Geotechnical Engineering

Environmental Engineering

Hydrogeology

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Materials Testing

Building Science

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Phase II Environmental Site Assessment

522 Lower Byron Avenue
City of Ottawa, Ontario

Prepared For

SerCo Realty Group

February 23, 2022

Report: PE5433-2

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EXECUTIVE SUMMARY

Assessment

A Phase II ESA was conducted for the property addressed 522 Lower Byron Avenue, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address an off-site potentially contaminating activity (PCA) that was identified during the Phase I ESA and considered to result in an area of potential environmental concern (APEC) on the northeastern portion of the Phase II ESA Property. Groundwater was identified as the potentially impacted media.

The subsurface investigation consisted of drilling three (3) boreholes, all of which were cored into the bedrock and instrumented with groundwater monitoring wells. The general soil profile encountered during the field program consisted of topsoil, followed by glacial till consisting of silty sand and gravel, underlain by limestone bedrock.

Groundwater samples from monitoring wells BH1-22, BH2-22 and BH3-22 were collected during the January 27, 2022 sampling event. No free product or petroleum hydrocarbon sheen was noted on the purge water during the groundwater sampling events.

Three (3) groundwater samples were analyzed for BTEX and PHCs (fractions, F1-F4). A duplicate sample was also analysed for BTEX parameters. No detectable BTEX or PHC concentrations were identified in any of the groundwater samples analyzed. The groundwater results comply with the MECP Table 7 Standards.

Based on the analytical results of the Phase II ESA, no further environmental investigation is recommended at this time.

Recommendations

If the monitoring wells installed on the Phase II ESA Property are not going to be used in the future, or will be destroyed during site redevelopment, they should be abandoned according to Ontario Regulation 903. The wells will be registered with the MECP under this regulation.

1.0 INTRODUCTION

At the request of SerCo Realty Group, Paterson Group (Paterson) conducted a Phase II Environmental Site Assessment at 522 Lower Byron Avenue (the Phase II ESA Property), in the City of Ottawa, Ontario. The purpose of this Phase II ESA has been to address the area of potential environmental concern (APEC) identified on the Phase II ESA Property, during the Phase I ESA conducted by Paterson in March of 2021.

1.1 Site Description

Address:	522 Lower Byron Avenue, Ottawa, Ontario
Location:	The Phase II ESA Property is located on the southside of Lower Byron Avenue, approximately 105 m east of Roosevelt Avenue, in the City of Ottawa, Ontario. Refer to Figure 1 - Key Plan in Appendix 1 for the site location.
Latitude and Longitude:	45° 23' 25.30" N, 75° 45' 17.15" W

Site Description:

Configuration:	Rectangular
Area:	625 m^2 (approximately)
Zoning:	R4U – Residential Zone.

1.2 Property Ownership

Paterson was engaged to conduct this Phase II-ESA by Ms. Loredana Porcari, with SerCo Realty Group. The head office of SerCo Realty Group is located at 9 Capella Court, Ottawa, Ontario. Ms. Porcari can be reached by telephone at (613) 226-2221.

1.3 Current and Proposed Future Uses

The Phase II ESA Property is currently occupied by a 2-storey residential dwelling and private garage constructed circa 1928. The remainder of the Phase II Property is landscaped with a paved driveway situated to the east side of the dwelling.

It is our understanding that the Phase II ESA Property will be redeveloped for residential use. There is no change in land use; therefore, a record of site condition (RSC) will not be required as per O.Reg 154/03.

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
- ❒ Generic site conditions for shallow soils
- ❒ Non-potable groundwater conditions
- ❒ Residential land use

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

Section 41 of O.Reg. 153/04 does not apply to the Phase II ESA Property, as the property is not within 30m of an environmentally sensitive area, and the pH value for surface soils is 7.60.

Section 43.1 of O.Reg. 153/04 does apply to the Phase II ESA Property in that the property is a Shallow Soil property. However, the Phase II Property is not located within 30m of a body of water.

The intended use of the Phase II ESA 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 ESA Property is located on the south side of Lower Byron Avenue, approximately 105 m east of Roosevelt Avenue, in the City of Ottawa, Ontario. The site is situated in a residential area.

The Phase II ESA Property is currently occupied by a 2-storey residential dwelling and private garage constructed circa 1928. The remainder of the Phase II Property is landscaped with a paved driveway situated to the east side of the dwelling.

Site drainage consists primarily of infiltration within landscaped areas, with some sheet flow to catch basins located on Lower Byron Avenue. The Phase II Property is relatively flat and at the grade of Lower Byron Avenue, while the regional topography slopes downwards in a northerly direction.

2.2 Past Investigations

Paterson completed a Phase I ESA in January 25 of 2022 for the Phase II ESA Property. Based on the findings of the Phase I ESA, there is one off-site potentially contaminating activity (PCA) that is considered to result in an area of potential environmental concern (APEC) on the Phase II ESA Property:

- ❒ APEC 1 – Resulting from a 400-L furnace oil at 516 Lower Byron Avenue (PCA 28).

The rationale for identifying the above APEC is based on a review of an ERIS search conducted for the subject property and properties within the 250m study area. A Phase II ESA was recommended to address the aforementioned APEC.

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The subsurface investigation was conducted on January 19 and 20, 2022 and consisted of drilling three (3) boreholes (BH1-22 through BH3-22), each of which was cored into the bedrock and completed with monitoring well installations. Boreholes were drilled to a maximum depth of 9.12 m below the ground surface (mbgs).

3.2 Media Investigated

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

Contaminants of potential concern on the Phase II ESA Property include benzene, toluene, ethylbenzene and xylenes (BTEX) and petroleum hydrocarbons (PHCs, F1-F4). These CPCs may be present in the groundwater beneath the Phase II ESA Property.

3.3 Phase I Conceptual Site Model

Geological and Hydrogeological Setting

According to the Geological Survey of Canada website, the bedrock in the area of the Phase I ESA Property is reported to consist of limestone and interbedded dolomite of the Gull River Formation. The overburden is reported to consist of plain till and exposed bedrock with depths ranging from 0 to 1 m over the entire site.

Based on the regional topography, the groundwater flow beneath the Phase I ESA Property is inferred to be in a northwesterly direction.

Existing Buildings and Structures

The Phase I ESA Property is currently occupied by a two-storey dwelling which was constructed prior to 1928. An addition was built on the southern end of the dwelling circa 2005. The exterior is finished in vinyl siding with a sloped shingle style roof. The dwelling is heated by a natural gas-fired furnace.

A private garage is situated to the east of the dwelling, while a small temporary shed structure is present on the south – central portion of the property. Both structures are finished with wood siding and a flat shingled style roof.

Subsurface Structures and Utilities

The Phase I ESA Property is situated in a municipally serviced area. Underground utilities and/or structures include electricity, natural gas and municipal water that enter the Phase I ESA Property from Lower Byron Avenue.

Areas of Natural Significance

No areas of natural significance were identified in the Phase I Study Area.

Water Bodies

No natural water bodies were identified in the Phase I Study Area.

Drinking Water Wells

There are no potable water wells on the Phase I ESA Property, nor are they expected to be present as the subject land is situated in a municipally serviced area.

Neighbouring Land Use

Neighbouring land use in the Phase I Study Area consists of residential with some commercial (retailers) and institutional/community properties.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

As per Table 1 in Section 7.1 of the Phase I ESA report, one off-site PCA is considered to result in an APEC on the Phase I Property:

- PCA 28: Gasoline and Associated Products Storage in Fixed Tanks – this PCA was selected based on a reported historical fuel spill at the adjacent property to the east, resulting in APEC 1 along the northeastern portion of the Phase I Property.

Contaminants of Potential Concern

As per Section 7.1, BTEX and PHCs (F_1-F_4) are contaminants of potential concern (CPCs) in the groundwater beneath the Phase I ESA Property.

Assessment of Uncertainty and/or Absence of Information

The information available for review as part of the preparation of this Phase I-ESA is considered to be sufficient to conclude that there is an off-site PCA that has resulted in an APEC on the Phase I ESA Property.

A variety of independent sources were consulted as part of this assessment, 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

There were no deviations from the Sampling and Analysis Plan.

3.5 Impediments

The location of the garage limited one borehole location. Otherwise, there were no impediments on the Phase II Property at the time of the field investigation.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation conducted for this Phase II ESA consisted of drilling three (3) boreholes (BH1-22 through BH3-22) across the Phase II ESA Property. The boreholes were cored into bedrock to a maximum depth of 9.12 m below ground surface (bgs) to intercept groundwater.

The boreholes were drilled using a low clearance track mounted 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 PE5433-3 – Test Hole Location Plan.

4.2 Soil Sampling

A total of six (6) soil samples and 16 rock core samples were obtained from the boreholes by means of grab sampling from shallow auger flights and rock coring.

The depths at which grab samples and core samples were obtained from the boreholes are shown as "**AU**" and "**RC**", respectively on the Soil Profile and Test Data Sheets.

The borehole profiles generally consist of topsoil, followed by glacial till consisting of silty sand and gravel, underlain by limestone bedrock.

4.3 Field Screening Measurements

Although soil was not considered to be a potentially impacted media, all soil samples collected were subjected to a preliminary screening procedure, which included visual screening as well as a soil vapour screening with an RKI Eagle gas detector with methane elimination and calibrated to hexane.

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

The parts per million (ppm) scale is used to measure concentrations of hydrocarbon vapours that are too low to register on the Lower Explosive Limit (LEL) scale. The explosive point, 100% LEL, represents the leanest mixture which will burn (or explode) if ignited.

The combustible vapour readings from the soil samples collected from this subsurface investigation generally ranged from 30ppm to 35 ppm. The combustible vapour readings were not considered to be indicative of petroleum hydrocarbon compounds. Vapour readings are noted on the Soil Profile and Test Data Sheets provided in Appendix 1.

4.4 Groundwater Monitoring Well Installation

Three (3) groundwater monitoring wells were installed on the Phase II ESA 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 below 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 1: 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
BH1-22	69.81	7.62	4.62-7.62	3.35-7.62	0.15-3.35	Stick-up
BH2-22	69.84	9.07	6.07-9.07	3.35-9.07	0.15-3.35	Stick-up
BH3-22	69.69	7.62	4.62-7.62	3.35-7.62	0.15-3.35	Stick-up

4.5 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.

4.6 Analytical Testing

Based on the guidelines outlined in the Sampling and Analysis Plan appended to this report, the following groundwater samples, as well as analyzed parameters are presented in Table 3.

TABLE 2: Groundwater Samples Submitted and Analyzed Parameters				
Sample ID	Screened Interval	Parameters Analyzed		Rationale
		BTEX	PHCs (F1-F4)	
January 27, 2022				
BH1-22	4.62-7.62m Limestone bedrock	X	X	Assess potential groundwater impacts from a historical furnace oil spill reported at the adjacent property to the east of the Phase II ESA Property.
BH2-22	6.07-9.07Limestone bedrock	X	X	
BH3-22	4.62-7.62m Limestone bedrock	X	X	
DUP	4.62-7.62m Limestone bedrock	X	X	Duplicate groundwater sample (BH3-22) for QA/QC purposes.

A soil sample (BH1-22-AU2) was submitted for pH analysis.

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.

4.7 Residue Management

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

4.8 Elevation Surveying

Boreholes were surveyed at geodetic elevations by Paterson personnel.

4.9 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 topsoil, followed by till and underlain by limestone bedrock. Bedrock was encountered at depths ranging from approximately 0.56 to 0.74 m below grade. Bedrock was cored to a maximum depth of 9.12m below grade.

Groundwater was encountered within the overburden at depths ranging from approximately 3.11 to 5.71 mbgs.

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 January 27, 2022 using an electronic water level meter. Groundwater levels are summarized below in Table 4.

TABLE 3: Groundwater Level Measurements

Borehole Location	Ground Surface Elevation (m)	Water Level Depth (m below grade)	Water Level Elevation (m ASL)	Date of Measurement
BH1-22	69.81	3.12	66.69	January 27, 2022
BH2-22	69.84	5.71	64.13	January 27, 2022
BH3-22	69.69	3.11	66.58	January 27, 2022

Based on the groundwater elevations measured during the sampling events, groundwater contour mapping was completed. Groundwater contours are shown on Drawing PE5433-3.

Based on the contour mapping, groundwater flow at the subject site is in a northerly direction. A horizontal hydraulic gradient of approximately 0.34m/m was calculated.

5.3 Fine-Coarse Soil Texture

A grain-size analysis was not conducted. Based on field observations, the coarse-grained soil standards were applied to the Phase II Property, as the site soils consisted of sand.

5.4 Groundwater Quality

Groundwater samples from monitoring wells installed in BH1-22 through BH3-22 were submitted for laboratory analysis of BTEX and PHC (fractions, F1-F4). A duplicate sample was analysed for BTEX only. The groundwater samples were obtained from the screened intervals noted in Table 2. The results of the analytical testing are presented in Table 5. The laboratory certificates of analysis are provided in Appendix 1.

TABLE 4: Analytical Test Results – Groundwater
BTEX and PHCs

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)				MECP Table 7 Standards (µg/L)
		January 27, 2022				
		BH1-22	BH2-22	BH3-22	DUP	
Benzene	0.5	nd	nd	nd	nd	0.5
Toluene	0.5	nd	nd	nd	nd	320
Ethylbenzene	0.5	nd	nd	nd	nd	54
Xylenes	0.5	nd	nd	nd	nd	72
PHC F_1	25	nd	nd	nd	NA	420
PHC F_2	100	nd	nd	nd	NA	150
PHC F_3	100	nd	nd	nd	NA	500
PHC F_4	100	nd	nd	nd	NA	500

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

No detectable BTEX or PHC concentrations were identified in the groundwater samples analyzed. The groundwater results comply with the MECP Table 7 Standards.

The analytical test results are presented on Drawing PE5433-4–Analytical Testing Plan – Groundwater.

5.5 Quality Assurance and Quality Control Results

All samples submitted as part of the January 2022 sampling event 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 groundwater sample (DUP) was obtained from BH3-22 and analyzed for BTEX. Test results for the duplicate groundwater sample were below the laboratory detection limit.

Based on the analytical laboratory results, it is our opinion that the overall quality of the field data collected during this Phase II-ESA is considered to be sufficient to meet the overall objectives of this assessment.

5.6 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 results of the Phase I ESA completed for the subject site, one off-site PCA was identified as the resultant APEC, which is summarized in the table below, along with their respective locations and contaminants of potential concern (CPCs).

Table 5: Potentially Contaminating Activities and Areas of Potential Environmental Concern

Area of Potential Environmental Concern	Location of Area of Potential Environmental Concern	Potentially Contaminating Activity	Location of PCA (on-site or off-site)	Contaminants of Potential Concern	Media Potentially Impacted (Groundwater, Soil, and/or Sediment)
APEC 1: Resulting from a historical oil spill at the adjacent property to the east	Northeastern portion of the Phase I ESA Property	PCA 28 – Gasoline and Associated Products Storage in Fixed Tanks	Off-site	BTEX PHCs (F_1-F_4)	Groundwater

Contaminants of Potential Concern

Contaminants of potential concern (CPCs) in groundwater at the Phase II Property include benzene, toluene, ethylbenzene, and xylenes (BTEX) and petroleum hydrocarbons (PHCs, F1-F4).

Physical Setting

Site Stratigraphy

The site stratigraphy, from ground surface to the deepest aquifer or aquitard investigated, is illustrated on Drawing PE5433-4A. The stratigraphy consists of:

- Topsoil was encountered in all of the boreholes, extending to depths of approximately 0.28 to 0.33 mbgs.
- Glacial till consisting of silty sand with some gravel was encountered in all of the boreholes, extending to depths of approximately 0.56 to 0.74 mbgs.
- Limestone bedrock was encountered beneath the overburden at each of the borehole locations. The boreholes were terminated in this layer at depths ranging from approximately 7.67 to 9.12 mbgs. Groundwater was encountered in this stratigraphic unit.

Hydrogeological Characteristics

Groundwater at the Phase II ESA Property was encountered in the bedrock. During the most recent groundwater monitoring event, groundwater flow was measured in a northerly direction, with a hydraulic gradient of 0.34 m/m. Groundwater contours are shown on Drawing PE5433-3 – Test Hole Location Plan.

Approximate Depth to Bedrock

Bedrock was encountered during the drilling program at depths ranging from approximately 0.56 to 0.74 mbgs.

Approximate Depth to Water Table

The depth to the water table at the Phase II Property varies between approximately 3.1 and 5.7 m below existing grade.

Sections 35, 41 and 43.1 of the Regulation

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

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, and the pH value for surface soil is 7.60.

Section 43.1 of the Regulation does apply to the Phase II Property as bedrock is located less than 2 m below ground surface. However, the Phase II Property is not located within 30m of a water body.

Existing Buildings and Structures

The Phase II ESA Property is currently occupied by a two-storey dwelling which was constructed prior to 1928. An addition was built on the southern end of the dwelling circa 2005. The exterior is finished in vinyl siding with a sloped shingle style roof. The dwelling is heated by a natural gas-fired furnace.

A private garage is situated to the east of the dwelling, while a small temporary shed structure is present on the south – central portion of the property. Both structures are finished with wood siding and a flat shingled style roof.

Subsurface Structures and Utilities

Other than the basement beneath the subject building, there are no subsurface structure at the Phase II Property. Underground utilities at the Phase II Property include electricity, natural gas and municipal water and sewer utilities that enter the Phase II ESA Property from Lower Byron Avenue.

Based on the findings of the Phase II ESA, underground utilities are not considered to have contributed to contaminant distribution and transport at the Phase II Property.

Areas of Natural Significance

There are no areas of natural significance within the 250m study area.

Water Bodies

There are no natural water bodies within 250m of the Phase II Property.

Environmental Condition

Areas Where Contaminants are Present

Based on the analytical results, there are no contaminants present on or beneath the Phase II Property.

Types of Contaminants

There are no contaminants on or beneath the Phase II Property.

Contaminated Media

There is no contaminated media on the Phase II Property.

What Is Known About Areas Where Contaminants Are Present

Based on the findings of the Phase II ESA, there are no contaminants on the Phase II Property.

Distribution and Migration of Contaminants

Based on the findings of the Phase II ESA, distribution and migration of contaminants are not considered to have occurred on the Phase II ESA Property.

Discharge of Contaminants

Based on the findings of the Phase II ESA, contaminants are not considered to have been discharged to the Phase II Property.

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 analytical results contaminant distribution is not considered to have occurred on the Phase II ESA Property.

Potential for Vapour Intrusion

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

6.0 CONCLUSIONS

Assessment

A Phase II ESA was conducted for the property addressed 522 Lower Byron Avenue, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address an off-site potentially contaminating activity (PCA) that was identified during the Phase I ESA and considered to result in an area of potential environmental concern (APEC) on the northeastern portion of the Phase II ESA Property. Groundwater was identified as the potentially impacted media.

The subsurface investigation consisted of drilling three (3) boreholes, all of which were cored into the bedrock and instrumented with groundwater monitoring wells. The general soil profile encountered during the field program consisted of topsoil, followed by glacial till consisting of silty sand and gravel, underlain by limestone bedrock.

Groundwater samples from monitoring wells BH1-22, BH2-22 and BH3-22 were collected during the January 27, 2022 sampling event. No free product or petroleum hydrocarbon sheen was noted on the purge water during the groundwater sampling events.

Three (3) groundwater samples were analyzed for BTEX and PHCs (fractions, F1-F4). A duplicate sample was also analysed for BTEX parameters. No detectable BTEX or PHC concentrations were identified in any of the groundwater samples analyzed. The groundwater results comply with the MECP Table 7 Standards.

Based on the analytical results of the Phase II ESA, no further environmental investigation is recommended at this time.

Recommendations

If the monitoring wells installed on the Phase II ESA Property are not going to be used in the future, or will be destroyed during site redevelopment, they should be abandoned according to Ontario Regulation 903. The wells will be registered with the MECP under this regulation.

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 (reaffirmed 2016). 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 SerCo Realty Group. Notification from SerCo Realty Group and Paterson Group will be required to release this report to any other party.

Paterson Group Inc.

Mandy Witteman, B.Eng., M.A.Sc.

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

Report Distribution:

- SerCo Realty Group
- Paterson Group

FIGURES

Figure 1 - Key Plan

Drawing PE5433-3 – Test Hole Location Plan

Drawing PE5433-4 – Analytical Testing Plan – Groundwater

Drawing PE5433-4A – Cross-section A – A' – Groundwater

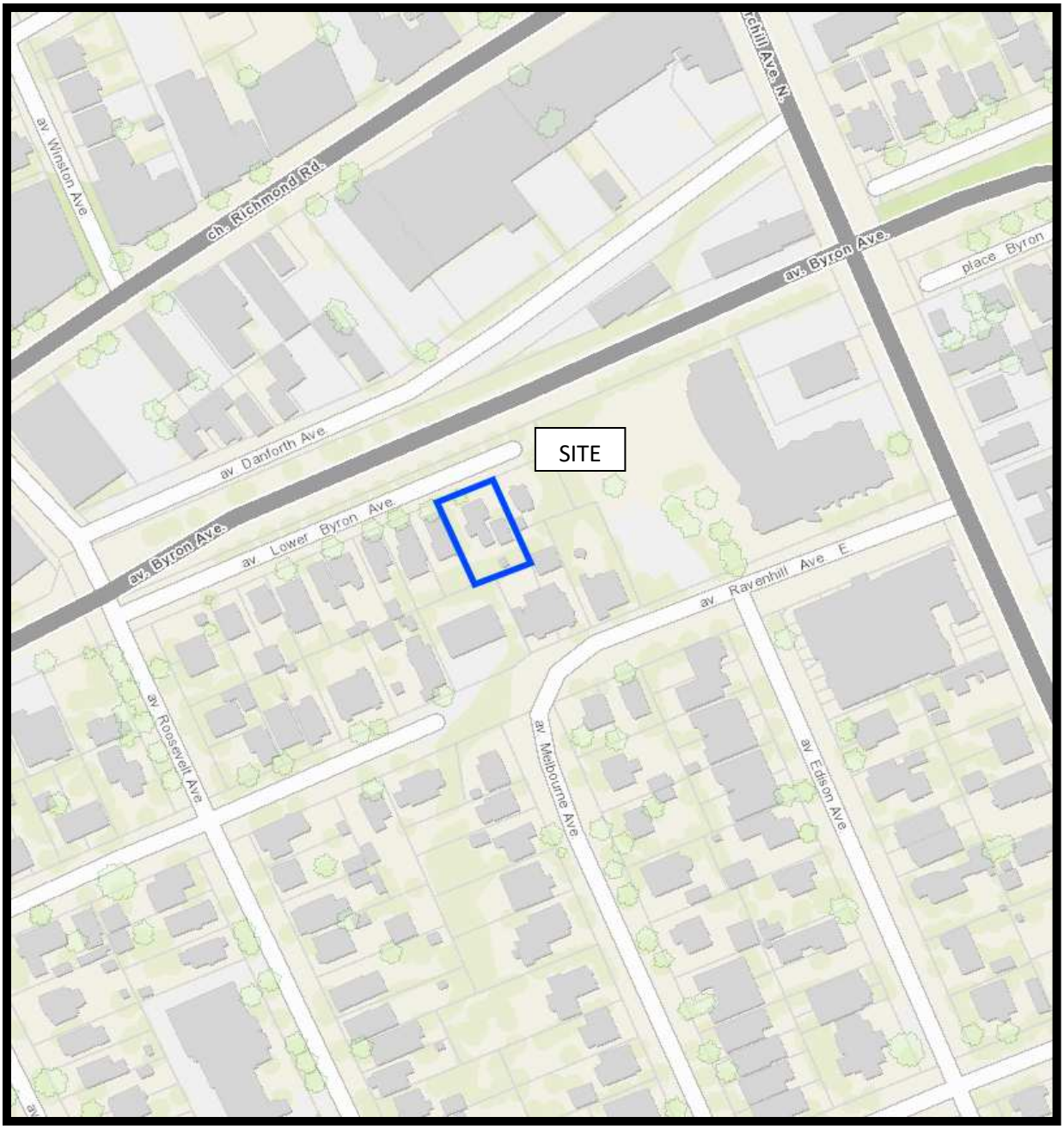
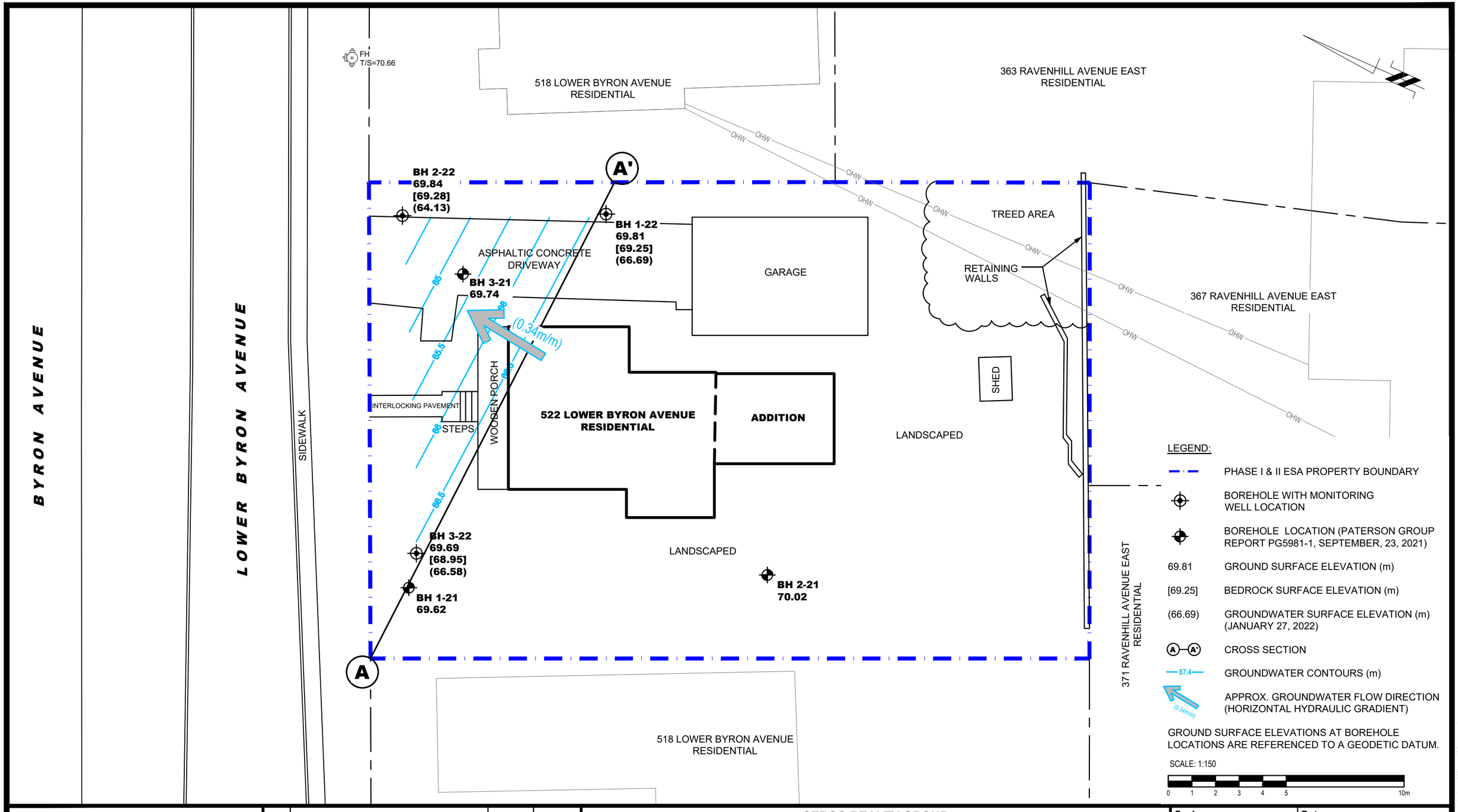


FIGURE 1

KEY PLAN



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NO.	REVISIONS	DATE	INITIAL

SERCO REALTY GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSEMENT

522 LOWER BYRON AVENUE

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:150	Date: 02/2022
Drawn by: YA	Report No.: PE5433-2
Checked by: MW	Dwg. No.: PE5433-3
Approved by: KM	Revision No.:

11x17

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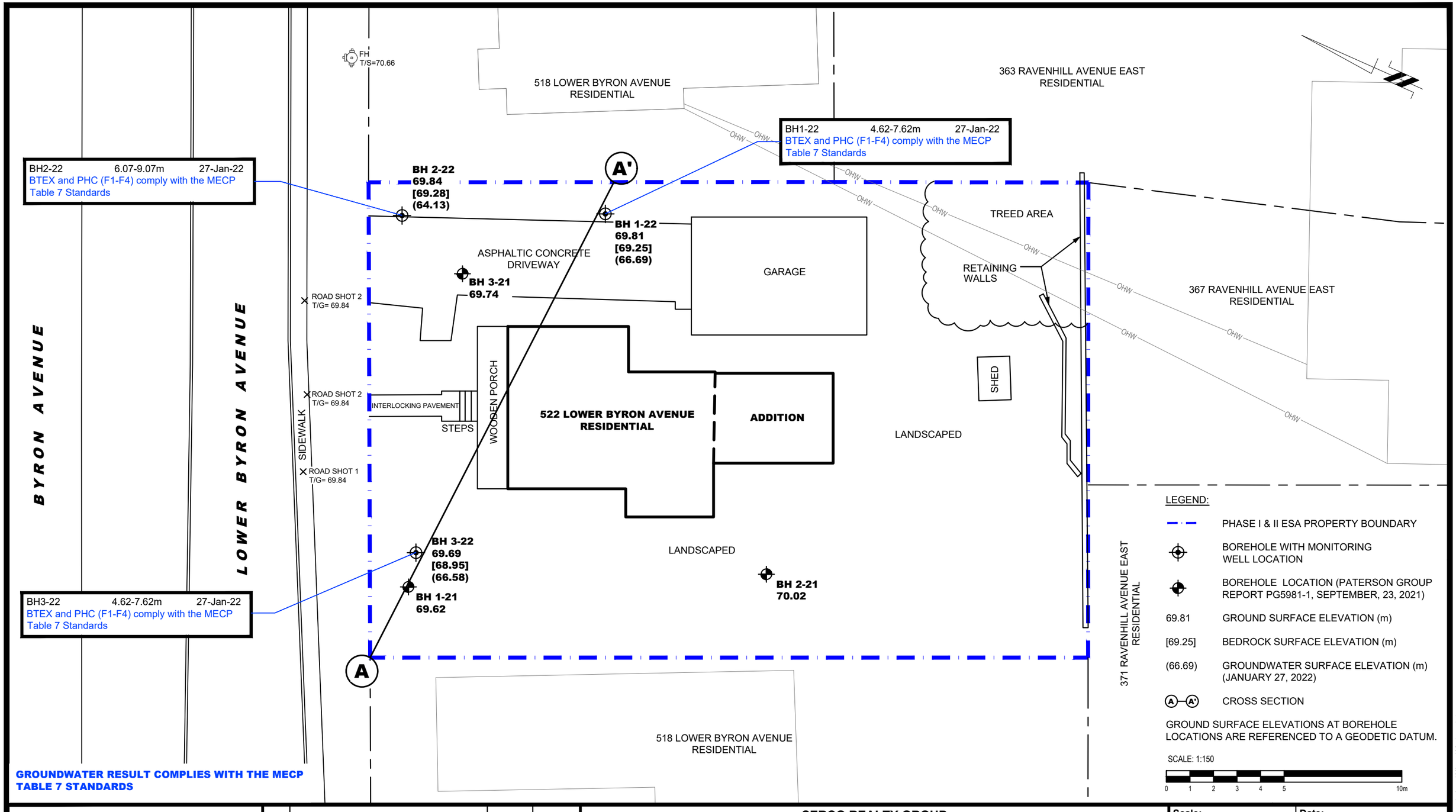

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NO.	REVISIONS	DATE	INITIAL

SERCO REALTY GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSEMENT
522 LOWER BYRON AVENUE
OTTAWA, ONTARIO

Title:
ANALYTICAL TESTING PLAN - GROUNDWATER (BTEX, PHCs)

Scale: 1:150	Date: 02/2022
Drawn by: YA	Report No.: PE5433-2
Checked by: MW	Dwg. No.: PE5433-4
Approved by: KM	Revision No.:

11x17

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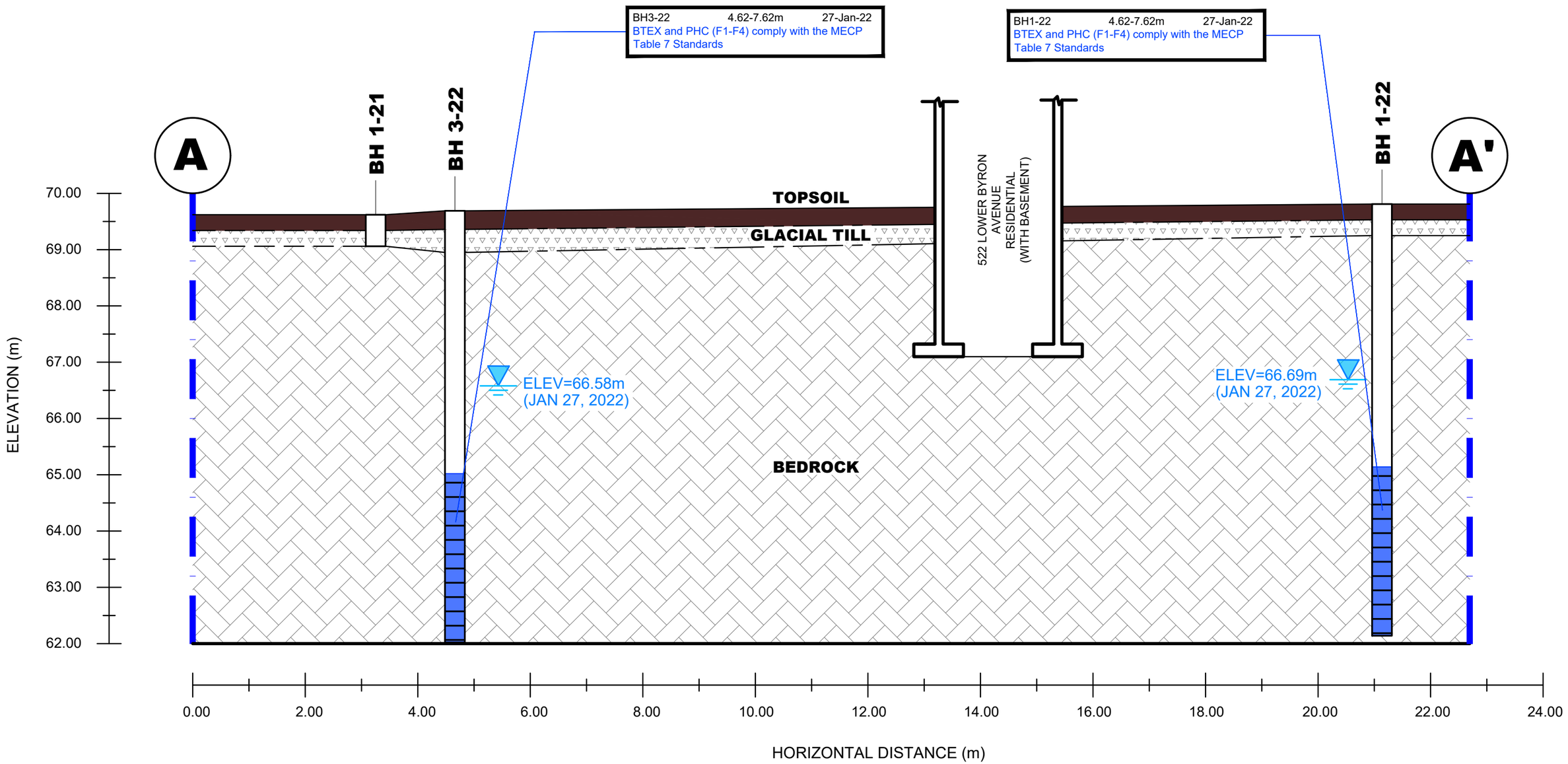

GROUNDWATER RESULT COMPLIES WITH THE MECP TABLE 7 STANDARDS

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NO.	REVISIONS	DATE	INITIAL

SERCO REALTY GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSEMENT

522 LOWER BYRON AVENUE

OTTAWA, ONTARIO

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

Scale: AS SHOWN	Date: 02/2022
Drawn by: YA	Report No.: PE5433-2
Checked by: MW	Dwg. No.: PE5433-4A
Approved by: KM	Revision No.:

11x17

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APPENDIX 1

SAMPLING AND ANALYSIS PLAN

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

LABORATORY CERTIFICATES OF ANALYSIS

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Paterson Group Inc.

Consulting Engineers
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patersongroup

Sampling & Analysis Plan

Phase II Environmental Site Assessment
522 Lower Byron Avenue
Ottawa, Ontario

Prepared For

SerCo Realty Group

January 2022

Report: PE5433-SAP

TABLE OF CONTENTS

1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by Ms. Loredana Porcari, with SerCo Realty Group, to conduct a Phase II Environmental Site Assessment (ESA) for the Phase II ESA Property addressed 522 Lower Byron Avenue, Ottawa, Ontario. Based on the findings of the Phase I ESA conducted by Paterson, dated January 2022, a subsurface investigation program consisting of borehole drilling was developed.

Borehole	Location & Rationale	Proposed Depth & Rationale
BH1-22	Assess groundwater conditions within APEC 1, on the eastern portion of the Phase II Property.	Auger to bedrock surface and core into bedrock to approximate depth of 13 mbgs to intercept water table. Complete boreholes with monitoring well installations.
BH2-22	Assess groundwater conditions within APEC 1 on the eastern portion of the Phase II Property.	
BH3-22	Place on the western portion of the Phase II Property so as to triangulate groundwater flow direction.	

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

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

2.0 ANALYTICAL TESTING PROGRAM

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

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

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

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

3.0 STANDARD OPERATING PROCEDURES

3.1 Environmental Drilling Procedure

Purpose

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

Equipment

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

- ❒ glass soil sample jars
- ❒ two buckets
- ❒ cleaning brush (toilet brush works well)
- ❒ dish detergent
- ❒ methyl hydrate
- ❒ water (if not available on site - water jugs available in 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 should be measured using a measuring tape or wheel rather than paced off. Elevations were surveyed at geodetic elevations by Paterson personnel.

Drilling Procedure

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

- ❒ Continuous split spoon samples (every 0.6 m or 2') or semi-continuous (every 0.76 m or 2'6") are required.

- ❒ Make sure samples are well sealed in plastic bags with no holes prior to screening and are kept cool but unfrozen.
- ❒ If sampling for VOCs, BTEX, or PHCs F1, a soil core from each soil sample which may be 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" [1.52 m x 50 mm] threaded sections of Schedule 40 PVC slotted well screen (5' x 1 ¼" [1.52 m x 32 mm] if installing in cored hole in bedrock)
- ❒ 5' x 2" [1.52 m x 50 mm] threaded sections of Schedule 40 PVC riser pipe (5' x 1 ¼" [1.52 m x 32 mm] if installing in 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 (0.5 x) the laboratory detection limit.

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

These considerations are discussed in the body of the report.

6.0 PHYSICAL IMPEDIMENTS TO SAMPLING & ANALYSIS PLAN

Physical impediments to the Sampling and Analysis plan may include:

- ❒ The location of underground utilities
- ❒ Poor recovery of split-spoon soil samples
- ❒ Insufficient groundwater volume for groundwater samples
- ❒ Breakage of sampling containers following sampling or while in transit to the laboratory
- ❒ Elevated detection limits due to matrix interference (generally related to soil colour or presence of organic material)
- ❒ Elevated detection limits due to high concentrations of certain parameters, necessitating dilution of samples in 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
522 Lower Byron Avenue
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE5433

REMARKS

HOLE NO. BH 1-22

BORINGS BY CME-55 Low Clearance Drill **DATE** January 19, 2022

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	69.81
TOPSOIL 0.28		AU	1				
GLACIAL TILL: Dense, brown silty sand with gravel 0.56		AU	2				
BEDROCK: Very poor to poor quality, grey limestone		RC	1	85	23	1	68.81
- good to excellent quality by 1.6m depth		RC	2	98	87	2	67.81
		RC	3	100	100	3	66.81
		RC	4	97	80	4	65.81
		RC	5	100	95	5	64.81
						6	63.81
						7	62.81
7.67 End of Borehole							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
522 Lower Byron Avenue
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE5433

REMARKS

HOLE NO. BH 2-22

BORINGS BY CME-55 Low Clearance Drill **DATE** January 19, 2022

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	69.84
TOPSOIL 0.30		AU	1				
GLACIAL TILL: Dense, brown silty sand with gravel 0.56		AU	2				
		RC	1	87	50	1	68.84
BEDROCK: Fair quality, grey limestone		RC	2	100	68	2	67.84
- excellent quality by 3.0m depth		RC	3	100	100	3	66.84
		RC	4	98	93	4	65.84
		RC	5	97	85	5	64.84
		RC	6	100	100	6	63.84
9.12 End of Borehole						7	62.84
						8	61.84
						9	60.84

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.

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SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
522 Lower Byron Avenue
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE5433

REMARKS

HOLE NO. BH 3-22

BORINGS BY CME-55 Low Clearance Drill **DATE** January 20, 2022

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	69.69
TOPSOIL 0.33		AU	1				
GLACIAL TILL: Dense, brown silty sand with gravel 0.74		AU	2			1	68.69
		RC	1	74	0		
BEDROCK: Very poor quality, grey limestone						2	67.69
- good to excellent quality by 1.6m depth		RC	2	100	82		
						3	66.69
		RC	3	100	100		
						4	65.69
						5	64.69
		RC	4	98	93		
						6	63.69
		RC	5	98	97	7	62.69
7.67 End of Borehole							

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.

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

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

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

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

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

CONSOLIDATION TEST

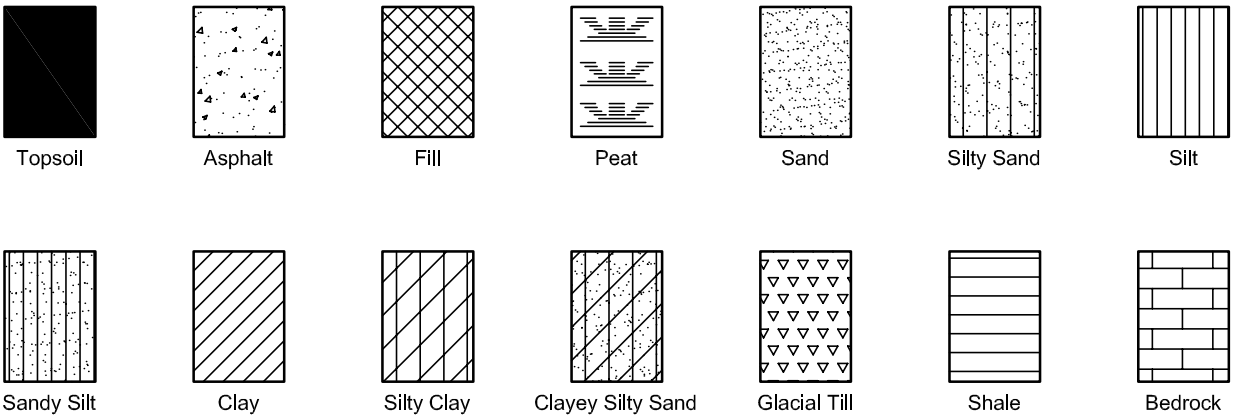
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

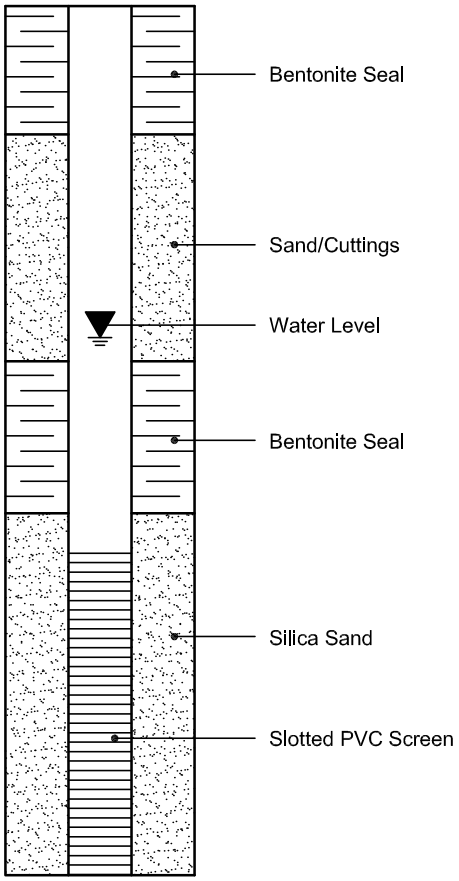
SYMBOLS AND TERMS (continued)

STRATA PLOT

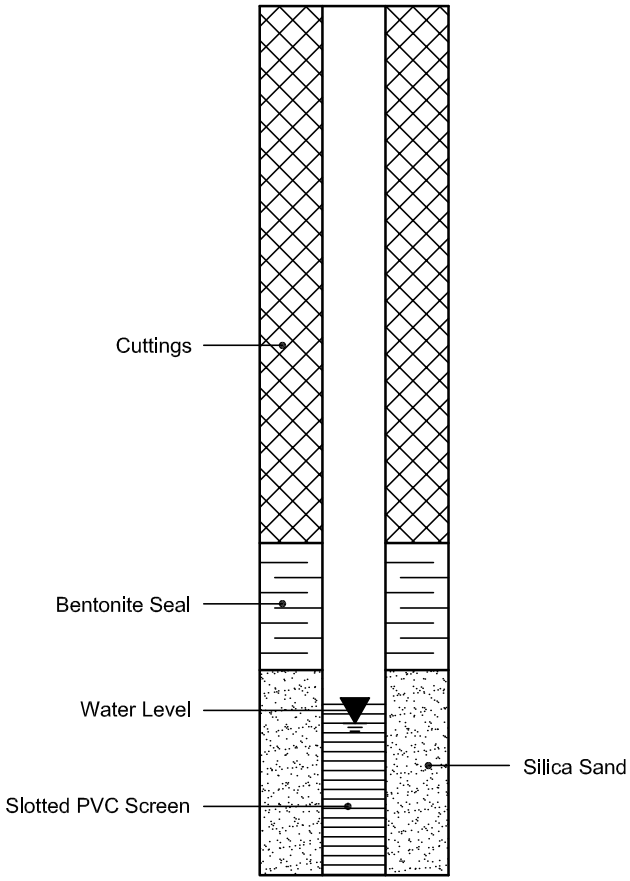


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Scott Dennis

Client PO: 32734
Project: PG5981
Custody:

Report Date: 30-Sep-2021
Order Date: 24-Sep-2021

Order #: 2139523

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

Paracel ID	Client ID
2139523-01	BH1-21 AU2

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 30-Sep-2021

Client: Paterson Group Consulting Engineers

Order Date: 24-Sep-2021

Client PO: 32734

Project Description: PG5981

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC, water extraction	28-Sep-21	28-Sep-21
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	25-Sep-21	25-Sep-21
Resistivity	EPA 120.1 - probe, water extraction	27-Sep-21	28-Sep-21
Solids, %	Gravimetric, calculation	24-Sep-21	27-Sep-21

Certificate of Analysis

Report Date: 30-Sep-2021

Client: Paterson Group Consulting Engineers

Order Date: 24-Sep-2021

Client PO: 32734

Project Description: PG5981

	Client ID:	BH1-21 AU2	-	-	-
	Sample Date:	23-Sep-21 09:00	-	-	-
	Sample ID:	2139523-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	97.8	-	-	-
General Inorganics					
pH	0.05 pH Units	7.60	-	-	-
Resistivity	0.10 Ohm.m	63.9	-	-	-
Anions					
Chloride	5 ug/g dry	18	-	-	-
Sulphate	5 ug/g dry	22	-	-	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 32734

Report Date: 30-Sep-2021

Order Date: 24-Sep-2021

Project Description: PG5981

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	5	ug/g						
Sulphate	ND	5	ug/g						
General Inorganics									
Resistivity	ND	0.10	Ohm.m						

Certificate of Analysis

Report Date: 30-Sep-2021

Client: Paterson Group Consulting Engineers

Order Date: 24-Sep-2021

Client PO: 32734

Project Description: PG5981

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	13.3	5	ug/g dry	13.1			1.8	20	
Sulphate	5.31	5	ug/g dry	ND			NC	20	
General Inorganics									
pH	7.75	0.05	pH Units	7.77			0.3	2.3	
Resistivity	89.4	0.10	Ohm.m	88.6			0.9	20	
Physical Characteristics									
% Solids	75.9	0.1	% by Wt.	73.9			2.8	25	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	105	5	ug/g	13.1	91.5	82-118			
Sulphate	97.7	5	ug/g	ND	97.7	80-120			

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.

PARACEL LABORATORIES LTD.

Paracel ID: 2139523

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

Client Name: Paterson Group	Project Ref: PG5981	Page __ of __
Contact Name: Scott Dennis	Quote #:	**Turnaround Time**
Address: 154 Colonnade Road, Ottawa	PO #: 32734	☐ 1 day ☐ 3 day
	E-mail: Sdennis@patersongroup.ca	☐ 2 day ☒ Regular
Telephone: 613-226-7381		Date Required:

☐ REG 153/04 ☐ REG 406/19

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

Other Regulation

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

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

Required Analysis

	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)	Chloride	Sulphate	Resistivity	PH	
1	BH1-21 AU2	S			SEPT 23, 2021									X	X	X	X	
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		

Comments:

Method of Delivery: Dropped

Relinquished By (Sign):	Received By Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): Puneet Bandi	Date/Time:	Date/Time: Sep 24, 2021 1800	Date/Time: Sept 24/21
Date/Time:	Temperature: °C	Temperature: 12.3	pH Verified: ☐ By:

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

Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Karyn Munch

Client PO: 33640
Project: PE5433
Custody: 64475

Report Date: 31-Jan-2022
Order Date: 27-Jan-2022

Order #: 2205477

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

Paracel ID	Client ID
2205477-01	BH1-22
2205477-02	BH2-22
2205477-03	BH3-22
2205477-04	DUP

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 33640

Report Date: 31-Jan-2022

Order Date: 27-Jan-2022

Project Description: PE5433

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	28-Jan-22	28-Jan-22
PHC F1	CWS Tier 1 - P&T GC-FID	28-Jan-22	28-Jan-22
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	28-Jan-22	29-Jan-22

Certificate of Analysis

Report Date: 31-Jan-2022

Client: Paterson Group Consulting Engineers

Order Date: 27-Jan-2022

Client PO: 33640

Project Description: PE5433

	Client ID:	BH1-22	BH2-22	BH3-22	DUP
	Sample Date:	27-Jan-22 09:00	27-Jan-22 09:00	27-Jan-22 09:00	27-Jan-22 09:00
	Sample ID:	2205477-01	2205477-02	2205477-03	2205477-04
	MDL/Units	Water	Water	Water	Water
Volatiles					
Benzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Toluene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
m,p-Xylenes	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
o-Xylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Xylenes, total	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Toluene-d8	Surrogate	84.3%	87.3%	84.6%	84.8%
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	<25	<25	-
F2 PHCs (C10-C16)	100 ug/L	<100	<100	<100	-
F3 PHCs (C16-C34)	100 ug/L	<100	<100	<100	-
F4 PHCs (C34-C50)	100 ug/L	<100	<100	<100	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 33640

Report Date: 31-Jan-2022

Order Date: 27-Jan-2022

Project Description: PE5433

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
Volatiles									
Benzene	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: Toluene-d8	*71.4*		*ug/L*		*89.3*	*50-140*			

Certificate of Analysis

Report Date: 31-Jan-2022

Client: Paterson Group Consulting Engineers

Order Date: 27-Jan-2022

Client PO: 33640

Project Description: PE5433

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND			NC	30	
Volatiles									
Benzene	ND	0.5	ug/L	ND			NC	30	
Ethylbenzene	ND	0.5	ug/L	ND			NC	30	
Toluene	ND	0.5	ug/L	ND			NC	30	
m,p-Xylenes	ND	0.5	ug/L	ND			NC	30	
o-Xylene	ND	0.5	ug/L	ND			NC	30	
Surrogate: Toluene-d8	*67.7*		*ug/L*		*84.7*	*50-140*			

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 33640

Report Date: 31-Jan-2022

Order Date: 27-Jan-2022

Project Description: PE5433

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	2020	25	ug/L	ND	101	68-117			
F2 PHCs (C10-C16)	1140	100	ug/L	ND	71.2	60-140			
F3 PHCs (C16-C34)	3180	100	ug/L	ND	81.2	60-140			
F4 PHCs (C34-C50)	2560	100	ug/L	ND	103	60-140			
Volatiles									
Benzene	32.1	0.5	ug/L	ND	80.2	60-130			
Ethylbenzene	28.4	0.5	ug/L	ND	71.0	60-130			
Toluene	35.0	0.5	ug/L	ND	87.4	60-130			
m,p-Xylenes	53.1	0.5	ug/L	ND	66.4	60-130			
o-Xylene	32.8	0.5	ug/L	ND	82.0	60-130			
Surrogate: Toluene-d8	*58.4*		*ug/L*		*73.0*	*50-140*			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

CCME PHC additional information:

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

PARACEL LABORATORIES LTD.

Paracel ID: 2205477

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2205477	Nº 64475

Client Name: Paterson
Contact Name: Karyn Munch
Address: 154 Colonnade
Telephone: 613 226 7381

Project Ref: PE 5433
Quote #:
PO #: 33640
E-mail: KMunch@Patersongroup.ca

Page __ of __

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

☒ REG 153/04 ☐ REG 406/19

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

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

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

Required Analysis

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	PHC's F1-F4 + BTEX	F1 + BTEX
1	BH1-22	GW		3	Jan 27 2022		✓	
2	BH2-22			3			✓	
3	BH3-22			3			✓	
4	Dup			2				✓
5								
6								
7								
8								
9								
10								

Comments:

Method of Delivery: Paracel Courier

Relinquished By (Sign): GPat	Received By Driver/Depot: T. Stone	Received at Lab: Shreeram Dokmai	Verified By: BS
Relinquished By (Print): Grant Paterson	Date/Time: 27/01/22 3:01	Date/Time: Jan 27, 2022 04:18	Date/Time: Jan 27, 22 16:47
Date/Time: Jan 27 2022	Temperature: °C FH	Temperature: 15.8 °C	pH Verified: ☐ By: