PATERSON GROUP

Phase II Environmental Site Assessment

4386 Rideau Valley Drive

Ottawa, Ontario

Prepared for Uniform Urban Developments

Report PE5295-2R2 dated April 9, 2024

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Assessment

A Phase II ESA was conducted for 4386 Rideau Valley Drive, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address three potentially contaminating activities (PCAs) that were identified during the Phase I ESA and were considered to result in areas of potential environmental concern (APECs) on the Phase II Property. The subsurface investigation consisted of drilling twelve boreholes, four of which were completed as groundwater monitoring wells.

Soil samples were obtained from the boreholes and screened using visual observations and organic vapour measurements. Six soil samples including one duplicate sample were submitted for laboratory analysis of petroleum hydrocarbons (PHCs) and benzene, toluene, ethylbenzene, xylene (BTEX). All PHC and BTEX concentrations identified in the soil samples were in compliance with MECP Table 2 Standards.

Four groundwater samples including one duplicate were obtained from the monitoring wells installed in BH8-21, BH9-21, BH10-21 and BH11-21 and were analyzed for PHCs, BTEX and VOCs. All PHC, BTEX and VOC concentrations in the groundwater samples analyzed were non-detect and therefore in compliance with the MECP Table 2 Standards.

Recommendations

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

1.0 INTRODUCTION

At the request of Urban Uniform Developments, Paterson Group (Paterson) conducted a Phase II Environmental Site Assessment for 4386 Rideau Valley Drive, in the City of Ottawa, Ontario. The purpose of this Phase II ESA has been to address three areas of potential environmental concern (APECs) identified on the Phase II Property, during the Phase I ESA conducted by Paterson in May 2021.

1.1 Site Description

Address:	4386 Rideau Valley Drive, Ottawa, Ontario
Legal Description:	Part of Lot 1, Concessions 1 and 2, Geographic Township of Nepean, in the City of Ottawa Ontario.
Location:	The subject site is located on the west side of Rideau Valley Drive, in the northwest quadrant of the Rideau Valley Drive and Bankfield Road intersection.
Latitude and Longitude:	45° 13' 43.99" N, 75° 41' 26.4" W

Site Description:

Configuration:	Irregular
Site Area:	14 ha (approximately)

1.2 Property Ownership

Paterson was engaged to conduct this Phase II ESA by Mr. Ryan MacDougal of Uniform Urban Developments, whose offices are located at 117 Centrepoint Drive, Suite 300 in Ottawa, Ontario.

1.3 Current and Proposed Future Uses

The Phase I – Property consists primarily of agricultural fields with a farmhouse and associated outbuildings located in the southeastern portion of the property. It is our understanding that the subject site is to be developed for residential purposes.

1.4 Applicable Site Condition Standard

The site condition standards for the property were obtained from Table 2 of the document entitled “Soil, Ground Water and Sediment Standards for Use Under Part

XV.1 of the Environmental Protection Act", prepared by the Ministry of the Environment, Conservation and Parks (MECP), April 2011. The MECP selected Table 2 Standards are based on the following considerations:

- ❒ Coarse-grained soil conditions
- ❒ Potable groundwater conditions
- ❒ Residential land use.

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

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The Phase II property is located in a mixed residential and agricultural area with the City of Ottawa Rideau Valley Depot located immediately north of the subject site. The subject site is located on the west side of Rideau Valley Drive, in the northwest quadrant of the Rideau Valley Drive and Bankfield Road intersection, in the City of Ottawa. The subject site is bounded to the east and south by Rideau Valley Drive and Bankfield Drive, respectively. The properties to the west of the subject site are occupied by residential dwellings that are part of a large subdivision.

The Phase II – Property slopes downward to the east towards the Rideau River. Site drainage consists primarily of surface infiltration, in addition to surface runoff towards ditches along Bankfield Road.

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The subsurface investigation was conducted through the interim of May 19 to May 20, 2021, as well as June 22 and June 25, 2021.

The field program consisted of drilling 12 boreholes, four of which were completed as groundwater monitoring wells. The boreholes were drilled to a maximum depth of 7.62 m below the existing grade.

3.2 Media Investigated

During the subsurface investigation, soil and groundwater samples were obtained with some samples submitted for laboratory analysis.

The rationale for sampling and analyzing these samples is based on the Contaminants of Potential Concern identified in the Phase I ESA.

3.3 Phase I Conceptual Site Model

Geological and Hydrogeological Setting

The Geological Survey of Canada website on the Urban Geology of the National Capital Area was consulted as part of this assessment. Based on the information from NRCAN, bedrock in the area of the subject site consists of dolostone of the Oxford Formation. Based on the maps, the surficial geology consists of offshore marine sediments of clay and silt with an overburden thickness ranging from 10 to 15 m.

Contaminants of Potential Concern

Based on the areas of potential environmental concern on the subject site, the Contaminants of Potential Concern (CPCs) on the Phase I Property consist of petroleum hydrocarbons (PHCs), benzene, toluene, ethylbenzene, and xylene (BTEX) and volatile organic compounds (VOCs).

Existing Buildings and Structures

The south-eastern portion of the Phase II – Property is occupied by a single-storey residential dwelling, private garage and four outbuildings.

Water Bodies

An unnamed creek runs north and east of the Phase I – Property and the Rideau River is the nearest named water body located approximately 82 m east of the subject site.

Areas of Natural Significance

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

Water Well Records

A search of the MECP's web site for all drilled well records within 250 m of the Phase I - Property was conducted on May 13, 2021. Based on the search results, no well records are documented for the Phase I - Property. Approximately 152 well records were identified in the Phase I Study Area and pertain to well abandonment records, monitoring well records and domestic wells drilled for the surrounding residential developments.

Based on the well records for the surrounding area, the subsurface profile consists primarily of native clay till overlaying limestone and interbedded sandstone bedrock. The bedrock was intercepted at an average depth of 15 m and groundwater was encountered at an average depth of 30 m.

Neighbouring Land Use

Neighbouring land use in the Phase I study area consists of residential, agricultural, and institutional properties. Surrounding land use is shown on Drawing PE5295-2 Surrounding Land Use Plan.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

Three APECs were identified on the Phase I – Property in the form of two on-site ASTs that had previously been used for fueling purposes and the Rideau Valley Depot works yard located on the adjacent property to the north.

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 are three APECs on the subject site. The presence of three APECs 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. No deviations from the sampling and analysis plan were identified during the Phase II ESA.

3.5 Impediments

No physical impediments were encountered during the Phase II ESA program.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation was conducted through the interim of May 19 to May 20, as well as June 22 and June 25, 2021. The field program consisted of the drilling of 12 boreholes on the Phase II Property, four of which were completed with monitoring well installations.

The boreholes were placed to address the aforementioned areas of potential environmental concern (APECs) and general coverage for geotechnical purposes.

The boreholes were drilled with a track-mounted drill rig, operated by George Downing Estate Drilling of Hawkesbury, Ontario, under the full-time supervision of Paterson personnel. Borehole locations are shown on Drawing PE5295-3 – Test Hole Location Plan appended to this report.

4.2 Soil Sampling

A total of 88 soil samples were obtained from the boreholes by means of sampling from shallow auger flights and split spoon sampling. The depths at which auger samples and split spoon samples were obtained from the boreholes are shown as "**AU**" and "**SS**" on the Soil Profile and Test Data Sheets, appended to this report.

Site soils generally consist of 0.30 m of topsoil underlain by silty clay and glacial till extending to a maximum depth of 7.62 m. Fill material was identified in BH8-21, extending to 1.07 m. The fill material consisted of reworked native material. Bedrock was not encountered during the subsurface investigation.

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 range from 0 to 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.

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

4.4 Groundwater Monitoring Well Installation

Four groundwater monitoring wells were installed on the Phase II Property as part of the current subsurface investigation.

The monitoring wells consisted of 50 mm diameter Schedule 40 threaded PVC risers and screens. Monitoring well construction details are listed below in Table 1 and are also presented on the Soil Profile and Test Data Sheets provided in Appendix 1.

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
BH8-21	91.32	6.70	3.10-6.10	2.70-6.10	0.0-3.10	Stick-up
BH9-21	90.52	6.70	3.10-6.10	2.70-6.10	0.0-3.10	Stick-up
BH10-21	86.33	6.80	3.80-6.80	3.0-6.80	0.3-3.0	Stick-up
BH11-12	86.42	6.70	3.70-6.70	3.0-6.70	0.3-3.0	Stick-up

4.5 Field Measurement of Water Quality Parameters

Groundwater sampling was conducted at BH8-21 and BH9-21 on May 26, 2021, and at BH10-21 and BH11-21 on June 28, 2021. No water quality parameters were measured in the field at that time, due to limited groundwater sample volume.

4.6 Groundwater Sampling

Groundwater sampling protocols were followed using the MECP document entitled “Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario,” dated May 1996. Groundwater samples were obtained from each monitoring well, using dedicated sampling equipment.

Standing water was purged from each well prior to sampling. Samples were stored in coolers to reduce analyte volatilization during transportation.

Details of our standard operating procedure for groundwater sampling are provided in the Sampling and Analysis Plan in Appendix 1.

4.7 Analytical Testing

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

Table 2: Soil Samples Submitted

Sample ID	Screened Interval/ Stratigraphic Unit	Parameter Analyzed		Rationale
		PHCs (F_1-F_4)	BTEX	
BH8-21-SS2	0.77 – 1.37 m Brown Silty Sand Fill	X	X	Assess potential impacts from APEC 1 (location of former AST)
BH8-21-SS8	5.34 – 5.94 m Native Glacial Till	X	X	Assess potential impacts from APEC 1 (location of former AST)
BH9-21-SS2	0.77 – 1.37 m Native Silty Clay	X	X	Assess potential impacts from APEC 2 (abandoned AST previously used to fuel farm equipment)
BH10-21-SS9	5.34 – 5.94 m Brown Silty Clay Native	X	X	Assess potential impacts from APEC 3 (City of Ottawa Rideau Valley Depot)
BH11-21-SS8	5.34 – 5.94 m Brown Silty Clay Native	X	X	Assess potential impacts from APEC 3 (City of Ottawa Rideau Valley Depot)
BH12-21-SS8	5.34 – 5.94 m Glacial Till Native	X	X	Assess potential impacts from APEC 3 (City of Ottawa Rideau Valley Depot)
BH13-21-SS9	5.34 – 5.94 m Brown Silty Clay Native	X	X	Duplicate sample

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

Table 3: Groundwater Samples Submitted

Sample ID	Screened Interval/ Stratigraphic Unit	Parameters Analyzed			Rationale
		VOCs	PHCs	BTEX	
BH8-21-GW1*	3.1-6.1 Native Glacial Till		X	X	Assess potential impacts from APEC 1 (location of former AST)
BH9–21-GW1	3.1-6.1 Native Glacial Till		X	X	Assess potential impacts from APEC 2 (abandoned AST previously used to fuel farm equipment)
BH13-21-SS9	3.80-6.80 Native Brown Silty Clay		X		Assess potential impacts from APEC 3 (City of Ottawa Rideau Valley Depot)
BH10-21-GW1	3.80-6.80 Native Brown Silty Clay	X	X		Assess potential impacts from APEC 3 (City of Ottawa Rideau Valley Depot)
BH11-21-	3.70-6.70	X	X		DUP

GW1	Native Brown Silty Clay				
* – Duplicate of BH10-21-GW1					

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

4.8 Residue Management

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

4.9 Elevation Surveying

Boreholes were surveyed to geodetic elevations by Paterson personnel.

4.10 Quality Assurance and Quality Control Measures

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

5.0 REVIEW AND EVALUATION

5.1 Geology

The soil profile primarily consists of 0.30 m of topsoil overlying 1.07 m of brown silty sand fill material (BH8-21), and/or glacial till with a brown silty sand matrix or brown silty clay, extending to a maximum depth of 7.62 m. The glacial till consisted of a coarse sand with cobbles, gravel, and boulders.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured during the groundwater sampling event on June 28, 2021, using an electronic water level meter. Groundwater levels are summarized below in Table 4.

Table 4: Groundwater Level Measurements				
Borehole Location	**Ground Surface Elevation (m)**	**Water Level Depth (m below grade)**	**Water Level Elevation (Asl)**	**Date of Measurement**
BH8-21	91.32	3.58	26.7	May 26, 2021
BH9-21	90.52	3.77	86.75	May 26, 2021
BH10-21	86.33	3.07	83.26	June 28, 2021
BH11-21	86.42	3.17	83.25	June 28, 2021

Based on the groundwater levels recorded, the groundwater appears to flow in a west/northwest direction.

5.3 Fine-Coarse Soil Texture

Based on the grain size distribution analysis that was completed for the subject site, the site soils are considered to be coarse grained.

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 visual or olfactory indications of potential contamination were identified in the soil samples at the time of the field program. The field screening results of each individual soil sample are provided on the Soil Profile, and Test Data Sheets appended to this report.

5.5 Soil Quality

Seven soil samples were submitted for analysis of BTEX and PHCs (F_1-F_4). The results of the analytical testing are presented below in Table 7. The laboratory certificates of analysis are provided in Appendix 1. Analytical test results are shown on Drawings PE5155-4 – Analytical Testing Plan-Soil (BTEX, PHCs).

Table 5: Analytical Test Results – Soil –BTEX and PHCs (F_1-F_4)									
Parameter	**MDL (µg/g)**	**Soil Samples (µg/g)**							**MECP Table 2 Residential Standards (µg/g)**
		May 21/2021			**June 22/2021**		**June 25/2021**		
		BH8-21-SS2	**BH8-21-SS8**	**BH9-21-SS2**	**BH10-21-SS9**	**BH13-21-SS9**	**BH11-21-SS8**	***BH12-21-SS8**	
Benzene	0.02	nd	nd	nd	nd	nd	nd	nd	0.21
Ethylbenzene	0.05	nd	nd	nd	nd	nd	nd	nd	1.1
Toluene	0.05	nd	nd	nd	nd	nd	nd	nd	2.3
Xylenes, total	0.05	nd	nd	nd	nd	nd	nd	nd	3.1

Table 5: Analytical Test Results – Soil –BTEX and PHCs (F_1-F_4)									
Parameter	**MDL (µg/g)**	**Soil Samples (µg/g)**							**MECP Table 2 Residential Standards (µg/g)**
		May 21/2021			**June 22/2021**		**June 25/2021**		
		BH8-21-SS2	**BH8-21-SS8**	**BH9-21-SS2**	**BH10-21-SS9**	**BH13-21-SS9**	**BH11-21-SS8**	***BH12-21-SS8**	
F1 PHCs (C6-C10)	7	nd	nd	nd	nd	nd	nd	nd	55
F2 PHCs (C10-C16)	4	nd	nd	nd	nd	nd	nd	nd	98
F3 PHCs (C16-C34)	8	nd	nd	nd	nd	nd	nd	nd	300
F4 PHCs (C34-C50)	6	nd	nd	nd	nd	nd	nd	nd	2800

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – Results exceed the selected MECP standards
- *Duplicate of BH10-21-SS9

All of the analyzed soil parameter results were non-detect and therefore in compliance wit the applicable MECP Table 2 standards.

5.6 Groundwater Quality

Groundwater samples from monitoring wells installed in BH8-21, BH9-21, BH10-21 and BH11-21 were submitted for laboratory analysis of VOCs and PHCs (F1-F4) and VOCs.

The groundwater samples were obtained from the screened intervals noted in Table 1. The results of the analytical testing are presented below in Tables 6 and 7. The laboratory certificate of analysis is provided in Appendix 1. Analytical test results are shown on PE5155- 5– Analytical Testing Plan – Groundwater.

Table 6: Analytical Test Results – Groundwater – PHCs (F_1-F_4) and BTEX						
Parameter	**MDL (µg/L)**	**Groundwater Samples (µg/L)**				**MECP Table 2 Residential Standards (µg/L)**
		May 26/2021		**June 28/2021**		
		BH8-21-GW1	**BH9-21-GW1**	**BH10-21-GW1**	**BH11-21-GW1**	
Benzene	0.5	nd	nd	N/A	N/A	5
Ethylbenzene	0.5	nd	nd	N/A	N/A	2.4
Toluene	0.5	nd	nd	N/A	N/A	24
Xylenes, total	0.5	nd	nd	N/A	N/A	300
F1 PHCs (C6-C10)	25	nd	nd	nd	nd	750
F2 PHCs (C10-C16)	100	nd	nd	nd	nd	150
F3 PHCs (C16-C34)	100	nd	nd	nd	nd	500
F4 PHCs (C34-C50)	100	nd	nd	nd	nd	500

Table 6: Analytical Test Results – Groundwater – PHCs (F_1-F_4) and BTEX						
Parameter	**MDL (µg/L)**	**Groundwater Samples (µg/L)**				**MECP Table 2 Residential Standards (µg/L)**
		May 26/2021		**June 28/2021**		
		BH8-21-GW1	**BH9-21-GW1**	**BH10-21-GW1**	**BH11-21-GW1**	
Notes: ▪ MDL – Method Detection Limit ▪ nd – not detected above the MDL ▪ **Bold and Underlined** – Results exceed the selected MECP standards ▪ **N/A** – Parameter not analyzed						

The analyzed PHC and BTEX concentrations were all non-detect and therefore in compliance with the applicable MECP Table 2 standards.

Table 7
Analytical Test Results – Groundwater
VOCs

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)		MECP Table 2 Residential Standards (µg/L)
		June 28/2021		
		BH10-21-GW1	BH11-21-GW1	
Acetone	5.0	nd	nd	2700
Benzene	0.5	nd	nd	5
Bromodichloromethane	0.5	nd	nd	16
Bromoform	0.5	nd	nd	25
Bromomethane	0.5	nd	nd	0.89
Carbon Tetrachloride	0.2	nd	nd	0.79
Chlorobenzene	0.5	nd	nd	30
Chloroform	0.5	nd	nd	2.4
Dibromochloromethane	0.5	nd	nd	25
Dichlorodifluoromethane	1.0	nd	nd	590
1,2-Dichlorobenzene	0.5	nd	nd	3
1,3-Dichlorobenzene	0.5	nd	nd	59
1,4-Dichlorobenzene	0.5	nd	nd	1
1,1-Dichloroethane	0.5	nd	nd	5
1,2-Dichlorethane	0.5	nd	nd	1.6
1,1-Dichloroethylene	0.5	nd	nd	1.6
Cis-1,2-Dichloroethylene	0.5	nd	nd	1.6
Trans-1,2-Dichloroethylene	0.5	nd	nd	1.6
1,2-Dichloropropane	0.5	nd	nd	5
Cis-1,3-Dichloropropylene	0.5	nd	nd	
Trans-1,3-Dichloropropylene	0.5	nd	nd	
1,3-Dichloropropene, Total	0.5	nd	nd	0.5
Ethylbenzene	0.5	nd	nd	2.4
Ethylene Dibromide	0.2	nd	nd	0.2
Hexane	1.0	nd	nd	51
Methyl Ethyl Ketone	5.0	nd	nd	1800
Methyl Isobutyl Ketone	5.0	nd	nd	640
Methyl Tert-Butyl Ether	2.0	nd	nd	15
Methylene Chloride	5.0	nd	nd	50
Styrene	0.5	nd	nd	5.4
1,1,1,2-Tetrachloroethane	0.5	nd	nd	1.1
1,1,2,2-Tetrachloroethane	0.5	nd	nd	1
Tetrachloroethylene	0.5	nd	nd	1.6
Toluene	0.5	nd	nd	24
1,1,1-Trichloroethane	0.5	nd	nd	200

1,1,2-Trichloroethane	0.5	nd	nd	4.7
Trichloroethylene	0.5	nd	nd	1.6
Trichlorofluoromethane	1.0	nd	nd	150
Vinyl Chloride	0.5	nd	nd	0.5
Xylenes	0.5	nd	nd	300

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – results exceed applicable MECP standards

The analyzed VOC concentrations were all non-detect and therefore in compliance wit the applicable MECP Table 2 standards.

5.7 Quality Assurance and Quality Control Results

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

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

As per the Sampling and Analysis Plan, a duplicate soil sample was obtained from sample BH10-21-SS9 and submitted for laboratory analysis of BTEX and PHC (F_1-F_4) parameters. No BTEX or PHC (F_1-F_4) concentrations were detected in the original or duplicate sample.

A duplicate groundwater sample was obtained from the monitoring well installed in BH1-21 and submitted for laboratory analysis of VOC parameters. No PHC (F_1-F_4) or VOC concentrations were detected in the original or duplicate sample.

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

5.8 Phase II Conceptual Site Model

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

Site Description

The Phase II Property is primarily occupied by agricultural fields with a residential dwelling, private garage and four outbuildings located in the southeastern portion of the property.

Potentially Contaminating Activity and Areas of Potential Environmental Concern

As indicated in the Phase I-ESA report and in Section 3.3 of this report, the following PCAs were considered to result in APECs on the Phase I/Phase II Property:

- Former AST
- Abandoned AST previously used to fuel farm equipment
- 'Rideau Valley Depot works yard

Contaminants of Potential Concern and Impacted Media

Contaminants of potential concern associated with the aforementioned PCAs include PHCs, BTEX and VOCs in the soil and groundwater.

Subsurface Structures and Utilities

Underground service locates were completed prior to the subsurface investigation. Underground utilities on the Phase II Property include private electrical and sewer services, a potable well and gas lines.

Physical Setting

Site Stratigraphy

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

- Topsoil with a thickness of 0.20 to 0.30 m.
- Fill material extended to a depth of 1.07 m in BH8-21 only.
- Native brown silty clay extended to depths ranging from 4.40 to 7.62 m.
- Glacial till extended to depths ranging from 6.70 to 7.47 m.

Hydrogeological Characteristics

Groundwater at the Phase II Property was encountered in the overburden material.

Water levels were measured at the subject site on May 26 and June 28, 2021, at depths ranging from 2.31 to 3.09 m below grade.

Based on the groundwater levels recorded, the groundwater appears to flow in a west/northwesterly direction towards the Rideau River.

Approximate Depth to Bedrock

Bedrock was not confirmed during the subsurface investigation, however, practical refusal was encountered on possible bedrock at depths of 15.16 m, 8.84 m and 4.4 m in boreholes BH3-21, BH5-21 and BH7-21.

Approximate Depth to Water Table

Depth to the water table at the subject site varies between approximately 2.31 to 3.09 m below the existing grade.

Sections 41 and 43.1 of the Regulation

Section 41 of the Regulation (Site Condition Standards, Environmentally Sensitive Areas) does not apply to the subject site.

Section 43.1 of the Regulation does not apply to the subject site in that the subject site is not a Shallow Soil Property.

Fill Placement

A surficial covering of topsoil overlying approximately native brown silty clay was identified throughout the majority of the subject site. Fill material consisting of brown silty sand and gravel, extending to a depth of 1.07 m was identified in BH8-21.

Proposed Buildings and Other Structures

It is our understanding that the subject site is to be redeveloped for residential purposes.

Areas of Natural Significance and Water Bodies

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

There are no water bodies on the subject property, or within the Phase I ESA study area.

Environmental Condition

Areas Where Contaminants are Present

No areas of contaminants were identified on the Phase II - Property.

Types of Contaminants

No contaminants were identified on the Phase II - Property.

Contaminated Media

No contaminants were identified on the Phase II - Property.

What Is Known About Areas Where Contaminants Are Present

No areas contaminants were identified on the Phase II - Property.

Distribution and Migration of Contaminants

Based on the findings of the Phase II ESA, no significant distribution and/or migration of contaminants is considered to have occurred.

Discharge of Contaminants

No contaminants were identified on the Phase II - Property.

Climatic and Meteorological Conditions

In general, climatic and meteorological conditions have the potential to affect contaminant distribution. Two ways by which climatic and meteorological conditions may affect contaminant distribution include the downward leaching of contaminants by means of the infiltration of precipitation, and the migration of contaminants via groundwater levels and/or flow, which may fluctuate seasonally. It is our opinion that climatic and meteorological conditions have not significantly influenced contaminant transport in the past.

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 4386 Rideau Valley Drive, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address three potentially contaminating activities (PCAs) that were identified during the Phase I ESA and were considered to result in areas of potential environmental concern (APECs) on the Phase II Property. The subsurface investigation consisted of drilling twelve boreholes, four of which were completed as groundwater monitoring wells.

Soil samples were obtained from the boreholes and screened using visual observations and organic vapour measurements. Six soil samples including one duplicate sample were submitted for laboratory analysis of petroleum hydrocarbons (PHCs) and benzene, toluene, ethylbenzene, xylene (BTEX). All PHC and BTEX concentrations identified in the soil samples were in compliance with MECP Table 2 Standards.

Four groundwater samples including one duplicate were obtained from the monitoring wells installed in BH8-21, BH9-21, BH10-21 and BH11-21 and were analyzed for PHCs, BTEX and VOCs. All PHC, BTEX and VOC concentrations in the groundwater samples analyzed were non-detect and therefore in compliance with the MECP Table 2 Standards.

Recommendations

Monitoring Wells

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

7.0 STATEMENT OF LIMITATIONS

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

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

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

This report was prepared for the sole use of Uniform Urban Developments. Notification from Uniform Urban Developments. and Paterson Group will be required to release this report to any other party.

Paterson Group Inc.

Joshua Dempsey, B.Sc.

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

Report Distribution:

- Uniform Urban Developments
- Paterson Group

FIGURES

FIGURE 1 – KEY PLAN

DRAWING PE5295-3R2 – TEST HOLE LOCATION PLAN

DRAWING PE5295-4R2– ANALYTICAL TESTING PLAN – SOIL (BTEX, PHCs)

DRAWING PE5295-5R2– ANALYTICAL TESTING PLAN – GROUNDWATER (BTEX, PHCs, VOCs)

DRAWING PE5295-4A, 5A– CROSS SECTION A-A' – SOIL AND GROUNDWATER (BTEX, PHCs, VOCs)

DRAWING PE5295-4B,5B– CROSS SECTION B-B' – SOIL AND GROUNDWATER (BTEX, PHCs, VOCs)

FIGURE 1

KEY PLAN

PARKLAND

5431 HILLTOP DRIVE
UNDEVELOPED LAND

RESIDENTIAL

RESIDENTIAL

RIDEAU RIVER

UNDEVELOPED LAND

UNDEVELOPED LAND

RESIDENTIAL

RESIDENTIAL

RIDEAU VALLEY DRIVE

ASPHALTIC CONCRETE DRIVEWAY

RESIDENTIAL DWELLING

TREED AREA

AREA OF SEPTIC TANK & FIELD

RESIDENTIAL

STORM DRAINAGE
86.09

CURB
86.75

FH
T/G = 88.05

MH 1
T/G = 87.18

B'

BH 10-21
86.33
{84.02}

BH 11-21
86.42
{84.03}

BH 12-21
86.50

B

4244 RIDEAU VALLEY DRIVE
RIDEAU VALLEY DEPOT

AGRICULTURAL

83.40
83.60
83.80
84.0
84.20
84.40
84.60
84.80
85.0
85.20
85.40
85.60
85.80
86.0
86.20
86.40
86.60
86.80
87.0
87.20
87.40

RESIDENTIAL

(0.007m/m)

TREED LAND

TREED LAND

MANOTICK WASTEWATER PUMPING STATION

PRIVATE GARAGE

A'

LANDSCAPED

BH 7-21
87.56

BH 9-21
90.52
(87.43)

BH 8-21
91.32
(88.42)

FORMER CHICKEN COOP

RESIDENTIAL

RESIDENTIAL

TREED LAND

BH 6-21
85.35

APPROXIMATE LOCATION OF DRILLED POTABLE WELL

ABANDONED EMPTY ABOVEGROUND STORAGE TANK

BARN

SILO

BARN

BH 2-21
89.55

4386 RIDEAU VALLEY DRIVE
ARICULTURAL

AGRICULTURAL

RUBBLE FROM PREVIOUSLY EXISTING SILO

BH 3-21
87.89

RESIDENTIAL

BANKFIELD ROAD

A

BH 5-21
85.36

BH 4-21
88.11

AGRICULTURAL

AGRICULTURAL

AGRICULTURAL

LEGEND:

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- 90.52 GROUND SURFACE ELEVATION (m)
- (87.43) GROUNDWATER SURFACE ELEVATION (m) (MAY 20, 2021)
- {84.03} GROUNDWATER SURFACE ELEVATION (m) (JUNE 28, 2021)
- A — A' CROSS SECTION
- 86.20 GROUNDWATER CONTOURS (m)
- (0.007m/m) APPROX. GROUNDWATER FLOW DIRECTION (HORIZONTAL HYDRAULIC GRADIENT)

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

SCALE: 1:2500

0 25 50 75 100 125 150 175m

TREED LAND

OTHER

RESIDENTIAL

RESIDENTIAL

RESIDENTIAL

LOCKMASTER CRESCENT

BH 1-21
88.26

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NO.	REVISIONS	DATE	INITIAL

UNIFORM URBAN DEVELOPMENTS

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
4386 RIDEAU VALLEY DRIVE

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:2500	Date: 04/2024
Drawn by: JM	Report No.: PE5295-1
Checked by: SB	Dwg No.: PE5295-3
Approved by: MSD	Revision No.:

BH10-21-SS9 5.34-5.94 m 22-JUN-2021
BTEX and PHC(F1-F4) comply with MECP Table 2 Standards

BH13-21-SS9 5.34-5.94 m 22-JUN-2021
(DUP of BH10-21-SS9)
BTEX and PHC(F1-F4) comply with MECP Table 2 Standards

BH8-21-SS2 0.77-1.37 m 21-MAY-2021
BTEX and PHC(F1-F4) comply with MECP Table 2 Standards

BH8-21-SS8 5.34-5.94 m 21-MAY-2021
BTEX and PHC(F1-F4) comply with MECP Table 2 Standards

BH9-21-SS2 0.77-1.37 m 21-MAY-2021
BTEX and PHC(F1-F4) comply with MECP Table 2 Standards

BH11-21-SS8 5.34-5.94 m 25-JUN-2021
BTEX and PHC(F1-F4) comply with MECP Table 2 Standards

BH12-21-SS8 5.34-5.94 m 25-JUN-2021
BTEX and PHC(F1-F4) comply with MECP Table 2 Standards

PARKLAND
5431 HILLTOP DRIVE
UNDEVELOPED LAND
RESIDENTIAL
RIDEAU RIVER
UNDEVELOPED LAND
RESIDENTIAL
RESIDENTIAL
RIDEAU VALLEY DRIVE
ASPHALTIC CONCRETE DRIVEWAY
RESIDENTIAL DWELLING
TREED AREA
AREA OF SEPTIC TANK & FIELD
LANDSCAPED
FORMER CHICKEN COOP
RESIDENTIAL
RESIDENTIAL
STORM DRAINAGE
CURB 86.75
FH T/G = 88.05
MH 1 T/G = 87.18
B'
BH 10-21
86.33
{84.02}
BH 11-21
86.42
{84.03}
BH 12-21
86.50
B
4244 RIDEAU VALLEY DRIVE
RIDEAU VALLEY DEPOT
AGRICULTURAL
TREED LAND
RESIDENTIAL
(0.007m/m)
TREED LAND
MANOTICK WASTEWATER PUMPING STATION
TREED LAND
PRIVATE GARAGE
BH 7-21
87.56
BH 9-21
90.52
(87.43)
A'
BH 8-21
91.32
(88.42)
BH 6-21
85.35
APPROXIMATE LOCATION OF DRILLED POTABLE WELL
ABANDONED EMPTY ABOVEGROUND STORAGE TANK
BARN
SILO
BARN
BH 2-21
89.55
4386 RIDEAU VALLEY DRIVE
ARICULTURAL
AGRICULTURAL
RUBBLE FROM PREVIOUSLY EXISTING SILO
BANKFIELD ROAD
A
BH 5-21
85.36
BH 3-21
87.89
BH 4-21
88.11
AGRICULTURAL
AGRICULTURAL
AGRICULTURAL
BH 1-21
88.26
TREED LAND
RESIDENTIAL
RESIDENTIAL
LOCKMASTER CRESCENT
RESIDENTIAL
RESIDENTIAL
RESIDENTIAL

LEGEND:

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- 90.52 GROUND SURFACE ELEVATION (m)
- (87.43) GROUNDWATER SURFACE ELEVATION (m) (MAY 20, 2021)
- {84.03} GROUNDWATER SURFACE ELEVATION (m) (JUNE 28, 2021)
- A — A' CROSS SECTION

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

SOIL RESULT COMPLIES WITH MECP TABLE 2 STANDARDS

SOIL RESULT EXCEEDS MECP TABLE 2 STANDARDS

SCALE: 1:2500

0 25 50 75 100 125 150 175m

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NO.	REVISIONS	DATE	INITIAL

UNIFORM URBAN DEVELOPMENTS

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
4386 RIDEAU VALLEY DRIVE

OTTAWA, ONTARIO

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

Scale: 1:2500	Date: 04/2024
Drawn by: YA	Report No.: PE5295-1
Checked by: SB	Dwg No.: PE5295-4
Approved by: MSD	Revision No.:

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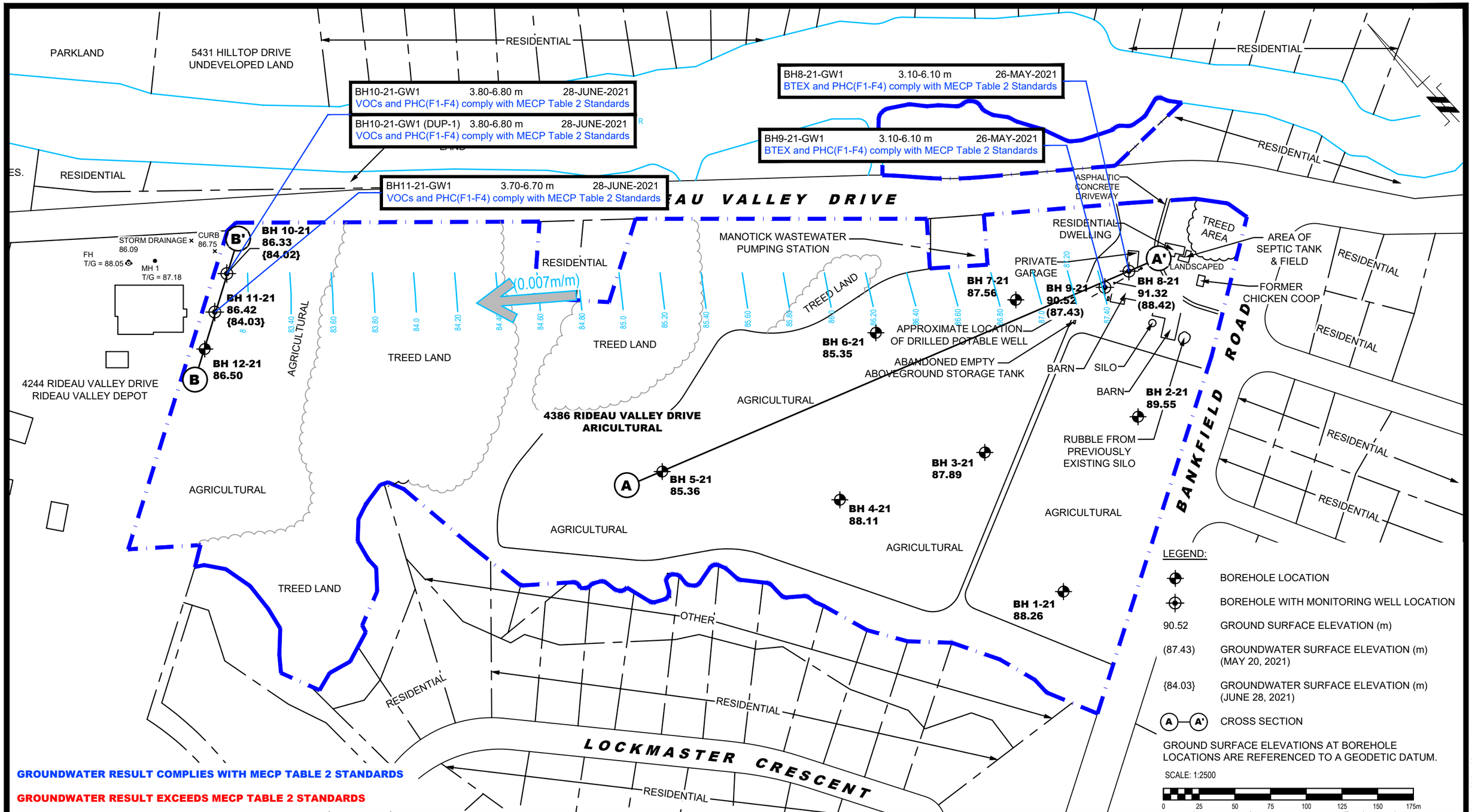

GROUNDWATER RESULT COMPLIES WITH MECP TABLE 2 STANDARDS

GROUNDWATER RESULT EXCEEDS MECP TABLE 2 STANDARDS

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NO.	REVISIONS	DATE	INITIAL

UNIFORM URBAN DEVELOPMENTS

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
4386 RIDEAU VALLEY DRIVE
OTTAWA, ONTARIO

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

Scale: 1:2500	Date: 04/2024
Drawn by: YA	Report No.: PE5295-1
Checked by: SB	Dwg No.: PE5295-5
Approved by: MSD	Revision No.:

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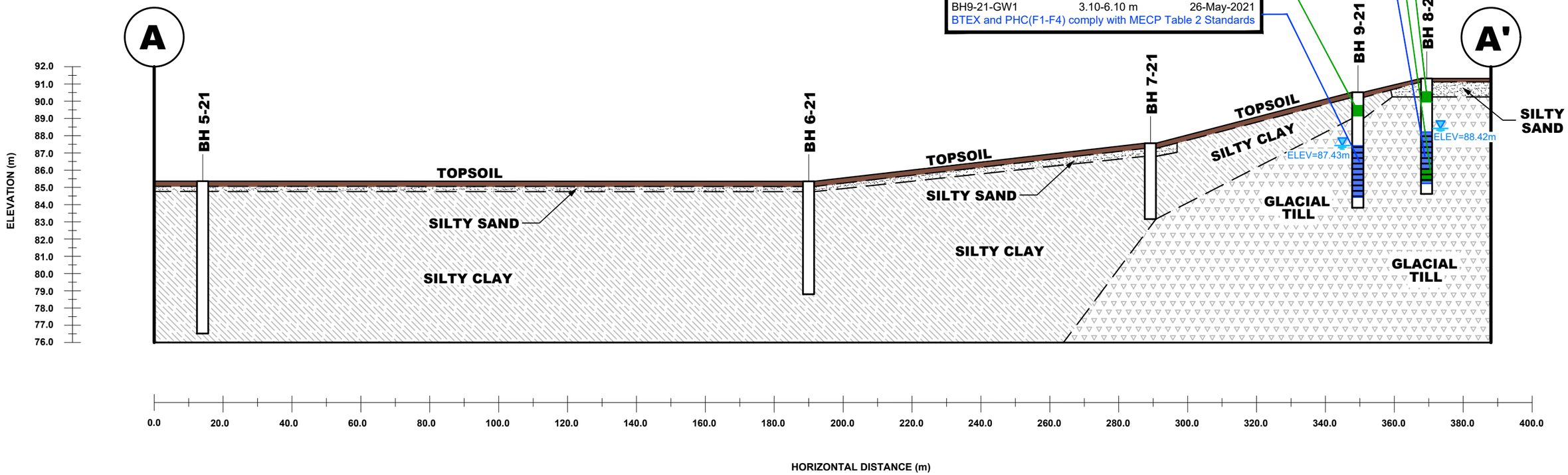
BH8-21-SS2	0.77-1.37 m	21-MAY-2021
BTEX and PHC(F1-F4) comply with MECP Table 2 Standards		
BH8-21-SS8	5.34-5.94 m	21-MAY-2021
BTEX and PHC(F1-F4) comply with MECP Table 2 Standards		
BH8-21-GW1	3.10-6.10 m	26-MAY-2021
BTEX and PHC(F1-F4) comply with MECP Table 2 Standards		

BH9-21-SS2	0.77-1.37 m	21-MAY-2021
BTEX and PHC(F1-F4) comply with MECP Table 2 Standards		
BH9-21-GW1	3.10-6.10 m	26-May-2021
BTEX and PHC(F1-F4) comply with MECP Table 2 Standards		



GROUNDWATER RESULT COMPLIES WITH MECP TABLE 2 STANDARDS

GROUNDWATER RESULT EXCEEDS MECP TABLE 2 STANDARDS

SOIL RESULT COMPLIES WITH MECP TABLE 2 STANDARDS

SOIL RESULT EXCEEDS MECP TABLE 2 STANDARDS

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NO.	REVISIONS	DATE	INITIAL

UNIFORM URBAN DEVELOPMENTS

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
4386 RIDEAU VALLEY DRIVE

OTTAWA, ONTARIO

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

Scale: AS SHOWN	Date: 07/2021
Drawn by: YA	Report No.: PE5295-1
Checked by: SB	Dwg No.: PE5295-4A,5A
Approved by: MSD	Revision No.:

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BH12-21-SS8 5.34-5.94 m 25-JUN-2021
BTEX and PHC(F1-F4) comply with MECP Table 2 Standards

BH11-21-SS8 5.34-5.94 m 25-JUN-2021
BTEX and PHC(F1-F4) comply with MECP Table 2 Standards

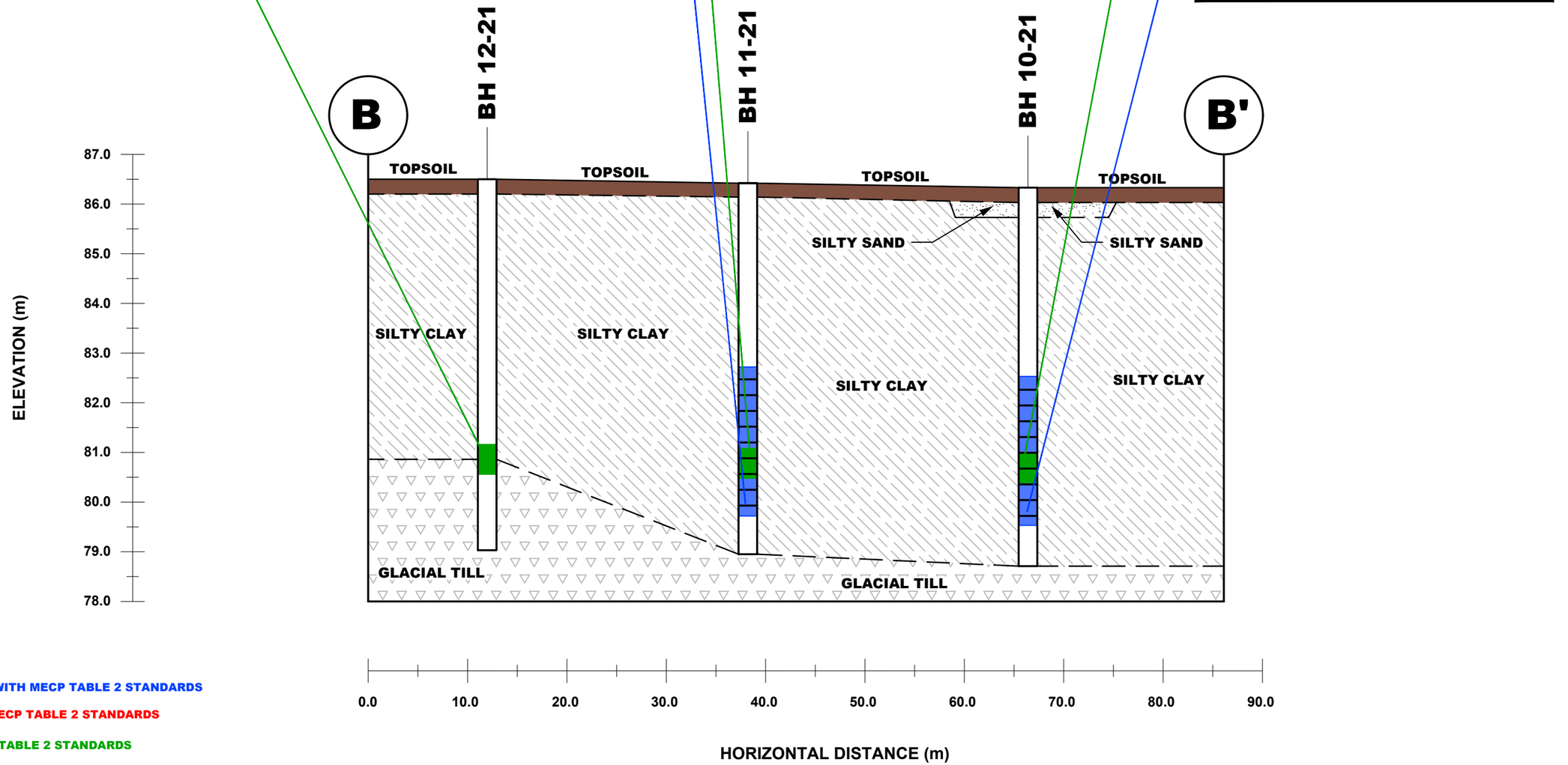
BH11-21-GW1 3.70-6.70 m 28-JUN-2021
VOCs and PHC(F1-F4) comply with MECP Table 2 Standards

BH10-21-SS9 5.34-5.94 m 22-JUN-2021
BTEX and PHC(F1-F4) comply with MECP Table 2 Standards

BH13-21-SS9 5.34-5.94 m 22-JUN-2021
(DUP of BH10-21-SS9)
BTEX and PHC(F1-F4) comply with MECP Table 2 Standards

BH10-21-GW1 3.80-6.80 m 28-JUN-2021
VOCs and PHC(F1-F4) comply with MECP Table 2 Standards

BH10-21-GW1 (DUP-1) 3.80-6.80 m 28-JUN-2021
VOCs and PHC(F1-F4) comply with MECP Table 2 Standards



GROUNDWATER RESULT COMPLIES WITH MECP TABLE 2 STANDARDS

GROUNDWATER RESULT EXCEEDS MECP TABLE 2 STANDARDS

SOIL RESULT COMPLIES WITH MECP TABLE 2 STANDARDS

SOIL RESULT EXCEEDS MECP TABLE 2 STANDARDS

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NO.	REVISIONS	DATE	INITIAL

UNIFORM URBAN DEVELOPMENTS

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
4386 RIDEAU VALLEY DRIVE

OTTAWA, ONTARIO

Title:
CROSS SECTION B-B' - SOIL & GROUNDWATER (BTEX, PHCs, VOCs)

Scale: AS SHOWN	Date: 07/2021
Drawn by: YA	Report No.: PE5295-1
Checked by: SB	Dwg No.: PE5295-4B,5B
Approved by: MSD	Revision No.:

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APPENDIX 1

SAMPLING AND ANALYSIS PLAN

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

LABORATORY CERTIFICATE OF ANALYSIS

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

patersongroup

Sampling & Analysis Plan

Phase II Environmental Site Assessment
4386 Rideau Valley Drive
Ottawa, Ontario

Prepared For
Uniform Urban Developments

May 2021
Report: PE5295-SAP

Paterson Group Inc.

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TABLE OF CONTENTS

1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by Uniform Urban Developments. to conduct a Phase II Environmental Site Assessment (ESA) of 4386 Rideau Valley Drive, Ottawa, Ontario. Based on our 2021 Phase I ESA completed for the subject property, a subsurface investigation program, consisting of borehole drilling, was developed.

Borehole	Location & Rationale	Proposed Depth & Rationale
BH1-21 to BH7-21	General Coverage	Through the native soil to assess soil conditions as part of the geotechnical investigation
BH8-21	Assess potential impacts from APEC 1 (location of former AST)	Through the native soil to intercept the groundwater table where applicable.
BH9-21	Assess potential impacts from APEC 2 (abandoned AST previously used to fuel farm equipment)	Borehole to be advanced to approximately 2m below the expected long-term groundwater table and install a monitoring well.
BH10-21	Assess potential impacts from APEC 3 (City of Ottawa Rideau Valley Depot)	Borehole to be advanced to approximately 2m below the expected long-term groundwater table and install a monitoring well.
BH11-21	Assess potential impacts from APEC 3 (City of Ottawa Rideau Valley Depot)	Borehole to be advanced to approximately 2m below the expected long-term groundwater table and install a monitoring well.
BH12-21	Assess potential impacts from APEC 3 (City of Ottawa Rideau Valley Depot)	Borehole to be advanced to approximately 2m below the expected long-term groundwater table and install a monitoring well.

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

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

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

2.0 ANALYTICAL TESTING PROGRAM

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

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

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

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

3.0 STANDARD OPERATING PROCEDURES

3.1 Environmental Drilling Procedure

Purpose

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

Equipment

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

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

Determining Borehole Locations

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

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

Drilling Procedure

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

- ❒ Continuous split spoon samples (every 0.6 m or 2') or semi-continuous (every 0.76 m or 2'6") are required.
- ❒ Make sure samples are well sealed in plastic bags with no holes prior to screening and are kept cool but unfrozen.
- ❒ If sampling for VOCs, BTEX, or PHCs F1, a soil core from each soil sample which may be analysed must be taken and placed in the laboratory-provided methanol vial.
- ❒ Note all and any odours or discolouration of samples.
- ❒ Split spoon samplers must be washed between samples.
- ❒ If obvious contamination is encountered, continue sampling until the vertical extent of contamination is delineated.
- ❒ As a general rule, environmental boreholes should be deep enough to intercept the groundwater table (unless this is impossible/impractical - call project manager to discuss).
- ❒ If at all possible, soil samples should be submitted to a preliminary screening procedure on site, either using an RKI Eagle, PID, etc. depending on the type of suspected contamination.

Spoon Washing Procedure

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

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

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

Screening Procedure

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

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

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

3.2 Monitoring Well Installation Procedure

Equipment

- ❒ 5’ x 2” [1.52 m x 50 mm] threaded sections of Schedule 40 PVC slotted well screen (5’ x 1 ¼” [1.52 m x 32 mm] if installing in a cored hole in bedrock)
- ❒ 5’ x 2” [1.52 m x 50 mm] threaded sections of Schedule 40 PVC riser pipe (5’ x 1 ¼” [1.52 m x 32 mm] if installing in a cored hole in bedrock)
- ❒ Threaded end-cap
- ❒ Slip-cap or J-plug
- ❒ Asphalt cold patch or concrete
- ❒ Silica Sand

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

Procedure

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

3.3 Monitoring Well Sampling Procedure

Equipment

- ❒ Water level metre or interface probe on hydrocarbon/LNAPL sites
- ❒ Spray bottles containing water and methanol to clean water level tape or interface probe
- ❒ Peristaltic pump
- ❒ Polyethylene tubing for peristaltic pump

- ❒ Flexible tubing for peristaltic pump
- ❒ Latex or nitrile gloves (depending on suspected contaminant)
- ❒ Allen keys and/or 9/16" socket wrench to remove well caps
- ❒ Graduated bucket with volume measurements
- ❒ pH/Temperature/Conductivity combo pen
- ❒ Laboratory-supplied sample bottles

Sampling Procedure

- ❒ Locate well and use a socket wrench or Allan key to open metal flush mount protector cap. Remove plastic well cap.
- ❒ Measure water level, with respect to the existing ground surface, using water level meter or interface probe. If using an interface probe on suspected NAPL site, measure the thickness of the free product.
- ❒ Measure the total depth of well.
- ❒ Clean water level tape or interface probe using methanol and water. Change gloves between wells.
- ❒ Calculate the volume of standing water within well and record.

- ❒ Insert polyethylene tubing into well and attach to the peristaltic pump. Turn on the peristaltic pump and purge into the graduated bucket. Purge at least three well volumes of water from the well. Measure and record field chemistry. Continue to purge, measuring field chemistry after every well volume purged, until appearance or field chemistry stabilizes.
- ❒ Note the appearance of purge water, including colour, opacity (clear, cloudy, silty), sheen, presence of LNAPL, and odour. Note any other unusual features (particulate matter, effervescence (bubbling) of dissolved gas, etc.).
- ❒ Fill the required sample bottles. If sampling for metals, attach 75-micron filter to discharge tube and filter metals sample. If sampling for VOCs, use low flow rate to ensure a continuous stream of non-turbulent flow into sample bottles. Ensure no headspace is present in VOC vials.
- ❒ Replace well cap and flushmount casing cap.

4.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

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

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

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

5.0 DATA QUALITY OBJECTIVES

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

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

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

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

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

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

These considerations are discussed in the body of the report.

6.0 PHYSICAL IMPEDIMENTS TO SAMPLING & ANALYSIS PLAN

Physical impediments to the Sampling and Analysis plan may include:

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

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

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SOIL PROFILE AND TEST DATA

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Ottawa, Ontario

DATUM Geodetic

FILE NO. PE5295

REMARKS

HOLE NO. BH 1-21

BORINGS BY Track-Mount Power Auger **DATE** May 19, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
TOPSOIL 0.30		AU	1			0	88.26
		SS	2	100	13	1	87.26
		SS	3	100	6	2	86.26
		SS	4	100	8		
Hard to very stiff, brown **SILTY CLAY,** trace sand		SS	5	100	7	3	85.26
		SS	6	100	5	4	84.26
		SS	7	83	P	5	83.26
- grey by 5.2m depth		SS	8	83	P		
		SS	9	83	P	6	82.26
6.70							
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

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FILE NO. PE5295

REMARKS

HOLE NO. BH 2-21

BORINGS BY Track-Mount Power Auger **DATE** May 19, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
TOPSOIL 0.30		AU	1			0	89.55
Hard to very stiff, brown **SILTY CLAY,** some to trace sand		SS	2	100	11	1	88.55
		SS	3	58	8	2	87.55
2.80		SS	4	60	8		
GLACIAL TILL: Dense to compact, brown silty sand with gravel, cobbles and boulders, trace clay		SS	5	67	46	3	86.55
		SS	6	62	27	4	85.55
		SS	7	60	21	5	84.55
		SS	8	58	15	6	83.55
6.70		SS	9	50	10		
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.

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FILE NO. PE5295

REMARKS

HOLE NO. BH 3-21

BORINGS BY Track-Mount Power Auger **DATE** May 20, 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									
TOPSOIL 0.25						0	87.89		
		AU	1						
		SS	2	83	9	1	86.89		
		SS	3	83	5	2	85.89		
Hard to very stiff, brown **SILTY CLAY,** trace sand		SS	4	83	P				
- sand content decreasing with depth		SS	5	83	P	3	84.89		
						4	83.89		
						5	82.89		
- stiff and grey by 5.2m depth						6	81.89		
6.55									
Dynamic Cone Penetration Test commenced at 6.55m depth. Cone pushed to 11.0m depth									
Practical refusal to DCPT at 15.16m depth. Borehole terminated.									

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.

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REMARKS

HOLE NO. BH 4-21

BORINGS BY Track-Mount Power Auger **DATE** May 19, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.11
TOPSOIL 0.36		AU	1				
		SS	2	83	8	1	87.11
		SS	3	83	5	2	86.11
Hard to very stiff, brown **SILTY CLAY,** some silty sand - sand content decreasing with depth		SS	4	100	6	3	85.11
						4	84.11
5.18						5	83.11
Stiff, grey **SILTY CLAY**						6	82.11
6.40							
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.

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FILE NO. PE5295

REMARKS

HOLE NO. BH 5-21

BORINGS BY Track-Mount Power Auger **DATE** May 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									
TOPSOIL 0.30						0	85.36		
Compact, brown **SILTY SAND** 0.60		AU	1						
		SS	2	50	10	1	84.36		
		SS	3	58	11	2	83.36		
Hard to very stiff, brown **SILTY CLAY**		SS	4	83	9				
		SS	5	100	7	3	82.36		
		SS	6	100	5	4	81.36		
- stiff and grey by 4.3m depth									
		SS	7	100	P	5	80.36		
6.10						6	79.36		
Dynamic Cone Penetration Test commenced at 6.10m depth. Cone pushed to 8.43m depth									
Practical refusal to DCPT at 8.84m depth. Borehole terminated.									

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.

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REMARKS

HOLE NO. BH 6-21

BORINGS BY Track-Mount Power Auger **DATE** May 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									
TOPSOIL 0.30						0	85.35		
Brown **SILTY SAND,** trace clay 0.60		AU	1						
		SS	2	83	6	1	84.35		
		SS	3	83	6	2	83.35		
Very stiff to stiff, brown **SILTY CLAY,** trace sand		SS	4	83	5	3	82.35		
- sand content decreasing with depth						4	81.35		
- grey by 4.6m depth						5	80.35		
						6	79.35		
6.55 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.

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REMARKS

HOLE NO. BH 7-21

BORINGS BY Track-Mount Power Auger **DATE** May 20, 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									
TOPSOIL 0.30						0	87.56		
Brown **SILTY SAND,** trace clay 0.76		AU	1						
		SS	2	75	7	1	86.56		
Very stiff, brown **SILTY CLAY,** trace sand		SS	3	83	7				
- sand content decreasing with depth		SS	4	83	3	2	85.56		
		SS	5	100	P	3	84.56		
- some sand, trace gravel by 4.1m depth		SS	6	87	8				
4.40						4	83.56		
End of Borehole									
Practical refusal to augering at 4.4m 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.

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REMARKS

HOLE NO. BH 8-21

BORINGS BY Track-Mount Power Auger **DATE** May 20, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.32
TOPSOIL 0.20							
FILL: Brown silty sand, some gravel, trace topsoil		AU	1				
1.07		SS	2	62	30	1	90.32
		SS	3	75	34	2	89.32
		SS	4	62	27		
		SS	5	75	32	3	88.32
GLACIAL TILL: Dense to compact, brown silty sand with gravel, cobbles and boulders		SS	6	62	39	4	87.32
		SS	7	50	27	5	86.32
		SS	8	42	26		
		SS	9	42	21	6	85.32
6.70							
End of Borehole							
(GWL @ 2.90m - May 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.

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REMARKS

HOLE NO. BH 9-21

BORINGS BY Track-Mount Power Auger **DATE** May 20, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.52
TOPSOIL 0.30							
Stiff, brown **SILTY CLAY,** some to trace sand		AU	1				
		SS	2	83	12	1	89.52
1.52						2	88.52
GLACIAL TILL: Compact to dense, brown silty sand with gravel, cobbles and boulders		SS	3	75	23	3	87.52
						4	86.52
						5	85.52
		SS	4	75	32	6	84.52
6.70							
End of Borehole							
(GWL @ 3.09m - May 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.

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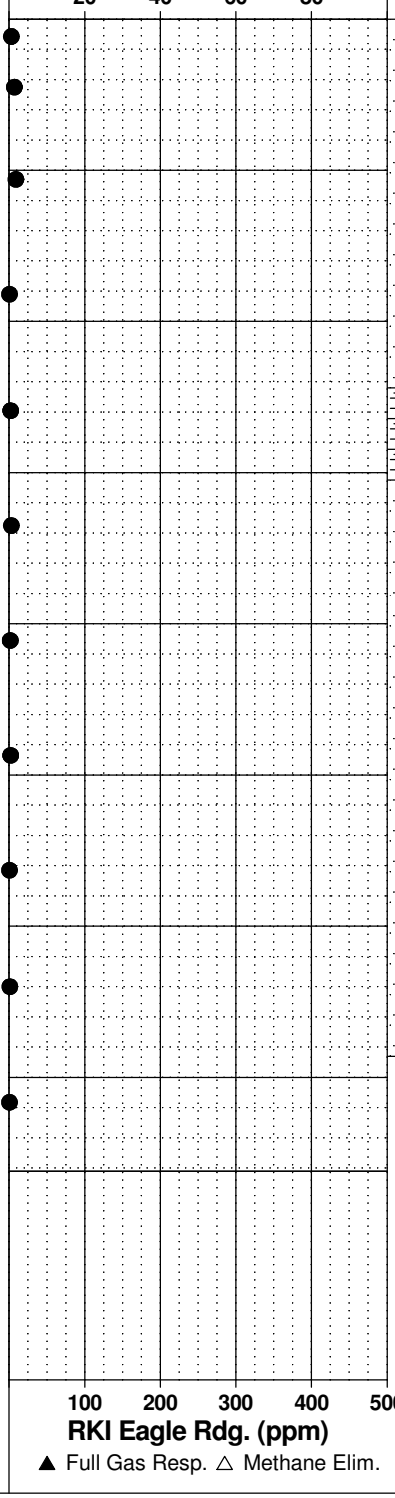
REMARKS

HOLE NO. BH10-21

BORINGS BY Track-Mount Power Auger **DATE** June 22, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	86.33
TOPSOIL 0.30		AU	1				
Brown **SILTY SAND** with clay 0.60		AU	2				
		SS	3	83	5	1	85.33
		SS	4	75	5	2	84.33
		SS	5	96	P		
Very stiff to stiff, brown **SILTY CLAY**		SS	6	83	2	3	83.33
		SS	7	83	6	4	82.33
		SS	8	83	P	5	81.33
		SS	9	96	2		
- grey by 5.8m depth		SS	10	96	P	6	80.33
		SS	11	96	2	7	79.33
7.62							
End of Borehole							
(GWL @ 2.31m - June 28, 2021)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)
○ **Lower Explosive Limit %**



Monitoring Well Construction

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FILE NO. PE5295

REMARKS

HOLE NO. BH11-21

BORINGS BY Track-Mount Power Auger **DATE** June 25, 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									
TOPSOIL 0.28		AU	1			0	86.42		
		SS	2	92	5	1	85.42		
		SS	3	100	4	2	84.42		
		SS	3	100	P				
Very stiff to stiff, brown **SILTY CLAY**		SS	5	100	6	3	83.42		
		SS	6	100	7	4	82.42		
		SS	7	92	P	5	81.42		
		SS	8	92	2	6	80.42		
- grey by 6.1m depth		SS	9	100	P				
		SS	10	0	1	7	79.42		
7.47 End of Borehole									
(GWL @ 2.39m - June 28, 2021)									

Photo Ionization Detector: 20 40 60 80

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

▲ Full Gas Resp. △ Methane Elim.

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REMARKS

HOLE NO. BH12-21

BORINGS BY Track-Mount Power Auger **DATE** June 25, 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									
TOPSOIL		AU	1			0	86.50		
0.30									
		SS	2	42	4	1	85.50		
		SS	3	100	4	2	84.50		
Hard to stiff, brown **SILTY CLAY**		SS	4	100	4				
		SS	5	100	P	3	83.50		
		SS	6	92	3	4	82.50		
		SS	7	92	4	5	81.50		
5.64		SS	8	100	17				
GLACIAL TILL: Compact, grey silty sand with gravel, cobbles and boulders		SS	9	25	22	6	80.50		
		SS	10	67	13	7	79.50		
7.47									
End of Borehole									

Photo Ionization Detector: ○ Lower Explosive Limit % (20, 40, 60, 80)

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

▲ Full Gas Resp. △ Methane Elim.

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

The standard terminology to describe the 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

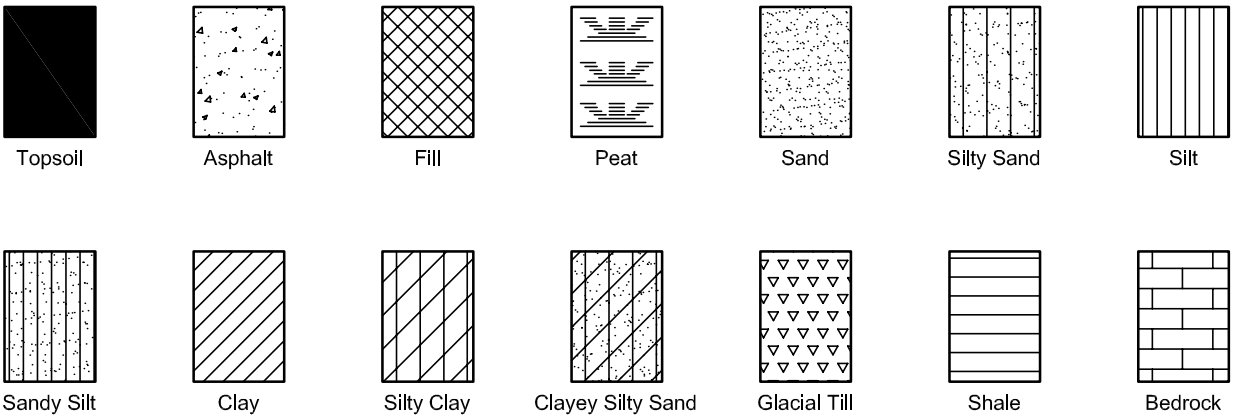
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

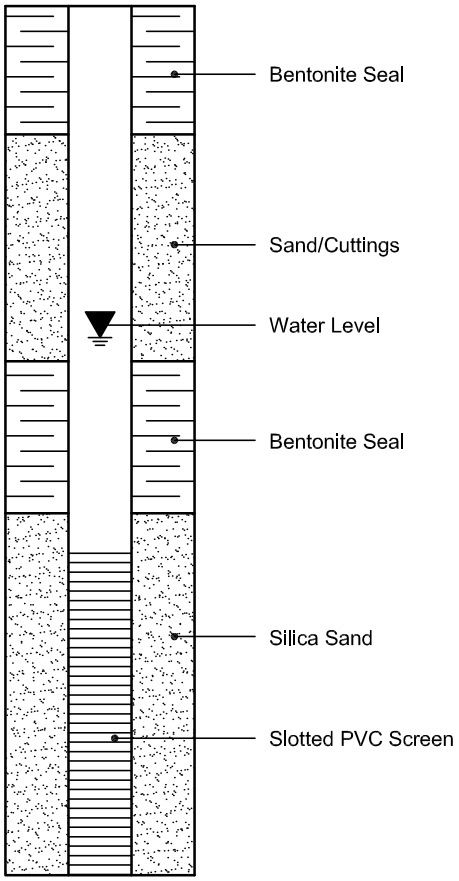
SYMBOLS AND TERMS (continued)

STRATA PLOT

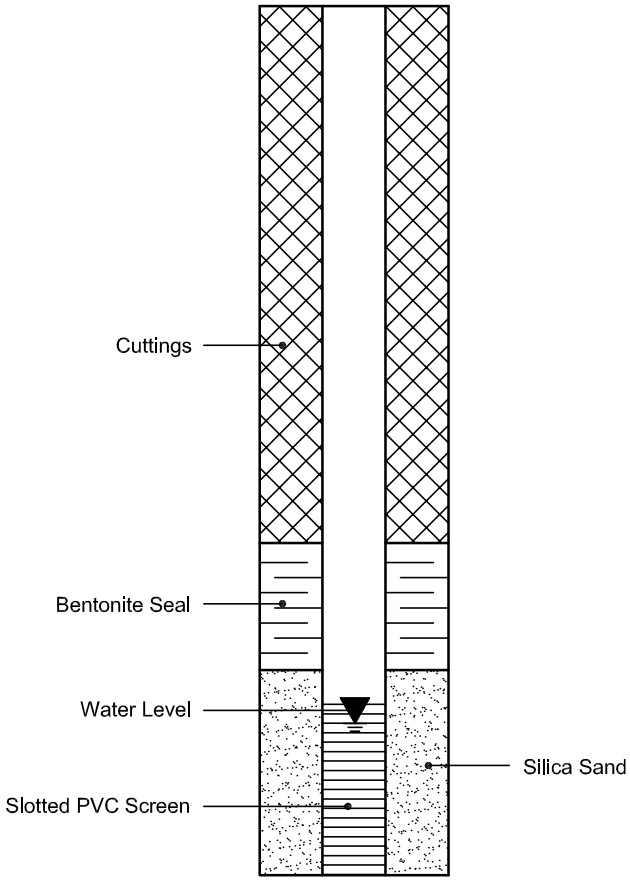


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 32213
Project: PE5295
Custody: 132344

Report Date: 7-Jun-2021
Order Date: 2-Jun-2021

Order #: 2123336

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

Paracel ID	Client ID
2123336-01	BH8-21-SS2
2123336-02	BH8-21-SS8
2123336-03	BH9-21-SS2

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 32213

Report Date: 07-Jun-2021

Order Date: 2-Jun-2021

Project Description: PE5295

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	3-Jun-21	3-Jun-21
PHC F1	CWS Tier 1 - P&T GC-FID	3-Jun-21	3-Jun-21
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	2-Jun-21	6-Jun-21
Solids, %	Gravimetric, calculation	4-Jun-21	4-Jun-21

Certificate of Analysis

Report Date: 07-Jun-2021

Client: Paterson Group Consulting Engineers

Order Date: 2-Jun-2021

Client PO: 32213

Project Description: PE5295

	Client ID:	BH8-21-SS2	BH8-21-SS8	BH9-21-SS2	-
	Sample Date:	21-May-21 09:00	21-May-21 09:00	21-May-21 09:00	-
	Sample ID:	2123336-01	2123336-02	2123336-03	-
	MDL/Units	Soil	Soil	Soil	-
Physical Characteristics					
% Solids	0.1 % by Wt.	85.9	86.8	79.6	-
Volatiles					
Benzene	0.02 ug/g dry	<0.02	<0.02	<0.02	-
Ethylbenzene	0.05 ug/g dry	<0.05	<0.05	<0.05	-
Toluene	0.05 ug/g dry	<0.05	<0.05	<0.05	-
m,p-Xylenes	0.05 ug/g dry	<0.05	<0.05	<0.05	-
o-Xylene	0.05 ug/g dry	<0.05	<0.05	<0.05	-
Xylenes, total	0.05 ug/g dry	<0.05	<0.05	<0.05	-
Toluene-d8	Surrogate	99.2%	106%	104%	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	-
F3 PHCs (C16-C34)	8 ug/g dry	<8	<8	<8	-
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	<6	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Volatiles									
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	*8.16*		*ug/g*		*102*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND			NC	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	
Physical Characteristics									
% Solids	92.0	0.1	% by Wt.	91.2			0.9	25	
Volatiles									
Benzene	ND	0.02	ug/g dry	ND			NC	50	
Ethylbenzene	ND	0.05	ug/g dry	ND			NC	50	
Toluene	ND	0.05	ug/g dry	ND			NC	50	
m,p-Xylenes	ND	0.05	ug/g dry	ND			NC	50	
o-Xylene	ND	0.05	ug/g dry	ND			NC	50	
Surrogate: Toluene-d8	*9.66*		*ug/g dry*		*104*	*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)	228	7	ug/g	ND	114	80-120			
F2 PHCs (C10-C16)	94	4	ug/g	ND	97.5	60-140			
F3 PHCs (C16-C34)	259	8	ug/g	ND	110	60-140			
F4 PHCs (C34-C50)	168	6	ug/g	ND	113	60-140			
Volatiles									
Benzene	3.69	0.02	ug/g	ND	92.2	60-130			
Ethylbenzene	3.93	0.05	ug/g	ND	98.2	60-130			
Toluene	3.67	0.05	ug/g	ND	91.7	60-130			
m,p-Xylenes	7.32	0.05	ug/g	ND	91.5	60-130			
o-Xylene	3.73	0.05	ug/g	ND	93.3	60-130			
Surrogate: Toluene-d8	*8.04*		*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.

PARACEL LABORATORIES LTD

Paracel ID: 2123336

Paracel Order Number (Lab Use Only): 2123336

Chain Of Custody (Lab Use Only) № 132344

Client Name: Paterson Group Inc.

Project Ref: PE5295

Page 1 of 1

Contact Name: Mark D'Arcy, Samuel Berube

Quote #:

Turnaround Time

Address: 154 Colonnade Rd South

PO #: 32213

☐ 1 day ☐ 3 day ☐ 2 day ☑ Regular

E-mail: mdarcy@patersongroup.ca, sberube@patersongroup.ca

Telephone: 613-226-7381

Date Required:

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

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

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)						
1	BH8-21-SS2	S		2	May 21/21		✓												
2	BH8-21-SS8	↓		↓	↓		↓												
3	BH9-21-SS2	↓		↓	↓		↓												
4																			
5																			
6																			
7																			
8																			
9																			
10																			

Comments:

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Date/Time:	Temperature: °C PM.	Temperature: 8.5 °C	pH Verified: ☐ By:

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 32213
Project: PE5295
Custody: 132345

Report Date: 8-Jun-2021
Order Date: 2-Jun-2021

Order #: 2123333

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

Paracel ID	Client ID
2123333-01	BH8-21-GW1
2123333-02	BH9-21-GW1

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 08-Jun-2021

Client: Paterson Group Consulting Engineers

Order Date: 2-Jun-2021

Client PO: 32213

Project Description: PE5295

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	4-Jun-21	4-Jun-21
PHC F1	CWS Tier 1 - P&T GC-FID	3-Jun-21	4-Jun-21
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	7-Jun-21	7-Jun-21

Certificate of Analysis

Report Date: 08-Jun-2021

Client: Paterson Group Consulting Engineers

Order Date: 2-Jun-2021

Client PO: 32213

Project Description: PE5295

	Client ID:	BH8-21-GW1	BH9-21-GW1	-	-
	Sample Date:	26-May-21 09:00	26-May-21 09:00	-	-
	Sample ID:	2123333-01	2123333-02	-	-
	MDL/Units	Water	Water	-	-
Volatiles					
Benzene	0.5 ug/L	<0.5	<0.5	-	-
Ethylbenzene	0.5 ug/L	<0.5	<0.5	-	-
Toluene	0.5 ug/L	<0.5	<0.5	-	-
m,p-Xylenes	0.5 ug/L	<0.5	<0.5	-	-
o-Xylene	0.5 ug/L	<0.5	<0.5	-	-
Xylenes, total	0.5 ug/L	<0.5	<0.5	-	-
Toluene-d8	Surrogate	97.1%	95.3%	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	<25	-	-
F2 PHCs (C10-C16)	100 ug/L	<100	<100	-	-
F3 PHCs (C16-C34)	100 ug/L	<100	<100	-	-
F4 PHCs (C34-C50)	100 ug/L	<100	<100	-	-

Certificate of Analysis

Report Date: 08-Jun-2021

Client: Paterson Group Consulting Engineers

Order Date: 2-Jun-2021

Client PO: 32213

Project Description: PE5295

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	*78.4*		*ug/L*		*98.0*	*50-140*			

Certificate of Analysis

Report Date: 08-Jun-2021

Client: Paterson Group Consulting Engineers

Order Date: 2-Jun-2021

Client PO: 32213

Project Description: PE5295

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	*74.2*		*ug/L*		*92.7*	*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)	1630	25	ug/L	ND	81.3	68-117			
F2 PHCs (C10-C16)	1710	100	ug/L	ND	107	60-140			
F3 PHCs (C16-C34)	4400	100	ug/L	ND	112	60-140			
F4 PHCs (C34-C50)	2590	100	ug/L	ND	104	60-140			
Volatiles									
Benzene	41.3	0.5	ug/L	ND	103	60-130			
Ethylbenzene	44.8	0.5	ug/L	ND	112	60-130			
Toluene	31.6	0.5	ug/L	ND	79.0	60-130			
m,p-Xylenes	89.1	0.5	ug/L	ND	111	60-130			
o-Xylene	45.3	0.5	ug/L	ND	113	60-130			
Surrogate: Toluene-d8	*61.5*		*ug/L*		*76.9*	*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.

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Paracel ID: 2123333

Chain Of Custody
(Lab Use Only)
№ 132345

Client Name: Paterson Group Inc.	Project Ref: PE5295	Page 1 of 1
Contact Name: Mark D'Arcy, Samuel Bérubé	Quote #: ~~3221~~	Turnaround Time
Address: ~~mdarcy@patersongroup.ca~~ 154 Colonnade R. 1 5 ~~Sberube@patersongroup.ca~~	PO #: 32213	☐ 1 day ☐ 3 day ☐ 2 day ☑ ~~Regular~~
Telephone:	E-mail: mdarcy@patersongroup.ca Sberube@patersongroup.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)						
1	BH8-21-GW1	GW		3	May 26/21		✓												
2	BH9-21-GW1	GW		3	↓		↓												
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			

Comments:

Method of Delivery: PARACEL COURIER

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Relinquished By (Print): Samuel Bérubé	Date/Time: 02/06/21 3:00 PM	Date/Time: JUN 02, 2021 03:55	Date/Time: 4:24 Jun 2
Date/Time:	Temperature: °C	Temperature: 8.5 °C	pH Verified: ☐ By: