PATERSON GROUP

Phase II – Environmental Site Assessment

8 Withrow Avenue

Ottawa, Ontario

Prepared for Julian of Norwich Anglican Church

Report PE4799-2R

May 2, 2023

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EXECUTIVE SUMMARY

Assessment

A Phase II ESA was conducted for 8 Withrow Avenue, in the City of 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 considered to result in areas of potential environmental concern (APECs) on the Phase II Property. The subsurface investigation consisted of drilling five (5) boreholes, three (3) of which were constructed with groundwater monitoring wells.

Soil samples were obtained from the boreholes and screened using visual observations and organic vapour measurements. Three (3) soil samples were submitted for laboratory analysis of benzene, toluene, ethylbenzene and xylenes (BTEX) and petroleum hydrocarbons (PHCs, F1-F4) while one (1) soil sample was submitted for analysis of VOCs. All PHC, BTEX and VOC concentrations were non-detect and in compliance with MECP Table 7 Standards.

Three (3) groundwater samples were obtained from the monitoring wells installed in BH1, BH2 and BH3 and were submitted for laboraotory analysis of PHCs, BTEX and/or VOCs. All of the analyzed PHC, BTEX and VOC concentrations were non-detect and therefore, are in compliance with the selected MECP Table 7 standards.

A second round of groundwater sampling was completed on April 18, 2023. Three samples (including one duplicate) were submitted from BH1 and BH3 for PHCs and BTEX. All of the PHC and BTEX parameters were non-detect and therefore, are in compliance with the selected Table 7 standards.

Conclusion

Based on the findings of the Phase II ESA, the soil and groundwater below the Phase II Property is in compliance with the selected MECP Table 7 standards. No further investigative work is considered to be required at this time.

It is expected that groundwater monitoring wells will be abandoned in accordance with O.Reg.903, at the time of construction excavation. It is recommended that the integrity of the monitoring wells be maintained, prior to future construction, for possible further groundwater monitoring purposes.

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1.0 INTRODUCTION

At the request of Julian of Norwich Anglican Church, Paterson Group (Paterson) conducted a Phase II Environmental Site Assessment for 8 Withrow Avenue, in the City of Ottawa, Ontario. The purpose of this Phase II ESA has been to address areas of potential environmental concern (APECs) identified on the Phase II Property, during the Phase I ESA conducted by Paterson on December 9, 2019.

1.1 Site Description

Address:	8 Withrow Avenue, Ottawa, Ontario.
Property Identification Number:	04689-0001
Location:	The subject site is situated on the western side of Merivale Road between Withrow Avenue and Rossland Avenue, in the City of Ottawa. For the purpose of this report, Merivale Road is assumed to travel in a north-south direction.
Latitude and Longitude:	45° 21' 17" N, 75° 44' 12" W;
Configuration:	Irregular.
Site Area:	7,800 m^2 (approximate).

1.2 Property Ownership

Paterson was engaged to conduct this Phase II ESA by Revered Monique Stone on behalf of Julian of Norwich Anglican Church.

1.3 Current and Proposed Future Uses

The subject site is currently occupied by a church fronting onto Merivale Road and a house (rectory) fronting on to Rossland Avenue. It is our understanding that the subject site is to be redeveloped with affordable housing, a new church and mixed-use community space. The development may include low and mid-rise buildings of up to 10 stories with both underground and surface-level parking.

1.4 Applicable Site Condition Standard

The site condition standards for the property were obtained from Table 7 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), April 2011. The MECP selected Table 7 Standards are based on the following considerations:

- ❒ Coarse-grained soil conditions
- ❒ Shallow soil (less than 2 m)
- ❒ Non-potable groundwater conditions
- ❒ Residential land use.

The residential standards were selected based on the proposed future use of the subject site. Coarse-grained soil standards were chosen as a conservative approach. Grain size analysis was not completed.

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The Phase II property is located in an area of mixed residential, institutional and commercial land use. The subject site is bound by Rossland Avenue to the south, Merivale Road to the east and Withrow Avenue to the north. The site is relatively flat and at grade with the adjacent properties. Site drainage consists of infiltration and runoff towards the adjacent roadways.

2.2 Past Investigations

Paterson completed a Phase I ESA for the Phase II Property in December 2019. Based on the Phase I ESA, four potentially contaminating activities (PCAs) that resulted in areas of potential environmental concern (APECs) on the Phase II Property were identified. The identified APECs consist of an on-site underground storage tank, former off-site dry cleaner and two off-site retail fuel outlets (RFO). The PCAs and resulting APECs as well as the associated contaminants of potential concern (CPCs) are summarised in Table 1.

Table 1: Areas of Potential Environmental Concern					
Areas of Potential Environmental Concern	**Location of APEC with respect to Phase I Property**	**Potentially Contaminating Activity**	**Location of PCA (on-site or off-site)**	**Contaminants of Potential Concern**	**Media Potentially Impacted**
Former heating oil UST	The central portion of the Phase I ESA property	Item 28 - Gasoline and Associated Products Storage in Fixed UST	On-Site	PHCs, BTEX	Soil and groundwater
King Cole Kleenette, 1528 Merivale Road	The northern portion of Phase I ESA property	Item 37 - operation of dry cleaning equipment	Off-Site	VOCs	Groundwater
Retail Fuel Outlet, 1548 Merivale Road	The southern portion of Phase I ESA property	Item 28 - Gasoline and Associated Products Storage in Fixed UST	Off-Site	PHCs, BTEX	Soil and groundwater
Retail Fuel Outlet, 1543 Merivale Road	Eastern portion of Phase I ESA property	Item 28 - Gasoline and Associated Products Storage in Fixed UST	Off-Site	PHCs, BTEX	Soil and groundwater

A Phase II ESA was recommended to address the aforementioned APECs.

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The subsurface investigation was conducted on December 6, 2019, and January 20 and 21, 2020. The field program consisted of drilling five (5) boreholes, three (3) of which were completed as groundwater monitoring wells. Boreholes were drilled to depths ranging from 1.47 to 6.66 m below the existing grade. The environmental site assessment was conducted alongside a geotechnical investigation.

3.2 Media Investigated

During the subsurface investigation, soil and groundwater samples were obtained with some samples submitted for laboratory analysis. The rationale for sampling and analyzing these samples is based on the Contaminants of Potential Concern identified in the Phase I ESA.

3.3 Phase I Conceptual Site Model

Geological and Hydrogeological Setting

Based on the information from NRCAN, bedrock in the area of the site consists of dolostone and sandstone of the Beekmantown Group.

Based on the maps, the thickness of overburden is anticipated to be around 1 m and consists of glacial till.

Contaminants of Potential Concern

Based on the identified APECs, the following CPCs were identifeid on the Phase I Property:

- Petroleum hydrocarbons (PHCs, fractions 1-4),
- Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX),
- Volatile Organic Compounds (VOCs).

Existing Buildings and Structures

The subject site is occupied by church and rectory, first constructed around 1955.

Water Bodies

There are no waterbodies on the subject property or within the Phase I ESA study area.

Areas of Natural Significance

There are no areas of natural and scientific interest on the subject property or within the Phase I ESA study area.

Water Well Records

Records of 71 wells were found in the study area, consisting of 44 water supply wells and 27 observation/monitoring wells.

Two wells were recorded on the subject site and consisted of water supply wells serving the rectory and church. These wells were drilled in 1955 and 1957.

Given the municipally supplied area, potable water wells in the subject area are expected to be obsolete.

Neighbouring Land Use

Neighbouring land use in the Phase I study area consists of residential, institutional and commercial properties. Land use is shown on Drawing PE4799-2 Surrounding Land Use Plan.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

Areas of Potential Environmental Concern (APEC) identified on the Phase I property are summarized in Table 1 of this report. Any other potentially contaminating activities (PCAs) within a 250 m radius are not considered to pose an environmental concern to the Phase I ESA Property due to their separation distance and/or location downgradient or cross-gradient of the Phase I ESA 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 areas of potential environmental concern (APECs) on the subject site. The presence of potentially contaminating activities was confirmed by a variety of independent sources, and as such, the conclusions of this report are not affected by uncertainty which may be present with respect to the individual sources.

3.4 Deviations from Sampling and Analysis Plan

The Sampling and Analysis Plan for this project is included in Appendix 1 of this report.

3.5 Impediments

Underground utilities and tree cover did not allow access with the drill equipment near the former underground storage tank. No other physical impediments were encountered during the Phase II ESA program.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation was conducted on December 6, 2019, and January 20 and 21, 2020. The field program consisted of five (5) boreholes on the Phase II Property, three (3) of which were completed with monitoring well installations. A geotechnical investigation was completed alongside the Phase II ESA.

The boreholes were placed to address the aforementioned areas of potential environmental concern (APECs).

The boreholes were drilled with a combination of truck-mounted and track-mounted low clearance drill rigs, operated by George Downing Estate Drilling of Hawkesbury, Ontario, under the full-time supervision of Paterson personnel. Borehole locations are shown on Drawing PE4799-3 – Test Hole Location Plan appended to this report.

4.2 Soil Sampling

A total of 18 soil samples were obtained from the boreholes by means of sampling from shallow auger flights and split spoon sampling. The depths at which auger samples and split spoon samples were obtained from the boreholes are shown as "**AU**" and "**SS**" on the Soil Profile and Test Data Sheets, appended to this report.

Site soils generally consist of 0.05 m of surficial topsoil or asphaltic concrete, underlain by sand-gravel pavement base or reworked native soil between 0.76m and 1.52 m thick and consisting of brown sand with some gravel and silt with occasional cobbles. This was underlain by till consisting of brown silty clay with sand and gravel. This material was encountered above the bedrock, which was found to lie between 1.47 m to 2.79 m below the existing grade.

4.3 Field Screening Measurements

The soil samples collected were subjected to a preliminary screening procedure, which included visual screening for colour and evidence of contamination, followed by soil vapour screening with a MiniRAE 2000 Portable VOC Monitor.

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

The vapour readings were found to range from 0 to 2.4 ppm. These readings are not considered to be indicative of significant concentrations of volatile compounds.

Vapour readings are noted on the Soil Profile and Test Data Sheets in Appendix 1.

4.4 Groundwater Monitoring Well Installation

Three (3) groundwater monitoring wells were installed on the Phase II Property as part of the 2019 subsurface investigation.

The monitoring wells consisted of 32 mm diameter Schedule 40 threaded PVC risers and screens. Monitoring well construction details are listed below in Table 2 and are also presented on the Soil Profile and Test Data Sheets provided in Appendix 1.

TABLE 2: Monitoring Well Construction Details

Well ID	Ground Surface Elevation	Total Depth (m BGS)	Screened Interval (m BGS)	Sand Pack (m BGS)	Bentonite Seal (m BGS)	Casing Type
BH1	96.77	6.65	3.65-6.65	3.20-6.65	0.60-3.20	Flush mount
BH2	97.01	4.52	3.02-4.52	2.74-4.52	0.60-2.74	Flush mount
BH3	96.96	4.52	3.02-4.52	2.74-4.52	0.16-2.74	Flush mount

4.5 Field Measurement of Water Quality Parameters

Groundwater sampling was conducted at BH1, BH2 and BH3 on January 10 and January 23, 2020. The monitoring wells in BH1 and BH3 were re-sampled on April 18, 2023 to further assess the potential for impacts resulting from the identified UST and RFOs. No water quality parameters were measured in the field at that time, due to limited groundwater sample volume.

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

4.7 Analytical Testing

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

TABLE 3: Soil Samples Submitted					
Sample ID	Screened Interval/ Stratigraphic Unit	Parameters Analyzed			Rationale
		PHCs (F1-F4)	BTEX	VOCs	
BH1-SS4	2.29 – 2.79 m Glacial till	X	X		Assess potential impacts from APEC 3 (RFO)
BH2-SS4	2.29 – 2.49 m Glacial till	X		X	Assess potential impacts from APEC 4 (dry cleaners)
BH3-SS4	2.29 – 2.62 m Glacial till	X	X		Assess potential impacts from APEC 1 and 3 (UST & RFO)

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

TABLE 4: Groundwater Samples Submitted					
Sample ID	Screened Interval/ Stratigraphic Unit	Parameters Analyzed			Rationale
		PHCs (F1-F4)	BTEX	VOCs	
BH1-GW1	3.65-6.65 m Bedrock	X	X		Assess potential impacts from APEC 3 (RFO)
BH2-GW1	3.02 – 4.52 m Bedrock	X		X	Assess potential impacts from APEC 4 (dry cleaners)
BH3-GW1	3.02 – 4.52 m Bedrock	X	X		Assess potential impacts from APEC 1 and 3 (UST & RFO)
BH1-GW2	3.65-6.65 m Bedrock	X	X		Assess potential impacts from APEC 3 (RFO)
BH3-GW2	3.02 – 4.52 m Bedrock	X	X		Assess potential impacts from APEC 1 and 3 (UST & RFO)
DUP-23[1]	3.65-6.65 m Bedrock	X	X		Quality Assurance and Quality Control
[1]- Duplicate sample of BH1-GW2					

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

4.8 Residue Management

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

4.9 Elevation Surveying

An elevation survey of all borehole locations was completed by Paterson following the subsurface investigation. All borehole elevations are relative to a brass geodetic survey point (Ele. 96.95) located on the southeast corner of the church building, as presented on Drawing PE4799-3.

4.10 Quality Assurance and Quality Control Measures

All soil and groundwater samples were handled in accordance with the Analytical Protocol with respect to holding time, preservation method, storage requirement, and container type.

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

A duplicate groundwater sample from BH1-GW2 was recovered, and both the original and duplicate sample were analysed for PHCs and BTEX. All of the analyzed parameters were non-detect in both the original and duplicate sample.

As a result of the analysed parameter concentrations being non-detect in both the original sample and duplicate, the RPD values cannot be calculated.

Based on the identical results in both the original and duplicate groundwater and samples, the data is considered to be of sufficient quality so as not to affect decision making.

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 soil profile consists of surficial topsoil or asphaltic concrete overlying fill or reworked natural soil overlying glacial till. Bedrock was encountered beneath the till at between 1.47 to 2.79 m below the existing grade.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured during the groundwater sampling events on January 23, 2020 and April 18, 2023, using an electronic water level meter. Groundwater levels are summarized below in Table 5.

TABLE 5: Groundwater Level Measurements

Borehole Location	Ground Surface Elevation (m)	Water Level Depth (m below grade)	Water Level Elevation (m ASL)	Date of Measurement
BH1	96.77	2.43	94.34	January 23, 2020
BH2	97.01	2.40	94.61	January 23, 2020
BH3	96.96	2.56	94.40	January 23, 2020
BH1	96.77	1.88	94.89	April 18, 2023
BH2	97.01	2.05	94.96	April 18, 2023
BH3	96.96	2.03	94.93	April 18, 2023

Based on the groundwater levels recorded, the groundwater flow direction is to the east, as shown on Drawing PE4799-3 – Test Hole Location Plan.

5.3 Fine-Coarse Soil Texture

No grain size analysis was completed for the Phase II Property. Coarse-grained standards were selected based on a conservative approach.

5.4 Soil: Field Screening

Field screening of the soil samples collected during drilling resulted in vapour readings ranging from 0 to 2.4 ppm. No visual or olfactory indications of potential contamination were identified in the soil samples at the time of the field program. 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

Three (3) soil samples were submitted for analysis of PHCs (F1-F4) and VOCs. The results of the analytical testing are presented below in Tables 6 and 7.

The laboratory certificates of analysis are provided in Appendix 1. Analytical test results are shown on Drawings PE4799-4 – Analytical Testing Plan – Soil, PE4799-4A – Cross Section A-A' – Soil and PE4799-4B – Cross Section B-B' – Soil.

TABLE 6: Analytical Test Results – Soil – PHCs (F1-F4)					
Parameter	**MDL (µg/g)**	**Soil Samples (µg/g)**			**MECP Table 7 Residential Standards (µg/g)**
		Dec 6, 2019	**Jan 21, 2020**		
		BH1-SS4	**BH2-SS4**	**BH3-SS4**	
PHC F1	7	nd	nd	nd	55
PHC F2	4	nd	nd	nd	98
PHC F3	8	nd	nd	nd	300
PHC F4	6	nd	nd	nd	2800

Notes:
- MDL - Method Detection Limit
- nd - Not Detected (< MDL)
- **Bold and underlined** – Exceeds MECP Table 7 Standard

No detectable PHC concentrations were identified in the soil samples analyzed and therefore, the results are in compliance with the selected MECP Table 7 standards.

TABLE 7: Analytical Test Results – Soil – VOCs including BTEX					
Parameter	**MDL (ug/g)**	**Soil Samples (µg/g)**			**MECP Table 7 Residential Standards (µg/g)**
		Dec 6, 2019	Jan 21, 2020		
		BH1-SS4	BH2-SS4	BH2-SS4	
Acetone	0.50	na	nd	na	16
Benzene	0.02	nd	nd	nd	0.21
Bromodichloromethane	0.05	na	nd	na	13
Bromoform	0.05	na	nd	na	0.27
Bromomethane	0.05	na	nd	na	0.05
Carbon Tetrachloride	0.05	na	nd	na	0.05
Chlorobenzene	0.05	na	nd	na	2.4
Chloroform	0.05	na	nd	na	0.05
Dibromochloromethane	0.05	na	nd	na	9.4
Dichlorodifluoromethane	0.05	na	nd	na	16
1,2-Dichlorobenzene	0.05	na	nd	na	3.4
1,3-Dichlorobenzene	0.05	na	nd	na	4.8
1,4-Dichlorobenzene	0.05	na	nd	na	0.083
1,1-Dichloroethane	0.05	na	nd	na	3.5
1,2-Dichloroethane	0.05	na	nd	na	0.05
1,1-Dichloroethylene	0.05	na	nd	na	0.05
cis-1,2-Dichloroethylene	0.05	na	nd	na	3.4
trans-1,2-Dichloroethylene	0.05	na	nd	na	0.084
1,2-Dichloropropane	0.05	na	nd	na	0.05
1,3-Dichloropropene, total	0.05	na	nd	na	0.05
Ethylbenzene	0.05	nd	nd	nd	2
Ethylene dibromide	0.05	na	nd	na	0.05
Hexane	0.05	na	nd	na	2.8
Methyl Ethyl Ketone	0.50	na	nd	na	16
Methyl Isobutyl Ketone	0.50	na	nd	na	1.7
Methyl tert-butyl ether	0.05	na	nd	na	0.75
Methylene Chloride	0.05	na	nd	na	0.1
Styrene	0.05	na	nd	na	0.7
1,1,1,2-Tetrachloroethane	0.05	na	nd	na	0.058
1,1,2,2-Tetrachloroethane	0.05	na	nd	na	0.05

TABLE 7: Analytical Test Results – Soil – VOCs including BTEX					
Parameter	MDL (ug/g)	Soil Samples (µg/g)			MECP Table 7 Residential Standards (µg/g)
		Dec 6, 2019	Jan 21, 2020		
		BH1-SS4	BH2-SS4	BH2-SS4	
Tetrachloroethylene	0.05	na	nd	na	0.28
Toluene	0.05	nd	nd	nd	2.3
1,1,1-Trichloroethane	0.05	na	nd	na	0.38
1,1,2-Trichloroethane	0.05	na	nd	na	0.05
Trichloroethylene	0.05	na	nd	na	0.061
Trichlorofluoromethane	0.05	na	nd	na	4
Vinyl Chloride	0.02	na	nd	na	0.02
Xylenes, total	0.05	nd	nd	nd	3.1

Notes:
- MDL - Method Detection Limit
- nd - Not Detected (< MDL)
- na – not analyzed
- **Bold and underlined** – Exceeds MECP Table 7 Standard

No detectable VOC concentrations were identified in the soil samples analyzed and therefore, the results are in compliance with the selected MECP Table 7 standards.

5.6 Groundwater Quality

Three (3) groundwater samples were submitted for analysis of PHCs (F1-F4), BTEX and/or VOCs in the 2019 assessment. Additionally, three groundwater samples (including one duplicate) were submitted for laboratory analysis of PHCs and BTEX as part of the current assessment. The results of the analytical testing are presented below in Tables 8 to 10. The laboratory certificates of analysis are provided in Appendix 1. Analytical test results are shown on Drawings PE4799-5 – Analytical Testing Plan – Groundwater, PE4799-5A – Cross Section A-A' – Groundwater and PE4799-5B – Cross Section B-B' – Groundwater.

TABLE 8: Analytical Test Results – Groundwater – PHCs (F1-F4)

Parameter	MDL (µg/L)	Water Samples (µg/L)						MECP Table 7 Standards (µg/L)
		Jan 10, 2020		Jan 23, 2020	April 18, 2023			
		BH1-GW1	BH2-GW1	BH3-GW1	BH1-GW2	BH3-GW2	DUP-23*	
PHC F1	25	nd	nd	nd	nd	nd	nd	420
PHC F2	100	nd	nd	nd	nd	nd	nd	150
PHC F3	100	nd	nd	nd	nd	nd	nd	500
PHC F4	100	nd	nd	nd	nd	nd	nd	500

Notes:
- * Duplicate sample of BH1-GW2
- MDL - Method Detection Limit
- nd - Not Detected (< MDL)
- na – not analyzed
- **Bold and underlined** – Exceeds MECP Table 7 Standard

No detectable PHC concentrations were identified in the groundwater samples analyzed and therefore, the results are in compliance with the selected MECP Table 7 standards.

TABLE 9: Analytical Test Results – Groundwater – BTEX

Parameter	MDL (µg/L)	Water Samples (µg/L)						MECP Table 7 Standards (µg/L)
		Jan 10, 2020		Jan 23, 2020	April 18, 2023			
		BH1-GW1	BH2-GW1	BH3-GW1	BH1-GW2	BH3-GW2	DUP-23	
Benzene	25	nd	nd	nd	nd	nd	nd	0.5
Toluene	100	nd	nd	nd	nd	nd	nd	54
Ethylbenzene	100	nd	nd	nd	nd	nd	nd	320
Xylenes, total	100	nd	nd	nd	nd	nd	nd	72

Notes:
- MDL - Method Detection Limit
- nd - Not Detected (< MDL)
- na – not analyzed
- **Bold and underlined** – Exceeds MECP Table 7 Standard

No detectable BTEX concentrations were identified in the groundwater samples analyzed and therefore, the results are in compliance with the selected MECP Table 7 standards.

TABLE 10: Analytical Test Results – Groundwater – VOCs					
Parameter	MDL (ug/L)	Groundwater Samples (µg/l)			MECP Table 7 Non-Potable Groundwater (µg/l)
		Jan 10, 2020	Jan 23, 2020		
		BH1-GW1	BH2-GW1	BH3-GW1	
Acetone	5.0	na	nd	na	100000
Benzene	0.5	nd	nd	nd	0.5
Bromodichloromethane	0.5	na	nd	na	67000
Bromoform	0.5	na	nd	na	5
Bromomethane	0.5	na	nd	na	0.89
Carbon Tetrachloride	0.2	na	nd	na	0.2
Chlorobenzene	0.5	na	nd	na	140
Chloroform	0.5	na	nd	na	2
Dibromochloromethane	0.5	na	nd	na	65000
Dichlorodifluoromethane	1.0	na	nd	na	3500
1,2-Dichlorobenzene	0.5	na	nd	na	150
1,3-Dichlorobenzene	0.5	na	nd	na	7600
1,4-Dichlorobenzene	0.5	na	nd	na	0.5
1,1-Dichloroethane	0.5	na	nd	na	11
1,2-Dichloroethane	0.5	na	nd	na	0.5
1,1-Dichloroethylene	0.5	na	nd	na	0.5
cis-1,2-Dichloroethylene	0.5	na	nd	na	1.6
trans-1,2-Dichloroethylene	0.5	na	nd	na	1.6
1,2-Dichloropropane	0.5	na	nd	na	0.58
1,3-Dichloropropene, total	0.5	na	nd	na	0.5
Ethylbenzene	0.5	nd	nd	nd	54
Ethylene dibromide	0.2	na	nd	na	0.2
Hexane	1.0	na	nd	na	5
Methyl Ethyl Ketone	5.0	na	nd	na	21000
Methyl Isobutyl Ketone	5.0	na	nd	na	5200
Methyl tert-butyl ether	2.0	na	nd	na	15
Methylene Chloride	5.0	na	nd	na	26
Styrene	0.5	na	nd	na	43
1,1,1,2-Tetrachloroethane	0.5	na	nd	na	1.1
1,1,2,2-Tetrachloroethane	0.5	na	nd	na	0.5
Tetrachloroethylene	0.5	na	nd	na	0.5
Toluene	0.5	nd	nd	nd	320
1,1,1-Trichloroethane	0.5	na	nd	na	23
1,1,2-Trichloroethane	0.5	na	nd	na	0.5
Trichloroethylene	0.5	na	nd	na	0.5
Trichlorofluoromethane	1.0	na	nd	na	2000
Vinyl Chloride	0.5	na	nd	na	0.5
Xylenes, total	0.5	nd	nd	nd	72

Notes:

- MDL - Method Detection Limit
- nd - Not Detected (< MDL)
- na – not analyzed
- **Bold and underlined** – Exceeds MECP Table 7 Standard

No detectable VOC concentrations were identified in the groundwater samples analyzed and therefore, the results are in compliance with the selected MECP Table 7 standards.

5.7 Phase II Conceptual Site Model

The following section has been prepared in accordance with the requirements of O.Reg. 269/11 amended by the Environmental Protection Act. Conclusions and recommendations are discussed in a subsequent section.

Site Description

The Phase II Property is located in an area of mixed residential, institutional and commercial land use. The Phase II Property is bound by Rossland Avenue to the south, Merivale Road to the east and Withrow Avenue to the north. The site is relatively flat and at grade with the adjacent properties. Site drainage consists of infiltration and runoff towards the adjacent roadways.

Potentially Contaminating Activity and Areas of Potential Environmental Concern

As indicated in the Phase I-ESA report and Table 1 in Section 2.2 of this report, the following PCAs are considered to result in APECs on the Phase I/Phase II Property:

- ❑ The former heating oil underground storage tank (UST) potentially impacting the central portion of the Phase II Property.
- ❑ The former King Cole Kleenette at 1528 Merivale Road, potentially impacting the northern portion of the Phase I Property.
- ❑ The Retail Fuel Outlet at 1548 Merivale Road, potentially impacting the southern portion of the Phase II Property.
- ❑ The Retail Fuel Outlet at 1543 Merivale Road potentially impacting the eastern portion of the Phase II Property.

Contaminants of Potential Concern and Impacted Media

Based on the findings of the Phase I, the following Contaminants of Potential Concern (CPC) were identified with respect to the soil and/or groundwater beneath the Phase II Property:

- ❑ Petroleum hydrocarbons (PHCs, fractions 1-4),
- ❑ Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX),

- ❑ Volatile Organic Compounds (VOCs).

Subsurface Structures and Utilities

Underground service locates were completed prior to the subsurface investigation. Underground utilities on the Phase II Property include natural gas, electrical, municipal water, and sewage services. No active private potable water wells or septic systems are present on the Phase II Property.

Physical Setting

Site Stratigraphy

The site stratigraphy, from the ground surface to the deepest aquifer or aquitard investigated consists of:

- ❒ A surficial covering of topsoil or asphaltic concrete up to 0.05 m thick.
- ❒ Pavement structure, consisting of a sand-gravel pavement base approximately 0.76m thick
- ❒ Fill consisting reworked native silty sand and gravel approximately 1.5m thick.
- ❒ Brown and grey silty sand (glacial till) found to depths of between 1.47 to 2.79 m.
- ❒ Grey limestone bedrock.

Hydrogeological Characteristics

Groundwater at the Phase II Property was encountered just above the bedrock surface, however it is expected to reside within the bedrock most of the year. The bedrock unit is interpreted to function as a local aquifer at the Phase II Property.

Water levels were measured at the subject site on January 23, 2020, at depths ranging from 2.40 to 2.56 m below grade. The groundwater is believed to be flowing in a generally southeasterly direction.

Approximate Depth to Bedrock

Bedrock is present at depths between 1.47 to 2.79 m below the existing grade.

Approximate Depth to Water Table

Depth to the water table at the subject site varies between approximately 2.40 to 2.56 m below the existing grade.

Sections 41 and 43.1 of the Regulation

Section 41 of the Regulation (Site Condition Standards, Environmentally Sensitive Areas) does not apply to the Phase II Property.

Section 43.1 of the Regulation does apply to the Phase II Property in that the Phase II Property is a Shallow Soil Property.

Fill Placement

Two types of fill material were encountered at the Phase II Property, a pavement structure consisting of gravel and sand and reworked native silty sand with trace gravel. Both fill materials identified at the subject site are not considered to represent an APEC.

Proposed Buildings and Other Structures

It is our understanding that the Phase II Property is to be redeveloped with affordable housing, a new church and mixed-use community space. The development may include low and mid-rise buildings of up to 10 stories with both underground and surface-level parking.

Areas of Natural Significance and Water Bodies

No areas of natural significance are present on or within the vicinity of the Phase II Property.

Environmental Condition

Areas Where Contaminants are Present

The soil and groundwater was determined to be in compliance with the MECP Table 7 standards. Analytical test results are shown in the drawings presented in the appendix.

Types of Contaminants

The soil and groundwater at the Phase II Property are in compliance with the selected MECP Standards Table 7 standards and no contaminants of concern have been identified.

Contaminated Media

The soil and groundwater at the Phase II Property are in compliance with the selected MECP Table 7 standards.

Known Areas Where Contaminants Are Present

The soil and groundwater at the Phase II Property are in compliance with the selected MECP Table 7 standards.

Distribution and Migration of Contaminants

All soil and groundwater samples were in compliance with MECP Table 7 standards.

Discharge of Contaminants

The soil and groundwater were determined to be in compliance with the MECP Table 7 standards.

Climatic and Meteorological Conditions

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

Two (2) ways by which climatic and meteorological conditions may affect contaminant distribution include the downward leaching of contaminants by means of the infiltration of precipitation, and the migration of contaminants via groundwater levels and/or flow, which may fluctuate seasonally.

Leaching is not considered an issue since the soil and groundwater are in compliance with MECP Table 7 Standards.

The fluctuation of groundwater levels is not considered to have significantly affected contaminant transport as the soil and groundwater beneath the Phase II Property are in compliance with MECP Table 7 Standards.

Potential for Vapour Intrusion

Based on the findings of the Phase II ESA, there is no potential for vapour intrusion on the Phase II Property.

6.0 CONCLUSIONS

Assessment

A Phase II ESA was conducted for 8 Withrow Avenue, in the City of 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 considered to result in areas of potential environmental concern (APECs) on the Phase II Property. The subsurface investigation consisted of drilling five (5) boreholes, three (3) of which were constructed with groundwater monitoring wells.

Soil samples were obtained from the boreholes and screened using visual observations and organic vapour measurements. Three (3) soil samples were submitted for laboratory analysis of benzene, toluene, ethylbenzene and xylenes (BTEX) and petroleum hydrocarbons (PHCs, F1-F4) while one (1) soil sample was submitted for analysis of VOCs. All PHC, BTEX and VOC concentrations were non-detect and in compliance with MECP Table 7 Standards.

Three (3) groundwater samples were obtained from the monitoring wells installed in BH1, BH2 and BH3 and were submitted for laboraotory analysis of PHCs, BTEX and/or VOCs. All of the analyzed PHC, BTEX and VOC concentrations were non-detect and therefore, are in compliance with the selected MECP Table 7 standards.

A second round of groundwater sampling was completed on April 18, 2023. Three samples (including one duplicate) were submitted from BH1 and BH3 for PHCs and BTEX. All of the PHC and BTEX parameters were non-detect and therefore, are in compliance with the selected Table 7 standards.

Conclusion

Based on the findings of the Phase II ESA, the soil and groundwater below the Phase II Property is in compliance with the selected MECP Table 7 standards. No further investigative work is considered to be required at this time.

It is expected that groundwater monitoring wells will be abandoned in accordance with O.Reg.903, at the time of construction excavation. It is recommended that the integrity of the monitoring wells be maintained, prior to future construction, for possible further groundwater monitoring purposes.

7.0 STATEMENT OF LIMITATIONS

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

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

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

This report was prepared for the sole use of Julian of Norwich Anglican Church. Notification from the Julian of Norwich Anglican Church and Paterson Group will be required to release this report to any other party.

Paterson Group Inc.

Samuel Berube, EIT.

Mark S. D'Arcy, P.Eng., QP$_{ESA}$

Report Distribution:

- Julian of Norwich Anglican Church
- Paterson Group

FIGURES

FIGURE 1 – KEY PLAN

DRAWING PE4799-3 – TEST HOLE LOCATION PLAN

DRAWING PE4799-4 – ANALYTICAL TESTING PLAN – SOIL

DRAWING PE4799-4A – CROSS SECTION A-A' – SOIL

DRAWING PE4799-4B – CROSS SECTION B-B' – SOIL

DRAWING PE4799-5 – ANALYTICAL TESTING PLAN - GROUNDWATER

DRAWING PE4799-5A – CROSS SECTION A-A' – GROUNDWATER

DRAWING PE4799-5B – CROSS SECTION B-B' - GROUNDWATER

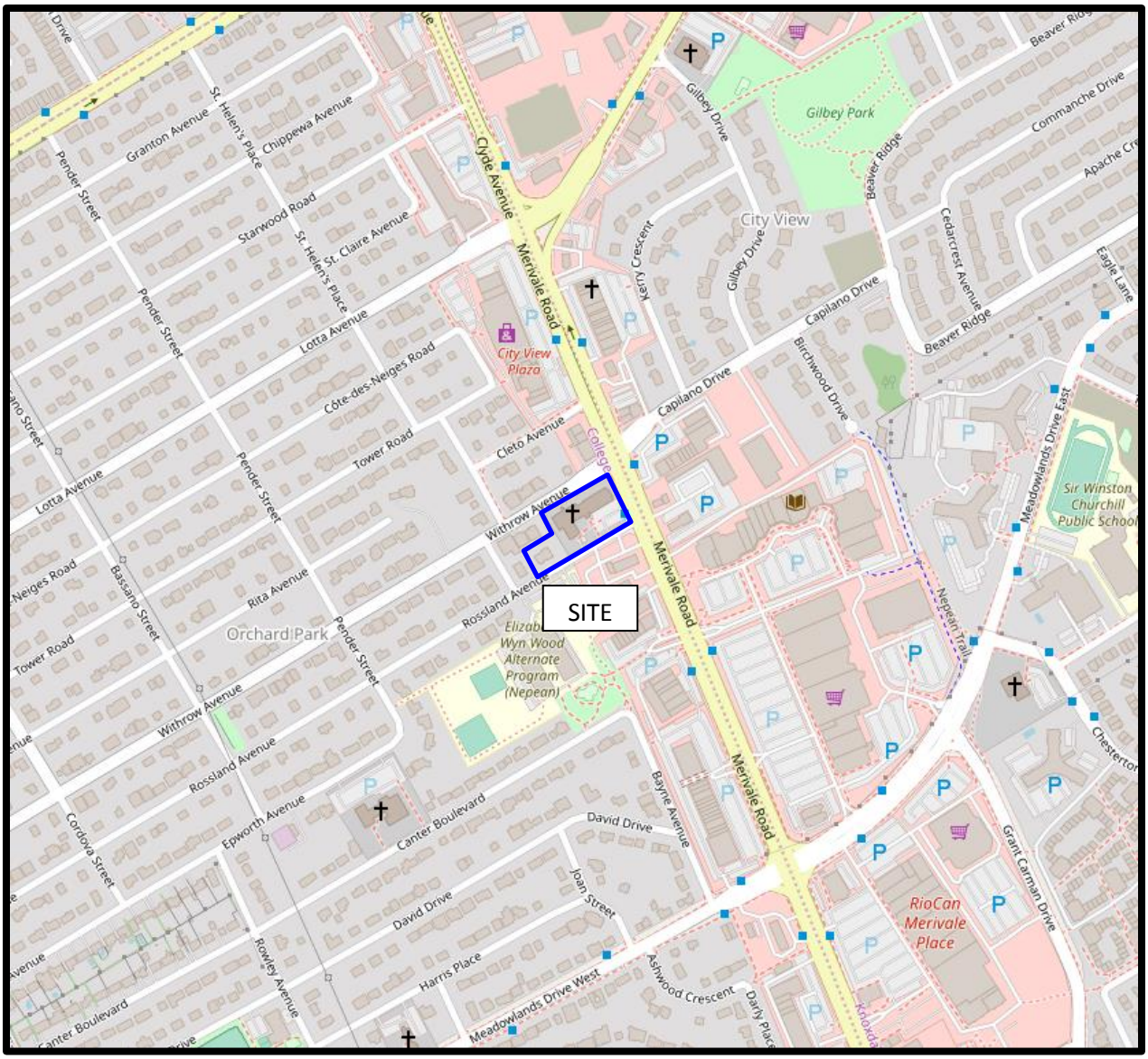
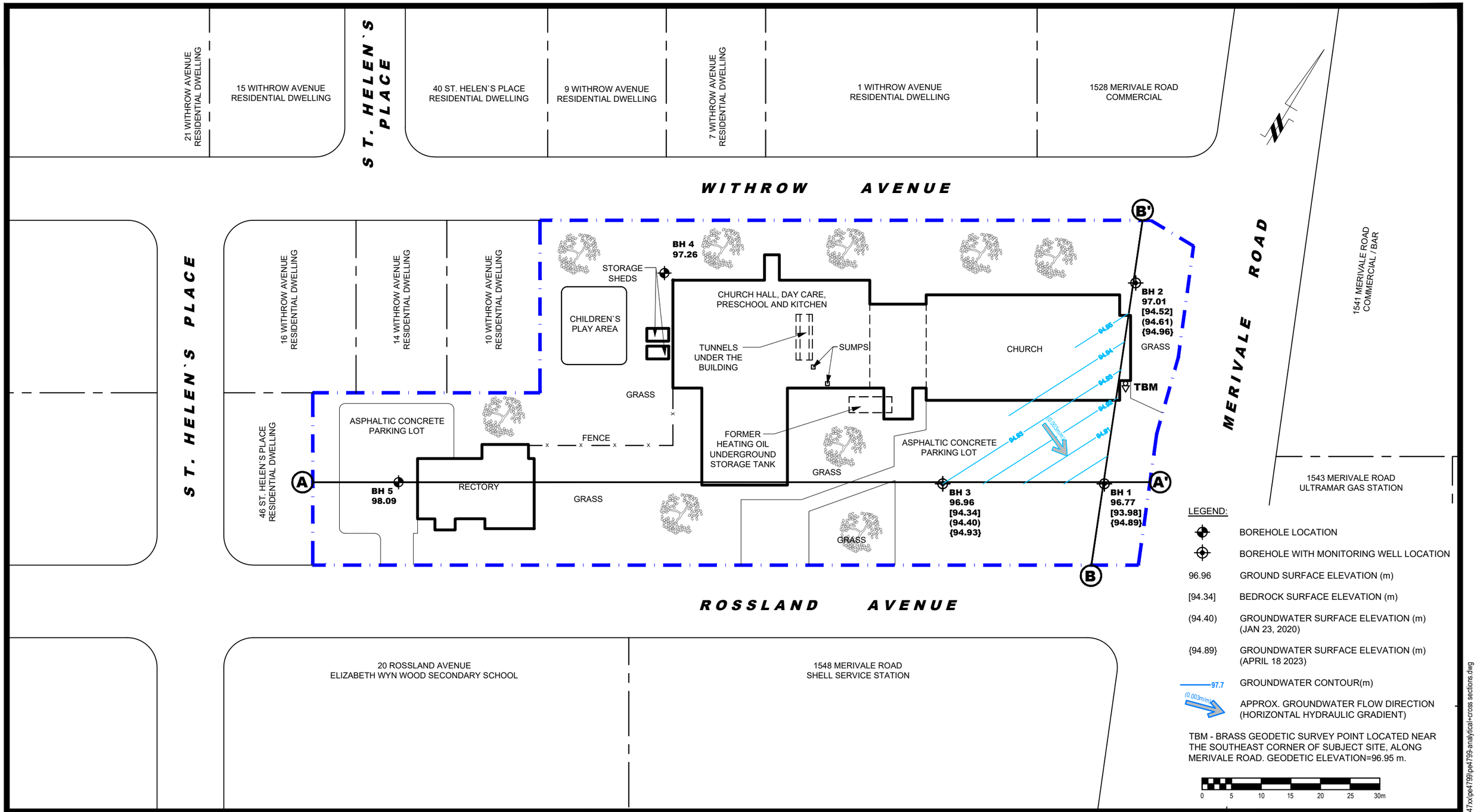


FIGURE 1

KEY PLAN



LEGEND:

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- 96.96 GROUND SURFACE ELEVATION (m)
- [94.34] BEDROCK SURFACE ELEVATION (m)
- (94.40) GROUNDWATER SURFACE ELEVATION (m) (JAN 23, 2020)
- {94.89} GROUNDWATER SURFACE ELEVATION (m) (APRIL 18 2023)
- 97.7 GROUNDWATER CONTOUR(m)
- (0.003m/m) APPROX. GROUNDWATER FLOW DIRECTION (HORIZONTAL HYDRAULIC GRADIENT)

TBM - BRASS GEODETIC SURVEY POINT LOCATED NEAR THE SOUTHEAST CORNER OF SUBJECT SITE, ALONG MERIVALE ROAD. GEODETIC ELEVATION=96.95 m.

0 5 10 15 20 25 30m

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7Z9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL

NORWICH ANGLICAN CHURCH

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
8 WITHROW AVENUE

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:600	Date: 04/2023
Drawn by: YA	Report No.: PE4799-2R
Checked by: SB	Dwg. No.: PE4799-3
Approved by: MSD	Revision No.:

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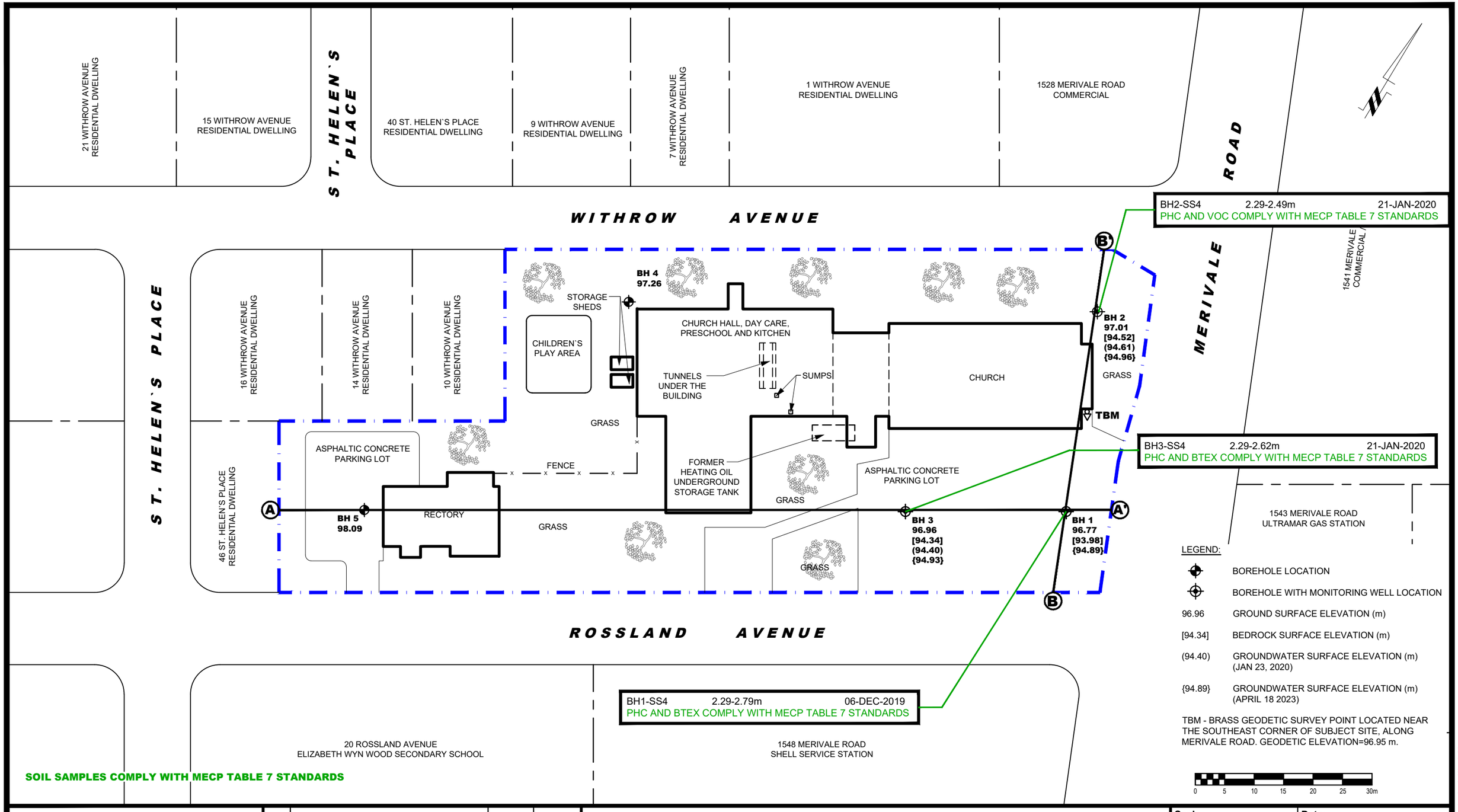

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NO.	REVISIONS	DATE	INITIAL

NORWICH ANGLICAN CHURCH

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
8 WITHROW AVENUE

OTTAWA, ONTARIO

Title:
ANALYTICAL TESTING PLAN-SOIL (BTEX, PHCs, VOCs)

Scale: 1:600	Date: 04/2023
Drawn by: YA	Report No.: PE4799-2R
Checked by: SB	Dwg. No.: PE4799-4
Approved by: MSD	Revision No.:

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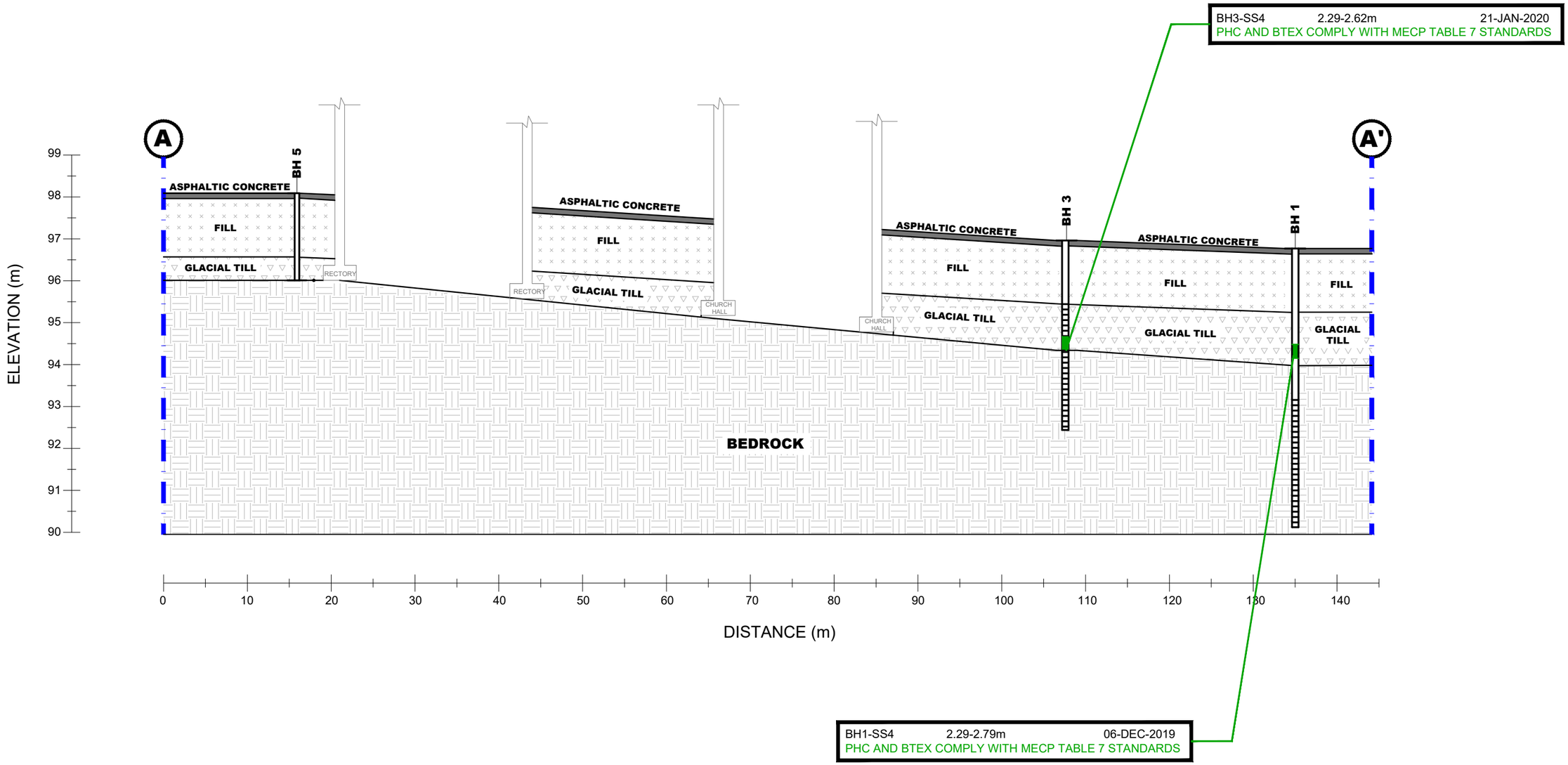

SOIL SAMPLES COMPLY WITH MECP TABLE 7 STANDARDS

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NO.	REVISIONS	DATE	INITIAL

NORWICH ANGLICAN CHURCH

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
8 WITHROW AVENUE

OTTAWA, ONTARIO

Title:

CROSS SECTION A-A'-SOIL (BTEX, PHC, VOC)

Scale: AS SHOWN	Date: 04/2023
Drawn by: YA	Report No.: PE4799-2R
Checked by: SB	Dwg. No.: PE4799-4A
Approved by: MSD	Revision No.:

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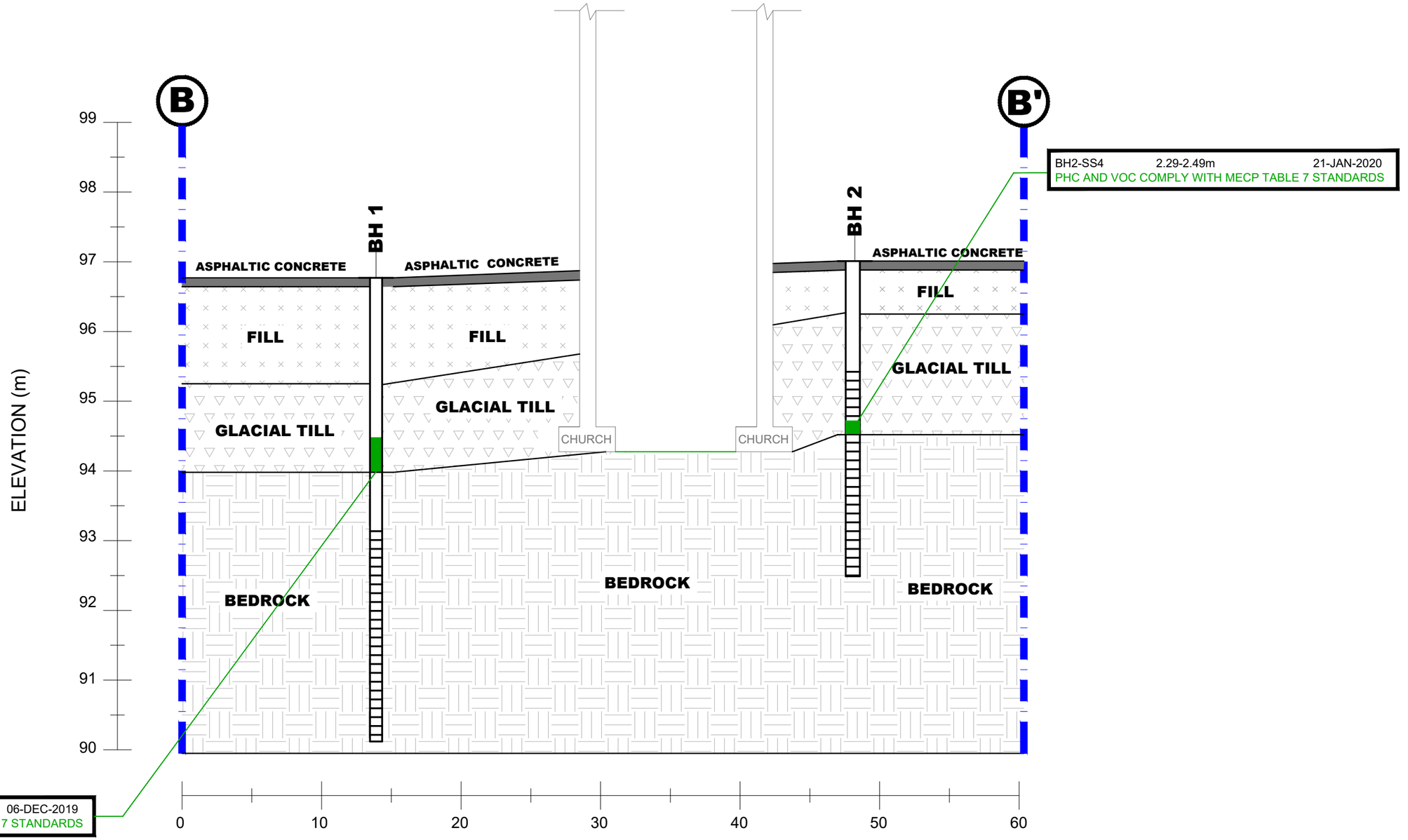

SOIL SAMPLES COMPLY WITH MECP TABLE 7 STANDARDS

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NO.	REVISIONS	DATE	INITIAL

NORWICH ANGLICAN CHURCH

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
8 WITHROW AVENUE

OTTAWA, ONTARIO

Title:

CROSS SECTION B-B'-SOIL (BTEX, PHCs, VOCs)

Scale: AS SHOWN	Date: 04/2023
Drawn by: YA	Report No.: PE4799-2R
Checked by: SB	Dwg. No.: PE4799-4B
Approved by: MSD	Revision No.:

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21 WITHROW AVENUE
RESIDENTIAL DWELLING

15 WITHROW AVENUE
RESIDENTIAL DWELLING

ST. HELEN`S PLACE

40 ST. HELEN`S PLACE
RESIDENTIAL DWELLING

9 WITHROW AVENUE
RESIDENTIAL DWELLING

7 WITHROW AVENUE
RESIDENTIAL DWELLING

1 WITHROW AVENUE
RESIDENTIAL DWELLING

1528 MERIVALE ROAD
COMMERCIAL

WITHROW AVENUE

BH2-GW1 3.02-4.52m 23-JAN-2020
PHCs and VOCs comply with MECP Table 3 standards

MERIVALE ROAD

1541 MERIVALE ROAD
COMMERCIAL / BAR

ST. HELEN`S PLACE

16 WITHROW AVENUE
RESIDENTIAL DWELLING

14 WITHROW AVENUE
RESIDENTIAL DWELLING

10 WITHROW AVENUE
RESIDENTIAL DWELLING

46 ST. HELEN`S PLACE
RESIDENTIAL DWELLING

B'

BH 4
97.26

STORAGE SHEDS

CHILDREN`S PLAY AREA

CHURCH HALL, DAY CARE, PRESCHOOL AND KITCHEN

TUNNELS UNDER THE BUILDING

SUMPS

CHURCH

BH 2
97.01
[94.52]
(94.61)
{94.96}

GRASS

TBM

BH3-GW1 3.02-4.52m 23-JAN-2020
PHCs and BTEX comply with MECP Table 3 standards

BH3-GW2 3.02-4.52m 18-APR-2023
PHCs and BTEX comply with MECP Table 3 standards

ASPHALTIC CONCRETE PARKING LOT

FENCE

GRASS

FORMER HEATING OIL UNDERGROUND STORAGE TANK

GRASS

ASPHALTIC CONCRETE PARKING LOT

A

BH 5
98.09

RECTORY

GRASS

BH 3
96.96
[94.34]
(94.40)
{94.93}

BH 1
96.77
[93.98]
{94.89}

A'

B

1543 MERIVALE ROAD
ULTRAMAR GAS STATION

LEGEND:

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- 96.96 GROUND SURFACE ELEVATION (m)
- [94.34] BEDROCK SURFACE ELEVATION (m)
- (94.40) GROUNDWATER SURFACE ELEVATION (m) (JAN 23, 2020)
- {94.89} GROUNDWATER SURFACE ELEVATION (m) (APRIL 18 2023)

TBM - BRASS GEODETIC SURVEY POINT LOCATED NEAR THE SOUTHEAST CORNER OF SUBJECT SITE, ALONG MERIVALE ROAD. GEODETIC ELEVATION=96.95 m.

0 5 10 15 20 25 30m

ROSSLAND AVENUE

BH1-GW 3.65-6.65m 10-JAN-2020
PHCs and BTEX comply with MECP Table 3 standards

BH1-GW2 3.65-6.65m 18-APR-2023
PHCs and BTEX comply with MECP Table 3 standards

DUP-23 (Dup BH1-GW2) 3.65-6.65m 18-APR-2023
PHCs and BTEX comply with MECP Table 3 standards

20 ROSSLAND AVENUE
ELIZABETH WYN WOOD SECONDARY SCHOOL

1548 MERIVALE ROAD
SHELL SERVICE STATION

GROUNDWATER SAMPLES COMPLY WITH MECP TABLE 7 STANDARDS

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NORWICH ANGLICAN CHURCH

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
8 WITHROW AVENUE

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN-GROUNDWATER (BTEX, PHC, VOC)

Scale: 1:600	Date: 04/2023
Drawn by: YA	Report No.: PE4799-2R
Checked by: SB	Dwg. No.: PE4799-5
Approved by: MSD	Revision No.:

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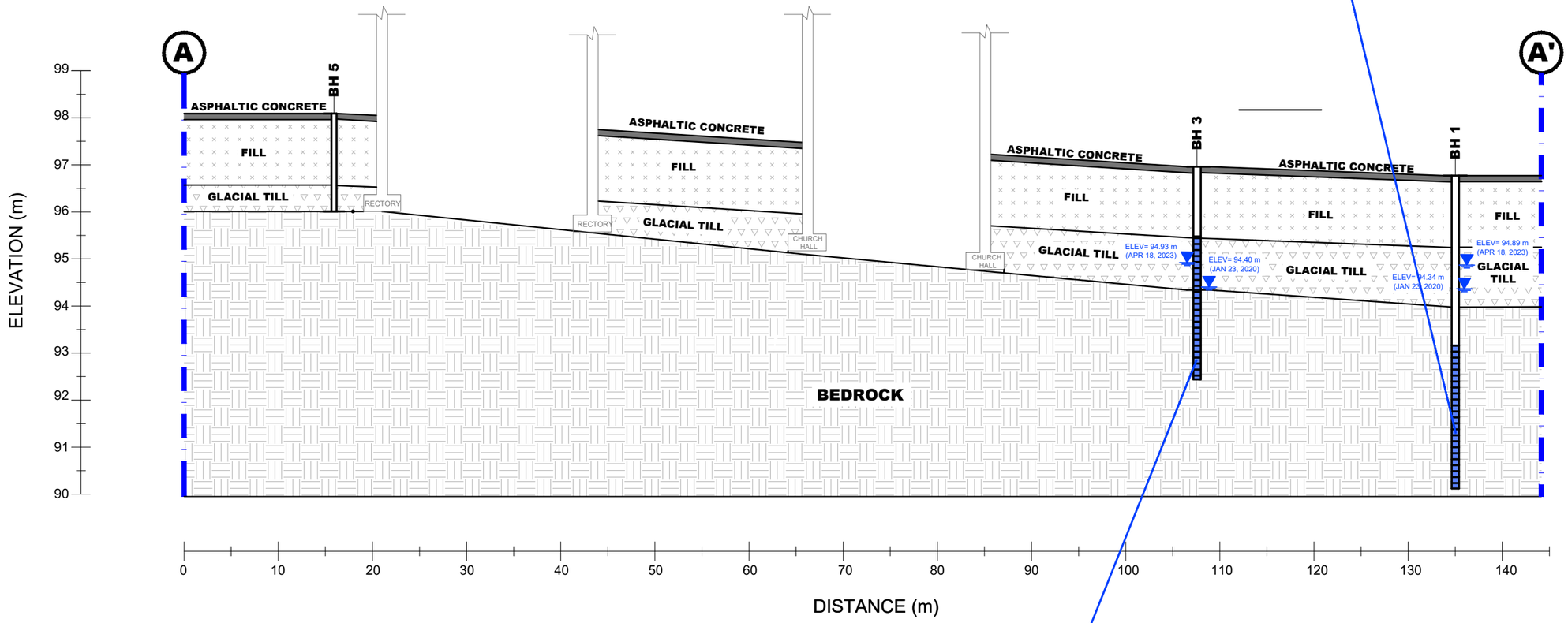
BH1-GW 3.65-6.65m 10-JAN-2020
PHCs and BTEX comply with MECP Table 3 standards

BH1-GW2 3.65-6.65m 18-APR-2023
PHCs and BTEX comply with MECP Table 3 standards

DUP-23 (Dup BH1-GW2) 3.65-6.65m 18-APR-2023
PHCs and BTEX comply with MECP Table 3 standards



BH3-GW1 3.02-4.52m 23-JAN-2020
PHCs and BTEX comply with MECP Table 3 standards

BH3-GW2 3.02-4.52m 18-APR-2023
PHCs and BTEX comply with MECP Table 3 standards

GROUNDWATER SAMPLES COMPLY WITH MECP TABLE 7 STANDARDS

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NORWICH ANGLICAN CHURCH

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
8 WITHROW AVENUE

OTTAWA, ONTARIO

Title:
CROSS SECTION A-A'-GROUNDWATER (BTEX, PHC, VOC)

Scale: AS SHOWN	Date: 04/2023
Drawn by: YA	Report No.: PE4799-2R
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Approved by: MSD	Revision No.:

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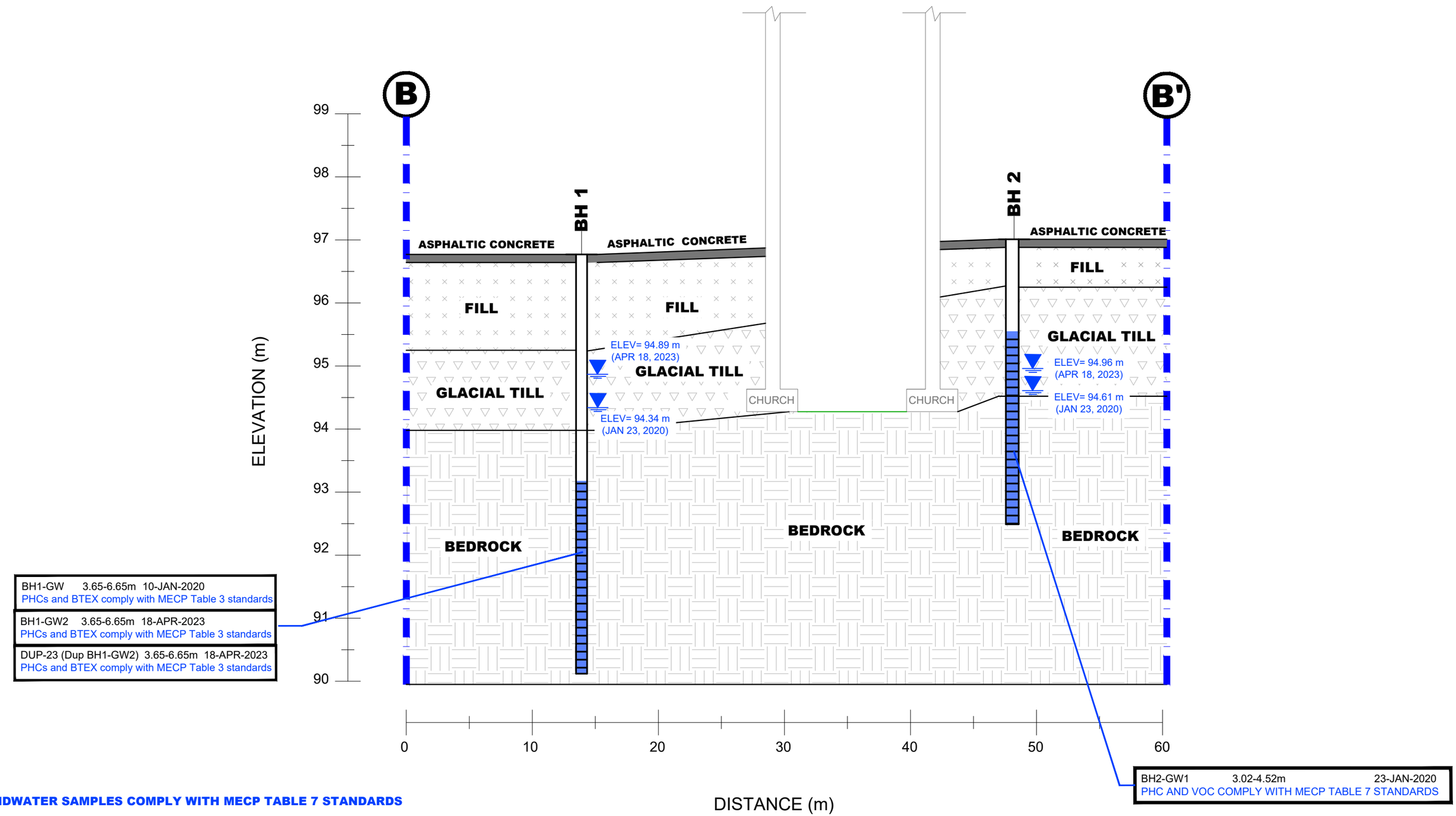

GROUNDWATER SAMPLES COMPLY WITH MECP TABLE 7 STANDARDS

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
8 WITHROW AVENUE

OTTAWA, ONTARIO

Title:

CROSS SECTION B-B'-GROUNDWATER (BTEX, PHCs, VOCs)

Scale: AS SHOWN	Date: 04/2023
Drawn by: YA	Report No.: PE4799-2R
Checked by: SB	Dwg. No.: PE4799-5B
Approved by: MSD	Revision No.:

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APPENDIX 1

SAMPLING AND ANALYSIS PLAN

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

LABORATORY CERTIFICATE OF ANALYSIS

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

Paterson Group Inc.

Consulting Engineers
154 Colonnade Road South
Ottawa (Nepean), Ontario
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patersongroup

Sampling & Analysis Plan

Phase II Environmental Site Assessment

8 Withrow Avenue
Ottawa, Ontario

Prepared For

Anglican Diocese of Ottawa

December 2019

Report: PE4799-SAP

TABLE OF CONTENTS

1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by the Anglican Diocese of Ottawa to conduct a Phase II Environmental Site Assessment (ESA) of 8 Withrow Avenue, Ottawa, Ontario. Based on our December 2019 Phase I ESA completed for the subject property, a subsurface investigation program, consisting of borehole drilling, was developed.

Borehole	Location & Rationale	Proposed Depth & Rationale
BH1	Place borehole towards the eastern boundary of the subject site, to assess any potential impacts from APEC 3; RFO.	Borehole to be advanced to approximately 2m below the expected long-term groundwater table and install a monitoring well.
BH2	Place borehole towards the northeastern corner of the subject site, to assess any potential impacts from APEC 4; dry cleaners.	Borehole to be advanced to approximately 2m below the expected long-term groundwater table and install a monitoring well.
BH3	Place borehole towards the central portion of the subject site, to assess any potential impacts from APEC 1 and 3; UST and RFO.	Borehole to be advanced to approximately 2m below the expected long-term groundwater table and install a monitoring well.
BH4	Place borehole towards the northern boundary of the subject site for general coverage and geotechnical purposes.	Borehole to be advanced to bedrock.
BH5	Place borehole towards the western portion of the subject site for general coverage and geotechnical purposes.	Borehole to be advanced to bedrock

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

Upon refusal, rock coring shall be undertaken to the required depth. Approximately every metre the well shall be purged by inertial pumping and the water level recorded to determine if groundwater water is entering the borehole.

Following borehole drilling, monitoring wells will be installed in selected boreholes (as above) for the measurement of water levels and the collection of groundwater samples. Borehole locations are shown on the Test Hole Location Plan appended to the main report.

2.0 ANALYTICAL TESTING PROGRAM

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

- ❒ At least one sample from each borehole should be submitted, in order to delineate the horizontal extent of contamination across the site.
- ❒ At least one sample from each stratigraphic unit should be submitted, in order to delineate the vertical extent of contamination at the site.
- ❒ In boreholes where there is visual or olfactory evidence of contamination, or where organic vapour meter or photoionization detector readings indicate the presence of contamination, the 'worst-case' sample from each borehole should be submitted for comparison with 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 groundwater at the subject site is based on the following general considerations:

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

3.0 STANDARD OPERATING PROCEDURES

3.1 Environmental Drilling Procedure

Purpose

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

Equipment

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

- ❒ glass soil sample jars
- ❒ two buckets
- ❒ cleaning brush (toilet brush works well)
- ❒ dish detergent
- ❒ methyl hydrate
- ❒ water (if not available on site - water jugs available in the 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 catch basin of known geodetic elevation.

Drilling Procedure

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

- ❒ Continuous split spoon samples (every 0.6 m or 2') or semi-continuous (every 0.76 m or 2'6") are required.
- ❒ Make sure samples are well sealed in plastic bags with no holes prior to screening and are kept cool but unfrozen.
- ❒ If sampling for VOCs, BTEX, or PHCs F1, a soil core from each soil sample which may be analysed 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 the 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 an RKI Eagle, PID, etc. depending on the 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 a brush in soapy water, inside and out, including the 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 the 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 the bag.
- ❒ Insert the probe into soil bag, creating a seal with your hand around the opening.
- ❒ Gently manipulate soil in the 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 the Sampling and Analysis Plan.

3.2 Monitoring Well Installation Procedure

Equipment

- ❒ 5’ x 2” [1.52 m x 50 mm] threaded sections of Schedule 40 PVC slotted well screen (5’ x 1 ¼” [1.52 m x 32 mm] if installing in a cored hole in bedrock)
- ❒ 5’ x 2” [1.52 m x 50 mm] threaded sections of Schedule 40 PVC riser pipe (5’ x 1 ¼” [1.52 m x 32 mm] if installing in a 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 the required depth, using drilling and sampling procedures described above.
- ❒ If the borehole is deeper than required monitoring well, backfill with bentonite chips to the 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 the screen. Thread the second section of the screen if required. Thread risers onto the screen. Lower into the borehole to the required depth. Ensure slip-cap or J-plug is inserted to prevent backfill materials from entering the 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 the 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 the 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 a socket wrench or Allan key to open metal flush mount protector cap. Remove plastic well cap.
- ❒ Measure water level, with respect to the existing ground surface, using water level meter or interface probe. If using an interface probe on suspected NAPL site, measure the thickness of the free product.
- ❒ Measure the total depth of well.
- ❒ Clean water level tape or interface probe using methanol and water. Change gloves between wells.
- ❒ Calculate the volume of standing water within well and record.
- ❒ Insert polyethylene tubing into well and attach to the peristaltic pump. Turn on the peristaltic pump and purge into the 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 the 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 the 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 a 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 the frequency of use.

5.0 DATA QUALITY OBJECTIVES

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

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

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

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

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

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

These considerations are discussed in the body of the report.

6.0 PHYSICAL IMPEDIMENTS TO SAMPLING & ANALYSIS PLAN

Physical impediments to the Sampling and Analysis plan may include:

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

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
8 Withrow Avenue
Ottawa, Ontario

DATUM Brass plate - southeast corner of building. Geodetic elevation = 96.95 m

FILE NO. PE4799

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** 2019 December 6

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
UNDERSIDE OF FOOTING							
Asphaltic concrete 0.06						0	96.77
FILL: Brown sand, some gravel, trace silt 0.60		AU	1				
FILL: Brown silty sand with gravel, some clay (reworked native soil) 1.52		SS	2	21	14	1	95.77
GLACIAL TILL: Brown silt with clay, some sand and gravel		SS	3	58	28	2	94.77
2.79		SS	4	100	24		
		RC	1	91	55	3	93.77
BEDROCK: Fair to excellent quality, grey limestone, some mud seams						4	92.77
		RC	2	97	95	5	91.77
		RC	3	99	99	6	90.77
6.65 End of Borehole							
(GWL @ 2.43m - Jan 23, 2020)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
8 Withrow Avenue
Ottawa, Ontario

DATUM Brass plate - southeast corner of building. Geodetic elevation = 96.95 m

FILE NO. PE4799

REMARKS

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger **DATE** 2020 January 21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
UNDERSIDE OF FOOTING							
TOPSOIL 0.08						0	97.01
FILL: Brown silty sand, some gravel 0.76		AU	1				
GLACIAL TILL: Brown silty clay with sand and gravel		SS	2	29	24	1	96.01
		SS	3	96	32	2	95.01
2.49		SS	4	100	50+		
		RC	1	100	0	3	94.01
BEDROCK: Very poor to fair quality, grey limestone		RC	2	100	50	4	93.01
4.52 End of Borehole							
(GWL @ 2.40m - Jan 23, 2020)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
8 Withrow Avenue
Ottawa, Ontario

DATUM Brass plate - southeast corner of building. Geodetic elevation = 96.95 m

FILE NO. PE4799

REMARKS

HOLE NO. BH 3

BORINGS BY CME 55 Power Auger **DATE** 2020 January 21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
UNDERSIDE OF FOOTING							
Asphaltic concrete 0.10						0	96.96
FILL: Brown silty sand with crushed stone 0.76		AU	1				
FILL: Brown silty sand (reworked native) 1.52		SS	2	54	11	1	95.96
GLACIAL TILL: Brown silty sand with gravel		SS	3	42	32	2	94.96
2.62		SS	4	78	50+		
BEDROCK: Very poor to poor quality, grey limestone		RC	1	100	0	3	93.96
		RC	2	100	30	4	92.96
4.52 End of Borehole							
(GWL @ 2.56m - Jan 23, 2020)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
8 Withrow Avenue
Ottawa, Ontario

DATUM Brass plate - southeast corner of building. Geodetic elevation = 96.95 m

FILE NO. PE4799

REMARKS

HOLE NO. BH 4

BORINGS BY CME 55 Power Auger **DATE** 2020 January 20

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Photo Ionization Detector: ● Volatile Organic Rdg. (ppm) / ○ Lower Explosive Limit %	Monitoring Well Construction
UNDERSIDE OF FOOTING						0	97.26		
FILL: Brown silty sand with gravel		AU	1						
1.00						1	96.26		
GLACIAL TILL: Very dense, brown silty sand with gravel		SS	2	58	13				
1.47									
End of Borehole									
Practical refusal to augering at 1.47m depth									

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

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
8 Withrow Avenue
Ottawa, Ontario

DATUM Brass plate - southeast corner of building. Geodetic elevation = 96.95 m

FILE NO. PE4799

REMARKS

HOLE NO. BH 5

BORINGS BY CME 55 Power Auger **DATE** 2020 January 20

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Photo Ionization Detector: ● Volatile Organic Rdg. (ppm) / ○ Lower Explosive Limit %	Monitoring Well Construction
UNDERSIDE OF FOOTING						0	98.09		
FILL: Brown silty sand with gravel		AU	1						
		SS	2	21	41	1	97.09		
1.52									
GLACIAL TILL: Very dense, brown silty sand with gravel		SS	3	56	50+				
2.08						2	96.09		
End of Borehole									
Practical refusal to augering at 2.08m depth									

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

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

▲ Full Gas Resp. △ Methane Elim.

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

The standard terminology to describe the 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

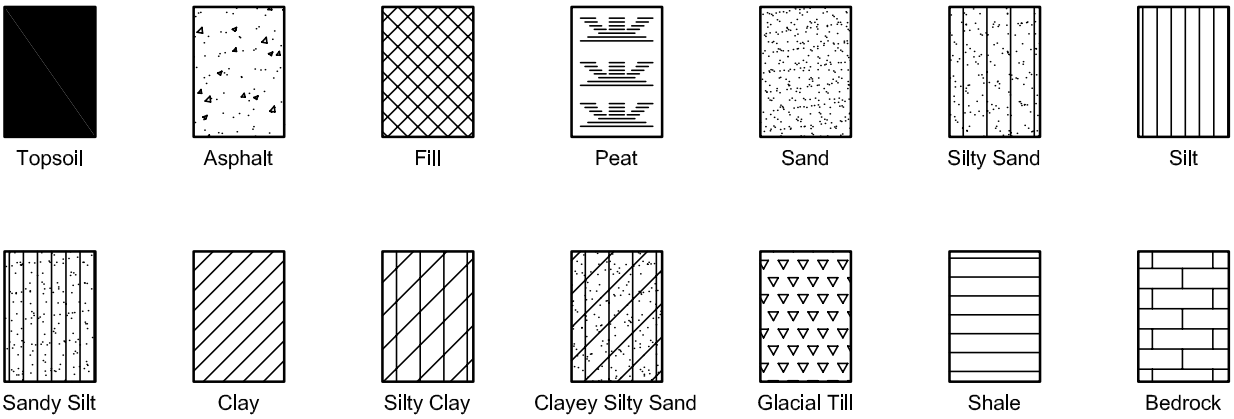
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void 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.

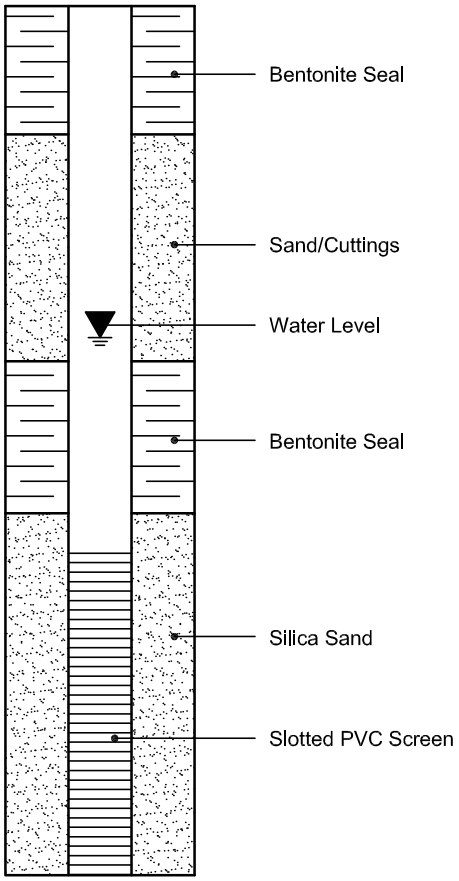
SYMBOLS AND TERMS (continued)

STRATA PLOT

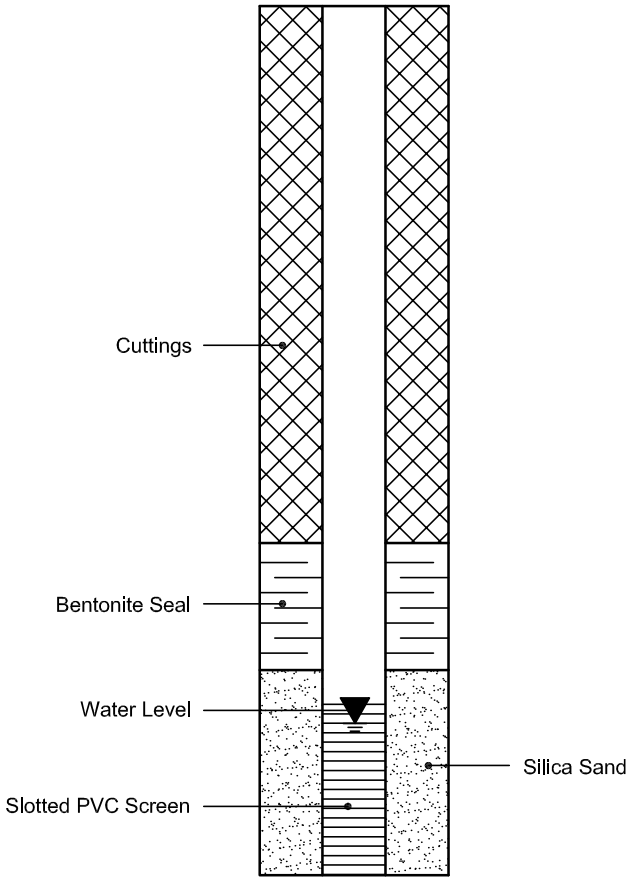


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 29324
Project: PE4799
Custody:

Report Date: 16-Jan-2020
Order Date: 10-Jan-2020

Order #: 2002473

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

Paracel ID	Client ID
2002473-01	BH1-GW1

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 29324

Report Date: 16-Jan-2020
Order Date: 10-Jan-2020
Project Description: PE4799

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	13-Jan-20	13-Jan-20
PHC F1	CWS Tier 1 - P&T GC-FID	10-Jan-20	13-Jan-20
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	15-Jan-20	15-Jan-20

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 29324

Report Date: 16-Jan-2020

Order Date: 10-Jan-2020

Project Description: PE4799

	Client ID:	BH1-GW1	-	-	-
	Sample Date:	10-Jan-20 13:15	-	-	-
	Sample ID:	2002473-01	-	-	-
	MDL/Units	Water	-	-	-
Volatiles					
Benzene	0.5 ug/L	<0.5	-	-	-
Ethylbenzene	0.5 ug/L	<0.5	-	-	-
Toluene	0.5 ug/L	<0.5	-	-	-
m,p-Xylenes	0.5 ug/L	<0.5	-	-	-
o-Xylene	0.5 ug/L	<0.5	-	-	-
Xylenes, total	0.5 ug/L	<0.5	-	-	-
Toluene-d8	Surrogate	87.5%	-	-	-
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	-	-	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 29324

Report Date: 16-Jan-2020
Order Date: 10-Jan-2020
Project Description: PE4799

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
Volatiles									
Benzene	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: Toluene-d8	*74.2*		*ug/L*		*92.8*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND				30	
Volatiles									
Benzene	ND	0.5	ug/L	ND				30	
Ethylbenzene	ND	0.5	ug/L	ND				30	
Toluene	ND	0.5	ug/L	ND				30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: Toluene-d8	*72.1*		*ug/L*		*90.2*	*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)	1820	25	ug/L		90.9	68-117			
F2 PHCs (C10-C16)	1090	100	ug/L		68.2	60-140			
F3 PHCs (C16-C34)	2630	100	ug/L		67.2	60-140			
F4 PHCs (C34-C50)	1510	100	ug/L		60.7	60-140			
Volatiles									
Benzene	28.0	0.5	ug/L		70.0	60-130			
Ethylbenzene	27.0	0.5	ug/L		67.6	60-130			
Toluene	27.4	0.5	ug/L		68.4	60-130			
m,p-Xylenes	60.8	0.5	ug/L		76.1	60-130			
o-Xylene	29.1	0.5	ug/L		72.7	60-130			
Surrogate: Toluene-d8	*67.5*		*ug/L*		*84.4*	*50-140*			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- 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: 2002473

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2002473	

Client Name: Paterson Group
Contact Name: Mark D'Arcy
Address: 154 Colonnade Road
Telephone: 613 - 226 - 7381

Project Ref: PE4799
Quote #:
PO #: 29324
E-mail: mdarcy@patersongroup.ca

Page 1 of 1

Turnaround Time
☐ 1 day ☐ 3 day
☐ 2 day ☑ Regular
Date Required: _____

Regulation 153/04
☐ 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)

Required Analysis

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	BTEX	PHCs (F1-F4)									
1	BH1 - GW1	GW		3	Jan 10/2020	1:15 PM	X	X									✓
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Comments:

Method of Delivery: Paracel

Relinquished By (Sign):	Received By Driver/Depot:	Received at Lab:	Verified By:
N. Sullivan	T. Clouse	Jumeepreet Dahmai	RDim
Relinquished By (Print): Nick Sullivan	Date/Time: 10/01/20 4:00	Date/Time: Jan 10, 2020 05:00	Date/Time: 01/10/20 17:46
Date/Time: Jan 10, 2020	Temperature: °C	Temperature: 14.8	pH Verified: ☐ By:

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 28473
Project: PE4799
Custody: 125918

Report Date: 27-Jan-2020
Order Date: 22-Jan-2020

Order #: 2004367

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

Paracel ID	Client ID
2004367-01	BH2-SS4
2004367-02	BH3-SS4

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 28473

Report Date: 27-Jan-2020
Order Date: 22-Jan-2020
Project Description: PE4799

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	23-Jan-20	24-Jan-20
PHC F1	CWS Tier 1 - P&T GC-FID	23-Jan-20	24-Jan-20
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	23-Jan-20	25-Jan-20
REG 153: VOCs by P&T GC/MS	EPA 8260 - P&T GC-MS	23-Jan-20	24-Jan-20
Solids, %	Gravimetric, calculation	23-Jan-20	25-Jan-20

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 28473

Report Date: 27-Jan-2020

Order Date: 22-Jan-2020

Project Description: PE4799

	Client ID:	BH2-SS4	BH3-SS4	-	-
	Sample Date:	21-Jan-20 09:00	21-Jan-20 09:00	-	-
	Sample ID:	2004367-01	2004367-02	-	-
	MDL/Units	Soil	Soil	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	86.1	91.2	-	-
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	-	-	-
1,4-Dichlorobenzene	0.05 ug/g dry	<0.05	-	-	-
1,1-Dichloroethane	0.05 ug/g dry	<0.05	-	-	-
1,2-Dichloroethane	0.05 ug/g dry	<0.05	-	-	-
1,1-Dichloroethylene	0.05 ug/g dry	<0.05	-	-	-
cis-1,2-Dichloroethylene	0.05 ug/g dry	<0.05	-	-	-
trans-1,2-Dichloroethylene	0.05 ug/g dry	<0.05	-	-	-
1,2-Dichloropropane	0.05 ug/g dry	<0.05	-	-	-
cis-1,3-Dichloropropylene	0.05 ug/g dry	<0.05	-	-	-
trans-1,3-Dichloropropylene	0.05 ug/g dry	<0.05	-	-	-
1,3-Dichloropropene, total	0.05 ug/g dry	<0.05	-	-	-
Ethylbenzene	0.05 ug/g dry	<0.05	-	-	-
Ethylene dibromide (dibromoethan	0.05 ug/g dry	<0.05	-	-	-
Hexane	0.05 ug/g dry	<0.05	-	-	-
Methyl Ethyl Ketone (2-Butanone)	0.50 ug/g dry	<0.50	-	-	-
Methyl Isobutyl Ketone	0.50 ug/g dry	<0.50	-	-	-
Methyl tert-butyl ether	0.05 ug/g dry	<0.05	-	-	-
Methylene Chloride	0.05 ug/g dry	<0.05	-	-	-
Styrene	0.05 ug/g dry	<0.05	-	-	-
1,1,1,2-Tetrachloroethane	0.05 ug/g dry	<0.05	-	-	-
1,1,2,2-Tetrachloroethane	0.05 ug/g dry	<0.05	-	-	-
Tetrachloroethylene	0.05 ug/g dry	<0.05	-	-	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 28473

Report Date: 27-Jan-2020

Order Date: 22-Jan-2020

Project Description: PE4799

	Client ID:	BH2-SS4	BH3-SS4	-	-
	Sample Date:	21-Jan-20 09:00	21-Jan-20 09:00	-	-
	Sample ID:	2004367-01	2004367-02	-	-
	MDL/Units	Soil	Soil	-	-
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	116%	-	-	-
Dibromofluoromethane	Surrogate	64.7%	-	-	-
Toluene-d8	Surrogate	125%	-	-	-
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	-	124%	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	-	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	-	-
F3 PHCs (C16-C34)	8 ug/g dry	<8	<8	-	-
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Volatiles									
Acetone	ND	0.50	ug/g						
Benzene	ND	0.02	ug/g						
Bromodichloromethane	ND	0.05	ug/g						
Bromoform	ND	0.05	ug/g						
Bromomethane	ND	0.05	ug/g						
Carbon Tetrachloride	ND	0.05	ug/g						
Chlorobenzene	ND	0.05	ug/g						
Chloroform	ND	0.05	ug/g						
Dibromochloromethane	ND	0.05	ug/g						
Dichlorodifluoromethane	ND	0.05	ug/g						
1,2-Dichlorobenzene	ND	0.05	ug/g						
1,3-Dichlorobenzene	ND	0.05	ug/g						
1,4-Dichlorobenzene	ND	0.05	ug/g						
1,1-Dichloroethane	ND	0.05	ug/g						
1,2-Dichloroethane	ND	0.05	ug/g						
1,1-Dichloroethylene	ND	0.05	ug/g						
cis-1,2-Dichloroethylene	ND	0.05	ug/g						
trans-1,2-Dichloroethylene	ND	0.05	ug/g						
1,2-Dichloropropane	ND	0.05	ug/g						
cis-1,3-Dichloropropylene	ND	0.05	ug/g						
trans-1,3-Dichloropropylene	ND	0.05	ug/g						
1,3-Dichloropropene, total	ND	0.05	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Ethylene dibromide (dibromoethane	ND	0.05	ug/g						
Hexane	ND	0.05	ug/g						
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g						
Methyl Isobutyl Ketone	ND	0.50	ug/g						
Methyl tert-butyl ether	ND	0.05	ug/g						
Methylene Chloride	ND	0.05	ug/g						
Styrene	ND	0.05	ug/g						
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g						
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g						
Tetrachloroethylene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
1,1,1-Trichloroethane	ND	0.05	ug/g						
1,1,2-Trichloroethane	ND	0.05	ug/g						
Trichloroethylene	ND	0.05	ug/g						
Trichlorofluoromethane	ND	0.05	ug/g						
Vinyl chloride	ND	0.02	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: 4-Bromofluorobenzene	*3.58*		*ug/g*		*112*	*50-140*			
Surrogate: Dibromofluoromethane	*1.66*		*ug/g*		*51.7*	*50-140*			
Surrogate: Toluene-d8	*3.93*		*ug/g*		*123*	*50-140*			
Benzene	ND	0.02	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: Toluene-d8	*3.93*		*ug/g*		*123*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	16	4	ug/g dry	13			16.7	30	
F3 PHCs (C16-C34)	18	8	ug/g dry	11			50.0	30	QR-01
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND				30	
Physical Characteristics									
% Solids	86.7	0.1	% by Wt.	86.6			0.1	25	
Volatiles									
Acetone	ND	0.50	ug/g dry	ND				50	
Benzene	ND	0.02	ug/g dry	ND				50	
Bromodichloromethane	ND	0.05	ug/g dry	ND				50	
Bromoform	ND	0.05	ug/g dry	ND				50	
Bromomethane	ND	0.05	ug/g dry	ND				50	
Carbon Tetrachloride	ND	0.05	ug/g dry	ND				50	
Chlorobenzene	ND	0.05	ug/g dry	ND				50	
Chloroform	ND	0.05	ug/g dry	ND				50	
Dibromochloromethane	ND	0.05	ug/g dry	ND				50	
Dichlorodifluoromethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,3-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,4-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
cis-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
trans-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
1,2-Dichloropropane	ND	0.05	ug/g dry	ND				50	
cis-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
trans-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Ethylene dibromide (dibromoethane	ND	0.05	ug/g dry	ND				50	
Hexane	ND	0.05	ug/g dry	ND				50	
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g dry	ND				50	
Methyl Isobutyl Ketone	ND	0.50	ug/g dry	ND				50	
Methyl tert-butyl ether	ND	0.05	ug/g dry	ND				50	
Methylene Chloride	ND	0.05	ug/g dry	ND				50	
Styrene	ND	0.05	ug/g dry	ND				50	
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
Tetrachloroethylene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
1,1,1-Trichloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2-Trichloroethane	ND	0.05	ug/g dry	ND				50	
Trichloroethylene	ND	0.05	ug/g dry	ND				50	
Trichlorofluoromethane	ND	0.05	ug/g dry	ND				50	
Vinyl chloride	ND	0.02	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	
Surrogate: 4-Bromofluorobenzene	*3.50*		*ug/g dry*		*87.5*	*50-140*			
Surrogate: Dibromofluoromethane	*2.30*		*ug/g dry*		*57.4*	*50-140*			
Surrogate: Toluene-d8	*5.05*		*ug/g dry*		*126*	*50-140*			
Benzene	ND	0.02	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	
Surrogate: Toluene-d8	*5.05*		*ug/g dry*		*126*	*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)	165	7	ug/g		82.6	80-120			
F2 PHCs (C10-C16)	92	4	ug/g	13	80.0	60-140			
F3 PHCs (C16-C34)	216	8	ug/g	11	85.7	60-140			
F4 PHCs (C34-C50)	113	6	ug/g	ND	75.0	60-140			
Volatiles									
Acetone	7.53	0.50	ug/g		75.3	50-140			
Benzene	2.75	0.02	ug/g		68.7	60-130			
Bromodichloromethane	2.86	0.05	ug/g		71.4	60-130			
Bromoform	4.01	0.05	ug/g		100	60-130			
Bromomethane	2.41	0.05	ug/g		60.3	50-140			
Carbon Tetrachloride	2.89	0.05	ug/g		72.3	60-130			
Chlorobenzene	3.95	0.05	ug/g		98.9	60-130			
Chloroform	2.86	0.05	ug/g		71.4	60-130			
Dibromochloromethane	4.09	0.05	ug/g		102	60-130			
Dichlorodifluoromethane	2.60	0.05	ug/g		65.0	50-140			
1,2-Dichlorobenzene	3.62	0.05	ug/g		90.5	60-130			
1,3-Dichlorobenzene	3.58	0.05	ug/g		89.4	60-130			
1,4-Dichlorobenzene	3.52	0.05	ug/g		87.9	60-130			
1,1-Dichloroethane	2.85	0.05	ug/g		71.3	60-130			
1,2-Dichloroethane	2.96	0.05	ug/g		74.1	60-130			
1,1-Dichloroethylene	2.74	0.05	ug/g		68.6	60-130			
cis-1,2-Dichloroethylene	2.62	0.05	ug/g		65.5	60-130			
trans-1,2-Dichloroethylene	2.87	0.05	ug/g		71.7	60-130			
1,2-Dichloropropane	2.69	0.05	ug/g		67.3	60-130			
cis-1,3-Dichloropropylene	2.91	0.05	ug/g		72.7	60-130			
trans-1,3-Dichloropropylene	2.99	0.05	ug/g		74.7	60-130			
Ethylbenzene	3.94	0.05	ug/g		98.6	60-130			
Ethylene dibromide (dibromoethane	3.73	0.05	ug/g		93.3	60-130			
Hexane	2.56	0.05	ug/g		63.9	60-130			
Methyl Ethyl Ketone (2-Butanone)	6.16	0.50	ug/g		61.6	50-140			
Methyl Isobutyl Ketone	6.96	0.50	ug/g		69.6	50-140			
Methyl tert-butyl ether	6.84	0.05	ug/g		68.4	50-140			
Methylene Chloride	2.66	0.05	ug/g		66.6	60-130			
Styrene	3.93	0.05	ug/g		98.3	60-130			
1,1,1,2-Tetrachloroethane	3.98	0.05	ug/g		99.6	60-130			
1,1,2,2-Tetrachloroethane	2.47	0.05	ug/g		61.8	60-130			
Tetrachloroethylene	3.67	0.05	ug/g		91.7	60-130			
Toluene	3.74	0.05	ug/g		93.6	60-130			
1,1,1-Trichloroethane	2.91	0.05	ug/g		72.7	60-130			
1,1,2-Trichloroethane	2.80	0.05	ug/g		70.1	60-130			
Trichloroethylene	3.24	0.05	ug/g		80.9	60-130			
Trichlorofluoromethane	2.99	0.05	ug/g		74.7	50-140			
Vinyl chloride	3.63	0.02	ug/g		90.7	50-140			
m,p-Xylenes	7.88	0.05	ug/g		98.4	60-130			
o-Xylene	4.01	0.05	ug/g		100	60-130			
Surrogate: 4-Bromofluorobenzene	*2.77*		*ug/g*		*86.6*	*50-140*			
Benzene	2.75	0.02	ug/g		68.7	60-130			
Ethylbenzene	3.94	0.05	ug/g		98.6	60-130			
Toluene	3.74	0.05	ug/g		93.6	60-130			
m,p-Xylenes	7.88	0.05	ug/g		98.4	60-130			
o-Xylene	4.01	0.05	ug/g		100	60-130			

Qualifier Notes:

Login Qualifiers :

Suspected methanol loss for preserved VOC soil vial.
Applies to samples: BH3-SS4

QC Qualifiers :

QR-01 : Duplicate RPD is high, however, the sample result is less than 10x the MDL.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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

CCME PHC additional information:

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

PARACEL LABORATORIES LTD.

Paracel ID: 2004367

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2004367	Nº 125918

Client Name: Mark D'Arcy	Project Ref: PE4999	Page 1 of 1
Contact Name: Patterson Group.	Quote #:	**Turnaround Time**
Address:	PO #: 28473	☐ 1 day ☐ 3 day
	E-mail:	☐ 2 day ☑ Regular
Telephone: 226-7381		Date Required:

Regulation 153/04	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 + PHCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)						
1	BH2-SS4	S	-	2	Jan 21/20	1		✓									120X	VIS	
2	BH3-SS4	S	-	2	" "		✓											11	
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			

Comments:

Method of Delivery: Swift

Relinquished By (Sign):	Received By Driver/Depot: EK 1262	Received at Lab:	Verified By:
Relinquished By (Print): Nic Bouchette	Date/Time: 3:23	Date/Time: Jan 22/2020 3:55pm	Date/Time: 01/22/2020 17:04
Date/Time:	Temperature: °C	Temperature: 8.7 °C	pH Verified: ☐ By:

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 29409
Project: PE4799
Custody: 125923

Report Date: 29-Jan-2020
Order Date: 24-Jan-2020

Order #: 2004594

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

Paracel ID	Client ID
2004594-01	BH2-GW1
2004594-02	BH3-GW1

Approved By:

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 29409

Report Date: 29-Jan-2020
Order Date: 24-Jan-2020
Project Description: PE4799

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	28-Jan-20	28-Jan-20
PHC F1	CWS Tier 1 - P&T GC-FID	27-Jan-20	28-Jan-20
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	28-Jan-20	28-Jan-20
REG 153: VOCs by P&T GC/MS	EPA 624 - P&T GC-MS	27-Jan-20	28-Jan-20

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 29409

Report Date: 29-Jan-2020

Order Date: 24-Jan-2020

Project Description: PE4799

	Client ID:	BH2-GW1	BH3-GW1	-	-
	Sample Date:	23-Jan-20 13:50	23-Jan-20 13:00	-	-
	Sample ID:	2004594-01	2004594-02	-	-
	MDL/Units	Water	Water	-	-
Volatiles					
Acetone	5.0 ug/L	<5.0	-	-	-
Benzene	0.5 ug/L	<0.5	-	-	-
Bromodichloromethane	0.5 ug/L	<0.5	-	-	-
Bromoform	0.5 ug/L	<0.5	-	-	-
Bromomethane	0.5 ug/L	<0.5	-	-	-
Carbon Tetrachloride	0.2 ug/L	<0.2	-	-	-
Chlorobenzene	0.5 ug/L	<0.5	-	-	-
Chloroform	0.5 ug/L	<0.5	-	-	-
Dibromochloromethane	0.5 ug/L	<0.5	-	-	-
Dichlorodifluoromethane	1.0 ug/L	<1.0	-	-	-
1,2-Dichlorobenzene	0.5 ug/L	<0.5	-	-	-
1,3-Dichlorobenzene	0.5 ug/L	<0.5	-	-	-
1,4-Dichlorobenzene	0.5 ug/L	<0.5	-	-	-
1,1-Dichloroethane	0.5 ug/L	<0.5	-	-	-
1,2-Dichloroethane	0.5 ug/L	<0.5	-	-	-
1,1-Dichloroethylene	0.5 ug/L	<0.5	-	-	-
cis-1,2-Dichloroethylene	0.5 ug/L	<0.5	-	-	-
trans-1,2-Dichloroethylene	0.5 ug/L	<0.5	-	-	-
1,2-Dichloropropane	0.5 ug/L	<0.5	-	-	-
cis-1,3-Dichloropropylene	0.5 ug/L	<0.5	-	-	-
trans-1,3-Dichloropropylene	0.5 ug/L	<0.5	-	-	-
1,3-Dichloropropene, total	0.5 ug/L	<0.5	-	-	-
Ethylbenzene	0.5 ug/L	<0.5	-	-	-
Ethylene dibromide (dibromoethan	0.2 ug/L	<0.2	-	-	-
Hexane	1.0 ug/L	<1.0	-	-	-
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	<5.0	-	-	-
Methyl Isobutyl Ketone	5.0 ug/L	<5.0	-	-	-
Methyl tert-butyl ether	2.0 ug/L	<2.0	-	-	-
Methylene Chloride	5.0 ug/L	<5.0	-	-	-
Styrene	0.5 ug/L	<0.5	-	-	-
1,1,1,2-Tetrachloroethane	0.5 ug/L	<0.5	-	-	-
1,1,2,2-Tetrachloroethane	0.5 ug/L	<0.5	-	-	-
Tetrachloroethylene	0.5 ug/L	<0.5	-	-	-
Toluene	0.5 ug/L	<0.5	-	-	-
1,1,1-Trichloroethane	0.5 ug/L	<0.5	-	-	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 29409

Report Date: 29-Jan-2020

Order Date: 24-Jan-2020

Project Description: PE4799

	Client ID:	BH2-GW1	BH3-GW1	-	-
	Sample Date:	23-Jan-20 13:50	23-Jan-20 13:00	-	-
	Sample ID:	2004594-01	2004594-02	-	-
	MDL/Units	Water	Water	-	-
1,1,2-Trichloroethane	0.5 ug/L	<0.5	-	-	-
Trichloroethylene	0.5 ug/L	<0.5	-	-	-
Trichlorofluoromethane	1.0 ug/L	<1.0	-	-	-
Vinyl chloride	0.5 ug/L	<0.5	-	-	-
m,p-Xylenes	0.5 ug/L	<0.5	-	-	-
o-Xylene	0.5 ug/L	<0.5	-	-	-
Xylenes, total	0.5 ug/L	<0.5	-	-	-
4-Bromofluorobenzene	Surrogate	113%	-	-	-
Dibromofluoromethane	Surrogate	107%	-	-	-
Toluene-d8	Surrogate	116%	-	-	-
Benzene	0.5 ug/L	-	<0.5	-	-
Ethylbenzene	0.5 ug/L	-	<0.5	-	-
Toluene	0.5 ug/L	-	<0.5	-	-
m,p-Xylenes	0.5 ug/L	-	<0.5	-	-
o-Xylene	0.5 ug/L	-	<0.5	-	-
Xylenes, total	0.5 ug/L	-	<0.5	-	-
Toluene-d8	Surrogate	-	110%	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	<25	-	-
F2 PHCs (C10-C16)	100 ug/L	<100	<100	-	-
F3 PHCs (C16-C34)	100 ug/L	<100	<100	-	-
F4 PHCs (C34-C50)	100 ug/L	<100	<100	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
Volatiles									
Acetone	ND	5.0	ug/L						
Benzene	ND	0.5	ug/L						
Bromodichloromethane	ND	0.5	ug/L						
Bromoform	ND	0.5	ug/L						
Bromomethane	ND	0.5	ug/L						
Carbon Tetrachloride	ND	0.2	ug/L						
Chlorobenzene	ND	0.5	ug/L						
Chloroform	ND	0.5	ug/L						
Dibromochloromethane	ND	0.5	ug/L						
Dichlorodifluoromethane	ND	1.0	ug/L						
1,2-Dichlorobenzene	ND	0.5	ug/L						
1,3-Dichlorobenzene	ND	0.5	ug/L						
1,4-Dichlorobenzene	ND	0.5	ug/L						
1,1-Dichloroethane	ND	0.5	ug/L						
1,2-Dichloroethane	ND	0.5	ug/L						
1,1-Dichloroethylene	ND	0.5	ug/L						
cis-1,2-Dichloroethylene	ND	0.5	ug/L						
trans-1,2-Dichloroethylene	ND	0.5	ug/L						
1,2-Dichloropropane	ND	0.5	ug/L						
cis-1,3-Dichloropropylene	ND	0.5	ug/L						
trans-1,3-Dichloropropylene	ND	0.5	ug/L						
1,3-Dichloropropene, total	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Ethylene dibromide (dibromoethane	ND	0.2	ug/L						
Hexane	ND	1.0	ug/L						
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L						
Methyl Isobutyl Ketone	ND	5.0	ug/L						
Methyl tert-butyl ether	ND	2.0	ug/L						
Methylene Chloride	ND	5.0	ug/L						
Styrene	ND	0.5	ug/L						
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L						
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L						
Tetrachloroethylene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
1,1,1-Trichloroethane	ND	0.5	ug/L						
1,1,2-Trichloroethane	ND	0.5	ug/L						
Trichloroethylene	ND	0.5	ug/L						
Trichlorofluoromethane	ND	1.0	ug/L						
Vinyl chloride	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: 4-Bromofluorobenzene	*97.6*		*ug/L*		*122*	*50-140*			
Surrogate: Dibromofluoromethane	*74.4*		*ug/L*		*93.0*	*50-140*			
Surrogate: Toluene-d8	*86.0*		*ug/L*		*108*	*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	*86.0*		*ug/L*		*108*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND				30	
Volatiles									
Acetone	ND	5.0	ug/L	ND				30	
Benzene	ND	0.5	ug/L	ND				30	
Bromodichloromethane	ND	0.5	ug/L	ND				30	
Bromoform	ND	0.5	ug/L	ND				30	
Bromomethane	ND	0.5	ug/L	ND				30	
Carbon Tetrachloride	ND	0.2	ug/L	ND				30	
Chlorobenzene	ND	0.5	ug/L	ND				30	
Chloroform	7.10	0.5	ug/L	7.11			0.1	30	
Dibromochloromethane	ND	0.5	ug/L	ND				30	
Dichlorodifluoromethane	ND	1.0	ug/L	ND				30	
1,2-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,3-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,4-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,1-Dichloroethane	ND	0.5	ug/L	ND				30	
1,2-Dichloroethane	ND	0.5	ug/L	ND				30	
1,1-Dichloroethylene	ND	0.5	ug/L	ND				30	
cis-1,2-Dichloroethylene	ND	0.5	ug/L	ND				30	
trans-1,2-Dichloroethylene	ND	0.5	ug/L	ND				30	
1,2-Dichloropropane	ND	0.5	ug/L	ND				30	
cis-1,3-Dichloropropylene	ND	0.5	ug/L	ND				30	
trans-1,3-Dichloropropylene	ND	0.5	ug/L	ND				30	
Ethylbenzene	ND	0.5	ug/L	ND				30	
Ethylene dibromide (dibromoethane	ND	0.2	ug/L	ND				30	
Hexane	ND	1.0	ug/L	ND				30	
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L	ND				30	
Methyl Isobutyl Ketone	ND	5.0	ug/L	ND				30	
Methyl tert-butyl ether	ND	2.0	ug/L	ND				30	
Methylene Chloride	ND	5.0	ug/L	ND				30	
Styrene	ND	0.5	ug/L	ND				30	
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L	ND				30	
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L	ND				30	
Tetrachloroethylene	ND	0.5	ug/L	ND				30	
Toluene	ND	0.5	ug/L	ND				30	
1,1,1-Trichloroethane	ND	0.5	ug/L	ND				30	
1,1,2-Trichloroethane	ND	0.5	ug/L	ND				30	
Trichloroethylene	ND	0.5	ug/L	ND				30	
Trichlorofluoromethane	ND	1.0	ug/L	ND				30	
Vinyl chloride	ND	0.5	ug/L	ND				30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: 4-Bromofluorobenzene	*93.1*		*ug/L*		*116*	*50-140*			
Surrogate: Dibromofluoromethane	*93.4*		*ug/L*		*117*	*50-140*			
Surrogate: Toluene-d8	*96.1*		*ug/L*		*120*	*50-140*			
Benzene	ND	0.5	ug/L	ND				30	
Ethylbenzene	ND	0.5	ug/L	ND				30	
Toluene	ND	0.5	ug/L	ND				30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: Toluene-d8	*96.1*		*ug/L*		*120*	*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)	2020	25	ug/L		101	68-117			
F2 PHCs (C10-C16)	1240	100	ug/L		77.3	60-140			
F3 PHCs (C16-C34)	3120	100	ug/L		79.5	60-140			
F4 PHCs (C34-C50)	1670	100	ug/L		67.2	60-140			
Volatiles									
Acetone	94.1	5.0	ug/L		94.1	50-140			
Benzene	48.2	0.5	ug/L		120	60-130			
Bromodichloromethane	44.8	0.5	ug/L		112	60-130			
Bromoform	44.0	0.5	ug/L		110	60-130			
Bromomethane	44.4	0.5	ug/L		111	50-140			
Carbon Tetrachloride	43.8	0.2	ug/L		110	60-130			
Chlorobenzene	40.2	0.5	ug/L		101	60-130			
Chloroform	45.1	0.5	ug/L		113	60-130			
Dibromochloromethane	40.6	0.5	ug/L		101	60-130			
Dichlorodifluoromethane	45.6	1.0	ug/L		114	50-140			
1,2-Dichlorobenzene	40.2	0.5	ug/L		100	60-130			
1,3-Dichlorobenzene	39.4	0.5	ug/L		98.5	60-130			
1,4-Dichlorobenzene	40.1	0.5	ug/L		100	60-130			
1,1-Dichloroethane	46.4	0.5	ug/L		116	60-130			
1,2-Dichloroethane	46.2	0.5	ug/L		115	60-130			
1,1-Dichloroethylene	45.8	0.5	ug/L		115	60-130			
cis-1,2-Dichloroethylene	42.5	0.5	ug/L		106	60-130			
trans-1,2-Dichloroethylene	46.0	0.5	ug/L		115	60-130			
1,2-Dichloropropane	47.9	0.5	ug/L		120	60-130			
cis-1,3-Dichloropropylene	52.0	0.5	ug/L		130	60-130			
trans-1,3-Dichloropropylene	51.2	0.5	ug/L		128	60-130			
Ethylbenzene	44.5	0.5	ug/L		111	60-130			
Ethylene dibromide (dibromoethane	42.2	0.2	ug/L		106	60-130			
Hexane	34.2	1.0	ug/L		85.4	60-130			
Methyl Ethyl Ketone (2-Butanone)	111	5.0	ug/L		111	50-140			
Methyl Isobutyl Ketone	131	5.0	ug/L		131	50-140			
Methyl tert-butyl ether	114	2.0	ug/L		114	50-140			
Methylene Chloride	45.7	5.0	ug/L		114	60-130			
Styrene	47.4	0.5	ug/L		118	60-130			
1,1,1,2-Tetrachloroethane	41.0	0.5	ug/L		103	60-130			
1,1,2,2-Tetrachloroethane	43.9	0.5	ug/L		110	60-130			
Tetrachloroethylene	42.0	0.5	ug/L		105	60-130			
Toluene	41.9	0.5	ug/L		105	60-130			
1,1,1-Trichloroethane	44.4	0.5	ug/L		111	60-130			
1,1,2-Trichloroethane	44.8	0.5	ug/L		112	60-130			
Trichloroethylene	43.9	0.5	ug/L		110	60-130			
Trichlorofluoromethane	44.4	1.0	ug/L		111	60-130			
Vinyl chloride	46.2	0.5	ug/L		115	50-140			
m,p-Xylenes	91.1	0.5	ug/L		114	60-130			
o-Xylene	46.9	0.5	ug/L		117	60-130			
Surrogate: 4-Bromofluorobenzene	*76.8*		*ug/L*		*96.0*	*50-140*			
Benzene	48.2	0.5	ug/L		120	60-130			
Ethylbenzene	44.5	0.5	ug/L		111	60-130			
Toluene	41.9	0.5	ug/L		105	60-130			
m,p-Xylenes	91.1	0.5	ug/L		114	60-130			
o-Xylene	46.9	0.5	ug/L		117	60-130			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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.

PARACE LABORATORIES LTD

Paracel ID: 2004594

rd. 8 com

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2004594	Nº 125923

Client Name: Paterson Group	Project Ref: PE4799	Page 1 of 1
Contact Name: Mark D'Arcy ; Phil Price	Quote #:	Turnaround Time
Address: 154 Colonnade Road	PO #: 29409	☐ 1 day ☐ 3 day
Telephone: 613 - 226 - 7381	E-mail: mdarcy@patersongroup.ca pprice@patersongroup.ca	☐ 2 day ☒ Regular
		Date Required:

Regulation 153/04	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/F1 ~~+ CHCs~~	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	PHCs (F2-F4)						
1	BH2 - GW1	GW		3	Jan 23/2020	1:50 PM		X						X						
2	BH3 - GW1	GW		3	Jan 23/2020	1:00 PM	X													
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Comments:

Method of Delivery: Paracel

Relinquished By (Sign):	Received By Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): Nicholas Doucette	Date/Time: 24/01/20 3:40	Date/Time: 01-24-20 16:40	Date/Time: 01-24-20 16:49
Date/Time:	Temperature: °C	Temperature: 15.9 °C	pH Verified: ☐ By:

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 29281
Project: PE4799
Custody: 51759

Report Date: 16-Dec-2019
Order Date: 10-Dec-2019

Order #: 1950261

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

Paracel ID	Client ID
1950261-01	BH1-SS4

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 29281

Report Date: 16-Dec-2019
Order Date: 10-Dec-2019
Project Description: PE4799

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	13-Dec-19	14-Dec-19
PHC F1	CWS Tier 1 - P&T GC-FID	13-Dec-19	14-Dec-19
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	11-Dec-19	14-Dec-19
Solids, %	Gravimetric, calculation	11-Dec-19	11-Dec-19

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 29281

Report Date: 16-Dec-2019

Order Date: 10-Dec-2019

Project Description: PE4799

	Client ID:	BH1-SS4	-	-	-
	Sample Date:	06-Dec-19 09:00	-	-	-
	Sample ID:	1950261-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	86.0	-	-	-
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	109%	-	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	-	-	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	-	-	-
F3 PHCs (C16-C34)	8 ug/g dry	<8	-	-	-
F4 PHCs (C34-C50)	6 ug/g dry	<6	-	-	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 29281

Report Date: 16-Dec-2019
Order Date: 10-Dec-2019
Project Description: PE4799

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Volatiles									
Benzene	ND	0.02	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: Toluene-d8	*3.42*		*ug/g*		*107*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND				30	
F3 PHCs (C16-C34)	ND	8	ug/g dry	ND				30	
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND				30	
Physical Characteristics									
% Solids	85.8	0.1	% by Wt.	87.3			1.8	25	
Volatiles									
Benzene	ND	0.02	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	
Surrogate: Toluene-d8	*3.89*		*ug/g dry*		*114*	*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)	185	7	ug/g		92.3	80-120			
F2 PHCs (C10-C16)	119	4	ug/g	ND	128	60-140			
F3 PHCs (C16-C34)	295	8	ug/g	ND	130	60-140			
F4 PHCs (C34-C50)	170	6	ug/g	ND	118	60-140			
Volatiles									
Benzene	2.50	0.02	ug/g		62.4	60-130			
Ethylbenzene	4.36	0.05	ug/g		109	60-130			
Toluene	4.55	0.05	ug/g		114	60-130			
m,p-Xylenes	8.90	0.05	ug/g		111	60-130			
o-Xylene	4.37	0.05	ug/g		109	60-130			
Surrogate: Toluene-d8	*2.66*		*ug/g*		*83.0*	*50-140*			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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

CCME PHC additional information:

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

PARACEL LABORATORIES

Paracel ID: 1950261

Head Office
300-2319 St. Laurent Blvd.
Ottawa, Ontario K1G 4J8
1-800-749-1947
paracel@paracellabs.com
www.paracellabs.com

Paracel Order Number (Lab Use Only): 1950261

Chain Of Custody (Lab Use Only) № 51759

Client Name: Paterson	Project Ref: PE4799
Contact Name: Mark D'Arcy	Quote #:
Address: 154 Colonnade Rd	PO #: 29281
	E-mail: MDarcy@Patersongroup.ca
Telephone: 613 226 7381	

Page 1 of 1

Turnaround Time

☐ 1 day ☐ 3 day
☐ 2 day ☑ Regular
Date Required: ____

Regulation 153/04	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)

Required Analysis

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	BTEX	PHC (F1-F4)									
1	BH1-SS4	S		2	6 Dec	–	✓	✓							120ml+1vial		✓
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Comments:

Method of Delivery: Paracel

Relinquished By (Sign): [signature]	Received By Driver/Depot: [signature]	Received at Lab: Sumeepvrm Dhmai	Verified By: [signature]
Relinquished By (Print): PHILIP PRICE	Date/Time: 10/12/19 3:10	Date/Time: Dec 10, 2019 05.14	Date/Time: 12-10-19 17:17
Date/Time: 9 Dec 2019	Temperature: °C PH.	Temperature: 12.6 °C	pH Verified: ☐ By:

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1-800-749-1947
www.paracellabs.com

Certificate of Analysis

Paterson Group Consulting Engineers

9 Auriga Drive
Ottawa, ON K2E 7T9
Attn: Sam Berube

Client PO: 57268
Project: PE4799
Custody:

Report Date: 21-Apr-2023
Order Date: 18-Apr-2023

Order #: 2316218

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

Paracel ID	Client ID
2316218-01	BH1-GW2
2316218-02	BH3-GW2
2316218-03	DUP-23

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 57268

Report Date: 21-Apr-2023

Order Date: 18-Apr-2023

Project Description: PE4799

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	20-Apr-23	20-Apr-23
PHC F1	CWS Tier 1 - P&T GC-FID	19-Apr-23	20-Apr-23
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	19-Apr-23	20-Apr-23

Certificate of Analysis

Report Date: 21-Apr-2023

Client: Paterson Group Consulting Engineers

Order Date: 18-Apr-2023

Client PO: 57268

Project Description: PE4799

	Client ID:	BH1-GW2	BH3-GW2	DUP-23	-
	Sample Date:	18-Apr-23 09:00	18-Apr-23 09:00	18-Apr-23 09:00	-
	Sample ID:	2316218-01	2316218-02	2316218-03	-
	MDL/Units	Ground Water	Ground Water	Ground Water	-
Volatiles					
Benzene	0.5 ug/L	<0.5	<0.5	<0.5	-
Ethylbenzene	0.5 ug/L	<0.5	<0.5	<0.5	-
Toluene	0.5 ug/L	<0.5	<0.5	<0.5	-
m,p-Xylenes	0.5 ug/L	<0.5	<0.5	<0.5	-
o-Xylene	0.5 ug/L	<0.5	<0.5	<0.5	-
Xylenes, total	0.5 ug/L	<0.5	<0.5	<0.5	-
Toluene-d8	Surrogate	118%	119%	119%	-
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	<25	<25	-
F2 PHCs (C10-C16)	100 ug/L	<100	<100	<100	-
F3 PHCs (C16-C34)	100 ug/L	<100	<100	<100	-
F4 PHCs (C34-C50)	100 ug/L	<100	<100	<100	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 57268

Report Date: 21-Apr-2023

Order Date: 18-Apr-2023

Project Description: PE4799

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
Volatiles									
Benzene	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: Toluene-d8	*94.6*		*ug/L*		*118*	*50-140*			

Certificate of Analysis

Report Date: 21-Apr-2023

Client: Paterson Group Consulting Engineers

Order Date: 18-Apr-2023

Client PO: 57268

Project Description: PE4799

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									
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	*95.8*		*ug/L*		*120*	*50-140*			

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 57268

Report Date: 21-Apr-2023

Order Date: 18-Apr-2023

Project Description: PE4799

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	2040	25	ug/L	ND	102	68-117			
F2 PHCs (C10-C16)	1710	100	ug/L	ND	107	60-140			
F3 PHCs (C16-C34)	4270	100	ug/L	ND	109	60-140			
F4 PHCs (C34-C50)	2460	100	ug/L	ND	99.3	60-140			
Volatiles									
Benzene	40.0	0.5	ug/L	ND	100	60-130			
Ethylbenzene	35.9	0.5	ug/L	ND	89.7	60-130			
Toluene	39.6	0.5	ug/L	ND	99.0	60-130			
m,p-Xylenes	75.9	0.5	ug/L	ND	94.8	60-130			
o-Xylene	32.2	0.5	ug/L	ND	80.6	60-130			
Surrogate: Toluene-d8	*81.1*		*ug/L*		*101*	*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.

PARACEL LABORATORIES LTD.

Paracel ID: 2316218

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2316218	

Client Name: Paterson	Project Ref: PE 4799
Contact Name: Sam Berube	Quote #:
Address: 9 Auriga Drive	PO #: 57268
Telephone: 613 226 7381	E-mail: sberube@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-GW2	GW		3	April 18, 2023		X						
2	BH3-GW2	↓		↓	↓		X						
3	DUP-23	↓		↓	↓		X						
4													
5													
6													
7													
8													
9													
10													

Required Analysis

Comments:

Method of Delivery: PARCEL COURIER

Relinquished By (Sign):	Received By Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): Bryce Lee	Date/Time: 18/04/23 15:12	Date/Time: Apr 18 2023 15:57	Date/Time: Apr 18 23 16:11
Date/Time: April 18, 2023	Temperature: °C	Temperature: 8.7	pH Verified: ☐ By: NA