Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

patersongroup

Phase II - Environmental Site Assessment

1137 Ogilvie Road and 1111 Cummings Avenue
Ottawa, Ontario

Prepared For

TCU Development Corporation

May 14, 2021

Report: PE5231-2

Paterson Group Inc.

Consulting Engineers
154 Colonnade Road South
Ottawa (Nepean), Ontario
Canada K2E 7J5

Tel: (613) 226-7381
Fax: (613) 226-6344
www.patersongroup.ca

TABLE OF CONTENTS

List of Figures

List of Appendices

EXECUTIVE SUMMARY

Assessment

A Phase II ESA was conducted for the properties addressed 1137 Ogilvie Road and 1111 Cummings Avenue, in the 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 five boreholes, three of which were constructed with groundwater monitoring wells. The general soil profile encountered during the field program consisted of a thin layer of asphaltic concrete, followed by fill material consisting of silty sand with crushed stone, underlain by a fill layer consisting of silty clay or sand with gravel, followed by shale bedrock. No unusual staining or odour was noted at the time of the field program.

Seven soil samples were submitted for laboratory analysis of Benzene, Toluene, Ethylbenzene and Xylenes (BTEX), Petroleum Hydrocarbons (PHCs, Fractions F_1-F_4), and Metals. BTEX parameter concentrations were not detected above the laboratory detection limit, while PHC and metals parameter concentrations were identified in the soil samples analyzed. Based on the analytical test results, a metal (mercury) concentration was identified in soil sample BH2-SS2 in exceedance of the MECP Table 7 Standards. All remaining parameter concentrations analyzed in the soil samples are in compliance with the selected MECP Table 7 Standards.

Groundwater samples from monitoring wells BH1, BH2 and BH3 were collected during the April 26, 2021 sampling event. No sheen, free product or odour was noted during the groundwater sampling event. The recovered groundwater samples were analysed for BTEX, PHC (F1-F4) and metals parameters. BTEX and PHC parameter concentrations were not detected above the laboratory detection limit, while metals parameter concentrations were identified in the groundwater samples analyzed. All parameter concentrations analyzed in the groundwater samples are in compliance with the selected MECP Table 7 Standards.

Recommendations

<u>Soil</u>

Based on the findings of the Phase II ESA, a layer of impacted fill material was identified in the southwest portion of subject site. This layer was observed to be approximately 0.85 m thick. Based on the observations made during the site visit and during the field program, it is expected that the fill material is impacted with metals. Any

impacted fill material can be removed from the subject site as part of redevelopment activities. It is recommended that the excavation of soil be monitored and confirmed by Paterson. Impacted material will require disposal at a licensed waste disposal facility. Following removal of impacted material, underlying native material will require testing to confirm compliance with site standards.

Non-impacted soil from the subject site must be managed in accordance with Ontario Regulation 406/19 (On-Site and Excess Soil Management). It is recommended that excess soil planning occurs prior to site redevelopment.

Groundwater

It is recommended that the monitoring wells installed on the subject site remain viable for future monitoring. Prior to site redevelopment, the monitoring wells must be decommissioned in accordance with O.Reg 903.

1.0 INTRODUCTION

At the request of TCU Development Corporation Paterson Group (Paterson) conducted a Phase II Environmental Site Assessment at 1137 Ogilvie Road and 1111 Cummings 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 in April of 2021.

1.1 Site Description

Address:	1137 Ogilvie Road and 1111 Cummings Avenue, Ottawa, Ontario.
Location:	The Phase II Property is located at the northeast corner of Ogilvie Road and Cummings Avenue, in the City of Ottawa, Ontario. The Phase I Property is shown on Figure 1 - Key Plan following the body of this report.
Latitude and Longitude:	45° 25' 36.4" N, 75° 37' 53.3" W.

Site Description:

Configuration:	Irregular
Site Area:	0.46 ha (approximate).
Zoning:	LC6 – Local Commercial Zone

1.2 Property Ownership

Paterson was engaged to conduct this Phase II-ESA by Mr. Dylan Desjardins of TCU Development Corporation. The head office of TCU Development Corporation is located at 150 Isabella Street, Ottawa, Ontario. Mr. Desjardins can be reached by telephone at (613) 725-4722.

1.3 Current and Proposed Future Uses

The Phase II Property is currently used for commercial purposes (grocery store and restaurant). It is our understanding that the Phase II Property will be redeveloped with a multi-storey residential building with underground parking covering the majority of the site. The proposed building will be surrounded by paved walkways and landscaped areas.

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 Ontario Ministry of 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 site conditions
- ❒ Non-potable groundwater conditions
- ❒ Residential land use

Section 35 of O.Reg. 153/04 does apply to the Phase II Property in that the property relies upon municipal drinking water.

Section 41 of O.Reg. 153/04 does not apply to the Phase II Property, as the property is not within 30m of an environmentally sensitive area.

Section 43.1 of the Regulation does apply as bedrock is located less than 2 m below ground surface for more than 1/3 of the area of the Phase II Property.

The intended use of the Phase II Property is residential; therefore, the Residential Standards have been selected for the purpose of this Phase II ESA.

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The Phase II Property is located at the northeast corner of Ogilvie Road and Cummings Avenue, in the City of Ottawa, Ontario. The Phase II Property is situated in a general mixed-use zone consisting of residential, commercial and parkland.

The south portion of the Phase II Property is occupied by a commercial plaza comprised of a restaurant and grocery store, with the remainder used as a parking lot. Site drainage consists of infiltration and sheet flow to catch basins located in the parking lots and adjacent roadways.

The site topography is above the grade of Ogilvie Road and Cummings Avenue with a downward slope towards both. The regional topography slopes down in a westerly direction toward the Rideau River.

2.2 Past Investigations

Paterson completed a Phase I ESA in April of 2021 for the Phase II Property. Based on the findings of the Phase I ESA, eight Potentially Contaminating Activities (PCAs) were identified in the Phase I study area. Several PCAs have resulted in the following APECs:

- APEC 1: Fill material of unknown quality;
- APEC 2: Existing retail fuel outlet;
- APEC 3: Existing retail fuel outlet;
- APEC 4: Former retail fuel outlet;
- APEC 5: Former retail fuel outlet;
- APEC 6: Application of road salt on the Phase II Property.

The APECs were identified based on fire insurance plans, aerial photographs, field observations, and personal interviews. 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 April 19, 2021. The field program consisted of drilling five boreholes, to address the APECs identified on the Phase II Property. Three (3) of the boreholes (BH1-21 through BH3-21) were instrumented with groundwater monitoring wells. Boreholes were drilled to a maximum depth of 6.83 m below the ground surface (mbgs).

3.2 Media Investigated

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

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

- Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX);
- Petroleum Hydrocarbons, fractions 1 - 4 (PHCs F_1-F_4);

- ❒ Metals (including Mercury and Hexavalent Chromium);

3.3 Phase I Conceptual Site Model

Based on information from the Geological Survey of Canada, the Phase I Property is located in an area of shale of the Billings Formation, with an overburden tanging from 0 to 10 m in thickness and consisting of till. Groundwater is anticipated to flow in a westerly direction towards the Rideau River.

Existing Building and Subsurface Structures

The south portion of the Phase I Property is occupied by a single-storey, with one basement level, commercial plaza comprised of a restaurant and grocery store. Constructed circa 1976, the commercial plaza is constructed with a concrete block foundation and is finished on the exterior with brick, in addition to a flat tar and gravel roof with sloped metal siding around the perimeter of the roof. The building is heated and cooled via natural gas-fired roof top units.

Subsurface Structures and Utilities

The Phase I Property is situated in a municipally serviced area. Underground utility services on the property include natural gas, water, hydro electric power and sewer services. Water and sewer services enter the Phase II Property from Ogilvie Road.

Areas of Natural Significance and Water Bodies

A search for areas of natural significance and features within the Phase I-ESA study area was conducted on the Ontario Ministry of Natural Resources (MNR) website and the search did not reveal any areas of natural significance within the Phase I-ESA study area.

Drinking Water Wells

No potable water wells were identified on the Phase I Property.

Neighbouring Land Use

Neighbouring land use in the Phase I-ESA study area consists of primarily residential with some commercial and parkland. Multiple potentially contaminating activities were identified within the Phase I-ESA study area. These activities consist of two existing retail fuel outlets and a dry cleaner. Based on the separation distance from the Phase I Property (230 m southwest), the existing dry cleaner is a potentially contaminating activity that does not represent an area

of potential concern on the Phase I Property. Based on their close proximity to the Phase I Property, the existing retail fuel outlets represent areas of potential concern on the Phase I Property.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

PCAs that represented APECs on the Phase I Property as well as the Contaminants of Potential Concern (CPCs) are presented in Table 1.

Table 1 - Areas of Potential Environmental Concern

Area of potential environmental concern	Location of area of potential environmental concern on phase one property	Potentially contaminating activity	Location of PCA (on-site or off-site)	Contaminants of potential concern	Media potentially Impacted (Ground water, soil and/or sediment)
Fill Material of Unknown Quality APEC 1	Northwest corner of Phase I Property	Item 30 - Importation of Fill Material of Unknown Quality	On-Site	PHCs, BTEX, Metals	Soil
Existing Retail Fuel Outlet APEC 2	Western portion of Phase I Property	Item 28 – Gasoline and Associated Products Storage in Fixed Tanks	Off-site	PHCs, BTEX	Groundwater
Existing Retail Fuel Outlet APEC 3	Southern portion of Phase I Property	Item 28 – Gasoline and Associated Products Storage in Fixed Tanks	Off-site	PHCs, BTEX	Groundwater
Former Retail Fuel Outlet APEC 4	Southern portion of Phase I Property	Item 28 – Gasoline and Associated Products Storage in Fixed Tanks	Off-site	PHCs, BTEX	Groundwater
Former Retail Fuel Outlet APEC 5	Eastern portion of Phase I Property	Item 28 – Gasoline and Associated Products Storage in Fixed Tanks	Off-site	PHCs, BTEX	Soil, Groundwater
Application of road salt for the safety of vehicular or pedestrian traffic under conditions of snow or ice APEC 6[1]	Within parking areas of the RSC property	Other: Application of road salt for the safety of vehicular or pedestrian traffic under conditions of snow or ice	On-site	Electrical Conductivity (EC) Sodium Adsorption Ratio (SAR)	Soil

1 – In accordance with Section 49.1 of O.Reg. 153/04 standards are deemed to be met if an applicable site condition standard is exceeded at a property solely because the qualified person has determined that a substance has been applied to surfaces for the safety of vehicular or pedestrian traffic under conditions of snow or ice or both. The exemption outlined in Section 49.1 is being relied up with respect to the RSC property.

Other off-site PCAs were identified within the Phase I study area but were deemed not to be of concern based on their separation distances and/or their down/cross-gradient orientations with respect to the Phase II Property.

Contaminants of Potential Concern

Based on the past uses of the Phase I Property and the surrounding potentially contaminating activities, the following Contaminants of Potential Concern (CPCs) have been identified:

- Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX);
- Petroleum Hydrocarbons, fractions 1 - 4 (PHCs F_1-F_4);
- Metals (including Mercury and Hexavalent Chromium).

Assessment of Uncertainty and/or Absence of Information

The information available for review as part of the preparation of this Phase II ESA is considered to be sufficient to conclude that there are potentially contaminating activities that have resulted in areas of potential environmental concern (APECs) on the Phase II Property.

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

No physical impediments, aside from the utilities, were encountered during the Phase II ESA program.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation conducted for this Phase II ESA consisted of drilling five boreholes (BH1-21 through BH5-21) across the Phase II property. The boreholes were drilled to a maximum depth of 6.83 m below ground surface (mbgs) to intercept groundwater.

The boreholes were drilled using a low clearance drill rig operated by George Downing Estate Drilling of Hawkesbury, Ontario, under full-time supervision of Paterson personnel. The borehole locations are indicated on the attached Drawing PE5231-3 - Test Hole Location Plan.

4.2 Soil Sampling

A total of 17 soil samples were obtained from the boreholes by means of grab sampling from auger flights/auger samples and split spoon sampling. Split spoon samples were taken at approximate 0.76 m intervals.

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

The borehole profiles generally consist of a thin layer of asphaltic concrete, followed by fill material consisting of silty sand with crushed stone, underlain by a fill layer consisting of silty clay or sand with gravel, followed by shale bedrock.

4.3 Field Screening Measurements

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

To measure the soil vapours, the analyser probe is inserted into the nominal headspace above the soil sample. A photo ionization detector (PID) was used to measure the volatile organic vapour concentrations. The sample is agitated/manipulated gently as the measurement is taken. The peak reading registered within the first 15 seconds is recorded as the vapour measurement.

The PID readings were found to be less than 1.2 ppm in the soil samples obtained. These results do not indicate the potential for significant contamination from volatile contaminants. Vapour readings are noted on the Soil Profile and Test Data Sheets in Appendix 1.

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

4.4 Groundwater Monitoring Well Installation

Three (3) groundwater monitoring wells were installed on the Phase II Property as part of the subsurface investigation. The monitoring wells consisted of 32 mm diameter, Schedule 40 threaded PVC risers and screens. Monitoring well construction details are listed in Table 2 and are also presented on the Soil Profile and Test Data Sheets provided in Appendix 1.

Borehole locations and elevations were surveyed geodetically by Paterson personnel.

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
BH1-21	72.33	6.83	3.78-6.83	3.66-6.83	0.15-3.66	Flushmount
BH2-21	71.97	6.17	3.12-6.17	3.12-6.17	0.15-3.12	Flushmount
BH3-21	71.78	5.87	2.82-5.87	2.21-5.87	0.15-2.82	Flushmount

4.5 Field Measurement of Water Quality Parameters

Groundwater samples were collected on April 26, 2021. Water quality parameters were measured in the field using a multi-parameter analyzer. Parameters measured in the field included temperature, pH, and electrical conductivity.

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

Table 3 - Field Measurement of Water Quality Parameters – April 26, 2021

Parameter	BH1	BH2	BH3
Temperature (°C)	10.2	10.1	10.0
pH	7.96	7.93	8.12
Electrical Conductivity (µS/cm)	1,273	1,224	1,301

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 and groundwater samples, as well as analyzed parameters are presented in Tables 4 and 5.

Table 4 - Testing Parameters for Submitted Soil Samples

Sample ID	Sample Depth & Stratigraphic Unit	Parameters Analyzed			Rationale
		BTEX	PHCs F_1-F_4	Metals	
April 19, 2021					
BH1-SS2	0.76 - 1.37 m Brown Silty Clay(Fill Material)			X[1]	Assess potential poor quality fill material.
BH1-SS4	0.33 m – 0.53 m Brown Silty Sand (Fill Material)	X	X		Assess potential soil impact resulting from a historical off-site RFO.
BH2-SS2	0.76 - 1.37 m Brown Silty Clay (Fill Material)			X[1]	Assess potential poor quality fill material and potential impacts resulting from an off-site RFO.
BH3-SS2	0.76 - 1.37 m Dark Grey to Brown Silty Sand with Clay (Fill Material)	X	X	X[1]	Assess potential poor quality fill material and potential impacts resulting from an off-site RFO.
BH4-SS2	0.76 - 1.37 m Brown Silty Clay (Fill Material)			X[1]	Assess potential poor quality fill material.
BH5-SS2	0.76 - 1.37 m Brown Silty Sand with Clay (Fill Material)			X[1]	Assess potential poor quality fill material.
DUP	0.76 - 1.37 m Brown Silty Clay (Fill Material)			X	Duplicate sample (BH2-SS2) for QA/QC purposes

❒ 1 – including Hg and Cr_{VI}

TABLE 5 - Testing Parameters for Submitted Groundwater Samples

Sample ID	Screened Interval	Parameters Analyzed			Rationale
		BTEX	PHCs (F1-F4)	Metals[1]	
April 26, 2021					
BH1-GW1	3.78-6.83	X	X	X	Assess potential groundwater impacts resulting from a historical off-site retail fuel outlet.
BH2-GW1	3.12-6.17	X	X	X	Assess potential groundwater impacts resulting from a historical off-site retail fuel outlet.
BH3-GW1	2.82-5.87	X	X	X	Assess potential groundwater impacts resulting from an existing off-site retail fuel outlet.

❒ 1 – including Hg and Cr_{VI}

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

4.8 Residue Management

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

4.9 Elevation Surveying

The ground surface elevations at each borehole location were surveyed using a GPS survey device by Paterson personnel and referenced to a geodetic datum.

4.10 Quality Assurance and Quality Control Measures

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

5.0 REVIEW AND EVALUATION

5.1 Geology

Site soils consist of a thin layer of asphaltic concrete, followed by fill material consisting of silty sand with crushed stone, underlain by fill later consisted of silty clay or sand with some gravel, followed by shale bedrock. The boreholes were terminated at depths ranging from 1.73 to 6.83 m below ground surface.

Groundwater was encountered within the bedrock at depths ranging from approximately 1.78 to 2.44 m below ground surface.

Site geology details are provided in the Soil Profile and Test Data Sheets provided in Appendix 1.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured during the groundwater sampling event on April 26, 2021 using an electronic water level meter. Groundwater levels are summarized in Table 6.

TABLE 6 - Groundwater Level Measurements

Borehole Location	Ground Surface Elevation (m)	Water Level Depth (m below grade)	Water Level Elevation (m ASL)	Date of Measurement
BH1-21	72.33	2.80	69.53	April 26, 2021
BH2-21	71.97	3.06	68.91	April 26, 2021
BH3-21	71.78	3.15	68.63	April 26, 2021

Based on the groundwater elevations measured during the sampling events, groundwater contour mapping was completed. Groundwater contours are shown on Drawing PE5231-3. Based on the contour mapping, groundwater flow at the Phase II Property is in a westerly direction. A horizontal hydraulic gradient of approximately 0.15 m/m was calculated.

Groundwater levels are expected to fluctuate throughout the year with seasonal variations.

5.3 Fine-Coarse Soil Texture

Grain size analysis was not completed as part of this investigation. Coarse grained soil standards were chosen based on field observations and the recovered soil samples.

5.4 Soil: Field Screening

Field screening of the soil samples collected during drilling resulted in vapour readings ranging from 0 to 1.2 ppm. No obvious visual or olfactory indications of potential environmental concerns were identified in the soil samples. The field screening results of each individual soil sample are provided on the Soil Profile and Test Data Sheets appended to this report.

5.5 Soil Quality

Seven soil samples (including one duplicate) were submitted for BTEX, PHCs and/or metals analysis. The results of the analytical testing are presented in Tables 7 to 9. The laboratory certificate of analysis is provided in Appendix 1.

TABLE 7 - Analytical Test Results – Soil
BTEX

Parameter	MDL (µg/g)	Soil Samples (µg/g) April 19, 2021		MECP Table 7 Residential Standards (µg/g)
		BH1-SS4	BH3-SS2	
Benzene	0.02	nd	nd	0.21
Toluene	0.05	nd	nd	2
Ethylbenzene	0.05	nd	nd	2.3
Xylenes	0.05	nd	nd	3.1

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

No BTEX parameters were detected in the soil samples analyzed. The results are in compliance with the selected MECP Table 7 standards.

TABLE 8 - Analytical Test Results – Soil
PHCs F_1-F_4

Parameter	MDL (µg/g)	Soil Samples (µg/g) April 19, 2021		MECP Table 7 Residential Standards (µg/g)
		BH1-SS4	BH3-SS2	
PHC F_1	0.02	nd	nd	55
PHC F_2	0.05	nd	nd	98
PHC F_3	0.05	nd	26	300
PHC F_4	0.05	nd	48	2,800

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

All detected PHC concentrations in the soil samples analysed are in compliance with the selected MECP Table 7 standards.

TABLE 9 - Analytical Test Results – Soil
Metals

Parameter	MDL (µg/g)	Soil Samples (µg/g) April 19, 2021						MECP Table 7 Residential Standards (µg/g)
		BH1-SS2	BH2-SS2	Dup 1 (BH2-SS2)	BH3-SS2	BH4-SS2	BH5-SS2	
Antimony	1.0	nd	nd	nd	nd	nd	nd	7.5
Arsenic	1.0	6.5	6.8	6.7	7.1	8.1	9.7	18
Barium	1.0	104	93.3	82.2	94.5	160	115	390
Beryllium	0.5	0.6	0.6	nd	0.6	0.6	0.8	4
Boron	5.0	9.0	6.4	5.4	6.8	8.0	10.0	120
Cadmium	0.5	nd	nd	nd	nd	0.7	nd	1.2
Chromium	5.0	20.8	26.2	23.0	25.5	28.9	28.2	160
Chromium (VI)	0.2	nd	nd	NA	nd	nd	nd	8
Cobalt	1.0	13.6	11.3	10.2	9.6	16.0	18.8	22
Copper	5.0	31.8	27.3	24.7	24.9	39.2	45.6	140
Lead	1.0	11.5	23.2	19.4	19.1	52.9	16.6	120
Mercury	0.1	nd	**0.5**	NA	0.2	0.1	nd	0.27
Molybdenum	1.0	4.3	3.5	3.5	2.4	4.6	3.2	6.9
Nickel	5.0	47.5	37.7	34.7	28.4	53.6	50.4	100
Selenium	1.0	nd	nd	nd	nd	nd	nd	2.4
Silver	0.3	nd	nd	nd	nd	nd	nd	20
Thallium	1.0	nd	nd	nd	nd	nd	nd	1
Uranium	1.0	1.3	1.3	1.2	1.3	1.5	1.1	23
Vanadium	10.0	30.1	33.8	29.7	34.4	35.5	37.0	86
Zinc	20.0	43.3	79.9	65.7	58.7	123	55.0	340

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- NA – Not Analyzed
- **Bold and underlined –** Results exceed selected MECP standard

Mercury concentrations in sample BH2-SS2 exceed the MECP Table 7 standards. The remaining metal parameters identified in each of the soil samples analysed comply with the MECP Table 7 standards.

The maximum concentrations of analyzed parameters in the soil at the Phase II Property are summarized in Table 10.

TABLE 10 - Maximum Concentrations – Soil

Parameter	Maximum Concentration (µg/g)	Sample ID	Depth Interval (m BGS)
PHC F_3	26	BH3-SS2	0.76 - 1.37 m; Fill
PHC F_4	48	BH3-SS2	0.76 - 1.37 m; Fill
Arsenic	9.7	BH5-SS2	0.76 - 1.37 m; Fill
Barium	115	BH5-SS2	0.76 - 1.37 m; Fill
Beryllium	0.8	BH5-SS2	0.76 - 1.37 m; Fill
Boron	10.0	BH5-SS2	0.76 - 1.37 m; Fill
Cadmium	0.7	BH4-SS2	0.76 - 1.37 m; Fill

TABLE 10 - Maximum Concentrations – Soil			
Parameter	**Maximum Concentration (µg/g)**	**Sample ID**	**Depth Interval (m BGS)**
Chromium	28.2	BH5-SS2	0.76 - 1.37 m; Fill
Cobalt	18.8	BH5-SS2	0.76 - 1.37 m; Fill
Copper	45.6	BH5-SS2	0.76 - 1.37 m; Fill
Lead	52.9	BH4-SS2	0.76 - 1.37 m; Fill
Mercury	**0.5**	BH2-SS2	0.76 - 1.37 m; Fill
Molybdenum	4.6	BH4-SS2	0.76 - 1.37 m; Fill
Nickel	53.6	BH4-SS2	0.76 - 1.37 m; Fill
Uranium	1.5	BH4-SS2	0.76 - 1.37 m; Fill
Vanadium	37.0	BH5-SS2	0.76 - 1.37 m; Fill
Zinc	123	BH4-SS2	0.76 - 1.37 m; Fill

Remaining parameters were not detected above the laboratory method detection limits. The analytical results for BTEX, PHCs and Metals tested in soil are shown on Drawing PE5228-4 – Analytical Testing Plan – Soil.

5.6 Groundwater Quality

Groundwater samples from monitoring wells installed in BH1 through BH3 were submitted for laboratory analysis of BTEX, PHCs and metals. The groundwater samples were obtained from the screened intervals noted in Table 2.

The results of the analytical testing are presented in Tables 11 to 13. The laboratory certificate of analysis is provided in Appendix 1.

TABLE 11 - Analytical Test Results – Groundwater
BTEX

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)			MECP Table 7 Standards (µg/L)
		April 26, 2021			
		BH1-GW1	BH2-GW1	BH3-GW1	
Benzene	0.5	nd	nd	nd	0.5
Toluene	0.5	nd	nd	nd	320
Ethylbenzene	0.5	nd	nd	nd	54
Xylenes	0.5	nd	nd	nd	72

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

No detectable BTEX concentrations were identified in the groundwater samples analyzed. All groundwater samples are in compliance with the MECP Table 7 Standards.

TABLE 12 - Analytical Test Results – Groundwater
PHCs

Parameter	MDL (µg/L)	Groundwater Samples (µg/L) April 26, 2021			MECP Table 7 Standards (µg/L)
		BH1-GW1	BH2-GW1	BH3-GW1	
PHC F_1	25	nd	nd	nd	420
PHC F_2	100	nd	nd	nd	150
PHC F_3	100	nd	nd	nd	500
PHC F_4	100	nd	nd	nd	500

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

No detectable PHC concentrations were identified in the groundwater samples analyzed. All groundwater samples are in compliance with the MECP Table 7 Standards.

TABLE 13 - Analytical Test Results – Groundwater
Metals

Parameter	MDL (µg/g)	Soil Samples (µg/g) April 26, 2021			MECP Table 7 Residential Standards (µg/g)
		BH1-GW1	BH2-GW1	BH3-GW1	
Antimony	0.5	nd	nd	0.6	16,000
Arsenic	1	nd	nd	nd	1,500
Barium	1	110	147	68	23,000
Beryllium	0.5	nd	nd	nd	53
Boron	10	98	74	79	36,000
Cadmium	0.1	nd	nd	0.5	2.1
Chromium	1	nd	nd	nd	640
Chromium (VI)	10	nd	nd	nd	110
Cobalt	0.5	nd	1.2	0.7	52
Copper	0.5	1.2	nd	1.8	69
Lead	0.1	nd	0.3	nd	20
Mercury	0.1	nd	nd	nd	0.1
Molybdenum	0.5	4.0	8.5	8.7	7,300
Nickel	1	nd	6	22	390
Selenium	1	nd	nd	2	50
Silver	0.1	nd	nd	nd	1.2
Sodium	200	119,000	364,000	282,000	1,800,000
Thallium	0.1	nd	nd	nd	400
Uranium	0.1	7.1	11.0	33.4	330
Vanadium	0.5	nd	0.8	nd	200
Zinc	5	9	16	9	890

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

All detected metals concentrations in the groundwater samples analysed are in compliance with the selected MECP Table 7 standards.

Analytical results for BTEX, PHCs and Metals tested in sgroundwater are shown on Drawing PE5228-5 – Analytical Testing Plan – Groundwater.

5.7 Quality Assurance and Quality Control Results

All samples submitted as part of the April 2021 sampling events were handled in accordance with the Analytical Protocol with respect to preservation method, storage requirement, and container type. As per Subsection 47(3) of O.Reg. 153/04, as amended, under the Environmental Protection Act, 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 soil sample (Dup 1) from BH2-SS2 was submitted for metals analysis. The duplicate was collected with the intent of calculating the relative percent difference (RPD) between duplicate sample values, as a way of assessing the quality of the analytical test results. Several of the test parameter results were below the laboratory detection limits, the RPD values are therefore considered to be 0% and therefore meet the 20% target.

The RPD calculations for the original soil and duplicate sample are provided in Table 14.

Table 14 - QA/QC Calculations – Soil

Parameter	MDL (µg/L)	BH1-21-SS5	DUP (BH1-21-SS5)	RPD (%)	QA/QC Result
Arsenic	1.0	6.8	6.7	1.48	Meets target
Barium	1.0	93.3	82.2	12.6	Meets target
Boron	5.0	6.4	5.4	16.9	Meets target
Chromium	5.0	26.2	23.0	13.0	Meets target
Cobalt	1.0	11.3	10.2	10.2	Meets target
Copper	5.0	27.3	24.7	10.0	Meets target
Lead	1.0	23.2	19.4	17.8	Meets target
Molybdenum	1.0	3.5	3.5	0	Meets target
Nickel	5.0	37.7	34.7	8.3	Meets target
Uranium	1.0	1.3	1.2	8	Meets target
Vanadium	10.0	33.8	29.7	12.9	Meets target
Zinc	20.0	79.9	65.7	19.5	Meets target

Notes:
- MDL – Method Detection Limit

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

5.8 Phase II Conceptual Site Model

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

Site Description

Potentially Contaminating Activity and Areas of Potential Environmental Concern

Based on the findings of the Phase I ESA, eight Potentially Contaminating Activities (PCAs) were identified in the Phase I study area. Several PCAs have resulted in the following APECs:

- ❒ APEC 1: Fill material of unknown quality;
- ❒ APEC 2: Existing retail fuel outlet;
- ❒ APEC 3: Existing retail fuel outlet;
- ❒ APEC 4: Former retail fuel outlet;
- ❒ APEC 5: Former retail fuel outlet;
- ❒ APEC 6: Application of road salt on the Phase II Property.

Contaminants of Potential Concern

The following CPCs have been identified with respect to the Phase II Property:

- ❒ Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX);
- ❒ Petroleum Hydrocarbons, fractions 1 - 4 (PHCs F_1-F_4);
- ❒ Metals (including Mercury and Hexavalent Chromium).

Subsurface Structures and Utilities

Utilities on the Phase II Property included sanitary and storm sewer lines, municipal water service, natural gas and telecommunications connections. Based on standard practice for subsurface utility installation, service trenches are expected to be present approximately 1 to 2m below grade.

Physical Setting

Site Stratigraphy

The stratigraphy of the Phase II Property generally consists of:

- Asphaltic concrete; encountered at ground surface and extending to a depth of approximately 0.05 to 0.13 m below ground surface;
- Fill material, consisting of brown silty sand with crushed stone encountered at depths ranging from approximately 0.05 to 0.69 m below ground surface;
- Fill material, consisting of brown silty clay with sand, gravel and trace topsoil; encountered in BH1, BH2 and BH4 at depths ranging from approximately 0.60 to 2.29 m below ground surface;
- Fill material, consisting of dark grey to brown silty sand with clay (and trace wood in BH5); encountered in BH3 and BH5 at depths ranging from approximately 0.46 to 2.08 m below ground surface;
- Fill material, consisting of brown silty sand with gravel and crushed stoned; encountered in BH1, BH2 and BH3 at depths ranging from 1.45 to 3.04 m below ground surface;
- Shale bedrock, encountered at depths ranging from approximately 1.78 to 3.05 m below ground surface.

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

Hydrogeological Characteristics

Groundwater at the Phase II Property was encountered in the fill material and bedrock. During the most recent groundwater monitoring event, groundwater flow was measured in a westerly direction, with a hydraulic gradient of 0.15 m/m. Groundwater contours are shown on Drawing PE5231-3 – Test Hole Location Plan and Groundwater Contour Plan.

Approximate Depth to Bedrock

Bedrock was encountered within all five of the boreholes at depths ranging from approximately 1.73 to 3.05 m below ground surface, as determined by practical refusal of augering and rock coring activities conducted at the time of the drilling program.

Approximate Depth to Water Table

The depth to the water table at the subject site varies between approximately 2.80 to 3.16 m below existing grade.

Sections 41 and 43.1 of the Regulation

Section 41 of the Regulation does not apply to the Phase II Property, in that the subject property is not within 30m of an environmentally sensitive area, and the pH of surface soil is between 5 and 9, while the pH of subsurface soil is between 5 and 11.

Section 43.1 of the Regulation does apply as bedrock is located less than 2 m below ground surface for more than 1/3 of the area of the Phase II Property.

Fill Placement

Fill material, consisting of brown silty sand and/or clay with gravel and crushed stone was identified throughout the Phase II Property.

Existing Buildings and Structures

The south portion of the Phase II Property is occupied by a single-storey, with one basement level, commercial plaza comprised of a restaurant and grocery store. Constructed circa 1976, the commercial plaza is constructed with a concrete block foundation and is finished on the exterior with brick, in addition to a flat tar and gravel roof with sloped metal siding around the perimeter of the roof. The building is heated and cooled via natural gas-fired roof top units.

Proposed Buildings and Other Structures

It is our understanding that the Phase II Property will be redeveloped with a multi-storey residential building with underground parking covering the majority of the site. The proposed building will be surrounded by paved walkways and landscaped areas.

Areas of Natural Scientific Interest and Water Bodies

There are no areas of natural and scientific interest or waterbodies on the Phase II Property or within the 250 m study area.

Environmental Condition

Areas Where Contaminants are Present

Based on the findings of the Phase II ESA, groundwater results are in compliance with the MECP Table 7 standards. However, soil results identified Mercury exceeding the applicable MECP Standards in the southwest portion of the Phase II Property.

Analytical test results are presented on Drawing PE5231-4 – Analytical Testing Plan – Soil and Drawing PE5231-5 – Analytical Testing Plan - Groundwater.

Types of Contaminants

Based on the findings of the Phase II ESA, the contaminants of concern at the subject site are considered to be Mercury in soil.

Contaminated Media

Based on the findings of the Phase II ESA, the concentration of Mercury at BH2 exceeds MECP Table 7 standards for soil. All groundwater samples were in compliance with MECP Table 7 Standards.

What Is Known About Areas Where Contaminants Are Present

The impacted soil identified in BH2 is interpreted to have originated off-site from the importation of fill material of poor quality. The area in which the impact was identified in the borehole has historically been used as parking.

Distribution and Migration of Contaminants

No contaminants exceeding MECP Table 7 standards were identified in the groundwater beneath the Phase II Property. A layer of impacted fill material was identified in the southwest portion of subject site. This layer was observed to be approximately 0.85 m thick. Based on the observations made during the field program, in conjunction with analytical test results, it is expected that a limited amount of the fill material is impacted with metals.

Discharge of Contaminants

The metals impacted fill material identified in the southwestern portion of the Phase II Property, is considered to be the result of the importation of fill material of a poor quality.

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. Based on the results of the Phase II ESA, downward leaching does not appear to have significantly affected contaminant distribution at the Phase II Property. Site groundwater was in compliance with MECP standards, so the fluctuation of the groundwater table was considered to have a limited effect on the distribution of contaminants at the Phase II Property.

Potential for Vapour Intrusion

Given the non-volatile nature of the impacts identified in the soil and the location of the soil impacts, the potential for vapour intrusion into the current site building is negligible. It is our understanding that any contamination on the site will be remediated prior to site redevelopment. As such, the potential for vapour intrusion at the subject site is considered to be limited.

6.0 CONCLUSIONS

Assessment

A Phase II ESA was conducted for the properties addressed 1137 Ogilvie Road and 1111 Cummings Avenue, in the 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 five boreholes, three of which were constructed with groundwater monitoring wells. The general soil profile encountered during the field program consisted of a thin layer of asphaltic concrete, followed by fill material consisting of silty sand with crushed stone, underlain by a fill layer consisting of silty clay or sand with gravel, followed by shale bedrock. No signs of staining or odour were identified at the time of the field program.

Seven soil samples were submitted for laboratory analysis of Benzene, Toluene, Ethylbenzene and Xylenes (BTEX), Petroleum Hydrocarbons (PHCs, Fractions F_1-F_4), and Metals. BTEX parameter concentrations were not detected above the laboratory detection limit, while PHC and metals parameter concentrations were identified in the soil samples analyzed. Based on the analytical test results, a metal (mercury) concentration was identified in soil sample BH2-SS2 in exceedance of the MECP Table 7 Standards. All remaining parameter concentrations analyzed in the soil samples are in compliance with the selected MECP Table 7 Standards.

Groundwater samples from monitoring wells BH1, BH2 and BH3 were collected during the April 26, 2021 sampling event. No sheen, free product or odour was noted during the groundwater sampling event. The recovered groundwater samples were analysed for BTEX, PHC (F1-F4) and metals parameters. BTEX and PHC parameter concentrations were not detected above the laboratory detection limit, while metals parameter concentrations were identified in the groundwater samples analyzed. All parameter concentrations analyzed in the groundwater samples are in compliance with the selected MECP Table 7 Standards.

Recommendations

Soil

Any impacted fill material can be removed from the subject site as part of redevelopment activities. The presence of the impacted fill material is not considered to have an impact on the current operations of the site. It is recommended that the excavation of soil be monitored and confirmed by Paterson. Impacted material will require disposal at a licensed waste disposal facility. Following removal of impacted material, underlying native material will require testing to confirm compliance with site standards.

Non-impacted soil from the subject site must be managed in accordance with Ontario Regulation 406/19 (On-Site and Excess Soil Management). It is recommended that excess soil planning occurs in conjunction with site redevelopment. Additional information regarding the excess soil requirements for this property can be provided, if required.

Groundwater

It is recommended that the monitoring wells installed on the subject site remain viable for future monitoring. Prior to site redevelopment, the monitoring wells must be decommissioned in accordance with O.Reg 903.

7.0 STATEMENT OF LIMITATIONS

This Phase II - Environmental Site Assessment report has been prepared under the supervision of a Qualified Person, 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 TCU Development Corporation. Notification from TCU Development Corporation and Paterson Group will be required to release this report to any other party.

Paterson Group Inc.

Jeremy Camposarcone, B. Eng.

Michael Beaudoin, P. Eng. QP_{ESA}

Report Distribution:

- TCU Development Corporation
- Paterson Group

FIGURES

FIGURE 1 – KEY PLAN

DRAWING 5231-3 – TEST HOLE LOCATION PLAN & GROUNDWATER CONTOUR

DRAWING 5231-4 – ANALYTICAL TESTING PLAN - SOIL

DRAWING 5231-4A – CROSS SECTION A – A' - SOIL

DRAWING 5231-5 – ANALYTICAL TESTING PLAN - GROUNDWATER

DRAWING 5231-5A – CROSS SECTION A – A' - GROUNDWATER

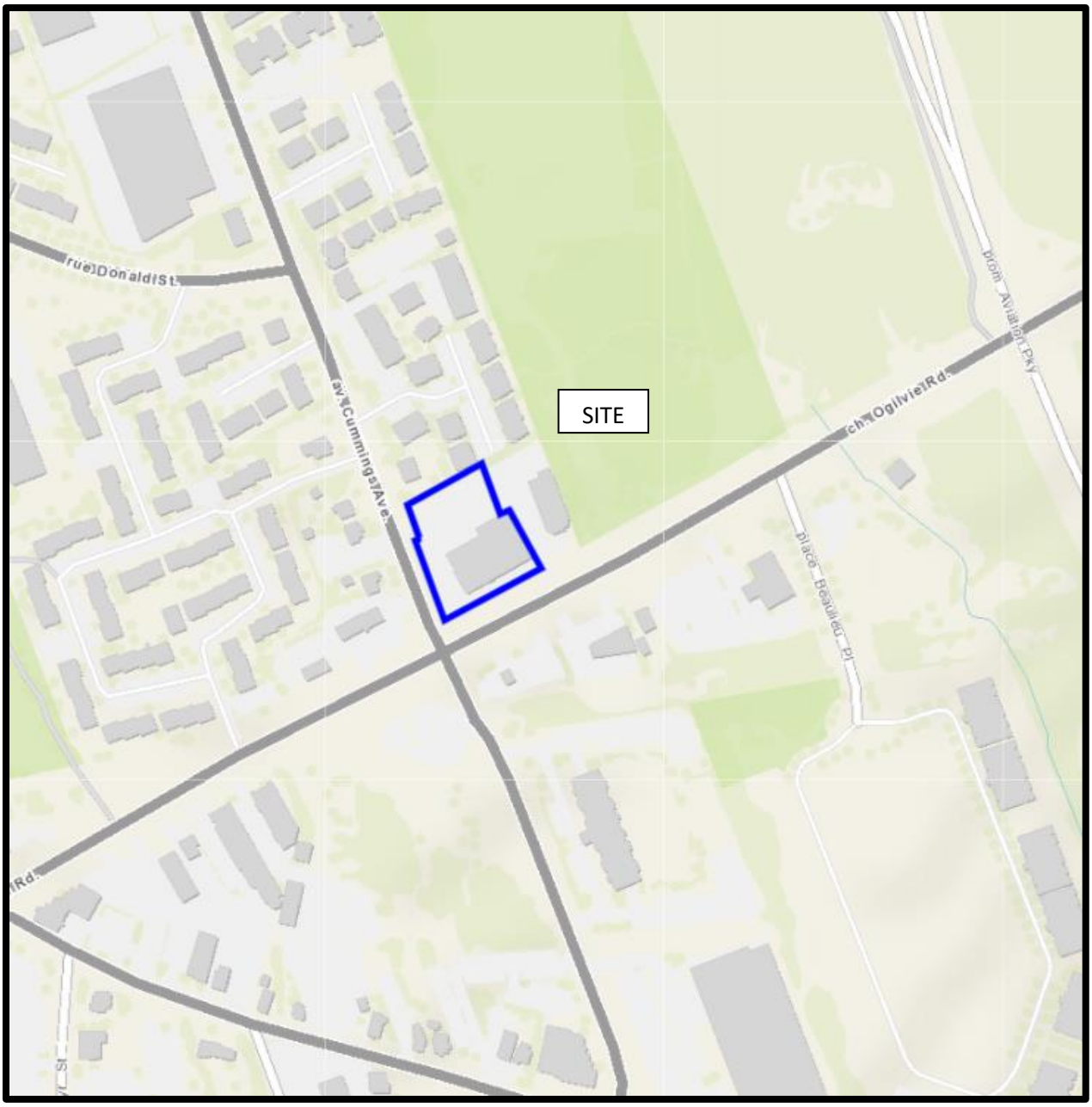
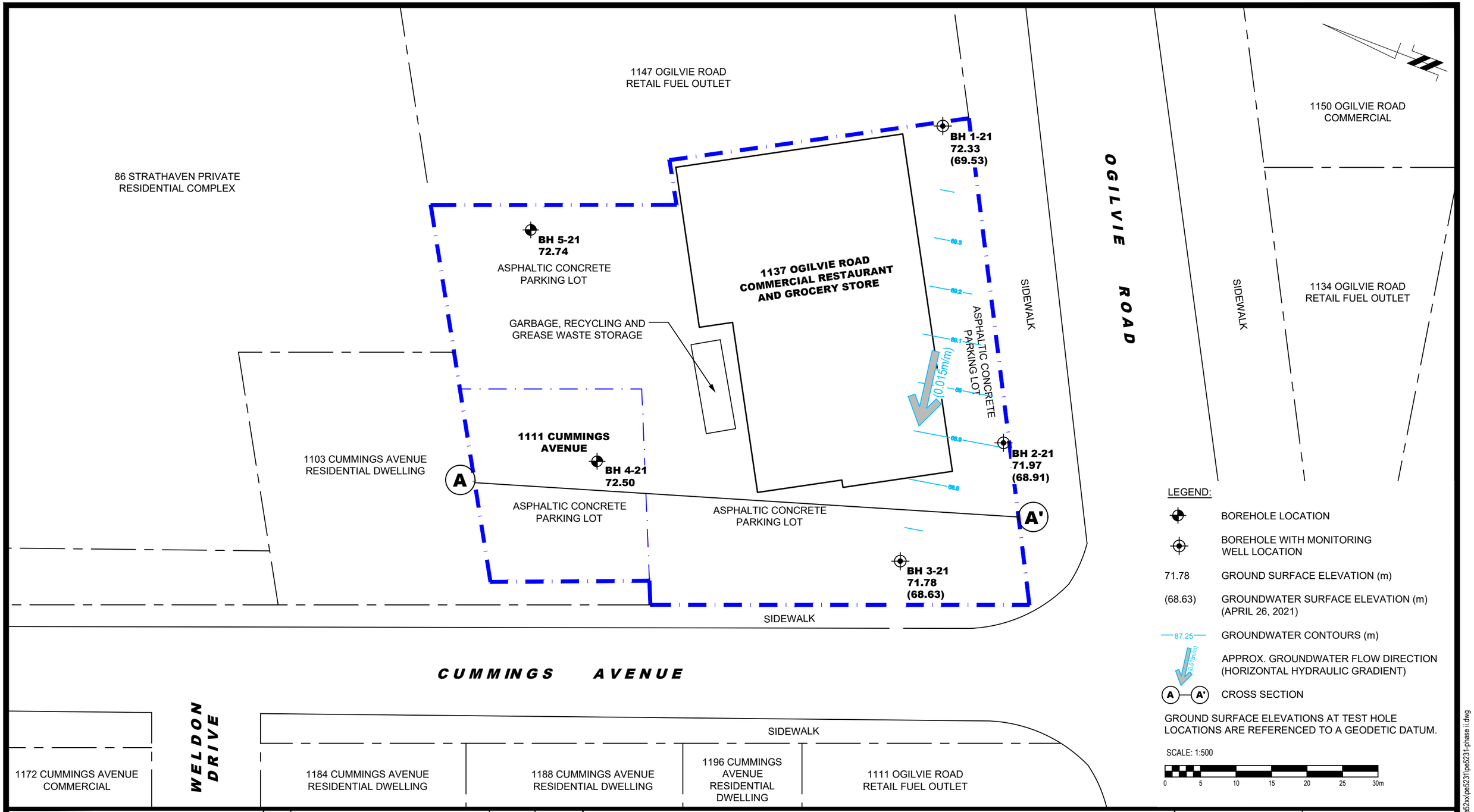


FIGURE 1

KEY PLAN`



LEGEND:

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- 71.78 GROUND SURFACE ELEVATION (m)
- (68.63) GROUNDWATER SURFACE ELEVATION (m) (APRIL 26, 2021)
- 87.25 GROUNDWATER CONTOURS (m)
- APPROX. GROUNDWATER FLOW DIRECTION (HORIZONTAL HYDRAULIC GRADIENT)
- A — A' CROSS SECTION

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

SCALE: 1:500

0 5 10 15 20 25 30m

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL

TCU DEVELOPMENT CORP.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1137 OGILVIE ROAD AND 1111 CUMMINGS AVENUE

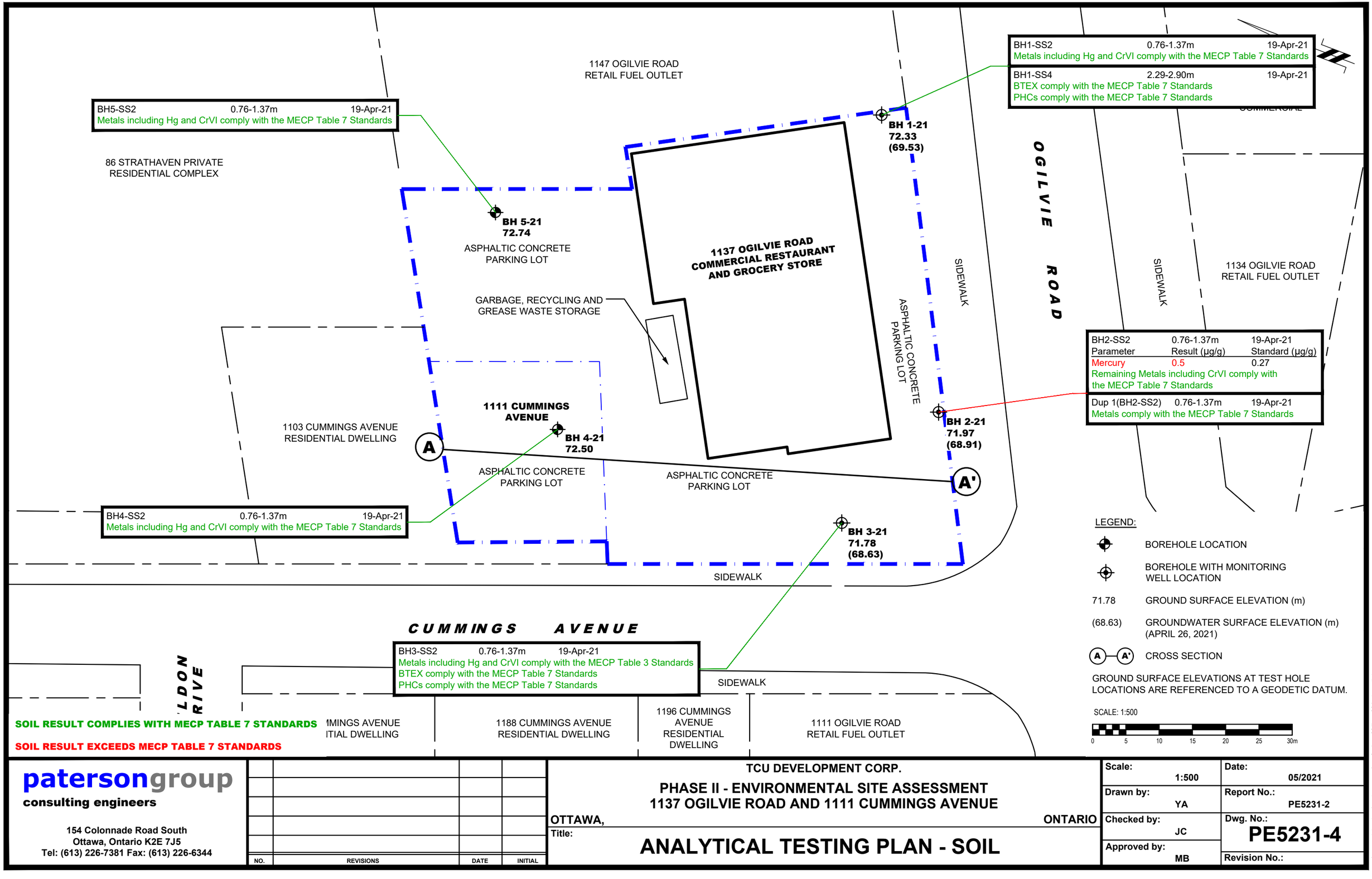
OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:500	Date: 05/2021
Drawn by: YA	Report No.: PE5231-2
Checked by: JC	Dwg. No.: PE5231-3
Approved by: MB	Revision No.:

p:\autocad drawings\environmental\pe52xx\pe5231\pe5231-phase ii.dwg



patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL

TCU DEVELOPMENT CORP.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1137 OGILVIE ROAD AND 1111 CUMMINGS AVENUE

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL

Scale: 1:500	Date: 05/2021
Drawn by: YA	Report No.: PE5231-2
Checked by: JC	Dwg. No.: PE5231-4
Approved by: MB	Revision No.:

p:\autocad drawings\environmental\pe52xx\pe5231\pe5231-phase ii.dwg

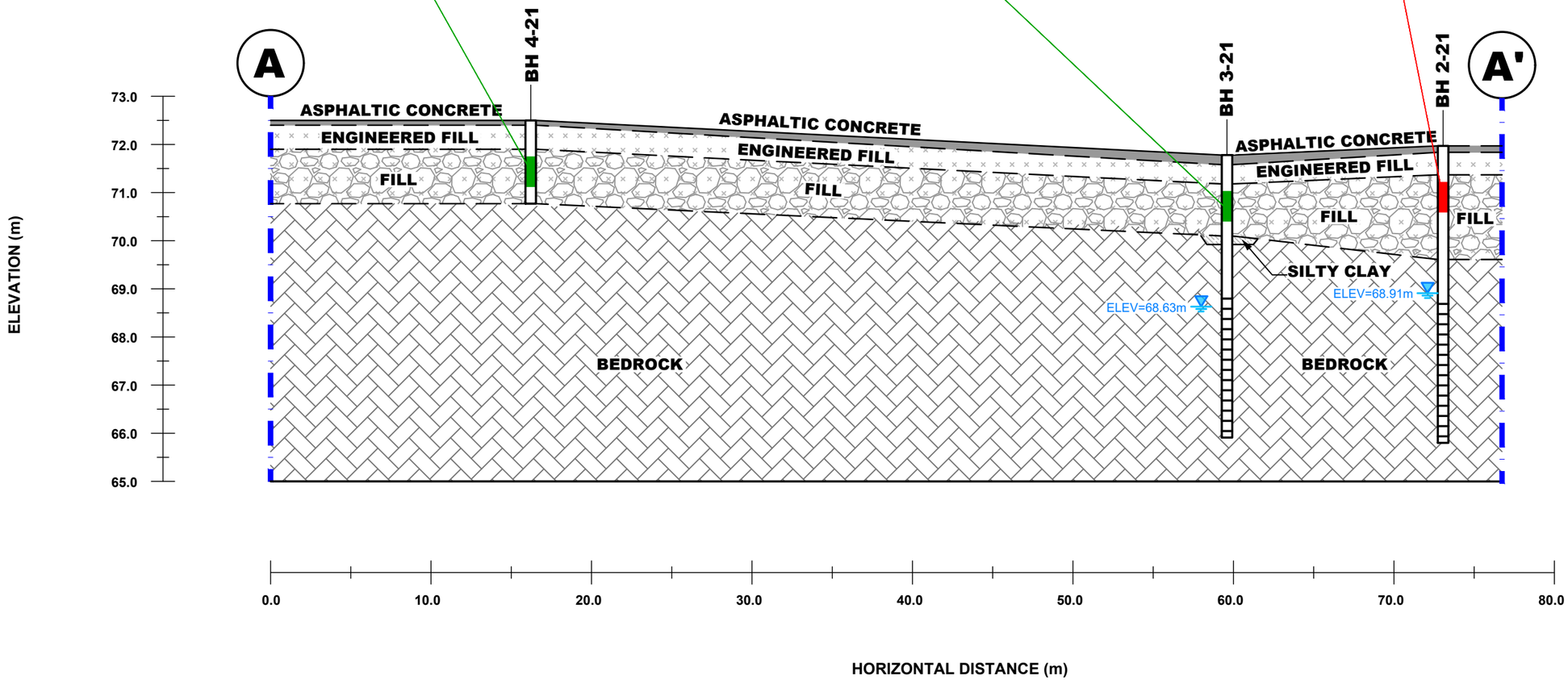
BH4-SS2 0.76-1.37m 19-Apr-21
Metals including Hg and CrVI comply with the MECP Table 7 Standards

BH3-SS2 0.76-1.37m 19-Apr-21
Metals including Hg and CrVI comply with the MECP Table 7 Standards
BTEX comply with the MECP Table 7 Standards
PHCs comply with the MECP Table 7 Standards

BH2-SS2	0.76-1.37m	19-Apr-21
Parameter	Result (µg/g)	Standard (µg/g)
Mercury	0.5	0.27

Remaining Metals including CrVI comply with the MECP Table 7 Standards

Dup 1(BH2-SS2) 0.76-1.37m 19-Apr-21
Metals comply with the MECP Table 7 Standards



SOIL RESULT COMPLIES WITH MECP TABLE 7 STANDARDS

SOIL RESULT EXCEEDS MECP TABLE 7 STANDARDS

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL

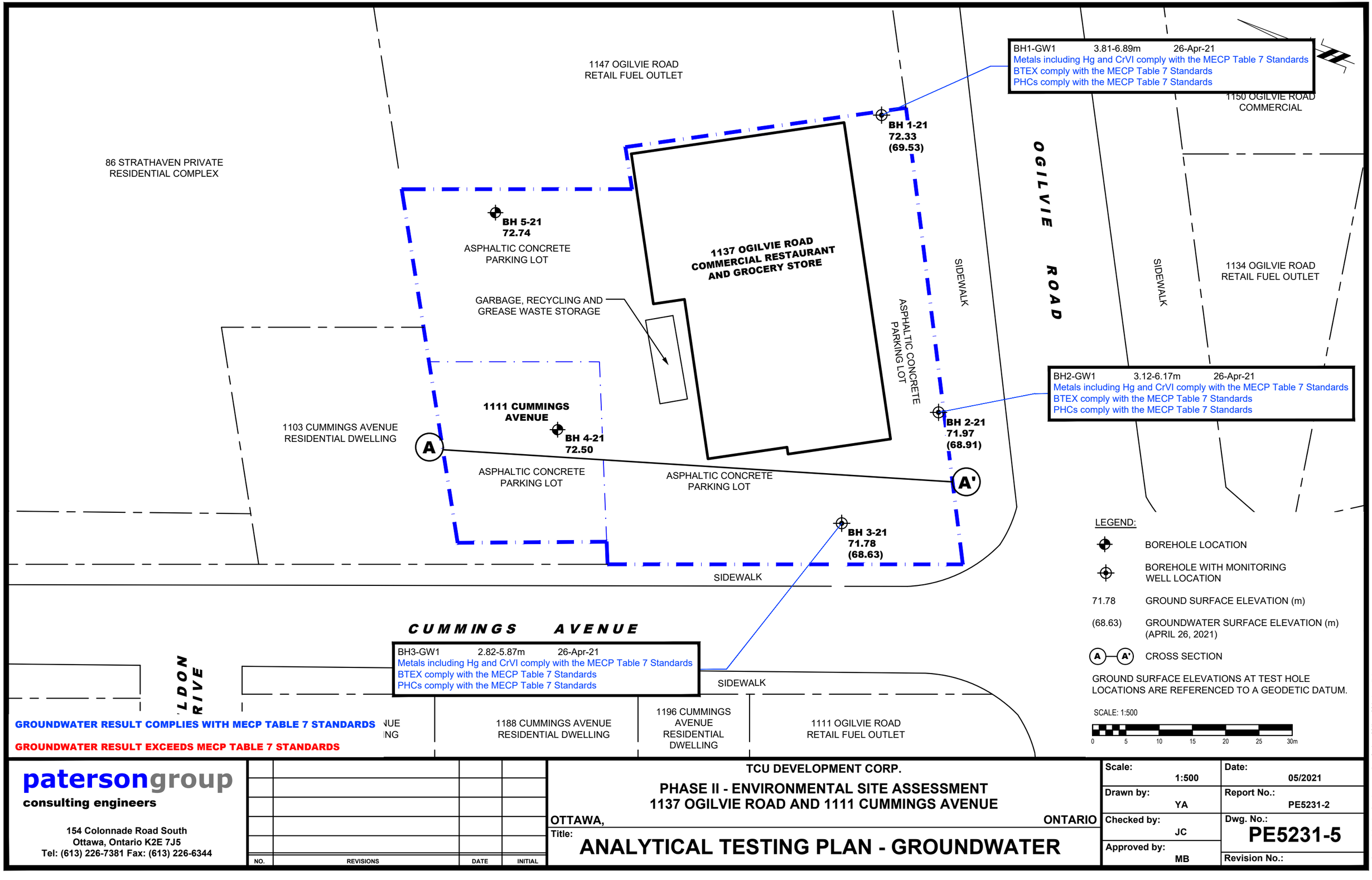
TCU DEVELOPMENT CORP.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1137 OGILVIE ROAD AND 1111 CUMMINGS AVENUE
OTTAWA, ONTARIO

Title:
ANALYTICAL TESTING PLAN - SOIL

Scale: AS SHOWN	Date: 05/2021
Drawn by: YA	Report No.: PE5231-2
Checked by: JC	Dwg. No.: PE5231-4A
Approved by: MB	Revision No.:

p:\autocad drawings\environmental\pe52xx\pe5231\pe5231-phase ii.dwg



patersongroup
consulting engineers
154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL

TCU DEVELOPMENT CORP.

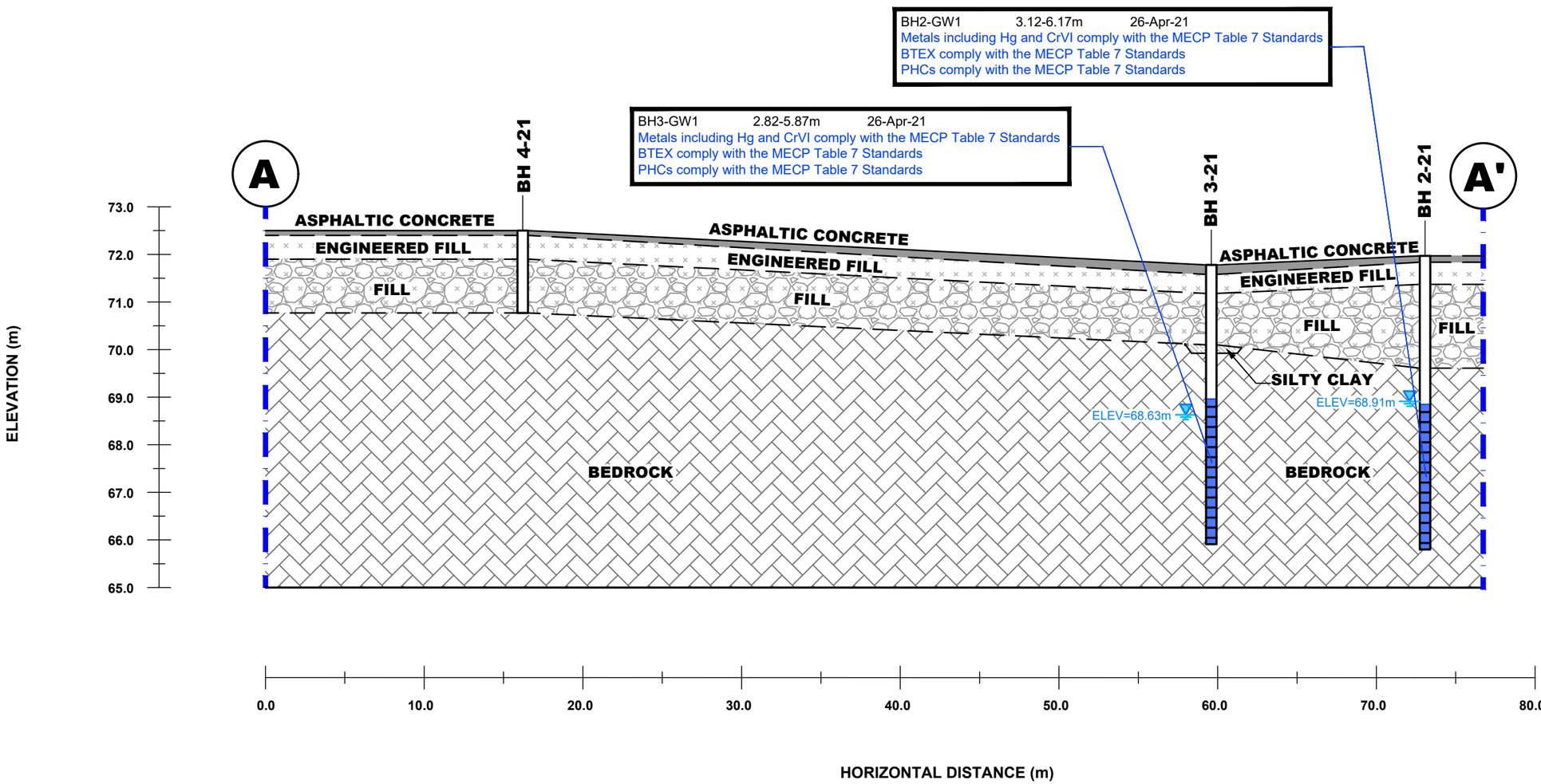
PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1137 OGILVIE ROAD AND 1111 CUMMINGS AVENUE

OTTAWA, ONTARIO

Title: ANALYTICAL TESTING PLAN - GROUNDWATER

Scale: 1:500	Date: 05/2021
Drawn by: YA	Report No.: PE5231-2
Checked by: JC	Dwg. No.: PE5231-5
Approved by: MB	Revision No.:

p:\autocad drawings\environmental\pe52xx\pe5231\pe5231-phase ii.dwg



GROUNDWATER RESULT COMPLIES WITH MECP TABLE 7 STANDARDS

GROUNDWATER RESULT EXCEEDS MECP TABLE 7 STANDARDS

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL

TCU DEVELOPMENT CORP.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1137 OGILVIE ROAD AND 1111 CUMMINGS AVENUE
OTTAWA, ONTARIO

Title:
ANALYTICAL TESTING PLAN - GROUNDWATER

Scale: AS SHOWN	Date: 05/2021
Drawn by: YA	Report No.: PE5231-2
Checked by: JC	Dwg. No.: PE5231-5A
Approved by: MB	Revision No.:

p:\autocad drawings\environmental\pe52xx\pe5231\pe5231-phase ii.dwg

APPENDIX 1

SAMPLING AND ANALYSIS PLAN

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

LABORATORY CERTIFICATES OF ANALYSIS

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

patersongroup

Sampling & Analysis Plan

Phase II – Environmental Site Assessment
1137 Ogilvie Road and 1111 Cummings Avenue
Ottawa, Ontario

Prepared For

TCU Development Corporation

April 10, 2021

Report: PE5231-SAP

Paterson Group Inc.

Consulting Engineers
154 Colonnade Road South
Ottawa (Nepean), Ontario
Canada K2E 7J5

Tel: (613) 226-7381
Fax: (613) 226-6344
www.patersongroup.ca

TABLE OF CONTENTS

1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by TCU Development Corporation, to conduct a Phase II – Environmental Site Assessment (Phase II ESA) at 1137 Ogilvie Road and 1111 Cummings Avenue, in the City of Ottawa, Ontario.

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

Borehole	Location & Rationale	Proposed Depth & Rationale
BH1	Placed on the southeastern portion of the Phase II Property to assess for potential soil and groundwater impacts resulting from the presence of the historical off-site retail fuel outlet adjacent to the east.	5-7 m; Drill to intercept water table for monitoring well installation. Core bedrock if there is no evidence of water in the overburden.
BH2	Placed on the southwest portion of the Phase II Property, to assess for potential soil and groundwater impacts resulting from the presence of the existing off-site retail fuel outlet to the south.	5-7 m; Drill to intercept water table for monitoring well installation. Core bedrock if there is no evidence of water in the overburden.
BH3	Placed on the southwest portion of the Phase II Property, to assess for potential soil and groundwater impacts resulting from the presence of the existing off-site retail fuel outlet to the west.	5-7 m; Drill to intercept water table for monitoring well installation. Core bedrock if there is no evidence of water in the overburden.
BH4	Placed on the northwestern portion of the subject site, to assess the quality of fill material.	1-3 m; For geotechnical purposes.
BH5	Placed on the northeastern portion of the subject site, for general coverage purposes.	1-3; For geotechnical and general coverage purposes.

Borehole locations are shown on Drawing PE5231-3 – Test Hole Location Plan, appended to the main report.

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

Following the borehole drilling, groundwater monitoring wells will be installed in boreholes (BH1-BH3) for the collection of groundwater samples.

2.0 ANALYTICAL TESTING PROGRAM

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

- ❒ At least one sample from each borehole should be submitted, in order to delineate the horizontal extent of contamination across the site.
- ❒ At least one sample from each stratigraphic unit should be submitted, in order to delineate the vertical extent of contamination at the site.
- ❒ In boreholes where there is visual or olfactory evidence of contamination, or where organic vapour meter or photoionization detector readings indicate the presence of contamination, the 'worst-case' sample from each borehole should be submitted for comparison with MECP site condition standards.
- ❒ In boreholes with evidence of contamination as described above, a sample should be submitted from the stratigraphic unit below the 'worst-case' sample to determine whether the contaminant(s) have migrated downward.
- ❒ Parameters analyzed should be consistent with the Contaminants of Potential Concern identified in the Phase I ESA.

The analytical testing program for soil at the 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 trailer)
- ❒ latex or nitrile gloves (depending on suspected contaminant)
- ❒ RKI Eagle organic vapour meter or MiniRae photoionization detector (depending on contamination suspected)

Determining Borehole Locations

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

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

Drilling Procedure

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

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

Spoon Washing Procedure

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

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

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

Screening Procedure

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

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

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

3.2 Monitoring Well Installation Procedure

Equipment

- ❒ 5' x 2" threaded sections of Schedule 40 PVC slotted well screen (5' x 1 ¼" if installing in cored hole in bedrock)
- ❒ 5' x 2" threaded sections of Schedule 40 PVC riser pipe (5' x 1 ¼" if installing in cored hole in bedrock)
- ❒ Threaded end-cap
- ❒ Slip-cap or J-plug
- ❒ Asphalt cold patch or concrete
- ❒ Silica Sand
- ❒ Bentonite chips (Holeplug)
- ❒ Steel flushmount casing

Procedure

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

3.3 Monitoring Well Sampling Procedure

Equipment

- ❒ Water level metre or interface probe on hydrocarbon/LNAPL sites
- ❒ Spray bottles containing water and methanol to clean water level tape or interface probe
- ❒ Peristaltic pump
- ❒ Polyethylene tubing for peristaltic pump
- ❒ Flexible tubing for peristaltic pump
- ❒ Latex or nitrile gloves (depending on suspected contaminant)
- ❒ Allen keys and/or 9/16” socket wrench to remove well caps
- ❒ Graduated bucket with volume measurements
- ❒ pH/Temperature/Conductivity combo pen
- ❒ Laboratory-supplied sample bottles

Sampling Procedure

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

4.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

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

- ❒ All non-dedicated sampling equipment (split spoons) will be decontaminated according to the SOPs listed above.
- ❒ All groundwater sampling equipment is dedicated (polyethylene and flexible peristaltic tubing is replaced for each well).
- ❒ Where groundwater samples are to be analyzed for VOCs, one laboratory-provided trip blank will be submitted for analysis with every laboratory submission.
- ❒ Approximately one (1) field duplicate will be submitted for every ten (10) samples submitted for laboratory analysis. A minimum of one (1) field duplicate per project will be submitted. Field duplicates will be submitted for soil and groundwater samples
- ❒ Where combo pens are used to measure field chemistry, they will be calibrated on an approximately monthly basis, according to frequency of use.

5.0 DATA QUALITY OBJECTIVES

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

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

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

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

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

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

These considerations are discussed in the body of the report.

6.0 PHYSICAL IMPEDIMENTS

Physical impediments to the Sampling and Analysis plan may include:

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

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1137 Ogilvie Road and 1111 Cummings Avenue
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE5231

REMARKS

HOLE NO. BH 1-21

BORINGS BY CME-55 Low Clearance Drill **DATE** April 19, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	72.33
Asphaltic concrete 0.08							
FILL: Brown silty sand with crushed stone 0.69		AU	1				
		SS	2	33	17	1	71.33
FILL: Brown silty clay with sand and gravel, some to trace topsoil		SS	3	50	53	2	70.33
2.29							
FILL: Brown silty sand with gravel and crushed stone 3.05		SS	4	75	35	3	69.33
		RC	1	100	19	4	68.33
BEDROCK: Very poor to fair quality, black shale						5	67.33
		RC	2	100	70		
- excellent quality by 6.0m depth						6	66.33
		RC	3	100	100		
6.83							
End of Borehole							
(GWL @ 2.80m - April 26, 2021)							

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
1137 Ogilvie Road and 1111 Cummings Avenue
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE5231

REMARKS

HOLE NO. BH 2-21

BORINGS BY CME-55 Low Clearance Drill **DATE** April 19, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	71.97
Asphaltic concrete 0.13							
FILL: Brown silty sand with crushed stone 0.60		AU	1				
FILL: Brown silty clay with sand and gravel, trace topsoil		SS	2	75	8	1	70.97
1.45							
FILL: Brown silty sand with gravel		SS	3	17	19	2	69.97
2.36		SS	4	20	50+		
BEDROCK: Very poor quality, black shale		RC	1	100	0	3	68.97
- good quality by 3.1m depth		RC	2	100	85	4	67.97
		RC	3	100	88	5	66.97
6.17						6	65.97
End Borehole							
(GWL @ 3.06m - April 26, 2021)							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

Monitoring Well Construction

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1137 Ogilvie Road and 1111 Cummings Avenue
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE5231

REMARKS

HOLE NO. BH 3-21

BORINGS BY CME-55 Low Clearance Drill **DATE** April 19, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
Asphaltic concrete 0.10						0	71.78
FILL: Brown silty sand with crushed stone 0.60		AU	1				
FILL: Dark grey to brown silty sand with clay, trace wood		SS	2	42	19	1	70.78
1.68		SS	3	60	50+		
Compact, brown **SILTY SAND,** trace gravel 1.78						2	69.78
		RC	1	87	0		
BEDROCK: Very poor to poor quality, black shale						3	68.78
		RC	2	72	25	4	67.78
- excellent quality by 4.6m depth							
		RC	3	100	94	5	66.78
5.87							
End of Borehole							
(GWL @ 3.15m - April 26, 2021)							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

Monitoring Well Construction

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1137 Ogilvie Road and 1111 Cummings Avenue
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE5231

REMARKS

HOLE NO. BH 4-21

BORINGS BY CME-55 Low Clearance Drill **DATE** April 19, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Photo Ionization Detector: Volatile Organic Rdg. (ppm) / Lower Explosive Limit %	Monitoring Well Construction
GROUND SURFACE									
Asphaltic concrete 0.05						0	72.50		
FILL: Brown silty sand with crushed stone 0.60		AU	1						
FILL: Brown silty clay with sand and gravel, trace shale fragments		SS	2	50	6	1	71.50		
1.73		SS	3	100	50+				
End of Borehole									
Practical refusal to augering at 1.73m 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.

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1137 Ogilvie Road and 1111 Cummings Avenue
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE5231

REMARKS

HOLE NO. BH 5-21

BORINGS BY CME-55 Low Clearance Drill **DATE** April 19, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Photo Ionization Detector: Volatile Organic Rdg. (ppm) / Lower Explosive Limit %	Monitoring Well Construction
GROUND SURFACE									
Asphaltic concrete 0.05						0	72.74		
FILL: Brown silty sand with crushed stone 0.46		AU	1						
FILL: Brown silty sand with clay and gravel		SS	2	58	12	1	71.74		
		SS	3	64	40				
2.08						2	70.74		
End of Borehole									
Practical refusal to augering at 2.08m depth									

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

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

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

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

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

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

CONSOLIDATION TEST

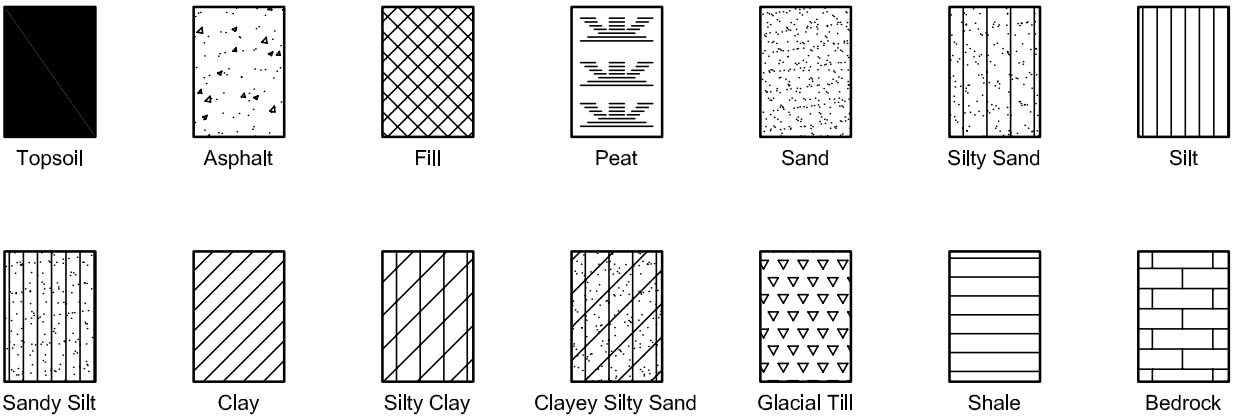
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

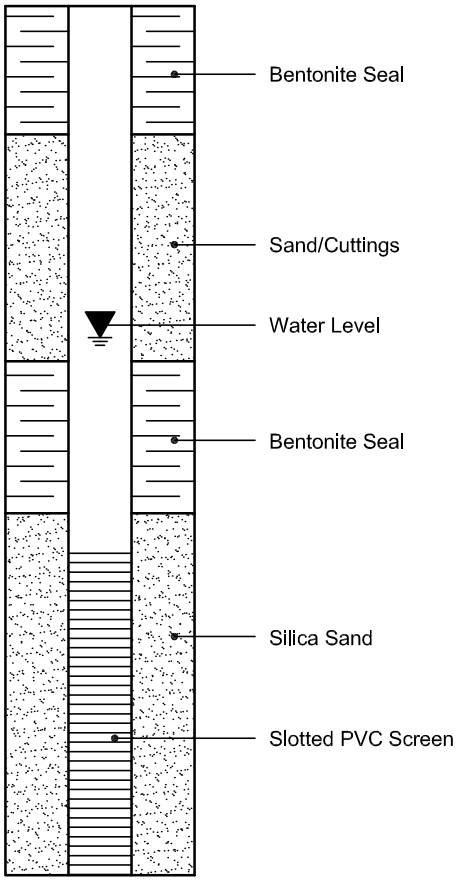
SYMBOLS AND TERMS (continued)

STRATA PLOT

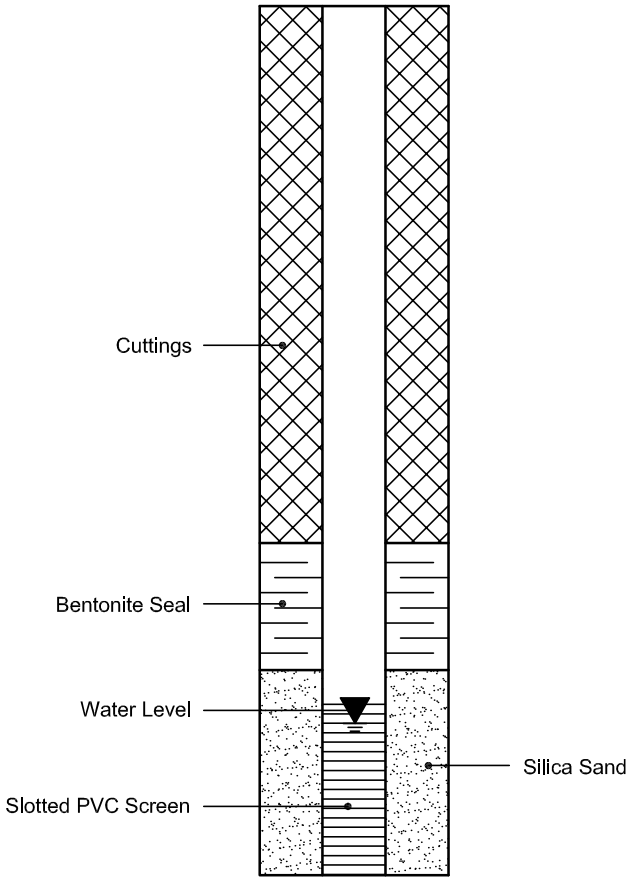


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



PARACEL LABORATORIES LTD.

TRUSTED.
RESPONSIVE.
RELIABLE.

300 - 2319 St. Laurent Blvd
Ottawa, ON, K1G 4J8
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 33055
Project: PE5231
Custody: 131534

Report Date: 26-Apr-2021
Order Date: 20-Apr-2021

Order #: 2117271

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

Paracel ID	Client ID
2117271-01	BH1-SS2
2117271-02	BH1-SS4
2117271-03	BH2-SS2
2117271-04	BH3-SS2
2117271-05	BH4-SS2
2117271-06	BH5-SS2
2117271-07	Dup 1

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 26-Apr-2021

Client: Paterson Group Consulting Engineers

Order Date: 20-Apr-2021

Client PO: 33055

Project Description: PE5231

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	22-Apr-21	22-Apr-21
Chromium, hexavalent - soil	MOE E3056 - Extraction, colourimetric	21-Apr-21	22-Apr-21
Mercury by CVAA	EPA 7471B - CVAA, digestion	26-Apr-21	26-Apr-21
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	22-Apr-21	22-Apr-21
PHC F1	CWS Tier 1 - P&T GC-FID	22-Apr-21	22-Apr-21
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	21-Apr-21	23-Apr-21
REG 153: Metals by ICP/MS, soil	EPA 6020 - Digestion - ICP-MS	22-Apr-21	22-Apr-21
Solids, %	Gravimetric, calculation	22-Apr-21	22-Apr-21

Certificate of Analysis

Report Date: 26-Apr-2021

Client: Paterson Group Consulting Engineers

Order Date: 20-Apr-2021

Client PO: 33055

Project Description: PE5231

	Client ID:	BH1-SS2	BH1-SS4	BH2-SS2	BH3-SS2
	Sample Date:	19-Apr-21 09:00	19-Apr-21 09:00	19-Apr-21 09:00	19-Apr-21 09:00
	Sample ID:	2117271-01	2117271-02	2117271-03	2117271-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	88.6	92.3	87.0	82.8
General Inorganics					
pH	0.05 pH Units	7.66	7.70	-	-
Metals					
Antimony	1.0 ug/g dry	<1.0	-	<1.0	<1.0
Arsenic	1.0 ug/g dry	6.5	-	6.8	7.1
Barium	1.0 ug/g dry	104	-	93.3	94.5
Beryllium	0.5 ug/g dry	0.6	-	0.6	0.6
Boron	5.0 ug/g dry	9.0	-	6.4	6.8
Cadmium	0.5 ug/g dry	<0.5	-	<0.5	<0.5
Chromium	5.0 ug/g dry	20.8	-	26.2	25.5
Chromium (VI)	0.2 ug/g dry	<0.2	-	<0.2	<0.2
Cobalt	1.0 ug/g dry	13.6	-	11.3	9.6
Copper	5.0 ug/g dry	31.8	-	27.3	24.9
Lead	1.0 ug/g dry	11.5	-	23.2	19.1
Mercury	0.1 ug/g dry	<0.1	-	0.5	0.2
Molybdenum	1.0 ug/g dry	4.3	-	3.5	2.4
Nickel	5.0 ug/g dry	47.5	-	37.7	28.4
Selenium	1.0 ug/g dry	<1.0	-	<1.0	<1.0
Silver	0.3 ug/g dry	<0.3	-	<0.3	<0.3
Thallium	1.0 ug/g dry	<1.0	-	<1.0	<1.0
Uranium	1.0 ug/g dry	1.3	-	1.3	1.3
Vanadium	10.0 ug/g dry	30.1	-	33.8	34.4
Zinc	20.0 ug/g dry	43.3	-	79.9	58.7
Volatiles					
Benzene	0.02 ug/g dry	-	<0.02	-	<0.02
Ethylbenzene	0.05 ug/g dry	-	<0.05	-	<0.05
Toluene	0.05 ug/g dry	-	<0.05	-	<0.05
m,p-Xylenes	0.05 ug/g dry	-	<0.05	-	<0.05
o-Xylene	0.05 ug/g dry	-	<0.05	-	<0.05
Xylenes, total	0.05 ug/g dry	-	<0.05	-	<0.05
Toluene-d8	Surrogate	-	105%	-	106%
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	-	<7	-	<7
F2 PHCs (C10-C16)	4 ug/g dry	-	<4	-	<4

Certificate of Analysis

Report Date: 26-Apr-2021

Client: Paterson Group Consulting Engineers

Order Date: 20-Apr-2021

Client PO: 33055

Project Description: PE5231

	Client ID:	BH1-SS2	BH1-SS4	BH2-SS2	BH3-SS2
	Sample Date:	19-Apr-21 09:00	19-Apr-21 09:00	19-Apr-21 09:00	19-Apr-21 09:00
	Sample ID:	2117271-01	2117271-02	2117271-03	2117271-04
	MDL/Units	Soil	Soil	Soil	Soil
F3 PHCs (C16-C34)	8 ug/g dry	-	<8	-	26
F4 PHCs (C34-C50)	6 ug/g dry	-	<6	-	48
	Client ID:	BH4-SS2	BH5-SS2	Dup 1	-
	Sample Date:	19-Apr-21 09:00	19-Apr-21 09:00	19-Apr-21 09:00	-
	Sample ID:	2117271-05	2117271-06	2117271-07	-
	MDL/Units	Soil	Soil	Soil	-
Physical Characteristics					
% Solids	0.1 % by Wt.	86.2	86.8	83.8	-
Metals					
Antimony	1.0 ug/g dry	<1.0	<1.0	<1.0	-
Arsenic	1.0 ug/g dry	8.1	9.7	6.7	-
Barium	1.0 ug/g dry	160	115	82.2	-
Beryllium	0.5 ug/g dry	0.6	0.8	<0.5	-
Boron	5.0 ug/g dry	8.0	10.0	5.4	-
Cadmium	0.5 ug/g dry	0.7	<0.5	<0.5	-
Chromium	5.0 ug/g dry	28.9	28.2	23.0	-
Chromium (VI)	0.2 ug/g dry	<0.2	<0.2	-	-
Cobalt	1.0 ug/g dry	16.0	18.8	10.2	-
Copper	5.0 ug/g dry	39.2	45.6	24.7	-
Lead	1.0 ug/g dry	52.9	16.6	19.4	-
Mercury	0.1 ug/g dry	0.1	<0.1	-	-
Molybdenum	1.0 ug/g dry	4.6	3.2	3.5	-
Nickel	5.0 ug/g dry	53.6	50.4	34.7	-
Selenium	1.0 ug/g dry	<1.0	<1.0	<1.0	-
Silver	0.3 ug/g dry	<0.3	<0.3	<0.3	-
Thallium	1.0 ug/g dry	<1.0	<1.0	<1.0	-
Uranium	1.0 ug/g dry	1.5	1.1	1.2	-
Vanadium	10.0 ug/g dry	35.5	37.0	29.7	-
Zinc	20.0 ug/g dry	123	55.0	65.7	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Metals									
Antimony	ND	1.0	ug/g						
Arsenic	ND	1.0	ug/g						
Barium	ND	1.0	ug/g						
Beryllium	ND	0.5	ug/g						
Boron	ND	5.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium (VI)	ND	0.2	ug/g						
Chromium	ND	5.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	5.0	ug/g						
Lead	ND	1.0	ug/g						
Mercury	ND	0.1	ug/g						
Molybdenum	ND	1.0	ug/g						
Nickel	ND	5.0	ug/g						
Selenium	ND	1.0	ug/g						
Silver	ND	0.3	ug/g						
Thallium	ND	1.0	ug/g						
Uranium	ND	1.0	ug/g						
Vanadium	ND	10.0	ug/g						
Zinc	ND	20.0	ug/g						
Volatiles									
Benzene	ND	0.02	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: Toluene-d8	*8.41*		*ug/g*		*105*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
pH	6.88	0.05	pH Units	6.89			0.1	2.3	
Hydrocarbons									
F1 PHCs (C6-C10)	19	7	ug/g dry	15			24.5	40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND			NC	30	
F3 PHCs (C16-C34)	ND	8	ug/g dry	ND			NC	30	
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND			NC	30	
Metals									
Antimony	ND	1.0	ug/g dry	ND			NC	30	
Arsenic	4.9	1.0	ug/g dry	4.2			13.6	30	
Barium	437	1.0	ug/g dry	384			12.9	30	
Beryllium	1.2	0.5	ug/g dry	1.0			14.2	30	
Boron	6.1	5.0	ug/g dry	5.5			11.2	30	
Cadmium	ND	0.5	ug/g dry	ND			NC	30	
Chromium (VI)	ND	0.2	ug/g dry	ND			NC	35	
Chromium	136	5.0	ug/g dry	121			11.5	30	
Cobalt	25.9	1.0	ug/g dry	23.5			9.8	30	
Copper	38.5	5.0	ug/g dry	34.9			9.9	30	
Lead	9.3	1.0	ug/g dry	8.5			9.8	30	
Mercury	ND	0.1	ug/g dry	ND			NC	30	
Molybdenum	1.0	1.0	ug/g dry	ND			NC	30	
Nickel	68.3	5.0	ug/g dry	61.8			9.9	30	
Selenium	ND	1.0	ug/g dry	ND			NC	30	
Silver	ND	0.3	ug/g dry	ND			NC	30	
Thallium	ND	1.0	ug/g dry	ND			NC	30	
Uranium	1.7	1.0	ug/g dry	1.4			14.1	30	
Vanadium	134	10.0	ug/g dry	120			11.2	30	
Zinc	136	20.0	ug/g dry	121			11.9	30	
Physical Characteristics									
% Solids	87.9	0.1	% by Wt.	85.5			2.8	25	
Volatiles									
Benzene	0.063	0.02	ug/g dry	0.070			10.4	50	
Ethylbenzene	0.055	0.05	ug/g dry	0.051			8.1	50	
Toluene	ND	0.05	ug/g dry	ND			NC	50	
m,p-Xylenes	0.097	0.05	ug/g dry	0.087			10.6	50	
o-Xylene	0.073	0.05	ug/g dry	0.078			6.4	50	
Surrogate: Toluene-d8	*9.40*		*ug/g dry*		*106*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	189	7	ug/g	ND	94.5	80-120			
F2 PHCs (C10-C16)	70	4	ug/g	ND	81.8	60-140			
F3 PHCs (C16-C34)	202	8	ug/g	ND	97.1	60-140			
F4 PHCs (C34-C50)	137	6	ug/g	ND	104	60-140			
Metals									
Antimony	51.4	1.0	ug/g	ND	103	70-130			
Arsenic	55.4	1.0	ug/g	1.7	107	70-130			
Barium	53.0	1.0	ug/g	ND	106	70-130			
Beryllium	46.9	0.5	ug/g	ND	93.0	70-130			
Boron	44.2	5.0	ug/g	ND	84.1	70-130			
Cadmium	51.0	0.5	ug/g	ND	102	70-130			
Chromium (VI)	4.3	0.2	ug/g	ND	86.0	70-130			
Chromium	106	5.0	ug/g	48.4	115	70-130			
Cobalt	62.5	1.0	ug/g	9.4	106	70-130			
Copper	66.0	5.0	ug/g	14.0	104	70-130			
Lead	52.0	1.0	ug/g	3.4	97.2	70-130			
Mercury	1.60	0.1	ug/g	ND	106	70-130			
Molybdenum	52.3	1.0	ug/g	ND	104	70-130			
Nickel	78.1	5.0	ug/g	24.7	107	70-130			
Selenium	49.4	1.0	ug/g	ND	98.5	70-130			
Silver	48.8	0.3	ug/g	ND	97.6	70-130			
Thallium	50.4	1.0	ug/g	ND	100	70-130			
Uranium	52.4	1.0	ug/g	ND	104	70-130			
Vanadium	109	10.0	ug/g	48.0	122	70-130			
Zinc	103	20.0	ug/g	48.4	109	70-130			
Volatiles									
Benzene	3.31	0.02	ug/g	ND	82.7	60-130			
Ethylbenzene	4.14	0.05	ug/g	ND	104	60-130			
Toluene	3.91	0.05	ug/g	ND	97.9	60-130			
m,p-Xylenes	7.77	0.05	ug/g	ND	97.1	60-130			
o-Xylene	4.11	0.05	ug/g	ND	103	60-130			
Surrogate: Toluene-d8	*8.05*		*ug/g*		*101*	*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.
NC: Not Calculated

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

CCME PHC additional information:

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

PARAC LABORATORIES

Paracel ID: 2117271

urent Blvd.
K1G 4J8
47
cellabs.com
s.com

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2117271	№ 131534

Client Name: Paterson Group	Project Ref: PE5231	Page 1 of 1
Contact Name: Michael Beaudoin	Quote #:	Turnaround Time
Address: 154 colonnade Road South	PO #: 33055	☐ 1 day ☐ 3 day ☐ 2 day ☑ Regular
Telephone: 613-226-7381	E-mail: MBeaudoin@pattersongroup.ca	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	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	pH
1	BH1-SS2	S		1	April 19, 21					X	X	X		X
2	BH1-SS4	S		2			X			[redacted]				X
3	BH2-SS2	↓		2	↓					X	X	X		
4	BH3-SS2			2			X			X	X	X		
5	BH4-SS2			2						X	X	X		
6	BH5-SS2			2						X	X	X		
7	Dup 2	↓		1	↓					X				
8														
9														
10														

Comments:

Method of Delivery: Paracel Courier

Relinquished By (Sign):	Received By Driver/Depot: T. Flowie	Received at Lab: Jurneeporn Ohmai	Verified By:
Relinquished By (Print): Mohammed Rumaltan	Date/Time: 20/04/21 3:30	Date/Time: APR 20, 2021 04.20	Date/Time: Apr 21 2021 9:20
Date/Time: April 20, 2021 / 2:15pm	Temperature: °C	Temperature: 15.3 °C	pH Verified: ☐ By: MA

PARACEL LABORATORIES LTD.

TRUSTED.
RESPONSIVE.
RELIABLE.

300 - 2319 St. Laurent Blvd
Ottawa, ON, K1G 4J8
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 29879
Project: PE5231
Custody: 59227

Report Date: 3-May-2021
Order Date: 27-Apr-2021

Order #: 2118209

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

Paracel ID	Client ID
2118209-01	BH1-GW1
2118209-02	BH2-GW1
2118209-03	BH3-GW1

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 03-May-2021

Client: Paterson Group Consulting Engineers

Order Date: 27-Apr-2021

Client PO: 29879

Project Description: PE5231

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	28-Apr-21	28-Apr-21
Chromium, hexavalent - water	MOE E3056 - colourimetric	29-Apr-21	29-Apr-21
Mercury by CVAA	EPA 245.2 - Cold Vapour AA	28-Apr-21	28-Apr-21
Metals, ICP-MS	EPA 200.8 - ICP-MS	28-Apr-21	28-Apr-21
PHC F1	CWS Tier 1 - P&T GC-FID	28-Apr-21	28-Apr-21
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	29-Apr-21	3-May-21

Certificate of Analysis

Report Date: 03-May-2021

Client: **Paterson Group Consulting Engineers**

Order Date: 27-Apr-2021

Client PO: **29879**

Project Description: PE5231

	Client ID:	BH1-GW1	BH2-GW1	BH3-GW1	-
	Sample Date:	26-Apr-21 09:00	26-Apr-21 09:00	26-Apr-21 09:00	-
	Sample ID:	2118209-01	2118209-02	2118209-03	-
	MDL/Units	Water	Water	Water	-
Metals					
Mercury	0.1 ug/L	<0.1	<0.1	<0.1	-
Antimony	0.5 ug/L	<0.5	<0.5	0.6	-
Arsenic	1 ug/L	<1	<1	<1	-
Barium	1 ug/L	110	147	68	-
Beryllium	0.5 ug/L	<0.5	<0.5	<0.5	-
Boron	10 ug/L	98	74	79	-
Cadmium	0.1 ug/L	<0.1	<0.1	0.5	-
Chromium	1 ug/L	<1	<1	<1	-
Chromium (VI)	10 ug/L	<10	<10	<10	-
Cobalt	0.5 ug/L	<0.5	1.2	0.7	-
Copper	0.5 ug/L	1.2	<0.5	1.8	-
Lead	0.1 ug/L	<0.1	0.3	<0.1	-
Molybdenum	0.5 ug/L	4.0	8.5	8.7	-
Nickel	1 ug/L	<1	6	22	-
Selenium	1 ug/L	<1	<1	2	-
Silver	0.1 ug/L	<0.1	<0.1	<0.1	-
Sodium	200 ug/L	119000	364000	282000	-
Thallium	0.1 ug/L	<0.1	<0.1	<0.1	-
Uranium	0.1 ug/L	7.1	11.0	33.4	-
Vanadium	0.5 ug/L	<0.5	0.8	<0.5	-
Zinc	5 ug/L	9	16	9	-
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	102%	101%	102%	-
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

Report Date: 03-May-2021

Client: Paterson Group Consulting Engineers

Order Date: 27-Apr-2021

Client PO: 29879

Project Description: PE5231

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						
Metals									
Mercury	ND	0.1	ug/L						
Antimony	ND	0.5	ug/L						
Arsenic	ND	1	ug/L						
Barium	ND	1	ug/L						
Beryllium	ND	0.5	ug/L						
Boron	ND	10	ug/L						
Cadmium	ND	0.1	ug/L						
Chromium (VI)	ND	10	ug/L						
Chromium	ND	1	ug/L						
Cobalt	ND	0.5	ug/L						
Copper	ND	0.5	ug/L						
Lead	ND	0.1	ug/L						
Molybdenum	ND	0.5	ug/L						
Nickel	ND	1	ug/L						
Selenium	ND	1	ug/L						
Silver	ND	0.1	ug/L						
Sodium	ND	200	ug/L						
Thallium	ND	0.1	ug/L						
Uranium	ND	0.1	ug/L						
Vanadium	ND	0.5	ug/L						
Zinc	ND	5	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	*83.4*		*ug/L*		*104*	*50-140*			

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 29879

Report Date: 03-May-2021

Order Date: 27-Apr-2021

Project Description: PE5231

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	
Metals									
Mercury	ND	0.1	ug/L	ND			NC	20	
Antimony	ND	0.5	ug/L	ND			NC	20	
Arsenic	ND	1	ug/L	ND			NC	20	
Barium	ND	1	ug/L	ND			NC	20	
Beryllium	ND	0.5	ug/L	ND			NC	20	
Boron	ND	10	ug/L	ND			NC	20	
Cadmium	ND	0.1	ug/L	ND			NC	20	
Chromium (VI)	ND	10	ug/L	ND			NC	20	
Chromium	ND	1	ug/L	ND			NC	20	
Cobalt	ND	0.5	ug/L	ND			NC	20	
Copper	ND	0.5	ug/L	ND			NC	20	
Lead	ND	0.1	ug/L	ND			NC	20	
Molybdenum	ND	0.5	ug/L	ND			NC	20	
Nickel	ND	1	ug/L	ND			NC	20	
Selenium	ND	1	ug/L	ND			NC	20	
Silver	ND	0.1	ug/L	ND			NC	20	
Sodium	ND	200	ug/L	ND			NC	20	
Thallium	ND	0.1	ug/L	ND			NC	20	
Uranium	ND	0.1	ug/L	ND			NC	20	
Vanadium	ND	0.5	ug/L	ND			NC	20	
Zinc	ND	5	ug/L	ND			NC	20	
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	*82.4*		*ug/L*		*103*	*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)	2160	25	ug/L	ND	108	68-117			
F2 PHCs (C10-C16)	1300	100	ug/L	ND	81.4	60-140			
F3 PHCs (C16-C34)	3400	100	ug/L	ND	86.8	60-140			
F4 PHCs (C34-C50)	2040	100	ug/L	ND	82.2	60-140			
Metals									
Mercury	3.29	0.1	ug/L	ND	110	70-130			
Antimony	45.9	0.5	ug/L	ND	91.7	80-120			
Arsenic	48.6	1	ug/L	ND	97.1	80-120			
Barium	50.5	1	ug/L	ND	100	80-120			
Beryllium	44.9	0.5	ug/L	ND	89.7	80-120			
Boron	42	10	ug/L	ND	81.8	80-120			
Cadmium	53.4	0.1	ug/L	ND	107	80-120			
Chromium (VI)	197	10	ug/L	ND	98.5	70-130			
Chromium	50.6	1	ug/L	ND	101	80-120			
Cobalt	49.9	0.5	ug/L	ND	99.8	80-120			
Copper	49.6	0.5	ug/L	ND	99.2	80-120			
Lead	46.3	0.1	ug/L	ND	92.5	80-120			
Molybdenum	42.7	0.5	ug/L	ND	85.3	80-120			
Nickel	49.3	1	ug/L	ND	98.7	80-120			
Selenium	49.3	1	ug/L	ND	98.7	80-120			
Silver	50.7	0.1	ug/L	ND	101	80-120			
Sodium	9200	200	ug/L	ND	90.2	80-120			
Thallium	49.5	0.1	ug/L	ND	99.1	80-120			
Uranium	43.1	0.1	ug/L	ND	86.2	80-120			
Vanadium	48.5	0.5	ug/L	ND	97.1	80-120			
Zinc	52	5	ug/L	ND	105	80-120			
Volatiles									
Benzene	33.0	0.5	ug/L	ND	82.6	60-130			
Ethylbenzene	42.8	0.5	ug/L	ND	107	60-130			
Toluene	39.8	0.5	ug/L	ND	99.4	60-130			
m,p-Xylenes	79.0	0.5	ug/L	ND	98.7	60-130			
o-Xylene	41.8	0.5	ug/L	ND	105	60-130			
Surrogate: Toluene-d8	*81.1*		*ug/L*		*101*	*50-140*			

Certificate of Analysis

Report Date: 03-May-2021

Client: Paterson Group Consulting Engineers

Order Date: 27-Apr-2021

Client PO: 29879

Project Description: PE5231

Qualifier Notes:

Login Qualifiers :

Samples received submerged in water, possibly melted ice. This condition can compromise sample integrity.

Applies to samples: BH1-GW1, BH2-GW1, BH3-GW1

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

Paracel ID: 2118209

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2118209	№ 59227

Client Name: Paterson Group	Project Ref: PE5731	Page 1 of 1
Contact Name: Mike Beaudoin	Quote #:	Turnaround Time
Address: 154 Colonnade Rd. S.	PO #: 29879	☐ 1 day ☐ 3 day
	E-mail: mbeaudoin@patersongroup.ca	☐ 2 day ☒ Regular
Telephone: 613-226-7381		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)

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	Required Analysis: PHCs + BTEX	Metals by ICP	Hg	CrVI
1	BH1-GW1	GW		6	Apr. 26/21	am	X	X	X	X
2	BH2-GW1	"		"	"	"	X	X	X	X
3	BH3-GW1	"		"	"	"	X	X	X	X
4										
5										
6										
7										
8										
9										
10										

Comments:

Method of Delivery: Drop Off

Relinquished By (Sign): DLattin	Received By Driver/Depot:	Received at Lab: Jinnee'Lynn Dokmai	Verified By: BS
Relinquished By (Print): Derek Lattin	Date/Time: Apr 27/21	Date/Time: APR 27, 2021 03:35	Date/Time: April 27, 2021 17:10
Date/Time: April 27 2021 1:36pm	Temperature: 8.1 °C	Temperature: 7.1 °C	pH Verified: ☑ By: BS

13:40