PATERSON GROUP

Phase II – Environmental Site Assessment

1540 Star Top Road

Ottawa, Ontario

Prepared for BBS Construction

Report: PE6080-2R
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TABLE OF CONTENTS

PAGE

List of Figures

List of Appendices

EXECUTIVE SUMMARY

Assessment

Paterson Group was retained by BBS Construction to conduct a Phase II – Environmental Site Assessment (Phase II-ESA) for the property addressed Star Top Road, Ottawa, Ontario. The purpose of the Phase II-ESA was to address potentially contaminating activities (PCAs) that were identified during the Phase I-ESA and were considered to result in areas of potential environmental concern (APECs) on Phase II Property.

The subsurface investigation for this assessment was conducted on May 10 and May 11, 2023, and consisted of drilling eleven boreholes (BH1-23 to BH10-23) across the Phase II Property, of which four were equipped with groundwater monitoring wells (BH1-23, BH2-23, BH3-23, and BH7-23). The boreholes were advanced to depths ranging from approximately 1.8 m to 6.8 m below the existing ground surface and terminated within an overburden layer of fill, silty sand, silty clay or within bedrock. Four boreholes were cored into the bedrock (BH1-23, BH2-23, BH3-23, and BH7-23) and completed with groundwater monitoring well installations to access the groundwater table.

In general, the subsurface soil profile encountered at the borehole locations consists of fill material (crushed stone, topsoil, brown silty sand, trace clay, occasional gravel) underlain by grey silty clay, brown silty sand, and glacial till. Bedrock consisting of black shale was encountered in BH1-23, BH2-23, BH3-23, and BH7-23 at depths ranging from approximately 1.9 to 2.9m below grade.

Nine soil samples were submitted for laboratory analysis of BTEX, PHCs (F1-F4), VOCs, metals and/or pH parameters. Based on the analytical test results, elevated levels of pH, outside the acceptable range for surface or subsurface soils, were identified in Soil Samples BH3-23-SS2, BH5-23-SS2, BH6-23-SS2 and BH9-23-SS2. In accordance with O.Reg. 153/04, Section 41 applies to the Phase II Property and Table 1 standards for a commercial land use were selected.

Parameter concentrations identified at the Phase II Property comply with the MECP Table 1 standards for a commercial land use, apart from the PHC F_4 concentrations identified in Soil Sample BH1-23-SS2.

Three groundwater samples were submitted for laboratory analysis of BTEX, PHCs (F1-F4) and VOCs. Chloroform and trichloroethylene parameters were detected at concentrations meeting the MECP Table 1 standards, in the groundwater sample recovered from BH2.

Otherwise, no parameter concentrations were identified in the groundwater samples analysed. As such, the groundwater at the Phase II Property complies with the selected MECP standards.

Recommendations

Soil Impacts

Based on the findings of this assessment, elevated pH levels were identified on the western portion of the Phase II Property. As such, Table 1 standards for a commercial land use were used, in accordance with O.Reg. 153/04. Fill material with PHC F_4 concentrations exceeding the MECP Table 1 standards was identified at BH1-23-SS2, on the northeastern portion of the Phase II Property. Given the shallow nature of the impacts, they are expected to be associated with the presence of transport trucks on this portion of the site.

Given the nature of the impacts and the location outside of the existing buildings and the proposed commercial warehouse building, in combination with the continued use of the Phase II Property for commercial/light industrial operations, the elevated levels of PHC and pH are not considered to pose a concern to the subject site.

On-site and Excess Soil Management

It is our understanding that the western portion of the Phase II Property will be redeveloped with a commercial warehouse building. Any excess soil generated from the construction of the proposed redevelopment should be handled in accordance with O.Reg. 406/19.

Monitoring Wells

The monitoring wells will be registered with the MECP under Ontario Regulation 903 (Ontario Water Resources Act). At such a time that the monitoring wells are no longer required, they must be decommissioned in accordance with O.Reg. 903.

1.0 INTRODUCTION

At the request of BBS Construction, Paterson Group (Paterson) conducted a Phase II – Environmental Site Assessment (Phase II-ESA) for the property addressed 1540 Star top Road, in the City of Ottawa, Ontario (the Phase II Property).

The purpose of this Phase II-ESA has been to address the areas of potential environmental concern (APECs) identified on the Phase II Property during the Phase I ESA conducted by Paterson in June of 2023.

1.1 Site Description

Address:	1540 Star top Road, in the City of Ottawa, Ontario.
Location:	The Phase II Property is located on the west side of Star Top Road approximately 210m south of the Star Top Road and Algoma Road intersection, in the City of Ottawa, Ontario. Refer to Figure 1 - Key Plan in the Figures section following the text.
Latitude and Longitude:	45° 24' 53.8164" N, 75° 36' 59.9976" W

Site Description:

Configuration:	Irregular.
Area:	3.41 ha (approximately).
Zoning:	IL – Light Industrial Zone
Current Use:	The Phase I Property is currently occupied by a commercial office building on the eastern portion of the subject site. Storage areas for Boone Plumbing and Heating Supply Inc. and Maurice Yelle Ltd. are located on the northern and southern portions of the Phase II Property.
Services:	The Phase II Property is situated in a municipally serviced area.

1.2 Property Ownership

The Phase II Property is currently owned by Boone Plumbing and Heating Supply Inc. Paterson was retained to complete this Phase II-ESA by Mr. Pete Van Grootheest with BBS Construction Ltd. Mr. Van Grootheest can be reached at (613) 226-8830.

1.3 Applicable Site Condition Standard

The site condition standards for the Phase II Property were obtained from Table 3 of the document entitled, *"Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act"*, prepared by the Ministry of the Environment, Conservation and Parks (MECP), and dated April 15, 2011. The selected MECP standards are based on the following considerations:

- ❒ Full depth soil conditions;
- ❒ Coarse-grained soil conditions;
- ❒ Non-potable groundwater conditions;
- ❒ Commercial/Industrial land use.

Section 35 of O.Reg. 153/04 does apply to the Phase II ESA Property in that the property does not rely upon potable groundwater.

While the Phase II Property is not within 30m of an environmentally sensitive area, the soil pH at some locations on the Phase II Property is outside of the acceptable range for surface and subsurface soil. As such, Section 41 applies to the Phase II Property and Table 1 standards have been selected.

Section 43.1 of O.Reg. 153/04 does not apply to the Phase II ESA Property in that the property is not a Shallow Soil property.

The intended use of the Phase II ESA Property is commercial; therefore, the Commercial/Industrial Standards have been selected for the purpose of this Phase II ESA.

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The eastern portion of the Phase I Property is occupied by a one-storey commercial office building that is currently being used for offices of Transport Training Centres of Canada Inc. The building is heated by natural gas and is finished on the exterior by painted concrete.

Adjacent to the east of the office building exists a former garage building with one service bay. The building is heated by natural gas. Two buildings with maintenance bays, that were part of the concrete plant, are also present on the southwestern and southeastern portions of the subject site and is currently being used as a storage area for Maurice Yell Ltd.

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The subsurface investigation for this assessment was conducted on May 10 and May 11, 2023 and consisted of drilling eleven boreholes (BH1-23 to BH10-23) across the Phase II Property.

The boreholes were advanced to depths ranging from approximately 1.8 m to 6.7 m below the existing ground surface and terminated within an overburden layer of silty sand, silty clay or bedrock. Four boreholes (BH1-23, BH2-23, BH3-23 and BH7-23) were completed with groundwater monitoring well installations in order to access the groundwater table.

3.2 Media Investigated

During the course of this subsurface investigation, soil and groundwater samples were obtained from the Phase II Property and submitted for laboratory analysis. The rationale for sampling and analyzing these media is based on the contaminants of potential concern identified in the Phase I ESA.

The contaminants of potential concern for the soil and/or groundwater on the Phase II Property include the following:

- ❒ Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX);
- ❒ Petroleum Hydrocarbons (PHCs, F1-F4);
- ❒ Volatile organic compounds (VOCs);
- ❒ Metals; and
- ❒ pH.

These CPCs have the potential to be present in the soil matrix and/or the groundwater situated beneath the Phase I Property.

3.3 Phase I ESA Conceptual Site Model

Geological and Hydrogeological Setting

The Geological Survey of Canada website on the Urban Geology of the National Capital Area was consulted as part of this assessment. Based on this information, bedrock in the area of the site consists of Shale of the Carlsbad Formation. Overburden consists of glacial till, with a drift thickness on the order of 2 to 5 m.

Groundwater is anticipated to flow in a northerly direction, towards the Ottawa River, and possibly influenced towards the east given the proximity of Green's Creek.

Water Bodies and Areas of Natural and Scientific Interest

No water bodies are present on the Phase I Property. The nearest named water body with respect to the subject site is Green's Creek, located approximately 385m to the east.

No areas of natural scientific interest were identified within the Phase I Study Area.

Drinking Water Wells

Based on the availability of municipal water services and results of the well records search, no drinking water wells are expected to be present within the Phase I Study Area. One potable water well was identified on the Phase I Property, this water well expected to be related to the operation of the concrete plant and is not considered to be any longer in use.

Neighbouring Land Use

The neighbouring lands within the Phase I study area consist of commercial/light industrial properties. Current land use is shown on Drawing PE6080-2 – Surrounding Land Use Plan, in the Figures section of this report.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

As per Section 7.1 of the Phase I ESA report, six potentially contaminating activities (PCAs) resulting in areas of potential environmental concern (APECs), were identified on the Phase I Property. These APECs include:

Table 1
Areas of Potential Environmental Concern

APEC	Location of APEC	PCA (O. Reg. 153/04 – Table 2)	Location of PCA	Contaminants of Potential Concern	Media Potentially Impacted
APEC #1 Garage building with maintenance bays and former in-ground hoist.	Eastern portion of subject site	*"Item 52: Storage, maintenance, fuelling and repair of equipment, vehicles, and material used to maintain transportation systems"*	On-Site	BTEX PHCs VOCs	Soil Groundwater
APEC #2 Former pump island with underground storage tanks	Eastern portion of subject site	*"Item 28: Gasoline and Associated Products Storage in Fixed Tanks"*	On-Site	BTEX PHCs	Soil Groundwater
APEC #3 Abandoned Aboveground storage tank	Southeastern portion of subject site	*"Item 28: Gasoline and Associated Products Storage in Fixed Tanks"*	On-Site	BTEX PHCs	Soil Groundwater
APEC #4 Former concrete plant.	Western portion of the subject site	*"Item 12: Concrete, Cement and Lime Manufacturing"*	On-Site	Metals pH	Soil
APEC #5 Former automotive service garage	Eastern Portion of subject site	*"Item 52: Storage, maintenance, fuelling and repair of equipment, vehicles, and material used to maintain transportation systems"*	Off-Site	BTEX PHCs	Soil Groundwater

Contaminants of Potential Concern

The contaminants of potential concern for the soil and/or groundwater on the Phase II Property include the following:

- ❒ Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX);
- ❒ Petroleum Hydrocarbons (PHCs, F1-F4);
- ❒ Volatile organic compounds (VOCs);
- ❒ Metals; and

- ❒ pH

These CPCs have the potential to be present in the soil matrix and/or the groundwater situated beneath the Phase I Property.

Assessment of Uncertainty and/or Absence of Information

The information available for review as part of the preparation of the Phase I ESA is considered to be sufficient to conclude that there are PCAs and APECs associated with the Phase II Property.

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

3.4 Deviations from the Sampling and Analysis Plan

No deviations from the Sampling and Analysis were made during the course of this Phase II-ESA. Given that possible buried Hydro was identified on the northeastern portion of the property and not located due to site conditions, a proposed borehole at this location was not advanced.

3.5 Physical Impediments

Some proposed borehole locations were impeded by site buildings and buried services. Otherwise, no physical impediments were encountered during the field program.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation for this assessment was conducted on May 10 and May 11, 2023 in conjunction with a Geotechnical Investigation, and consisted of drilling 11 boreholes (BH1-23 to BH10-23) across the Phase II Property to depths ranging from approximately 1.8 m to 6.8 m below grade. Four of the of boreholes (BH1-23, BH2-23, BH3-23 and BH7-23) were cored into the bedrock and completed with monitoring well installations to access the groundwater table. which four were equipped with groundwater monitoring wells.

The boreholes were placed to address the aforementioned areas of potential environmental concern (APECs) and to provide coverage of the proposed building footprint. Under the full-time supervision of Paterson personnel, the boreholes were drilled using a low-clearance drill rig provided by George Downing Estate Drilling of Hawkesbury, Ontario. The locations of the boreholes are illustrated on Drawing PE6080-3 – Test Hole Location Plan, appended to this report.

4.2 Soil Sampling

A total of 33 soil samples and 12 rock core samples were obtained from the boreholes by means of grab sampling from auger flights/auger samples and split spoon sampling, as well as rock cores. Split spoon samples were taken at approximate 0.76 m intervals.

The depths at which auger and split spoon samples were obtained from the boreholes are shown as "**AU**", "**SS**" and "**RC**" respectively, on the Soil Profile and Test Data Sheets appended to this report.

The borehole profiles generally consist of fill consisting of fill consisting of crushed stone, topsoil, brown silty sand, trace clay and occasional gravel underlain by the bedrock formation. The fill layer was observed to be underlain by a layer of silty clay and/or silty sand at BH 3-23, BH 4-23 and BH 8-23.

4.3 Field Screening Measurements

All soil samples collected were subjected to a preliminary screening procedure, which included visual screening for colour and evidence of metals, as well as soil vapour screening with a Photo Ionization Detector.

The recovered soil samples were placed immediately into airtight plastic bags with nominal headspace. All lumps of soil inside the bags were broken by hand, and the soil was allowed to come to room temperature prior to conducting the vapour survey, ensuring consistency of readings between samples.

To measure the soil vapours, the analyser probe was inserted into the nominal headspace above the sample. The sample was then agitated and manipulated gently by hand as the measurement was taken. The peak reading registered within the first 15 seconds was recorded as the vapour measurement. The parts per million (ppm) scale was used to measure concentrations of organic vapours.

A Honeywell MiniRae 3000 photoionization detector (PID) was used to measure volatile organic compound concentration in the headspace of soil samples. The PID device has a range of 0-15,000 ppm, and an accuracy of 0.1 ppm (up to 999.9 ppm), and an accuracy of 1 ppm for measurements between 1000 ppm and 15,000 ppm. The device is calibrated using isobutylene gas.

The PID readings were found to be less than 55 ppm in the soil samples obtained. These results do not indicate the potential for significant contamination from volatile contaminants. Vapour readings are noted on the Soil Profile and Test Data Sheets in Appendix 1.

No olfactory indications of potential contamination were identified in the soil samples. The results of the vapour survey are presented on the Soil Profile and Test Data sheets.

4.4 Groundwater Monitoring Well Installation

Four groundwater monitoring wells were installed on the Phase II Property as part of this assessment. All wells were installed by Downing Drilling, using the Low-Clearance, track-mounted drill rig. Borehole locations and elevations were surveyed geodetically by Paterson personnel.

The monitoring wells were constructed using 32 mm diameter Schedule 40 threaded PVC risers and screens. A sand pack consisting of silica sand was placed around the screen with a bentonite seal placed above to minimize cross-contamination. A summary of the monitoring well construction details are listed below in Table 1 as well as on the Soil Profile and Test Data Sheets provided in Appendix 1.

Table 2
Monitoring Well Construction Details

Well ID	Ground Surface Elevation (m ASL)	Total Depth (m BGS)	Screened Interval (m BGS)	Sand Pack (m BGS)	Bentonite Seal (m BGS)	Casing Type
BH1-23	66.01	5.82	2.19 – 5.53	2.13 – 5.53	0.00 – 2.13	Flush Mount
BH2-23	65.92	5.72	2.34 – 5.38	2.13 – 5.38	0.00 – 2.13	Flush Mount
BH3-23	67.44	6.76	3.25 – 6.29	2.43 – 6.29	0.00 – 2.43	Flush Mount
BH7-23	66.83	5.13	2.09 – 5.13	1.82 – 5.13	0.00 – 1.82	Flush Mount

4.5 Field Measurement of Water Quality Parameters

Groundwater sampling was conducted at BH1, BH2, BH3 and BH7 on May 19, 2023. Water quality parameters were measured in the field using a multi-parameter analyzer. Parameters measured in the field included temperature, pH, and electrical conductivity.

Field parameters were measured after each well volume purged. Wells were purged prior to sampling until at least three well volumes had been removed, the field parameters were relatively stable or the well was dry. Stabilized field parameter values are summarized in Table 3.

Table 3: Field Measurement of Water Quality Parameters – May 19, 2023

Parameter	BH1	BH2	BH3	BH7
Temperature (°C)	10.7	11.6	10.1	10.9
pH	7.28	7.63	7.74	11.38
Electrical Conductivity (µS/cm)	>3999	2190	>3999	>3999

4.6 Groundwater Sampling

Groundwater sampling protocols were followed using the MECP document entitled, *"Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario"*, dated May 1996.

Standing water was purged from each monitoring well prior to the recovery of the groundwater samples using dedicated sampling equipment. The samples were then stored in coolers to reduce possible analyte volatilization during their transportation.

Further details of our standard operating procedure for groundwater sampling are provided in the Sampling and Analysis Plan, appended to this report.

4.7 Analytical Testing

The following soil and groundwater samples were submitted for laboratory analysis:

Table 4
Testing Parameters for Submitted Soil Samples

Sample ID	Sample Depth & Stratigraphic Unit	Parameters Analyzed					Rationale
		BTEX	VOCs	PHCs (F_1-F_4)	Metals	pH	
BH1-23-SS2	0.76 m – 1.37 m Fill Material	X		X			To assess for potential impacts resulting from the former presence of an underground storage tank.
BH2-23-SS3	1.5 m – 2.13 m Fill Material	X	X	X			To assess for potential impacts resulting from the former presence of an in-ground hoist/garage.
BH3-23-SS2	0.76 m – 1.37 m Fill Material	X		X	X	X	To assess for potential impacts resulting from the former presence of a concrete plant.
BH5-23-SS2	0.76 m – 1.37 m Fill Material				X	X	To assess for potential impacts resulting from the presence of former wash pads associated with concrete plant
BH5-23-SS3	1.5 m – 2.13 m Fill Material	X		X			To assess for potential impacts resulting from the presence of former wash pads associated with concrete plant.
BH6-23-SS2	0.76 m – 1.37 m Fill Material				X	X	To assess for potential impacts resulting from the former presence of a concrete plant.
BH7-23-AU1	0.15 m – 0.60 m Fill Material	X		X			To assess for potential impacts resulting from the on-site presence of an AST.
BH8-23-SS2	0.76 m – 1.37 m Fill Material				X	X	To assess for potential impacts resulting from the former presence of a concrete plant.
BH9-23-SS3	1.5 m – 2.13 m Fill Material				X	X	To assess for potential impacts resulting from the former presence of a concrete plant.
DUP-2[1]	0.15 m – 0.60 m Fill Material	X		X			For laboratory QA/QC purposes.
DUP-3[2]	3.04 m – 3.65 m Silty Clay				X		For laboratory QA/QC purposes.

1 – Duplicate sample of BH7-23-AU1
2 – Duplicate sample of BH6-23-SS2

Table 5
Testing Parameters for Submitted Groundwater Samples

Sample ID	Screened Interval & Stratigraphic Unit	Parameters Analyzed			Rationale
		BTEX	VOCs	PHCs (F_1-F_4)	
BH1-23-GW1	2.19 – 5.53 Bedrock	X		X	To assess for potential impacts resulting from the former presence of an underground storage tank.
BH2-23-GW1	2.34 – 5.38 Bedrock	X	X	X	To assess for potential impacts resulting from the former presence of an in-ground hoist/garage.
BH3-23-GW1	3.25 – 6.29 Bedrock	X		X	To assess for potential impacts resulting from the former presence of a concrete plant.
BH7-23-GW1	2.09 – 5.13 Bedrock	X		X	To assess for potential impacts resulting from the on-site presence of an AST.
DUP-1[1]	2.34 – 5.38 Bedrock	X	X	X	For laboratory QA/QC purposes.

1 – Duplicate sample of BH2-23-GW1

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

4.8 Residue Management

All soil cuttings were retained on-site from the site following the field program, while all purge water and equipment cleaning fluids were retained on-site.

4.9 Elevation Surveying

The ground surface elevations at each borehole location were surveyed using a high-precision GPS device by Paterson personnel.

4.10 Quality Assurance and Quality Control Measures

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

5.0 REVIEW AND EVALUATION

5.1 Geology

The borehole profiles generally consist of fill consisting of fill consisting of crushed stone, topsoil, brown silty sand, trace clay and occasional gravel underlain by the bedrock formation. The fill layer was observed to be underlain by a layer of silty clay and/or silty sand at BH 3-23, BH 4-23 and BH 8-23.

Bedrock consisting of black shale was confirmed in BH1-23, BH2-23, BH3-23 and BH7-23 at depths ranging between approximately 1.9 to 2.9 m below grade. Site geology details are provided in the Soil Profile and Test Data Sheets in Appendix 1.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured using an electronic water level meter at BH1-23, BH2-23, BH3-23 and BH7-23 on May 19, 2023. The groundwater levels are summarized below in Table 4.

Table 6
Groundwater Level Measurements

Borehole Location	Ground Surface Elevation (m)	Water Level Depth (m below grade)	Water Level Elevation (m ASL)	Date of Measurement
BH1-23	66.01	2.95	63.06	May 19, 2023
BH2-23	65.92	1.87	64.05	
BH3-23	67.44	1.89	65.55	
BH7-23	66.83	2.19	64.64	

The groundwater at the Phase II Property was encountered within the overburden at depths ranging from approximately 1.87 m to 2.95 m below the existing ground surface. Using the groundwater elevations recorded during the sampling event, groundwater contour mapping was completed as part of this assessment.

According to the mapped contour data, illustrated on Drawing PE6080-3 – Test Hole Location Plan in the appendix, the groundwater flow on the subject site was calculated to be in a northerly direction. A horizontal hydraulic gradient of approximately 0.02 m/m was also calculated as part of this assessment. It should be noted that groundwater levels are expected to fluctuate throughout the year with seasonal variations.

5.3 Fine/Coarse Soil Texture

Grain-size analysis was not completed for the Phase II ESA Property. As such, the more stringent, coarse-grained soil standards were used.

5.4 Field Screening

Field screening of the soil samples collected during the drilling program resulted in organic vapour readings ranging from 0 ppm to 55 ppm. No obvious visual or olfactory indications of potential environmental concerns were identified in the soil samples. The field screening results of each individual soil sample are provided on the Soil Profile and Test Data Sheets appended to this report.

5.5 Soil Quality

Nine soil samples were submitted for laboratory analysis of BTEX, PHCs (F_1-F_4), VOCs, metals and/or pH parameters. The results of the analytical testing are presented below in Tables 7 to 10, as well as on the laboratory Certificates of Analysis included in Appendix 1.

Table 7
Analytical Test Results – Soil
pH

Parameter	MDL (pH Units)	Soil Samples (ug/g)				
		May 10, 2023	May 11, 2023			
		BH3-23-SS2	BH5-23-SS2	BH6-23-SS2	BH8-23-SS2	BH9-23-SS3
		Sample Depth (m bgs)				
		0.76 - 1.37	0.76-1.37	0.76 - 1.37	0.76-1.37	1.52-2.13
pH	0.05	**11.93**	**11.83**	**12.13**	8.43	**12.25**

Notes:
- Acceptable range surface soil (0-1.5m) 5 to 9
- Acceptable range subsurface soil (below 1.5m) 5 to 11
- **Bold and Underlined** – value outside of acceptable range

The pH value in surface soil at BH8 is within the acceptable range, however the pH values in surface soil at BH3, BH5 and BH6 are outside the acceptable range of 5 to 9.

The pH value of 12.25 in the subsurface soil at BH9 is outside the acceptable range of 5 to 11.

Given the pH values fall outside the acceptable ranges for both surface and subsurface soils, section 41 of *Ontario Regulation 153/04* applies, and the Full Depth Background Site Condition Standards of Table 1 must be applied to the property.

Table 8
Analytical Test Results – Soil
BTEX & PHCs (F_1-F_4)

Parameter	MDL (µg/g)	Soil Samples (ug/g)					MECP Table 1 Commercial/ Industrial Soil Standards (µg/g)
		May 10, 2023			May 11, 2023		
		BH1-23-SS2	BH2-23-SS3	BH3-23-SS2	BH5-23-SS3	BH7-23-AU1	
		Sample Depth (m bgs)					
		0.76–1.37	1.5–2.13	0.76 - 1.37	1.5– 2.13	0.15– 0.60	
Benzene	0.02	nd	nd	nd	nd	nd	0.32
Ethylbenzene	0.05	nd	nd	nd	nd	nd	9.5
Toluene	0.05	nd	nd	nd	nd	nd	68
Xylenes	0.05	nd	nd	nd	nd	nd	26
PHCs F_1	7	nd	nd	nd	nd	nd	25
PHCs F_2	4	nd	nd	nd	nd	nd	10
PHCs F_3	8	nd	nd	18	26	88	240
PHCs F_4	6	**777**	nd	28	16	86	120
PHCs F_{4G}	50	**1520**	nd	nd	nd	nd	120

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – value exceeds selected MECP standards

All BTEX or PHCs parameter concentrations comply with the selected MECP Table 1 Commercial/Industrial Soil Standards except for the PHC F_4 and F4G concentrations identified in Soil Sample BH1-23-SS2.

Table 9
Analytical Test Results – Soil
Volatile Organic Compounds (VOCs)

Parameter	MDL (µg/g)	Soil Samples (ug/g)	MECP Table 1 Commercial/Industrial Soil Standards (µg/g)
		May 10, 2023	
		BH2-23-SS3	
		Sample Depth (m bgs)	
		1.5 – 2.13	
Acetone	0.50	nd	0.5
Benzene	0.02	nd	0.02
Bromodichloromethane	0.05	nd	0.05
Bromoform	0.05	nd	0.05
Bromomethane	0.05	nd	0.05
Carbon Tetrachloride	0.05	nd	0.05
Chlorobenzene	0.05	nd	0.05
Chloroform	0.05	nd	0.05
Dibromochloromethane	0.05	nd	0.05
Dichlorodifluoromethane	0.05	nd	0.05
1,2-Dichlorobenzene	0.05	nd	0.05
1,3-Dichlorobenzene	0.05	nd	0.05
1,4-Dichlorobenzene	0.05	nd	0.05
1,1-Dichloroethane	0.05	nd	0.05
1,2-Dichloroethane	0.05	nd	0.05
1,1-Dichloroethylene	0.05	nd	0.05
cis-1,2-Dichloroethylene	0.05	nd	0.05
trans-1,2-Dichloroethylene	0.05	nd	0.05
1,2-Dichloropropane	0.05	nd	0.05
1,3-Dichloropropene	0.05	nd	0.05
Ethylbenzene	0.05	nd	0.05
Ethylene Dibromide	0.05	nd	0.05
Hexane	0.05	nd	0.05
Methyl Ethyl Ketone	0.50	nd	0.5
Methyl Isobutyl Ketone	0.50	nd	0.5
Methyl tert-butyl ether	0.05	nd	0.05
Methylene Chloride	0.05	nd	0.05
Styrene	0.05	nd	0.05
1,1,1,2-Tetrachloroethane	0.05	nd	0.05
1,1,2,2-Tetrachloroethane	0.05	nd	0.05
Tetrachloroethylene	0.05	nd	0.05
Toluene	0.05	nd	0.2
1,1,1-Trichloroethane	0.05	nd	0.05
1,1,2-Trichloroethane	0.05	nd	0.05
Trichloroethylene	0.05	nd	0.05
Trichlorofluoromethane	0.05	nd	0.25
Vinyl Chloride	0.02	nd	0.02
Xylenes	0.05	nd	0.05

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

No VOC parameters were identified in the sample analysed. As such, the results are in compliance with the selected MECP Table 1 Commercial/Industrial Soil Standards.

Table 10
Analytical Test Results – Soil
Metals

Parameter	MDL (µg/g)	Soil Samples (ug/g)					MECP Table 1 Commercial/ Industrial Soil Standards (µg/g))
		May 10, 2023	May 11, 2023				
		BH3-23-SS2	BH5-23-SS2	BH6-23-SS2	BH8-23-SS2	BH9-23-SS3	
		Sample Depth (m bgs)					
		0.76 - 1.37	0.76 - 1.37	0.76 - 1.37	0.76 - 1.37	1.5 - 2.13	
Antimony	1.0	nd	nd	nd	nd	nd	1.3
Arsenic	1.0	1.9	1.8	1.3	3.0	nd	18
Barium	1.0	33.6	46.4	33.6	80.8	25.1	220
Beryllium	0.5	nd	nd	nd	nd	nd	2.5
Boron	5.0	9.9	8.1	8.2	9.2	7.9	36
Cadmium	0.5	nd	nd	nd	nd	nd	1.2
Chromium	5.0	7.7	11.0	8.5	13.4	8.4	70
Cobalt	1.0	2.1	2.3	1.5	3.7	2.8	21
Copper	5.0	nd	5.1	nd	7.4	6.7	92
Lead	1.0	2.6	4.2	2.4	5.6	4.8	120
Molybdenum	1.0	nd	1.2	nd	nd	nd	2
Nickel	5.0	nd	5.6	nd	9.4	5.1	82
Selenium	1.0	nd	nd	nd	nd	nd	1.5
Silver	0.3	nd	nd	nd	nd	nd	0.5
Thallium	1.0	nd	nd	nd	nd	nd	1
Uranium	1.0	nd	nd	nd	nd	nd	2.5
Vanadium	10.0	10.5	10.4	nd	15.9	nd	86
Zinc	20.0	nd	29.1	nd	nd	nd	290

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

All metal parameter concentrations identified in the soil samples analysed comply with the MECP Table 1 Commercial/Industrial Soil Standards.

Maximum concentrations are provided in Table 11 below.

Table 11
Maximum Concentrations – Soil

Parameter	Maximum Concentration (µg/g)	Sample ID	Depth Interval (m BGS)
PHCs F_3	88	BH7-23-AU1	0.15 m – 0.60 m
PHCs F_4	777	BH1-23-SS2	0.76 m – 1.37 m
PHCs F_{4G}	**1520**	BH1-23-SS2	0.76 m – 1.37 m
Arsenic	3.0	BH8-23-SS2	0.76m – 1.37m
Barium	80.8	BH8-23-SS2	0.76m – 1.37m
Boron	9.9	BH3-23-SS2	0.76m – 1.37m
Chromium	13.4	BH8-23-SS2	0.76m – 1.37m
Cobalt	3.7	BH8-23-SS2	0.76m – 1.37m
Copper	7.4	BH8-23-SS2	0.76m – 1.37m
Lead	5.6	BH8-23-SS2	0.76m – 1.37m
Molybdenum	1.2	BH5-23-SS2	0.76m – 1.37m
Nickel	9.4	BH8-23-SS2	0.76m – 1.37m
Vanadium	15.9	BH8-23-SS2	0.76m – 1.37m
Zinc	29.1	BH5-23-SS2	0.76m – 1.37m
pH	**12.25 pH Units**	BH9-23-SS3	1.52m - 2.13m

Notes:
- **Bold and Underlined** – value exceeds selected MECP standards

All other parameter concentrations analyzed were below the laboratory detection limits.

5.6 Groundwater Quality

Three groundwater samples were submitted for laboratory analysis of BTEX, PHCs (F_1-F_4) and VOCs. The results of the analytical testing are presented below in Tables 12 and 13, as well as on the laboratory Certificates of Analysis included in Appendix 1.

Table 12
Analytical Test Results – Groundwater
BTEX and PHCs (F_1-F_4)

Parameter	MDL (µg/L)	Groundwater Samples (ug/L)				MECP Table 1 Non-Potable Groundwater Standards (µg/L)
		May 19, 2023				
		BH1-23-GW1	BH2-23-GW1	BH3-23-GW1	BH7-23-GW1	
		Screening Interval (m bgs)				
		2.19 – 5.53	2.34 – 5.38	3.25 – 6.29	2.09 – 5.13	
Benzene	0.5	nd	nd	nd	nd	0.5
Ethylbenzene	0.5	nd	nd	nd	nd	0.5
Toluene	0.5	nd	nd	nd	nd	0.8
Xylenes	0.5	nd	nd	nd	nd	72
PHCs F_1	25	nd	nd	nd	nd	420
PHCs F_2	100	nd	nd	nd	nd	150
PHCs F_3	100	nd	nd	nd	nd	500
PHCs F_4	100	nd	nd	nd	nd	500

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

No BTEX or PHC parameter concentrations were detected above the laboratory method detection limits in the groundwater samples analyzed. As such, the results comply with the selected MECP Table 1 Non-Potable Standards.

Table 13
Analytical Test Results – Groundwater
Volatile Organic Compounds (VOCs)

Parameter	MDL (µg/L)	Groundwater Sample (ug/L)	MECP Table 1 Non-Potable Groundwater Standards (µg/L)
		May 19, 2023	
		BH2-23-GW1	
		Sample Depth (m bgs)	
		2.19m – 5.53m	
Acetone	5.0	nd	2700
Benzene	0.5	nd	0.5
Bromodichloromethane	0.5	nd	2
Bromoform	0.5	nd	5
Bromomethane	0.5	nd	0.89
Carbon Tetrachloride	0.2	nd	0.2
Chlorobenzene	0.5	nd	0.5
Chloroform	0.5	1.1	2
Dibromochloromethane	0.5	nd	2
Dichlorodifluoromethane	1.0	nd	590
1,2-Dichlorobenzene	0.5	nd	0.5
1,3-Dichlorobenzene	0.5	nd	0.5
1,4-Dichlorobenzene	0.5	nd	0.5
1,1-Dichloroethane	0.5	nd	0.5
1,2-Dichloroethane	0.5	nd	0.5
1,1-Dichloroethylene	0.5	nd	0.5
cis-1,2-Dichloroethylene	0.5	nd	1.6
trans-1,2-Dichloroethylene	0.5	nd	1.6
1,2-Dichloropropane	0.5	nd	0.5
1,3-Dichloropropene	0.5	nd	0.5
Ethylbenzene	0.5	nd	0.5
Ethylene Dibromide	0.2	nd	0.2
Hexane	1.0	nd	5
Methyl Ethyl Ketone	5.0	nd	400
Methyl Isobutyl Ketone	5.0	nd	640
Methyl tert-butyl ether	2.0	nd	15
Methylene Chloride	5.0	nd	5
Styrene	0.5	nd	0.5
1,1,1,2-Tetrachloroethane	0.5	nd	1.1
1,1,2,2-Tetrachloroethane	0.5	nd	0.5
Tetrachloroethylene	0.5	nd	0.5
Toluene	0.5	nd	0.8
1,1,1-Trichloroethane	0.5	nd	0.5
1,1,2-Trichloroethane	0.5	nd	0.5
Trichloroethylene	0.5	0.5	0.5
Trichlorofluoromethane	1.0	nd	150
Vinyl Chloride	0.5	nd	0.5
Xylenes	0.5	nd	72

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

No VOC parameters were identified in the sample analysed, with the exception of chloroform (1.1µg/L) and trichloroethylene (0.5µg/L), which comply with the MECP Table 1 standards.

Maximum groundwater concentrations are presented in Table 14 below.

Table 14
Maximum Concentrations – Groundwater

Parameter	Maximum Concentration (µg/L)	Sample ID	Depth Interval (m BGS)
Chloroform	1.1	BH2-23-GW1	2.19m – 5.53m
Trichloroethylene	0.5	BH2-23-GW1	2.19m – 5.53m

All other parameter concentrations analyzed were below the laboratory detection limits. The laboratory certificates of analysis are provided in Appendix 1.

5.7 Quality Assurance and Quality Control Results

All samples submitted as part of this Phase II ESA were handled in accordance with the analytical protocols with respect to holding time, preservation method, storage requirement, and container type. As per Subsection 47(3) of O. Reg. 153/04, as amended by the Environmental Protection Act, the certificates of analysis have been received for each sample submitted for laboratory analysis and have been appended to this report.

Duplicate soil and groundwater samples from BH7-23-AU1, BH6-23-SS2 and BH2-23-GW1 were submitted for laboratory analysis of metals, BTEX, PHCs (F1-F4) and/or VOCs.

The duplicates were collected with the intent of calculating the relative percent difference (RPD) between duplicate sample values, as a way of assessing the quality of the analytical test results. Several parameter concentrations were not detected in either or both the original sample and duplicate. The RPD values are therefore considered to be 0% and therefore meet the 20% target. The relative percent difference (RPD) calculations for the original and duplicate samples are provided below in Tables 15 and 16.

Table 15
QA/QC Calculations – Soil

Parameter	MDL (µg/g)	BH7-23-AU1	DUP-2	RPD (%)	QA/QC Result (Target: <20% RPD)
Benzene	0.50	nd	nd	0	Meets Target
Ethylbenzene	0.02	nd	nd	0	Meets Target
Toluene	0.05	nd	nd	0	Meets Target
Xylenes	0.05	nd	nd	0	Meets Target
PHCs F_1	0.05	nd	nd	0	Meets Target
PHCs F_2	0.05	nd	nd	0	Meets Target
PHCs F_3	0.05	88	86	2.3	Meets Target
PHCs F_4	0.05	86	89	3.4	Meets Target

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

Table 15 Continued
QA/QC Calculations – Soil

Parameter	MDL (µg/L)	BH6-23-SS2	DUP-3	RPD (%)	QA/QC Result (Target: <20% RPD)
Antimony	1.0	nd	nd	0	Meets Target
Arsenic	1.0	1.3	1.3	0	Meets Target
Barium	1.0	33.6	34.8	3.50	Meets Target
Beryllium	0.5	nd	nd	0	Meets Target
Boron	5.0	8.2	8.6	4.76	Meets Target
Cadmium	0.5	nd	nd	0	Meets Target
Chromium	5.0	8.5	8.6	1.16	Meets Target
Cobalt	1.0	1.5	1.6	6.45	Meets Target
Copper	5.0	nd	nd	0	Meets Target
Lead	1.0	2.4	2.6	4	Meets Target
Molybdenum	1.0	nd	nd	0	Meets Target
Nickel	5.0	nd	nd	0	Meets Target
Selenium	1.0	nd	nd	0	Meets Target
Silver	0.3	nd	nd	0	Meets Target
Thallium	1.0	nd	nd	0	Meets Target
Uranium	1.0	nd	nd	0	Meets Target
Vanadium	10.0	nd	nd	0	Meets Target
Zinc	20.0	nd	nd	0	Meets Target

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

Table 16
QA/QC Calculations – Groundwater

Parameter	MDL (µg/L)	BH2-23-GW1	DUP-GW	RPD (%)	QA/QC Result (Target: <20% RPD)
Acetone	5.0	nd	nd	0	Meets Target
Benzene	0.5	nd	nd	0	Meets Target
Bromodichloromethane	0.5	nd	nd	0	Meets Target
Bromoform	0.5	nd	nd	0	Meets Target
Bromomethane	0.5	nd	nd	0	Meets Target
Carbon Tetrachloride	0.2	nd	nd	0	Meets Target
Chlorobenzene	0.5	nd	nd	0	Meets Target
Chloroform	0.5	1.1	1.2	8.69	Meets Target
Dibromochloromethane	0.5	nd	nd	0	Meets Target
Dichlorodifluoromethane	1.0	nd	nd	0	Meets Target
1,2-Dichlorobenzene	0.5	nd	nd	0	Meets Target
1,3-Dichlorobenzene	0.5	nd	nd	0	Meets Target
1,4-Dichlorobenzene	0.5	nd	nd	0	Meets Target
1,1-Dichloroethane	0.5	nd	nd	0	Meets Target
1,2-Dichloroethane	0.5	nd	nd	0	Meets Target
1,1-Dichloroethylene	0.5	nd	nd	0	Meets Target
cis-1,2-Dichloroethylene	0.5	nd	nd	0	Meets Target
trans-1,2-Dichloroethylene	0.5	nd	nd	0	Meets Target
1,2-Dichloropropane	0.5	nd	nd	0	Meets Target
1,3-Dichloropropene	0.5	nd	nd	0	Meets Target
Ethylbenzene	0.5	nd	nd	0	Meets Target
Ethylene Dibromide	0.2	nd	nd	0	Meets Target
Hexane	1.0	nd	nd	0	Meets Target
Methyl Ethyl Ketone	5.0	nd	nd	0	Meets Target
Methyl Isobutyl Ketone	5.0	nd	nd	0	Meets Target
Methyl tert-butyl ether	2.0	nd	nd	0	Meets Target
Methylene Chloride	5.0	nd	nd	0	Meets Target
Styrene	0.5	nd	nd	0	Meets Target
1,1,1,2-Tetrachloroethane	0.5	nd	nd	0	Meets Target
1,1,2,2-Tetrachloroethane	0.5	nd	nd	0	Meets Target
Tetrachloroethylene	0.5	nd	nd	0	Meets Target
Toluene	0.5	nd	nd	0	Meets Target
1,1,1-Trichloroethane	0.5	nd	nd	0	Meets Target
1,1,2-Trichloroethane	0.5	nd	nd	0	Meets Target
Trichloroethylene	0.5	0.5	0.5	0	Meets Target
Trichlorofluoromethane	1.0	nd	nd	0	Meets Target
Vinyl Chloride	0.5	nd	nd	0	Meets Target
Xylenes	0.5	nd	nd	0	Meets Target

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

Based on the results of the QA/QC analysis, the quality of the field data collected during this Phase II ESA is considered to be sufficient to meet the overall objectives of this assessment.

5.8 Phase II Conceptual Site Model

The following section has been prepared in accordance with the requirements of O. Reg. 153/04 amended by the Environmental Protection Act. Conclusions and recommendations are discussed in a subsequent section.

Site Description

Potentially Contaminating Activity and Areas of Potential Environmental Concern

As described in Section 7.1 of the Phase I ESA report, as well as Section 2.2 of this report, the following PCAs, as defined by Table 2 of O. Reg. 153/04, are considered to result in APECs on the Phase II Property:

Table of Areas of Potential Environmental Concern

Area of Potential Environmental Concern	Location of APEC on Phase I Property	Potentially Contaminating Activity (Table 2 – O. Reg. 153/04)	Location of PCA (On-Site or Off-Site)	Contaminants of Potential Concern	Media Potentially Impacted (Groundwater, Soil, and/or Sediment)
APEC #1 Garage building with maintenance bays and former in-ground hoist.	Eastern portion of subject site	*"Item 52: Storage, maintenance, fuelling and repair of equipment, vehicles, and material used to maintain transportation systems"*	On-Site	BTEX PHCs VOCs	Soil Groundwater
APEC #2 Former pump island with underground storage tanks	Eastern portion of subject site	*"Item 28: Gasoline and Associated Products Storage in Fixed Tanks"*	On-Site	BTEX PHCs	Soil Groundwater
APEC #3 Abandoned Aboveground storage tank	Southeastern portion of subject site	*"Item 28: Gasoline and Associated Products Storage in Fixed Tanks"*	On-Site	BTEX PHCs	Soil Groundwater
APEC #4 Former concrete plant.	Western portion of the subject site	*"Item 12: Concrete, Cement and Lime Manufacturing"*	On-Site	Metals pH	Soil
APEC #5 Former automotive service garage	Eastern Portion of subject site	*"Item 52: Storage, maintenance, fuelling and repair of equipment, vehicles, and material*	Off-Site	BTEX PHCs	Soil Groundwater

Table of Areas of Potential Environmental Concern					
Area of Potential Environmental Concern	**Location of APEC on Phase I Property**	**Potentially Contaminating Activity (Table 2 – O. Reg. 153/04)**	**Location of PCA (On-Site or Off-Site)**	**Contaminants of Potential Concern**	**Media Potentially Impacted (Groundwater, Soil, and/or Sediment)**
		used to maintain transportation systems"			

Contaminants of Potential Concern (CPCs)

The contaminants of potential concern for the soil and/or groundwater on the Phase II Property include the following:

- ❒ Benzene, Ethylbenzene, Toluene, and Xylenes (BTEX);
- ❒ Volatile Organic Compounds (VOCs);
- ❒ Petroleum Hydrocarbons, fractions 1 – 4 (PHCs F_1-F_4);
- ❒ Polycyclic Aromatic Hydrocarbons (PAHs);
- ❒ Metals; and
- ❒ pH

These CPCs have the potential to be present in the soil matrix and/or the groundwater situated beneath the Phase I Property.

Physical Setting

Site Stratigraphy

The stratigraphy of the Phase II Property generally consists of:

- ❒ Concrete (approximately 0.10m thick) or fill material was identified at ground surface at each borehole location. Fill material generally consisted of brown silty sand with gravel and/or crushed stone. The fill generally extended to depths ranging from approximately 0.69 to to 3.7m below grade.

- ❒ Native silty sand or glacial till consisting of a brown silty sand with clay matrix, was identified beneath the fill material at BH2-23, BH3-23 and BH4-23, although a thin layer of topsoil was observed between the fill and topsoil at BH3-23.

- ❒ Black shale bedrock was expected to be present beneath the fill and/or native layers at depths ranging from approximately 1.9 to 3.7m below grade.

As noted previously, bedrock was confirmed at 4 locations at depths ranging from approximately 1.9 to 2.9m below grade.

The site stratigraphy, from ground surface to the deepest aquifer or aquitard investigated, is provided in the Soil Profile and Test Data Sheets in Appendix 1.

Hydrogeological Characteristics

The groundwater at the Phase II Property was encountered within the bedrock at depths ranging from approximately 1.9 m to 2.9 m below the existing ground surface.

Based on the measured groundwater levels, the groundwater was calculated to flow in a northerly direction.

Approximate Depth to Bedrock

Bedrock was confirmed at four borehole locations (BH1-23, BH2-23, BH3-23 and BH7-23) at depths ranging from approximately 1.9 to 2.9 m below ground surface. At the remaining borehole locations, practical refusal to augering was encountered at depths ranging from approximately 1.8 to 3.7m below grade.

Approximate Depth to Water Table

The depth to the water table is approximately 1.9 m to 3.0 m below the existing ground surface.

Sections 41 and 43.1 of Ontario Regulation 153/04

While the Phase II Property is not within 30m of an environmentally sensitive area, the soil pH at some locations on the Phase II Property is outside of the acceptable range for both surface and sub-surface soil. As such, *Section 41 applies to the Phase II Property and Table 1 standards have been selected.*

Section 43.1 of O.Reg. 153/04 does not apply to the Phase II ESA Property in that the property is not a Shallow Soil property.

Environmental Condition

Elevated levels of pH were identified on the western portion of the site in the vicinity of the former concrete plant operation and are expected to be related to the historical concrete industry and the probable deposition of cement dust on the ground. As such, Table 1 standards are applicable to the Phase II Property.

Areas Where Contaminants are Present

Based on the findings of this Phase II ESA, soil impacted with PHC F_4 and F_{4G} concentrations exceeding the MECP Table 1 standards are present on the northeastern portion of the Phase II Property. Groundwater at the Phase II Property was determined to comply with MECP Table 1 standards.

Areas where contaminants are present in soil are identified on Drawing PE6080-5– Analytical Testing Plan.

Types of Contaminants

Based on the findings of this Phase II ESA, types of contaminants on or beneath the Phase II Property include PHC F_4 and F_{4G} in the soil.

Contaminated Media

Soil (fill material) at the Phase II Property is impacted with PHC F_4 and $F_{4G.}$ The groundwater at the Phase II Property complies with the MECP Table 1 standards.

What Is Known About Areas Where Contaminants Are Present

Although the PHC impacted soil was identified in the vicinity of the reported former UST nest, based on the concentrations identified and depth of impact in the shallow fill material, the PHC F_4/F_{4G} concentrations are expected to be related to leaks from transport trucks on site.

Distribution and Migration of Contaminants

The surficial soil/fill in the vicinity of BH1-23 contains concentrations of PHC F4 and F_{4G} in excess of the selected MECP Table 1 Soil Standards. No PHC exceedances were identified in the other analyzed fill samples or the groundwater. As such, no significant distribution or migration of PHCs is considered to have occurred on site.

Discharge of Contaminants

As noted above, the PHC F_4/F_{4G} soil impacts are expected to be related to leaks from transport trucks on site.

Climatic and Meteorological Conditions

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

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

Based on the analytical results, climatic and meteorological conditions are not considered to have significantly impacted contaminant transport on the Phase II Property.

Potential for Vapour Intrusion

Given that PHC F_4 and F_{4G} have low volatility and the identified soil impacts were located outside the existing and future building footprints, there is no significant potential for current or future vapour intrusion at the Phase II Property.

6.0 CONCLUSIONS

Assessment

Paterson Group was retained by BBS Construction to conduct a Phase II – Environmental Site Assessment (Phase II-ESA) for the property addressed Star Top Road, Ottawa, Ontario. The purpose of the Phase II-ESA was to address potentially contaminating activities (PCAs) that were identified during the Phase I-ESA and were considered to result in areas of potential environmental concern (APECs) on Phase II Property.

The subsurface investigation for this assessment was conducted on May 10 and May 11, 2023, and consisted of drilling eleven boreholes (BH1-23 to BH10-23) across the Phase II Property, of which four were equipped with groundwater monitoring wells (BH1-23, BH2-23, BH3-23, and BH7-23). The boreholes were advanced to depths ranging from approximately 1.8 m to 6.8 m below the existing ground surface and terminated within an overburden layer of fill, silty sand, silty clay or within bedrock. Four boreholes were cored into the bedrock (BH1-23, BH2-23, BH3-23, and BH7-23) and completed with groundwater monitoring well installations to access the groundwater table.

In general, the subsurface soil profile encountered at the borehole locations consists of fill material (crushed stone, topsoil, brown silty sand, trace clay, occasional gravel) underlain by grey silty clay, brown silty sand, and glacial till. Bedrock consisting of black shale was encountered in BH1-23, BH2-23, BH3-23, and BH7-23 at depths ranging from approximately 1.9 to 2.9m below grade.

Nine soil samples were submitted for laboratory analysis of BTEX, PHCs (F_1-F_4), VOCs, metals and/or pH parameters. Based on the analytical test results, elevated levels of pH, outside the acceptable range for surface or subsurface soils, were identified in Soil Samples BH3-23-SS2, BH5-23-SS2, BH6-23-SS2 and BH9-23-SS2. In accordance with O.Reg. 153/04, Section 41 applies to the Phase II Property and Table 1 standards for a commercial land use were selected.

Parameter concentrations identified at the Phase II Property comply with the MECP Table 1 standards for a commercial land use, apart from the PHC F_4 concentrations identified in Soil Sample BH1-23-SS2.

Three groundwater samples were submitted for laboratory analysis of BTEX, PHCs (F_1-F_4) and VOCs. Chloroform and trichloroethylene parameters were detected at concentrations meeting the MECP Table 1 standards, in the groundwater sample recovered from BH2.

Otherwise, no parameter concentrations were identified in the groundwater samples analysed. As such, the groundwater at the Phase II Property complies with the selected MECP standards.

Recommendations

Soil Impacts

Based on the findings of this assessment, elevated pH levels were identified on the western portion of the Phase II Property. As such, Table 1 standards for a commercial land use were used, in accordance with O.Reg. 153/04. Fill material with PHC F_4 concentrations exceeding the MECP Table 1 standards was identified at BH1-23-SS2, on the northeastern portion of the Phase II Property. Given the shallow nature of the impacts, they are expected to be associated with the presence of transport trucks on this portion of the site.

Given the nature of the impacts and the location outside of the existing buildings and the proposed commercial warehouse building, in combination with the continued use of the Phase II Property for commercial/light industrial operations, the elevated levels of PHC and pH are not considered to pose a concern to the subject site.

On-site and Excess Soil Management

It is our understanding that the western portion of the Phase II Property will be redeveloped with a commercial warehouse building. Any excess soil generated from the construction of the proposed redevelopment should be handled in accordance with O.Reg. 406/19.

Monitoring Wells

The monitoring wells will be registered with the MECP under Ontario Regulation 903 (Ontario Water Resources Act). At such a time that the monitoring wells are no longer required, they must be decommissioned in accordance with O.Reg. 903.

7.0 STATEMENT OF LIMITATIONS

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

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

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

This report was prepared for the sole use of BBS Construction. Permission and notification from BBS Construction. and Paterson Group will be required prior to the release of this report to any other party.

Paterson Group Inc.

Mohammed Ramadan, B.Sc.

Karyn Munch, P.Eng., QP_{ESA}

Report Distribution:

- BBS Construction
- Paterson Group Inc.

FIGURES

FIGURE 1 – KEY PLAN

DRAWING PE6080-1 – SITE PLAN

DRAWING PE6080-2 – SURROUNDING LAND USE PLAN

DRAWING PE6080-3 – TEST HOLE LOCATION PLAN

DRAWING PE6080-4 – ANALYTICAL TESTING PLAN – SOIL & GROUNDWATER

DRAWING PE6080-4A – CROSS SECTION A-A' – SOIL & GROUNDWATER

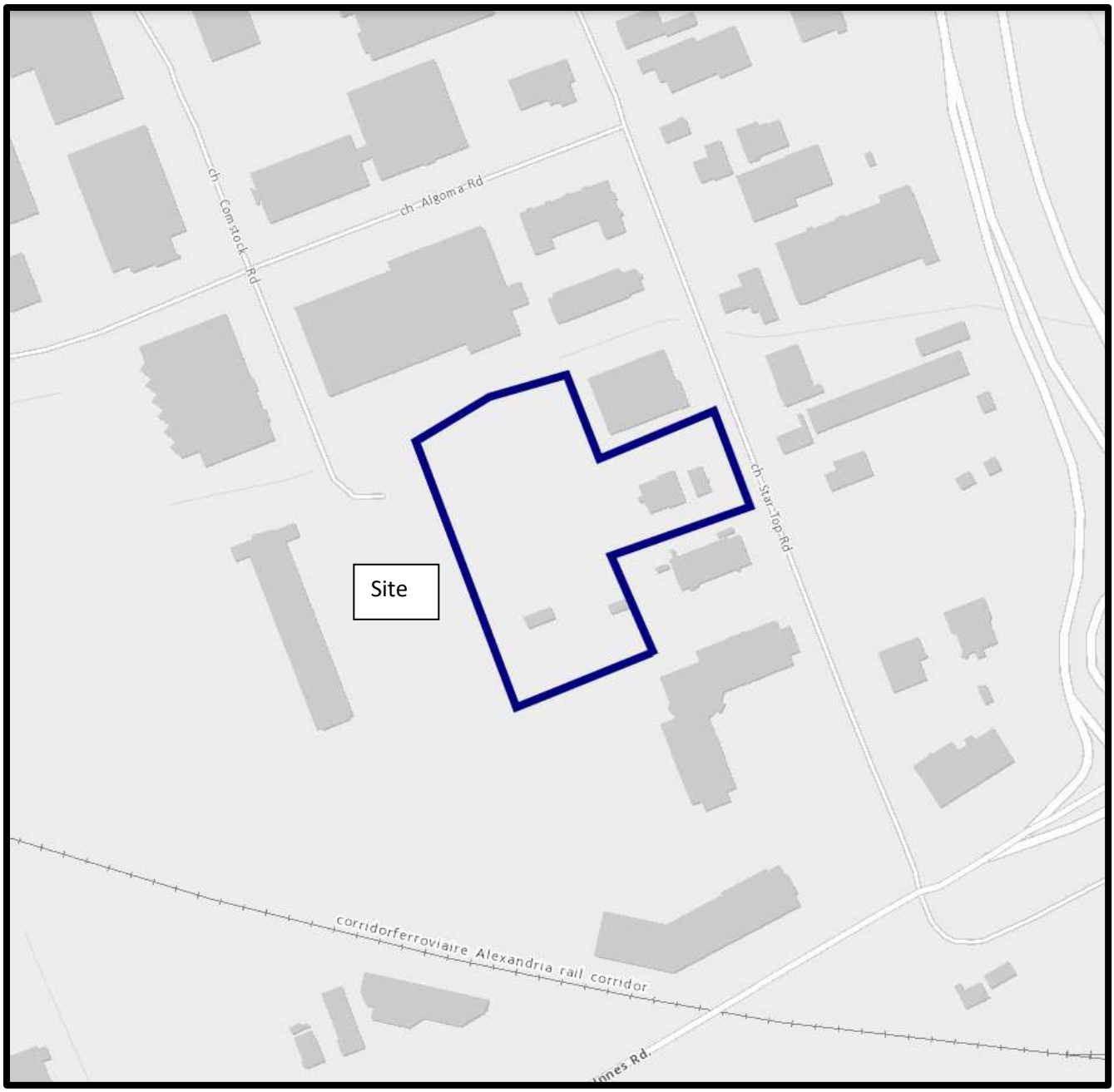
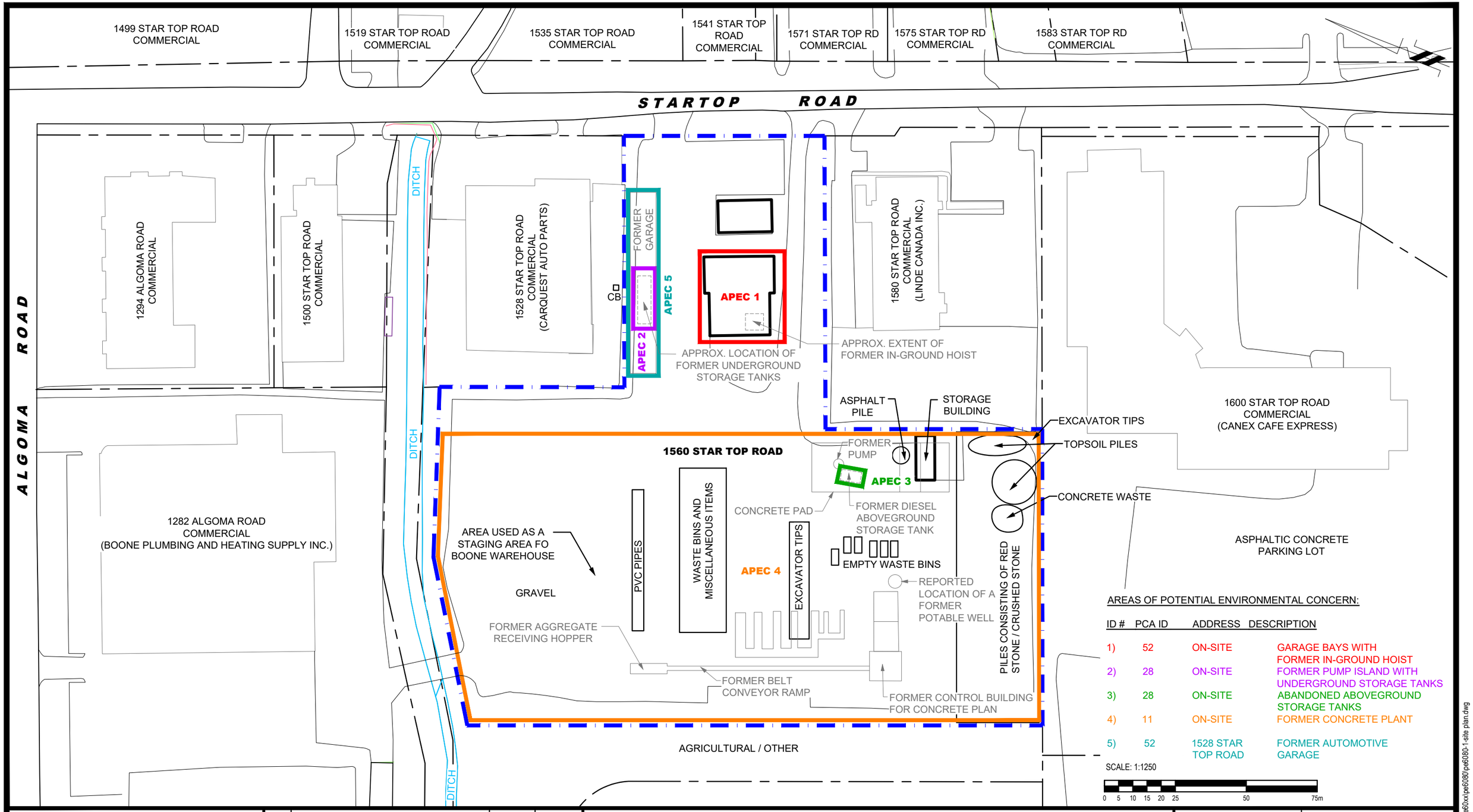


FIGURE 1

KEY PLAN



AREAS OF POTENTIAL ENVIRONMENTAL CONCERN:

ID #	PCA ID	ADDRESS	DESCRIPTION
1)	52	ON-SITE	GARAGE BAYS WITH FORMER IN-GROUND HOIST
2)	28	ON-SITE	FORMER PUMP ISLAND WITH UNDERGROUND STORAGE TANKS
3)	28	ON-SITE	ABANDONED ABOVEGROUND STORAGE TANKS
4)	11	ON-SITE	FORMER CONCRETE PLANT
5)	52	1528 STAR TOP ROAD	FORMER AUTOMOTIVE GARAGE

SCALE: 1:1250

0 5 10 15 20 25 50 75m

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL

BBS CONSTRUCTION

PHASE I - ENVIRONMENTAL SITE ASSESSMENT
1540 STARTOP ROAD

OTTAWA, **ONTARIO**

Title:

SITE PLAN

Scale: 1:1250	**Date:** 06/2023
Drawn by: GK	**Report No.:** PE6080-1
Checked by: MR	**Dwg. No.:** PE6080-1
Approved by: KM	**Revision No.:**

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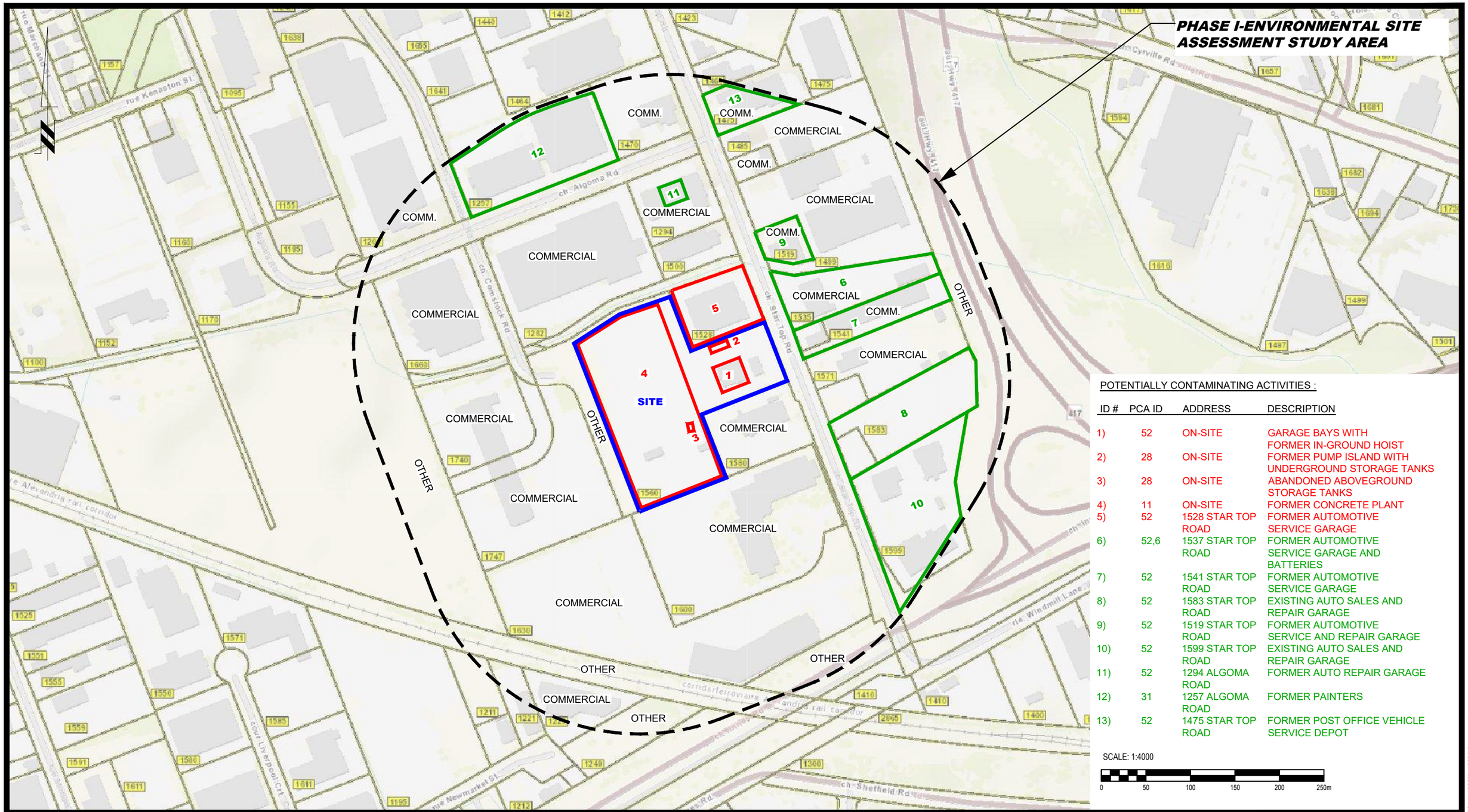

POTENTIALLY CONTAMINATING ACTIVITIES :

ID #	PCA ID	ADDRESS	DESCRIPTION
1)	52	ON-SITE	GARAGE BAYS WITH FORMER IN-GROUND HOIST
2)	28	ON-SITE	FORMER PUMP ISLAND WITH UNDERGROUND STORAGE TANKS
3)	28	ON-SITE	ABANDONED ABOVEGROUND STORAGE TANKS
4)	11	ON-SITE	FORMER CONCRETE PLANT
5)	52	1528 STAR TOP ROAD	FORMER AUTOMOTIVE SERVICE GARAGE
6)	52,6	1537 STAR TOP ROAD	FORMER AUTOMOTIVE SERVICE GARAGE AND BATTERIES
7)	52	1541 STAR TOP ROAD	FORMER AUTOMOTIVE SERVICE GARAGE
8)	52	1583 STAR TOP ROAD	EXISTING AUTO SALES AND REPAIR GARAGE
9)	52	1519 STAR TOP ROAD	FORMER AUTOMOTIVE SERVICE AND REPAIR GARAGE
10)	52	1599 STAR TOP ROAD	EXISTING AUTO SALES AND REPAIR GARAGE
11)	52	1294 ALGOMA ROAD	FORMER AUTO REPAIR GARAGE
12)	31	1257 ALGOMA ROAD	FORMER PAINTERS
13)	52	1475 STAR TOP ROAD	FORMER POST OFFICE VEHICLE SERVICE DEPOT

SCALE: 1:4000

0 50 100 150 200 250m

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NO.	REVISIONS	DATE	INITIAL

BBS CONSTRUCTION

PHASE I - ENVIRONMENTAL SITE ASSESSMENT
1540 STARTOP ROAD

OTTAWA, ONTARIO

Title:

SURROUNDING LAND USE PLAN

Scale: 1:1250	**Date:** 06/2023
Drawn by: GK	**Report No.:** PE6080-1
Checked by: MR	**Dwg. No.:** PE6080-2
Approved by: KM	**Revision No.:**

11x17

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1499 STAR TOP ROAD COMMERCIAL
1519 STAR TOP ROAD COMMERCIAL
1535 STAR TOP ROAD COMMERCIAL
1541 STAR TOP ROAD COMMERCIAL
1571 STAR TOP RD COMMERCIAL
1575 STAR TOP RD COMMERCIAL
1583 STAR TOP RD COMMERCIAL

STARTOP ROAD

ALGOMA ROAD

1294 ALGOMA ROAD COMMERCIAL
1500 STAR TOP ROAD COMMERCIAL
1528 STAR TOP ROAD COMMERCIAL (CARQUEST AUTO PARTS)
1580 STAR TOP ROAD COMMERCIAL (LINDE CANADA INC.)
1600 STAR TOP ROAD COMMERCIAL (CANEX CAFE EXPRESS)
1282 ALGOMA ROAD COMMERCIAL (BOONE PLUMBING AND HEATING SUPPLY INC.)
1560 STAR TOP ROAD

DITCH
DITCH
DITCH

FORMER GARAGE
CB
APPROX. LOCATION OF FORMER UNDERGROUND STORAGE TANKS
APPROX. EXTENT OF FORMER IN-GROUND HOIST
ASPHALT PILE
STORAGE BUILDING
EXCAVATOR TIPS
TOPSOIL PILES
CONCRETE WASTE
FORMER PUMP
CONCRETE PAD
FORMER DIESEL ABOVEGROUND STORAGE TANK
EMPTY WASTE BINS
EXCAVATOR TIPS
PILES CONSISTING OF RED STONE / CRUSHED STONE
AREA USED AS A STAGING AREA FO BOONE WAREHOUSE
GRAVEL
PVC PIPES
WASTE BINS AND MISCELLANEOUS ITEMS
REPORTED LOCATION OF A FORMER POTABLE WELL
FORMER BELT CONVEYOR RAMP
FORMER AGGREGATE RECEIVING HOPPER
FORMER CONTROL BUILDING FOR CONCRETE PLAN
AGRICULTURAL / OTHER

BH 1-23
66.01
[64.10]
(63.06)

BH 2-23
65.92
[63.00]
(64.05)

BH 10-23
66.16

BH 7-23
66.83
[64.62]
(64.64)

BH 6-23
66.83

BH 4-23
66.56

BH 5-23
67.04

BH 5A-23
67.04

BH 8-23
67.32

BH 3-23
67.44
[64.82]
(65.55)

BH 9-23
67.89

A
A'

63.5
64
64.5
65
(0.02m/m)

LEGEND:

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- 67.44 GROUND SURFACE ELEVATION (m)
- [64.82] BEDROCK SURFACE ELEVATION (m)
- (65.55) GROUNDWATER SURFACE ELEVATION (m) (MAY 19, 2023)
- A — A' CROSS SECTION
- 64.5 GROUNDWATER CONTOURS (m)
- (0.02m/m) APPROX. GROUNDWATER FLOW DIRECTION (HORIZONTAL HYDRAULIC GRADIENT)

GROUND SURFACE ELEVATIONS AT BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM.

SCALE: 1:1250

0 5 10 15 20 25 50 75m

PATERSON GROUP
9 AURIGA DRIVE
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NO.	REVISIONS	DATE	INITIAL

BBS CONSTRUCTION

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1540 STARTOP ROAD

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:1250	Date: 06/2023
Drawn by: YA	Report No.: PE6080-2
Checked by: MR	Dwg. No.: PE6080-3
Approved by: KM	Revision No.:

11x17

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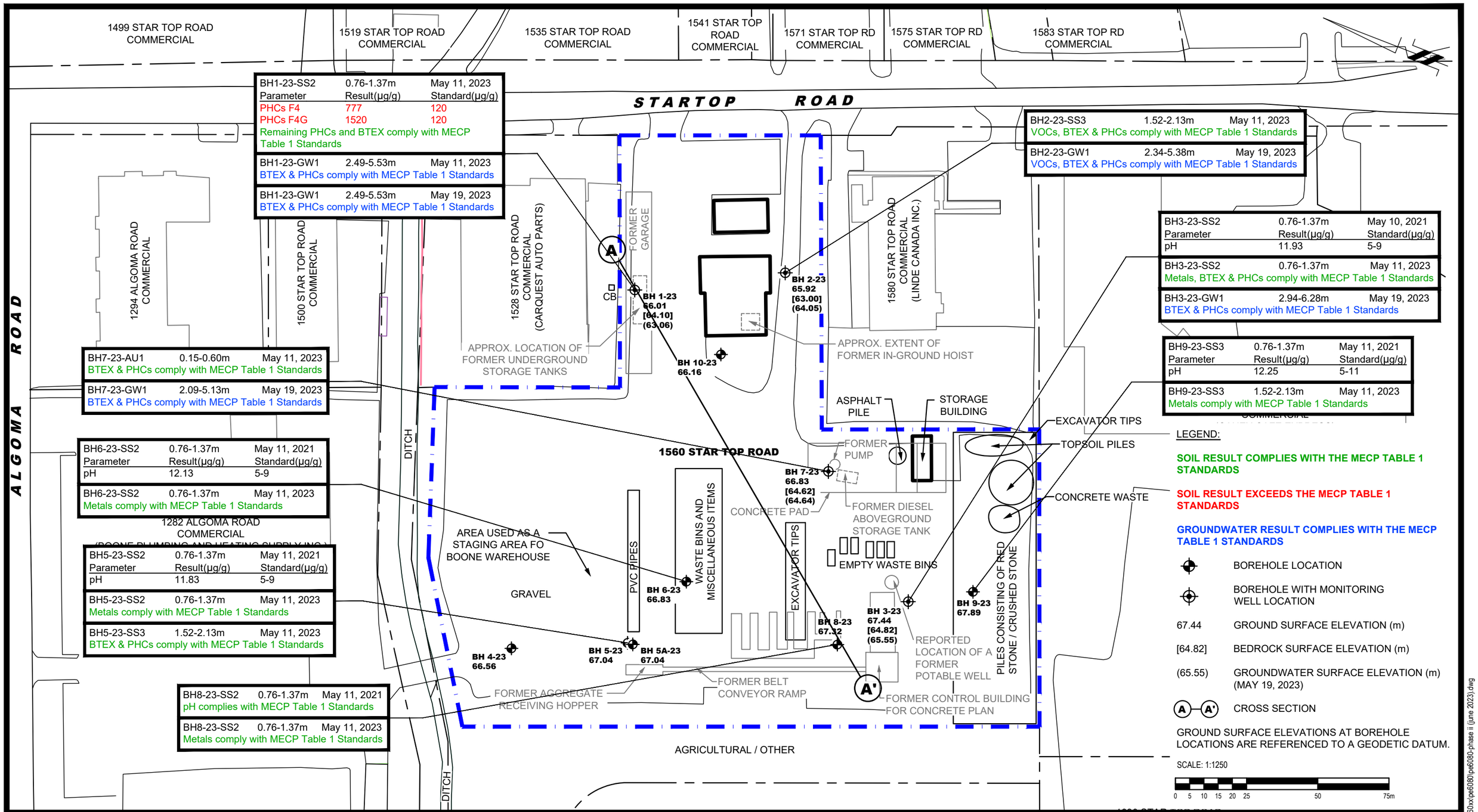

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NO.	REVISIONS	DATE	INITIAL

BBS CONSTRUCTION

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1540 STARTOP ROAD

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL AND GROUNDWATER

Scale: 1:1250	**Date:** 06/2023
Drawn by: YA	**Report No.:** PE6080-2
Checked by: MR	**Dwg. No.:** PE6080-4
Approved by: KM	**Revision No.:**

11x17

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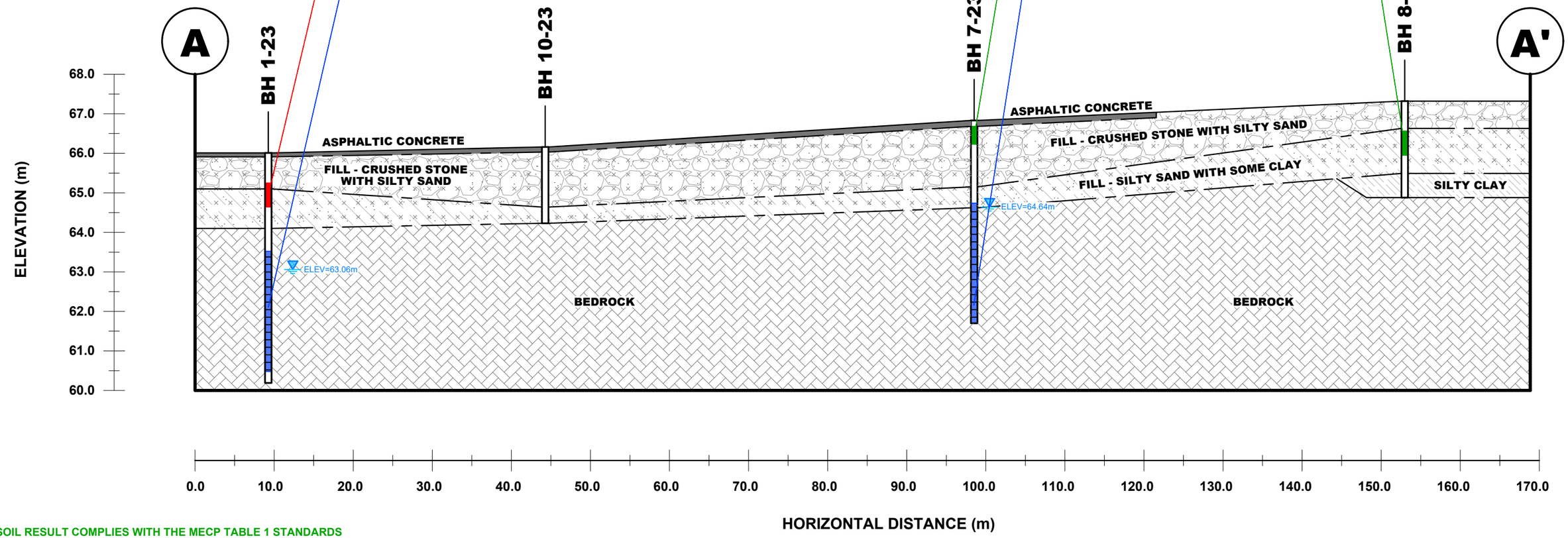
BH1-23-SS2	0.76-1.37m	May 11, 2023
Parameter	Result(µg/g)	Standard(µg/g)
PHCs F4	777	120
PHCs F4G	1520	120
Remaining PHCs and BTEX comply with MECP Table 1 Standards		
BH1-23-GW1	2.49-5.53m	May 11, 2023
BTEX & PHCs comply with MECP Table 1 Standards		
BH1-23-GW1	2.49-5.53m	May 19, 2023
BTEX & PHCs comply with MECP Table 1 Standards		

BH7-23-AU1	0.15-0.60m	May 11, 2023
BTEX & PHCs comply with MECP Table 1 Standards		
BH7-23-GW1	2.09-5.13m	May 19, 2023
BTEX & PHCs comply with MECP Table 1 Standards		

BH8-23-SS2	0.76-1.37m	May 11, 2021
pH complies with MECP Table 1 Standards		
BH8-23-SS2	0.76-1.37m	May 11, 2023
Metals comply with MECP Table 1 Standards		



SOIL RESULT COMPLIES WITH THE MECP TABLE 1 STANDARDS

SOIL RESULT EXCEEDS THE MECP TABLE 1 STANDARDS

GROUNDWATER RESULT COMPLIES WITH THE MECP TABLE 1 STANDARDS

PATERSON GROUP
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NO.	REVISIONS	DATE	INITIAL

BBS CONSTRUCTION

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1540 STARTOP ROAD

OTTAWA, ONTARIO

Title: CROSS SECTION A-A' - SOIL AND GROUNDWATER

Scale: AS SHOWN	Date: 06/2023
Drawn by: YA	Report No.: PE6080-2
Checked by: MR	Dwg. No.: PE6080-4A
Approved by: KM	Revision No.:

11x17

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APPENDIX 1

SAMPLING AND ANALYSIS PLAN

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

LABORATORY CERTIFICATES OF ANALYSIS

PATERSON GROUP

Sampling & Analysis Plan

1540 Star Top Road

Ottawa, Ontario

Prepared for BBS Construction

Report: PE6080-SAP
May 8, 2023

TABLE OF CONTENTS

PAGE

1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by BBS Construction, to conduct a Phase II – Environmental Site Assessment (Phase II ESA) for the property addressed 1540 Star Top Road, in the City of Ottawa, Ontario.

Based on the findings of the Phase I ESA, the following subsurface investigation program was developed.

Borehole	Location & Rationale	Proposed Depth & Rationale
BH1-23	Eastern portion of the Phase I Property to assess for potential impacts resulting from the former presence of an underground storage tank.	2-6 m; to intercept the groundwater table for the purpose of installing a monitoring well.
BH2-23	Eastern portion of the Phase I Property to assess for potential impacts resulting from the former presence of an in-ground hoist/garage.	2-6 m; to intercept the groundwater table for the purpose of installing a monitoring well.
BH3-23	Southern portion of the Phase I Property to assess for potential impacts resulting from the former presence of a concrete plant.	2-6 m; to intercept the groundwater table for the purpose of installing a monitoring well.
BH4-23	Northern portion of the Phase I Property to assess for potential impacts resulting from the former presence of a concrete plant.	2-6 m; for general coverage purposes.
BH5-23	North-central portion of the Phase I Property to assess former wash pads associated with concrete plant.	2-6 m; for general coverage purposes.
BH5A-23	North-central portion of the Phase I Property to assess former wash pads associated with concrete plant.	2-6 m; for general coverage purposes.
BH6-23	North-central portion of the Phase I Property to assess for potential impacts resulting from the former presence of a concrete plant.	2-6 m; for general coverage purposes.
BH7-23	Southeastern portion of the Phase I Property to assess for potential impacts resulting from the on-site presence of an AST.	2-6 m; to intercept the groundwater table for the purpose of installing a monitoring well.
BH8-23	West-central portion of the Phase I Property to assess former wash pads associated with concrete plant.	2-6 m; for general coverage purposes.
BH9-23	Southern portion of the Phase I Property to assess former wash pads associated with concrete plant.	2-6 m; for general coverage purposes.
BH10-23	Eastern portion of the Phase I Property to assess for potential impacts resulting from the former presence of an in-ground hoist/garage.	2-6 m; for general coverage purposes.
BH11-23	Northeastern portion of the western half of the Phase I Property to assess former wash pads associated with concrete plant.	2-6 m; for general coverage purposes.

Borehole locations are shown on Drawing PE6080-3 – Test Hole Location Plan, appended to the main report.

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

Following the borehole drilling, groundwater monitoring wells will be installed in three boreholes to allow for the collection of groundwater samples.

2.0 ANALYTICAL TESTING PROGRAM

The analytical testing program for soil at the Phase I Property is based on the following general considerations:

- ❒ At least one sample from each borehole should be submitted, in order to delineate the horizontal extent of contamination across the site.

- ❒ At least one sample from each stratigraphic unit should be submitted, in order to delineate the vertical extent of contamination at the site.

- ❒ In boreholes where there is visual or olfactory evidence of contamination, or where organic vapour meter or photoionization detector readings indicate the presence of contamination, the 'worst-case' sample from each borehole should be submitted for comparison with MECP site condition standards.

- ❒ In boreholes with evidence of contamination as described above, a sample should be submitted from the stratigraphic unit below the 'worst-case' sample to determine whether the contaminant(s) have migrated downward.

- ❒ Parameters analyzed should be consistent with the Contaminants of Potential Concern identified in the Phase I ESA.

The analytical testing program for soil at the Phase I Property is based on the following general considerations:

- ❒ Groundwater monitoring wells should be installed in all boreholes with visual or olfactory evidence of soil contamination, in stratigraphic units where soil contamination was encountered, where those stratigraphic units are at or below the water table (i.e. a water sample can be obtained).

- ❒ Groundwater monitoring well screens should straddle the water table at sites where the contaminants of concern are suspected to be LNAPLs.

- ❒ At least one groundwater monitoring well should be installed in a stratigraphic unit below the suspected contamination, where said stratigraphic unit is water-bearing.

- ❒ Parameters analyzed should be consistent with the Contaminants of Concern identified in the Phase I ESA and with the contaminants identified in the soil samples.

3.0 STANDARD OPERATING PROCEDURES

3.1 Environmental Drilling Procedure

Purpose

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

Equipment

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

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

Determining Borehole Locations

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

After drilling is completed a plan with the borehole locations must be provided. Distances and orientations of boreholes with respect to site features (buildings, roadways, etc.) must be provided. Distances should be measured using a measuring tape or wheel rather than paced off. Ground surface elevations at each

borehole should be surveyed relative to a geodetic benchmark, if one is available, or a temporary site benchmark which can be tied in at a later date if necessary.

Drilling Procedure

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

- ❒ Continuous split spoon samples (every 0.6 m or 2') or semi-continuous (every 0.76 m or 2'6") are required.
- ❒ Make sure samples are well sealed in plastic bags with no holes prior to screening and are kept cool but unfrozen.
- ❒ If sampling for VOCs, BTEX, or PHCs F_1, a soil core from each soil sample, which may be analyzed, must be taken and placed in the laboratory-provided methanol vial.
- ❒ Note all and any odours or discolouration of samples.
- ❒ Split spoon samplers must be washed between samples.
- ❒ If obvious contamination is encountered, continue sampling until vertical extent of contamination is delineated.
- ❒ As a general rule, environmental boreholes should be deep enough to intercept the groundwater table (unless this is impossible/impractical - call project manager to discuss).
- ❒ If at all possible, soil samples should be submitted to a preliminary screening procedure on site, either using a RKI Eagle, PID, etc. depending on type of suspected contamination.

Spoon Washing Procedure

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

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

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

Screening Procedure

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

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

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

3.2 Monitoring Well Installation Procedure

Equipment

- ❒ 5’ x 2” threaded sections of Schedule 40 PVC slotted well screen (5’ x 1 ¼” if installing in cored hole in bedrock)
- ❒ 5’ x 2” threaded sections of Schedule 40 PVC riser pipe (5’ x 1 ¼” if installing in cored hole in bedrock)
- ❒ Threaded end-cap
- ❒ Slip-cap or J-plug
- ❒ Asphalt cold patch or concrete

- ❒ Silica Sand
- ❒ Bentonite chips (Holeplug)
- ❒ Steel flushmount casing

Procedure

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

3.3 Monitoring Well Sampling Procedure

Equipment

- ❒ Water level metre or interface probe on hydrocarbon/LNAPL sites
- ❒ Spray bottles containing water and methanol to clean water level tape or interface probe
- ❒ Peristaltic pump
- ❒ Polyethylene tubing for peristaltic pump
- ❒ Flexible tubing for peristaltic pump
- ❒ Latex or nitrile gloves (depending on suspected contaminant)

- ❒ Allen keys and/or 9/16" socket wrench to remove well caps
- ❒ Graduated bucket with volume measurements
- ❒ pH/Temperature/Conductivity combo pen
- ❒ Laboratory-supplied sample bottles

Sampling Procedure

- ❒ Locate well and use socket wrench or Allan key to open metal flush mount protector cap. Remove plastic well cap.
- ❒ Measure water level, with respect to existing ground surface, using water level meter or interface probe. If using interface probe on suspected NAPL site, measure the thickness of free product.
- ❒ Measure total depth of well.
- ❒ Clean water level tape or interface probe using methanol and water. Change gloves between wells.
- ❒ Calculate volume of standing water within well and record.
- ❒ Insert polyethylene tubing into well and attach to peristaltic pump. Turn on peristaltic pump and purge into graduated bucket. Purge at least three well volumes of water from the well. Measure and record field chemistry. Continue to purge, measuring field chemistry after every well volume purged, until appearance or field chemistry stabilizes.
- ❒ Note appearance of purge water, including colour, opacity (clear, cloudy, silty), sheen, presence of LNAPL, and odour. Note any other unusual features (particulate matter, effervescence (bubbling) of dissolved gas, etc.).
- ❒ Fill required sample bottles. If sampling for metals, attach 75-micron filter to discharge tube and filter metals sample. If sampling for VOCs, use low flow rate to ensure continuous stream of non-turbulent flow into sample bottles. Ensure no headspace is present in VOC vials.
- ❒ Replace well cap and flushmount casing cap.

4.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

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

- ❒ All non-dedicated sampling equipment (split spoons) will be decontaminated according to the SOPs listed above.

- ❒ All groundwater sampling equipment is dedicated (polyethylene and flexible peristaltic tubing is replaced for each well).

- ❒ Where groundwater samples are to be analyzed for VOCs, one laboratory-provided trip blank will be submitted for analysis with every laboratory submission.
- ❒ Approximately one (1) field duplicate will be submitted for every ten (10) samples submitted for laboratory analysis. A minimum of one (1) field duplicate per project will be submitted. Field duplicates will be submitted for soil and groundwater samples
- ❒ Where combo pens are used to measure field chemistry, they will be calibrated on an approximately monthly basis, according to frequency of use.

5.0 DATA QUALITY OBJECTIVES

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

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

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

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

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

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

Phase II Conceptual Site Model even if DQOs are not met for certain individual samples.

These considerations are discussed in the body of the report.

6.0 PHYSICAL IMPEDIMENTS

Physical impediments to the Sampling and Analysis plan may include:

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

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

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 1540 Star Top Road
Ottawa, Ontario

DATUM Elevations are referenced to a geodetic datum

FILE NO. PG6674

REMARKS

HOLE NO. BH 1-23

BORINGS BY CME-55 Low Clearance Drill **DATE** May 10, 2023

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
Concrete Slab 0.10						0	66.01
FILL: Loose to compact, brown silty sand, trace to some crushed stone and gravel		AU	1				
0.91		SS	2	42	10	1	65.01
FILL: Brown sandy silt to silty sand, trace to some clay		SS	3	8	50+		
1.91						2	64.01
		RC	1	98	46	3	63.01
BEDROCK: Poor to fair quality, black shale						4	62.01
		RC	2	100	54		
						5	61.01
		RC	3	65	32		
5.82							
End of Borehole							
(GWL @ 2.95m - May 19, 2023)							

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**
○ **Water Content %**

20 40 60 80

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Monitoring Well Construction

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 1540 Star Top Road
Ottawa, Ontario

DATUM Elevations are referenced to a geodetic datum

FILE NO. PG6674

REMARKS

HOLE NO. BH 2-23

BORINGS BY CME-55 Low Clearance Drill **DATE** May 10, 2023

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	65.92
Concrete Slab 0.10		AU	1				
FILL: Compact to loose, brown silty sand, some crushed stone, trace gravel		SS	2	50	12	1	64.92
		SS	3	83	4	2	63.92
2.21							
GLACIAL TILL: Compact to loose, brown silty sand, with clay, trace gravel, occasional cobbles and boulders		SS	4	17	50+		
2.92						3	62.92
		RC	1	85	0		
BEDROCK: Very poor to excellent quality, black shale		RC	2	97	63	4	61.92
		RC	3	71	71	5	60.92
5.72							
End of Borehole							
(GWL @ 1.87m - May 19, 2023)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

Monitoring Well Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 1540 Star Top Road
Ottawa, Ontario

DATUM Elevations are referenced to a geodetic datum

FILE NO. PG6674

REMARKS

HOLE NO. BH 3-23

BORINGS BY CME-55 Low Clearance Drill **DATE** May 10, 2023

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	67.44
Concrete Slab 0.10		AU	1				
FILL: Dense to loose. brown silty sand, some crushed stone, trace gravel and asphalt		SS	2	66	50+	1	66.44
1.83		SS	3	8	5		
TOPSOIL 2.13						2	65.44
Stiff, grey **SILTY CLAY,** trace sand 2.62		SS	4	25	50+		
		RC	1	100	30	3	64.44
BEDROCK: Poor to excellent quality, black shale		RC	2	69	46	4	63.44
						5	62.44
		RC	3	100	96	6	61.44
6.76							
End of Borehole							
(GWL @ 1.89m - May 19, 2023)							

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**
○ **Water Content %**

20 40 60 80

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Monitoring Well Construction

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 1540 Star Top Road
Ottawa, Ontario

DATUM Elevations are referenced to a geodetic datum

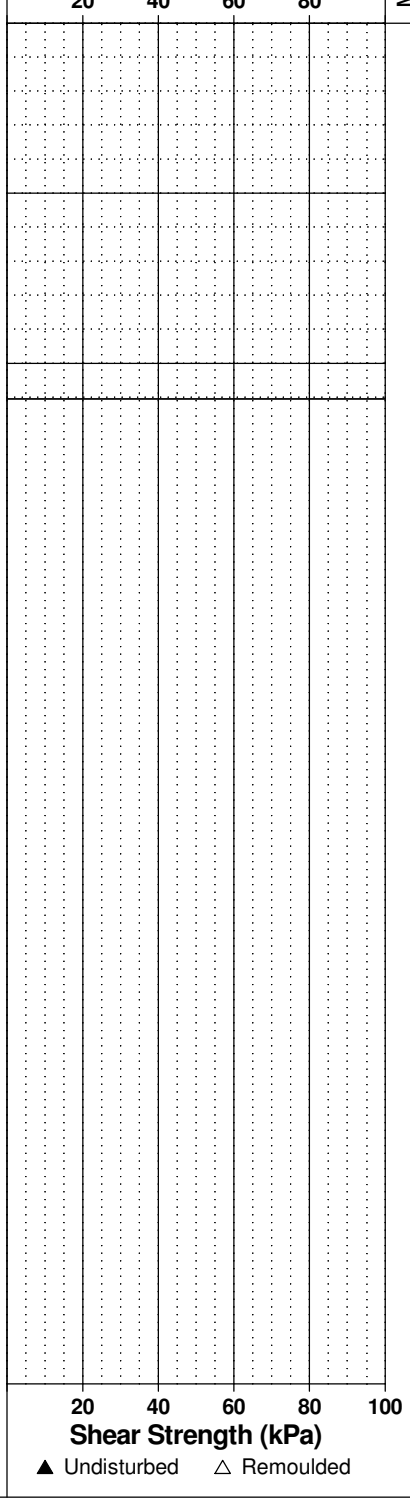
FILE NO. PG6674

REMARKS

HOLE NO. BH 4-23

BORINGS BY CME-55 Low Clearance Drill **DATE** May 11, 2023

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Monitoring Well Construction
GROUND SURFACE									
FILL: Brown silty sand with gravel and crushed stone (0.33)		AU	1			0	66.56		
FILL: Brown silty sand (0.69)		AU	2						
Compact, brown **SILTY SAND,** trace gravel (1.52)		SS	3	25	25	1	65.56		
Loose, grey **SILTY SAND** with some clay (2.21)		SS	4	42	7	2	64.56		
End of Borehole									
Practical refusal to augering at 2.21m depth									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 1540 Star Top Road
Ottawa, Ontario

DATUM Elevations are referenced to a geodetic datum

FILE NO. PG6674

REMARKS

HOLE NO. BH 5-23

BORINGS BY CME-55 Low Clearance Drill **DATE** May 11, 2023

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Monitoring Well Construction
GROUND SURFACE						0	67.04		
FILL: Compact. brown silty sand with gravel and crushed stone		AU	1						
		SS	2	42	20	1	66.04		▽
1.52									
		SS	3	25	14	2	65.04		
FILL: Compact gravel with some sand		SS	4	33	15				
		SS	5	42	17	3	64.04		
3.71									
End of Borehole									
Practical refusal to augering at 3.71m depth									
(Open hole GWL @ 1.5m depth)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 1540 Star Top Road
Ottawa, Ontario

DATUM Elevations are referenced to a geodetic datum

FILE NO. PG6674

REMARKS

HOLE NO. BH 5A-23

BORINGS BY CME-55 Low Clearance Drill **DATE** May 11, 2023

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Monitoring Well Construction
GROUND SURFACE						0	67.04		
						1	66.04		
OVERBURDEN						2	65.04		
						3	64.04		
3.71									
End of Borehole Practical refusal to augering at 3.71m depth.									

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 1540 Star Top Road
Ottawa, Ontario

DATUM Elevations are referenced to a geodetic datum

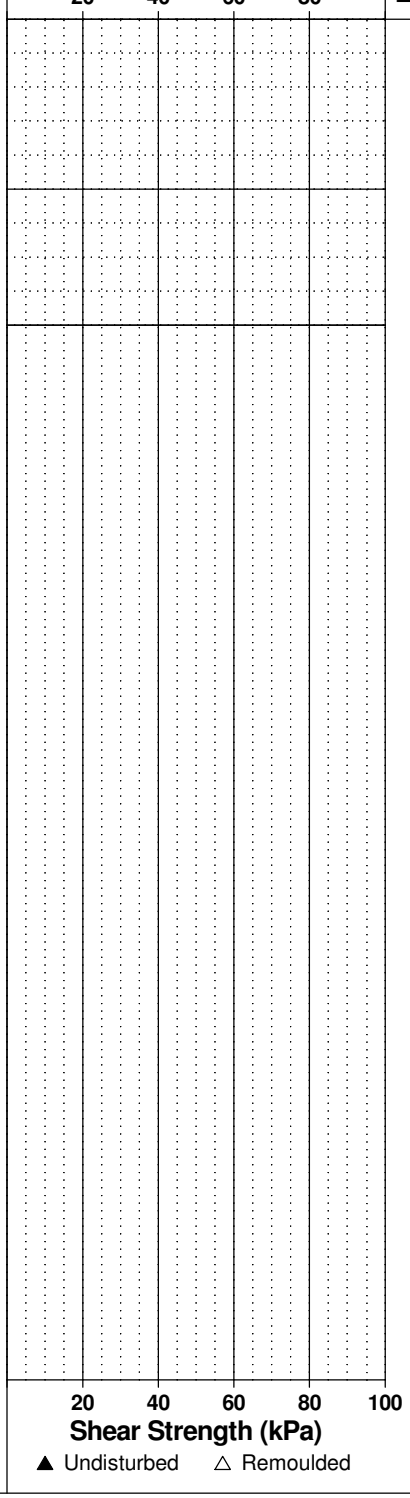
FILE NO. PG6674

REMARKS

HOLE NO. BH 6-23

BORINGS BY CME-55 Low Clearance Drill **DATE** May 11, 2023

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Monitoring Well Construction
GROUND SURFACE						0	66.83		
FILL: Compact to loose brown silty sand with gravel and crushed stone		AU	1						
0.68									
FILL: Light brown to white silty sand with some gravel		SS	2	100	26	1	65.83		
		SS	3	25	50+				
1.80									
End of Borehole									
Practical refusal to augering at 1.80m depth									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 1540 Star Top Road
Ottawa, Ontario

DATUM Elevations are referenced to a geodetic datum

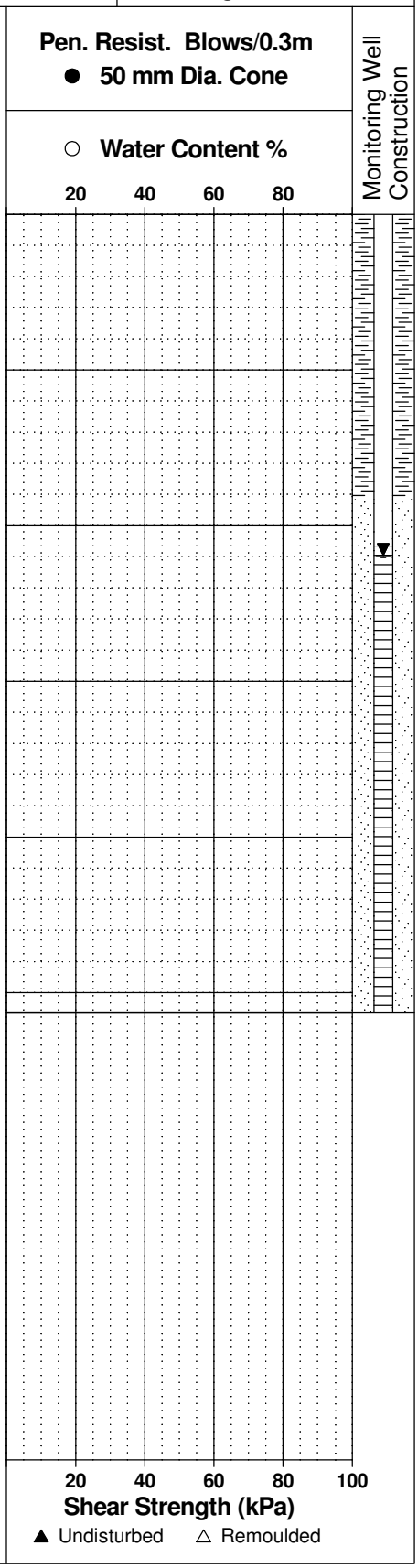
FILE NO. PG6674

REMARKS

HOLE NO. BH 7-23

BORINGS BY CME-55 Low Clearance Drill **DATE** May 11, 2023

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	66.83
Concrete Slab 0.15							
FILL: Compact, brown silty sand with gravel and crushed stone 0.69		AU	1				
FILL: Compact, brown silty sand, trace gravel		SS	2	50	50+	1	65.83
1.68		SS	3	54	79		
FILL: Very dense, black silty sand with crushed stone 2.21						2	64.83
		RC	1	64	0		
						3	63.83
BEDROCK: Very poor to good quality, black shale		RC	2	98	49		
						4	62.83
		RC	3	100	50		
5.13						5	61.83
End of Borehole							
(GWL @ 2.19m - May 19, 2023)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 1540 Star Top Road
Ottawa, Ontario

DATUM Elevations are referenced to a geodetic datum

FILE NO. PG6674

REMARKS

HOLE NO. BH 8-23

BORINGS BY CME-55 Low Clearance Drill **DATE** May 11, 2023

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Monitoring Well Construction
GROUND SURFACE						0	67.32		
FILL: Compact, brown silty sand with gravel and crushed stone		AU	1						
0.69									
FILL: Very dense to compact, brown silty sand with gravel		SS	2	50	50+	1	66.32		
1.83		SS	3	50	21				
FILL: Grey-brown silty clay, trace sand and gravel						2	65.32		
2.44		SS	4	0	50+				
End of Borehole									
Practical refusal to augering at 2.44m depth									

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 1540 Star Top Road
Ottawa, Ontario

DATUM Elevations are referenced to a geodetic datum

FILE NO. PG6674

REMARKS

HOLE NO. BH 9-23

BORINGS BY CME-55 Low Clearance Drill **DATE** May 11, 2023

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Monitoring Well Construction
GROUND SURFACE						0	67.89		
FILL: Very loose, brown silty sand with gravel and crushed stone		AU	1						
0.61									
FILL: Very loose, brown silty sand with clay, trace gravel		SS	2	100	3	1	66.89		
0.91									
FILL: Very loose to compact, light brown silty clay, trace sand and gravel		SS	3	33	5	2	65.89		
2.29									
End of Borehole									
Practical refusal to augering at 2.29m depth									

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 1540 Star Top Road
Ottawa, Ontario

DATUM Elevations are referenced to a geodetic datum

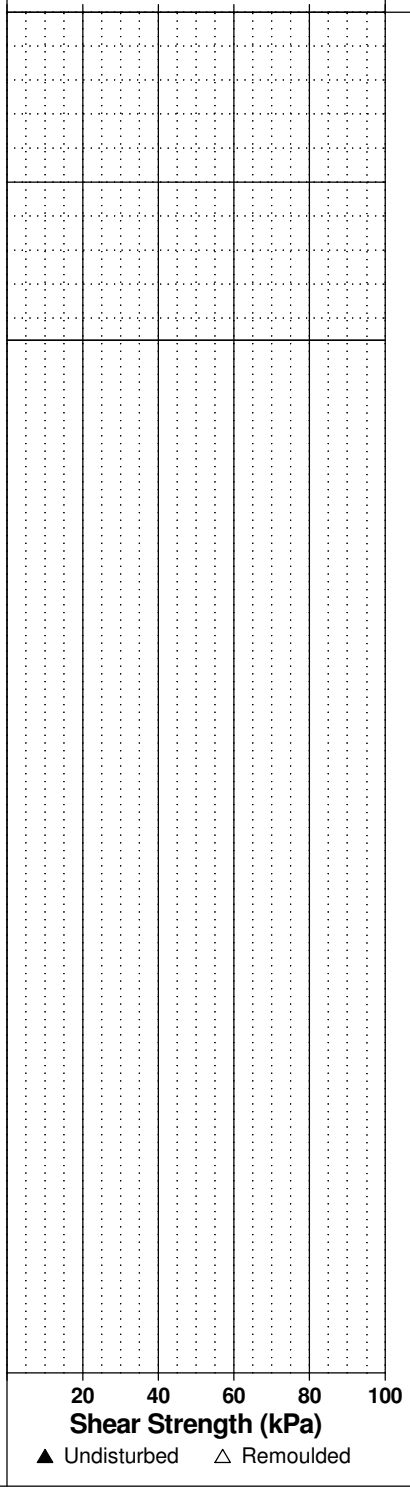
FILE NO. PG6674

REMARKS

HOLE NO. BH10-23

BORINGS BY CME-55 Low Clearance Drill **DATE** May 11, 2023

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Monitoring Well Construction
GROUND SURFACE									
Concrete Slab 0.13						0	66.16		
FILL: Very dense, brown silty sand trace gravel		AU	1						
		SS	2	8	50+	1	65.16		
1.52									
FILL: Firm, grey to black silty clay trace sand and gravel 1.93		SS	3	42	50+				
End of Borehole									
Practical refusal to augering at 1.93m depth									



SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

The standard terminology to describe the relative strength of cohesionless soils is the compactness condition, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm. An SPT N value of "P" denotes that the split-spoon sampler was pushed 300 mm into the soil without the use of a falling hammer.

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

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their "sensitivity". The sensitivity, S_t, is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil. The classes of sensitivity may be defined as follows:

Low Sensitivity:	$S_t < 2$
Medium Sensitivity:	$2 < S_t < 4$
Sensitive:	$4 < S_t < 8$
Extra Sensitive:	$8 < S_t < 16$
Quick Clay:	$S_t > 16$

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube, generally recovered using a piston sampler
G	-	"Grab" sample from test pit or surface materials
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size BQ, NQ, HQ, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

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

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

CONSOLIDATION TEST

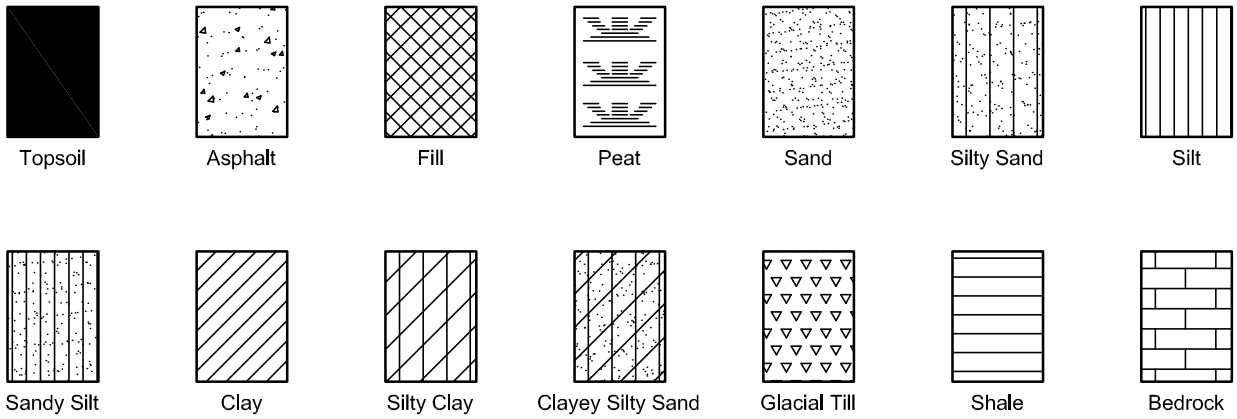
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

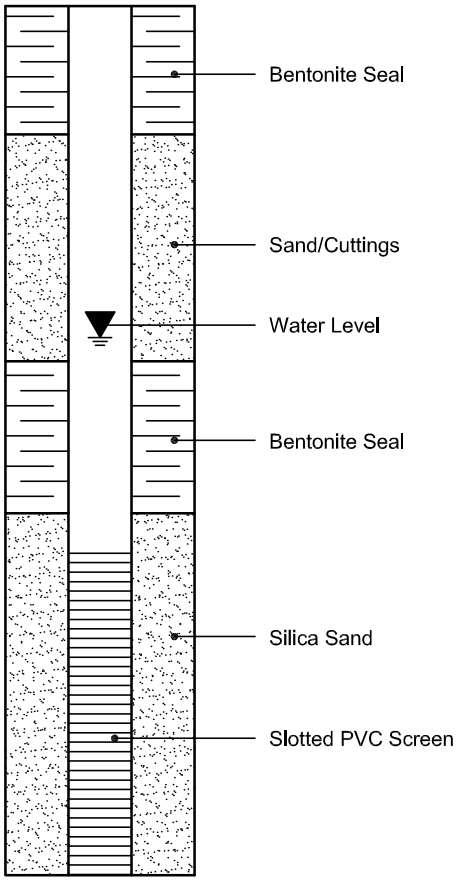
SYMBOLS AND TERMS (continued)

STRATA PLOT

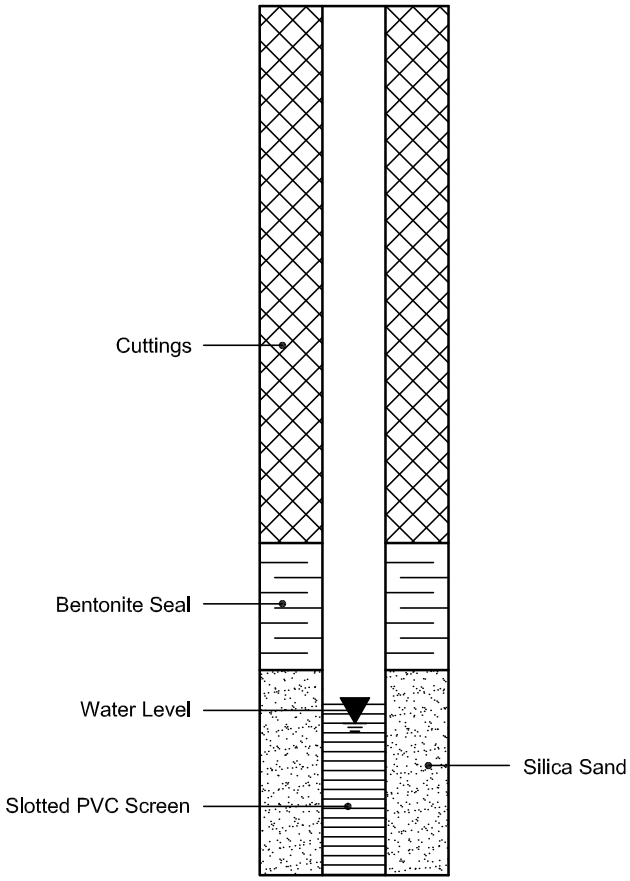


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Certificate of Analysis

Paterson Group Consulting Engineers

9 Auriga Drive
Ottawa, ON K2E 7T9
Attn: Karyn Munch

Client PO: 57506
Project: PE6080
Custody:

Report Date: 25-May-2023
Order Date: 18-May-2023

Order #: 2320361

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

Paracel ID	Client ID
2320361-01	BH5-23-SS2
2320361-02	BH5-23-SS3
2320361-03	BH6-23-SS2
2320361-04	BH7-23-AU1
2320361-05	BH8-23-SS2
2320361-07	BH9-23-SS3
2320361-10	DUP 02
2320361-11	DUP 03
2320361-12	BH1-23-SS2
2320361-13	BH2-23-SS3
2320361-14	BH3-23-SS2

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 57506

Report Date: 25-May-2023

Order Date: 18-May-2023

Project Description: PE6080

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	19-May-23	19-May-23
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	24-May-23	24-May-23
PHC F1	CWS Tier 1 - P&T GC-FID	19-May-23	19-May-23
PHC F4G (gravimetric)	CWS Tier 1 - Extraction Gravimetric	25-May-23	25-May-23
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	18-May-23	24-May-23
REG 153: Metals by ICP/MS, soil	EPA 6020 - Digestion - ICP-MS	23-May-23	23-May-23
REG 153: VOCs by P&T GC/MS	EPA 8260 - P&T GC-MS	19-May-23	23-May-23
Solids, %	CWS Tier 1 - Gravimetric	23-May-23	24-May-23

Certificate of Analysis

Report Date: 25-May-2023

Client: **Paterson Group Consulting Engineers**

Order Date: 18-May-2023

Client PO: **57506**

Project Description: PE6080

	Client ID:	BH5-23-SS2	BH5-23-SS3	BH6-23-SS2	BH7-23-AU1
	Sample Date:	11-May-23 09:00	11-May-23 09:00	11-May-23 09:00	11-May-23 09:00
	Sample ID:	2320361-01	2320361-02	2320361-03	2320361-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	92.8	85.4	77.3	90.4
General Inorganics					
pH	0.05 pH Units	11.83	-	12.13	-
Metals					
Antimony	1.0 ug/g dry	<1.0	-	<1.0	-
Arsenic	1.0 ug/g dry	1.8	-	1.3	-
Barium	1.0 ug/g dry	46.4	-	33.6	-
Beryllium	0.5 ug/g dry	<0.5	-	<0.5	-
Boron	5.0 ug/g dry	8.1	-	8.2	-
Cadmium	0.5 ug/g dry	<0.5	-	<0.5	-
Chromium	5.0 ug/g dry	11.0	-	8.5	-
Cobalt	1.0 ug/g dry	2.3	-	1.5	-
Copper	5.0 ug/g dry	5.1	-	<5.0	-
Lead	1.0 ug/g dry	4.2	-	2.4	-
Molybdenum	1.0 ug/g dry	1.2	-	<1.0	-
Nickel	5.0 ug/g dry	5.6	-	<5.0	-
Selenium	1.0 ug/g dry	<1.0	-	<1.0	-
Silver	0.3 ug/g dry	<0.3	-	<0.3	-
Thallium	1.0 ug/g dry	<1.0	-	<1.0	-
Uranium	1.0 ug/g dry	<1.0	-	<1.0	-
Vanadium	10.0 ug/g dry	10.4	-	<10.0	-
Zinc	20.0 ug/g dry	29.1	-	<20.0	-
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	-	90.4%	-	87.9%
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	-	<7	-	<7
F2 PHCs (C10-C16)	4 ug/g dry	-	<4	-	<4
F3 PHCs (C16-C34)	8 ug/g dry	-	26	-	88
F4 PHCs (C34-C50)	6 ug/g dry	-	16	-	86

Certificate of Analysis

Report Date: 25-May-2023

Client: Paterson Group Consulting Engineers

Order Date: 18-May-2023

Client PO: 57506

Project Description: PE6080

	Client ID:	BH8-23-SS2	BH9-23-SS3	DUP 02	DUP 03
	Sample Date:	11-May-23 09:00	11-May-23 09:00	11-May-23 09:00	11-May-23 09:00
	Sample ID:	2320361-05	2320361-07	2320361-10	2320361-11
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	92.0	60.9	91.5	77.7
General Inorganics					
pH	0.05 pH Units	8.43	12.25	-	12.26
Metals					
Antimony	1.0 ug/g dry	<1.0	<1.0	-	<1.0
Arsenic	1.0 ug/g dry	3.0	<1.0	-	1.3
Barium	1.0 ug/g dry	80.8	25.1	-	34.8
Beryllium	0.5 ug/g dry	<0.5	<0.5	-	<0.5
Boron	5.0 ug/g dry	9.2	7.9	-	8.6
Cadmium	0.5 ug/g dry	<0.5	<0.5	-	<0.5
Chromium	5.0 ug/g dry	13.4	8.4	-	8.6
Cobalt	1.0 ug/g dry	3.7	2.8	-	1.6
Copper	5.0 ug/g dry	7.4	6.7	-	<5.0
Lead	1.0 ug/g dry	5.6	4.8	-	2.6
Molybdenum	1.0 ug/g dry	<1.0	<1.0	-	<1.0
Nickel	5.0 ug/g dry	9.4	5.1	-	<5.0
Selenium	1.0 ug/g dry	<1.0	<1.0	-	<1.0
Silver	0.3 ug/g dry	<0.3	<0.3	-	<0.3
Thallium	1.0 ug/g dry	<1.0	<1.0	-	<1.0
Uranium	1.0 ug/g dry	<1.0	<1.0	-	<1.0
Vanadium	10.0 ug/g dry	15.9	<10.0	-	<10.0
Zinc	20.0 ug/g dry	<20.0	<20.0	-	<20.0
Volatiles					
Benzene	0.02 ug/g dry	-	-	<0.02	-
Ethylbenzene	0.05 ug/g dry	-	-	<0.05	-
Toluene	0.05 ug/g dry	-	-	<0.05	-
m,p-Xylenes	0.05 ug/g dry	-	-	<0.05	-
o-Xylene	0.05 ug/g dry	-	-	<0.05	-
Xylenes, total	0.05 ug/g dry	-	-	<0.05	-
Toluene-d8	Surrogate	-	-	86.5%	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	-	-	<7	-
F2 PHCs (C10-C16)	4 ug/g dry	-	-	<4	-
F3 PHCs (C16-C34)	8 ug/g dry	-	-	86	-
F4 PHCs (C34-C50)	6 ug/g dry	-	-	89	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 57506

Report Date: 25-May-2023

Order Date: 18-May-2023

Project Description: PE6080

	Client ID:	BH1-23-SS2	BH2-23-SS3	BH3-23-SS2	-
	Sample Date:	10-May-23 09:00	10-May-23 09:00	10-May-23 09:00	-
	Sample ID:	2320361-12	2320361-13	2320361-14	-
	MDL/Units	Soil	Soil	Soil	-
Physical Characteristics					
% Solids	0.1 % by Wt.	82.5	79.9	85.9	-
General Inorganics					
pH	0.05 pH Units	-	-	11.93	-
Metals					
Antimony	1.0 ug/g dry	-	-	<1.0	-
Arsenic	1.0 ug/g dry	-	-	1.9	-
Barium	1.0 ug/g dry	-	-	33.6	-
Beryllium	0.5 ug/g dry	-	-	<0.5	-
Boron	5.0 ug/g dry	-	-	9.9	-
Cadmium	0.5 ug/g dry	-	-	<0.5	-
Chromium	5.0 ug/g dry	-	-	7.7	-
Cobalt	1.0 ug/g dry	-	-	2.1	-
Copper	5.0 ug/g dry	-	-	<5.0	-
Lead	1.0 ug/g dry	-	-	2.6	-
Molybdenum	1.0 ug/g dry	-	-	<1.0	-
Nickel	5.0 ug/g dry	-	-	<5.0	-
Selenium	1.0 ug/g dry	-	-	<1.0	-
Silver	0.3 ug/g dry	-	-	<0.3	-
Thallium	1.0 ug/g dry	-	-	<1.0	-
Uranium	1.0 ug/g dry	-	-	<1.0	-
Vanadium	10.0 ug/g dry	-	-	10.5	-
Zinc	20.0 ug/g dry	-	-	<20.0	-
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: Paterson Group Consulting Engineers

Client PO: 57506

Report Date: 25-May-2023

Order Date: 18-May-2023

Project Description: PE6080

	Client ID:	BH1-23-SS2	BH2-23-SS3	BH3-23-SS2	-
	Sample Date:	10-May-23 09:00	10-May-23 09:00	10-May-23 09:00	-
	Sample ID:	2320361-12	2320361-13	2320361-14	-
	MDL/Units	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 (dibromoethane, 1	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	-	110%	-	-
Dibromofluoromethane	Surrogate	-	95.6%	-	-
Toluene-d8	Surrogate	-	95.0%	-	-
Benzene	0.02 ug/g dry	<0.02	-	<0.02	-
Ethylbenzene	0.05 ug/g dry	<0.05	-	<0.05	-

Certificate of Analysis

Report Date: 25-May-2023

Client: Paterson Group Consulting Engineers

Order Date: 18-May-2023

Client PO: 57506

Project Description: PE6080

	Client ID:	BH1-23-SS2	BH2-23-SS3	BH3-23-SS2	-
	Sample Date:	10-May-23 09:00	10-May-23 09:00	10-May-23 09:00	-
	Sample ID:	2320361-12	2320361-13	2320361-14	-
	MDL/Units	Soil	Soil	Soil	-
Toluene	0.05 ug/g dry	<0.05	-	<0.05	-
m,p-Xylenes	0.05 ug/g dry	<0.05	-	<0.05	-
o-Xylene	0.05 ug/g dry	<0.05	-	<0.05	-
Xylenes, total	0.05 ug/g dry	<0.05	-	<0.05	-
Toluene-d8	Surrogate	90.5%	-	85.9%	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	-
F2 PHCs (C10-C16)	4 ug/g dry	<40 [1]	<4	<4	-
F3 PHCs (C16-C34)	8 ug/g dry	<80 [1]	<8	18	-
F4 PHCs (C34-C50)	6 ug/g dry	777 [2]	<6	28	-
F4G PHCs (gravimetric)	50 ug/g dry	1520	-	-	-

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	0.5	ug/g						
Boron	ND	5.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium	ND	5.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	5.0	ug/g						
Lead	ND	1.0	ug/g						
Molybdenum	ND	1.0	ug/g						
Nickel	ND	5.0	ug/g						
Selenium	ND	1.0	ug/g						
Silver	ND	0.3	ug/g						
Thallium	ND	1.0	ug/g						
Uranium	ND	1.0	ug/g						
Vanadium	ND	10.0	ug/g						
Zinc	ND	20.0	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, 1,2-	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	*8.32*		*ug/g*		*104*	*50-140*			
Surrogate: Dibromofluoromethane	*7.63*		*ug/g*		*95.4*	*50-140*			
Surrogate: Toluene-d8	*8.64*		*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	*8.64*		*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	7.79	0.05	pH Units	7.75			0.5	2.3	
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g	ND			NC	40	
F2 PHCs (C10-C16)	ND	4	ug/g	ND			NC	30	
F3 PHCs (C16-C34)	ND	8	ug/g	ND			NC	30	
F4 PHCs (C34-C50)	ND	6	ug/g	ND			NC	30	
Metals									
Antimony	ND	1.0	ug/g	ND			NC	30	
Arsenic	5.4	1.0	ug/g	6.3			16.1	30	
Barium	68.3	1.0	ug/g	84.1			20.7	30	
Beryllium	0.7	0.5	ug/g	0.8			8.5	30	
Boron	7.5	5.0	ug/g	9.7			25.9	30	
Cadmium	ND	0.5	ug/g	ND			NC	30	
Chromium	18.9	5.0	ug/g	22.3			16.6	30	
Cobalt	5.9	1.0	ug/g	7.0			16.9	30	
Copper	17.1	5.0	ug/g	19.6			13.5	30	
Lead	18.3	1.0	ug/g	21.4			15.6	30	
Molybdenum	1.2	1.0	ug/g	1.3			6.0	30	
Nickel	16.0	5.0	ug/g	18.7			15.9	30	
Selenium	ND	1.0	ug/g	ND			NC	30	
Silver	ND	0.3	ug/g	ND			NC	30	
Thallium	ND	1.0	ug/g	ND			NC	30	
Uranium	1.3	1.0	ug/g	1.5			12.8	30	
Vanadium	30.1	10.0	ug/g	36.1			18.3	30	
Zinc	55.5	20.0	ug/g	65.1			15.9	30	
Physical Characteristics									
% Solids	87.9	0.1	% by Wt.	88.3			0.4	25	
Volatiles									
Acetone	ND	0.50	ug/g	ND			NC	50	
Benzene	ND	0.02	ug/g	ND			NC	50	
Bromodichloromethane	ND	0.05	ug/g	ND			NC	50	
Bromoform	ND	0.05	ug/g	ND			NC	50	
Bromomethane	ND	0.05	ug/g	ND			NC	50	
Carbon Tetrachloride	ND	0.05	ug/g	ND			NC	50	
Chlorobenzene	ND	0.05	ug/g	ND			NC	50	
Chloroform	ND	0.05	ug/g	ND			NC	50	
Dibromochloromethane	ND	0.05	ug/g	ND			NC	50	
Dichlorodifluoromethane	ND	0.05	ug/g	ND			NC	50	
1,2-Dichlorobenzene	ND	0.05	ug/g	ND			NC	50	
1,3-Dichlorobenzene	ND	0.05	ug/g	ND			NC	50	
1,4-Dichlorobenzene	ND	0.05	ug/g	ND			NC	50	
1,1-Dichloroethane	ND	0.05	ug/g	ND			NC	50	
1,2-Dichloroethane	ND	0.05	ug/g	ND			NC	50	
1,1-Dichloroethylene	ND	0.05	ug/g	ND			NC	50	
cis-1,2-Dichloroethylene	ND	0.05	ug/g	ND			NC	50	
trans-1,2-Dichloroethylene	ND	0.05	ug/g	ND			NC	50	
1,2-Dichloropropane	ND	0.05	ug/g	ND			NC	50	
cis-1,3-Dichloropropylene	ND	0.05	ug/g	ND			NC	50	
trans-1,3-Dichloropropylene	ND	0.05	ug/g	ND			NC	50	
Ethylbenzene	ND	0.05	ug/g	ND			NC	50	
Ethylene dibromide (dibromoethane, 1,2	ND	0.05	ug/g	ND			NC	50	
Hexane	ND	0.05	ug/g	ND			NC	50	
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g	ND			NC	50	
Methyl Isobutyl Ketone	ND	0.50	ug/g	ND			NC	50	
Methyl tert-butyl ether	ND	0.05	ug/g	ND			NC	50	
Methylene Chloride	ND	0.05	ug/g	ND			NC	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	ND			NC	50	
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g	ND			NC	50	
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g	ND			NC	50	
Tetrachloroethylene	ND	0.05	ug/g	ND			NC	50	
Toluene	ND	0.05	ug/g	ND			NC	50	
1,1,1-Trichloroethane	ND	0.05	ug/g	ND			NC	50	
1,1,2-Trichloroethane	ND	0.05	ug/g	ND			NC	50	
Trichloroethylene	ND	0.05	ug/g	ND			NC	50	
Trichlorofluoromethane	ND	0.05	ug/g	ND			NC	50	
Vinyl chloride	ND	0.02	ug/g	ND			NC	50	
m,p-Xylenes	ND	0.05	ug/g	ND			NC	50	
o-Xylene	ND	0.05	ug/g	ND			NC	50	
Surrogate: 4-Bromofluorobenzene	*8.86*		*ug/g*		*105*	*50-140*			
Surrogate: Dibromofluoromethane	*9.12*		*ug/g*		*108*	*50-140*			
Surrogate: Toluene-d8	*9.24*		*ug/g*		*109*	*50-140*			
Benzene	ND	0.02	ug/g	ND			NC	50	
Ethylbenzene	ND	0.05	ug/g	ND			NC	50	
Toluene	ND	0.05	ug/g	ND			NC	50	
m,p-Xylenes	ND	0.05	ug/g	ND			NC	50	
o-Xylene	ND	0.05	ug/g	ND			NC	50	
Surrogate: Toluene-d8	*9.24*		*ug/g*		*109*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	187	7	ug/g	ND	93.6	80-120			
F2 PHCs (C10-C16)	98	4	ug/g	ND	92.4	60-140			
F3 PHCs (C16-C34)	299	8	ug/g	ND	115	60-140			
F4 PHCs (C34-C50)	202	6	ug/g	ND	123	60-140			
F4G PHCs (gravimetric)	1000	50	ug/g	ND	100	80-120			
Metals									
Antimony	37.0	1.0	ug/g	ND	73.9	70-130			
Arsenic	51.4	1.0	ug/g	2.5	97.8	70-130			
Barium	75.5	1.0	ug/g	33.6	83.7	70-130			
Beryllium	51.3	0.5	ug/g	ND	102	70-130			
Boron	50.2	5.0	ug/g	ND	92.8	70-130			
Cadmium	48.6	0.5	ug/g	ND	96.9	70-130			
Chromium	57.0	5.0	ug/g	8.9	96.2	70-130			
Cobalt	51.3	1.0	ug/g	2.8	96.9	70-130			
Copper	54.0	5.0	ug/g	7.9	92.2	70-130			
Lead	48.9	1.0	ug/g	8.5	80.7	70-130			
Molybdenum	47.5	1.0	ug/g	ND	94.0	70-130			
Nickel	54.5	5.0	ug/g	7.5	93.9	70-130			
Selenium	49.0	1.0	ug/g	ND	97.3	70-130			
Silver	41.1	0.3	ug/g	ND	82.2	70-130			
Thallium	45.5	1.0	ug/g	ND	90.8	70-130			
Uranium	41.9	1.0	ug/g	ND	82.6	70-130			
Vanadium	62.0	10.0	ug/g	14.5	95.1	70-130			
Zinc	67.8	20.0	ug/g	26.0	83.5	70-130			
Volatiles									
Acetone	13.2	0.50	ug/g	ND	132	50-140			
Benzene	4.34	0.02	ug/g	ND	109	60-130			
Bromodichloromethane	4.20	0.05	ug/g	ND	105	60-130			
Bromoform	3.69	0.05	ug/g	ND	92.1	60-130			
Bromomethane	4.06	0.05	ug/g	ND	101	50-140			
Carbon Tetrachloride	4.42	0.05	ug/g	ND	111	60-130			
Chlorobenzene	4.26	0.05	ug/g	ND	107	60-130			
Chloroform	3.44	0.05	ug/g	ND	86.0	60-130			
Dibromochloromethane	3.92	0.05	ug/g	ND	98.1	60-130			
Dichlorodifluoromethane	4.02	0.05	ug/g	ND	100	50-140			
1,2-Dichlorobenzene	3.86	0.05	ug/g	ND	96.6	60-130			
1,3-Dichlorobenzene	3.83	0.05	ug/g	ND	95.9	60-130			
1,4-Dichlorobenzene	3.73	0.05	ug/g	ND	93.3	60-130			
1,1-Dichloroethane	4.62	0.05	ug/g	ND	116	60-130			
1,2-Dichloroethane	4.23	0.05	ug/g	ND	106	60-130			
1,1-Dichloroethylene	4.21	0.05	ug/g	ND	105	60-130			
cis-1,2-Dichloroethylene	3.43	0.05	ug/g	ND	85.7	60-130			
trans-1,2-Dichloroethylene	3.91	0.05	ug/g	ND	97.7	60-130			
1,2-Dichloropropane	4.14	0.05	ug/g	ND	104	60-130			
cis-1,3-Dichloropropylene	4.89	0.05	ug/g	ND	122	60-130			
trans-1,3-Dichloropropylene	4.63	0.05	ug/g	ND	116	60-130			
Ethylbenzene	4.25	0.05	ug/g	ND	106	60-130			
Ethylene dibromide (dibromoethane, 1,2	3.74	0.05	ug/g	ND	93.5	60-130			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hexane	4.13	0.05	ug/g	ND	103	60-130			
Methyl Ethyl Ketone (2-Butanone)	11.3	0.50	ug/g	ND	113	50-140			
Methyl Isobutyl Ketone	12.2	0.50	ug/g	ND	122	50-140			
Methyl tert-butyl ether	12.8	0.05	ug/g	ND	128	50-140			
Methylene Chloride	4.49	0.05	ug/g	ND	112	60-130			
Styrene	3.65	0.05	ug/g	ND	91.2	60-130			
1,1,1,2-Tetrachloroethane	4.14	0.05	ug/g	ND	104	60-130			
1,1,2,2-Tetrachloroethane	4.55	0.05	ug/g	ND	114	60-130			
Tetrachloroethylene	4.21	0.05	ug/g	ND	105	60-130			
Toluene	4.39	0.05	ug/g	ND	110	60-130			
1,1,1-Trichloroethane	4.30	0.05	ug/g	ND	107	60-130			
1,1,2-Trichloroethane	4.14	0.05	ug/g	ND	104	60-130			
Trichloroethylene	4.04	0.05	ug/g	ND	101	60-130			
Trichlorofluoromethane	4.60	0.05	ug/g	ND	115	50-140			
Vinyl chloride	4.22	0.02	ug/g	ND	106	50-140			
m,p-Xylenes	8.30	0.05	ug/g	ND	104	60-130			
o-Xylene	4.18	0.05	ug/g	ND	104	60-130			
Surrogate: 4-Bromofluorobenzene	*8.47*		*ug/g*		*106*	*50-140*			
Surrogate: Dibromofluoromethane	*7.02*		*ug/g*		*87.8*	*50-140*			
Surrogate: Toluene-d8	*8.05*		*ug/g*		*101*	*50-140*			
Benzene	4.34	0.02	ug/g	ND	109	60-130			
Ethylbenzene	4.25	0.05	ug/g	ND	106	60-130			
Toluene	4.39	0.05	ug/g	ND	110	60-130			
m,p-Xylenes	8.30	0.05	ug/g	ND	104	60-130			
o-Xylene	4.18	0.05	ug/g	ND	104	60-130			
Surrogate: Toluene-d8	*8.05*		*ug/g*		*101*	*50-140*			

Qualifier Notes:

Sample Qualifiers :

1 : Elevated reporting limits due to the nature of the sample matrix.

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

Sample Data Revisions

None

Work Order Revisions / Comments:

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.
NC: Not Calculated

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.
- When reported, data for F4G has been processed using a silica gel cleanup.

PARACEL LABORATORIES LTD.

Paracel ID: 2320361

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Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2320361	

Client Name: Paterson Group	Project Ref: PE 6080	Page 1 of 2
Contact Name: Karyn Munch	Quote #:	Turnaround Time
Address: 9 Auriga Dr, Ottawa ON, K2E 7T9	PO #: 57506	☐ 1 day ☐ 3 day ☐ 2 day ☒ Regular
Telephone: 613 226-7381	E-mail: KMunch@patersongroup.ca	Date Required:

☒ REG 153/04 ☐ REG 406/19	Other Regulation
☐ Table 1 ☐ Res/Park ☐ Med/Fine	☐ REG 558 ☐ PWQO
☐ Table 2 ☒ Ind/Comm ☐ Coarse	☐ CCME ☐ MISA
☒ Table 3 ☐ Agri/Other	☐ SU - Sani ☐ SU - Storm
☐ Table ___	Mun: ___
For RSC: ☐ Yes ☐ No	☐ Other:

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

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	pH	HOLD				
1	BH5-23-SS2	S		1	May 11 2023					X				X					
2	BH5-23-SS3			2			X												
3	BH6-23-SS2			1						X				X					
4	BH7-23-AU1			2			X												
5	BH8-23-SS2			1						X				X					
6	BH8-23-SS3			1											X				
7	BH9-23-SS3			1						X				X					
8	BH10-23-SS3			2											X				
9	DUP01			2											X				
10	DUP02	↓		2	↓		X												

Comments:

Method of Delivery: Paracel Courier

Relinquished By (Sign): Trudy Blair	Received By Driver/Depot:	Received at Lab:	Verified By: SD
Relinquished By (Print): Trudy Blair	Date/Time:	Date/Time: May 18/23 1224	Date/Time: May 18, 24
Date/Time: May 17 2023	Temperature: °C	Temperature: 16.4	pH Verified: ☐ By:

PARACEL LABORATORIES LTD. | T R R

Paracel ID: 2320361

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2320361	

Client Name: Paterson Group	Project Ref: PE6080	Page 2 of 2
Contact Name: Karyn Munch	Quote #:	Turnaround Time
Address: 9 Auriga Dr, Ottawa ON, K2E 7T9	PO #: 57506	☐ 1 day ☐ 3 day ☐ 2 day ☒ Regular
Telephone: 613 226-7381	E-mail: KMunch@patersongroup.ca	Date Required:

☒ REG 153/04 ☐ REG 406/19

☐ Table 1 ☐ Res/Park ☐ Med/Fine
☐ Table 2 ☒ Ind/Comm ☐ Coarse
☒ Table 3 ☐ Agri/Other
☐ Table
For RSC: ☐ Yes ☐ No

Other Regulation: ☐ REG 558 ☐ PWQO ☐ CCME ☐ MISA ☐ SU - Sani ☐ SU - Storm
Mun:
☐ Other:

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

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	pH				
1	DUP 03	S		1	May 11 2023					X				X				
2	[redacted] BH1-23-SS2	↓		2	May 10 2023		X											
3	[redacted] BH2-23-SS3	↓		2	↓		X	X										
4	BH3-23-SS2	↓		2	↓		X			X				X			/	
5																		
6																		
7																		
8																		
9																		
10																		

Comments:

Method of Delivery: ~~Paracel Courier~~

Relinquished By (Sign): Trudy Blair	Received By Driver/Depot:	Received at Lab:	Verified By: SD
Relinquished By (Print): Trudy Blair	Date/Time:	Date/Time: May 18/23 1224	Date/Time: May 18, 12:14
Date/Time: May 17 2023	Temperature: °C	Temperature: 16.4	pH Verified: ☐ By:

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Certificate of Analysis

Paterson Group Consulting Engineers

9 Auriga Drive
Ottawa, ON K2E 7T9
Attn: Karyn Munch

Client PO: 57554
Project: PE6080
Custody:

Report Date: 29-May-2023
Order Date: 23-May-2023

Order #: 2321054

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

Paracel ID	Client ID
2321054-01	BH1-23-GW
2321054-02	BH2-23-GW
2321054-03	BH3-23-GW
2321054-04	BH7-23-GW
2321054-05	DUP-GW-May19

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 57554

Report Date: 29-May-2023

Order Date: 23-May-2023

Project Description: PE6080

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	24-May-23	24-May-23
PHC F1	CWS Tier 1 - P&T GC-FID	24-May-23	24-May-23
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	26-May-23	27-May-23
REG 153: VOCs by P&T GC/MS	EPA 624 - P&T GC-MS	24-May-23	24-May-23

Certificate of Analysis

Report Date: 29-May-2023

Client: Paterson Group Consulting Engineers

Order Date: 23-May-2023

Client PO: 57554

Project Description: PE6080

	Client ID:	BH1-23-GW	BH2-23-GW	BH3-23-GW	BH7-23-GW
	Sample Date:	19-May-23 09:00	19-May-23 09:00	19-May-23 09:00	19-May-23 09:00
	Sample ID:	2321054-01	2321054-02	2321054-03	2321054-04
	MDL/Units	Ground Water	Ground Water	Ground Water	Ground 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	-	1.1	-	-
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 (dibromoethane, 1,2-)	0.2 ug/L	-	<0.2	-	-
Hexane	1.0 ug/L	-	<1.0	-	-
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	-	<5.0	-	-
Methyl Isobutyl Ketone	5.0 ug/L	-	<5.0	-	-
Methyl tert-butyl ether	2.0 ug/L	-	<2.0	-	-
Methylene Chloride	5.0 ug/L	-	<5.0	-	-
Styrene	0.5 ug/L	-	<0.5	-	-
1,1,1,2-Tetrachloroethane	0.5 ug/L	-	<0.5	-	-
1,1,2,2-Tetrachloroethane	0.5 ug/L	-	<0.5	-	-
Tetrachloroethylene	0.5 ug/L	-	<0.5	-	-
Toluene	0.5 ug/L	-	<0.5	-	-
1,1,1-Trichloroethane	0.5 ug/L	-	<0.5	-	-

Certificate of Analysis

Report Date: 29-May-2023

Client: Paterson Group Consulting Engineers

Order Date: 23-May-2023

Client PO: 57554

Project Description: PE6080

	Client ID:	BH1-23-GW	BH2-23-GW	BH3-23-GW	BH7-23-GW
	Sample Date:	19-May-23 09:00	19-May-23 09:00	19-May-23 09:00	19-May-23 09:00
	Sample ID:	2321054-01	2321054-02	2321054-03	2321054-04
	MDL/Units	Ground Water	Ground Water	Ground Water	Ground 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	-	104%	-	-
Dibromofluoromethane	Surrogate	-	76.6%	-	-
Toluene-d8	Surrogate	-	107%	-	-
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	110%	-	107%	108%
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	<25	<25	<25
F2 PHCs (C10-C16)	100 ug/L	<100	<100	<100	<100
F3 PHCs (C16-C34)	100 ug/L	<100	<100	<100	<100
F4 PHCs (C34-C50)	100 ug/L	<100	<100	<100	<100

Certificate of Analysis

Report Date: 29-May-2023

Client: **Paterson Group Consulting Engineers**

Order Date: 23-May-2023

Client PO: **57554**

Project Description: PE6080

	Client ID:	DUP-GW-May19	-	-	-
	Sample Date:	19-May-23 09:00	-	-	-
	Sample ID:	2321054-05	-	-	-
	MDL/Units	Ground 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	1.2	-	-	-
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 (dibromoethane, 1	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	-	-	-

Certificate of Analysis

Report Date: 29-May-2023

Client: Paterson Group Consulting Engineers

Order Date: 23-May-2023

Client PO: 57554

Project Description: PE6080

	Client ID:	DUP-GW-May19	-	-	-
	Sample Date:	19-May-23 09:00	-	-	-
	Sample ID:	2321054-05	-	-	-
	MDL/Units	Ground Water	-	-	-
1,1,1-Trichloroethane	0.5 ug/L	<0.5	-	-	-
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	101%	-	-	-
Dibromofluoromethane	Surrogate	76.6%	-	-	-
Toluene-d8	Surrogate	106%	-	-	-
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						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
Volatiles									
Acetone	ND	5.0	ug/L						
Benzene	ND	0.5	ug/L						
Bromodichloromethane	ND	0.5	ug/L						
Bromoform	ND	0.5	ug/L						
Bromomethane	ND	0.5	ug/L						
Carbon Tetrachloride	ND	0.2	ug/L						
Chlorobenzene	ND	0.5	ug/L						
Chloroform	ND	0.5	ug/L						
Dibromochloromethane	ND	0.5	ug/L						
Dichlorodifluoromethane	ND	1.0	ug/L						
1,2-Dichlorobenzene	ND	0.5	ug/L						
1,3-Dichlorobenzene	ND	0.5	ug/L						
1,4-Dichlorobenzene	ND	0.5	ug/L						
1,1-Dichloroethane	ND	0.5	ug/L						
1,2-Dichloroethane	ND	0.5	ug/L						
1,1-Dichloroethylene	ND	0.5	ug/L						
cis-1,2-Dichloroethylene	ND	0.5	ug/L						
trans-1,2-Dichloroethylene	ND	0.5	ug/L						
1,2-Dichloropropane	ND	0.5	ug/L						
cis-1,3-Dichloropropylene	ND	0.5	ug/L						
trans-1,3-Dichloropropylene	ND	0.5	ug/L						
1,3-Dichloropropene, total	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Ethylene dibromide (dibromoethane, 1,2	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	*81.8*		*ug/L*		*102*	*50-140*			
Surrogate: Dibromofluoromethane	*67.0*		*ug/L*		*83.7*	*50-140*			
Surrogate: Toluene-d8	*86.9*		*ug/L*		*109*	*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	*86.9*		*ug/L*		*109*	*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			NC	30	
Volatiles									
Acetone	23.5	5.0	ug/L	25.6			8.8	30	
Benzene	ND	0.5	ug/L	ND			NC	30	
Bromodichloromethane	ND	0.5	ug/L	ND			NC	30	
Bromoform	ND	0.5	ug/L	ND			NC	30	
Bromomethane	ND	0.5	ug/L	ND			NC	30	
Carbon Tetrachloride	ND	0.2	ug/L	ND			NC	30	
Chlorobenzene	ND	0.5	ug/L	ND			NC	30	
Chloroform	ND	0.5	ug/L	ND			NC	30	
Dibromochloromethane	ND	0.5	ug/L	ND			NC	30	
Dichlorodifluoromethane	ND	1.0	ug/L	ND			NC	30	
1,2-Dichlorobenzene	ND	0.5	ug/L	ND			NC	30	
1,3-Dichlorobenzene	ND	0.5	ug/L	ND			NC	30	
1,4-Dichlorobenzene	ND	0.5	ug/L	ND			NC	30	
1,1-Dichloroethane	ND	0.5	ug/L	ND			NC	30	
1,2-Dichloroethane	ND	0.5	ug/L	ND			NC	30	
1,1-Dichloroethylene	ND	0.5	ug/L	ND			NC	30	
cis-1,2-Dichloroethylene	ND	0.5	ug/L	ND			NC	30	
trans-1,2-Dichloroethylene	ND	0.5	ug/L	ND			NC	30	
1,2-Dichloropropane	ND	0.5	ug/L	ND			NC	30	
cis-1,3-Dichloropropylene	ND	0.5	ug/L	ND			NC	30	
trans-1,3-Dichloropropylene	ND	0.5	ug/L	ND			NC	30	
Ethylbenzene	ND	0.5	ug/L	ND			NC	30	
Ethylene dibromide (dibromoethane, 1,2-	ND	0.2	ug/L	ND			NC	30	
Hexane	ND	1.0	ug/L	ND			NC	30	
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L	ND			NC	30	
Methyl Isobutyl Ketone	ND	5.0	ug/L	ND			NC	30	
Methyl tert-butyl ether	ND	2.0	ug/L	ND			NC	30	
Methylene Chloride	ND	5.0	ug/L	ND			NC	30	
Styrene	ND	0.5	ug/L	ND			NC	30	
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L	ND			NC	30	
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L	ND			NC	30	
Tetrachloroethylene	ND	0.5	ug/L	ND			NC	30	
Toluene	ND	0.5	ug/L	ND			NC	30	
1,1,1-Trichloroethane	ND	0.5	ug/L	ND			NC	30	
1,1,2-Trichloroethane	ND	0.5	ug/L	ND			NC	30	
Trichloroethylene	ND	0.5	ug/L	ND			NC	30	
Trichlorofluoromethane	ND	1.0	ug/L	ND			NC	30	
Vinyl chloride	ND	0.5	ug/L	ND			NC	30	
m,p-Xylenes	ND	0.5	ug/L	ND			NC	30	
o-Xylene	ND	0.5	ug/L	ND			NC	30	
Surrogate: 4-Bromofluorobenzene	*81.8*		*ug/L*		*102*	*50-140*			
Surrogate: Dibromofluoromethane	*80.5*		*ug/L*		*101*	*50-140*			
Surrogate: Toluene-d8	*84.8*		*ug/L*		*106*	*50-140*			
Benzene	ND	0.5	ug/L	ND			NC	30	
Ethylbenzene	ND	0.5	ug/L	ND			NC	30	
Toluene	ND	0.5	ug/L	ND			NC	30	
m,p-Xylenes	ND	0.5	ug/L	ND			NC	30	
o-Xylene	ND	0.5	ug/L	ND			NC	30	
Surrogate: Toluene-d8	*84.8*		*ug/L*		*106*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	1710	25	ug/L	ND	85.5	68-117			
F2 PHCs (C10-C16)	1570	100	ug/L	ND	98.4	60-140			
F3 PHCs (C16-C34)	3950	100	ug/L	ND	101	60-140			
F4 PHCs (C34-C50)	2860	100	ug/L	ND	115	60-140			
Volatiles									
Acetone	122	5.0	ug/L	ND	122	50-140			
Benzene	39.3	0.5	ug/L	ND	98.3	60-130			
Bromodichloromethane	32.3	0.5	ug/L	ND	80.7	60-130			
Bromoform	33.6	0.5	ug/L	ND	83.9	60-130			
Bromomethane	43.6	0.5	ug/L	ND	109	50-140			
Carbon Tetrachloride	33.6	0.2	ug/L	ND	83.9	60-130			
Chlorobenzene	43.1	0.5	ug/L	ND	108	60-130			
Chloroform	33.3	0.5	ug/L	ND	83.2	60-130			
Dibromochloromethane	34.9	0.5	ug/L	ND	87.3	60-130			
Dichlorodifluoromethane	44.0	1.0	ug/L	ND	110	50-140			
1,2-Dichlorobenzene	41.6	0.5	ug/L	ND	104	60-130			
1,3-Dichlorobenzene	40.9	0.5	ug/L	ND	102	60-130			
1,4-Dichlorobenzene	39.8	0.5	ug/L	ND	99.4	60-130			
1,1-Dichloroethane	42.8	0.5	ug/L	ND	107	60-130			
1,2-Dichloroethane	38.8	0.5	ug/L	ND	97.1	60-130			
1,1-Dichloroethylene	43.2	0.5	ug/L	ND	108	60-130			
cis-1,2-Dichloroethylene	34.4	0.5	ug/L	ND	86.0	60-130			
trans-1,2-Dichloroethylene	37.4	0.5	ug/L	ND	93.4	60-130			
1,2-Dichloropropane	36.7	0.5	ug/L	ND	91.8	60-130			
cis-1,3-Dichloropropylene	33.6	0.5	ug/L	ND	84.1	60-130			
trans-1,3-Dichloropropylene	39.0	0.5	ug/L	ND	97.4	60-130			
Ethylbenzene	42.2	0.5	ug/L	ND	106	60-130			
Ethylene dibromide (dibromoethane, 1,2-	37.0	0.2	ug/L	ND	92.6	60-130			
Hexane	40.7	1.0	ug/L	ND	102	60-130			
Methyl Ethyl Ketone (2-Butanone)	107	5.0	ug/L	ND	107	50-140			
Methyl Isobutyl Ketone	132	5.0	ug/L	ND	132	50-140			
Methyl tert-butyl ether	113	2.0	ug/L	ND	113	50-140			
Methylene Chloride	42.1	5.0	ug/L	ND	105	60-130			
Styrene	37.1	0.5	ug/L	ND	92.8	60-130			
1,1,1,2-Tetrachloroethane	37.0	0.5	ug/L	ND	92.6	60-130			
1,1,2,2-Tetrachloroethane	40.6	0.5	ug/L	ND	101	60-130			
Tetrachloroethylene	44.0	0.5	ug/L	ND	110	60-130			
Toluene	43.7	0.5	ug/L	ND	109	60-130			
1,1,1-Trichloroethane	36.0	0.5	ug/L	ND	90.0	60-130			
1,1,2-Trichloroethane	35.7	0.5	ug/L	ND	89.2	60-130			
Trichloroethylene	37.5	0.5	ug/L	ND	93.7	60-130			
Trichlorofluoromethane	43.1	1.0	ug/L	ND	108	60-130			
Vinyl chloride	37.6	0.5	ug/L	ND	94.0	50-140			
m,p-Xylenes	84.0	0.5	ug/L	ND	105	60-130			
o-Xylene	42.7	0.5	ug/L	ND	107	60-130			
Surrogate: 4-Bromofluorobenzene	*83.6*		*ug/L*		*104*	*50-140*			
Surrogate: Dibromofluoromethane	*66.8*		*ug/L*		*83.6*	*50-140*			
Surrogate: Toluene-d8	*81.3*		*ug/L*		*102*	*50-140*			

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 57554

Report Date: 29-May-2023

Order Date: 23-May-2023

Project Description: PE6080

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Benzene	39.3	0.5	ug/L	ND	98.3	60-130			
Ethylbenzene	42.2	0.5	ug/L	ND	106	60-130			
Toluene	43.7	0.5	ug/L	ND	109	60-130			
m,p-Xylenes	84.0	0.5	ug/L	ND	105	60-130			
o-Xylene	42.7	0.5	ug/L	ND	107	60-130			
Surrogate: Toluene-d8	*81.3*		*ug/L*		*102*	*50-140*			

Qualifier Notes:

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.
NC: Not Calculated

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.
- When reported, data for F4G has been processed using a silica gel cleanup.

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Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)

Client Name: Paterson Group
Contact Name: Karyn Munch
Address: 9 Auriga Dr.
Telephone: 613-226-7381

Project Ref: PE6080
Quote #:
PO #: 57554
E-mail: Kmunch@patersongroup.ca

Page 1 of 1

Turnaround Time
☐ 1 day ☐ 3 day
☐ 2 day ☒ Regular
Date Required:

☒ REG 153/04 ☐ REG 406/19

☐ Table 1 ☒ Res/Park ☐ Med/Fine
☐ Table 2 ☐ Ind/Comm ☒ Coarse
☒ Table 3 ☐ Agri/Other
☐ Table
For RSC: ☒ Yes ☐ No

Other Regulation
☐ REG 558 ☐ PWQO
☐ CCME ☐ MISA
☐ SU - Sani ☐ SU - Storm
Mun:
☐ Other:

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

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)				
1	BH1-23-GW	GW		3	May 19/23		X										
2	BH2-23-GW						X	X									
3	BH3-23-GW						X										
4	BH7-23-GW						X										
5	DUP-GW-May 19						X	X									
6																	
7																	
8																	
9																	
10																	

Comments:

Method of Delivery: Paracel Courier

Relinquished By (Sign): DLatt	Received By Driver/Depot:	Received at Lab: Stonecown Dehradi	Verified By:
Relinquished By (Print): Derek Lattin	Date/Time:	Date/Time: May 23, 2023 12.40	Date/Time: May 23/23 13:14pm
Date/Time: May 23 2023	Temperature: °C	Temperature: 16.6	pH Verified: ☐ By: