products Storage in Fixed Tanks	25 m east of Parcels A & B	PHC, and benzene, toluene, ethylbenzene, xylene (BTEX)	Soil and groundwater:
3. Former Off-Site Retail Fuel Outlet (260 Beechwood Ave.) operated between the 1950s and 1970s	#28 – Gasoline and Associated Products Storage in Fixed Tanks	25 m northeast of Parcel B	PHC, and BTEX	Soil and groundwater:
4. Former Off-Site Retail Fuel Outlet (266 Beechwood Ave.) operated between the 1950s and 1970s	#28 – Gasoline and Associated Products Storage in Fixed Tanks	70 m northeast of Parcel B	PHC and BTEX	Soil and groundwater:
5. Former Off-Site Industrial Garage & Repair Shop (25 Carsdale Ave. operated between 1960s and 2000s.	#27 – Garages and Maintenance	Adjacent west of Parcels A & B	PHC and BTEX	Soil and groundwater:

Area of Potential Environmental Concern (APEC)	Potentially Contaminating Activity (PCA)	Location of PCA (On-Site or Off-Site)	Contaminants of Concern	Media Potentially Impacted (Groundwater, Soil and/or Sediment)
6. Furnace oil spill at 249 Beechwood Ave. (2002)	Not applicable	Adjacent north of Parcel B	PHC	Soil and groundwater:

Based on the Phase One ESA findings, a Phase Two ESA was recommended for the Site.

The Phase Two ESA consisted advancing a total of six (6) boreholes (MW17-1, BH17-2, MW17-3, MW17-4, MW17-5, and BH17-6) at the site. Soil and groundwater samples were collected and submitted for laboratory analysis of metals, BTEX and/or volatile organic compounds (VOC).

For assessment purposes, **exp** selected the Site Condition Standards (SCS), provided in Table 7 of *Soil, Groundwater and Sediment Standards for use Under Part XV.1 of the Environmental Protection Act*, Ministry of the Environment (MOECC), 2011 for residential use at a site with coarse textured soil and shallow soil conditions in accordance with Ontario Regulation 153/04 (as amended).

Based on the Phase Two ESA results, the following summary is provided:

- Below the topsoil in Borehole Nos. 2, 5 and 6 and below asphaltic concrete in the remaining boreholes, fill was encountered to 0.8 m to 2.4 m depth. The fill consists of sand and gravel to silty sand containing crusher run limestone, debris of bricks, silty clay layers/pockets, topsoil, organic matter, roots, etc. The topsoil in Borehole No. 3 is underlain by brown fine sand with some silt, which extends to 1.5 m depth. The sand in Borehole No. 3 is underlain by till which extended to refusal depth of 3 m. The sand till contains some gravel, some silt and trace clay and occasional cobbles and boulders. No odours or visual indications of impact were observed in the native material. Auger/spoon refusals were encountered at 0.8 m to 3 m depth below ground surface. These refusals encountered in Borehole Nos. 2 to 4 are likely have been met on shale bedrock, however, the refusals met in Borehole Nos. 5 and 6, may be on cobbles/boulders or bedrock.
- On July 7, 2017. Groundwater was encountered at a depth of 0.99 m bgs in MW17-5 to 2.82 m bgs in MW17-1. No petroleum sheens were observed in the monitoring wells during the sampling event. Based on the groundwater level measurements, the groundwater flow in the area of the boreholes is to the southwest.
- The concentrations of PHC and VOC measured in the four (4) analysed soil samples and blind duplicate were either less than the laboratory detection limit and or the MOECC 2011 Table 7 SCS, with the exception of PHC F3 in the sample collected from MW17-1 at a depth of 0.7 m to 1.35 m. The PHC F3 concentration was 324 ug/g and the MOECC Table 7 SCS is 300 ug/g. Three additional shallow boreholes were drilled within 5 m of MW17-1 to delineate the PHC impact to soil. The three submitted soil samples had concentrations of PHC that were less than the MOECC Table 7 SCS and therefore, the area of PHC impacted soil is limited to a small area around MW17-1.
- The concentration of PHC F4 in the same sample from MW17-1 also exceeded the MOECC Table 1 background concentration. If excess soil is generated from this small area around MW17-1 and requires off-site disposal, it will have to be disposed of at a licensed landfill.

- The analyzed parameters in the groundwater samples were either less the laboratory detection limit or less than the 2011 MOECC Table 7 SCS.

Based on the Phase Two ESA findings, no further work is recommended at this time. If the wells are no longer needed, they should be decommissioned in accordance with Ontario Regulation 903.

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1 Introduction

Exp Services Inc. (**exp**) was retained by Takyan Developments to conduct a Phase Two Environmental Site Assessment (ESA) of the property located at 229-231 Beechwood Avenue (Parcel A), and 241-247 Beechwood Avenue (Parcel B) in Ottawa, Ontario, hereinafter referred to as the 'Site'. The objective of the Phase Two ESA was to address areas of potential environmental concern (APEC) identified in a Phase One ESA conducted at the Site by **exp** in May 2017. It is understood that this report is required as part of the permitting process with the City of Ottawa. We understand that a Record of Site Condition (RSC) is not required.

This report has been prepared in accordance with the Phase Two ESA standard as defined by Ontario Regulation 153/04 (as amended), and in accordance with generally accepted professional practices. Subject to this standard of care, **exp** makes no express or implied warranties regarding its services and no third party beneficiaries are intended. Limitation of liability, scope of report and third party reliance are outlined in Section 9 of this report.

1.1 Site Description

The Site consists of two (2) parcels: the two (2) properties located at 229/231 Beechwood Avenue (Parcel A) and the three (3) properties located at 241/245/247 Beechwood Avenue (Parcel B), Ottawa. Ontario. Both parcels of the Site are located on the western side of Beechwood Avenue between Green Avenue and Corona Avenue. Parcel A is located 15 metres (m) to the south of Parcel B. Parcel A is located to the north and Parcel B is located to the south of a City-owned laneway (previously Carlsdale Avenue), which intersects the two Parcels. The site plan is presented as Figure. 2 in Appendix B. The following describes each of Site Parcels:

Parcel A

- 229 Beechwood Avenue: City of Ottawa PIN's are 042260120 and 042260121 and legally described as Plan M30 Lot 10 to 11 PT Lane and RP 4R5284; Part 2, City of Ottawa; and,
- 231 Beechwood Avenue: City of Ottawa PIN's are 042260122 and 042260123 and legally described as Plan M30 Lot 12 PT Lane and RP 4R5284; Part 1, City of Ottawa.

At the time of the investigation, Parcel A was developed as two (2) 2-storey residential buildings with three (3) storage sheds (two sheds present in the western quadrant and one shed present in the northern quadrant of Parcel A), mature trees, and two (2) asphalt driveways/parking areas. One parking area serving 229 Beechwood is located to the south of the dwelling and there is a small parking area to the north serving 231 Beechwood Ave., which connects to the laneway that intersects the two Parcels. Parcel A is square in shape, covering an area of 0.105 hectares (0.26 acres).

Parcel B

- 241 Beechwood Avenue: City of Ottawa PIN's are 042260136 and 042260166 and legally described as Plan M30 Lot 24 RP4R1168; Part 3, City of Ottawa;
- 245 Beechwood Avenue: City of Ottawa PIN's are 042260137 and 042260167 and legally described as Plan M30 Lot 25 RP 4R1168; Part 4, City of Ottawa; and,
- 247 Beechwood Avenue: City of Ottawa PIN's are 042260138 and 042260168 and legally described as Plan M30 Lot 26 RP 4R1168; Part 5, City of Ottawa.

Parcel B is currently developed as three (3) 2-storey residential buildings with three (3) storage sheds in the western quadrant, mature trees and an asphalt driveway/parking area that is shared and located

between the dwellings at 245 and 247 Beechwood Ave. There is a small asphalt parking area to the south serving 241 Beechwood Ave., which connects to the City-owned laneway that intersects the two Parcels. Parcel B is square in shape, covering an area of 0.109 hectares (0.27 acres).

Both Parcels are both municipally serviced parts of the City of Ottawa and are both neighboured by residential to the north, south, and west and commercial followed by residential to the east.

There is no waterbody on or within 100 m of either Parcel. The closest water bodies are located 750 m to the southwest of the Parcel A (Rideau River) and 1.6 km east of Parcel A (Ottawa River). The local topography was observed to be sloping downwards towards the east (Beechwood Avenue) with regional topography sloping toward the southeast.

Regional groundwater flow direction is inferred to be in the southwestern direction towards the Rideau River (approximately 750 m from the Site). The approximate Universal Transverse Mercator (UTM) coordinates for Parcel A centroid is NAD83, Zone 18, 447536 m E, 5032436 m N and 447544 m E, 5032484 m N for Parcel B. The UTM coordinates were based on an estimate derived using Google Earth™. The accuracy of the centroid is estimated to range from 5 to 50 m.

1.2 Property Ownership

The owner contact information is provided below:

Owner Contact: Mr. Domenic Saikaley
Takyan Developments
100 Argyle Avenue, Suite 300
Ottawa, Ontario K2P 1B6

1.3 Current and Proposed Future Uses

At the time of the Phase Two ESA investigation, the Site consisted of several residences. The future land use will be residential. A site plan is included in Appendix B.

1.4 Applicable Site Condition Standards

Analytical results obtained for Site soil and groundwater samples were assessed against Site Condition Standards (SCS) as established under subsection 169.4(1) of the Environmental Protection Act, and presented in the document MOE *Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act*, ("SGWS" Standards), (MOE, 2011a). Tabulated background SCS (Table 1) applicable to environmentally sensitive Sites and effects based generic SCS (Tables 2 to 9) applicable to non-environmentally sensitive Sites are provided in MOE (2011a). The effects based SCS (Tables 2 to 9) are protective of human health and the environment for different groundwater conditions (potable and non-potable), land use scenarios (residential, parkland, institutional, commercial, industrial, community and agricultural/other), soil texture (coarse or medium/fine) and restoration depth (full or stratified).

Tables 1 to 9 of MOE (2011a) are summarized as follows:

- Table 1 – applicable to sites where background concentrations must be met (full depth), such as sensitive sites where site-specific criteria have not been derived;
- Table 2 – applicable to sites with potable groundwater and full depth restoration;
- Table 3 – applicable to sites with non-potable groundwater and full depth restoration;
- Table 4 – applicable to sites with potable groundwater and stratified restoration;

- Table 5 – applicable to sites with non-potable groundwater and stratified restoration;
- Table 6 – applicable to sites with potable groundwater and shallow soils;
- Table 7 – applicable to sites with non-potable groundwater and shallow soils;
- Table 8 – applicable to sites with potable groundwater and that are within 30 m of a water body; and,
- Table 9 – applicable to sites with non-potable groundwater and that are within 30 m of a water body.

Application of the generic or background SCS to a specific site is based on a consideration of site conditions related to soil pH (i.e. surface and subsurface soil), thickness and extent of overburden material, (i.e. shallow soil conditions), and proximity to an area of environmental sensitivity or of natural significance. For some chemical constituents, consideration is also given to soil textural classification with SCS having been derived for both coarse and medium-fine textured soil conditions.

For assessment purposes, **exp** selected the MOE (2011) Table 7: Full Depth Generic Site Condition Standards in a Non-Potable Ground Water Condition for Industrial/Commercial/Community Property Use and coarse textured soil. The selection of this category was based on the following factors:

- The predominant soil type on the Site was considered to be coarse textured (refer to the results of the Grain Size Analysis as provided in the Certificates of Analysis presented in Appendix E); and,
- There was no intention to carry out a stratified restoration at the Site.
- Less than two-thirds of the Site has an overburden thickness greater than 2 m.
- The Site is not located within 30 m of a surface water body or an area of natural significance.
- The soil at the Site has a pH value between 5 and 9 for surficial soils; and, between 5 and 11 for subsurface soils.
- The property is not within an area of natural significance; does not include, nor is it adjacent to an area of natural significance, nor is it part of such an area; and, it does not include land that is within 30 m of an area of natural significance, nor is it part of such an area.
- The Site is fully serviced by the City of Ottawa water distribution system and, to the best of **exp**'s knowledge; all properties within 250 m of the Site are also serviced by the municipal water supply (i.e. there are no potable water supply wells located within the Phase One Study Area).
- The Site was residential and will be residential in the future.

2 Background Information

2.1 Past Investigations

The findings of the Phase I ESA were presented in a report entitled *Phase I Environmental Site Assessment, 229-231, 241-247 Beechwood Avenue, Ottawa, Ontario,* **exp** Services Inc., dated May 11, 2017. The Phase I ESA identified the following APECs:

Table 2.1: Areas of Potential Environmental Concern

Area of Potential Environmental Concern (APEC)	Potentially Contaminating Activity (PCA)	Location of PCA (On-Site or Off-Site)	Contaminants of Concern	Media Potentially Impacted (Groundwater, Soil and/or Sediment)
1. Furnace oil spill at 241 Beechwood Ave. (1991)	Not applicable	On-site (Parcel B)	petroleum hydrocarbons (PHC)	Soil and groundwater:
2. Former Off-Site Retail Fuel Outlet (222 Beechwood Ave.) present between the 1950s and 2000s. Also operated as an automotive garage.	#27 – Garages and Maintenance #28 – Gasoline and Associated Products Storage in Fixed Tanks	25 m east of Parcels A & B	PHC, and benzene, toluene, ethylbenzene, xylene (BTEX)	Soil and groundwater:
3. Former Off-Site Retail Fuel Outlet (260 Beechwood Ave.) operated between the 1950s and 1970s	#28 – Gasoline and Associated Products Storage in Fixed Tanks	25 m northeast of Parcel B	PHC, and BTEX	Soil and groundwater:
4. Former Off-Site Retail Fuel Outlet (266 Beechwood Ave.) operated between the 1950s and 1970s	#28 – Gasoline and Associated Products Storage in Fixed Tanks	70 m northeast of Parcel B	PHC and BTEX	Soil and groundwater:
5. Former Off-Site Industrial Garage & Repair Shop (25 Carsdale Ave. operated between 1960s and 2000s.	#27 – Garages and Maintenance	Adjacent west of Parcels A & B	PHC and BTEX	Soil and groundwater:
6. Furnace oil spill at 249 Beechwood Ave. (2002)	Not applicable	Adjacent north of Parcel B	PHC	Soil and groundwater:

Based on the Phase One ESA findings, a Phase Two ESA was recommended to assess the soil and groundwater quality at the Site from the above-noted APECs. A site plan with the APECs is provided on Figure 3.

3 Scope of the Investigation

3.1 Overview of Site Investigation

The purpose of the Phase Two ESA was to investigate the soil and groundwater quality at the Site and to obtain soil and groundwater data to further characterize conditions in the surficial fill/shallow overburden soils.

It is understood that the site is to be re-developed into a residential land use. As part of the permitting process, the City of Ottawa requires that a Phase Two ESA be completed in accordance with Ontario Regulation 153/04 (as amended).

3.2 Scope of Work

The scope of work for the Phase Two ESA was as follows:

- Request local utility locating companies (e.g., cable, telephone, gas, hydro) to mark any underground utilities present at the subject site;
- Retain a private utility locating company to mark any underground utilities present in the vicinity of the borehole locations and to clear the individual borehole locations;
- Advance a total of six (6) boreholes and complete four (4) of them as groundwater monitoring wells;
- Collect representative soil samples for chemical analysis of metals, PHC, BTEX and volatile organic compounds (VOC);
- Collect representative groundwater samples for chemical analysis of metals, PHC, VOC;
- Measure groundwater levels in the monitoring wells;
- Complete a survey of the monitoring well locations relative to a geodetic or other permanent benchmark and in reference with the Universal Transverse Mercator (UTM) coordinate system for vertical and horizontal control; and
- Review the analytical data and prepare a report of the findings.

Mark Devlin, B. Sc. conducted assessment work for this project and was supervised by Mark McCalla, P.Geo., QP_{ESA}. Mark McCalla is a qualified person as defined by O. Reg. 153/04.

3.3 Media Investigated

The Phase Two ESA included the investigation of on-Site soil and groundwater. As there are no water bodies on the Site, no surface water or sediment sampling was required.

The potential contaminants of concern (PCOCs) identified in the Phase One ESA were identified as target parameters for this Phase Two ESA. The areas of potential environmental concern (APEC) and PCOCs identified in the Phase One ESA are outlined in Table 3.1.

The rationale for the selection of borehole and monitoring well locations during this investigation are to place them near the west property line towards the off-site PCA and in the north part of the site to assess the former on-site heating oil tank to assess the soil and groundwater conditions. A copy of the Sampling and Analysis Plan prepared for the site is provided in Appendix A.

3.4 Deviations from Sampling and Analysis Plan

The field investigative and sampling program was carried out following the requirements of the Site Sampling and Analysis Plan (SAAP in Appendix A). No significant deviations from the Sampling and Analysis Plan were reported that affected the sampling and data quality objectives for the Site.

3.5 Impediments

No physical impediments were encountered during the field investigation. The entire property was accessible at the time of the investigation.

4 Investigation Method

4.1 General

The Site investigative activities consisted of the drilling of boreholes to facilitate the collection of soil samples for chemical analysis and the installation of monitoring wells for hydrogeological property characterization and the collection of groundwater samples for chemical analysis.

4.2 Borehole Drilling

Prior to the commencement of drilling, the locations of underground public utilities including telephone, natural gas and electrical lines were marked at the Site by locating companies. A private utility locating contractor was also retained to clear the individual borehole locations.

On June 26 and 27, 2017, six (6) boreholes (MW17-1, BH17-2, MW17-3 to MW17-5, and BH17-6) were advanced at the Site by Marathon Drilling, a licensed well contractor, under the full-time supervision of **exp** staff. Marathon used hollow stem augers and a stainless steel split spoon to drill the borehole and collect the soil samples. On August 11, 2017, three shallow hand auger boreholes (BH1A to BH1C) were drilled within 3 m of MW17-1 by **exp** personnel. The locations of the boreholes and monitoring wells are presented on Figure 3 in Appendix B.

The intent of the boreholes on Parcel A is to address the potential for soil/groundwater contamination mainly due to the former off-site RFO located at 222 Beechwood Avenue. and the former off-site industrial garage located at 25 Carsdale Avenue. Secondly, these boreholes will also assess for potential contamination from the previous on-site oil spill at 241 Beechwood Avenue.

The boreholes on Parcel B will address the potential for contamination due to the former off-site RFO's located at 260 and 266 Beechwood Avenue and the former off-site industrial garage located at 25 Carsdale Avenue. The boreholes will also assess for potential contaminant migration from the previous off-site oil spill at 249 Beechwood Avenue.

No petroleum-based greases or solvents were used during drilling activities. **Exp** staff continuously monitored the drilling activities and recorded the depth of soil sample collection and total depth of boring. Field observations are summarized on the borehole logs provided in Appendix C.

4.3 Soil Sampling

The soil sampling during the completion of this Phase Two ESA was undertaken in general accordance with the SAAP presented in Appendix A.

Soil samples for geologic characterization were collected on a continuous basis in the overburden materials using 5 cm diameter, 61 cm long, split spoon samplers advanced into the subsurface using a jack hammer. The soil cores were removed from the samplers upon retrieval by drilling personnel. Geologic details of the recovered cores were logged by **exp** field staff. **Exp** staff continuously monitored the drilling activities to log the stratigraphy observed from the recovered soil cores, to record the depth of soil sample collection, to record total depths of borings, and to record visual or olfactory observations of potential impacts. Field observations are summarized on the borehole logs provided in Appendix C.

Soil samples identified for possible laboratory analysis were collected from the split-spoon sampler and placed directly into pre-cleaned, laboratory-supplied glass sample jars/vials. Samples to be analysed for PHC fraction F1 and VOC were collected using a soil core sampler and placed in to vials containing methanol as a preservative. The jars and vials were sealed with Teflon-lined lids to minimize head-space and reduce the potential for induced volatilization during storage/transport prior to analysis. All soil samples

were placed in clean coolers containing ice prior to and during transportation to the subcontract laboratory, Paracel Laboratories Limited (Paracel) of Ottawa, Ontario. The samples were transported/submitted within 24 hours of collection to Paracel following chain of custody protocols for chemical analysis.

The core barrel/split spoon samplers were decontaminated between sampling intervals by the drilling contractor using a potable water/phosphate-free detergent solution followed by rinses with potable water.

4.4 Field Screening Measurements

The remaining portion of each soil sample was placed in a sealed Ziploc plastic bag and allowed to reach ambient temperature prior to field screening with a combustible vapour meter calibrated to hexane gas prior to use. The field screening measurements were made by inserting the instrument's probe into the plastic bag while manipulating the sample to ensure volatilization of the soil gases. These 'headspace' readings provide a real-time indication of the relative concentration of combustible vapours encountered in the subsurface during drilling and are used to aid in the assessment of the vertical and horizontal extent of potential impacts and the selection of soil samples for analysis. The field screening measurements, in parts per million (ppm) hexane equivalents, are presented with the borehole logs provided in Appendix C.

4.5 Soil Sample Submission

Soil samples were selected for laboratory analysis based on combustible vapour measurements and visual and olfactory evidence of impacts, where observed. One worst case soil sample from each borehole was submitted for laboratory analysis of metals, PHC, BTEX and VOC. One soil sample was also submitted for grain size analysis and pH.

4.6 Groundwater: Monitoring Well Installation

Groundwater monitoring wells were installed in boreholes MW17-1, MW17-3, MW17-4, and MW17-5. The monitoring wells were installed in general accordance with the Ontario Water Resources Act - R.R.O. 1990, Regulation 903 (as-amended) and were installed by Marathon Drilling, a licensed well contractor.

The monitoring wells consisted of a 3.0 m length of 31 mm diameter Schedule 40 PVC screen and an appropriate length of PVC riser pipe. The annular space around the wells was backfilled with sand to an average height of 0.3 m above the top of the screen. A bentonite seal was added from the top of the sand pack to approximately 0.3 m below ground surface. The monitoring wells were completed with flush mount protector at the asphalt surface. Details of the monitoring well installations are shown on the Borehole Logs provided in Appendix C.

The installation details of the installed monitoring wells are summarized in Table 4.1.

Table 4.1: Monitoring Well Installation Details

Monitoring Well/Piezometer	TOC Elevation (m)	Top of Sand Elevation (m)	Top of Screen Elevation (m)	Bottom of Screen Elevation (m)	Bottom of Borehole Elevation (m)	Depth of Borehole (mbgs)
MW17-1	58.59	55.95	55.65	52.60	52.60	6.10
MW17-3	59.37	57.90	57.80	56.50	56.50	3.00
MW17-4	60.41	59.50	59.20	58.20	58.20	2.30

Monitoring Well/Piezometer	TOC Elevation (m)	Top of Sand Elevation (m)	Top of Screen Elevation (m)	Bottom of Screen Elevation (m)	Bottom of Borehole Elevation (m)	Depth of Borehole (mbgs)
MW17-5	60.60	60.70	60.40	58.80	58.80	1.80

Note: Elevations were collected using a level survey and a topographic survey of the property. A geodetic datum was established at the site (iron bar at northeast corner of 247 Beechwood Avenue) with a known elevation of 60.72 m above sea level).
mbgs – metres below ground surface
TOC - top of plastic well casing

When the monitoring wells are no longer required, they must be decommissioned in accordance with the procedure outlined in the Ontario Water Resources Act - R.R.O. 1990, Regulation 903 - Amended to O. Reg. 128/03.

Measures taken to minimize the potential for cross contamination or the introduction of contaminants during well construction included:

- The use of well pipe components (e.g. riser pipe and well screens) with factory machined threaded flush coupling joints;
- Construction of wells without the use of glues or adhesives;
- Removing the protective plastic wraps from well components at the time of borehole insertion to prevent contact with the ground and other surfaces;
- Cleaning of augers between sampling locations; and,
- The use of hollow stem augers to prevent loose and potentially contaminated material in overlying layers from sloughing into the boreholes and coming into contact with groundwater.

4.7 Groundwater: Field Measurement of Water Quality Parameters

The static water level was measured, the depth of each well was recorded and the well sampled. **Exp** used an interface probe to measure the possible presence of light non-aqueous phase liquid (LNAPL) in each monitoring well. During development of the wells, pH, conductivity, temperature, and salinity were measured at regular intervals using a YSI 550 multi probe water quality meter that was calibrated using in-house pH and conductivity reference standards.

4.8 Groundwater: Sampling

Groundwater samples were collected from four (4) monitoring wells on July 7, 2017. The monitoring activities consisted of measuring the depth to groundwater in each monitoring well so that groundwater flow and direction below the Site could be assessed. The water level measurements were recorded on water level log sheets. The water level meter probe was decontaminated between monitoring well locations with a spray bottle of water and alconox solution, paper towel, then potable water.

The wells were then sampled using a “low flow” technique whereby the wells were continuously purged using an electric pump (equipped with dedicated tubing) and parameters within the purged water were monitored using a groundwater chemistry multi-meter at 3 minute intervals. These parameters include: pH, conductivity, temperature, and salinity. Once these parameters were found to deviate less than 10%

over three testing events, equilibrium was deemed to have occurred and a sample of the groundwater was collected.

The purge water was also continuously monitored for visual and olfactory evidence of petroleum and solvent impact (sheen and odour).

The groundwater samples and a blind duplicate were collected in laboratory provided sample bottles and submitted to Paracel for analysis of PHC, BTEX and/or VOC. The groundwater samples were placed in clean coolers containing ice prior to and during transportation to the subcontract laboratory.

4.9 Sediment: Sampling

As no water body was present at the Site, sediment sampling was not part of the Phase Two ESA.

4.10 Analytical Testing

The contracted laboratory selected to perform chemical analysis on all soil and water samples was Paracel Laboratories Limited and Maxxam Analytics Inc. Paracel and Maxxam are an accredited laboratory under the Standards Council of Canada/Canadian Association for Laboratory Accreditation in accordance with ISO/IEC 17025:1999- *General Requirements for the Competence of Testing and Calibration Laboratories*.

4.11 Elevation Survey

An elevation survey was conducted to obtain vertical control of the monitoring well locations. The top of casing and ground surface elevation of each monitoring well location was surveyed using a level and a topographic survey of the property. A geodetic datum was established at the site (iron bar at northeast corner of 247 Beechwood Avenue) with a known elevation of 60.72 m above sea level).

4.12 Residue Management

Due to the shallow depth to bedrock, minimal auger cuttings were generated. The drill cuttings were disposed of on the site.

Due to the low flow sampling method, purged water from groundwater sampling was stored in a pail. Since there were no visual or olfactory evidence of impact, the water was disposed of on the grass at the Site.

4.13 Quality Assurance and Quality Control Measures

A QA/QC program was also implemented to ensure that the analytical results received are accurate and dependable. A QA/QC program is a system of documented checks that validate the reliability of the data collected regarding any given Site. Quality Assurance is a system that ensures that quality control procedures are correctly performed and documented. Quality Control refers to the established procedures observed both in the field and in the laboratory, designed to ensure that the resulting end data meet intended quality objectives. The QA/QC program implemented by **exp** incorporated the following components:

- Collection and analysis of blind duplicate soil and groundwater samples to ensure analytical precision;
- Using dedicated and/or disposal sampling equipment;
- Following proper decontamination protocols to minimize cross-contamination;
- Maintaining field notes and completing field forms to document on-Site activities; and,

- Using only laboratory supplied sample containers and following prescribed sample protocols, including proper preservation, meeting sample hold times, proper chain of custody documentation, to ensure integrity of the samples.

Paracel's QA/QC program involved the systematic analysis of control standards for the purpose of optimizing the measuring system as well as establishing system precision and accuracy and included calibration standards, method blanks, reference standards, spiked samples, surrogates and duplicates.

5 Review and Evaluation

5.1 Geology

The detailed soil profiles encountered in the borehole are provided on the attached borehole logs (Appendix C). Boundaries of soils indicated on the logs are intended to reflect transition zones for the purpose of environmental assessment and should not be interpreted as exact planes of geological change. A brief description of the soil stratigraphy at the Site, in order of depth, is summarized in the following sections. The interpreted Site geology is shown on the enclosed cross section (Figure 4, Appendix B).

5.1.1 Asphalt/Topsoil

A layer of 50 to 150 mm-thick asphaltic concrete was encountered in Borehole Nos. 1, 3 and 4. A 125 to 200 mm thick topsoil was encountered in Borehole Nos. 2, 5 and 6.

5.1.2 Fill Material

Below the topsoil in Borehole Nos. 2, 5 and 6 and below asphaltic concrete in the remaining boreholes, fill was encountered to 0.8 m to 2.4 m depth. The fill consists of sand and gravel to silty sand containing crusher run limestone, debris of bricks, silty clay layers/pockets, topsoil, organic matter, roots, etc. The presence of cobbles and/or boulders is also possible. No odours or visual indications of impact were observed in the fill material.

The grain size analysis showed that less than 50% of the soil had a grain size of silt or finer. This indicates that the native soil is coarse grained. The results of the grain size analysis is found in Appendix A.

5.1.3 Native Material

Below the fill in Borehole No. 3, a 75 mm thick topsoil was encountered. The topsoil in Borehole No. 3 is underlain by brown fine sand with some silt, which extends to 1.5 m depth. The sand in Borehole No. 3 is underlain by till which extended to refusal depth of 3 m. The sand till contains some gravel to gravelly, some silt and trace clay and occasional cobbles and boulders. No odours or visual indications of impact were observed in the native material.

5.1.4 Bedrock

Auger/spoon refusals were encountered at 0.8 m to 3 m depth below ground surface. These refusals encountered in Borehole Nos. 2 to 4 are likely have been met on shale bedrock, however, the refusals met in Borehole Nos. 5 and 6 , may be on cobbles/boulders or bedrock.

Borehole Nos. 1 was cased and advanced by core drilling techniques below the refusal depth into limestone bedrock to 6.1 m depth. A review of the recovered cores indicates that the bedrock at the site is dark grey to black Shale of Rockcliffe Formation: grey shale.

5.2 Groundwater: Elevations and Flow Direction

The monitoring well network advanced as part of this Phase Two ESA consists of four (4) monitoring wells screened within the geologic overburden at the Site.

Groundwater elevations and water levels were measured at the Site on July 7, 2017. Groundwater was encountered at a depth of 0.99 m bgs in MW17-5 to 2.82 m bgs in MW17-1. No petroleum sheens were observed in the monitoring wells during either sampling event.

A summary of the elevation survey and groundwater levels for each well are shown on Table 5.1.

Table 5.1: Groundwater Elevations

Monitoring Well ID	Top of Well Casing (m)	July 7, 2017	
		Water Level (mbtoc)	Water Level (MASL)
MW17-1	58.59	2.71	55.88
MW17-3	59.37	1.70	57.67
MW17-4	60.41	1.70	58.71
MW17-5	60.60	0.96	59.64

Note: Elevations were referenced using a level and a topographic survey of the property. A geodetic datum was established at the site (iron bar at northeast corner of 247 Beechwood Avenue) with a known elevation of 60.72 m above sea level).
mbtoc – metres below top of plastic well casing
mASL – metres above sea level
NA – not applicable

Based on the groundwater level measurements, the groundwater flow in the area of the boreholes is to the southwest as shown on Figure 3 in Appendix B. **Exp** notes that groundwater flow direction and level can be influenced by utility trenches and other subsurface structures and may migrate in the bedding stone of nearby subsurface utility trenches.

5.3 Groundwater: Hydraulic Gradients

Horizontal hydraulic gradients were estimated for the groundwater flow components identified in the overburden aquifer (i.e. southwest flow) based on the July 7, 2017 groundwater elevations.

The horizontal hydraulic gradient, between each monitoring well pair, is calculated using the following equation:

$$i = \Delta h/\Delta s$$

Where,
i = horizontal hydraulic gradient;
Δh (m) = groundwater elevation difference; and,
Δs (m) = separation distance.

Since there are three wells on the Site that were used to generate the groundwater flow direction. The horizontal hydraulic gradient, based on the groundwater elevations, is estimated at 0.094.

5.4 Single Well Response Tests (SWRTs) Analysis

A single well response test was conducted on MW1 as a part of this Phase Two ESA. The test consisted of purging the well and measuring the water level recovery within the well over time.

5.5 Groundwater: Hydraulic Conductivity

The horizontal hydraulic conductivity in the overburden unit was calculated from the rising head test using Hvorslev's method. The calculated horizontal hydraulic conductivity is 3 x 10^{-6} m/s.

5.6 Soil Texture

Based on field observations, the grain size of the soil at the site at the water table at the Site was assessed to be coarse textured. Therefore, the soil texture is coarse grained.

5.7 Soil: Field Screening

Field screening involved using the combustible vapour meter to measure vapour concentrations, in parts per million (ppm) hexane equivalents, in the collected soil samples in order to assess the presence of soil gases which would imply potential petroleum hydrocarbon impact. The vapour readings obtained during the drilling activities are presented on the borehole logs in Appendix C. As indicated, all boreholes have vapour readings ranging from 25 ppm to 75 ppm. These results do not indicate any significant petroleum impact to soil.

Inspection of the soil cores retrieved from the boreholes did not indicate the presence of sheen, the presence of a separate organic phase, or other evidence of a non-aqueous phase liquid (NAPL) either in the surficial fill or overburden soil materials. No petroleum staining or odours were observed in any of the soil samples).

5.8 Soil Quality

In accordance with the scope of work, chemical analyses were performed on selected soil samples recovered from the boreholes. The selection of representative "worst case" soil samples from each borehole was based on field visual or olfactory evidence of impacts and/or presence of potential water bearing zones. Summaries of the soil analytical results from June 2017 are found in Appendix D. Copies of the laboratory Certificates of Analysis for the tested soil samples are provided in Appendix E.

The MOECC Table 7 SCS are applicable if soil pH is in the range of 5 to 11 for subsurface soil (greater than 1.5 m below soil surface). The Certificates of Analysis includes a pH measurement taken from the subsurface. One soil sample was submitted for pH analysis with results of 7.59. The pH value was within the acceptable range for the application of MOECC Table 7 SCS.

5.8.1 Petroleum Hydrocarbons and Volatile Organic Compounds

The concentrations of PHC and VOC measured in the four (4) analysed soil samples and blind duplicate were either less than the laboratory detection limit and or the MOECC 2011 Table 7 SCS, with the exception of PHC F3 in the sample collected from MW17-1 at a depth of 0.7 m to 1.35 m. The PHC F3 concentration was 324 ug/g and the MOECC Table 7 SCS is 300 ug/g/. The soil exceedence is shown on Figure 5 in Appendix A. Three additional shallow boreholes were drilled within 5 m of MW17-1 to delineate the PHC impact to soil. The three submitted soil samples had concentrations of PHC that were less than the MOECC Table 7 SCS and therefore, the area of PHC impacted soil is limited to a small area around MW17-1. The PHC and VOC results are shown in Table 1 in Appendix D. The concentration of PHC F4 in the same sample from MW17-1 also exceeded the MOECC Table 1 background concentration.

5.8.2 Metals

The concentrations of metals measured in the two (2) analysed soil samples were less than the MOECC 2011 Table 7 SCS. In addition, the metals concentrations were less than the Table 1 background concentrations in the two samples.

5.8.3 Chemical Transformation and Soil Contaminant Sources

The organic chemical constituents detected in the soil sample comprised PHCs F3. The PHC related impacts were detected only in the southwest part of the Site. The presence of PHC related parameters is likely attributed to the presence fill material. If excess soil is generated from this part of the site and requires off-site disposal, it will have to be disposed of at a licensed landfill.

5.8.4 Evidence of Non-Aqueous Phase Liquid

Inspection of the soil cores retrieved from the boreholes did not indicate the presence of non-aqueous phase liquid (NAPL), staining or sheen. Odours were not observed during soil sampling activities. NAPLs are not expected to be present at the Phase Two property.

5.9 Groundwater Quality

Representative groundwater samples were collected from the monitoring wells to assess groundwater quality at the Site. Evidence of free product (i.e. visible film or sheen), and odour was not noted during well development or purging.

The groundwater analytical results are summarized on Table 3 in Appendix D and the Certificates of Analysis are enclosed in Appendix E.

5.9.1 Petroleum Hydrocarbons and Volatile Organic Compounds

Four (4) groundwater samples and a blind duplicate were submitted for the chemical analysis of PHC and/or VOC. As shown in Table 3 in Appendix D, the concentrations of PHC and VOC parameters in all of the groundwater samples were non-detect and therefore below the MOECC Table 7 SCS. The laboratory RDLs were also below the MOECC Table 7 SCS.

5.9.2 Chemical Transformation and Contaminant Sources

There are no groundwater contaminant sources on the Phase Two property. All parameters met the applicable Table 7 SCS and as such chemical transformations are not a significant concern at the Site.

5.9.3 Evidence of Non-Aqueous Phase Liquid

Inspection of the groundwater monitoring wells did not indicate the presence of non-aqueous phase liquid (NAPL), staining or sheen. Odours were not observed during groundwater sampling activities. NAPLs are not expected to be present at the Phase Two property.

5.10 Sediment Quality

As there were no water bodies on-Site, surface water and sediment sampling was not required.

5.11 Quality Assurance and Quality Control Results

Quality assurance and quality control measures were taken during the field activities to meet the objectives of the sampling and quality assurance plan to collect unbiased and representative samples to characterize existing conditions in the fill/upper overburden materials and groundwater at the Site. QA/QC measures, as described in Section 4.12, included:

- Using dedicated and/or disposal sampling equipment;
- Following proper decontamination protocols to minimize cross-contamination;
- Maintaining field notes and completing field forms to document on-Site activities; and,
- Using only laboratory supplied sample containers and following prescribed sample protocols, including proper preservation, meeting sample hold times, proper chain of custody documentation, to ensure integrity of the samples.

Review of field activity documentation indicated that recommended sample volumes were collected from groundwater for each analytical test group into appropriate containers and preserved with proper chemical reagents in accordance with the protocols set out in the *Protocol for Analytical Methods used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act* (MOE, 2004). Samples were preserved at the required temperatures in insulated coolers and met applicable holding time requirements, when relinquished to the receiving laboratory.

Duplicate soil sample pair MW17-5 S3 (BH17-10 SS7) were submitted for chemical analysis of PHC and BTEX. For QA/QC purposes, the analytical sample results are quantitatively evaluated by calculating the relative percent difference (RPD) between the samples and their duplicates. The concentrations of BTEX in the duplicate soil samples were less than the laboratory reported detection limits for both the primary and duplicate samples and therefore RPD could not be calculated.

Duplicate groundwater samples MW17-5 (MW0) were submitted for chemical analysis PHC and BTEX. The concentrations of BTEX and PHC in the duplicate groundwater samples were less than the laboratory reported detection limits for both the primary and duplicate samples and therefore RPD could not be calculated.

Certificates of Analysis were received from Paracel reporting the results of all the chemical analyses performed on the submitted soil and groundwater samples. Copies of the Paracel Certificates of Analysis are provided in Appendix E. A review of the Certificates of Analysis prepared by Paracel indicates that they were in compliance with the requirements set out under subsection 47(3) of O.Reg. 511/09.

The analytical program conducted by Paracel included analytical test group specific QA/QC measures to evaluate the accuracy and precision of the analytical results and the efficiency of analyte recovery during solute extraction procedures. The Paracel laboratory QA/QC program consisted of the preparation and analysis of laboratory duplicate samples to assess precision and sample homogeneity, method blanks to assess analytical bias, spiked blanks and QC standards to evaluate analyte recovery, matrix spikes to evaluate matrix interferences and surrogate compound recoveries (VOCs only) to evaluate extraction efficiency. The laboratory QA/QC results are presented in the Quality Assurance Report provided in the Certificate of Analysis prepared by Paracel. The QA/QC results are reported as percent recoveries for matrix spikes, spike blanks and QC standards, relative percent difference for laboratory duplicates and analyte concentrations for method blanks.

The Paracel QA/QC results were assessed against test group control limits in the case of spiked blanks, matrix spikes and surrogate recoveries and alert criteria in the case of method blanks and laboratory duplicates. Review of the laboratory QA/QC results reported by Paracel indicated that they were within

acceptable control limits or below applicable alert criteria for the sampled media and analytical test groups. Based on the assessment of the QA/QC, the analytical results reported by Paracel are of acceptable quality and data qualifications are not required.

5.12 Phase Two Conceptual Site Model

This section presents a Conceptual Site Model (CSM) providing a narrative, graphical and tabulated description integrating information related to the Site's geologic and hydrogeological conditions, areas of potential environmental concern/potential contaminating activities, the presence and distribution of contaminants of concern, contaminant fate and transport, and potential exposure pathways.

For the purposes of this Phase Two CSM, the information relied upon was taken from all current and previous environmental reports conducted for the Site. However, the data relied upon was limited to the most recent information to convey the current Site conditions.

5.12.1 Introduction

The Site consists of two (2) parcels, the two residential properties located at 229/231 Beechwood Avenue (Parcel A) and the three (3) residential properties located at 241/245/247 Beechwood Avenue (Parcel B), Ottawa. Ontario, as shown on Figure 2 in Appendix B. The surrounding properties are residential and commercial in nature.

Refer to the following table for the Site identification information.

Civic Address	229-231, 241-247 Beechwood Avenue, Ottawa, ON
Current Land Use	Residential
Proposed Land Use	Residential
Property Identification Number	042260120 and 042260121 042260122 and 042260123 042260136 and 042260166 042260137 and 042260167 042260138 and 042260168
UTM Coordinates	447536 m E, 5032436 m N for Parcel A and 447544 m E, 5032484 m N for Parcel B
Site Area	0.214 ha
Property Owner	Takyan Developments
Owner Contact	Domenic Saikaley
Owner Address	100 Argyle Avenue, Suite 200, Ottawa, Ontario K2P 1B6

5.12.2 Physical Site Description

The Phase Two CSM provides a narrative and graphical interpretation of the Site surface features, near surface geologic and hydrogeologic conditions, PCOCs, contaminant fate and transport mechanisms, and relevant receptors and exposure pathways. These components are discussed in the following sections and summarized in Table 1 in the Tables appendix.

The Site is located in a developed commercial and residential area of Ottawa where potable water is supplied by the City of Ottawa and therefore the MOECC Table 7 Site Condition Standard (SCS) is applied

to the Site. The City of Ottawa obtains its water from the Rideau River, located approximately 0.8 km southwest of the Site.

In accordance with Section 41 of the Ontario Regulation 153/04 (as amended), the Site is not an environmentally sensitive area. The Site is not located within an area of natural significance and it does not include land that is within 30 metres of an area of natural significance.

Based on the Phase Two ESA investigation, the Site is a shallow soil property as defined in Section 43.1 of the regulation. The Site does not include all or part of a water body or is adjacent to a water body or includes land that is within 30 metres of a water body.

5.12.3 Geological and Hydrogeological Setting

Based on the Phase Two ESA, below the topsoil in Borehole Nos. 2, 5 and 6 and below asphaltic concrete in the remaining boreholes, fill was encountered to 0.8 m to 2.4 m depth. The fill consists of sand and gravel to silty sand containing crusher run limestone, debris of bricks, silty clay layers/pockets, topsoil, organic matter, roots, etc. The topsoil in Borehole No. 3 is underlain by brown fine sand with some silt, which extends to 1.5 m depth. The sand in Borehole No. 3 is underlain by till which extended to refusal depth of 3 m. The sand till contains some gravel to gravelly, some silt and trace clay and occasional cobbles and boulders. No odours or visual indications of impact were observed in the native material. Auger/spoon refusals were encountered at 0.8 m to 3 m depth below ground surface. These refusals encountered in Borehole Nos. 2 to 4 are likely have been met on shale bedrock, however, the refusals met in Borehole Nos. 5 and 6, may be on cobbles/boulders or bedrock.

The geologic cross-sections prepared from Site boreholes are presented on Figure 4 in Appendix B.

Based on the groundwater level measurements, the groundwater flow in the area of the boreholes is to the southwest.

5.12.4 Underground Utilities

The Site is serviced by underground utilities such as bell, gas, water and sewer. The groundwater flow pattern at the site is likely to be influenced by buried services since the groundwater was found at a minimum depth of 0.99 m below ground.

5.12.5 Potentially Contaminating Activities

The Phase One ESA conducted by **exp** in 2017 identified one on-site PCA and six off-site PCAs:

- **PCA1** – Former off-site RFO located at 222 Beechwood Avenue (25 m east of Parcels A & B) operated between the 1950s and 2000s. This property was also formerly operated as an automotive garage (rust check centre) between the 1990s and 2000s (PCA#27 - Garages and Maintenance, PCA#28 – Gasoline and Associated Products Storage in Fixed Tanks).
- **PCA2** – Former off-site RFO located at 260 Beechwood Avenue (25 m northeast of Parcel B) operated between the 1950s and 1970s (PCA#28 – Gasoline and Associated Products Storage in Fixed Tanks).
- **PCA3** – Former off-site RFO located at 266 Beechwood Avenue (70 m northeast of Parcel B) operated between the 1950s and 1970s (PCA#28 – Gasoline and Associated Products Storage in Fixed Tanks).

- **PCA4** – Former off-site industrial garage and repair shop located at 25 Carsdale Avenue (adjacent west of Parcels A & B) operated between the 1960s and 2000s (PCA#27 - Garages and Maintenance).
- **PCA5** – 910L AST currently located at the rear of the residence located at 229 Beechwood Avenue (Parcel A). The tank was previously located in the basement for an undetermined amount of time according to an interview and evidence of fill/vent pipes (PCA#28 – Gasoline and Associated Products Storage in Fixed Tanks).
- **PCA6** – Former off-site RFO located at 188 Beechwood Avenue (120 m south of Parcel A) operated between the 1980s and 2000s. The property was also formerly operated as an automotive garage between the 1960s and 1980s (PCA#27 - Garages and Maintenance, PCA#28 – Gasoline and Associated Products Storage in Fixed Tanks).
- **PCA7** – Former off-site automotive garage located at 131 Beechwood Avenue (140 m southwest of Parcel A) operated between the 1940s and 1960s (PCA#27 - Garages and Maintenance).

5.12.6 Areas of Potential Environmental Concern/Potential Contaminants of Concern

As per Ontario Regulation 153/04 (as amended), Potential Contaminating Activity (PCA) is defined as one of the 59 industrial operations set out in Table 2 of Schedule D that occurs or has occurred on the Site or within the Phase I ESA study area. Based on Phase I ESA, the identified areas of potential environmental concern (APEC) and potential contaminants of concern (PCOC) are summarized in the table below and are shown on Figure 2 in Appendix B.

Table 5.2: Areas of Potential Environmental Concern

Area of Potential Environmental Concern (APEC)	Potentially Contaminating Activity (PCA)	Location of PCA (On-Site or Off-Site)	Contaminants of Concern	Media Potentially Impacted (Groundwater, Soil and/or Sediment)
1. Furnace oil spill at 241 Beechwood Ave. (1991)	Not applicable	On-site (Parcel B)	petroleum hydrocarbons (PHC)	Soil and groundwater:
2. Former Off-Site Retail Fuel Outlet (222 Beechwood Ave.) present between the 1950s and 2000s. Also operated as an automotive garage.	#27 – Garages and Maintenance #28 – Gasoline and Associated Products Storage in Fixed Tanks	25 m east of Parcels A & B	PHC, and benzene, toluene, ethylbenzene, xylene (BTEX)	Soil and groundwater:
3. Former Off-Site Retail Fuel Outlet (260 Beechwood Ave.) operated between the 1950s and 1970s	#28 – Gasoline and Associated Products Storage in Fixed Tanks	25 m northeast of Parcel B	PHC, and BTEX	Soil and groundwater:

Area of Potential Environmental Concern (APEC)	Potentially Contaminating Activity (PCA)	Location of PCA (On-Site or Off-Site)	Contaminants of Concern	Media Potentially Impacted (Groundwater, Soil and/or Sediment)
4. Former Off-Site Retail Fuel Outlet (266 Beechwood Ave.) operated between the 1950s and 1970s	#28 – Gasoline and Associated Products Storage in Fixed Tanks	70 m northeast of Parcel B	PHC and BTEX	Soil and groundwater:
5. Former Off-Site Industrial Garage & Repair Shop (25 Carsdale Ave. operated between 1960s and 2000s.	#27 – Garages and Maintenance	Adjacent west of Parcels A & B	PHC and BTEX	Soil and groundwater:
6. Furnace oil spill at 249 Beechwood Ave. (2002)	Not applicable	Adjacent north of Parcel B	PHC	Soil and groundwater:

5.12.7 Investigation and Remediation

The Phase Two ESA was conducted to assess the soil and groundwater quality at the Site. As indicated in the APEC and PCOC Table (above), the analytical program of the Phase Two ESA included testing of soil and groundwater for PHC, VOC, and/or metals from the monitoring wells installed on the Site. The borehole and monitoring well locations are shown on Figure 3 in Appendix B.

5.12.8 Contaminants of Concern (COC)

Based on the results of the investigation, all of the soil and groundwater samples had concentrations of PHC, VOC, and metals that were less than the 2011 MOECC Table 7 SCS, with the exception of PHC F3 in one sample collected at MW17-1 at a depth of 0.75 m to 1.35 m. Therefore, the COC on the Site is PHC F3 and the limited area of PHC impacted soil at MW17-1 is shown on Figure 5 in Appendix B.

5.12.9 Contaminant Fate and Transport

Soil COCs

A variety of physical, chemical and biochemical mechanisms affect the fate and transport of the potential COCs in soil, the contribution of which is dependent on the soil conditions and the chemical/physical properties of the COCs. Relevant fate and transport mechanisms are natural attenuation mechanisms, including advection mixing, mechanical dispersion/molecular diffusion, phase partitions (i.e. sorption and volatilization), and possibly abiotic or biotic chemical reactions, which effectively reduce COC concentrations.

Concentrations of the COCs in soil will be reduced by the effects of molecular diffusion and the creation of concentration gradients. As non-volatile chemical constituents PHC F3 and F4 may undergo abiotic or biotic chemical reactions associated with the soil mineral particles and the micro-organisms present in the overburden material.

As a result of the various natural attenuation mechanisms in the soil environment, the concentrations of any COCs in soil will be reduced at the Site. The soil impacts are shown on a geologic cross section (Figure 4A).

Groundwater COCs

No impacts were observed in the groundwater at the Site and therefore, there are no contaminants of concern in groundwater at the subject Site.

5.12.10 Receptors and Exposure Pathways

Human Health Receptors and Exposure Pathways

The Site is currently used for residential purposes and is occupied five residences with associated parking and will be redeveloped for residential purposes. The potential on-Site human receptors currently comprise residents (adult, teen, child, toddler and infant), property visitors (adult, teen, child, toddler and infant), and construction workers.

The potential on-Site exposure pathways for the residents and property visitors are indoor air inhalation (sourced from soil).

Ecological Receptors and Exposure Pathways

The Site is comprised of developed residential lands capable of supporting some terrestrial ecological receptors. Relevant terrestrial receptors are terrestrial vegetation, such as trees, grasses and weeds; soil invertebrates, such as earthworms, millipedes and beetles; terrestrial birds, such as pigeons, sparrows and robins; and, terrestrial mammals, such as moles, voles and mice.

The potential on-Site exposure pathways for terrestrial vegetation are root uptake (soil), and stem and foliar uptake of vapours (sourced from soil).

The potential on-Site exposure pathways for soil invertebrates are soil particulate inhalation, soil dermal contact, soil ingestion, vapour inhalation (sourced from soil), and dermal contact and ingestion of groundwater.

The potential on-Site exposure pathways for mammals and birds are soil particulate inhalation, soil dermal contact, soil ingestion, vapour inhalation (sourced from soil), and animal tissue ingestion (as a result of biotransformation of soil).

6 Conclusions

Based on the Phase Two ESA results, the following summary is provided:

- Below the topsoil in Borehole Nos. 2, 5 and 6 and below asphaltic concrete in the remaining boreholes, fill was encountered to 0.8 m to 2.4 m depth. The fill consists of sand and gravel to silty sand containing crusher run limestone, debris of bricks, silty clay layers/pockets, topsoil, organic matter, roots, etc. The topsoil in Borehole No. 3 is underlain by brown fine sand with some silt, which extends to 1.5 m depth. The sand in Borehole No. 3 is underlain by till which extended to refusal depth of 3 m. The sand till contains some gravel to gravelly, some silt and trace clay and occasional cobbles and boulders. No odours or visual indications of impact were observed in the native material. Auger/spoon refusals were encountered at 0.8 m to 3 m depth below ground surface. These refusals encountered in Borehole Nos. 2 to 4 are likely have been met on shale bedrock, however, the refusals met in Borehole Nos. 5 and 6, may be on cobbles/boulders or bedrock.
- On July 7, 2017. Groundwater was encountered at a depth of 0.99 m bgs in MW17-5 to 2.82 m bgs in MW17-1. No petroleum sheens were observed in the monitoring wells during the sampling event. Based on the groundwater level measurements, the groundwater flow in the area of the boreholes is to the southwest.
- The concentrations of PHC and VOC measured in the four (4) analysed soil samples and blind duplicate were either less than the laboratory detection limit and or the MOECC 2011 Table 7 SCS, with the exception of PHC F3 in the sample collected from MW17-1 at a depth of 0.7 m to 1.35 m. The PHC F3 concentration was 324 ug/g and the MOECC Table 7 SCS is 300 ug/g. Three additional shallow boreholes were drilled within 5 m of MW17-1 to delineate the PHC impact to soil. The three submitted soil samples had concentrations of PHC that were less than the MOECC Table 7 SCS and therefore, the area of PHC impacted soil is limited to a small area around MW17-1.
- The concentration of PHC F4 in the same sample from MW17-1 also exceeded the MOECC Table 1 background concentration. If excess soil is generated from this small area around MW17-1 and requires off-site disposal, it will have to be disposed of at a licensed landfill.
- The analyzed parameters in the groundwater samples were either less the laboratory detection limit or less than the 2011 MOECC Table 7 SCS.

Based on the Phase Two ESA findings, no further work is recommended at this time. If the wells are no longer needed, they should be decommissioned in accordance with Ontario Regulation 903.

7 General Limitations

The information presented in this report is based on a limited investigation designed to provide information to support an assessment of the current environmental conditions within the subject property. The conclusions and recommendations presented in this report reflect Site conditions existing at the time of the investigation.

More specific information with respect to the conditions between samples, or the lateral and vertical extent of materials may become apparent during excavation operations. The interpretation of the borehole information must, therefore, be validated during any such excavation operations. Consequently, during the future development of the property, conditions not observed during this investigation may become apparent. Should this occur, **exp** Services Inc. should be contacted to assess the situation, and the need for additional testing and reporting. **Exp** has qualified personnel to provide assistance in regards to any future geotechnical and environmental issues related to this property.

The environmental investigation was carried out to address the intent of applicable provincial Regulations, Guidelines, Policies, Standards, Protocols and Objectives administered by the Ministry of Environment. It should also be noted that current environmental Regulations, Guidelines, Policies, Standards, Protocols and Objectives are subject to change, and such changes, when put into effect, could alter the conclusions and recommendations noted throughout this report. Achieving the study objectives stated in this report has required us to arrive at conclusions based upon the best information presently known to us. No investigative method can completely eliminate the possibility of obtaining partially imprecise or incomplete information; it can only reduce the possibility to an acceptable level. Professional judgment was exercised in gathering and analyzing the information obtained and in the formulation of the conclusions. Like all professional persons rendering advice we do not act as absolute insurers of the conclusions we reach, but we commit ourselves to care and competence in reaching those conclusions.

Our undertaking at **exp**, therefore, is to perform our work within limits prescribed by our clients, with the usual thoroughness and competence of the engineering profession. It is intended that the outcome of this investigation assist in reducing the client's risk associated with environmental impairment. Our work should not be considered 'risk mitigation'. No other warranty or representation, either expressed or implied, is included or intended in this report.

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8 References

This study was conducted in general accordance with the applicable Regulations, Guidelines, Policies, Standards, Protocols and Objectives administered by the Ministry of the Environment. Specific reference is made to the following:

- Environmental Protection Act, R.S.O. 1990, Chapter E.19, as amended, September 2004.
- Ministry of the Environment [MOE] (1996) Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario. Ontario Ministry of the Environment, December 1996.
- MOE (2011) Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act. Ontario Ministry of the Environment, April 15, 2011.
- MOE (2011) Guide for Completing Phase Two Environmental Site Assessments under Ontario Regulation 153/04. Ontario Ministry of the Environment, June 2011.
- MOE (2011) Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. Ontario Ministry of the Environment, March 2004, amended as of July 1, 2011.
- Ontario Regulation 153/04, made under the Environmental Protection Act, May 2004, last amended to O.Reg.333/13.
- Ontario Water Resources Act – R.R.O. 1990, Regulation 903, amended to O.Reg. 128/03, August 2003.
- Groundwater, Freeze and Cheery 1979. Prentice Hall.
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Tables

Table 1

Characteristic	Description
Minimum Depth to Bedrock	1.8 m
Minimum Depth to Overburden Groundwater	0.99 m July 7, 2017
Shallow Soil Property	Yes, less than 2.0 m
Proximity to water body or ANSI	750 m
Soil pH	7.59
Soil Texture	Coarse
Current Property Use	Residential
Future Property Use	Residential
Proposed Future Building	Central part of the site
Areas where soil has been brought to the Site	None identified

Appendix A – Sampling and Analysis Plan

1 Introduction

This appendix presents the Sampling and Analysis Plan (SAAP) that was developed in support of the Phase Two Environmental Site Assessment (ESA) for the property located at 229-231 Beechwood Avenue (Parcel A), and 241-247 Beechwood Avenue (Parcel B) in Ottawa, Ontario (hereinafter referred to as the 'site'). The SAAP presents the procedures and measures that will be undertaken during field investigative activities to characterize the site conditions and meet the data quality objectives of the Phase Two ESA.

The SAAP presents the sampling program proposed for the site, the recommended procedures and protocols for sampling and related field activities, the data quality objectives, and the quality assurance/ quality control measures that will be undertaken to provide for the collection of accurate, reproducible and representative data. These components are described in further detail below.

2 Field Sampling Program

The field sampling program was developed to provide for the collection of samples of the soil and groundwater for chemical analysis of petroleum hydrocarbons (PHC), benzene, toluene, ethylbenzene and xylenes (collectively known as 'BTEX'), volatile organic compounds (VOC), and metals. The soil sampling media is to consist of the overburden materials (depths up to 6 m of overburden beneath site). The soil sampling will be location-specific to assess for the potential presence of PHC, VOC, and metals based on the identification of potential areas of potential environmental concern identified in a Phase One ESA completed by **others** in 2014. Vapour readings will also be taken in the field to determine samples to be submitted for VOC/BTEX and PHC F1-F2 analysis. The soil sample intervals will extend from the surface up to a maximum depth of approximately 4.5 m below grade.

Each of the groundwater samples will be submitted for analysis of PHC and VOC. The monitoring well network is to comprise of three newly installed wells.

Vertical control of the boreholes and monitoring wells will be obtained through the completion of an elevation survey with reference to a geodetic benchmark. Groundwater flow and direction in the overburden aquifer will also be determined through groundwater level measurements and the elevations established in the site elevation survey.

3 Field Methods

To meet the requirements of the field sampling program, the following field investigative methods will be undertaken:

- Borehole Drilling;
- Soil Sampling;
- Monitoring Well Installation;
- Groundwater Level Measurements;
- Elevation Survey; and,
- Groundwater Sampling.

The field investigative methods will be performed following the procedures and protocols set out in **exp's** standard operating procedures and are outlined below:

3.1 Borehole Drilling

Boreholes will be advanced at the site to facilitate the collection of soil samples for chemical analysis and geologic characterization; and, for the installation of groundwater monitoring wells. A total of six (6) boreholes are proposed to be advanced at the site, up to a maximum overburden depth of approximately 4.5 m below grade, to provide for the collection of samples of the surficial and overburden materials beneath the site. The borehole locations will be selected to delineate the extent and magnitude of PCOC related impacts to the soils and the groundwater.

Prior to borehole drilling, utility clearances will be obtained from public and private locators, as required. The borehole drilling program will be conducted by a licensed driller under the oversight of **exp** field staff. All drilling equipment will be cleaned prior to the commencement of drilling at each borehole location.

3.2 Soil Sampling

Soil samples will be collected for chemical analysis and geologic property characterization. The soil samples will be collected using 5 cm diameter, 60 cm long, stainless steel split-spoon sampling devices advanced ahead of the direct push drilling equipment at continuous intervals. The split spoon sampling devices will be attached to drill rods and advanced into the soil by means of a direct push hammer. Upon retrieval from the boreholes, the split-spoon samplers will be placed on a flat surface and disassembled by drilling personnel to provide access of the recovered cores. Geologic and sampling details of the recovered cores will be logged and the samples will be assessed for the potential presence of non-aqueous phase liquids. Samples for chemical analysis will be selected on the basis of visual and olfactory evidence of impacts and at specific intervals to define the lateral and vertical extent of known impacts.

Recommended volumes of soil samples selected for chemical analysis will be collected into pre-cleaned, laboratory supplied, analytical test group specific containers. The samples will be placed into clean insulated coolers chilled with ice for storage and transport. Samples intended for analysis of BTEX and PHC F1-F2 will be collected into 40 ml vials. The samples will be assigned unique identification numbers, and the date, time, location, and requested analyses for each sample will be documented in a bound field note book. The samples will be submitted to the contract laboratory within analytical test group holding times under Chain of Custody (COC) protocols. New disposable chemical resistant gloves will be used for each soil core to prevent sample cross-contamination.

3.3 Monitoring Well Installation

It is proposed that four (4) boreholes will be instrumented as groundwater monitoring wells installed with slotted screens intercepting either the native overburden material or the shallow bedrock, where the water table aquifer is expected, extending to depths of approximately 3 to 5 m below grade. The monitoring wells will be constructed using 31 mm diameter, Schedule 40, PVC riser pipe and number 10 slot size (0.25 mm) well screens. The base of the well screens will be sealed with threaded flush PVC end caps. All well pipe connections will be factory machined threaded flush couplings. The annular space around the well screens will be backfilled with silica sand, to an average height of 0.3 m above the top of the screen. Granular bentonite will be placed in the borehole annulus from the top of the sand pack to approximately 0.3 m below grade. The monitoring wells will be completed with either a flush-mounted protective steel casing or above ground protective casings cemented into place.

3.4 Monitoring Well Development

The newly installed monitoring wells will be developed to remove fine sediment particles potentially lodged in the sand pack and well screen to enhance hydraulic communication with the surrounding formation waters.

Standing water volumes will be determined by means of an electronic water level meter. Approximately 1 wetted well volume will be removed. Well development details will be documented on a well development log sheet or in a bound hard cover notebook. All development waters will be collected and stored in labeled, sealed containers.

3.5 Groundwater Level Measurements

Groundwater level measurements will be recorded for all monitoring wells to determine groundwater flow and direction in the water table aquifer beneath the site. Water levels will be measured with respect to the top of the casing by means of an electronic water level meter. The water levels will be recorded on water level log sheets. The water level meter probe will be decontaminated between monitoring well locations.

3.6 Elevation Survey

An elevation survey will be conducted to obtain vertical control of all monitoring well locations. The top of casing and ground surface elevation of each monitoring well location will be surveyed against a known geodetic benchmark, or if unavailable, against a suitable arbitrary benchmark. Elevations measured against using a high precision GPS unit and a benchmark with an assigned elevation will be recorded as meters above mean sea level (m AMSL. The elevation survey will be accurate to within ± 0.5 cm.

3.7 Groundwater Sampling

Groundwater samples will be collected from all monitoring wells for chemical analysis. The wells will be sampled using a “low flow” technique whereby the wells are continuously purged using an electric pump (equipped with dedicated tubing) and parameters within the purged water are monitored using a groundwater chemistry multi-meter at 3 minute intervals. These parameters include: pH, conductivity, temperature, and salinity. Once these parameters are found to deviate less than 10% over three testing events, equilibrium is deemed to have occurred and a sample of the groundwater will be collected. The water sample collected from the deep monitoring well will be collected using a foot valve and plastic tubing. The purge water will also be continuously monitored for visual and olfactory evidence of petroleum and solvent impact (sheen and odour).

Recommended groundwater sample volumes will be collected into pre-clean laboratory-supplied vials or bottles provided with analytical test group specific preservatives, as required. The samples will be placed in an insulated cooler chilled with ice for storage and transport. Each VOC/BTEX vial will be inverted and inspected for gas bubbles prior to being placed in the cooler to ensure that no head-space is present. All groundwater samples will be assigned unique identification numbers, and the date, time, project number, company name, location and requested analyses for each sample will be documented in a bound hard cover notebook. The samples will be submitted to the contractual laboratory within analytical test group holding times under COC protocols. New disposable chemical resistant gloves will be used for each sampling location to prevent sample cross-contamination.

4 Field Quality Assurance/Quality Control Program

The objective of the field quality assurance/quality control (QA/QC) program is to obtain soil and groundwater samples and other field measurements that provide data of acceptable quality that meets the objectives of the Phase Two ESA. The objectives of the QA/QC program will be achieved through the implementation of procedures for the collection of unbiased (i.e. non-contaminated) samples, sample documentation and the collection of appropriate QC samples to provide a measure of sample reproducibility and accuracy. The field QA/QC measures will comprise:

- Decontamination Protocols;
- Equipment Calibration;
- Sample Preservation;
- Sample Documentation; and,
- Field Quality Control Samples.

Details on the field QA/QC measures are provided below.

4.1 Decontamination Protocols

Decontamination protocols will be followed during field sampling where non-dedicated sampling equipment is used to prevent sample cross contamination. The split spoon soil sampling device will be cleaned/decontaminated between sampling intervals in according with SOP requirements. For the monitoring well installation, well components are not to come into contact with the ground surface prior to insertion into boreholes. Electronic water level meters will be decontaminated between monitoring well locations during well development, and purging activities. For hydraulic conductivity tests, the electronic water level meters will be decontaminated between sampling locations. All decontamination fluids will be collected and stored in sealed, labeled containers.

4.2 Equipment Calibration

All equipment requiring calibration will be calibrated in the field according to manufacturer's requirements using analytical grade reagents, or by the supplier prior to conducting field activities, and subsequently checked in the field. The calibration of all pre-calibrated instruments will be checked in the field using analytical grade reagents and re-calibrated as required. For multiple day sampling events, equipment calibration will be checked prior to the beginning of sampling activities. All calibration data will be documented in a bound hard cover notebook.

4.3 Sample Preservation

All samples will be preserved using appropriate analytical test group specific reagents, as required, and upon collection placed in pre-chilled insulated coolers packed with ice for storage and transport.

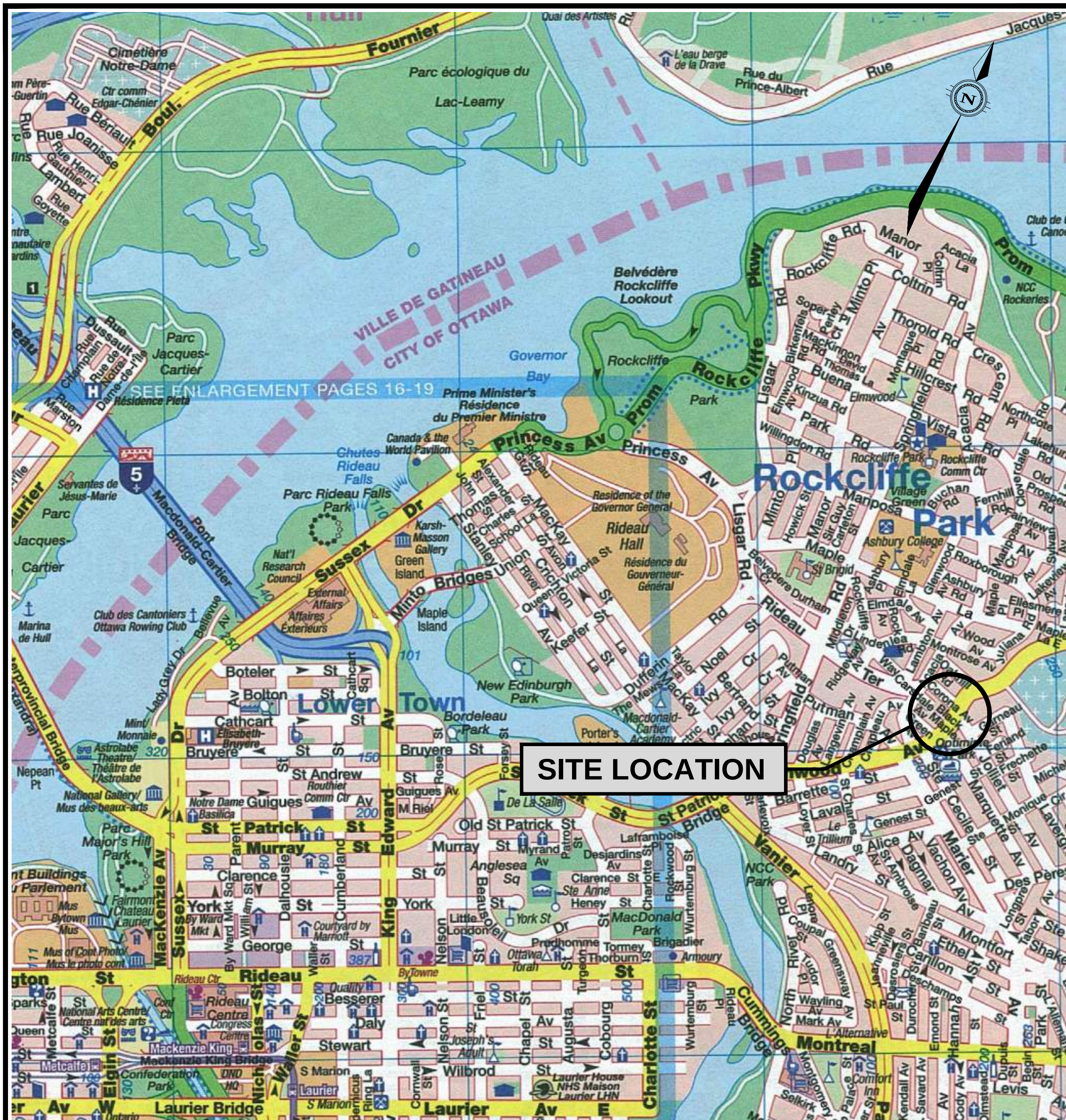
4.4 Sample Documentation

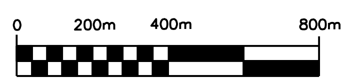
All samples will be assigned a unique identification number, which is to be recorded along with the date, time, project number, company name, location and requested analysis in a bound field notebook. All samples will be handled and transported following COC protocols.

4.5 Field Quality Control

Field quality controls samples will be collected to evaluate the accuracy and reproducibility of the field sampling procedures. For soil and groundwater sampling, one (1) field duplicate is to be collected for every ten (10) samples submitted for chemical analysis. The field duplicate samples will be assessed by calculating the relative percent difference and comparing to the analytical test group specific acceptance criteria.

Appendix B – Figures





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scale: 1:20,000	CLIENT: TAKYAN DEVELOPMENTS	project no.: OTT-00238207-A0
date: JULY 2017	TITLE: SITE LOCATION PLAN	
drawn by: M.N.	PHASE TWO ESA, PROPOSED RESIDENTIAL DEVELOPMENT, 229 - 247 BEECHWOOD AVENUE, OTTAWA, ON	FIG 1

Filename: r:\230000\238000\238207-a0 229-247 beechwood\environ\238207-a0 fig 1-2 ground water 2.dwg
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Last Plotted: 8/2/2017 10:29:38 AM Plotted by: RevellJ Pen Table:: trow standard, july 01, 2004.ctb

N

0 5 10 20 30 40 50 Metres

Legend

- APEC 1
- APEC 2
- APEC 3
- APEC 4
- APEC 5
- Approximate Site Boundary
- Potentially Contaminating Activity (PCA)

RFO = retail fuel outlet

OS = oil spill

APEC = Area of Potential Environmental Concern

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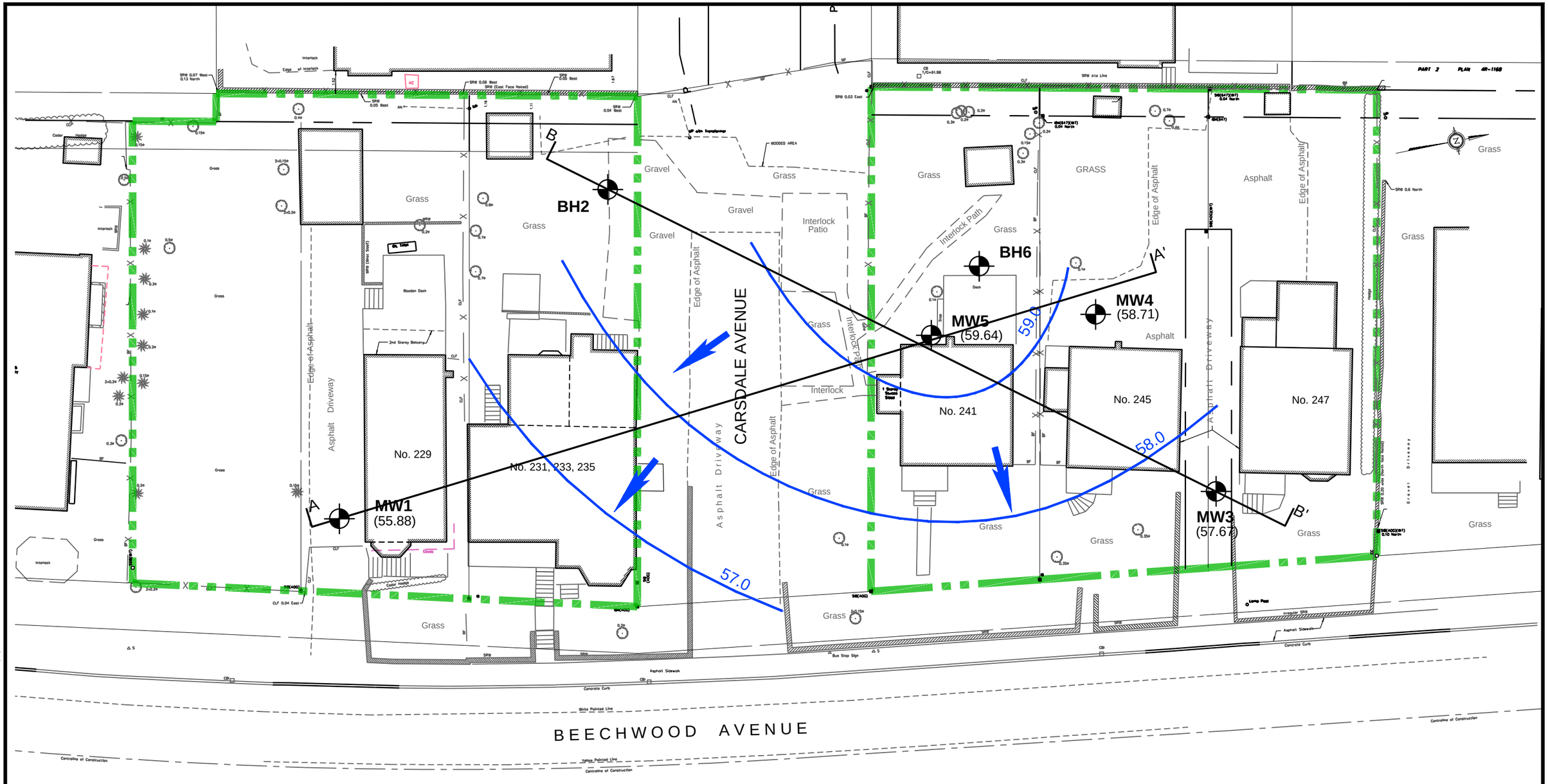
PROJECT TITLE:
PHASE TWO ENVIRONMENTAL SITE ASSESSMENT
229-231, 241-247 Beechwood Avenue
Ottawa, Ontario

DRAWING TITLE:
SITE PLAN

PROJECT No.:	DWN:
OTT-00238207-A0	SL
SCALE: AS SHOWN	CHKD: CK
DATE: July 2017	FIG. No.: 2



LEGEND

BH1
(55.88)

BOREHOLE NUMBER, LOCATION AND GROUNDWATER ELEVATION JULY 7, 2017

INFERRED GROUNDWATER FLOW DIRECTION

PROPERTY BOUNDARY

0 2m 4m 10m

HORIZONTAL 1:250

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scale: 1:250	CLIENT: TAKYAN DEVELOPMENTS	project no.: OTT-00238207-A0
date: JUNE 2017	TITLE: GROUNDWATER ELEVATION CONTOUR PLAN PHASE TWO ESA, PROPOSED RESIDENTIAL DEVELOPMENT, 229 - 247 BEECHWOOD AVENUE, OTTAWA, ON	FIG 3
drawn by: M.N.		

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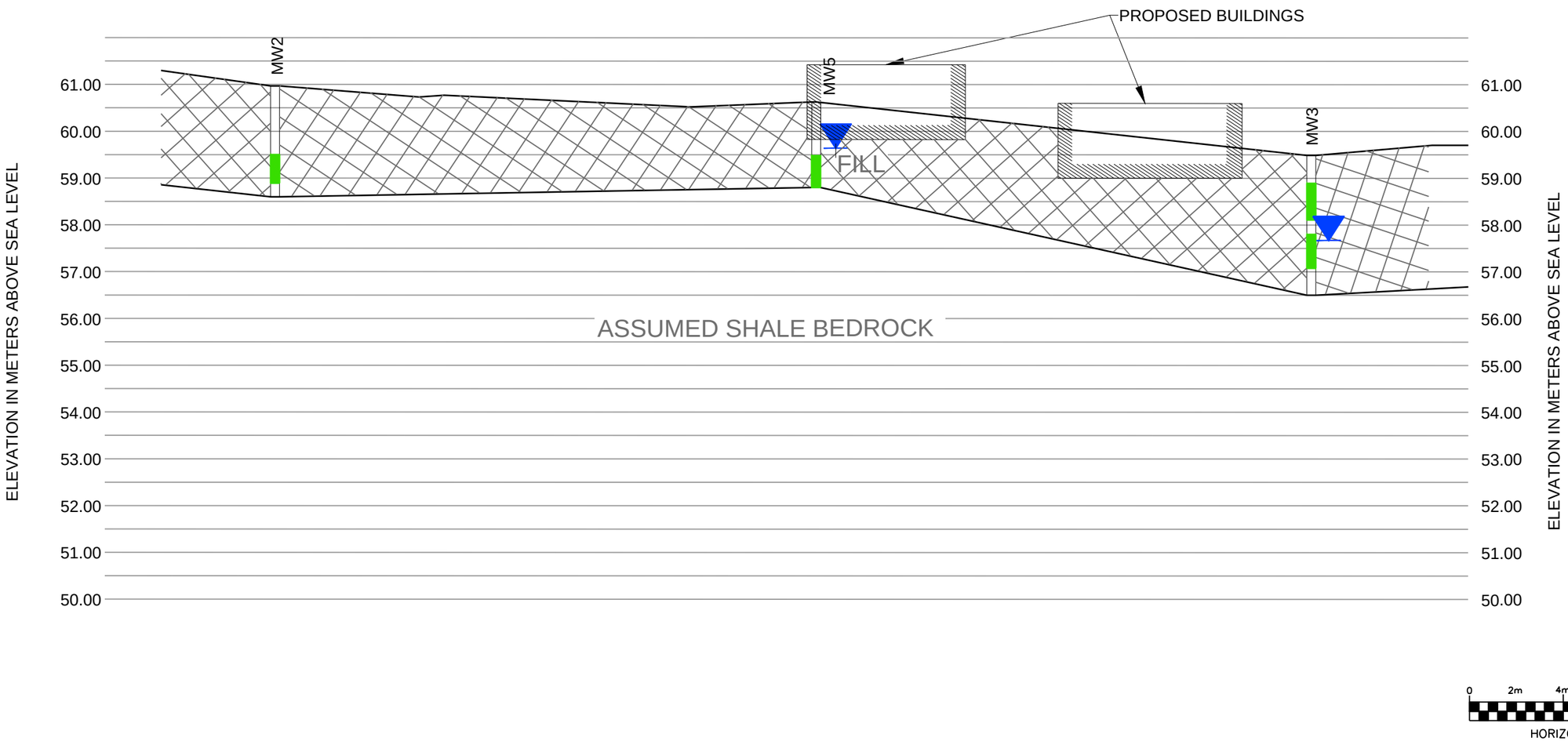
B

LOOKING NORTHWEST

B'



LEGEND

GROUNDWATER ELEVATION

SOIL SAMPLE EXCEEDS MOECC TABLE 3 SCS

SOIL SAMPLE PASSES MOECC TABLE 3 SCS

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scale: AS NOTED	CLIENT: TAKYAN DEVELOPMENTS	project no.: OTT-00238207-A0
date: JULY 2017	TITLE: CROSS SECTION B-B'	
drawn by: M.N./ J.R.	PHASE TWO ESA, PROPOSED RESIDENTIAL DEVELOPMENT, 229 - 247 BEECHWOOD AVENUE, OTTAWA, ON	FIG 4B

Filename: r:\230000\238000\238207-a0 229-247 beechwood\environ\238207-a0 fig 1-2 ground water 2.dwg
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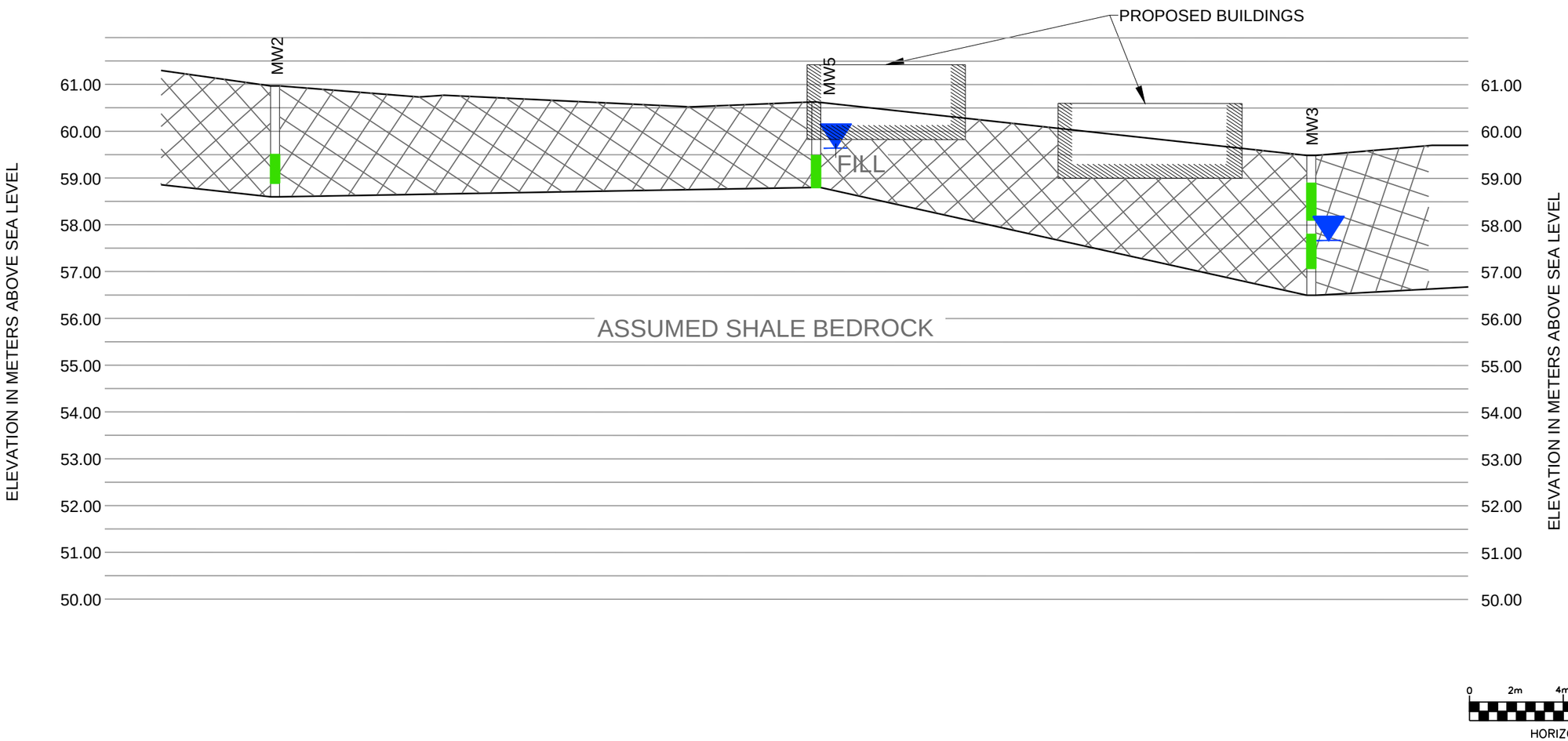
B

LOOKING NORTHWEST

B'



LEGEND

GROUNDWATER ELEVATION

SOIL SAMPLE EXCEEDS MOECC TABLE 3 SCS

SOIL SAMPLE PASSES MOECC TABLE 3 SCS

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scale: AS NOTED	CLIENT: TAKYAN DEVELOPMENTS	project no.: OTT-00238207-A0
date: JULY 2017	TITLE: CROSS SECTION B-B'	
drawn by: M.N./ J.R.	PHASE TWO ESA, PROPOSED RESIDENTIAL DEVELOPMENT, 229 - 247 BEECHWOOD AVENUE, OTTAWA, ON	FIG 4B

Filename: r:\230000\238000\238207-a0 229-247 beechwood\environ\238207-a0 fig 1-2 ground water 2.dwg
Last Saved: 8/1/2017 12:26:12 PM
Last Plotted:8/2/2017 10:07:33 AM Plotted by: ReveliJ Pen Table:: trow standard, july 01, 2004.ctb

MW17-1 SS2	Sample Depth	Concentration µg/g	MOECC Table 7 SCS µg/g
PHC	0.7-1.3 m	324	300

BH2
BH1B
MW1
(55.88)
BH1C
BH1A
BH6
MW4
(58.71)
MW5
(59.64)
MW3
(57.67)
A
A'
B
B'
No. 229
No. 231, 233, 235
No. 241
No. 245
No. 247
CARSDALE AVENUE
BEECHWOOD AVENUE
Grass
GRASS
BUILDING AREA
Asphalt Sidewalk
Concrete Curb
Centreline of Construction
White Painted Line
Yellow Painted Line
Bus Stop Sign
Lamp Post
Gravel Driveway

LEGEND

- BH1 (55.88) — BOREHOLE NUMBER, LOCATION AND GROUNDWATER ELEVATION JULY 7, 2017
- BH1C — BOREHOLE NUMBER, LOCATION AUGUST 11, 2017
- INFERRED GROUNDWATER FLOW DIRECTION
- PROPERTY BOUNDARY
- APEC 1
- APEC 2
- APEC 3
- APEC 4
- APEC 5

0 2m 4m 10m
HORIZONTAL 1:250

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scale: 1:250	CLIENT: TAKYAN DEVELOPMENTS	project no.: OTT-00238207-A0
date: JUNE 2017	TITLE: APECS AND EXCEEDANCES PHASE TWO ESA, PROPOSED RESIDENTIAL DEVELOPMENT, 229 - 247 BEECHWOOD AVENUE, OTTAWA, ON	FIG 5
drawn by: M.N.		

Filename: r:\2300002380000\238207-a0 229-247 beechwoodenviron\238207-a0 fig 1-2 ground water 2.dwg
Last Saved: 8/17/2017 2:38:38 PM
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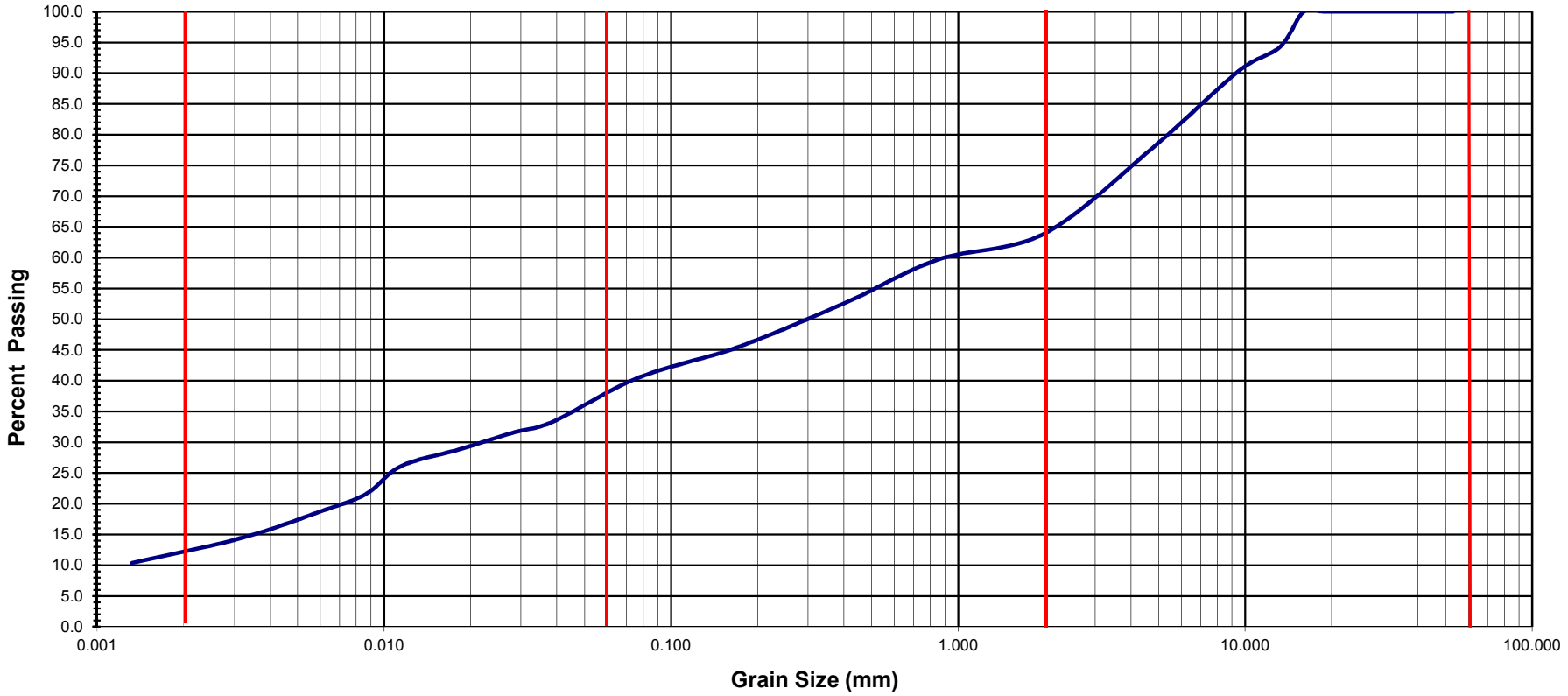
Grain-Size Distribution Curve

Method of Test for Particle Size Analysis of Soil

MTO Test Method LS - 702, Rev. No. 19

Modified M.I.T. Classification

CLAY	SILT			SAND			GRAVEL			
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	



Exp Project No.:	**OTT-00238207**	**Project Name :**	**Geotechnical Investigation of Beechwood Avenue**		
Client :	**Takyan Developments**	**Project Location :**	**245 Beechwood Ave, Ottawa**		
Date Sampled :	**June 27, 2017**	**Bore Hole/Test Pit No.:**	**3**	**Sample No.: SS4**	**Depth (m) : 2.3-2.9**
Sample Description :		**Silty Sandy Gravel, with some Clay**			**Figure :**

Appendix C: Borehole Logs

Log of Borehole MW17-1

Project No: OTT-00238207-A0

Project: Phase Two ESA

Location: 229-247 Beechwood Avenue, Ottawa, ON

Figure No. 3

Page. 1 of 1

Date Drilled: 'June 26, 2017

Drill Type: Truck CME55

Datum: Geodetic

Logged by: MD Checked by: ZG

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
	ASPHALT ~50 mm	58.7	0				
	FILL Sand and gravel, some silt, crusher run limestone, grey to brown, moist to wet, (very loose to compact)	58.7	0	1	75		
			1	10	70		
				50/100 mm	65		
	SHALE BEDROCK Dark grey shale, moderately to highly fractured, weathered at the surface (very poor to poor quality). a 13 cm of drak grey to black stiff silty clay seam/layer/pocket was encountered at 3.8 m depth.	56.9	2			RUN 1	
		55.88	3			RUN 2	
			4			RUN 3	
			5			RUN 4	
			6			RUN 5	
		52.6				RUN 6	
	Auger Refusal at 6.1 m Depth						

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 31-mm diameter slotted standpipe was installed in the borehole at 6.1 m depth and sealed from 2.7 m depth to ground surface
3. Field work supervised by an **exp** representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00238207-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	1.4	
1 day	2.5	
11 days	2.8	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	1.75 - 2.24	100	0
2	2.24 - 3.58	100	18
3	3.58 - 3.91	100	0
4	3.91 - 5.05	100	19
5	5.05 - 5.79	100	34
6	5.8 - 6.1	100	0

LOG OF BOREHOLE - BH LOGS - 238207-A0 229-247 BEECHWOOD AVENUE.GPJ TROW OTTAWA.GDT 7/24/17

Log of Borehole BH17- 2

Project No: OTT-00238207-A0

Project: Phase Two ESA

Location: 229-247 Beechwood Avenue, Ottawa, ON

Figure No. 4

Page. 1 of 1

Date Drilled: 'June 26, 2017

Drill Type: Truck CME55

Datum: Geodetic

Logged by: MD Checked by: ZG

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		TOPSOIL ~125 mm	60.97	0
		FILL Sand and gravel, some silt to silty, crusher run limestone, grey to brown, moist to wet, (loose to compact). Fragments of shale bedrock at 2.4 m depth.	60.9	
		Spoon Refusal at 2.4 m Depth	58.6	2
▼			58.02	

Standard Penetration Test N Value: 20 40 60 80
Shear Strength kPa: 50 100 150 200
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES | Natural Unit Wt. kN/m³

Depth 0: 7 ○ | 15 □ ×
Depth 1: 14 ○ | 45 ⊠
Depth 2: 17 ○ | 35 □ ×
50/100 mm ○ | 35 ⊠

LOG OF BOREHOLE BH LOGS - 238207-A0 229-247 BEECHWOOD AVENUE.GPJ TROW OTTAWA.GDT 7/24/17

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with bentonite upon completion
3. Field work supervised by an **exp** representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00238207-A0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	Dry	
11 days	3.0	

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole MW17-3

Project No: OTT-00238207-A0

Project: Phase Two ESA

Location: 229-247 Beechwood Avenue, Ottawa, ON

Figure No. 5

Page. 1 of 1

Date Drilled: 'June 27, 2017

Drill Type: Truck CME55

Datum: Geodetic

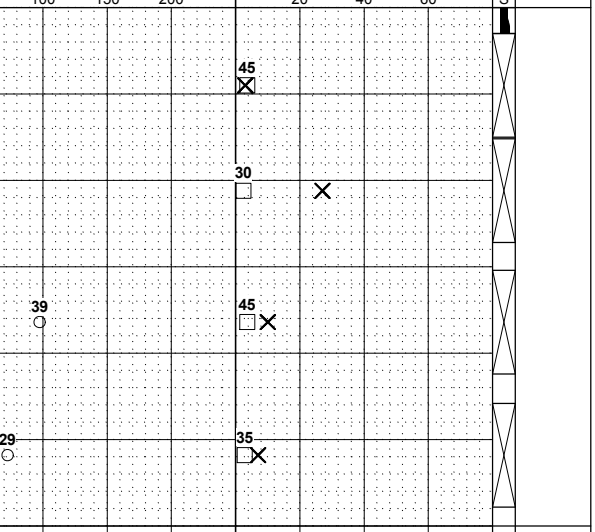
Logged by: MD Checked by: ZG

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		ASPHALT ~150 mm	59.49	0
		FILL Sand and gravel, some silt to silty, crusher run limestone, grey to brown, moist to wet, (loose)	59.3	
		TOPSOIL ~75 mm	58.7	
		SAND Fine, some silt, dark brown to grey, (loose).	58.6	1
		TILL Sand, with some gravel to gravelly, cobbles and boulders, grey (compact to dense). Fragments of shale bedrock below 2.7 m depth.	58.0	
			57.67	2
		Auger Refusal at 3 m Depth	56.5	3

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60
SAMPLES
Natural Unit Wt. kN/m³



NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 31-mm diameter slotted standpipe was installed in the borehole at 4.9 m depth and sealed from 1.5 m depth to ground surface
3. Field work supervised by an **exp** representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00238207-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	3.1	
12 days	1.8	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE BH LOGS - 238207-A0 229-247 BEECHWOOD AVENUE.GPJ TROW OTTAWA.GDT 7/24/17

Log of Borehole MW17-4

Project No: OTT-00238207-A0

Project: Phase Two ESA

Location: 229-247 Beechwood Avenue, Ottawa, ON

Figure No. 6

Page. 1 of 1

Date Drilled: 'June 27, 2017

Drill Type: Truck CME55

Datum: Geodetic

Logged by: MD Checked by: ZG

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		ASPHALT ~150 mm	60.5	0	20 40 60 80 / 50 100 150 200 kPa	250 500 750 / 20 40 60		
		FILL Sand and silt, some silt, debris of brick, organic matter and roots, grey to brown, moist to wet, (very loose to dense). Fragments of shale bedrock below 1.8 m depth.	60.4		7	25		
				1	17	40		
			58.7		46	45		
				2				
		Auger Refusal at 2.3 m Depth	58.2					

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 31-mm diameter slotted standpipe was installed in the borehole at 4.4 m depth and sealed from 1.1 m depth to ground surface
3. Field work supervised by an **exp** representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00238207-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
12 days	1.8	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE BH LOGS - 238207-A0 229-247 BEECHWOOD AVENUE.GPJ TROW OTTAWA.GDT 7/24/17

Log of Borehole MW17-5

Project No: OTT-00238207-A0

Project: Phase Two ESA

Location: 229-247 Beechwood Avenue, Ottawa, ON

Figure No. 7

Page. 1 of 1

Date Drilled: 'June 27, 2017

Drill Type: Manual

Datum: Geodetic

Logged by: MD Checked by: ZG

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~180 mm	60.63	0	20 40 60 80 / 50 100 150 200 kPa	250 500 750 / 20 40 60		
		FILL Sand, some gravel to gravelly, some silt, organic matter, roots, silty clay pockets, grey to brown, moist to wet. Silty clay, roots, between 0.6 m and 2.4 m depth.	60.5			40		
			59.64	1		45		
						55		
		Borehole Terminated at 1.8 m Depth	58.8					

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 31-mm diameter slotted standpipe was installed in the borehole at 1.8 m depth and sealed at the ground surface
3. Field work supervised by an **exp** representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00238207-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
12 days	1.0	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE BH LOGS - 238207-A0 229-247 BEECHWOOD AVENUE.GPJ TROW OTTAWA.GDT 7/24/17

Log of Borehole BH17-6

Project No: OTT-00238207-A0

Project: Phase Two ESA

Location: 229-247 Beechwood Avenue, Ottawa, ON

Figure No. 8

Page. 1 of 1

Date Drilled: 'June 27, 2017

Drill Type: Manual

Datum: Geodetic

Logged by: MD Checked by: ZG

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth 0	Standard Penetration Test N Value 20 40 60 80 / Shear Strength kPa 50 100 150 200	Combustible Vapour Reading (ppm) 250 500 750 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~200 mm	60.79					
		FILL Sand and gravel, some silt, brown, moist.	60.6			40 □		
			60.0			×		
		Auger Refusal at 0.8 m Depth						

LOG OF BOREHOLE BH LOGS - 238207-A0 229-247 BEECHWOOD AVENUE.GPJ TROW OTTAWA.GDT 7/24/17

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled with bentonite upon completion
3. Field work supervised by an **exp** representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00238207-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Upon Completion	Dry	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Appendix D - Analytical Summary Tables

TABLE 1 SOIL ANALYTICAL RESULTS *(µg/g)*
PETROLEUM HYDROCARBONS
229-231, 239-247 Beechwood Avenue, Ottawa, Ontario

(µg/g)

Parameter	**MOECC Table 1[1]**	**MOECC Table 7[2]**	MW17-1 SS2	BH17-1A	BH17-1B	BH17-1C	MW17-3 SS3	MW17-4 SS3	MW17-5 S3	MW17-10 SS7
Sample Date (d/m/y)	**Background**	**Residential**	26/6/2017	08/11/17	08/11/17	08/11/17	27/6/2017	27/6/2017	27/6/2017	Duplicate of
Sample Depth (mbsg)			0.75 - 1.35	0.00 - 0.30	0.05 - 0.60	0.30 - 0.75	1.5 - 2.1	1.5 - 2.1	1.2 - 1.8	MW17-5 S3
Acetone	0.5	16	NA	NA	NA	NA	NA	<0.50	NA	NA
Benzene	0.02	0.21	<0.02	NA	NA	NA	<0.02	<0.02	<0.02	<0.02
Bromodichloromethane	0.05	13	NA	NA	NA	NA	NA	<0.05	NA	NA
Bromoform	0.05	0.27	NA	NA	NA	NA	NA	<0.05	NA	NA
Bromomethane	0.05	0.05	NA	NA	NA	NA	NA	<0.05	NA	NA
Carbon Tetrachloride	0.05	0.05	NA	NA	NA	NA	NA	<0.05	NA	NA
Chlorobenzene	0.05	2.4	NA	NA	NA	NA	NA	<0.05	NA	NA
Chloroform	0.05	0.05	NA	NA	NA	NA	NA	<0.05	NA	NA
Dibromochloromethane	0.05	9.4	NA	NA	NA	NA	NA	<0.05	NA	NA
Dibromodifluoromethane	0.05	16	NA	NA	NA	NA	NA	<0.05	NA	NA
1,2-Dichlorobenzene	0.05	3.4	NA	NA	NA	NA	NA	<0.05	NA	NA
1,3-Dichlorobenzene	0.05	4.8	NA	NA	NA	NA	NA	<0.05	NA	NA
1,4-Dichlorobenzene	0.05	0.083	NA	NA	NA	NA	NA	<0.05	NA	NA
1,1-Dichloroethane	0.05	3.5	NA	NA	NA	NA	NA	<0.05	NA	NA
1,2-Dichloroethane	0.05	0.05	NA	NA	NA	NA	NA	<0.05	NA	NA
1,1-Dichloroethylene	0.05	0.05	NA	NA	NA	NA	NA	<0.05	NA	NA
Cis-1,2-Dichloroethylene	0.05	3.4	NA	NA	NA	NA	NA	<0.05	NA	NA
Trans-1,2-Dichloroethylene	0.05	0.084	NA	NA	NA	NA	NA	<0.05	NA	NA
1,2-Dichloropropane	0.05	0.05	NA	NA	NA	NA	NA	<0.05	NA	NA
Cis-1,3-Dichloropropylene	0.05	0.05	NA	NA	NA	NA	NA	<0.05	NA	NA
Trans-1,3-Dichloropropylene	0.05		NA	NA	NA	NA	NA		NA	NA
Ethylbenzene	0.05	2	<0.05	NA	NA	NA	<0.05	<0.05	<0.05	<0.05
Ethylene Dibromide	0.05	0.05	NA	NA	NA	NA	NA	<0.05	NA	NA
Hexane	0.05	2.8	NA	NA	NA	NA	NA	<0.05	NA	NA
Methyl Ethyl Ketone	0.5	16	NA	NA	NA	NA	NA	<0.50	NA	NA
Methyl Isobutyl Ketone	0.5	1.7	NA	NA	NA	NA	NA	<0.50	NA	NA
Methyl-t-Butyl Ether	0.05	0.75	NA	NA	NA	NA	NA	<0.05	NA	NA
Methylene Chloride	0.05	0.1	NA	NA	NA	NA	NA	<0.05	NA	NA
Styrene	0.05	0.7	NA	NA	NA	NA	NA	<0.05	NA	NA
1,1,1,2-Tetrachloroethane	0.05	0.058	NA	NA	NA	NA	NA	<0.05	NA	NA
1,1,2,2-Tetrachloroethane	0.05	0.05	NA	NA	NA	NA	NA	<0.05	NA	NA
Tetrachloroethylene	0.2	0.28	NA	NA	NA	NA	NA	<0.05	NA	NA
Toluene	0.05	2.3	<0.05	NA	NA	NA	<0.05	<0.05	<0.05	<0.05
1,1,1-Trichloroethane	0.05	0.38	NA	NA	NA	NA	NA	<0.05	NA	NA
1,1,2-Trichloroethane	0.05	0.05	NA	NA	NA	NA	NA	<0.05	NA	NA
Trichloroethylene	0.05	0.061	NA	NA	NA	NA	NA	<0.05	NA	NA
Trichlorofluoromethane	0.25	4	NA	NA	NA	NA	NA	<0.05	NA	NA
Vinyl Chloride	0.02	0.02	NA	NA	NA	NA	NA	<0.02	NA	NA
Total Xylenes	0.05	3.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
PHC F1	25	55	<7	NA	NA	NA	<7	12	<7	<7
PHC F2	10	98	9	<10	<10	<10	<4	<4	9	7
PHC F3	240	300	**324**	100	<50	<50	<8	<8	<8	9
PHC F4	120	2800	**980**	<50	<50	<50	<6	<6	<6	<6
PHC F4 (gravimetric)	120	2800	1610	NA	NA	NA	NA	NA	NA	NA

NOTES:

1 MOECC *Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the EPA, April 2011, Table 1 background concentrations.*

2 MOECC *Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the EPA, April 2011, Table 7 non potable residential standards, coarse grained soil.*

Bold Concentration exceeds MOECC Table 1 background concentrations.

Shaded Concentration exceeds MOECC Table 7 residential soil quality standard.

TABLE 2 SOIL ANALYTICAL RESULTS *(µg/g)*
METALS
229-231, 239-247 Beechwood Avenue, Ottawa, Ontario

Parameter	**MOECC Table 1[1]**	**MOECC Table 7[2]**	MW17-2 SS3	MW17-3 SS2
Sample Date (d/m/y)	**Background**	**Residential**	26/6/2017	27/6/2017
Sample Depth (mbsg)			1.5 - 2.1	0.75 - 1.35
Antimony	1.3	7.5	<1.0	<1.0
Arsenic	18	18	<1.0	<1.0
Barium	220	390	38.1	21.6
Beryllium	2.5	4	<1.0	<1.0
Boron	36	120	4.9	5.4
Cadmium	1.2	1.2	<0.5	<0.5
Chromium	70	160	17.8	11.0
Cobalt	21	22	9.7	4.7
Copper	92	140	16.6	10.0
Lead	120	120	7.4	5.4
Molybdenum	2.0	6.9	<1.0	<1.0
Nickel	82	100	14.3	7.9
Selenium	1.5	2.4	<1.0	<1.0
Silver	0.5	20	<0.5	<0.5
Thallium	1	1	<1.0	<1.0
Uranium	2.5	23	<1.0	<1.0
Vanadium	86	86	27.8	14.9
Zinc	290	340	22.3	8.9
pH	5 - 11	5 - 11	7.59	NA

NOTES:

1	MOECC *Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the EPA, April 2011, Table 1 background concentrations.*
2	MOECC *Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the EPA, April 2011, Table 7 non potable residential standards, coarse grained soil.*
Bold	Concentration exceeds MOECC Table 1 background concentrations.
Shaded	Concentration exceeds MOECC Table 7 soil quality standard.
N/A	Not analyzed
NV	no value

TABLE 3 GROUNDWATER ANALYTICAL RESULTS *(µg/L)*
PHC and BTEX
229-231, 239-247 Beechwood Avenue, Ottawa, Ontario

Parameter	MOECC Table 7[1]	MW17-1	MW17-3	MW17-4	MW17-5	MW0
Sample Date (d/m/y)		5/7/17	5/7/17	5/7/17	5/7/17	Dup of MW17-5
Acetone	100,000	NA	NA	<5	NA	NA
Benzene	1	<0.5	<0.5	<0.5	<0.5	<0.5
Bromodichloromethane	67,000	NA	NA	<0.5	NA	NA
Bromoform	5	NA	NA	<0.5	NA	NA
Bromomethane	0.89	NA	NA	<0.5	NA	NA
Carbon Tetrachloride	0.20	NA	NA	<0.2	NA	NA
Chlorobenzene	140	NA	NA	<0.5	NA	NA
Chloroform	2	NA	NA	<0.5	NA	NA
Dibromochloromethane	65,000	NA	NA	<0.5	NA	NA
Dichlorodifluoromethane	3,500	NA	NA	<1	NA	NA
1,2-Dichlorobenzene	150	NA	NA	<0.5	NA	NA
1,3-Dichlorobenzene	7,600	NA	NA	<0.5	NA	NA
1,4-Dichlorobenzene	0.5	NA	NA	<0.5	NA	NA
1,1-Dichloroethane	11	NA	NA	<0.5	NA	NA
1,2-Dichloroethane	0.5	NA	NA	<0.5	NA	NA
1,1-Dichloroethylene	0.5	NA	NA	<0.5	NA	NA
Cis-1,2-Dichloroethylene	1.6	NA	NA	<0.5	NA	NA
Trans-1,2-Dichloroethylene	1.6	NA	NA	<0.5	NA	NA
1,2-Dichloropropane	0.58	NA	NA	<0.5	NA	NA
Cis-1,3-Dichloropropylene	0.5	NA	NA	<0.5	NA	NA
Trans-1,3-Dichloropropylene		NA	NA	<0.5	NA	NA
Ethylbenzene	54	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylene Dibromide	0.2	NA	NA	<0.2	NA	NA
Hexane	5	NA	NA	<1	NA	NA
Methyl Ethyl Ketone	21,000	NA	NA	<5	NA	NA
Methylene Chloride	26	NA	NA	<5	NA	NA
Methyl Isobutyl Ketone	5,200	NA	NA	<2	NA	NA
Methyl-t-Butyl Ether	15	NA	NA	<5	NA	NA
Styrene	43	NA	NA	<0.5	NA	NA
1,1,1,2-Tetrachloroethane	1.1	NA	NA	<0.5	NA	NA
1,1,2,2-Tetrachloroethane	0.5	NA	NA	<0.5	NA	NA
Tetrachloroethylene	0.5	NA	NA	<0.5	NA	NA
Toluene	320	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,1-Trichloroethane	23	NA	NA	<0.5	NA	NA
1,1,2-Trichloroethane	0.5	NA	NA	<0.5	NA	NA
Trichloroethylene	0.5	NA	NA	<0.5	NA	NA
Trichlorofluoromethane	2,000	NA	NA	<1	NA	NA
Vinyl Chloride	0.5	NA	NA	<0.5	NA	NA
Total Xylenes	72	<0.5	<0.5	<0.5	<0.5	<0.5
PHC F1	420	<25	<25	<25	<25	<25
PHC F2	150	<100	<100	NA	<100	<100
PHC F3	500	<100	<100	NA	<100	<100
PHC F4	500	<100	<100	NA	<100	<100

NOTES:

1 *XV.1 of the EPA, April 2011, Table 7 non potable standards, coarse grained*

Shaded Concentration exceeds MOECC Table 7 groundwater quality standard.

Appendix E – Laboratory Certificates of Analysis

PARACEL LABORATORIES LTD.
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Certificate of Analysis

exp Services Inc. (Ottawa)

100-2650 Queensview Dr.
Ottawa, ON K2B 8K2
Attn: Mark Devlin

Client PO:
Project: OTT00238207A0
Custody: 37571

Report Date: 5-Jul-2017
Order Date: 28-Jun-2017

Order #: 1726277

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

Paracel ID	Client ID
1726277-01	BH1-SS2
1726277-02	BH2-SS3
1726277-03	BH3-SS3
1726277-04	BH4-SS3
1726277-05	BH5-S3
1726277-06	BH10-SS7

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis
Client: exp Services Inc. (Ottawa)
Client PO:

Report Date: 05-Jul-2017
Order Date: 28-Jun-2017
Project Description: OTT00238207A0

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	3-Jul-17	4-Jul-17
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	30-Jun-17	30-Jun-17
PHC F1	CWS Tier 1 - P&T GC-FID	3-Jul-17	4-Jul-17
PHC F4G (gravimetric)	CWS Tier 1 - Extraction Gravimetric	5-Jul-17	5-Jul-17
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	28-Jun-17	30-Jun-17
REG 153: Metals by ICP/OES, soil	based on MOE E3470, ICP-OES	30-Jun-17	30-Jun-17
REG 153: VOCs by P&T GC/MS	EPA 8260 - P&T GC-MS	3-Jul-17	4-Jul-17
Solids, %	Gravimetric, calculation	29-Jun-17	29-Jun-17

Certificate of Analysis
Client: exp Services Inc. (Ottawa)
Client PO:

Report Date: 05-Jul-2017
Order Date: 28-Jun-2017
Project Description: OTT00238207A0

	Client ID:	BH1-SS2	BH2-SS3	BH3-SS3	BH4-SS3
	Sample Date:	26-Jun-17	26-Jun-17	28-Jun-17	27-Jun-17
	Sample ID:	1726277-01	1726277-02	1726277-03	1726277-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	87.1	96.9	85.4	85.9
General Inorganics					
pH	0.05 pH Units	-	7.59	-	-
Metals					
Antimony	1.0 ug/g dry	-	<1.0	<1.0	-
Arsenic	1.0 ug/g dry	-	<1.0	<1.0	-
Barium	1.0 ug/g dry	-	38.1	21.6	-
Beryllium	1.0 ug/g dry	-	<1.0	<1.0	-
Boron	1.0 ug/g dry	-	4.9	5.4	-
Cadmium	0.5 ug/g dry	-	<0.5	<0.5	-
Chromium	1.0 ug/g dry	-	17.8	11.0	-
Cobalt	1.0 ug/g dry	-	9.7	4.7	-
Copper	1.0 ug/g dry	-	16.6	10.0	-
Lead	1.0 ug/g dry	-	7.4	5.4	-
Molybdenum	1.0 ug/g dry	-	<1.0	<1.0	-
Nickel	1.0 ug/g dry	-	14.3	7.9	-
Selenium	1.0 ug/g dry	-	<1.0	<1.0	-
Silver	0.5 ug/g dry	-	<0.5	<0.5	-
Thallium	1.0 ug/g dry	-	<1.0	<1.0	-
Uranium	1.0 ug/g dry	-	<1.0	<1.0	-
Vanadium	1.0 ug/g dry	-	27.8	14.9	-
Zinc	1.0 ug/g dry	-	22.3	8.9	-
Volatiles					
Acetone	0.50 ug/g dry	-	-	-	<0.50
Benzene	0.02 ug/g dry	-	-	-	<0.02
Bromodichloromethane	0.05 ug/g dry	-	-	-	<0.05
Bromoform	0.05 ug/g dry	-	-	-	<0.05
Bromomethane	0.05 ug/g dry	-	-	-	<0.05
Carbon Tetrachloride	0.05 ug/g dry	-	-	-	<0.05
Chlorobenzene	0.05 ug/g dry	-	-	-	<0.05
Chloroform	0.05 ug/g dry	-	-	-	<0.05
Dibromochloromethane	0.05 ug/g dry	-	-	-	<0.05
Dichlorodifluoromethane	0.05 ug/g dry	-	-	-	<0.05
1,2-Dichlorobenzene	0.05 ug/g dry	-	-	-	<0.05
1,3-Dichlorobenzene	0.05 ug/g dry	-	-	-	<0.05

Certificate of Analysis
Client: exp Services Inc. (Ottawa)
Client PO:

Report Date: 05-Jul-2017
Order Date: 28-Jun-2017
Project Description: OTT00238207A0

	Client ID:	BH1-SS2	BH2-SS3	BH3-SS3	BH4-SS3
	Sample Date:	26-Jun-17	26-Jun-17	28-Jun-17	27-Jun-17
	Sample ID:	1726277-01	1726277-02	1726277-03	1726277-04
	MDL/Units	Soil	Soil	Soil	Soil
1,4-Dichlorobenzene	0.05 ug/g dry	-	-	-	<0.05
1,1-Dichloroethane	0.05 ug/g dry	-	-	-	<0.05
1,2-Dichloroethane	0.05 ug/g dry	-	-	-	<0.05
1,1-Dichloroethylene	0.05 ug/g dry	-	-	-	<0.05
cis-1,2-Dichloroethylene	0.05 ug/g dry	-	-	-	<0.05
trans-1,2-Dichloroethylene	0.05 ug/g dry	-	-	-	<0.05
1,2-Dichloropropane	0.05 ug/g dry	-	-	-	<0.05
cis-1,3-Dichloropropylene	0.05 ug/g dry	-	-	-	<0.05
trans-1,3-Dichloropropylene	0.05 ug/g dry	-	-	-	<0.05
1,3-Dichloropropene, total	0.05 ug/g dry	-	-	-	<0.05
Ethylbenzene	0.05 ug/g dry	-	-	-	<0.05
Ethylene dibromide (dibromoethan	0.05 ug/g dry	-	-	-	<0.05
Hexane	0.05 ug/g dry	-	-	-	<0.05
Methyl Ethyl Ketone (2-Butanone)	0.50 ug/g dry	-	-	-	<0.50
Methyl Isobutyl Ketone	0.50 ug/g dry	-	-	-	<0.50
Methyl tert-butyl ether	0.05 ug/g dry	-	-	-	<0.05
Methylene Chloride	0.05 ug/g dry	-	-	-	<0.05
Styrene	0.05 ug/g dry	-	-	-	<0.05
1,1,1,2-Tetrachloroethane	0.05 ug/g dry	-	-	-	<0.05
1,1,2,2-Tetrachloroethane	0.05 ug/g dry	-	-	-	<0.05
Tetrachloroethylene	0.05 ug/g dry	-	-	-	<0.05
Toluene	0.05 ug/g dry	-	-	-	<0.05
1,1,1-Trichloroethane	0.05 ug/g dry	-	-	-	<0.05
1,1,2-Trichloroethane	0.05 ug/g dry	-	-	-	<0.05
Trichloroethylene	0.05 ug/g dry	-	-	-	<0.05
Trichlorofluoromethane	0.05 ug/g dry	-	-	-	<0.05
Vinyl chloride	0.02 ug/g dry	-	-	-	<0.02
m,p-Xylenes	0.05 ug/g dry	-	-	-	<0.05
o-Xylene	0.05 ug/g dry	-	-	-	<0.05
Xylenes, total	0.05 ug/g dry	-	-	-	<0.05
4-Bromofluorobenzene	Surrogate	-	-	-	104%
Dibromofluoromethane	Surrogate	-	-	-	75.5%
Toluene-d8	Surrogate	-	-	-	92.8%
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	-

Certificate of Analysis
Client: exp Services Inc. (Ottawa)
Client PO:

Report Date: 05-Jul-2017
Order Date: 28-Jun-2017
Project Description: OTT00238207A0

	Client ID:	BH1-SS2	BH2-SS3	BH3-SS3	BH4-SS3
	Sample Date:	26-Jun-17	26-Jun-17	28-Jun-17	27-Jun-17
	Sample ID:	1726277-01	1726277-02	1726277-03	1726277-04
	MDL/Units	Soil	Soil	Soil	Soil
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	97.5%	-	97.3%	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	-	<7	12
F2 PHCs (C10-C16)	4 ug/g dry	9	-	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	324	-	<8	<8
F4 PHCs (C34-C50)	6 ug/g dry	980 [1]	-	<6	<6
F4G PHCs (gravimetric)	50 ug/g dry	1610	-	-	-

	Client ID:	BH5-S3	BH10-SS7	-	-
	Sample Date:	27-Jun-17	27-Jun-17	-	-
	Sample ID:	1726277-05	1726277-06	-	-
	MDL/Units	Soil	Soil	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	81.2	79.4	-	-
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	94.6%	95.6%	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	-	-
F2 PHCs (C10-C16)	4 ug/g dry	9	7	-	-
F3 PHCs (C16-C34)	8 ug/g dry	<8	9	-	-
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
F4G PHCs (gravimetric)	ND	50	ug/g						
Metals									
Antimony	ND	1.0	ug/g						
Arsenic	ND	1.0	ug/g						
Barium	ND	1.0	ug/g						
Beryllium	ND	1.0	ug/g						
Boron	ND	1.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium	ND	1.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	1.0	ug/g						
Lead	ND	1.0	ug/g						
Molybdenum	ND	1.0	ug/g						
Nickel	ND	1.0	ug/g						
Selenium	ND	1.0	ug/g						
Silver	ND	0.5	ug/g						
Thallium	ND	1.0	ug/g						
Uranium	ND	1.0	ug/g						
Vanadium	ND	1.0	ug/g						
Zinc	ND	1.0	ug/g						
Volatiles									
Acetone	ND	0.50	ug/g						
Benzene	ND	0.02	ug/g						
Bromodichloromethane	ND	0.05	ug/g						
Bromoform	ND	0.05	ug/g						
Bromomethane	ND	0.05	ug/g						
Carbon Tetrachloride	ND	0.05	ug/g						
Chlorobenzene	ND	0.05	ug/g						
Chloroform	ND	0.05	ug/g						
Dibromochloromethane	ND	0.05	ug/g						
Dichlorodifluoromethane	ND	0.05	ug/g						
1,2-Dichlorobenzene	ND	0.05	ug/g						
1,3-Dichlorobenzene	ND	0.05	ug/g						
1,4-Dichlorobenzene	ND	0.05	ug/g						
1,1-Dichloroethane	ND	0.05	ug/g						
1,2-Dichloroethane	ND	0.05	ug/g						
1,1-Dichloroethylene	ND	0.05	ug/g						
cis-1,2-Dichloroethylene	ND	0.05	ug/g						
trans-1,2-Dichloroethylene	ND	0.05	ug/g						
1,2-Dichloropropane	ND	0.05	ug/g						
cis-1,3-Dichloropropylene	ND	0.05	ug/g						
trans-1,3-Dichloropropylene	ND	0.05	ug/g						
1,3-Dichloropropene, total	ND	0.05	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Ethylene dibromide (dibromoethane	ND	0.05	ug/g						
Hexane	ND	0.05	ug/g						
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g						
Methyl Isobutyl Ketone	ND	0.50	ug/g						
Methyl tert-butyl ether	ND	0.05	ug/g						
Methylene Chloride	ND	0.05	ug/g						
Styrene	ND	0.05	ug/g						
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g						
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g						
Tetrachloroethylene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
1,1,1-Trichloroethane	ND	0.05	ug/g						
1,1,2-Trichloroethane	ND	0.05	ug/g						
Trichloroethylene	ND	0.05	ug/g						
Trichlorofluoromethane	ND	0.05	ug/g						
Vinyl chloride	ND	0.02	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: 4-Bromofluorobenzene	*3.06*		*ug/g*		*95.5*	*50-140*			
Surrogate: Dibromofluoromethane	*3.33*		*ug/g*		*104*	*50-140*			
Surrogate: Toluene-d8	*3.44*		*ug/g*		*108*	*50-140*			
Benzene	ND	0.02	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: Toluene-d8	*3.44*		*ug/g*		*108*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
pH	6.99	0.05	pH Units	6.89			1.4	10	
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	8	4	ug/g dry	9			5.4	30	
F3 PHCs (C16-C34)	176	8	ug/g dry	324			59.2	30	QR-04
F4 PHCs (C34-C50)	597	6	ug/g dry	980			48.5	30	ORG01, QR-04
Metals									
Antimony	ND	1.0	ug/g dry	ND			0.0	30	
Arsenic	ND	1.0	ug/g dry	ND				30	
Barium	140	1.0	ug/g dry	141			1.3	30	
Beryllium	ND	1.0	ug/g dry	ND			0.0	30	
Boron	12.2	1.0	ug/g dry	13.5			10.3	30	
Cadmium	ND	0.5	ug/g dry	ND			0.0	30	
Chromium	27.0	1.0	ug/g dry	27.7			2.6	30	
Cobalt	10.5	1.0	ug/g dry	10.8			2.6	30	
Copper	15.9	1.0	ug/g dry	16.4			2.7	30	
Lead	21.1	1.0	ug/g dry	21.4			1.6	30	
Molybdenum	ND	1.0	ug/g dry	ND			0.0	30	
Nickel	17.6	1.0	ug/g dry	18.7			6.3	30	
Selenium	ND	1.0	ug/g dry	ND			0.0	30	
Silver	ND	0.5	ug/g dry	ND			0.0	30	
Thallium	ND	1.0	ug/g dry	ND			0.0	30	
Uranium	ND	1.0	ug/g dry	ND				30	
Vanadium	40.0	1.0	ug/g dry	41.3			3.3	30	
Zinc	52.3	1.0	ug/g dry	55.4			5.9	30	
Physical Characteristics									
% Solids	81.7	0.1	% by Wt.	82.2			0.6	25	
Volatiles									
Acetone	ND	0.50	ug/g dry	ND				50	
Benzene	ND	0.02	ug/g dry	ND				50	
Bromodichloromethane	ND	0.05	ug/g dry	ND				50	
Bromoform	ND	0.05	ug/g dry	ND				50	
Bromomethane	ND	0.05	ug/g dry	ND				50	
Carbon Tetrachloride	ND	0.05	ug/g dry	ND				50	
Chlorobenzene	ND	0.05	ug/g dry	ND				50	
Chloroform	ND	0.05	ug/g dry	ND				50	
Dibromochloromethane	ND	0.05	ug/g dry	ND				50	
Dichlorodifluoromethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,3-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,4-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
cis-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
trans-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
1,2-Dichloropropane	ND	0.05	ug/g dry	ND				50	
cis-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
trans-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Ethylene dibromide (dibromoethane	ND	0.05	ug/g dry	ND				50	
Hexane	ND	0.05	ug/g dry	ND				50	
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g dry	ND				50	
Methyl Isobutyl Ketone	ND	0.50	ug/g dry	ND				50	
Methyl tert-butyl ether	ND	0.05	ug/g dry	ND				50	
Methylene Chloride	ND	0.05	ug/g dry	ND				50	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Styrene	ND	0.05	ug/g dry	ND				50	
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
Tetrachloroethylene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
1,1,1-Trichloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2-Trichloroethane	ND	0.05	ug/g dry	ND				50	
Trichloroethylene	ND	0.05	ug/g dry	ND				50	
Trichlorofluoromethane	ND	0.05	ug/g dry	ND				50	
Vinyl chloride	ND	0.02	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	
Surrogate: 4-Bromofluorobenzene	*1.71*		*ug/g dry*		*96.9*	*50-140*			
Surrogate: Dibromofluoromethane	*1.46*		*ug/g dry*		*82.4*	*50-140*			
Surrogate: Toluene-d8	*1.72*		*ug/g dry*		*97.1*	*50-140*			
Benzene	ND	0.02	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	
Surrogate: Toluene-d8	*1.72*		*ug/g dry*		*97.1*	*50-140*			

Certificate of Analysis
Client: exp Services Inc. (Ottawa)
Client PO:

Report Date: 05-Jul-2017
Order Date: 28-Jun-2017
Project Description: OTT00238207A0

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	191	7	ug/g		95.5	80-120			
F2 PHCs (C10-C16)	116	4	ug/g	9	104	60-140			
F3 PHCs (C16-C34)	427	8	ug/g	324	48.3	60-140			QM-4X
F4 PHCs (C34-C50)	126	6	ug/g		102	80-120			
F4G PHCs (gravimetric)	830	50	ug/g		83.0	80-120			
Metals									
Antimony	247		ug/L	ND	98.3	70-130			
Arsenic	317		ug/L	ND	127	70-130			
Barium	1080		ug/L	851	91.2	70-130			
Beryllium	252		ug/L	4.49	98.9	70-130			
Boron	507		ug/L	271	94.4	70-130			
Cadmium	246		ug/L	3.36	97.0	70-130			
Chromium	766		ug/L	554	84.4	70-130			
Cobalt	432		ug/L	216	86.4	70-130			
Copper	557		ug/L	327	91.9	70-130			
Lead	651		ug/L	428	89.0	70-130			
Molybdenum	234		ug/L	9.15	89.9	70-130			
Nickel	551		ug/L	374	71.0	70-130			
Selenium	224		ug/L	ND	89.7	70-130			
Silver	245		ug/L	5.80	95.6	70-130			
Thallium	216		ug/L	9.27	82.6	70-130			
Uranium	262		ug/L	ND	105	70-130			
Vanadium	1020		ug/L	826	79.0	70-130			
Zinc	631		ug/L	429	80.9	70-130			
Volatiles									
Acetone	7.78	0.50	ug/g		77.8	50-140			
Benzene	3.22	0.02	ug/g		80.6	60-130			
Bromodichloromethane	4.11	0.05	ug/g		103	60-130			
Bromoform	4.78	0.05	ug/g		119	60-130			
Bromomethane	3.28	0.05	ug/g		82.0	50-140			
Carbon Tetrachloride	4.02	0.05	ug/g		101	60-130			
Chlorobenzene	3.67	0.05	ug/g		91.8	60-130			
Chloroform	3.55	0.05	ug/g		88.8	60-130			
Dibromochloromethane	4.74	0.05	ug/g		118	60-130			
Dichlorodifluoromethane	4.58	0.05	ug/g		114	50-140			
1,2-Dichlorobenzene	3.50	0.05	ug/g		87.6	60-130			
1,3-Dichlorobenzene	3.42	0.05	ug/g		85.6	60-130			
1,4-Dichlorobenzene	3.42	0.05	ug/g		85.6	60-130			
1,1-Dichloroethane	4.41	0.05	ug/g		110	60-130			
1,2-Dichloroethane	3.25	0.05	ug/g		81.2	60-130			
1,1-Dichloroethylene	4.58	0.05	ug/g		114	60-130			
cis-1,2-Dichloroethylene	3.75	0.05	ug/g		93.8	60-130			
trans-1,2-Dichloroethylene	4.38	0.05	ug/g		109	60-130			
1,2-Dichloropropane	3.72	0.05	ug/g		92.9	60-130			
cis-1,3-Dichloropropylene	4.17	0.05	ug/g		104	60-130			
trans-1,3-Dichloropropylene	4.16	0.05	ug/g		104	60-130			
Ethylbenzene	3.98	0.05	ug/g		99.4	60-130			
Ethylene dibromide (dibromoethane	3.56	0.05	ug/g		89.0	60-130			
Hexane	3.91	0.05	ug/g		97.6	60-130			
Methyl Ethyl Ketone (2-Butanone)	12.5	0.50	ug/g		125	50-140			
Methyl Isobutyl Ketone	10.1	0.50	ug/g		101	50-140			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Methyl tert-butyl ether	9.76	0.05	ug/g		97.6	50-140			
Methylene Chloride	4.11	0.05	ug/g		103	60-130			
Styrene	3.88	0.05	ug/g		97.1	60-130			
1,1,1,2-Tetrachloroethane	4.16	0.05	ug/g		104	60-130			
1,1,2,2-Tetrachloroethane	3.52	0.05	ug/g		87.9	60-130			
Tetrachloroethylene	3.66	0.05	ug/g		91.4	60-130			
Toluene	3.78	0.05	ug/g		94.4	60-130			
1,1,1-Trichloroethane	3.41	0.05	ug/g		85.3	60-130			
1,1,2-Trichloroethane	3.58	0.05	ug/g		89.6	60-130			
Trichloroethylene	3.72	0.05	ug/g		93.0	60-130			
Trichlorofluoromethane	4.86	0.05	ug/g		121	50-140			
Vinyl chloride	3.85	0.02	ug/g		96.2	50-140			
m,p-Xylenes	7.85	0.05	ug/g		98.2	60-130			
o-Xylene	3.92	0.05	ug/g		98.0	60-130			
Surrogate: 4-Bromofluorobenzene	*3.23*		*ug/g*		*101*	*50-140*			
Benzene	3.22	0.02	ug/g		80.6	60-130			
Ethylbenzene	3.98	0.05	ug/g		99.4	60-130			
Toluene	3.78	0.05	ug/g		94.4	60-130			
m,p-Xylenes	7.85	0.05	ug/g		98.2	60-130			
o-Xylene	3.92	0.05	ug/g		98.0	60-130			

Qualifier Notes:

Sample Qualifiers :

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

QC Qualifiers :

ORG01 : GC-FID signal did not return to baseline by C50

QM-4X : The spike recovery was outside of QC acceptance limits due to elevated analyte concentration.

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

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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

CCME PHC additional information:

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

Paracel ID: 1726277

PARACEL LABORATORIES LTD. | TRUSTEI RESPON RELIABLE

e: paracel@paracellabs.com

Chain of Custody (Lab Use Only)

№ 37571

Page 1 of 1

Client Name: Exp Services Inc.	Project Reference: OTT-00238207-A0	**Turnaround Time:**
Contact Name: Mark Devlin / Shawn Doherty / Mark Hi	Quote #: 9116	☐ 1 Day ☐ 3 Day
Address: 100-2650 Queensview Dr. Ottawa	PO #:	☐ 2 Day ☒ Regular
Telephone: (613) 688 1899	Email Address:	Date Required:

Criteria: ☐ O. Reg. 153/04 (As Amended) Table 1 ☐ 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: 1726277

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	Required Analyses: PHC/BTEX	Metals (TCP)	pH	(hold)	VOC					
1	BH1-SS2	S		2	June 26, 17		X							250ml + 1 vial		
2	BH2-SS2	↓		1	↓			X		X				250ml		
3	BH2-SS3			1				X	X					↓		
4	BH3-SS2			1	June 27, 17 ✓			X		X						
5	BH3-SS3			2			X	X						250ml + 1 vial		
6	BH4-SS3			2			X				X					
7	BH5-SS3			2			X									
8	BH10-SS7	↓		2	↓		X							↓		
9																
10																

* No. 4 - Sample date on jar read = June 28, 17

Comments: hold BH2-SS2 inless BH2-SS3 has insufficient volume → June 28th as per mark D.
hold BH3-SS2 inless BH3-SS3 has insufficient volume

Method of Delivery: Walk in

Relinquished By (Sign): Mark Devlin	Received by Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): Mark Devlin	Date/Time:	Date/Time: June 28/17	Date/Time: June 28/17 2:35pm
Date/Time: June 28, 2017 / 12:11 pm	Temperature: °C	Temperature: 10.9 °C 12:10P	pH Verified [ ] By:

Chain of Custody (Blank) - Rev 0.4 Feb 2016

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Certificate of Analysis

exp Services Inc. (Ottawa)

100-2650 Queensview Dr.
Ottawa, ON K2B 8K2
Attn: Jeff O'Banion

Client PO:
Project: 238207
Custody: 37609

Report Date: 13-Jul-2017
Order Date: 7-Jul-2017

Order #: 1728068

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

Paracel ID	Client ID
1728068-01	MW1
1728068-02	MW3
1728068-03	MW4
1728068-04	MW5
1728068-05	MW0

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis
Client: exp Services Inc. (Ottawa)
Client PO:

Report Date: 13-Jul-2017
Order Date: 7-Jul-2017
Project Description: 238207

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	13-Jul-17	13-Jul-17
PHC F1	CWS Tier 1 - P&T GC-FID	12-Jul-17	13-Jul-17
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	11-Jul-17	12-Jul-17
REG 153: VOCs by P&T GC/MS	EPA 624 - P&T GC-MS	12-Jul-17	13-Jul-17

Certificate of Analysis
Client: exp Services Inc. (Ottawa)
Client PO:

Report Date: 13-Jul-2017
Order Date: 7-Jul-2017
Project Description: 238207

	Client ID:	MW1	MW3	MW4	MW5
	Sample Date:	07-Jul-17	07-Jul-17	07-Jul-17	07-Jul-17
	Sample ID:	1728068-01	1728068-02	1728068-03	1728068-04
	MDL/Units	Water	Water	Water	Water
Volatiles					
Acetone	5.0 ug/L	-	-	<5.0	-
Benzene	0.5 ug/L	-	-	<0.5	-
Bromodichloromethane	0.5 ug/L	-	-	<0.5	-
Bromoform	0.5 ug/L	-	-	<0.5	-
Bromomethane	0.5 ug/L	-	-	<0.5	-
Carbon Tetrachloride	0.2 ug/L	-	-	<0.2	-
Chlorobenzene	0.5 ug/L	-	-	<0.5	-
Chloroform	0.5 ug/L	-	-	<0.5	-
Dibromochloromethane	0.5 ug/L	-	-	<0.5	-
Dichlorodifluoromethane	1.0 ug/L	-	-	<1.0	-
1,2-Dichlorobenzene	0.5 ug/L	-	-	<0.5	-
1,3-Dichlorobenzene	0.5 ug/L	-	-	<0.5	-
1,4-Dichlorobenzene	0.5 ug/L	-	-	<0.5	-
1,1-Dichloroethane	0.5 ug/L	-	-	<0.5	-
1,2-Dichloroethane	0.5 ug/L	-	-	<0.5	-
1,1-Dichloroethylene	0.5 ug/L	-	-	<0.5	-
cis-1,2-Dichloroethylene	0.5 ug/L	-	-	<0.5	-
trans-1,2-Dichloroethylene	0.5 ug/L	-	-	<0.5	-
1,2-Dichloropropane	0.5 ug/L	-	-	<0.5	-
cis-1,3-Dichloropropylene	0.5 ug/L	-	-	<0.5	-
trans-1,3-Dichloropropylene	0.5 ug/L	-	-	<0.5	-
1,3-Dichloropropene, total	0.5 ug/L	-	-	<0.5	-
Ethylbenzene	0.5 ug/L	-	-	<0.5	-
Ethylene dibromide (dibromoethan	0.2 ug/L	-	-	<0.2	-
Hexane	1.0 ug/L	-	-	<1.0	-
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	-	-	<5.0	-
Methyl Isobutyl Ketone	5.0 ug/L	-	-	<5.0	-
Methyl tert-butyl ether	2.0 ug/L	-	-	<2.0	-
Methylene Chloride	5.0 ug/L	-	-	<5.0	-
Styrene	0.5 ug/L	-	-	<0.5	-
1,1,1,2-Tetrachloroethane	0.5 ug/L	-	-	<0.5	-
1,1,2,2-Tetrachloroethane	0.5 ug/L	-	-	<0.5	-
Tetrachloroethylene	0.5 ug/L	-	-	<0.5	-
Toluene	0.5 ug/L	-	-	<0.5	-
1,1,1-Trichloroethane	0.5 ug/L	-	-	<0.5	-

Certificate of Analysis
Client: exp Services Inc. (Ottawa)
Client PO:

Report Date: 13-Jul-2017
Order Date: 7-Jul-2017
Project Description: 238207

	Client ID:	MW1	MW3	MW4	MW5
	Sample Date:	07-Jul-17	07-Jul-17	07-Jul-17	07-Jul-17
	Sample ID:	1728068-01	1728068-02	1728068-03	1728068-04
	MDL/Units	Water	Water	Water	Water
1,1,2-Trichloroethane	0.5 ug/L	-	-	<0.5	-
Trichloroethylene	0.5 ug/L	-	-	<0.5	-
Trichlorofluoromethane	1.0 ug/L	-	-	<1.0	-
Vinyl chloride	0.5 ug/L	-	-	<0.5	-
m,p-Xylenes	0.5 ug/L	-	-	<0.5	-
o-Xylene	0.5 ug/L	-	-	<0.5	-
Xylenes, total	0.5 ug/L	-	-	<0.5	-
4-Bromofluorobenzene	Surrogate	-	-	102%	-
Dibromofluoromethane	Surrogate	-	-	111%	-
Toluene-d8	Surrogate	-	-	109%	-
Benzene	0.5 ug/L	<0.5	<0.5	-	<0.5
Ethylbenzene	0.5 ug/L	<0.5	<0.5	-	<0.5
Toluene	0.5 ug/L	<0.5	<0.5	-	<0.5
m,p-Xylenes	0.5 ug/L	<0.5	<0.5	-	<0.5
o-Xylene	0.5 ug/L	<0.5	<0.5	-	<0.5
Xylenes, total	0.5 ug/L	<0.5	<0.5	-	<0.5
Toluene-d8	Surrogate	109%	110%	-	112%
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	<25	<25	<25
F2 PHCs (C10-C16)	100 ug/L	<100	<100	-	<100
F3 PHCs (C16-C34)	100 ug/L	<100	<100	-	<100
F4 PHCs (C34-C50)	100 ug/L	<100	<100	-	<100

Certificate of Analysis
Client: exp Services Inc. (Ottawa)
Client PO:

Report Date: 13-Jul-2017
Order Date: 7-Jul-2017
Project Description: 238207

	Client ID:	MW0	-	-	-
	Sample Date:	07-Jul-17	-	-	-
	Sample ID:	1728068-05	-	-	-
	MDL/Units	Water	-	-	-
Volatiles					
Benzene	0.5 ug/L	<0.5	-	-	-
Ethylbenzene	0.5 ug/L	<0.5	-	-	-
Toluene	0.5 ug/L	<0.5	-	-	-
m,p-Xylenes	0.5 ug/L	<0.5	-	-	-
o-Xylene	0.5 ug/L	<0.5	-	-	-
Xylenes, total	0.5 ug/L	<0.5	-	-	-
Toluene-d8	Surrogate	111%	-	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	-	-	-
F2 PHCs (C10-C16)	100 ug/L	<100	-	-	-
F3 PHCs (C16-C34)	100 ug/L	<100	-	-	-
F4 PHCs (C34-C50)	100 ug/L	<100	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
Volatiles									
Acetone	ND	5.0	ug/L						
Benzene	ND	0.5	ug/L						
Bromodichloromethane	ND	0.5	ug/L						
Bromoform	ND	0.5	ug/L						
Bromomethane	ND	0.5	ug/L						
Carbon Tetrachloride	ND	0.2	ug/L						
Chlorobenzene	ND	0.5	ug/L						
Chloroform	ND	0.5	ug/L						
Dibromochloromethane	ND	0.5	ug/L						
Dichlorodifluoromethane	ND	1.0	ug/L						
1,2-Dichlorobenzene	ND	0.5	ug/L						
1,3-Dichlorobenzene	ND	0.5	ug/L						
1,4-Dichlorobenzene	ND	0.5	ug/L						
1,1-Dichloroethane	ND	0.5	ug/L						
1,2-Dichloroethane	ND	0.5	ug/L						
1,1-Dichloroethylene	ND	0.5	ug/L						
cis-1,2-Dichloroethylene	ND	0.5	ug/L						
trans-1,2-Dichloroethylene	ND	0.5	ug/L						
1,2-Dichloropropane	ND	0.5	ug/L						
cis-1,3-Dichloropropylene	ND	0.5	ug/L						
trans-1,3-Dichloropropylene	ND	0.5	ug/L						
1,3-Dichloropropene, total	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Ethylene dibromide (dibromoethane	ND	0.2	ug/L						
Hexane	ND	1.0	ug/L						
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L						
Methyl Isobutyl Ketone	ND	5.0	ug/L						
Methyl tert-butyl ether	ND	2.0	ug/L						
Methylene Chloride	ND	5.0	ug/L						
Styrene	ND	0.5	ug/L						
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L						
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L						
Tetrachloroethylene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
1,1,1-Trichloroethane	ND	0.5	ug/L						
1,1,2-Trichloroethane	ND	0.5	ug/L						
Trichloroethylene	ND	0.5	ug/L						
Trichlorofluoromethane	ND	1.0	ug/L						
Vinyl chloride	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: 4-Bromofluorobenzene	*87.9*		*ug/L*		*110*	*50-140*			
Surrogate: Dibromofluoromethane	*83.9*		*ug/L*		*105*	*50-140*			
Surrogate: Toluene-d8	*89.4*		*ug/L*		*112*	*50-140*			
Benzene	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: Toluene-d8	*89.4*		*ug/L*		*112*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND				30	
Volatiles									
Acetone	ND	5.0	ug/L	ND				30	
Benzene	ND	0.5	ug/L	ND				30	
Bromodichloromethane	ND	0.5	ug/L	ND				30	
Bromoform	ND	0.5	ug/L	ND				30	
Bromomethane	ND	0.5	ug/L	ND				30	
Carbon Tetrachloride	ND	0.2	ug/L	ND				30	
Chlorobenzene	ND	0.5	ug/L	ND				30	
Chloroform	ND	0.5	ug/L	ND				30	
Dibromochloromethane	ND	0.5	ug/L	ND				30	
Dichlorodifluoromethane	ND	1.0	ug/L	ND				30	
1,2-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,3-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,4-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,1-Dichloroethane	ND	0.5	ug/L	ND				30	
1,2-Dichloroethane	ND	0.5	ug/L	ND				30	
1,1-Dichloroethylene	0.76	0.5	ug/L	0.97			24.3	30	
cis-1,2-Dichloroethylene	250	0.5	ug/L	264			5.7	30	
trans-1,2-Dichloroethylene	111	0.5	ug/L	118			6.3	30	
1,2-Dichloropropane	ND	0.5	ug/L	ND				30	
cis-1,3-Dichloropropylene	ND	0.5	ug/L	ND				30	
trans-1,3-Dichloropropylene	ND	0.5	ug/L	ND				30	
Ethylbenzene	ND	0.5	ug/L	ND				30	
Ethylene dibromide (dibromoethane	ND	0.2	ug/L	ND				30	
Hexane	ND	1.0	ug/L	ND				30	
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L	ND				30	
Methyl Isobutyl Ketone	ND	5.0	ug/L	ND				30	
Methyl tert-butyl ether	ND	2.0	ug/L	ND				30	
Methylene Chloride	ND	5.0	ug/L	ND				30	
Styrene	ND	0.5	ug/L	ND				30	
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L	ND				30	
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L	ND				30	
Tetrachloroethylene	ND	0.5	ug/L	ND				30	
Toluene	ND	0.5	ug/L	ND				30	
1,1,1-Trichloroethane	ND	0.5	ug/L	ND				30	
1,1,2-Trichloroethane	ND	0.5	ug/L	ND				30	
Trichloroethylene	258	0.5	ug/L	276			6.6	30	
Trichlorofluoromethane	ND	1.0	ug/L	ND				30	
Vinyl chloride	8.06	0.5	ug/L	8.41			4.3	30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: 4-Bromofluorobenzene	*83.6*		*ug/L*		*104*	*50-140*			
Surrogate: Dibromofluoromethane	*84.2*		*ug/L*		*105*	*50-140*			
Surrogate: Toluene-d8	*89.0*		*ug/L*		*111*	*50-140*			
Benzene	ND	0.5	ug/L	ND				30	
Ethylbenzene	ND	0.5	ug/L	ND				30	
Toluene	ND	0.5	ug/L	ND				30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: Toluene-d8	*89.0*		*ug/L*		*111*	*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)	1910	25	ug/L		95.7	68-117			
Volatiles									
Acetone	96.6	5.0	ug/L		96.6	50-140			
Benzene	34.5	0.5	ug/L		86.2	60-130			
Bromodichloromethane	38.8	0.5	ug/L		97.0	60-130			
Bromoform	46.2	0.5	ug/L		115	60-130			
Bromomethane	35.0	0.5	ug/L		87.6	50-140			
Carbon Tetrachloride	40.1	0.2	ug/L		100	60-130			
Chlorobenzene	38.7	0.5	ug/L		96.8	60-130			
Chloroform	35.6	0.5	ug/L		88.9	60-130			
Dibromochloromethane	44.4	0.5	ug/L		111	60-130			
Dichlorodifluoromethane	28.9	1.0	ug/L		72.3	50-140			
1,2-Dichlorobenzene	41.7	0.5	ug/L		104	60-130			
1,3-Dichlorobenzene	41.5	0.5	ug/L		104	60-130			
1,4-Dichlorobenzene	41.8	0.5	ug/L		104	60-130			
1,1-Dichloroethane	34.7	0.5	ug/L		86.8	60-130			
1,2-Dichloroethane	34.0	0.5	ug/L		85.1	60-130			
1,1-Dichloroethylene	31.0	0.5	ug/L		77.5	60-130			
cis-1,2-Dichloroethylene	36.8	0.5	ug/L		92.0	60-130			
trans-1,2-Dichloroethylene	30.8	0.5	ug/L		77.1	60-130			
1,2-Dichloropropane	38.2	0.5	ug/L		95.4	60-130			
cis-1,3-Dichloropropylene	43.0	0.5	ug/L		108	60-130			
trans-1,3-Dichloropropylene	39.8	0.5	ug/L		99.6	60-130			
Ethylbenzene	42.0	0.5	ug/L		105	60-130			
Ethylene dibromide (dibromoethane	40.0	0.2	ug/L		100	60-130			
Hexane	33.6	1.0	ug/L		84.1	60-130			
Methyl Ethyl Ketone (2-Butanone)	78.5	5.0	ug/L		78.5	50-140			
Methyl Isobutyl Ketone	98.3	5.0	ug/L		98.3	50-140			
Methyl tert-butyl ether	89.6	2.0	ug/L		89.6	50-140			
Methylene Chloride	35.9	5.0	ug/L		89.8	60-130			
Styrene	41.4	0.5	ug/L		103	60-130			
1,1,1,2-Tetrachloroethane	43.3	0.5	ug/L		108	60-130			
1,1,2,2-Tetrachloroethane	42.7	0.5	ug/L		107	60-130			
Tetrachloroethylene	39.3	0.5	ug/L		98.3	60-130			
Toluene	39.3	0.5	ug/L		98.2	60-130			
1,1,1-Trichloroethane	36.6	0.5	ug/L		91.6	60-130			
1,1,2-Trichloroethane	34.6	0.5	ug/L		86.4	60-130			
Trichloroethylene	33.1	0.5	ug/L		82.7	60-130			
Trichlorofluoromethane	33.6	1.0	ug/L		84.0	60-130			
Vinyl chloride	34.2	0.5	ug/L		85.6	50-140			
m,p-Xylenes	79.2	0.5	ug/L		99.0	60-130			
o-Xylene	39.1	0.5	ug/L		97.8	60-130			
Surrogate: 4-Bromofluorobenzene	*83.2*		*ug/L*		*104*	*50-140*			
Benzene	34.5	0.5	ug/L		86.2	60-130			
Ethylbenzene	42.0	0.5	ug/L		105	60-130			
Toluene	39.3	0.5	ug/L		98.2	60-130			
m,p-Xylenes	79.2	0.5	ug/L		99.0	60-130			
o-Xylene	39.1	0.5	ug/L		97.8	60-130			

Qualifier Notes:

Login Qualifiers :

Sample - Received with >5% sediment, instructed to perform whole bottle extraction (analyze with sediment)
Applies to samples: MW1

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

CCME PHC additional information:

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

Paracel ID: 1728068

PARACEL LABORATORIES LTD. | TRUSTE RESPON RELIABLE.

e: paracel@paracellabs.com

Chain of Custody
(Lab Use Only)
№ 37609

Page ___ of ___

Client Name: exp. Services	Project Reference: 238207	**Turnaround Time:**
Contact Name: Jeff O'Banion / Mark McCalla	Quote #	☐ 1 Day ☐ 3 Day
Address: 2650 Queensview Drive	PO #	☐ 2 Day ☒ Regular
Telephone: 613-897-7645	Email Address: mark.mccalla@exp.com jeffery.o'banion@exp.com	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: 1728068

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	F1-F4	PHC	VOC								Bottles
1	MW1	GW			07.07.2017	11:00am	✓	✓				>5% sediment.					3
2	MW3						✓	✓									3
3	MW4					11:45am		✓	✓	F1-VOC per Jeff SC							2
4	MW5					10:30am	✓	✓									3
5	MW6						✓	✓									3
6																	
7																	
8																	
9																	
10																	

Comments: Whole bottle extraction as per Jeff SC

Method of Delivery: Walk-in

Relinquished By (Sign):	Received by Driver/Depot: Karen Cull	Received at Lab: SUNEERAJAN DENMAI	Verified By:
Relinquished By (Print): Jeff O'Banion	Date/Time: July 7/17 4:06	Date/Time: JUL 10 2017 10:50	Date/Time: 07/10/17 1:46pm
Date/Time: 07.07.2017	Temperature: 13.7°C	Temperature: 7.6°C	pH Verified [ ] By:

Your Project #: 238207-AO
Site Location: BEACH WOOD
Your C.O.C. #: 98213

Attention:Jeffery O'Banion

exp Services Inc
100-2650 Queensview Drive
Ottawa, ON
K2B 8H6

Report Date: 2017/08/17
Report #: R4657564
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7H2433
Received: 2017/08/11, 11:45

Sample Matrix: Soil
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Petroleum Hydrocarbons F2-F4 in Soil (1)	3	2017/08/15	2017/08/15	OTT SOP-00001	CCME CWS
Moisture	3	N/A	2017/08/15	CAM SOP-00445	McKeague 2nd ed 1978

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following "Alberta Environment's Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003". Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxam.ca

Your Project #: 238207-AO
Site Location: BEACH WOOD
Your C.O.C. #: 98213

Attention:Jeffery O'Banion

exp Services Inc
100-2650 Queensview Drive
Ottawa, ON
K2B 8H6

Report Date: 2017/08/17
Report #: R4657564
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7H2433
Received: 2017/08/11, 11:45

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Alison Cameron, Project Manager
Email: ACameron@maxxam.ca
Phone# (613) 274-0573
==========
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Maxxam Job #: B7H2433
Report Date: 2017/08/17

exp Services Inc
Client Project #: 238207-AO
Site Location: BEACH WOOD
Sampler Initials: JO

RESULTS OF ANALYSES OF SOIL

Maxxam ID		EXQ120	EXQ120	EXQ121	EXQ122		
Sampling Date		2017/08/11 10:30	2017/08/11 10:30	2017/08/11 10:30	2017/08/11 10:30		
COC Number		98213	98213	98213	98213		
	UNITS	**BH17-1**	**BH17-1 Lab-Dup**	**BH17-2**	**BH17-3**	**RDL**	**QC Batch**
Inorganics							
Moisture	%	13	14	16	13	0.2	5119167

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

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Report Date: 2017/08/17

exp Services Inc
Client Project #: 238207-AO
Site Location: BEACH WOOD
Sampler Initials: JO

PETROLEUM HYDROCARBONS (CCME)

Maxxam ID		EXQ120	EXQ121	EXQ122		
Sampling Date		2017/08/11 10:30	2017/08/11 10:30	2017/08/11 10:30		
COC Number		98213	98213	98213		
	UNITS	**BH17-1**	**BH17-2**	**BH17-3**	**RDL**	**QC Batch**
F2-F4 Hydrocarbons						
F2 (C10-C16 Hydrocarbons)	ug/g	<10	<10	<10	10	5119128
F3 (C16-C34 Hydrocarbons)	ug/g	100	<50	<50	50	5119128
F4 (C34-C50 Hydrocarbons)	ug/g	<50	<50	<50	50	5119128
Reached Baseline at C50	ug/g	Yes	Yes	Yes		5119128
Surrogate Recovery (%)						
o-Terphenyl	%	95	107	109		5119128

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B7H2433
Report Date: 2017/08/17

exp Services Inc
Client Project #: 238207-AO
Site Location: BEACH WOOD
Sampler Initials: JO

TEST SUMMARY

Maxxam ID: EXQ120
Sample ID: BH17-1
Matrix: Soil

Collected: 2017/08/11
Shipped:
Received: 2017/08/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	5119128	2017/08/15	2017/08/15	Paul Rubinato
Moisture	BAL	5119167	N/A	2017/08/15	Liliana Gaburici

Maxxam ID: EXQ120 Dup
Sample ID: BH17-1
Matrix: Soil

Collected: 2017/08/11
Shipped:
Received: 2017/08/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	5119167	N/A	2017/08/15	Liliana Gaburici

Maxxam ID: EXQ121
Sample ID: BH17-2
Matrix: Soil

Collected: 2017/08/11
Shipped:
Received: 2017/08/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	5119128	2017/08/15	2017/08/15	Paul Rubinato
Moisture	BAL	5119167	N/A	2017/08/15	Liliana Gaburici

Maxxam ID: EXQ122
Sample ID: BH17-3
Matrix: Soil

Collected: 2017/08/11
Shipped:
Received: 2017/08/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	5119128	2017/08/15	2017/08/15	Paul Rubinato
Moisture	BAL	5119167	N/A	2017/08/15	Liliana Gaburici

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Maxxam Job #: B7H2433
Report Date: 2017/08/17

exp Services Inc
Client Project #: 238207-AO
Site Location: BEACH WOOD
Sampler Initials: JO

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	14.3°C

Results relate only to the items tested.

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Maxxam Job #: B7H2433
Report Date: 2017/08/17

QUALITY ASSURANCE REPORT

exp Services Inc
Client Project #: 238207-AO
Site Location: BEACH WOOD
Sampler Initials: JO

			SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5119128	o-Terphenyl	2017/08/15	108	30 - 130	101	%		
5119128	F2 (C10-C16 Hydrocarbons)	2017/08/15	103	80 - 120	<10	ug/g	4.0	50
5119128	F3 (C16-C34 Hydrocarbons)	2017/08/15	103	80 - 120	<50	ug/g	4.0	50
5119128	F4 (C34-C50 Hydrocarbons)	2017/08/15	103	80 - 120	<50	ug/g	4.0	50
5119167	Moisture	2017/08/15					7.5	50

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

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exp Services Inc
Client Project #: 238207-AO
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Sampler Initials: JO

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Steve Roberts, Ottawa Lab Manager

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CAM FCD-01191/3

CHAIN OF CUSTODY RECORD 098213

Page ____ of ____

Invoice Information	Report Information (if differs from invoice)	Project Information (where applicable)	Turnaround Time (TAT) Required
Company Name: exp.	Company Name: exp.	Quotation #:	[X] Regular TAT (5-7 days) Most analyses
Contact Name:	Contact Name: Jeff O'Brien	P.O. #/ AFE#:	PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address:	Address: Mark McCalla	Project #: 238207-A0	Rush TAT (Surcharges will be applied)
		Site Location: Beach Road	[ ] 1 Day [ ] 2 Days [ ] 3-4 Days
Phone: Fax:	Phone: 613-897-7645 Fax:	Site #:	
Email:	Email: jeffery.obanion@exp.com Mark.McCalla@exp.com	Sampled By: Jeff O.	Date Required:

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Rush Confirmation #:

Regulation 153
[ ] Table 1 [X] Res/Park [ ] Med/ Fine
[ ] Table 2 [ ] Ind/Comm [ ] Coarse
[ ] Table 3 [ ] Agri/ Other
[ ] Table ____
FOR RSC (PLEASE CIRCLE) Y / N

Other Regulations
[ ] CCME [ ] Sanitary Sewer Bylaw
[ ] MISA [ ] Storm Sewer Bylaw
[ ] PWQO Region ____
[ ] Other (Specify) ____
[ ] REG 558 (MIN. 3 DAY TAT REQUIRED)

Include Criteria on Certificate of Analysis: Y / N

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

Analysis Requested

LABORATORY USE ONLY

CUSTODY SEAL (Y) / N — Present: Y — Intact: Y
COOLER TEMPERATURES: 15, 14, 15
COOLING MEDIA PRESENT: (Y) / N

	SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED (CIRCLE) Metals / Hg / CrVI	BTEX/ PHC F1	PHCs F2 - F4	VOCs	REG 153 METALS & INORGANICS	REG 153 ICPMS METALS	REG 153 METALS (Hg, Cr VI, ICPMS Metals, HWS - B)	HOLD- DO NOT ANALYZE	COMMENTS
1	BH17-1	08.11.2017	10:30am	Soil				✓						Disp Disposal F1 vials
2	BH17-2	"	"	"				✓						
3	BH17-3	"	"	"				✓						
4														
5														
6														On ice packs
7														
8														
9														
10														

RECEIVED IN OTTAWA
11-Aug-17 11:45
Alison Cameron
B7H2433
KIV OTT-001

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	MAXXAM JOB #
Jeff O'Brien	2017.08.11	11:45am	Mariana Dawson/Dawson	2017/08/14	11:45	

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COC-1004 (03/17)

White: Maxxam ~ Yellow: Client