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Phase II Environmental Site Assessment

1499 Star Top Road
Ottawa, Ontario

Prepared For

4015274 Canada Inc.

January 4, 2019

Report: PE4482-2

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EXECUTIVE SUMMARY

Assessment

A Phase II ESA was conducted for part of the property addressed 1499 Star Top Road, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address potentially contaminating activities (PCAs) that were identified during the Phase I ESA and considered to result in areas of potential environmental concern (APECs) on the Phase II Property. The subsurface investigation was carried out in conjunction with a Geotechnical Investigation and consisted of drilling five (5) boreholes, three (3) of which were constructed with groundwater monitoring wells.

Soil samples were obtained from the boreholes and screened using visual observations and organic vapour measurements. Three (3) soil samples were submitted for laboratory analysis of of benzene, toluene, ethylbenzene and xylenes (BTEX) and petroleum hydrocarbons (PHCs, F_1-F_4). Two (2) petroleum hydrocarbon fractions F1 (in BH2) and F2 (BH3) exceeded the MECP Table 3 Standards. Impacted fill was identified where the former UST and automotive repair garage were identified on the southeast and central north portion of the Phase II Property, respectively. The extent of the impacted soil is considered to be limited to the immediate area of the former UST and drainage pits.

Groundwater samples from monitoring wells installed in BH1, BH2 and BH3 were recovered and analyzed for volatile organic compounds (VOCs) and PHC parameters. Groundwater samples were in compliance with the MECP Table 3 Standards, with no detectable VOC and PHC concentrations.

Conclusion

Based on the findings of the Phase II ESA, soil impacted with PHC (F1 and F2) concentrations exceeding MECP Table 3 Standards is present on the Phase II Property. It is our understanding that the subject site is to be redeveloped with a commercial building. It is our recommendation that an environmental site remediation program, involving the removal of all contaminated soil, be completed concurrently with the site redevelopment.

Prior to offsite disposal at a licenced landfill site, a leachate analysis of a representative sample of contaminated soil must be conducted in accordance with Ontario Regulation 347/558. It is recommended that Paterson personnel be onsite during construction activities to direct the excavation and segregation of impacted soil and to conduct confirmatory sampling as required.

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

1.0 INTRODUCTION

At the request of 4015274 Canada Inc. c/o Cannonbye Construction Ltd., Paterson Group (Paterson) conducted a Phase II Environmental Site Assessment for part of 1499 Star Top Road, in the City of Ottawa, Ontario. The purpose of this Phase II ESA has been to address areas of potential environmental concern (APECs) identified on the Phase II Property, during the Phase I ESA conducted by Paterson in December 2018.

1.1 Site Description

Address:	1499 Star Top Road, Ottawa, Ontario.
Legal Description:	Part of Lot 24, Concession 2, in the City of Ottawa.
Property Identification Number:	04355-0016
Location:	The subject site is located on the east side of Star Top Road, approximately 60 m south of the Algoma Road and Star Top Road intersection, in Ottawa, Ontario.
Latitude and Longitude:	45° 24' 1.6" N, 75° 36' 55.4" W
Configuration:	Rectangular.
Site Area:	443 m^2 (approximate).

1.2 Property Ownership

The current registered property owner of 1499 Star Top Road is Gratien Proulx of 4015274 Canada Inc. Paterson was retained to complete this Phase II ESA by Mr. Ron Johnson of Cannonbye Construction Limited. Cannonbye Construction Ltd.'s office is located at 1499 Star Top Road, in Ottawa, Ontario. Mr. Johnson can be contacted by telephone at 613-247-0049.

1.3 Current and Proposed Future Uses

The western portion of the Phase II Property is currently occupied by a single-storey, slab-on-grade commercial building, while the eastern portion is occupied by parking lot. It is our understanding that the eastern half of the property will be

redeveloped with a commercial building and the existing building will be demolished and serve as a parking lot.

1.4 Applicable Site Condition Standard

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

- ❒ Coarse-grained soil conditions
- ❒ Full depth generic site conditions
- ❒ Non-potable groundwater conditions
- ❒ Commercial land use

The commercial 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 light-industrial and commercial area. The site is relatively flat and at grade with the adjacent properties. Regional topography slopes slightly down towards the south, in the direction of a tributary of Green's Creek, approximately 60 m from the subject site. Site drainage consists primarily of runoff to catch basins on Star Top Road.

2.2 Past Investigations

Paterson completed a Phase I ESA in December 2018 for the subject site. Based on the Phase I ESA, the historical review indicated three (3) Potentially Contaminating Activities (PCAs) on-site: three (3) former above ground storage tank (ASTs), a former underground storage tank (UST) and a former automotive repair garage, all of which represented Areas of Potential Environmental Concern (APECs) on the Phase I Property. A site inspection revealed that the former automotive garage interior floor drains had a trace of oil in a drain pit. The garage and associated drainage system resulted in an APEC on the Phase I Property. The PCAs that represent APECs on the Phase I Property as well as Contaminants of Potential Concern (CPCs) are presented in Table 1.

TABLE 1: Areas of Potential Environmental Concern

Area of Potential Environmental Concern (APEC)	Location of APEC with respect to Phase I Property	Potentially Contaminating Activity (PCA)	Contaminants of Potential Concern (CPC)	Media Potentially Impacted
Former underground Storage Tank (UST)	South eastern portion of the Phase I ESA property.	Item 28 - Gasoline and Associated Products Storage in Fixed UST	PHCs, BTEX	Soil and groundwater
Former above ground storage tanks (ASTs)	Central west portion of the Phase I ESA property	Item 28 - Gasoline and Associated Products Storage in Fixed ASTs	PHCs, BTEX	Soil and groundwater
Former automotive garage	Central north portion of the Phase I ESA Property	Item 52 - Storage, maintenance, fuelling and repair of equipment, vehicles, and materials used to maintain transportation systems	PHCs, BTEX	Soil and groundwater

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

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The subsurface investigation was conducted on December 12, 2018, in conjunction with a Geotechnical Investigation. The field program consisted of drilling five (5) boreholes, three (3) of which were completed as groundwater monitoring wells. Boreholes were drilled to depths of ranging from approximately 2 to 5 m below the existing grade.

3.2 Media Investigated

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

Contaminants of concern for soil and groundwater include petroleum hydrocarbons (PHCs, fractions F_1-F_4); benzene, toluene, ethylbenzene and xylenes (BTEX) and/or volatile organic compounds (VOCs).

3.3 Phase I Conceptual Site Model

Geological and Hydrogeological Setting

Based on the information from NRCAN, bedrock in the area of the site consists of shale of the Carlsbad Formation. Based on the maps, the thickness of overburden ranges from 2 to 3 m. Overburden consists of glacial till.

Contaminants of Potential Concern

As per Section 7.1 of the Phase I ESA report, petroleum hydrocarbons (PHCs), volatile organic compounds (VOCs) or benzene, toluene, ethylbenzene and xylenes (BTEX) were identified as contaminants of potential concern (CPCs) on the subject site.

Existing Buildings and Structures

The subject site is occupied by a single-storey industrial building constructed in approximately 1970 with a slab-on-grade foundation.

Water Bodies

There are no waterbodies on the subject property. The nearest body of water is a tributary of Green's Creek, identified 60 m south 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

Drinking Water Wells

There are no drinking water wells on the Phase I Property. Seven (7) domestic water supply wells installed between 1957 and 1960 were identified in the Phase I Study Area. Based on the age of these wells and the availability of municipal water in the area, these wells are no longer considered to be in use.

Neighbouring Land Use

Neighbouring land use in the Phase I Study Area consisted of commercial and light-industrial properties. The surrounding land use is shown on Drawing PE4482-2 Surrounding Land Use Plan, in the Phase I ESA.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

As per Section 7.1 of the Phase I ESA report, Potentially Contaminating Activities (PCAs) and Areas of Potential Environmental Concern (APEC) were identified within the Phase I ESA Study Area. Three (3) PCAs were identified on the subject site during the historical review and/or identified on-site during a site visit. These on-site PCAs represented APECs on the Phase I Property and are as follows:

- A former underground storage tank (UST) located on the south eastern portion of the Phase I Property;
- Three (3) former above ground storage tanks (ASTs) located on the central west portion of the Phase I Property;
- A former automotive garage with a floor drainage pit located on the central north portion of the Phase I Property.

Assessment of Uncertainty and/or Absence of Information

The information available for review as part of the preparation of the Phase I ESA is considered to be sufficient to conclude that there are areas of potential environmental concern on the subject site. The presence of potentially contaminating activities was confirmed by a variety of independent sources, and as such, the conclusions of this report are not affected by uncertainty which may be present with respect to the individual sources.

3.4 Deviations from Sampling and Analysis Plan

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

3.5 Impediments

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

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation was conducted on December 12, 2018, in conjunction with a Geotechnical Investigation. The field program consisted of drilling five (5) boreholes on the Phase II Property. The boreholes were drilled to

a maximum depth of 5 m below the existing grade, three (3) of which were completed as groundwater monitoring wells to access the groundwater table.

The boreholes were placed to address the aforementioned areas of potential environmental concern (APECs) and to provide coverage of the site from a geotechnical perspective. The boreholes were drilled with a truck mounted power auger drill rig. The truck mounted drill rig was provided by George Downing Estate Drilling of Hawkesbury, Ontario. Borehole locations are shown on Drawing PE4482-3 – Test Hole Location Plan, appended to this report.

4.2 Soil Sampling

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

Site soils generally consist of a pavement structure underlain by fill material and sometimes glacial till and bedrock. Fill material present beneath the pavement structure extended from 0.28 m to a maximum depth of 2.89 m in BH3 and consisted of crushed stone or reworked native soils. Glacial till was sometimes present beneath the fill material and extended to depths of 1.62 m and 2.29 m below the existing grade in BH1 and BH4, respectively. Bedrock was encountered between depths of 1.60 to 2.90 m but was beneath 2 m depth across the majority of the site.

4.3 Field Screening Measurements

All soil samples collected were subjected to a preliminary screening procedure, which included visual screening for colour and evidence of metals, as well as soil vapour screening with a MiniRAE 2000 Portable VOC Monitor.

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

The vapour readings were found to range from 0.5 ppm to 224.5 ppm. Vapour readings are noted on the Soil Profile and Test Data Sheets in Appendix 1.

No visual or olfactory indications of potential contamination were identified in the soil samples at the time of the field program, with the exception of BH2-SS3. A hydrocarbon odour was identified in BH2-SS3. Several soil samples, including BH2-SS3, were selected for analytical testing.

4.4 Groundwater Monitoring Well Installation

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

TABLE 2: Monitoring Well Construction Details

Well ID	Ground Surface Elevation	Total Depth (m BGS)	Screened Interval (m BGS)	Sand Pack (m BGS)	Bentonite Seal (m BGS)	Casing Type
BH1	66.00	5.03	3.53-5.03	3.20-5.03	0.30 -3.20	Flushmount
BH2	66.08	5.18	3.68-5.18	3.35-5.18	0.30-3.35	Flushmount
BH3	66.10	3.05	1.55-3.05	1.22-3.05	0.30-1.22	Flushmount

4.5 Field Measurement of Water Quality Parameters

Groundwater sampling was conducted at BH1, BH2 and BH3 on December 17, 2018. No water quality parameters were measured in the field at that time.

4.6 Groundwater Sampling

Groundwater sampling protocols were followed using the MECP document entitled “Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario”, dated May 1996. Groundwater samples were obtained from each monitoring well, using dedicated sampling equipment. Standing water was purged from each well prior to sampling. Samples were stored in coolers to reduce analyte volatilization during transportation. Details of our standard operating procedure for groundwater sampling are provided in the Sampling and Analysis Plan in Appendix 1.

4.7 Analytical Testing

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

TABLE 3: Soil Samples Submitted

Sample ID	Sample Depth / Stratigraphic Unit	Parameters Analyzed		Rationale
		PHCs (F_1-F_4)	BTEX	
BH1-SS3	1.52-2.13m, Fill	X	X	Assess potential impacts beneath the former ASTs.
BH2-SS3	1.52-2.13m, Fill	X	X	Assess potential impacts due to the former UST located on the south eastern portion of the subject site.
BH3-SS2-3-4	0.79-1.40m, Fill	X	X	Assess potential impacts relating to the former automotive garage drainage system.

TABLE 4: Groundwater Samples Submitted

Sample ID	Screened Interval/ Stratigraphic Unit	Parameters Analyzed		Rationale
		VOCs	PHCs (F_1-F_4)	
BH1-GW1	3.53-5.03m, Shale Bedrock	X	X	Assess potential impacts beneath the former ASTs.
BH2-GW1	3.68-5.18m, Shale Bedrock	X	X	Assess potential impacts due to the former UST located on the south eastern portion of the subject site.
BH3-GW1	1.55-3.05m, Shale Bedrock	X	X	Assess potential impacts relating to the former automotive garage drainage system.

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

4.8 Residue Management

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

4.9 Elevation Surveying

An elevation survey of all borehole locations was completed by Paterson at the time of the subsurface investigation. All borehole elevations are relative to the finished floor level of the warehouse building on the southeastern portion of the subject property, as presented in Drawing PE4482-3, with a geodetic elevation of 66.38 m above sea level (m asl).

4.10 Quality Assurance and Quality Control Measures

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

5.0 REVIEW AND EVALUATION

5.1 Geology

The soil profile generally consists of a pavement structure over fill material, underlain by glacial till, followed by shale bedrock. The site stratigraphy is shown on Drawing PE4482-7– Cross-Section A-A' – Soil.

Groundwater was encountered within shale at depths ranging from approximately 1.39 to 1.53 m below the existing grade, as shown on Drawing PE4482-8– Cross-Section A-A' – Groundwater.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured during the groundwater sampling event on December 17, 2018, using an electronic water level meter. Groundwater levels are summarized below in Table 5. All borehole elevations are relative to the finished floor level of the warehouse building on the southeastern portion of the subject property, with a geodetic elevation of 66.38 m above sea level (m asl).

TABLE 5: Groundwater Level Measurements				
Borehole Location	**Ground Surface Elevation (m)**	**Water Level Depth (m below grade)**	**Water Level Elevation (m ASL)**	**Date of Measurement**
BH1	66.00	1.39	64.61	December 17, 2018
BH2	66.08	1.53	64.55	December 17, 2018
BH3	66.10	1.43	64.67	December 17, 2018

Based on the groundwater elevations measured during the December 2018 sampling event, groundwater contour mapping was completed. Groundwater contours are shown on Drawing PE4482-4 – Groundwater Contour Plan. Based on the contour mapping, groundwater beneath the Phase II Property appears to flow towards the southeast. A horizontal hydraulic gradient of approximately 0.0029 m/m was calculated.

5.3 Fine-Coarse Soil Texture

No grain size analysis was completed for the subject site. Coarse grained standards were chosen as a conservative approach.

5.4 Soil: Field Screening

Field screening of the soil samples collected during drilling resulted in vapour readings ranging from 0.5 ppm to 224.5 ppm. No visual or olfactory indications of potential contamination were identified in the soil samples at the time of the field program, with the exception of BH2-SS3, where a hydrocarbon odour was identified. The field screening results of each individual soil sample are provided on the Soil Profile and Test Data Sheets appended to this report.

5.5 Soil Quality

Three (3) soil samples were submitted for analysis of PHCs (F1-F4) and BTEX. The results of the analytical testing are presented below in Table 6. The laboratory certificates of analysis are provided in Appendix 1.

TABLE 6: Analytical Test Results – Soil – BTEXs and PHCs (F1-F4)					
Parameter	**MDL (µg/g)**	**Soil Samples (µg/g)**			**MOECP Table 3 Industrial Standards (µg/g)**
		December 13, 2018			
		BH1-SS3	**BH2-SS3**	**BH3-SS2-3-4**	
Benzene	0.02	nd	nd	0.04	0.32
Ethylbenzene	0.05	nd	nd	5.88	9.5
Toluene	0.05	nd	nd	nd	68

TABLE 6: Analytical Test Results – Soil – BTEXs and PHCs (F1-F4)					
Parameter	**MDL (µg/g)**	**Soil Samples (µg/g)**			**MOECP Table 3 Industrial Standards (µg/g)**
		December 13, 2018			
		BH1-SS3	**BH2-SS3**	**BH3-SS2-3-4**	
Xylenes (Total)	0.05	nd	0.34	15.6	26
PHC F1	7	nd	19	**201**	55
PHC F2	4	6	**1440**	nd	230
PHC F3	8	11	819	136	1700
PHC F4	6	29	nd	27	3300

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – Value exceeds MOECC Table 3 standards

Concentrations of PHC F_2 and F_1 exceeding the MECP Table 3 Standards were identified in soil Sample BH2-SS3 and BH3-SS2-3-4, respectively. BTEX parameters in soil were in compliance with the MECP Standards. The remaining BTEX and PHC concentrations identified in the soil samples are in compliance with MECP Table 3 Standards. Analytical results of soil sampled with respect to borehole locations is shown on Drawing PE4482-5.

The maximum concentrations of analyzed parameters in the soil at the site are summarized below in Table 7.

TABLE 7: Maximum Concentrations – Soil			
Parameter	**Maximum Concentrations (µg/g)**	**Borehole**	**Depth Interval (m BGS)**
Benzene	0.04	BH3-SS2-3-4	0.79-1.40, Fill
Ethylbenzene	5.88		
Xylenes (Total)	15.6		
PHC F1	**201**		
PHC F2	**1440**	BH2-SS3	1.52-2.13, Fill
PHC F3	819		
PHC F4	29	BH1-SS3	1.52-2.13, Fill

Notes:
- **Bold and Underlined** – Value exceeds MECP Table 3 Standards

All other parameter concentrations were below laboratory detection limits.

5.6 Groundwater Quality

Groundwater samples from monitoring wells installed in BH1, BH2 and BH3 were submitted for laboratory analysis of VOC and PHC (F1-F2) parameters. The groundwater samples were obtained from the screened intervals noted on Table 2. The results of the analytical testing are presented below in Tables 8 and 9. The laboratory certificates of analysis are provided in Appendix 1.

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

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)			MECP Table 3 Standards (µg/L)
		December 17, 2018			
		BH1-GW1	BH2-GW1	BH3-GW1	
PHC F1	25	nd	nd	nd	750
PHC F2	100	nd	nd	nd	150
PHC F3	100	nd	nd	nd	500
PHC F4	100	nd	nd	nd	500

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

No detectable PHC concentrations were identified in the groundwater samples analyzed. The groundwater is in compliance with the selected Standards for PHCs.

TABLE 9: Analytical Test Results – Groundwater (VOCs)

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)			MECP Table 3 Standards (µg/L)
		December 17, 2018			
		BH1-GW1	BH3-GW1	BH1-GW1	
Acetone	5	nd	nd	nd	130,000
Benzene	0.5	nd	nd	nd	44
Bromodichloromethane	0.5	nd	nd	nd	85,000
Bromoform	0.5	nd	nd	nd	380
Bromomethane	0.5	nd	nd	nd	5.6
Carbon Tetrachloride	0.2	nd	nd	nd	0.79
Chlorobenzene	0.5	nd	nd	nd	630
Chloroform	0.5	nd	nd	nd	2.4
Dibromochloromethane	0.5	nd	nd	nd	82,000
Dichlorodifluoromethane	1	nd	nd	nd	4,400
1,2-Dichlorobenzene	0.5	nd	nd	nd	4,600
1,3-Dichlorobenzene	0.5	nd	nd	nd	9,600
1,4-Dichlorobenzene	0.5	nd	nd	nd	8
1,1-Dichloroethane	0.5	nd	nd	nd	320
1,2-Dichloroethane	0.5	nd	nd	nd	1.6
1,1-Dichloroethylene	0.5	nd	nd	nd	1.6
cis-1,2-Dichloroethylene	0.5	nd	nd	nd	1.6
trans-1,2-Dichloroethylene	0.5	nd	nd	nd	1.6
1,2-Dichloropropane	0.5	nd	nd	nd	16

TABLE 9: Analytical Test Results – Groundwater (VOCs)

Parameter	MDL (µg/L)	Groundwater Samples (µg/L) December 17, 2018			MECP Table 3 Standards (µg/L)
		BH1-GW1	BH3-GW1	BH1-GW1	
1,3-Dichloropropene, total	0.5	nd	nd	nd	5.2
Ethylbenzene	0.5	nd	nd	nd	2,300
Ethylene dibromide	0.2	nd	nd	nd	0.25
Hexane	1	nd	nd	nd	51
Methyl Ethyl Ketone	5	nd	nd	nd	470,000
Methyl Isobutyl Ketone	5	nd	nd	nd	140,000
Methyl tert-butyl ether	2	nd	nd	nd	190
Methylene Chloride	5	nd	nd	nd	610
Styrene	0.5	nd	nd	nd	1,300
1,1,1,2-Tetrachloroethane	0.5	nd	nd	nd	3.3
1,1,2,2-Tetrachloroethane	0.5	nd	nd	nd	3.2
Tetrachloroethylene	0.5	nd	nd	nd	1.6
Toluene	0.5	nd	nd	nd	18,000
1,1,1-Trichloroethane	0.5	nd	nd	nd	640
1,1,2-Trichloroethane	0.5	nd	nd	nd	4.7
Trichloroethylene	0.5	nd	nd	nd	1.6
Trichlorofluoromethane	1	nd	nd	nd	2,500
Vinyl Chloride	0.5	nd	nd	nd	0.5
Xylenes, total	0.5	nd	nd	nd	4,200

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

No detectable VOC concentrations were identified in the groundwater samples analyzed. The groundwater is in compliance with the selected MECP standards. Analytical results of groundwater sampled with respect to borehole locations are shown on Drawing PE4482-6.

All parameter concentrations were below laboratory detection limits.

5.7 Quality Assurance and Quality Control Results

All samples submitted as part of the December 2018 sampling events were handled in accordance with the Analytical Protocol with respect to preservation method, storage requirement, and container type. Based on the results of the vapour survey and the non-detect soil results, the sample is considered to be representative of the soil quality.

As per Subsection 47(3) of O.Reg. 153/04 as amended by 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.

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

5.8 Phase II Conceptual Site Model

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

Site Description

Potentially Contaminating Activity and Areas of Potential Environmental Concern

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

- A former underground storage tank (UST) located on the south eastern portion of the Phase I Property;
- Three (3) former above ground storage tanks (ASTs) located on the central west of the Phase I Property;
- A former automotive garage and floor drainage system located on the central north portion of the Phase I Property.

Contaminants of potential concern associated with the aforementioned PCAs include a combination of PHCs (F1-F4), VOCs, and BTEXs in the groundwater and and/or soil.

Subsurface Structures and Utilities

Underground service locates were completed prior to the subsurface investigation. Underground utilities on the Phase II Property include natural gas, electrical, communications, water, and sewerage services. No private wells or septic systems are present on the Phase II Property. Seven (7) domestic water supply wells were identified in the Phase I Study Area, however based on the age of these wells and the availability of municipal water in the area, these wells are no longer considered to be in use.

Physical Setting

Site Stratigraphy

The site stratigraphy, from ground surface to the deepest aquifer or aquitard investigated, is illustrated on Drawing PE4482-7. The stratigraphy consists of:

- Pavement structure consisting of approximately 0.06 to 0.18 m of asphaltic concrete over crushed stone.
- Fill material generally consisting of crushed stone or reworked shale an and till material, beneath the pavement structure and extending to depths ranging from approximately 1.52 to 2.89 m below the existing grade.
- Glacial till comprised of brown silty sand with clay and some gravel was identified beneath some of the fill material (BH1 and BH4). Till material extends to depths ranging from approximately 1.60 to 2.69 m below the existing grade.
- Bedrock comprised of weathered black shale was identified beneath the fill material and glacial till. Bedrock extends to depths ranging from approximately 2.23 to 5.18 m below the existing grade.

Hydrogeological Characteristics

Groundwater at the Phase II Property was encountered within the overburden soil. This unit is interpreted to function as a local aquifer at the subject site.

Water levels were measured at the subject site on December 17, 2018, at depths ranging from 1.39 to 1.53 m below grade. Based on the groundwater elevations measured during this monitoring event, groundwater contour mapping was completed and the horizontal hydraulic gradient for the subject site was calculated. Groundwater flow at the subject site was in a southeasterly direction, with a hydraulic gradient of approximately 0.0029 m/m. The groundwater contour plan of the subject site is shown on Drawing PE4482-4.

Approximate Depth to Bedrock

Bedrock is present at approximately 1.6 to 2.9 m below the existing grade; however, it is below 2 m depth across the majority of the site.

Approximate Depth to Water Table

Depth to water table at the subject site varies between approximately 1.39 to 1.53 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

Fill material was identified across the Phase II Property beneath the pavement structure and extending to depths ranging from 1.40 to 2.60 m below grade. The fill material is suspected to have been placed during the regrading of the site during the construction of the existing building and the adjacent property to the south.

Proposed Buildings and Other Structures

It is our understanding that the eastern half of the Phase II Property will be redeveloped with a commercial building and the existing building on the western half will be demolished and serve as a parking lot.

Existing Buildings and Structures

The western half of the subject site is occupied by a single-storey industrial building constructed in approximately 1970 with a slab-on-grade foundation. The eastern half of the site is occupied by an asphalt covered lot.

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 Phase II Property. The nearest body of water is a tributary of Green's Creek, located approximately 60 m to the south of the subject property.

Environmental Condition

Areas Where Contaminants are Present

Concentrations of PHC F_2 and PHC F_1 exceeding the MECP Table 3 Standards were identified in the fill material in BH2 and BH3. Groundwater was determined to be in compliance with the MECP Table 3 Standards. Analytical test results are shown on Drawings PE4482-4 and PE4482-5 – Analytical Testing Plan.

Types of Contaminants

Based on the analytical testing, contaminants of concern in the soil are PHC fractions F_1 and F_2.

As noted previously, the groundwater at the Phase II Property is in compliance with the selected MECP Standards.

Contaminated Media

Based on the results of the Phase II ESA, the fill material at BH2 and BH3 are impacted with PHC F_2 and PHC F_1 to depths of approximately 2.9 and 1.4 m, respectively. Groundwater samples obtained from the Phase II Property were in compliance with the selected MECP standards.

Known Areas Where Contaminants Are Present

Fill material is impacted in the southeast and central north portion of the subject site. Analytical test results exceeding the MECP Table 3 Standards are presented on Drawing PE4482- 4- Analytical Testing Plan.

Distribution and Migration of Contaminants

As previously noted, impacted fill material was identified in the southeast and central north portion of the subject site in the area of BH3 and BH2. The PHC F_1, and PHC F_2 impacts were identified at BH2 and BH3 near the water table. However, all groundwater samples were in compliance with MECP Standards. Therefore, the impacts are not considered to have migrate vertically or horizontally a significant distance. The impacts are considered to be minimal as the current soil and groundwater testing results from BH3 show no down-gradient impact on BH2.

Please refer to Drawings PE4482-7 – Cross Sections A-A' – Soil, which depict the anticipated vertical distribution of contaminants based on the available information to date.

Discharge of Contaminants

The PHC impacted soil is considered to have resulted from the former underground diesel tank and the former automotive garage drainage pit.

Climatic and Meteorological Conditions

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

Leaching is not considered an issue since the groundwater is clean.

The fluctuation of groundwater levels is not considered to have significantly affected contaminant transport as the groundwater beneath the Phase II Property is in compliance with MECP Table 3 Standards.

Potential for Vapour Intrusion

The potential for vapour intrusion is considered to be low based on the non-volatile nature of the PHC fractions.

6.0 CONCLUSIONS

Assessment

A Phase II ESA was conducted for part of the property addressed 1499 Star Top Road, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address potentially contaminating activities (PCAs) that were identified during the Phase I ESA and considered to result in areas of potential environmental concern (APECs) on the Phase II Property. The subsurface investigation was carried out in conjunction with a Geotechnical Investigation and consisted of drilling five (5) boreholes, three (3) of which were constructed with groundwater monitoring wells.

Soil samples were obtained from the boreholes and screened using visual observations and organic vapour measurements. Three (3) soil samples were submitted for laboratory analysis of of benzene, toluene, ethylbenzene and xylenes (BTEX) and petroleum hydrocarbons (PHCs, F_1-F_4). Two (2) petroleum hydrocarbon fractions F1 (in BH2) and F2 (BH3) exceeded the MECP Table 3 Standards. Impacted fill was identified where the former UST and automotive repair garage were identified on the southeast and central north portion of the Phase II Property, respectively. The extent of the impacted soil is considered to be limited to the immediate area of the former UST and drainage pits.

Groundwater samples from monitoring wells installed in BH1, BH2 and BH3 were recovered and analyzed for volatile organic compounds (VOCs) and PHC parameters. Groundwater samples were in compliance with the MECP Table 3 Standards, with no detectable VOC and PHC concentrations.

Conclusion

Based on the findings of the Phase II ESA, soil impacted with PHC (F1 and F2) concentrations exceeding MECP Table 3 Standards is present on the Phase II Property. It is our understanding that the subject site is to be redeveloped with a commercial building. It is our recommendation that an environmental site remediation program, involving the removal of all contaminated soil, be completed concurrently with the site redevelopment.

Prior to offsite disposal at a licenced landfill site, a leachate analysis of a representative sample of contaminated soil must be conducted in accordance with Ontario Regulation 347/558. It is recommended that Paterson personnel be

onsite during construction activities to direct the excavation and segregation of impacted soil and to conduct confirmatory sampling as required.

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

7.0 STATEMENT OF LIMITATIONS

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

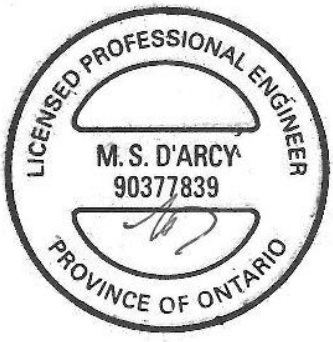
The client should be aware that any information pertaining to soils and all test hole logs are furnished as a matter of general information only and test hole descriptions or logs are not to be interpreted as descriptive of conditions at locations other than those of the test holes themselves.

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

This report was prepared for the sole use of 4015274 Canada Inc. Notification from 4015274 Canada Inc. and Paterson Group will be required to release this report to any other party.

Paterson Group Inc.

Mandy Witteman, M.A.Sc.



Mark S. D'Arcy, P.Eng.

Report Distribution:

- 4015274 Canada Inc. c/o Cannonbye Construction Ltd.
- Paterson Group

FIGURES

FIGURE 1 – KEY PLAN

DRAWING PE4482-3 – TEST HOLE LOCATION PLAN

DRAWING PE4482-4 – GROUNDWATER CONTOUR PLAN

DRAWING PE4482-5 – ANALYTICAL TESTING PLAN – SOIL

DRAWING PE4482-6 – ANALYTICAL TESTING PLAN – GROUNDWATER

DRAWING PE4482-7 – CROSS-SECTION A-A' – SOIL

DRAWING PE4482-8 – CROSS-SECTION A-A' – GROUNDWATER

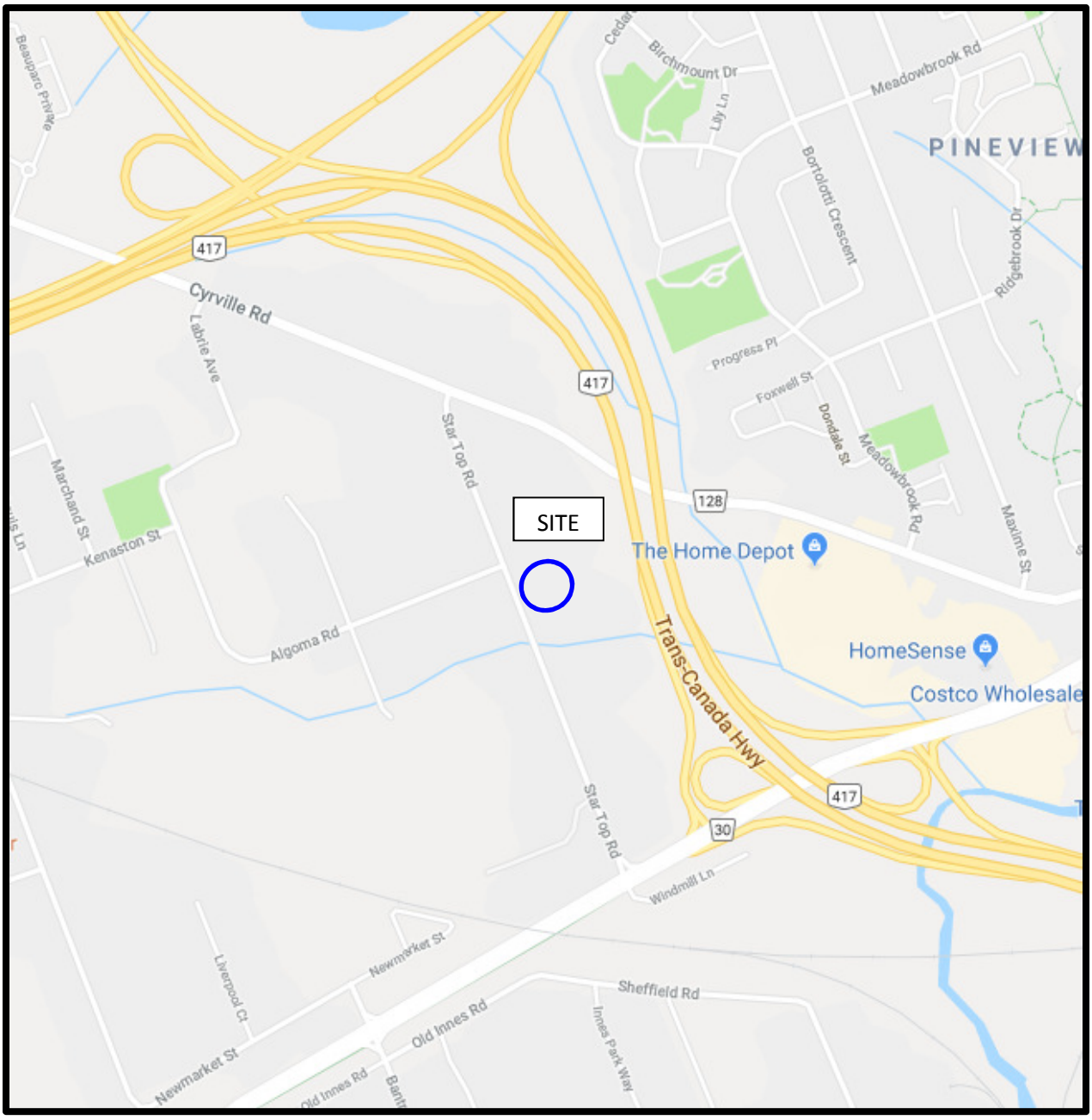


FIGURE 1

KEY PLAN

#1294 ALGOMA ROAD
MULTI-UNIT COMMERCIAL
AND LIGHT INDUSTRIAL

#1500 STAR TOP ROAD
MULTI-UNIT COMMERCIAL OFFICES AND WAREHOUSE

STAR TOP ROAD

#1495 STAR TOP ROAD
CITY LOCKSMITH

WASTE OIL
BUCKETS, SPILL

#1485 STAR TOP ROAD
GERVAIS TOWING AND
RECOVERY

STORAGE AREA

OFFICE SPACE

GARAGE BAYS

A

A'

BH 3
66.10
(64.67)

BH 5
66.13

BH 4
66.18

CHAIN LINK FENCE

APPROX. LOCATION OF FORMER
ABOVEGROUND STORAGE TANK

BH 1
66.00
(64.61)

BH 2
66.08
(64.55)

ASPHALTIC CONCRETE
PARKING AREA

#1499 STAR TOP ROAD
GRATIEN PROULX BUILDING
MATERIALS LTD.
ALUMINUM STORAGE

FUEL AST

#1499 STAR TOP ROAD

#1519 STAR TOP ROAD
REGIONAL ELEVATOR
OFFICE AND SERVICE

TBM

#1499 STAR TOP ROAD
GRATIEN PROULX BUILDING MATERIALS LTD.
WAREHOUSE

LEGEND:

- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION
- 66.00 GROUND SURFACE ELEVATION (m)
- [63.31] BEDROCK SURFACE ELEVATION (m)
- {63.84} PRACTICAL REFUSAL TO AUGERING ELEVATION (m)
- (64.67) GROUNDWATER SURFACE ELEVATION (m)
- (A)—(A') CROSS-SECTION LOCATION

TBM - FINISHED FLOOR LEVEL OF EXISTING WAREHOUSE. GEODETIC ELEVATION = 66.38m.

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NO.	REVISIONS	DATE	INITIAL
0			

4015274 CANADA INC.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1499 STAR TOP ROAD

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:400	Date: 12/2018
Drawn by: MPG	Report No.: PE4482-2
Checked by: MW	Dwg. No.: PE4482-3
Approved by: MSD	Revision No.: 0

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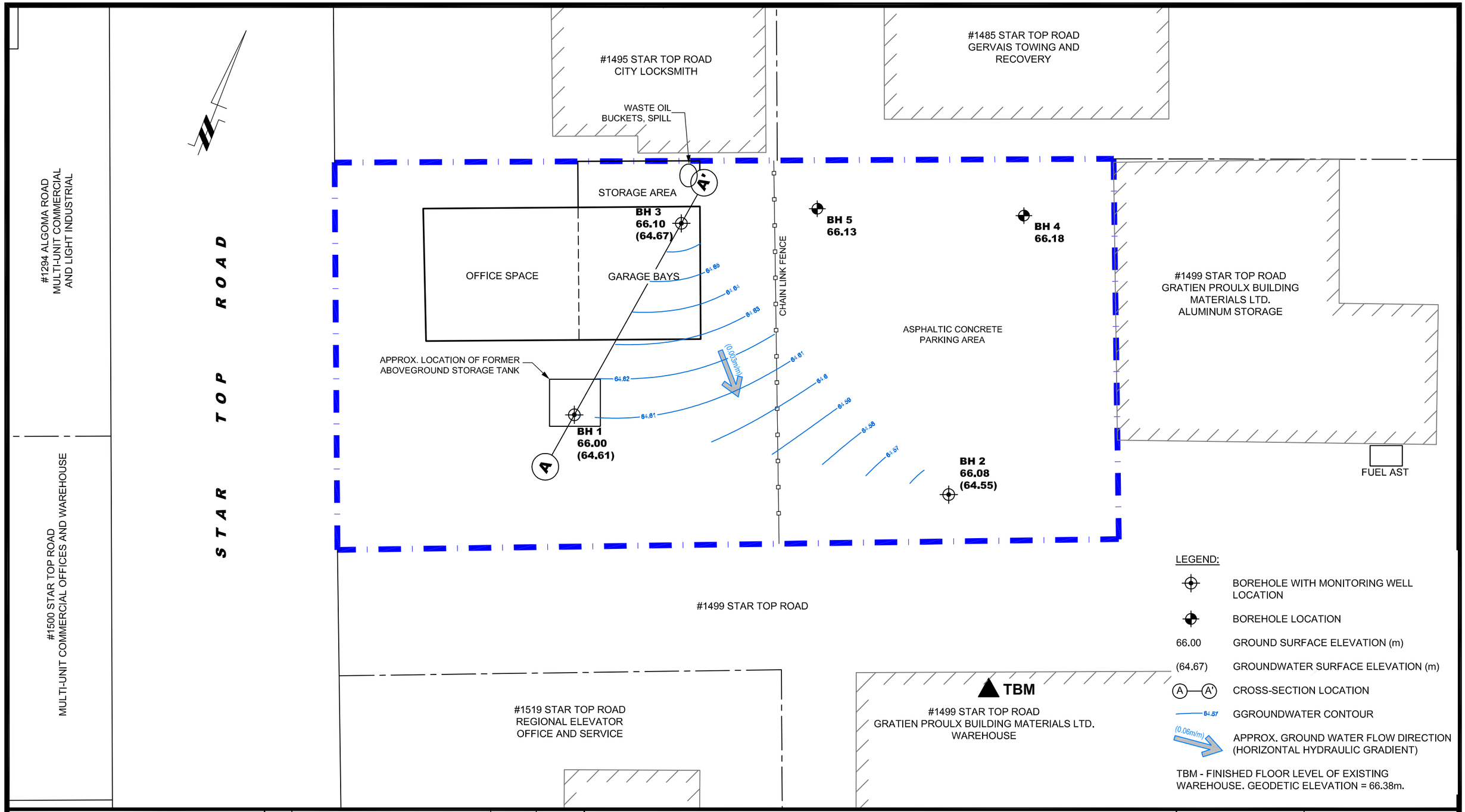

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0			

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1499 STAR TOP ROAD

OTTAWA, ONTARIO

Title:

GROUNDWATER CONTOUR PLAN

Scale: 1:400	Date: 12/2018
Drawn by: MPG	Report No.: PE4482-2
Checked by: MW	Dwg. No.: PE4482-4
Approved by: MSD	Revision No.: 0

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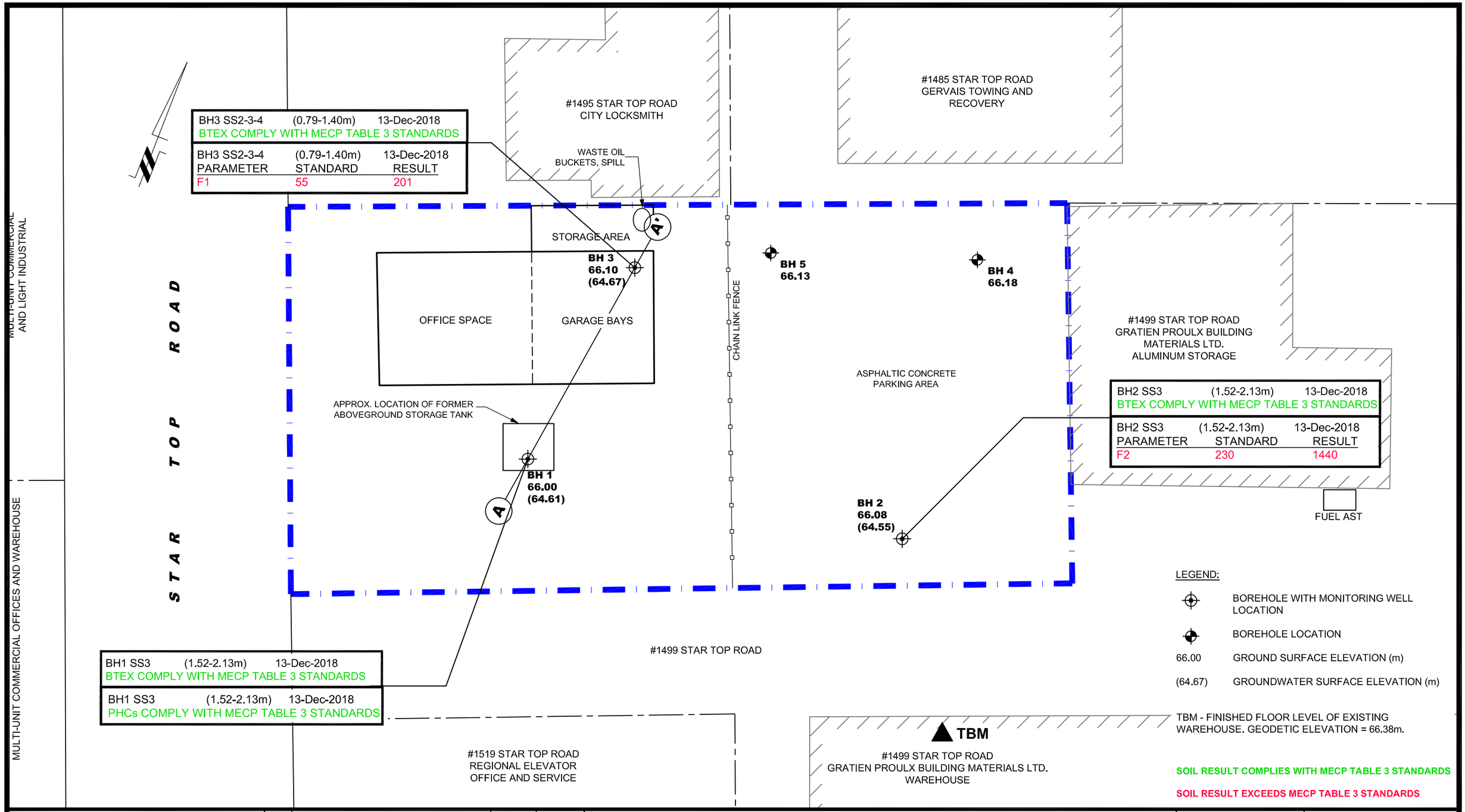

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4015274 CANADA INC.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1499 STAR TOP ROAD

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL

Scale: 1:400	Date: 12/2018
Drawn by: MPG	Report No.: PE4482-2
Checked by: MW	Dwg. No.: PE4482-5
Approved by: MSD	Revision No.: 0

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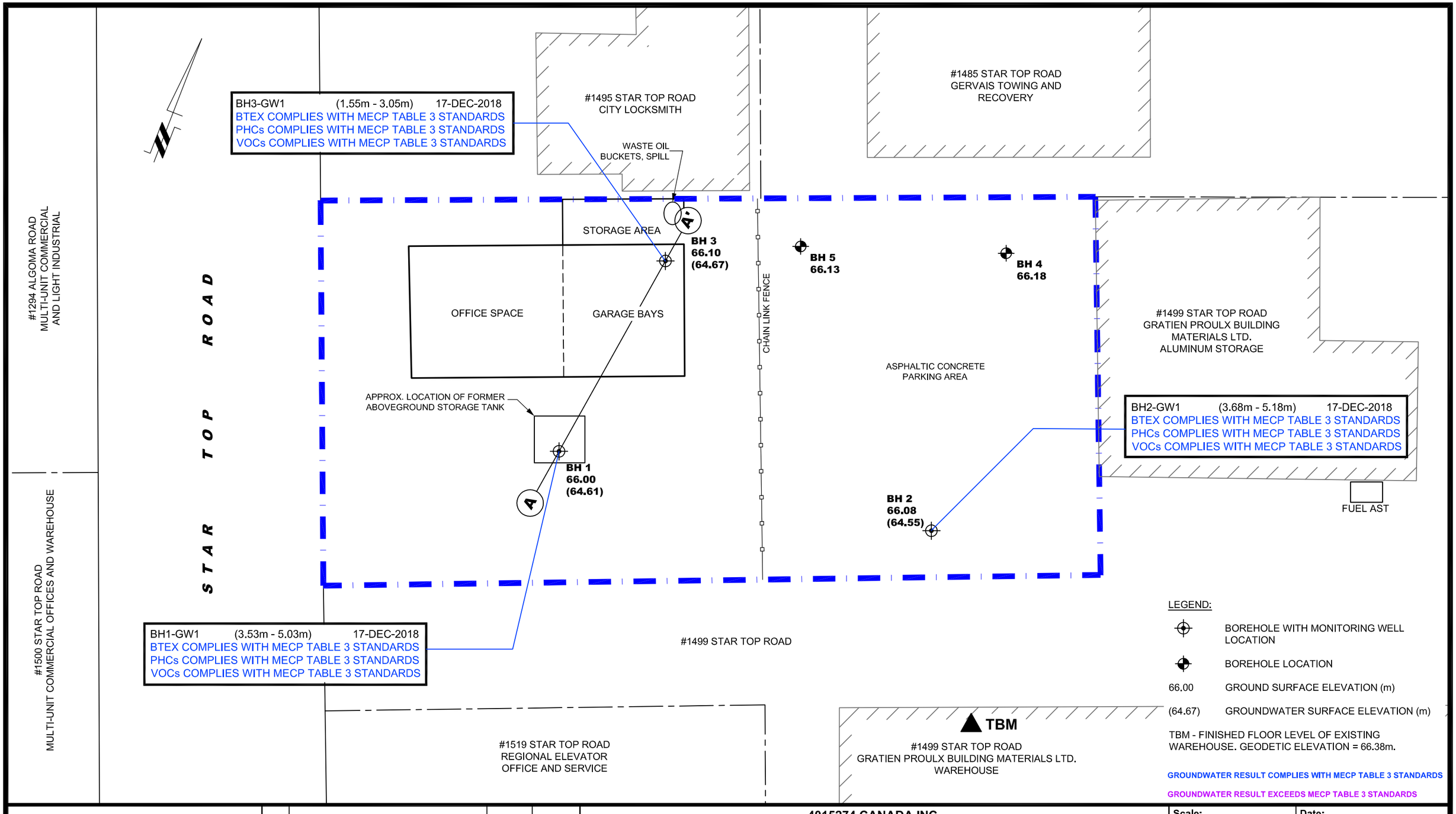

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4015274 CANADA INC.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1499 STAR TOP ROAD

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - GROUNDWATER

Scale: 1:400	Date: 12/2018
Drawn by: MPG	Report No.: PE4482-2
Checked by: MW	Dwg. No.: PE4482-6
Approved by: MSD	Revision No.: 0

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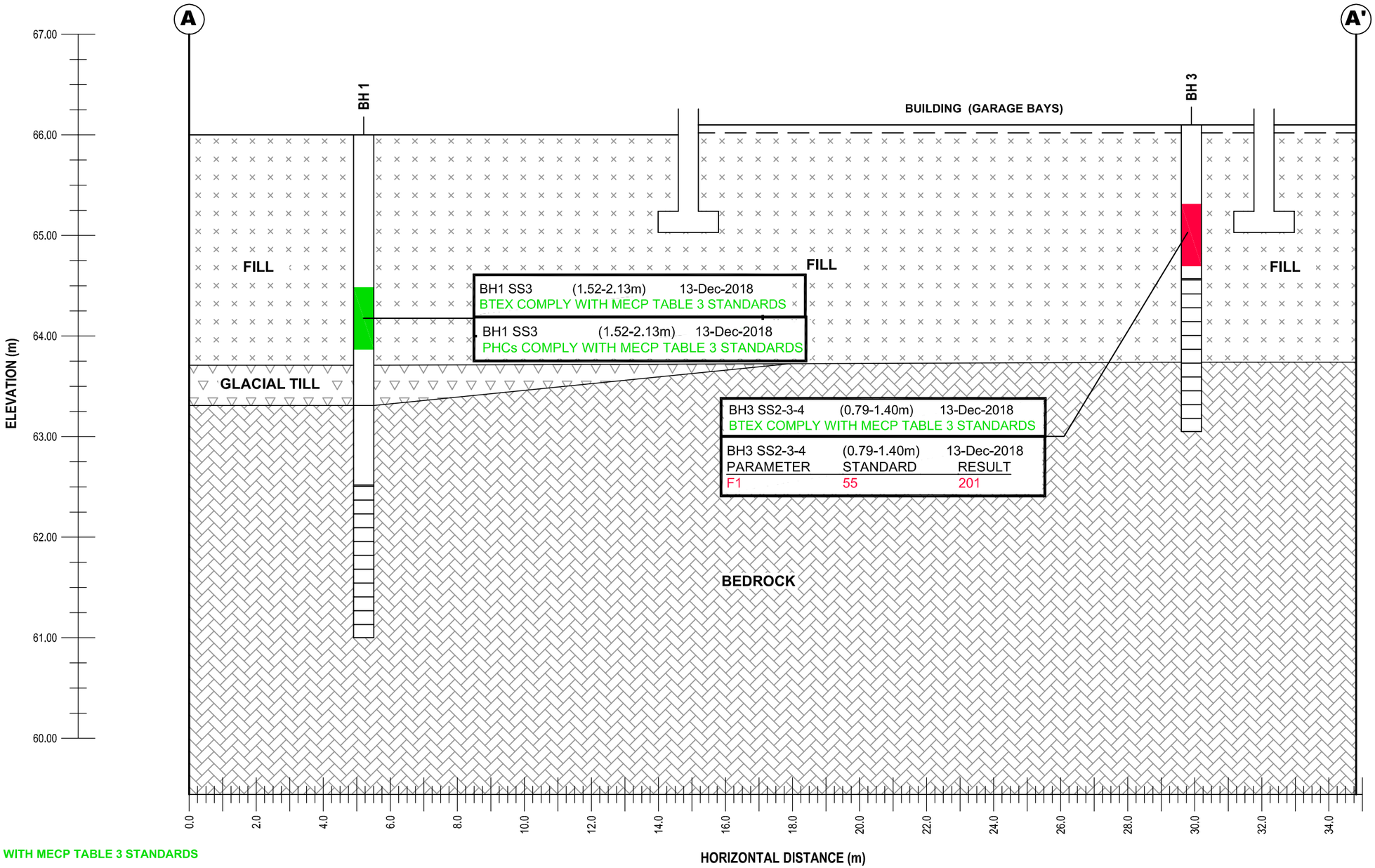

LEGEND:

SOIL RESULT COMPLIES WITH MECP TABLE 3 STANDARDS

SOIL RESULT EXCEEDS MECP TABLE 3 STANDARDS

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0			

4015274 CANADA INC.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1499 STAR TOP ROAD

OTTAWA, ONTARIO

Title: CROSS SECTION A-A' - SOIL

Scale: AS SHOWN	Date: 01/2019
Drawn by: RCG	Report No.: PE4482-2
Checked by: MW	Dwg. No.: PE4482-7
Approved by: MSD	Revision No.: 0

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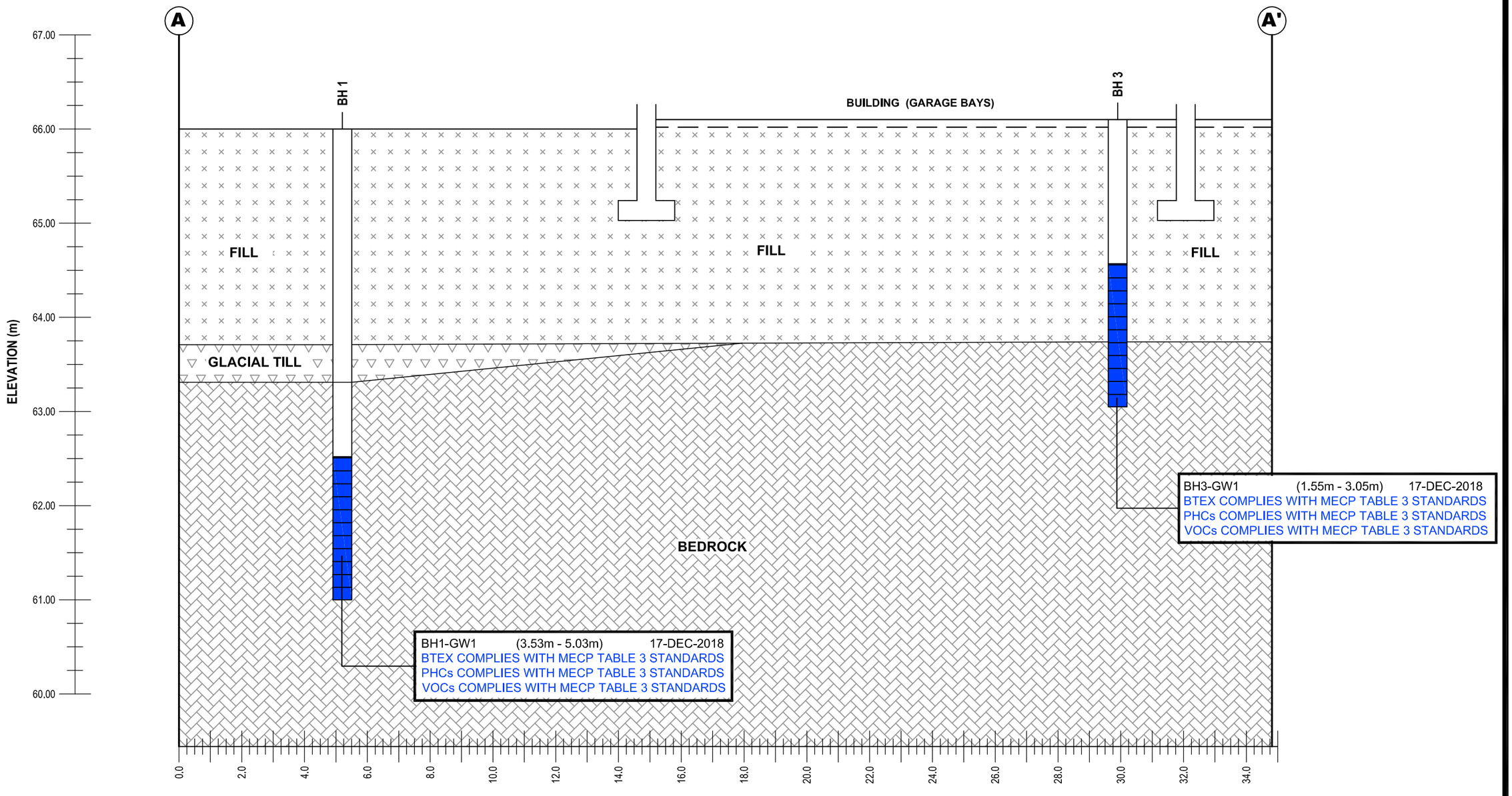

LEGEND:

GROUNDWATER RESULT COMPLIES WITH MECP TABLE 3 STANDARDS

GROUNDWATER RESULT EXCEEDS MECP TABLE 3 STANDARDS

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4015274 CANADA INC.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1499 STAR TOP ROAD

OTTAWA, ONTARIO

Title:

CROSS SECTION A-A' - GROUNDWATER

Scale: AS SHOWN	Date: 01/2019
Drawn by: RCG	Report No.: PE4482-2
Checked by: MW	Dwg. No.: PE4482-8
Approved by: MSD	Revision No.: 0

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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

Archaeological Services

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Sampling & Analysis Plan

Phase II Environmental Site Assessment
1499 Star Top Road
Ottawa, Ontario

Prepared For

4015274 Canada Inc.

December 2018

Report: PE4482-SAP

TABLE OF CONTENTS

1.0 SAMPLING PROGRAM 1
2.0 ANALYTICAL TESTING PROGRAM 2
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1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by 4015274 Canada Inc. to conduct a Phase II Environmental Site Assessment (ESA) at a portion of the property addressed 1499 Star Top Road, in the City of Ottawa, Ontario. Based on our December 2018 Phase I ESA completed for the subject property, a subsurface investigation program, consisting of borehole drilling, was developed. A geotechnical investigation was conducted concurrently with the environmental subsurface investigation.

Borehole	Location & Rationale	Proposed Depth & Rationale
BH1	Placed borehole on the central west portion of the subject site, where the former above ground storage tanks were identified.	Borehole advanced to until bedrock is reached to approximately 2m below the expected long-term groundwater table and installed a monitoring well.
BH2	Placed borehole on the central north portion of the subject site, where the former automotive repair garage was identified.	Borehole advanced to until bedrock is reached to approximately 2m below the expected long-term groundwater table and installed a monitoring well.
BH3	Placed borehole on the south east portion of the subject site, where the former underground storage tanks were identified.	Borehole advanced to until bedrock is reached to approximately 2m below the expected long-term groundwater table and installed a monitoring well.
BH4	Placed borehole along the north east corner of the subject site to cover a wide subsurface investigation.	Borehole advanced until bedrock is reached or until practical refusal to augering is reached for Geotechnical Investigation.
BH5	Placed borehole along the central north portion of the subject site, east of the existing building to cover a wide subsurface investigation.	Borehole advanced until bedrock is reached or until practical refusal to augering is reached for Geotechnical Investigation.

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.

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 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 the finished floor in the warehouse, located at 1499 Star Top Road, with a geodetic elevation of 66.38 m above sea level (asl).

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.

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1499 Star Top Road
Ottawa, Ontario

DATUM TBM - Finished floor level of warehouse building. Geodetic elevation = 66.38m.

FILE NO. PE4482

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** December 12, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	66.00
Concrete 0.18							
FILL: Brown silty sand, some crushed stone		AU	1				
0.76							
FILL: Brown clayey silt 0.97		SS	2	67	50+	1	65.00
FILL: Brown sand and gravel, trace to some silt		SS	3	79	21	2	64.00
2.29		SS	4	100	50+		
GLACIAL TILL: Brown silty sand with clay, gravel, cobbles and boulders 2.69		RC	1	94	62	3	63.00
BEDROCK: Fair to excellent quality, black shale		RC	2	100	77	4	62.00
		RC	3	100	94		
5.00 End of Borehole						5	61.00
(GWL @ 1.39m - Dec. 17, 2018)							

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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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1499 Star Top Road
Ottawa, Ontario

DATUM TBM - Finished floor level of warehouse building. Geodetic elevation = 66.38m.

FILE NO. PE4482

REMARKS

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger **DATE** December 12, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	66.08
Asphaltic concrete 0.06		AU	1				
		SS	2	21	8	1	65.08
FILL: Brown silty sand, some crushed stone		SS	3	75	17		
		SS	4	100	50+	2	64.08
2.87		RC	1	93	93	3	63.08
BEDROCK: Good to excellent quality, black shale		RC	2	100	98	4	62.08
		RC	3	98	88	5	61.08
5.18							
End of Borehole							
(GWL @ 1.53m - Dec. 17, 2018)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

2245

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1499 Star Top Road
Ottawa, Ontario

DATUM TBM - Finished floor level of warehouse building. Geodetic elevation = 66.38m.

FILE NO. PE4482

REMARKS

HOLE NO. BH 3

BORINGS BY CME 55 Power Auger **DATE** December 12, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	66.10
Concrete 0.08							
FILL: Crushed stone, trace sand 0.28		AU	1				
FILL: Loose to compact, brown sand and gravel, trace to some silt		SS	2	25	6	1	65.10
		SS	3	17	38	2	64.10
2.36		SS	4	67			
BEDROCK: Weathered black shale						3	63.10
3.05 End of Borehole							
Practical refusal to augering at 3.05m depth							
(GWL @ 1.43m - Dec. 17, 2018)							

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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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1499 Star Top Road
Ottawa, Ontario

DATUM TBM - Finished floor level of warehouse building. Geodetic elevation = 66.38m.

FILE NO. PE4482

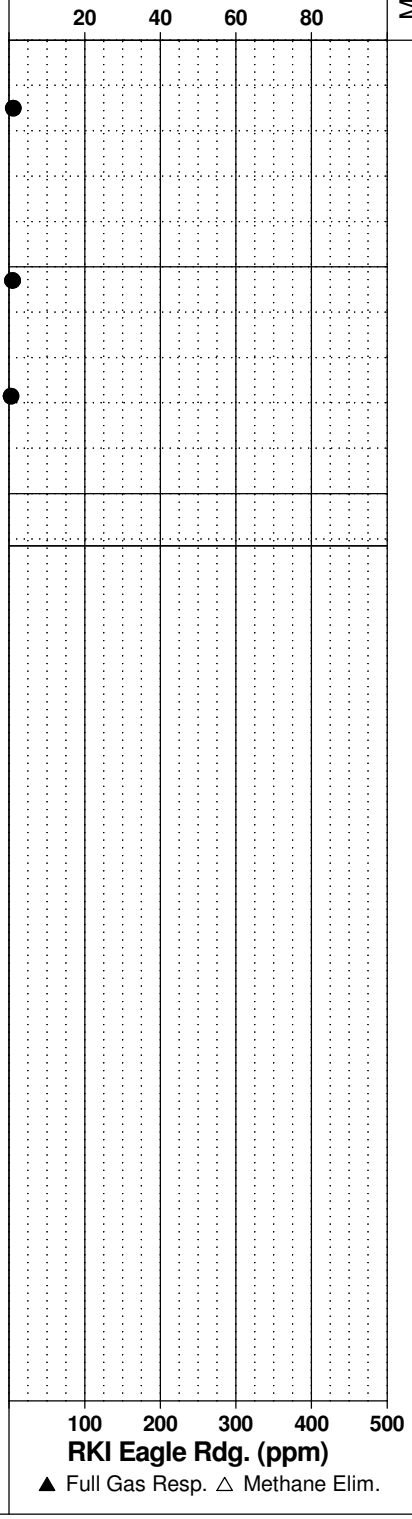
REMARKS

HOLE NO. BH 4

BORINGS BY CME 55 Power Auger **DATE** December 12, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	66.18
Asphaltic concrete 0.06		AU	1				
FILL: Brown silty sand with crushed stone		SS	2	50	16	1	65.18
1.52							
GLACIAL TILL: Brown silty sand, some gravel, cobbles and boulders 1.60		SS	3	100	50+		
BEDROCK: Weathered black shale						2	64.18
2.23							
End of Borehole							
Practical refusal to augering at 2.23m depth							

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



Monitoring Well Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1499 Star Top Road
Ottawa, Ontario

DATUM TBM - Finished floor level of warehouse building. Geodetic elevation = 66.38m.

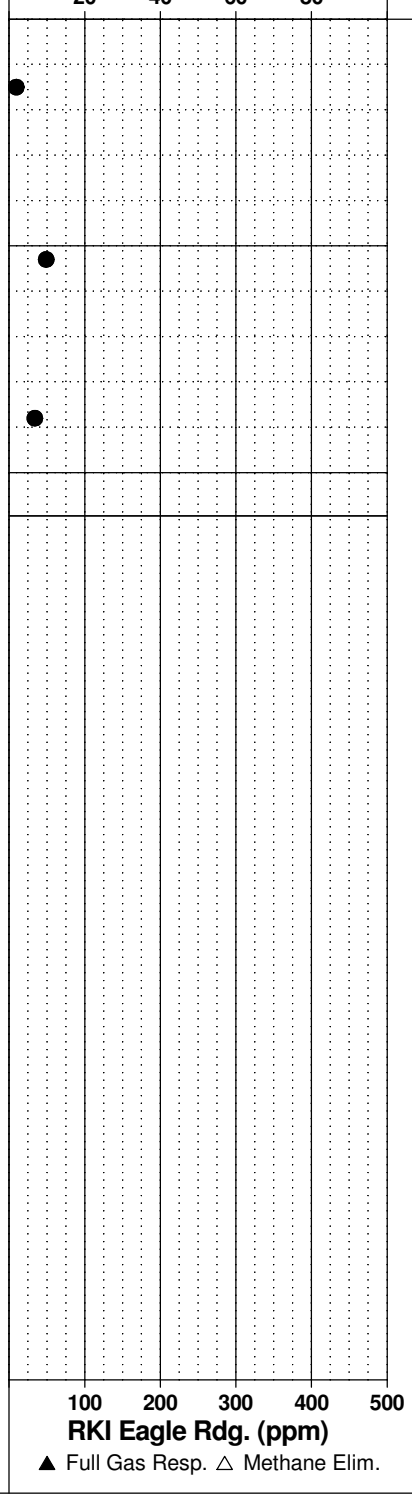
FILE NO. PE4482

REMARKS

HOLE NO. BH 5

BORINGS BY CME 55 Power Auger **DATE** December 12, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Photo Ionization Detector: Volatile Organic Rdg. (ppm) / Lower Explosive Limit %	Monitoring Well Construction
GROUND SURFACE									
Asphaltic concrete 0.06						0	66.13		
		AU	1						
FILL: Brown silty sand, some crushed stone						1	65.13		
		SS	2	58	9				
		SS	3	63	21	2	64.13		
2.29									
End of Borehole									
Practical refusal to augering at 2.29m depth									



SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

The standard terminology to describe the 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

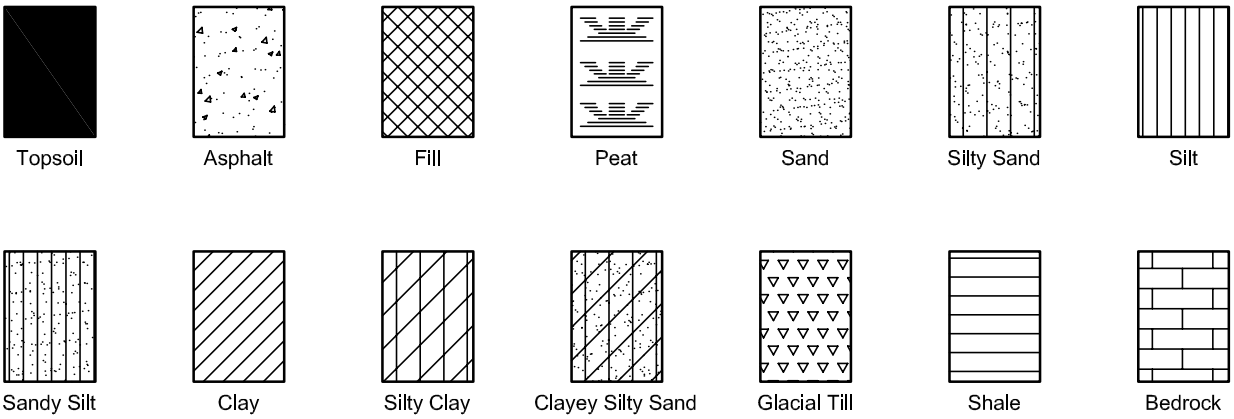
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

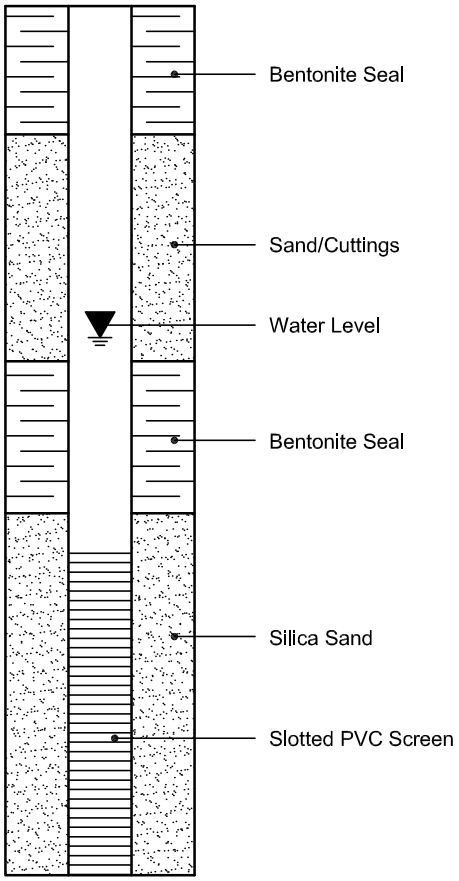
SYMBOLS AND TERMS (continued)

STRATA PLOT

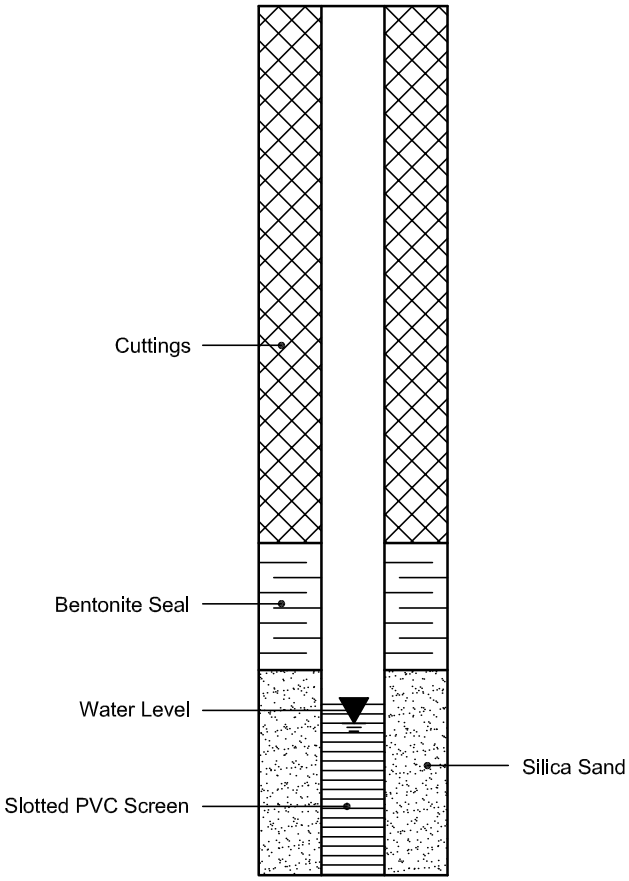


MONITORING WELL AND PIEZOMETER CONSTRUCTION

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: 24829
Project: PE4482
Custody: 46450

Report Date: 19-Dec-2018
Order Date: 13-Dec-2018

Order #: 1850475

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

Paracel ID	Client ID
1850475-01	BH1-SS3
1850475-02	BH2-SS3
1850475-03	BH3-SS2-3-4

Approved By:

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 24829

Report Date: 19-Dec-2018
Order Date: 13-Dec-2018
Project Description: PE4482

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	13-Dec-18	17-Dec-18
PHC F1	CWS Tier 1 - P&T GC-FID	13-Dec-18	17-Dec-18
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	13-Dec-18	18-Dec-18
Solids, %	Gravimetric, calculation	18-Dec-18	18-Dec-18

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 24829

Report Date: 19-Dec-2018

Order Date: 13-Dec-2018

Project Description: PE4482

	Client ID:	BH1-SS3	BH2-SS3	BH3-SS2-3-4	-
	Sample Date:	12/13/2018 10:30	12/13/2018 12:00	12/13/2018 13:30	-
	Sample ID:	1850475-01	1850475-02	1850475-03	-
	MDL/Units	Soil	Soil	Soil	-
Physical Characteristics					
% Solids	0.1 % by Wt.	89.2	88.6	81.4	-
Volatiles					
Benzene	0.02 ug/g dry	<0.02	<0.02	0.04	-
Ethylbenzene	0.05 ug/g dry	<0.05	<0.05	5.88	-
Toluene	0.05 ug/g dry	<0.05	<0.05	<0.05	-
m,p-Xylenes	0.05 ug/g dry	<0.05	0.22	15.5	-
o-Xylene	0.05 ug/g dry	<0.05	0.12	0.12	-
Xylenes, total	0.05 ug/g dry	<0.05	0.34	15.6	-
Toluene-d8	Surrogate	101%	95.4%	93.9%	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	19	201	-
F2 PHCs (C10-C16)	4 ug/g dry	6	1440	<4	-
F3 PHCs (C16-C34)	8 ug/g dry	11	819	136	-
F4 PHCs (C34-C50)	6 ug/g dry	29	<6	27	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 24829

Report Date: 19-Dec-2018
Order Date: 13-Dec-2018
Project Description: PE4482

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				40	
F2 PHCs (C10-C16)	ND	4	ug/g wet	ND				30	
F3 PHCs (C16-C34)	18	8	ug/g wet	13			29.1	30	
F4 PHCs (C34-C50)	11	6	ug/g wet	9			15.1	30	
Physical Characteristics									
% Solids	79.2	0.1	% by Wt.	87.9			10.4	25	
Volatiles									
Benzene	ND	0.02	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	
Surrogate: Toluene-d8	*8.52*		*ug/g dry*		*96.5*	*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)	172	7	ug/g		85.9	80-120			
F2 PHCs (C10-C16)	88	4	ug/g	ND	110	60-140			
F3 PHCs (C16-C34)	259	8	ug/g	13	125	60-140			
F4 PHCs (C34-C50)	158	6	ug/g	9	120	60-140			
Volatiles									
Benzene	3.87	0.02	ug/g		96.7	60-130			
Ethylbenzene	4.25	0.05	ug/g		106	60-130			
Toluene	4.15	0.05	ug/g		104	60-130			
m,p-Xylenes	8.43	0.05	ug/g		105	60-130			
o-Xylene	4.04	0.05	ug/g		101	60-130			
Surrogate: Toluene-d8	*7.50*		*ug/g*		*93.8*	*50-140*			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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

CCME PHC additional information:

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

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REL

Paracel ID: 1850475

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47
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Chain of Custody
(Lab Use Only)
№ 46450

Page 1 of 1

Client Name: Paterson Group	Project Reference: PE4482
Contact Name: Mark D'Arcy	Quote #
Address:	PO # 24829
Telephone: 226-7381	Email Address:

Turnaround Time:
☐ 1 Day ☐ 3 Day
☐ 2 Day ☑ Regular
Date Required:

Criteria: ☑ O. Reg. 153/04 (As Amended) Table _ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ☐ Other:

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

Required Analyses

Paracel Order Number: 1850475

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	BTEX F1-F4										
1	BH1-SS3	S		2	Dec 13/18	10:30	✓				250ml tube						
2	BH2-SS3	S	"	2	"	12:00	✓				"						
3	BH2-SS4	S	"	2	"	~~1:30~~	HOLD				120ml tube						
4	BH3-SS2-3-4	S	"	2	"	1:30	✓				250ml tube						
5																	
6																	
7																	
8																	
9																	
10																	

Comments: Sample dates on All Jars Read Dec 2/18 for Reels BH3-2-3+4

Method of Delivery: Person

Relinquished By (Sign):	Received by Driver/Depot: A Seguin	Received at Lab:	Verified By:
Relinquished By (Print): Mark St Pierre	Date/Time: 13/12/18 2:40 PM	Date/Time: Dec 13/18 @ 8:44	Date/Time: Dec 13, 18 5:10
Date/Time:	Temperature: °C	Temperature: 17.9 °C	pH Verified [ ] By: NA

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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: 21755
Project: PE4482
Custody: 46456

Report Date: 19-Dec-2018
Order Date: 17-Dec-2018

Order #: 1851082

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

Paracel ID	Client ID
1851082-01	BH3-GW1
1851082-02	BH1-GW1
1851082-03	BH2-GW1

Approved By:

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 21755

Report Date: 19-Dec-2018
Order Date: 17-Dec-2018
Project Description: PE4482

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
PHC F1	CWS Tier 1 - P&T GC-FID	17-Dec-18	18-Dec-18
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	18-Dec-18	19-Dec-18
REG 153: VOCs by P&T GC/MS	EPA 624 - P&T GC-MS	17-Dec-18	18-Dec-18

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 21755

Report Date: 19-Dec-2018

Order Date: 17-Dec-2018

Project Description: PE4482

	Client ID:	BH3-GW1	BH1-GW1	BH2-GW1	-
	Sample Date:	12/17/2018 12:00	12/17/2018 12:00	12/17/2018 12:00	-
	Sample ID:	1851082-01	1851082-02	1851082-03	-
	MDL/Units	Water	Water	Water	-
Volatiles					
Acetone	5.0 ug/L	<5.0	<5.0	<5.0	-
Benzene	0.5 ug/L	<0.5	<0.5	<0.5	-
Bromodichloromethane	0.5 ug/L	<0.5	<0.5	<0.5	-
Bromoform	0.5 ug/L	<0.5	<0.5	<0.5	-
Bromomethane	0.5 ug/L	<0.5	<0.5	<0.5	-
Carbon Tetrachloride	0.2 ug/L	<0.2	<0.2	<0.2	-
Chlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	-
Chloroform	0.5 ug/L	<0.5	<0.5	<0.5	-
Dibromochloromethane	0.5 ug/L	<0.5	<0.5	<0.5	-
Dichlorodifluoromethane	1.0 ug/L	<1.0	<1.0	<1.0	-
1,2-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	-
1,3-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	-
1,4-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	-
1,1-Dichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	-
1,2-Dichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	-
1,1-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	-
cis-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	-
trans-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	-
1,2-Dichloropropane	0.5 ug/L	<0.5	<0.5	<0.5	-
cis-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	<0.5	-
trans-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	<0.5	-
1,3-Dichloropropene, total	0.5 ug/L	<0.5	<0.5	<0.5	-
Ethylbenzene	0.5 ug/L	<0.5	<0.5	<0.5	-
Ethylene dibromide (dibromoethan	0.2 ug/L	<0.2	<0.2	<0.2	-
Hexane	1.0 ug/L	<1.0	<1.0	<1.0	-
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	<5.0	<5.0	<5.0	-
Methyl Isobutyl Ketone	5.0 ug/L	<5.0	<5.0	<5.0	-
Methyl tert-butyl ether	2.0 ug/L	<2.0	<2.0	<2.0	-
Methylene Chloride	5.0 ug/L	<5.0	<5.0	<5.0	-
Styrene	0.5 ug/L	<0.5	<0.5	<0.5	-
1,1,1,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	<0.5	-
1,1,2,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	<0.5	-
Tetrachloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	-
Toluene	0.5 ug/L	<0.5	<0.5	<0.5	-
1,1,1-Trichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 21755

Report Date: 19-Dec-2018

Order Date: 17-Dec-2018

Project Description: PE4482

	Client ID:	BH3-GW1	BH1-GW1	BH2-GW1	-
	Sample Date:	12/17/2018 12:00	12/17/2018 12:00	12/17/2018 12:00	-
	Sample ID:	1851082-01	1851082-02	1851082-03	-
	MDL/Units	Water	Water	Water	-
1,1,2-Trichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	-
Trichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	-
Trichlorofluoromethane	1.0 ug/L	<1.0	<1.0	<1.0	-
Vinyl chloride	0.5 ug/L	<0.5	<0.5	<0.5	-
m,p-Xylenes	0.5 ug/L	<0.5	<0.5	<0.5	-
o-Xylene	0.5 ug/L	<0.5	<0.5	<0.5	-
Xylenes, total	0.5 ug/L	<0.5	<0.5	<0.5	-
4-Bromofluorobenzene	Surrogate	115%	118%	112%	-
Dibromofluoromethane	Surrogate	110%	110%	103%	-
Toluene-d8	Surrogate	101%	96.9%	107%	-
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	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
Volatiles									
Acetone	ND	5.0	ug/L						
Benzene	ND	0.5	ug/L						
Bromodichloromethane	ND	0.5	ug/L						
Bromoform	ND	0.5	ug/L						
Bromomethane	ND	0.5	ug/L						
Carbon Tetrachloride	ND	0.2	ug/L						
Chlorobenzene	ND	0.5	ug/L						
Chloroform	ND	0.5	ug/L						
Dibromochloromethane	ND	0.5	ug/L						
Dichlorodifluoromethane	ND	1.0	ug/L						
1,2-Dichlorobenzene	ND	0.5	ug/L						
1,3-Dichlorobenzene	ND	0.5	ug/L						
1,4-Dichlorobenzene	ND	0.5	ug/L						
1,1-Dichloroethane	ND	0.5	ug/L						
1,2-Dichloroethane	ND	0.5	ug/L						
1,1-Dichloroethylene	ND	0.5	ug/L						
cis-1,2-Dichloroethylene	ND	0.5	ug/L						
trans-1,2-Dichloroethylene	ND	0.5	ug/L						
1,2-Dichloropropane	ND	0.5	ug/L						
cis-1,3-Dichloropropylene	ND	0.5	ug/L						
trans-1,3-Dichloropropylene	ND	0.5	ug/L						
1,3-Dichloropropene, total	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Ethylene dibromide (dibromoethane	ND	0.2	ug/L						
Hexane	ND	1.0	ug/L						
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L						
Methyl Isobutyl Ketone	ND	5.0	ug/L						
Methyl tert-butyl ether	ND	2.0	ug/L						
Methylene Chloride	ND	5.0	ug/L						
Styrene	ND	0.5	ug/L						
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L						
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L						
Tetrachloroethylene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
1,1,1-Trichloroethane	ND	0.5	ug/L						
1,1,2-Trichloroethane	ND	0.5	ug/L						
Trichloroethylene	ND	0.5	ug/L						
Trichlorofluoromethane	ND	1.0	ug/L						
Vinyl chloride	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: 4-Bromofluorobenzene	*87.3*		*ug/L*		*109*	*50-140*			
Surrogate: Dibromofluoromethane	*80.2*		*ug/L*		*100*	*50-140*			
Surrogate: Toluene-d8	*81.7*		*ug/L*		*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	25	ug/L	ND				30	
Volatiles									
Acetone	ND	5.0	ug/L	ND				30	
Benzene	ND	0.5	ug/L	ND				30	
Bromodichloromethane	ND	0.5	ug/L	ND				30	
Bromoform	ND	0.5	ug/L	ND				30	
Bromomethane	ND	0.5	ug/L	ND				30	
Carbon Tetrachloride	ND	0.2	ug/L	ND				30	
Chlorobenzene	ND	0.5	ug/L	ND				30	
Chloroform	ND	0.5	ug/L	ND				30	
Dibromochloromethane	ND	0.5	ug/L	ND				30	
Dichlorodifluoromethane	ND	1.0	ug/L	ND				30	
1,2-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,3-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,4-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,1-Dichloroethane	ND	0.5	ug/L	ND				30	
1,2-Dichloroethane	ND	0.5	ug/L	ND				30	
1,1-Dichloroethylene	ND	0.5	ug/L	ND				30	
cis-1,2-Dichloroethylene	ND	0.5	ug/L	ND				30	
trans-1,2-Dichloroethylene	ND	0.5	ug/L	ND				30	
1,2-Dichloropropane	ND	0.5	ug/L	ND				30	
cis-1,3-Dichloropropylene	ND	0.5	ug/L	ND				30	
trans-1,3-Dichloropropylene	ND	0.5	ug/L	ND				30	
Ethylbenzene	ND	0.5	ug/L	ND				30	
Ethylene dibromide (dibromoethane	ND	0.2	ug/L	ND				30	
Hexane	ND	1.0	ug/L	ND				30	
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L	ND				30	
Methyl Isobutyl Ketone	ND	5.0	ug/L	ND				30	
Methyl tert-butyl ether	ND	2.0	ug/L	ND				30	
Methylene Chloride	ND	5.0	ug/L	ND				30	
Styrene	ND	0.5	ug/L	ND				30	
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L	ND				30	
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L	ND				30	
Tetrachloroethylene	ND	0.5	ug/L	ND				30	
Toluene	ND	0.5	ug/L	ND				30	
1,1,1-Trichloroethane	ND	0.5	ug/L	ND				30	
1,1,2-Trichloroethane	ND	0.5	ug/L	ND				30	
Trichloroethylene	ND	0.5	ug/L	ND				30	
Trichlorofluoromethane	ND	1.0	ug/L	ND				30	
Vinyl chloride	ND	0.5	ug/L	ND				30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: 4-Bromofluorobenzene	*82.1*		*ug/L*		*103*	*50-140*			
Surrogate: Dibromofluoromethane	*93.6*		*ug/L*		*117*	*50-140*			
Surrogate: Toluene-d8	*84.5*		*ug/L*		*106*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	1960	25	ug/L		97.9	68-117			
F2 PHCs (C10-C16)	1640	100	ug/L		102	60-140			
F3 PHCs (C16-C34)	3740	100	ug/L		95.5	60-140			
F4 PHCs (C34-C50)	2000	100	ug/L		80.6	60-140			
Volatiles									
Acetone	60.6	5.0	ug/L		60.6	50-140			
Benzene	28.2	0.5	ug/L		70.4	60-130			
Bromodichloromethane	30.0	0.5	ug/L		75.0	60-130			
Bromoform	33.8	0.5	ug/L		84.6	60-130			
Bromomethane	31.6	0.5	ug/L		79.1	50-140			
Carbon Tetrachloride	29.1	0.2	ug/L		72.6	60-130			
Chlorobenzene	36.2	0.5	ug/L		90.6	60-130			
Chloroform	34.3	0.5	ug/L		85.6	60-130			
Dibromochloromethane	31.1	0.5	ug/L		77.8	60-130			
Dichlorodifluoromethane	28.6	1.0	ug/L		71.6	50-140			
1,2-Dichlorobenzene	40.5	0.5	ug/L		101	60-130			
1,3-Dichlorobenzene	33.1	0.5	ug/L		82.8	60-130			
1,4-Dichlorobenzene	39.5	0.5	ug/L		98.7	60-130			
1,1-Dichloroethane	37.2	0.5	ug/L		93.1	60-130			
1,2-Dichloroethane	29.2	0.5	ug/L		73.0	60-130			
1,1-Dichloroethylene	32.8	0.5	ug/L		82.0	60-130			
cis-1,2-Dichloroethylene	32.2	0.5	ug/L		80.6	60-130			
trans-1,2-Dichloroethylene	33.6	0.5	ug/L		84.0	60-130			
1,2-Dichloropropane	29.3	0.5	ug/L		73.2	60-130			
cis-1,3-Dichloropropylene	39.6	0.5	ug/L		99.0	60-130			
trans-1,3-Dichloropropylene	44.9	0.5	ug/L		112	60-130			
Ethylbenzene	36.8	0.5	ug/L		92.1	60-130			
Ethylene dibromide (dibromoethane	28.3	0.2	ug/L		70.6	60-130			
Hexane	29.8	1.0	ug/L		74.5	60-130			
Methyl Ethyl Ketone (2-Butanone)	65.4	5.0	ug/L		65.4	50-140			
Methyl Isobutyl Ketone	66.8	5.0	ug/L		66.8	50-140			
Methyl tert-butyl ether	70.1	2.0	ug/L		70.1	50-140			
Methylene Chloride	30.1	5.0	ug/L		75.3	60-130			
Styrene	24.8	0.5	ug/L		61.9	60-130			
1,1,1,2-Tetrachloroethane	36.8	0.5	ug/L		92.1	60-130			
1,1,2,2-Tetrachloroethane	30.1	0.5	ug/L		75.2	60-130			
Tetrachloroethylene	34.8	0.5	ug/L		87.0	60-130			
Toluene	36.5	0.5	ug/L		91.3	60-130			
1,1,1-Trichloroethane	29.7	0.5	ug/L		74.2	60-130			
1,1,2-Trichloroethane	27.8	0.5	ug/L		69.4	60-130			
Trichloroethylene	41.1	0.5	ug/L		103	60-130			
Trichlorofluoromethane	39.3	1.0	ug/L		98.2	60-130			
Vinyl chloride	37.7	0.5	ug/L		94.2	50-140			
m,p-Xylenes	85.0	0.5	ug/L		106	60-130			
o-Xylene	46.9	0.5	ug/L		117	60-130			
Surrogate: 4-Bromofluorobenzene	*55.4*		*ug/L*		*69.3*	*50-140*			

Qualifier Notes:

Login Qualifiers :

Container(s) - Bottle and COC sample ID don't match -
Applies to samples: BH3-GW1, BH1-GW1, BH2-GW1

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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.

PARACEL LABORATORIES LTD.

Paracel ID: 1851082

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Chain of Custody
(Lab Use Only)
№ 46456

Page 1 of 1

Client Name: Paterson	Project Reference: P2482	**Turnaround Time:**
Contact Name: Mark D'Arcy	Quote #	☐ 1 Day ☐ 3 Day
Address: 154 Colonnade Rd	PO # 21755	☐ 2 Day ☑ Regular
Telephone: 613 726 7381	Email Address: MDarcy@Patersongrp.ca	Date Required:

Criteria: ☐ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ☐ Other

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

Required Analyses

Paracel Order Number: 1851082

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	PHC (F1+BTEX)	VOC									
1	BH A	W		3	17 Dec	PM	✓	✓									
2	BH B	W		3	17 Dec	PM	✓	✓									
3	BH C	W		3	17 Dec	PM	✓	✓									
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Comments: Report samples as 1: BH3-GW1
2: BH1-GW1 as per phillip.dn
3 ~~BH2-GW1~~

Method of Delivery: Paracel

Relinquished By (Sign):	Received by Driver/Depot: M. Sloane	Received at Lab:	Verified By:
Relinquished By (Print): Mark St Pierre	Date/Time: 17/12/18 3:10 PM	Date/Time: Dec 17/18 5:00	Date/Time: Dec 17/18 · 552p
Date/Time:	Temperature: °C	Temperature: 12.9 °C	pH Verified [ ] By:

Chain of Custody (Blank) - Rev 0.4 Feb 2016