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Phase II Environmental Site Assessment Update

151 Chapel Street
Ottawa, Ontario

Prepared For

Trinity Development Group

Paterson Group Inc.

Consulting Engineers
154 Colonnade Road South
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April 4, 2019

Report: PE2930-LET.05

April 4, 2019
File: PE2930-LET.05

Trinity Development Group Inc.
77 Bloor Street West, Suite 1601
Toronto, Ontario
M5S 1M2

Attention: **Mr. Mathew Laing**

Subject: **Phase II - Environmental Site Assessment Update
Vacant Lot – 151 Chapel Street
Ottawa, Ontario**

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Dear Sir,

Further to your request, Paterson Group (Paterson) carried out a Phase II - Environmental Site Assessment (ESA) Update for the aforementioned property. This report updates a previous Phase II-ESA report entitled, "Supplemental Phase II Environmental Site Assessment – 151 Chapel Street, Ottawa, Ontario," completed by Paterson, dated March 11, 2016. This Phase II ESA Update is intended to meet the requirements of a Phase II ESA, as per O.Reg. 153/04, as amended, under the Environmental Protection Act. This report is to be read in conjunction with the Supplemental Phase II ESA Report (PE2930-REP.03R), which is appended to this report (Appendix 2).

Background Information

Physical Setting

The subject site addressed 151 Chapel Street is situated on the northeast quadrant of the Chapel Street and Rideau Street intersection, in the City of Ottawa, Ontario. The site was previously occupied by a synagogue/community centre that was constructed, circa 1950 and later demolished in October 2015. The site is presently a vacant lot and is fenced along the perimeter of the property. A large pit exists where the former synagogue was situated. Remnants of a concrete foundation wall along the east and south property boundaries are present, as well as an exterior concrete staircase on the central-west side of the property. The edges of the site are vegetated with grass and some low brush with some detection of gravel and rocks along the perimeter of the pit where the previous building once stood.

The property is at grade with the adjacent streets and slopes downwards in a south-to-north direction. The regional topography slopes downwards in a northerly direction towards the Rideau River.

Past Investigations

Paterson conducted a Phase I ESA and Phase II ESA in March and April 2013, respectively, and a Supplementary Phase II ESA in March 2016.

The Phase I ESA identified one on-site and off-site potentially contaminating activity (PCA); a former exterior underground storage tank (UST) on the northwestern side of the former building and a former retail fuel outlet (RFO) 40 m east of the site that were considered to represent areas of potential environmental concern (APEC) on the subject. A Phase II ESA was subsequently conducted to address these APECs. Four (4) boreholes were drilled, of which, three (3) were completed as monitoring wells. Several soil samples from various borehole locations were submitted and analyzed for metals, BTEX and PHC fractions (F1-F4). Soil obtained from the former UST nest (BH4-13) exceeded the selected MECP Standards. All other sample results were in compliance. Groundwater samples were obtained and analyzed for PHCs and VOCs. All groundwater results were in compliance with the selected MECP Table 3 (Residential) Standards.

A Supplementary Phase II ESA was conducted, post-demolition of the former subject building, in March 2016. The purpose of 2016 Phase II ESA was to address the APECs identified during the 2013 ESAs (contaminated soil in the former UST nest and fill material of unknown quality) and delineate contaminants of concern.

Twenty-one (21) boreholes were drilled, four (4) of which were completed as monitoring wells. Soil samples were retrieved and analyzed for BTEX, PAHs and PHCs. Several fill samples in the immediate vicinity of the footprint of the former UST nest exceeded the selected MECP Standards for several PAH parameters, BTEX and PHCs (F1-F4). All other sample results were in compliance. Groundwater samples were obtained and analyzed for BTEX and PHCs. All groundwater results were in compliance with the selected MECP standards.

Based on the results of the 2016 Phase II ESA, the impacted soil in the immediate vicinity of the former UST remains an APEC on the Phase I Property.

Impediments

Several groundwater monitoring wells were installed in 2013 and 2015, as part of the original and Supplemental Phase II ESA. As part of this update, three wells (3) were viable for sampling. All drilled boreholes and monitoring wells on the Phase II Property are shown on Drawing PE2930-12 – Test Hole Location Plan which is appended to this report.

Investigation Method

Groundwater sampling was conducted at BH1-12, BH2-13 and BH3-13 on March 25, 2019. Two (2) monitoring wells (BH2-13 and BH3-13) were found to be dry, where there was insufficient water volume. Groundwater samples from BH1-12 were collected and submitted for benzene, toluene, ethylbenzene and xylenes (BTEX) and petroleum hydrocarbon (PHC, fractions 1-4) analysis.

Review and Evaluation

Geology

Site geology details are provided in the 2016 Phase II ESA Report in Appendix 1 - Soil Profile and Test Data Sheets. The soils on site generally consisted of fill material overlying silty sand, underlain by a silty clay, followed by glacial till and limestone bedrock. The fill material varied in thickness between approximately 0.7 and 3.7 m, and consisted of brown silty sand with clay, gravel, and crushed stone. The silty sand layer varied in thickness between 0.7 and 1.6 m. The silty clay layer varied in thickness between 6.3 to 12.0 m. Bedrock was encountered at depths ranging from 12.1 to 19.0 m below ground surface.

Groundwater Elevations, Flow Direction and Hydraulic Gradient

Groundwater levels onsite were measured between April 2013 to March 2019, using an electronic water level meter. The last sampling date was on March 25, 2019. Only one water level was obtained in BH1-12, due to dry monitoring wells in BH2-13 and BH3-13. The water level in BH1-12 was 2.28 m below the ground surface.

Based on the 2013 Phase II ESA, the groundwater flow beneath the Phase II Property is flowing in a northerly direction. The hydraulic gradient of approximately 0.125 m/m was calculated. A groundwater contour plan is shown on Drawing PE2930-13.

Groundwater Quality

Groundwater samples from monitoring well BH1-12 was submitted for laboratory analysis of BTEX and/or PHCs. The results of the analytical testing are presented in Table 1. The laboratory certificates of analysis are provided in Appendix 1.

Table 1. Analytical Test Results – Groundwater – BTEX and PHCs				
Parameter	MDL (µg/L)	Groundwater Sample (µg/L)		MECP Table 3 Residential Fine-Grained Standards
		March 25, 2019		
		BH1-12-GW1	BH10-GW1 (duplicate)	
Benzene	0.05	nd	nd	430
Ethylbenzene	0.05	nd	nd	2,300
Toluene	0.05	nd	nd	18,000
Xylenes	0.05	nd	nd	4,200
PHCs F1	25	nd	NA	750
PHCs F2	100	nd	NA	150
PHCs F3	100	nd	NA	500
PHCs F4	100	nd	NA	500
Notes:				
<input type="checkbox"/> MDL – Method Detection Limit <input type="checkbox"/> NA – Parameter not analyzed <input type="checkbox"/> nd – Not detected above the MDL <input type="checkbox"/> Bold – Value exceeds applicable MECP Standard				

All BTEX and PHC results are in compliance with the selected MECP Table 3 Standards.

Phase II Conceptual Site Model

Contaminants of Potential Concern

The contaminants of potential concern (CPCs) include benzene, toluene, ethylbenzene and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAHs), petroleum hydrocarbons (PHCs, F1-F4) and metals in soil and/or groundwater.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

Based on the 2013 Phase I and Phase II ESAs, two (2) onsite PCAs were identified on the Phase II Property. As per Table 2 of O.Reg 153/04, a description of the PCAs that represent APECs on the Phase II Property are listed below:

- Item 28: Gasoline and Associated Products Storage in Fixed Tanks* – Historical presence of a former fuel oil underground storage tank (UST) on the subject site.

- ❑ *Item 30: Importation of Fill Material of Unknown Quality* – Presence of fill material on the subject site.

Existing Structures and Utilities

The Phase II Property is located in a municipally serviced area. Underground services are no longer in service. Service infrastructures may still be intact along the western (Chapel Street) and northern (Beausoleil Drive) property boundaries. Remains of the former building foundation are present onsite.

Physical Setting

Site Stratigraphy

The site stratigraphy, from ground surface to the deepest aquifer or aquitard investigated, is provided in the 2016 Phase II ESA report in Appendix 1 - Soil Profile and Test Data Sheets. The stratigraphy of the subject site generally consists of:

- ❑ Fill material, extending to depths ranging from approximately 0.2 to 2.39 m below grade;
- ❑ Silty sand, extending to depths ranging from approximately 1.30 to 4.95 below grade;
- ❑ Silty clay, extending to depths ranging from approximately 7.47 to 14.48 m below grade;
- ❑ Glacial till (sandy silt, trace gravel), extending to depths ranging from approximately 10.8 to 19.0 m below grade;
- ❑ Bedrock (interbedded limestone and shale), extending to depths ranging from approximately 12.1 to 19.0 m below grade;

Hydrogeological Setting

The Geological Survey of Canada website on the Urban Geology of the National Capital Area was consulted as part of this assessment. Based on this information, bedrock in the area of the site consists of middle Ordovician interbedded shale and limestone of the Verulam Formation. Overburden soils are shown as fluvial sand and silt, with a drift thickness on the order of 5-15 m.

The regional topography slopes downwards in a northerly direction. The ground water flow is anticipated to flow in a northerly direction.

Approximate Depth to Bedrock

At locations where bedrock was cored in 2015, bedrock was encountered at depths varying from 12.1 to 19.0 m.

Approximate Depth to Water Table

Depth to water table at the subject site was reported to range from 7.5 to 10.7 m during the April 2013 to March 2019 monitoring events.

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 or within 30 m of a water body.

Fill Placement

Fill was identified in the boreholes drilled during the previous 2013 and 2016 subsurface investigations. This fill material was likely placed at the time of the redevelopment of the site between 1949 and 1956, although some of it appears to have been placed at a later date (2002-2005) in the northeast and northwest quadrant of where the former swimming pool and UST excavation were situated. Although the source of the fill cannot be verified at this point, analytical results for metals and PAHs indicated that fill material identified within close proximity of BH2-12 and BH3-13 were in compliance with Table 3 Standards as shown in Drawing PE2930-14D – Analytical Testing Plan – Soils (PAHs). Soil results for metals are shown in Drawing PE2930-14B – Analytical Testing Plan – Soil (Metals).

Existing Buildings and Structures

The subject site is currently vacant. The previous building and structures were removed in 2015. Remnants of the former foundation walls are present on site. It is our understanding that the foundation walls will be removed concurrently with site redevelopment.

Proposed Buildings and Other Structures

It is our understanding that a combined commercial/residential high-rise is proposed for the site. The footprint of the development will cover the majority of the site. The development will consist of two 25-storey structures with 3 to 4 levels of underground parking.

Environmental Condition

Areas Where Contaminants are Present

Based on analytical results of the 2013 and 2016 Phase II ESA, contaminants that were present in concentrations greater than the selected site condition standards are shown on Drawings PE2930-14A to PE2930-14D for Metals, BTEX, PHCs and PAHs, respectively. Contaminated soil was observed primarily in the vicinity of the former UST. Groundwater results for BTEX, PHCs and VOCs are shown on Drawing PE2930-15. Groundwater results from 2013, 2016 and 2019 are in compliance with the selected MECP Table 3 Standards.

Types of Contaminants

Contaminants found in soil at concentrations greater than the selected MECP standards consist of PHC fractions F1-F3 in BH4-13; several PAH parameters (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, dibenzo[a,h]anthracene, fluoranthene, indeno[1,2,3-cd]pyrene) in BH21-15; benzene and PHC fractions F1-F4 in BH2-15; benzene, toluene, xylenes and PHC fractions F1-F4 in BH1-15; and PHC fraction F3 in BH21A-15.

All contaminant concentrations in groundwater were below laboratory detection limits.

Contaminated Media

Based on the results of the Phase II ESA, the fill material at BH3-14, BH16-15 and BH21-15 is impacted with PHCs and seven (7) PAH parameters at concentrations exceeding the MECP Standards. The silty sand layer at BH2-15 and BH1-15 is impacted with BTEX and PHC concentrations in excess of the selected MECP standards. No impacts were identified in the glacial till (silty clay) of the Phase I Property.

Analytical testing indicates that the groundwater beneath the site is not contaminated.

What Is Known About Areas where Contaminants are Present

The area of contamination discussed in the 2016 Phase II ESA report, is interpreted to be centered in the northwest quadrant of the property around the footprint of the former UST nest. The southern and eastern limits of the contamination have been delineated, and based on testing results, the contamination appears to extend to the northwest corner of the property. Based on the soil sample results, contamination appears to be confined

to the coarser-grained fill layer and underlying silty sand layer. It appears that the contaminants have not penetrated to the less permeable underlying silty clay layer.

Distribution of Contaminants

The horizontal distribution of petroleum hydrocarbon contamination is considered to be confined in the northwest corner of the property in the approximate vicinity of the former UST. The vertical distribution is considered to be limited based on the low permeability of the silty clay soils underlying the fill and silty sand soils on the Phase II Property.

Discharge of Contaminants

It is our interpretation that the presence of contaminants on-site is a result of the historical presence of the fuel oil UST. The presence of several PAH, benzene, toluene, xylenes and PHC parameters in the soil on-site, is considered to be a result of historic leakage or spills related to the removal of the former fuel oil UST.

Migration of Contaminants

Given the low permeability of native silty clay soils at the site and the consistency of the hydrocarbon contamination, it is our interpretation that migration of contaminants within site soils is extremely limited and confined to the fill and silty sand layer.

Climatic and Meteorological Conditions

In general, climatic and meteorological conditions have the potential to affect contaminant distribution. Two ways by which climatic and meteorological conditions may affect contaminant distribution include the downward leaching of contaminants by means of the infiltration of precipitation, and the migration of contaminants via groundwater levels and/or flow, which may fluctuate seasonally. Based on the results of the subsurface investigation, the contaminated areas appear to be restricted to the overburden soils, and as such, the aforementioned climatic and meteorological conditions are not considered to have affected contaminant distribution at the subject site.

Potential for Vapour Intrusion

The low volatility of the heavy-fraction hydrocarbons, PAHs and BTEX encountered at the subject site is not a concern as there are present no buildings on the subject site. The contaminated soil onsite will be fully remediated prior to the redevelopment of the site. There is no potential environmental concern for the proposed building.

Recommendations

Based on the 2013 and 2016 Phase II ESA results, BTEX, PAH and PHC impacted soil is present on the northwestern corner of the Phase II Property. It is our understanding that the subject site is to be redeveloped with residential and commercial buildings. It is our recommendation that an environmental site remediation program, involving the removal of all contaminated soil, be completed concurrently with site redevelopment.

It is our understanding that the subject site will be redeveloped, and a Record of Site Condition (RSC) will be obtained for the subject site in support of a Brownfield Redevelopment Grant for the site.

Statement of Limitations

This Phase II - Environmental Site Assessment Update report has been prepared in general accordance with Ontario Regulation 153/04, as amended, by O.Reg. 269/11 under the Environmental Protection Act. The conclusions presented herein are based on information gathered from a limited historical review and field inspection program. The findings of the Phase II - ESA Update are based on a review of readily available geological, historical and regulatory information and a cursory review made at the time of the field assessment.

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 Trinity Development Inc. Permission and notification from the above noted party and this firm will be required to release this report to any other party.

We trust that this submission satisfies your current requirements. Should you have any questions please contact the undersigned.

Paterson Group Inc.



Mandy Witteman, M.A.Sc.



Mark D'Arcy, P. Eng., QP_{ESA}



Report Distribution

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Appendix A

- Drawing PE2930-12 – Test Hole Location Plan
- Drawing PE2930-13 - Groundwater Contour Plan
- Drawing PE2930-14A – Analytical Testing Plan – Soils (Metals)
- Drawing PE2930-14B – Analytical Testing Plan– Soils (BTEX)
- Drawing PE2930-14C– Analytical Testing Plan –Soils (PHCs)
- Drawing PE2930-14D – Analytical Testing Plan –Soils (PAHs)
- Drawing PE2930-15 – Analytical Testing Plan – Groundwater (BTEX, PAHs, PHCs, VOCs)
- Laboratory Certificates of Analysis

Appendix B

- Supplemental Phase II ESA (PE2930-REP.03R)

APPENDIX A

DRAWING PE2930-12 – TEST HOLE LOCATION PLAN

DRAWING PE2930-13 – GROUNDWATER CONTOUR PLAN

**DRAWING PE2930-14A – ANALYTICAL TESTING PLAN – SOILS
(METALS)**

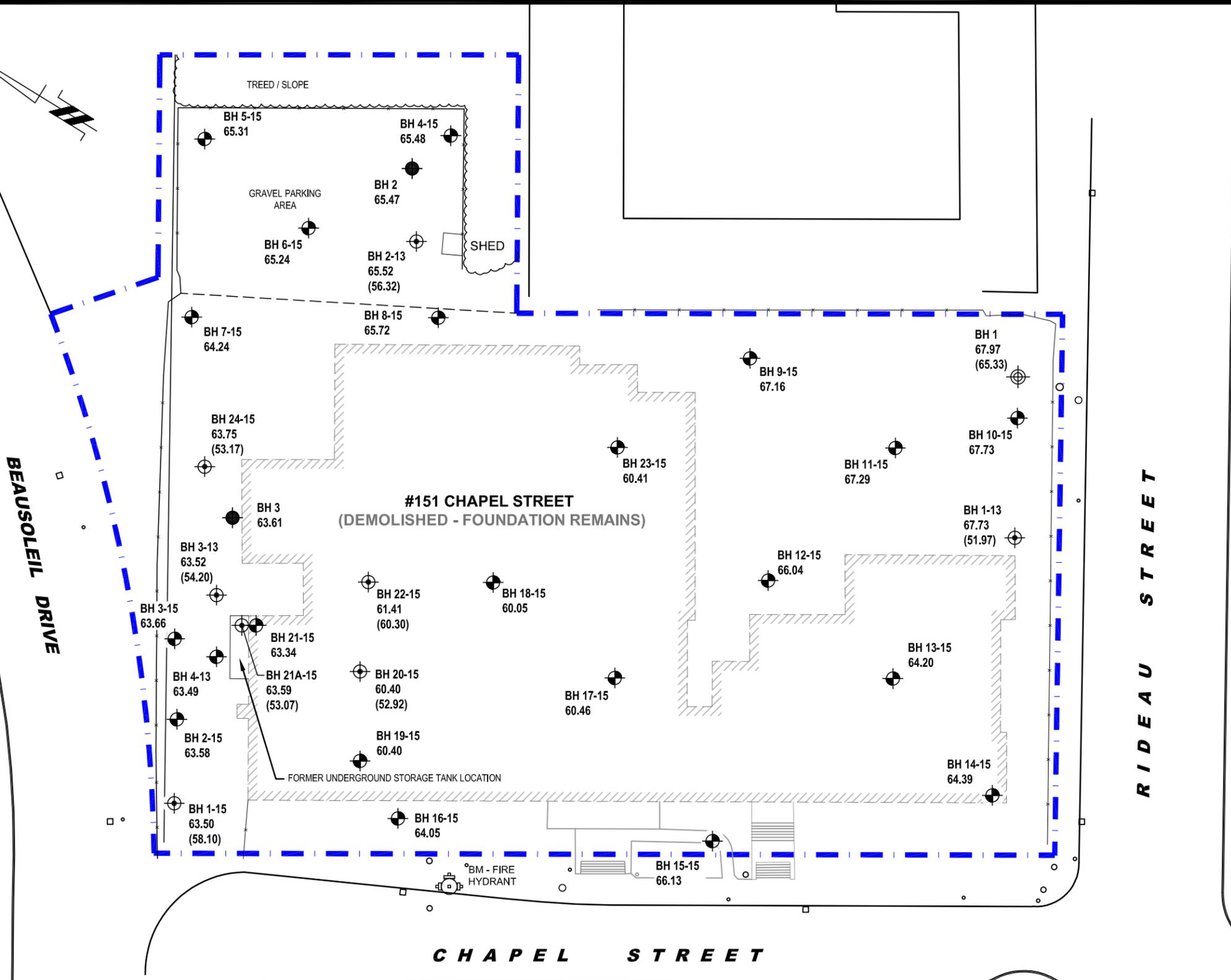
**DRAWING PE2930-14B – ANALYTICAL TESTING PLAN – SOILS
(BTEX)**

**DRAWING PE2930-14C – ANALYTICAL TESTING PLAN – SOILS
(PHCs)**

**DRAWING PE2930-14D – ANALYTICAL TESTING PLAN – SOILS
(PAHs)**

**DRAWING PE2930-15 – ANALYTICAL TESTING PLAN –
GROUNDWATER**

LABORATORY CERTIFICATES OF ANALYSIS



LEGEND:

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION, PREVIOUS INVESTIGATION, PATERSON GROUP REPORT PG2757, 2012
- BOREHOLE WITH MONITORING WELL LOCATION, PREVIOUS INVESTIGATION, PATERSON GROUP REPORT PG2757, 2012
- 67.73 GROUND SURFACE ELEVATION (m)
- (51.97) GROUNDWATER SURFACE ELEV. (m)

BM - TOP SPINDLE OF FIRE HYDRANT. GEODETIC ELEVATION = 65.12m.

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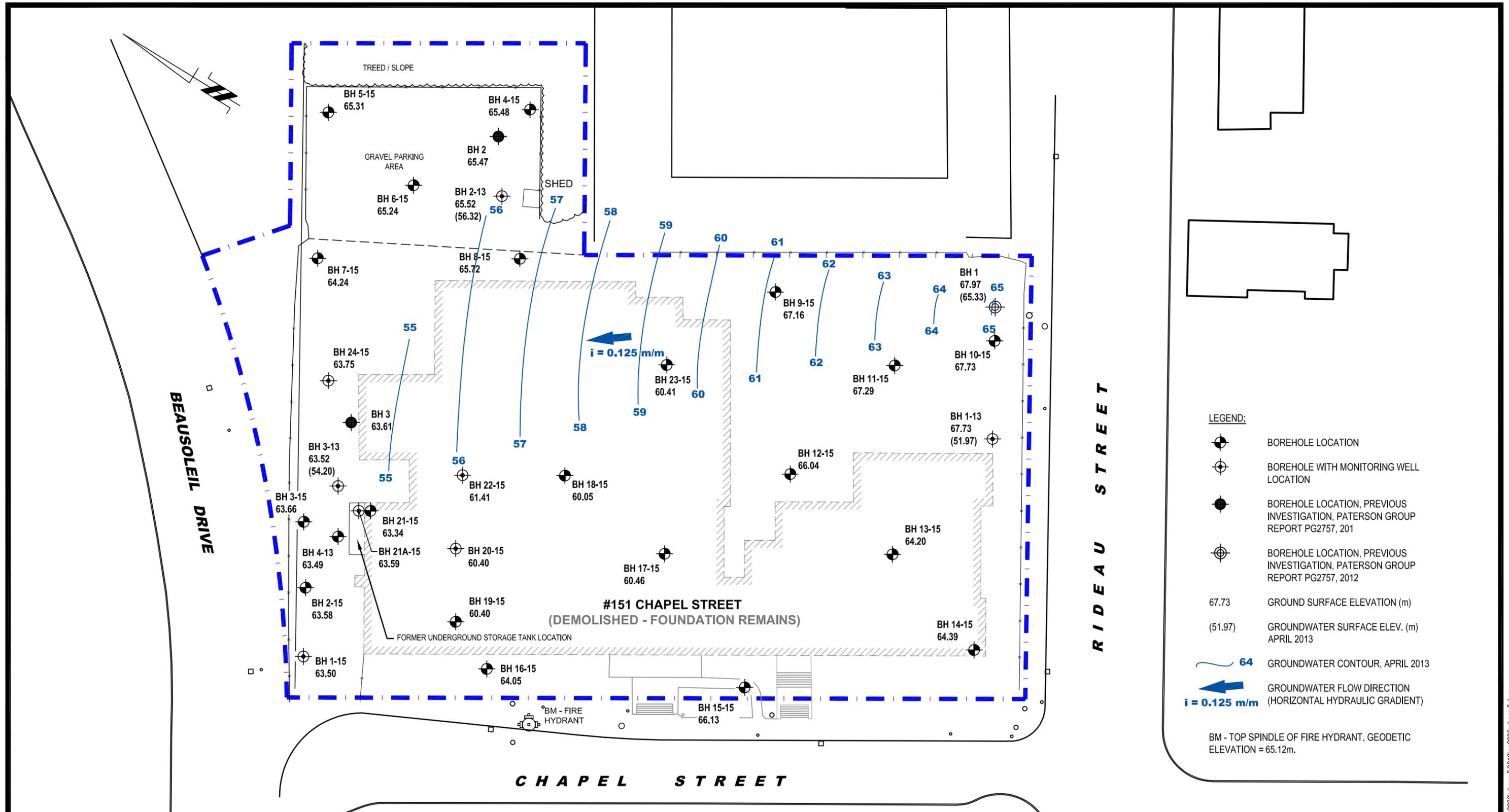
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TEST HOLE LOCATION PLAN

Scale:	1:500	Date:	04/2019
Drawn by:	DJA	Report No.:	PE2930-LET.05
Checked by:	MW	Drawing No.:	PE2930-12
Approved by:	MSD		

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- LEGEND:**
- BOREHOLE LOCATION
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 - BOREHOLE LOCATION, PREVIOUS INVESTIGATION, PATERSON GROUP REPORT PG2757, 201
 - BOREHOLE LOCATION, PREVIOUS INVESTIGATION, PATERSON GROUP REPORT PG2757, 2012
 - 67.73 GROUND SURFACE ELEVATION (m)
 - (51.97) GROUNDWATER SURFACE ELEV. (m) APRIL 2013
 - 64 GROUNDWATER CONTOUR, APRIL 2013
 - $i = 0.125 \text{ m/m}$ GROUNDWATER FLOW DIRECTION (HORIZONTAL HYDRAULIC GRADIENT)
 - BM - TOP SPINDLE OF FIRE HYDRANT, GEODETIC ELEVATION = 65.12m.

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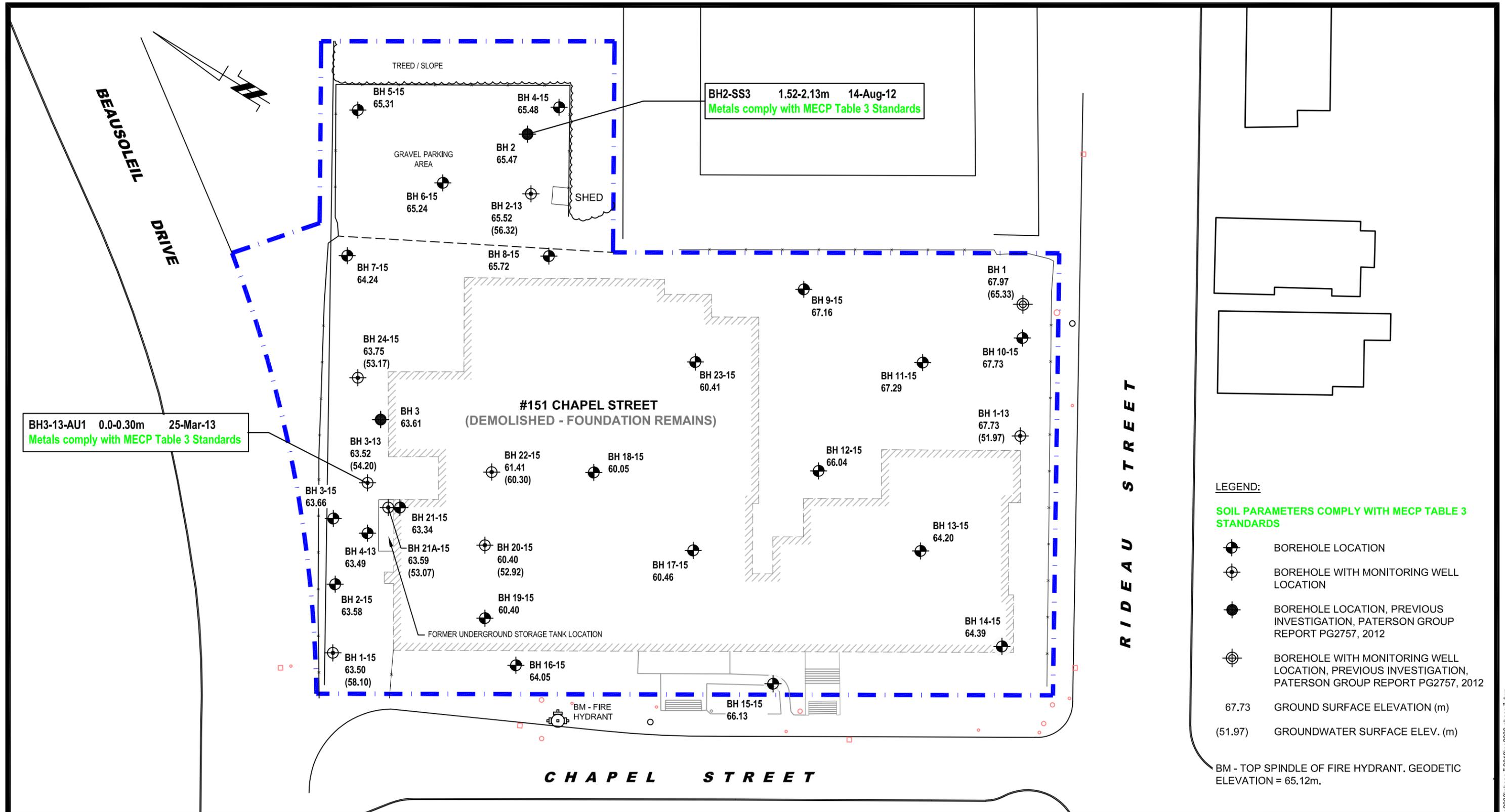
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GROUNDWATER CONTOUR PLAN

Scale:	1:500	Date:	04/2019
Drawn by:	MPG	Report No.:	PE2930-LET.05
Checked by:	MW	Drawing No.:	PE2930-13
Approved by:	MSD		

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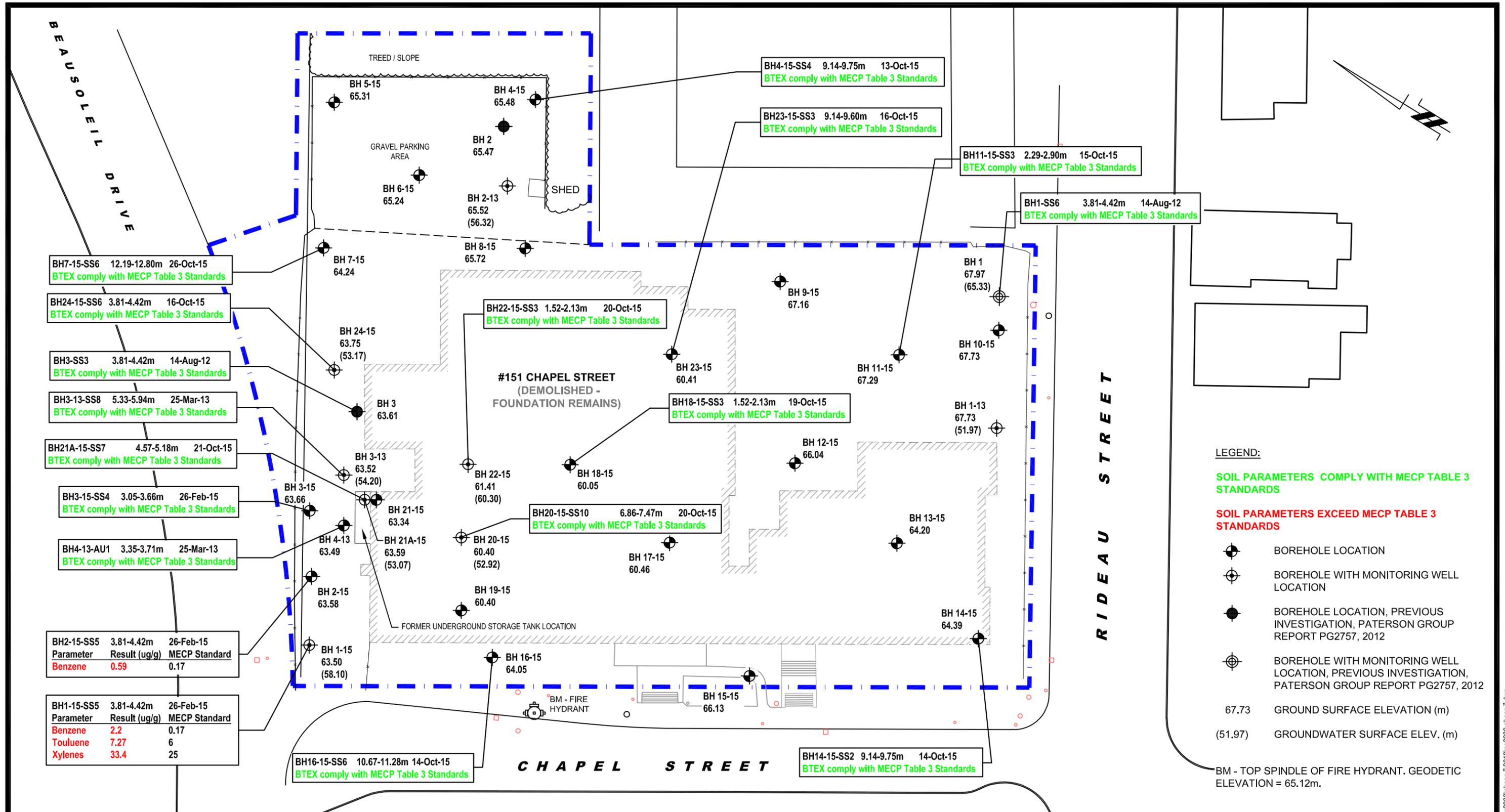
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ANALYTICAL TESTING PLAN - SOIL (METALS)

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Checked by:	MW	Drawing No.:	PE2930-14A
Approved by:	MSD		



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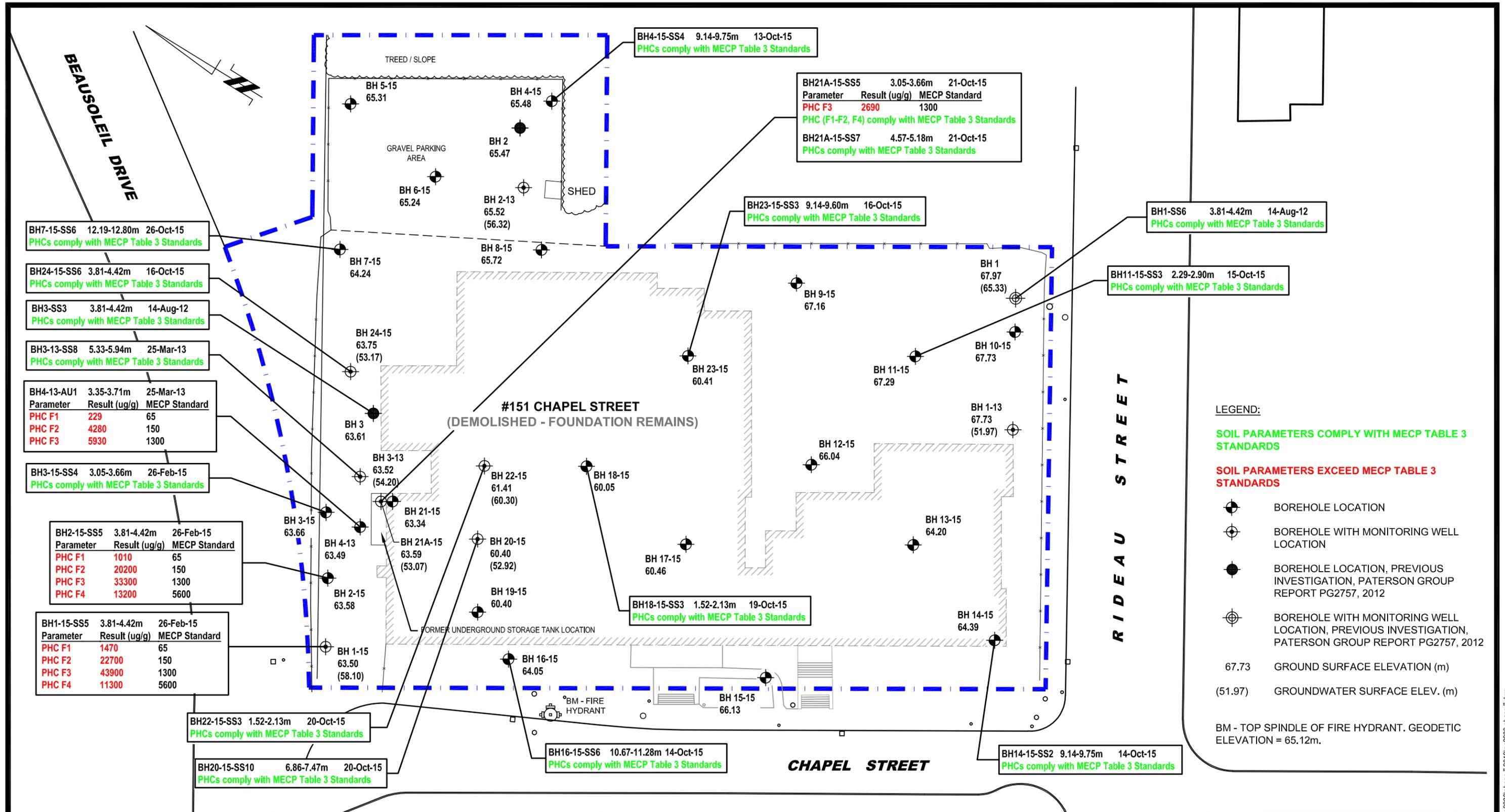
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ANALYTICAL TESTING PLAN - SOIL (BTEX)

Scale:	1:500	Date:	04/2019
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Approved by:	MSD		

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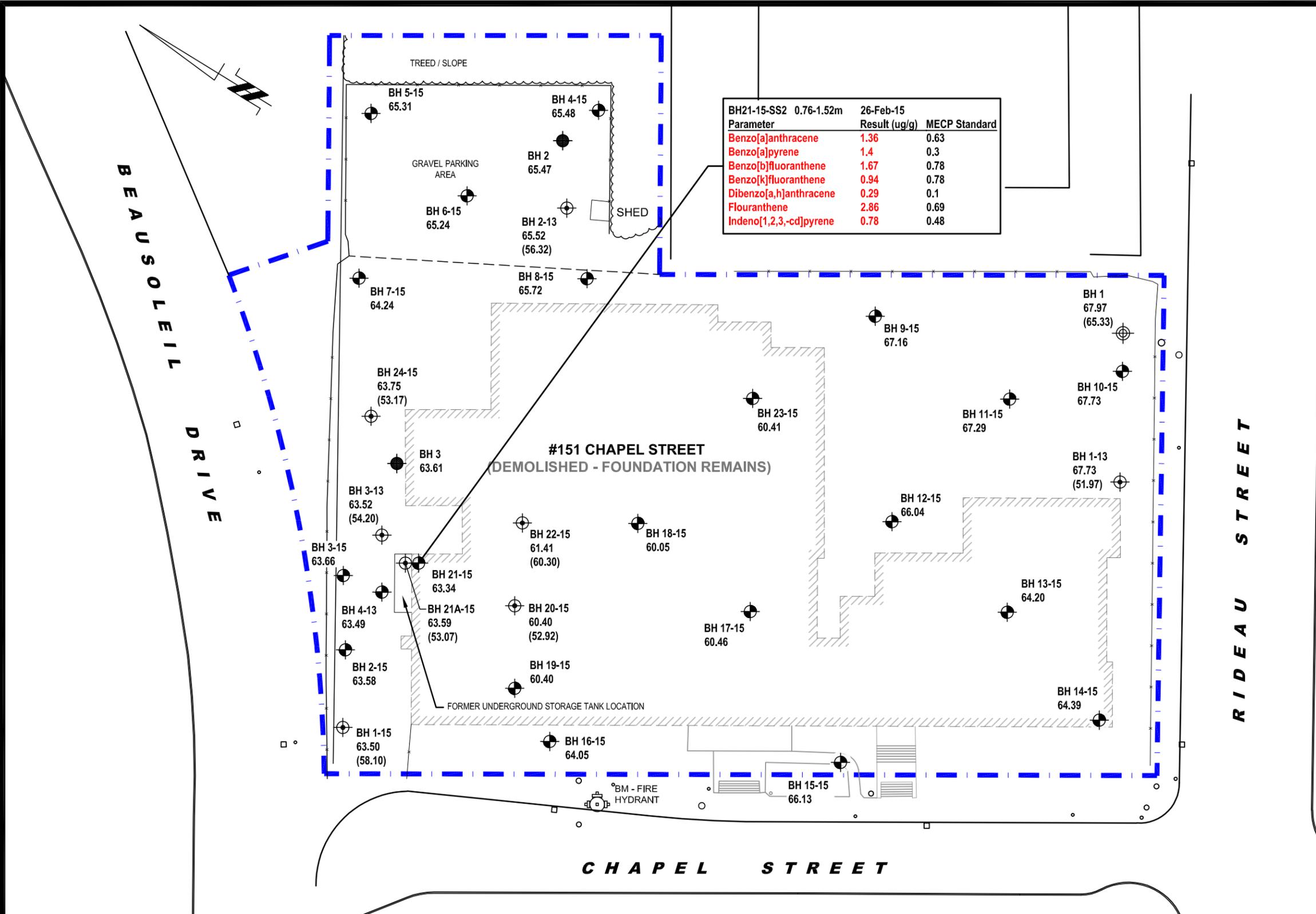
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ANALYTICAL TESTING PLAN - SOIL (PHCs)

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Approved by:	MSD		



Parameter	Result (ug/g)	MECP Standard
Benzo[a]anthracene	1.36	0.63
Benzo[a]pyrene	1.4	0.3
Benzo[b]fluoranthene	1.67	0.78
Benzo[k]fluoranthene	0.94	0.78
Dibenzo[a,h]anthracene	0.29	0.1
Flouranthene	2.86	0.69
Indeno[1,2,3-cd]pyrene	0.78	0.48

- LEGEND:**
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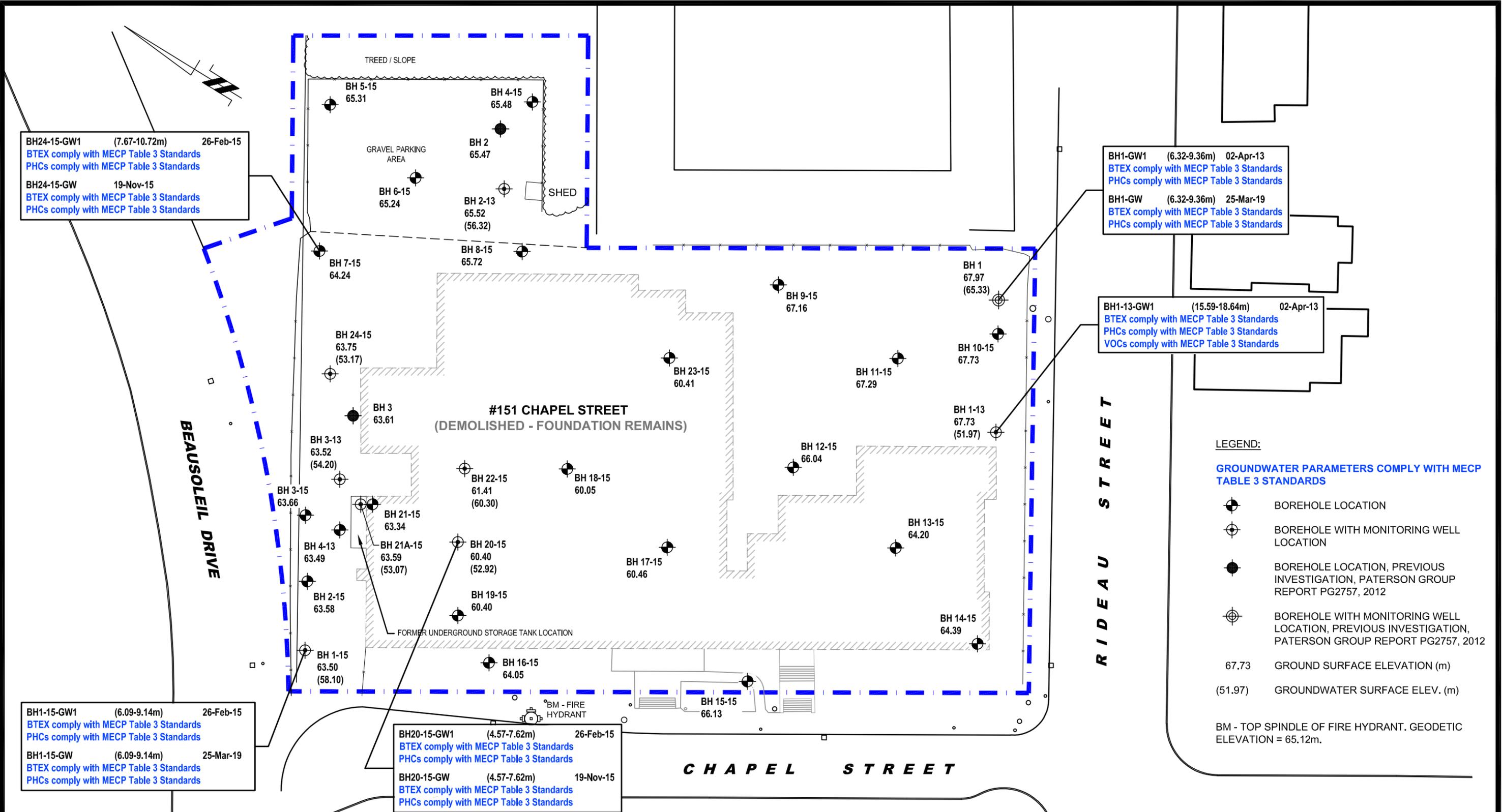
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ANALYTICAL TESTING PLAN - SOIL (PAHs)

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Checked by:	MW	Drawing No.:	PE2930-14D
Approved by:	MSD		

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BH24-15-GW1 (7.67-10.72m) 26-Feb-15
 BTEX comply with MECP Table 3 Standards
 PHCs comply with MECP Table 3 Standards
 BH24-15-GW 19-Nov-15
 BTEX comply with MECP Table 3 Standards
 PHCs comply with MECP Table 3 Standards

BH1-GW1 (6.32-9.36m) 02-Apr-13
 BTEX comply with MECP Table 3 Standards
 PHCs comply with MECP Table 3 Standards
 BH1-GW (6.32-9.36m) 25-Mar-19
 BTEX comply with MECP Table 3 Standards
 PHCs comply with MECP Table 3 Standards

BH1-13-GW1 (15.59-18.64m) 02-Apr-13
 BTEX comply with MECP Table 3 Standards
 PHCs comply with MECP Table 3 Standards
 VOCs comply with MECP Table 3 Standards

BH1-15-GW1 (6.09-9.14m) 26-Feb-15
 BTEX comply with MECP Table 3 Standards
 PHCs comply with MECP Table 3 Standards
 BH1-15-GW (6.09-9.14m) 25-Mar-19
 BTEX comply with MECP Table 3 Standards
 PHCs comply with MECP Table 3 Standards

BH20-15-GW1 (4.57-7.62m) 26-Feb-15
 BTEX comply with MECP Table 3 Standards
 PHCs comply with MECP Table 3 Standards
 BH20-15-GW (4.57-7.62m) 19-Nov-15
 BTEX comply with MECP Table 3 Standards
 PHCs comply with MECP Table 3 Standards

LEGEND:
GROUNDWATER PARAMETERS COMPLY WITH MECP TABLE 3 STANDARDS

- BOREHOLE LOCATION
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 151 CHAPEL STREET

OTTAWA,
 Title:

ONTARIO

ANALYTICAL TESTING PLAN - GROUNDWATER

Scale:	1:500	Date:	04/2019
Drawn by:	MPG	Report No.:	PE2930-LET.05
Checked by:	MW	Drawing No.:	PE2930-15
Approved by:	MSD		

Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Rd South
Nepean, ON K2E 7J5
Attn: Mark St. Pierre

Client PO: 26253
Project: PE2930
Custody: 121056

Report Date: 29-Mar-2019
Order Date: 25-Mar-2019

Order #: 1913158

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

Parcel ID	Client ID
1913158-01	BH1-12-GW1
1913158-02	BH10-GW1

Approved By:



Dale Robertson, BSc
Laboratory Director

Certificate of Analysis
Client: **Paterson Group Consulting Engineers**
Client PO: **26253**

Report Date: 29-Mar-2019
Order Date: 25-Mar-2019
Project Description: **PE2930**

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	27-Mar-19	27-Mar-19
PHC F1	CWS Tier 1 - P&T GC-FID	26-Mar-19	27-Mar-19
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	27-Mar-19	27-Mar-19

Certificate of Analysis
 Client: Paterson Group Consulting Engineers
 Client PO: 26253

Report Date: 29-Mar-2019

Order Date: 25-Mar-2019

Project Description: PE2930

Client ID:	BH1-12-GW1	BH10-GW1	-	-
Sample Date:	03/25/2019 09:00	03/25/2019 09:00	-	-
Sample ID:	1913158-01	1913158-02	-	-
MDL/Units	Water	Water	-	-

Volatiles

Benzene	0.5 ug/L	<0.5	<0.5	-	-
Ethylbenzene	0.5 ug/L	<0.5	<0.5	-	-
Toluene	0.5 ug/L	<0.5	<0.5	-	-
m,p-Xylenes	0.5 ug/L	<0.5	<0.5	-	-
o-Xylene	0.5 ug/L	<0.5	<0.5	-	-
Xylenes, total	0.5 ug/L	<0.5	<0.5	-	-
Toluene-d8	Surrogate	111%	113%	-	-

Hydrocarbons

F1 PHCs (C6-C10)	25 ug/L	<25	-	-	-
F2 PHCs (C10-C16)	100 ug/L	<100	-	-	-
F3 PHCs (C16-C34)	100 ug/L	<100	-	-	-
F4 PHCs (C34-C50)	100 ug/L	<100	-	-	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 26253

Report Date: 29-Mar-2019
 Order Date: 25-Mar-2019
Project Description: PE2930

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
Volatiles									
Benzene	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: Toluene-d8	91.1		ug/L		114	50-140			

Certificate of Analysis
 Client: Paterson Group Consulting Engineers
 Client PO: 26253

Report Date: 29-Mar-2019
 Order Date: 25-Mar-2019
 Project Description: PE2930

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND				30	
Volatiles									
Benzene	ND	0.5	ug/L	ND				30	
Ethylbenzene	ND	0.5	ug/L	ND				30	
Toluene	ND	0.5	ug/L	ND				30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: Toluene-d8	88.0		ug/L		110	50-140			

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 26253

Report Date: 29-Mar-2019
 Order Date: 25-Mar-2019
Project Description: PE2930

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	1730	25	ug/L		86.5	68-117			
F2 PHCs (C10-C16)	1420	100	ug/L		88.7	60-140			
F3 PHCs (C16-C34)	3700	100	ug/L		94.4	60-140			
F4 PHCs (C34-C50)	2120	100	ug/L		85.3	60-140			
Volatiles									
Benzene	33.3	0.5	ug/L		83.2	60-130			
Ethylbenzene	33.4	0.5	ug/L		83.5	60-130			
Toluene	31.6	0.5	ug/L		79.1	60-130			
m,p-Xylenes	65.0	0.5	ug/L		81.3	60-130			
o-Xylene	32.3	0.5	ug/L		80.8	60-130			
Surrogate: Toluene-d8	80.0		ug/L		100	50-140			

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 26253

Report Date: 29-Mar-2019
Order Date: 25-Mar-2019
Project Description: PE2930

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

CCME PHC additional information:

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



Client Name: Paterson Group	Project Reference: PE 2930	Turnaround Time: <input type="checkbox"/> 1 Day <input type="checkbox"/> 3 Day <input type="checkbox"/> 2 Day <input checked="" type="checkbox"/> Regular Date Required: _____
Contact Name: Mark St Pierre	Quote #	
Address: 154 Colonnade Rd South	PO # 26253	
	Email Address: mstpierre@patersongroup	
Telephone: 63-226-7381	Criteria: <input type="checkbox"/> O. Reg. 153/04 (As Amended) Table ___ <input type="checkbox"/> RSC Filing <input type="checkbox"/> O. Reg. 558/00 <input type="checkbox"/> PWQO <input type="checkbox"/> CCME <input type="checkbox"/> SUB (Storm) <input type="checkbox"/> SUB (Sanitary) Municipality: _____ <input type="checkbox"/> Other: _____	

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)				Required Analyses																
Parcel Order Number: 1913158				Sample Taken		P/PICs FI-F4+BTEX	VOCs	PAHs	Metals by ICP			Cu/Vi	B (HWS)	BTEX						
Sample ID/Location Name	Matrix	Air Volume	# of Containers	Date	Time				Hg	Cd	Pb									
1 BH1-12 - GW1	GW	-	3	Mar 25, 19																
2 BH10 - GW1	GW	-	2	Mar 25, 19																
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Comments: _____ Method of Delivery: **Paracel**

Relinquished By (Sign):	Received by Driver/Depot: A. Frouse	Received at Lab: Sumner Environmental	Verified By:
Relinquished By (Print):	Date/Time: 25/03/19 4:30 PM	Date/Time: Mar 27, 2019 05:05	Date/Time: 3/25/19 17:10
Date/Time:	Temperature: 7.1 °C	Temperature: 16.8 °C	pH Verified [] By: _____

APPENDIX 2

SUPPLEMENTAL PHASE II ESA REPORT- PE2930.REP.03R

Geotechnical
Engineering

Environmental
Engineering

Hydrogeology

Geological
Engineering

Materials Testing

Building Science

Archaeological
Services

Paterson Group Inc.

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patersongroup

**Supplemental Phase II
Environmental Site Assessment**

151 Chapel Street
Ottawa, Ontario

Prepared For

Trinity Development Group

March 11, 2016

Report: PE2930-3R

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EXECUTIVE SUMMARY

Assessment

A Supplemental Phase II ESA was conducted for the property addressed as 151 Chapel Street, Ottawa, Ontario. The Phase II ESA incorporated the findings of previous investigations at the subject site, as well as the results of a subsurface investigation program completed in October 2015 which consisted of drilling 21 boreholes at the subject site and installing four (4) monitoring wells. The purpose of this Phase II ESA was to address Areas of Potential Environmental Concern identified during the Phase I ESA, which included the historical presence of a heating oil UST at the subject site and the presence of fill material of unknown quality encountered during the subsurface investigation.

Soil samples were obtained from the boreholes and were screened using visual observations and organic vapour measurements. Based on the screening results, a total of 17 soil samples were submitted for analysis of benzene, toluene, ethylbenzene, and xylenes (BTEX), petroleum hydrocarbons, fractions 1 through 4 (PHCs F1-F4), and polycyclic aromatic hydrocarbons (PAHs). Several of the fill samples in the immediate vicinity of the footprint of the former UST exceeded the selected MOECC Table 3 standards for BTEX, PHCs, and/or PAHs. Remaining soil samples were in compliance with selected standards.

Groundwater samples were obtained from two (2) of the monitoring wells at the subject site and analyzed for BTEX and PHCs. The remaining wells were not sampled due to incomplete recovery as a result of the low hydraulic conductivity of site soils, and low sample volume was encountered in one of the wells. A second sampling event was completed in February 2016, with similar low sample volume recovery for all wells with the exception of BH24-15. Groundwater analytical results from both sampling events were in compliance with selected MOECC Table 3 standards.

Recommendations

Based on the above results, soil exists at the subject property with BTEX, PHC, and PAH concentrations which exceed the applicable MOECC Table 3 soil standards. It is our understanding that the subject site is to be redeveloped with residential and commercial buildings. It is our recommendation that an environmental site remediation program, involving the removal of all contaminated soil, be completed concurrently with site redevelopment.

It is our understanding that the subject site will be redeveloped, and a Record of Site Condition (RSC) will be obtained for the subject site in support of a Brownfield Redevelopment Grant for the site. It is recommended that the monitoring wells at the subject site be maintained for future sampling if possible, and that groundwater monitoring be completed following remediation.

1.0 INTRODUCTION

At the request of Trinity Development Group (Trinity), Paterson Group (Paterson) conducted a Supplemental Phase II Environmental Site Assessment of the property addressed as 151 Chapel Street, in the City of Ottawa, Ontario. The purpose of this Phase II ESA was to further delineate contamination identified on-site by previous investigations, associated with the historical presence of an underground storage tank containing furnace oil. The subsurface investigation portion of the Phase II ESA was completed concurrently with a geotechnical investigation at the subject site.

1.1 Site Description

Address: 151 Chapel Street, Ottawa, Ontario.

Legal Description: Lots 25, 26, and 27 north of Rideau Street, Lots 1, 2, and part of Lot 3 east of Chapel Street, and part of Lots 1, 2, and 3 west of Augusta Street, Registered Plan 43586, in the City of Ottawa, Ontario.

Property Identification

Number: 04213-0186.

Location: The subject site is located at the northeast corner of Chapel Street and Rideau Street. The subject site is shown on Figure 1 - Key Plan following the body of this report.

Latitude and Longitude: 45° 25' 53" N, 75° 40' 50" W.

Configuration: Irregular.

Site Area: 0.756 hectares (approximate).

1.2 Property Ownership

The subject property is currently owned by Trinity Development Group Ltd. Paterson was retained to complete this Phase II ESA by Mr. Brad Caco of Trinity. Mr. Caco can be reached by telephone at (416) 255-8800.

1.3 Current and Proposed Future Uses

The subject site was formerly occupied by a large institutional building housing a synagogue, Torah school, community centre, dance studio, trampoline school, and institutional and office space associated with the Heartwood House not-for-profit collective. Associated parking areas are present to the east and north of the building. Historical research indicates that the subject site was initially developed with residential dwellings and a school in approximately 1885, and developed with the current building in approximately 1949.

At the time of Paterson's October 2015 subsurface investigation at the subject site, the above-noted institutional building was being demolished. The proposed redevelopment of the site includes residential and commercial spaces, including retail spaces, residential condominiums, and townhomes along Beausoleil Drive.

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 Ontario Ministry of the Environment and Climate Change (MOECC), April 2011. The MOECC Table 3 Standards are based on the following considerations:

- Fine-grained soil conditions
- Non-potable groundwater conditions
- Residential land use

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The subject site is currently occupied by the foundations of a demolished institutional building and associated asphalt and gravel parking areas. Site topography slopes downward from south to north. Drainage consists primarily of sheet flow to catch basins along Beausoleil Drive and Chapel Street, with some infiltration occurring in the gravel parking lot on the northeast portion of the site, the landscaped area along the west site boundary, and in areas in which impermeable materials have been removed by demolition activities. No areas of stained soil, vegetation, or pavement, or stressed vegetation were observed on-site. No water wells or private sewage systems were observed on the subject property at the time of the site visit. No rail lines or loading areas were observed at the subject site. No unidentified substances were observed on-site.

No water bodies are present on the subject site. The nearest significant water body is the Rideau River, located approximately 600 m to the east of the site. No Areas of Natural or Scientific Interest (ANSIs) are present within 250 m of the subject site.

2.2 Past Investigations

The following reports were available for review:

- "Phase I Environmental Site Assessment, 151 Chapel Street, Ottawa, Ontario", prepared by AGRA Earth & Environmental Ltd. dated July 2000.
- "Phase I Environmental Site Assessment, 151 Chapel Street, Ottawa, Ontario", prepared by Paterson, dated March 25, 2013.
- "Phase II Environmental Site Assessment, Institutional Building, 151 Chapel Street, Ottawa, Ontario", prepared by Paterson, dated April 9, 2013.
- "Supplemental Phase II Environmental Site Assessment, Proposed Mixed Use Development, 151 Chapel Street - Ottawa", prepared by Paterson, dated April 7, 2015.

The 2000 AGRA Phase I ESA identified the potential presence of a heating oil UST on the property, and the 2013 Paterson Phase I ESA provided further details: that the tank was apparently removed, and had been located on the north side of the building adjacent to the boiler room. No reports detailing the removal of the tank were available for review, with the exception of an emergency waste generator number issued in 2001. Paterson identified the historical presence of the tank, as well as the historical presence of a retail fuel outlet at 481 Rideau Street, to the east of the subject site, as Areas of Potential Environmental Concern with respect to the subject site.

The 2013 Phase II ESA by Paterson incorporates the results of subsurface investigations completed in 2012 and 2013 by Paterson. A total of seven (7) boreholes were drilled, and four (4) groundwater monitoring wells were installed. Xylene and PHC F1-F4 exceedences were observed at BH4-13, in the approximate location of the former tank. All other soil and groundwater results were in compliance with MOECC standards.

In February 2015, Paterson completed a supplementary subsurface investigation at the site, consisting of drilling three (3) boreholes in the vicinity of the former tank nest (BH1-15, BH2-15, and BH3-15). Three (3) soil samples were submitted for laboratory analysis of BTEX and PHCs, and exceedences were noted at two of the borehole locations. The findings of this subsurface investigation are incorporated into the current report.

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

This report incorporates the results of subsurface investigations completed in February and October 2015. The February 2015 subsurface investigation consisted of drilling three (3) boreholes at the subject site. Boreholes were drilled to a maximum depth of 9.14 m below ground surface. One (1) monitoring well was installed in BH1-15 as a component of the February 2015 subsurface investigation.

The October 2015 subsurface investigation consisted of drilling 21 boreholes, concurrently with a geotechnical investigation at the subject site. Boreholes were drilled to a maximum depth of 20.5 m below ground surface. Three (3) groundwater monitoring wells were installed in the vicinity of the former tank nest. The purpose of this investigation was to provide further delineation of BTEX and PHC contamination in the vicinity of the tank nest in support of a Record of Site Condition (RSC) application for the subject site, as well as to address the quality of fill material identified during the subsurface investigations.

Due to low sample volume during the initial sampling event, an attempt was made to re-sample groundwater monitoring wells at the site in February 2016. Similarly low sample volume was encountered, and only BH24-15 was able to be sampled.

3.2 Media Investigated

During the subsurface investigations, soil samples and groundwater samples were obtained and submitted for laboratory analysis. The rationale for sampling and analyzing these media is based on the Contaminants of Potential Concern identified in the Phase I ESA and the contamination identified by previous investigations in the vicinity of the tank nest. Contaminants of concern for soil and groundwater are BTEX, PHCs, and PAHs.

3.3 Phase I Conceptual Site Model

Geological and Hydrogeological Setting

The geological and hydrogeological setting of the subject site is discussed in detail in the subsequent sections. Information available at the time of the previous Phase I and II ESAs has been augmented by information obtained by the 2015 subsurface investigation.

Contaminants of Potential Concern

The following CPCs were identified with respect to the subject site:

- Petroleum Hydrocarbons Fractions 1 through 4 (PHCs F1-F4) – this suite of parameters encompasses gasoline (Fraction 1), diesel and fuel oil (Fraction 2), and heavy oils (Fractions 3 and 4). PHCs F1-F4 were selected as CPCs for the Phase I property based on the presence of the former fuel oil UST. Diesel-fraction hydrocarbons were commonly used as heating oil, with heavier fractions also occasionally used. PHCs may be present in the soil matrix, sorbed to soil particles, as well as in free or dissolved phase in the groundwater system. PHCs are generally considered to be LNAPLs – light non-aqueous phase liquids, indicating that when present in sufficient concentrations above the solubility limit, they will partition into a separate phase above the water table, due to their lower density.
- BTEX – this suite of parameters includes Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX), associated with gasoline. These parameters were selected as CPCs for the Phase I study area based on the presence of the former fuel oil UST on-site. BTEX may be present in the soil matrix as well as in the dissolved phase in the groundwater system.
- Polycyclic Aromatic Hydrocarbons (PAHs) – this suite of parameters encompasses various complex hydrocarbons, commonly associated with coal and/or combustion. PAHs were selected as a CPC for the site based on the observed presence of fill material at the subject site, specifically in the vicinity of BH21-15. PAHs may be present in the soil matrix or dissolved in site groundwater.

The mechanisms of contaminant transport within the site soils include physical transportation and leaching. Despite demolition activities at the subject site, significant excavation or soil disturbance was not observed, and as such, physical transport is not anticipated to be an issue at the subject site. Leaching is anticipated to be limited by the low permeability of the asphalt pavement and concrete floor slabs over much of the site. As such, contaminants identified in the soil are considered to have a low potential to migrate to the groundwater below the site.

The mechanisms of contaminant transport within the groundwater system include advection, dispersion, and diffusion. Advection and dispersion will be the dominant mechanisms of contaminant transport in soils with higher hydraulic conductivities, such as sands, gravels, silts, and some glacial till soils, whereas diffusion will dominate in soils with lower hydraulic conductivity, such as clays.

Existing Buildings and Structures

The institutional building present on-site during the previous investigations had been demolished at the time of the October 2015 subsurface investigation. The concrete foundations and basement walls remain on-site.

Water Bodies

There are no water bodies on the subject site or within the Phase I study area. The closest water body is the Rideau River, located approximately 600 m to the east of the site.

Areas of Natural Significance

No areas of natural significance were identified on the site or in the Phase I study area.

Drinking Water Wells

No drinking water wells are located at the subject site or within the Phase I study area.

Neighbouring Land Use

Neighbouring land use in the Phase I study area is currently commercial, residential, and institutional. Immediately adjacent properties have been listed as residential or commercial since their first developed use. Several retail fuel outlets, automotive service garages, and dry cleaners were identified within the Phase I study area. Based on their separation distance from the subject site, inferred cross-gradient or downgradient locations with respect to the subject site, and the results of previous investigations, they are generally not considered to have the potential to have impacted the subject site.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

Based on the Phase I ESA for the site and on the results of previous investigation, the presence of the former UST on the subject site is considered to represent an Area of Potential Environmental Concern with respect to the subject site. Fill identified during the October 2015 subsurface investigation was also identified as an Area of Potential Environmental Concern. Additional Potentially Contaminating Activities were identified within the Phase I study area but were not considered to represent Areas of Potential Environmental Concern.

Assessment of Uncertainty and/or Absence of Information

The information available for review as part of the preparation of this Phase I ESA and the results of previous subsurface investigations is considered to be sufficient to conclude that there are areas of potential environmental concern on the subject site which have the potential to have impacted 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. Groundwater samples could not be obtained from BH21A-15 and BH22-15 due to the low permeability of the silty clay soils in which these wells were screened and the limited quantity of groundwater available at the time of the Phase II ESA. A second sampling event was attempted in February 2016, with similar results. No other deviations from the Sampling and Analysis Plan were noted.

3.5 Impediments

No physical impediments or denial of access were encountered during the Phase II Environmental Site Assessment.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The February 2015 subsurface investigation was conducted on February 26, 2015, and consisted of drilling three (3) boreholes at the subject site, to provide additional coverage in the vicinity of the former underground storage tank at the subject site. The October 2015 subsurface investigation consisted of drilling 22 boreholes at the subject site and the installation of four (4) monitoring wells. The boreholes were placed to provide general coverage of the subject site for geotechnical purposes, as well as to provide additional coverage in the area of the former UST. The boreholes were advanced using truck-mounted and track-mounted CME 55 power auger drill rigs. The drilling contractor was George Downing Estate Drilling of Hawkesbury, Ontario. Drilling occurred under full-time supervision of Paterson personnel. Borehole locations are shown on Drawing No. PE2930-8 – Test Hole Location Plan, appended to this report.

4.2 Soil Sampling

A total of 201 soil samples were obtained from the boreholes by means of split spoon sampling and the sampling of shallow soils directly from auger flights. Split spoon samples were taken at approximate 0.76 m intervals. The depths at which split spoon and auger flight samples were obtained from the boreholes are shown as “**SS**” and “**AU**” respectively on the Soil Profile and Test Data Sheets, appended to this report.

Upon refusal of the augers, several boreholes was advanced into bedrock using a diamond coring system. Rock core samples were recovered, and are shown as “**RC**” on the Soil Profile and Test Data Sheets.

Site soils consist of fill over silty clay, underlain by glacial till and interbedded limestone and shale bedrock. The fill material consisted of crushed stone under paved parking areas, underlain by silty sand and gravel. An intermittent layer of native silty sand was observed between the fill and silty clay layers at several locations. The glacial till material consisted primarily of silty sand with gravel, cobbles, and trace clay. Bedrock (confirmed by coring) was encountered at depths varying from 12.1 to 19.0 m below existing grade. Practical refusal to augering was encountered at depths varying from 10.7 to 19.0 m below existing grade.

4.3 Field Screening Measurements

All soil samples collected underwent a preliminary screening procedure, which included visual screening for colour and evidence of metals, as well as screening with a RKI Eagle combustible gas detector. The detection limit is 5 ppm, with a precision of +/- 5 ppm.

The soil vapours were measured by inserting the analyzer probe into the nominal headspace above the soil sample. Samples were then agitated and the peak readings recorded. The combustible vapour readings ranged from 0 ppm to 170 ppm. Combustible vapour readings are noted on the Soil Profile and Test Data Sheets in Appendix 1.

It is noted that heavier-fraction hydrocarbons, such as those observed on-site during previous investigations, are less volatile and not as readily detectable by the RKI Eagle. As such, soil samples were selected for analysis based on visual appearance and location, as well as vapour readings.

4.4 Groundwater Monitoring Well Installation

One (1) groundwater monitoring well was installed during the February 2015 investigation and four (4) groundwater monitoring wells were installed during the October 2015 subsurface investigation. Wells were installed by George Downing Estate Drilling of Hawkesbury, Ontario, under full-time supervision by Paterson personnel. The monitoring wells consisted of 51 mm diameter Schedule 40 threaded PVC risers and screens. A sand pack consisting of silica sand was placed around the screen, and a bentonite seal was placed above the screen to minimize cross-contamination. Monitoring well construction details are provided on the Soil Profile and Test Data Sheets in Appendix 1. A summary of monitoring well construction details is provided below in Table 1.

The groundwater monitoring wells were developed upon completion using a peristaltic pump or dedicated inertial lift pump. A minimum of three (3) well volumes were removed from the wells, or wells were purged dry a minimum of three (3) times.

Table 1: Monitoring Well Construction Details						
Well ID	Ground Surface Elevation	Total Depth (m BGS)	Screened Interval (m BGS)	Sand Pack (m BGS)	Bentonite Seal (m BGS)	Casing Type
2015 Investigations						
BH1-15	63.50	9.14	6.09-9.14	5.49-9.14	0.00-5.14	Stickup
BH20-15	60.40	7.62	4.57-7.62	3.97-7.62	0.30-3.97	Stickup
BH21A-15	63.34	10.67	7.62-10.67	7.02-10.67	0.30-7.02	Flushmt.
BH22-15	61.41	7.62	4.57-7.62	3.97-7.62	0.30-3.97	Flushmt.
BH24-15	63.75	10.72	7.67-10.72	7.37-10.72	0.30-7.37	Flushmt.

4.5 Field Measurement of Water Quality Parameters

Due to the low sample volumes obtained from the monitoring wells during the February and November 2015 sampling events, field measurement of water quality parameters was not undertaken.

4.6 Groundwater Sampling

Groundwater sampling protocols were followed using the MOECC 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 groundwater and soil samples were submitted for analysis:

Table 2: Soil Samples Submitted					
Sample ID	Sample Depth/ Stratigraphic Unit	Parameters Analyzed			Rationale
		PHCs F₁- F₄	BTEX	PAHs	
BH1-15-SS5	3.18-4.42 m; silty sand	X	X		Vicinity of former UST
BH2-15-SS5	3.18-4.42 m; silty sand	X	X		Vicinity of former UST
BH3-15-SS4	3.05-3.66 m; silty sand	X	X		Vicinity of former UST
BH4-15-SS4	9.14-9.75 m; silty clay	X	X		General site coverage
BH7-15-SS6	12.19-12.80 m; till	X	X		General site coverage
BH11-15-SS6	2.29-2.90 m; till	X	X		General site coverage
BH14-15-SS2	9.14-9.75 m; silty clay	X	X		General site coverage
BH16-15-SS6	10.67-11.28 m; silty clay	X	X		General site coverage; vicinity of former UST
BH18-15-SS3	1.52-2.13 m; silty clay	X	X		General site coverage; vicinity of former UST
BH19-15-SS10	6.86-7.47 m; silty clay	X	X		General site coverage; vicinity of former UST.
BH20-15-SS10	6.86-7.47 m; silty clay	X	X		Vicinity of former UST
BH21-15-SS2	0.76-1.52 m; fill			X	Vicinity of former UST; assessment of fill material
BH21A-15-SS5	3.05-3.66 m; fill	X	X		Vicinity of former UST
BH21A-15-SS6	3.81-4.42 m; fill	X	X		Vicinity of former UST
BH21A-15-SS7	4.57-5.18 m; silty clay	X	X		Vicinity of former UST
BH22-15-SS3	1.52-2.13 m; fill	X	X		Vicinity of former UST
BH23-15-SS3	9.14-9.60 m; till	X	X		Vicinity of former UST
BH24-15-SS6	3.81-4.42 m; silty clay	X	X		Vicinity of former UST

Table 3: Groundwater Samples Submitted					
Sample ID	Screened Interval/ Stratigraphic Unit	PHCs F ₁₋₄	Parameters Analyzed		Rationale
			PAHs	BTEX	
BH1-15-GW1	6.09-9.14 m; silty clay	X		X	Assessment of groundwater quality in vicinity of the former UST
BH20-15-GW1	4.57-7.62 m; silty clay	X		X	
BH24-15-GW1	7.62-10.67 m; silty clay	X		X	
BH24-15-GW2	7.62-10.67 m; silty clay	X	X	X	Assessment of groundwater quality in vicinity of the former UST; re-sampled in hopes of achieving higher sample volume sufficient for PAH analysis

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

4.8 Residue Management

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

4.9 Elevation Surveying

Monitoring well locations were surveyed using a laser level. Elevations were surveyed relative to the top spindle of a fire hydrant on the east side of Chapel Street. Geodetic elevation of the top spindle (65.12 m ASL) was provided on the survey plan by Annis, O'Sullivan, Vollebekk Ltd. The location of the benchmark is shown on Drawing PE2930-8 – Test Hole Location Plan Map.

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

- An intermittent of asphaltic concrete, encountered in paved areas, approximately 0.05 to 0.25 m thick.
- An intermittent layer of concrete, encountered within the footprint of the former building, approximately 0.20 m thick.
- An intermittent layer of fill, consisting of crushed stone with sand, encountered beneath paved areas, varying in thickness from 0.20 to 0.43 m.
- An intermittent layer of fill, consisting of silty sand with trace gravel, and with trace asphalt, crushed stone, coal, organics, brick, concrete, glass, ash, and slag at intermittent locations. This fill layer was encountered at depths varying from 0.20 to 0.43 m, and varied in thickness from 0.38 to 4.60 m where encountered. The deepest fill deposits were found within the basement of the former building in the vicinity of BH21A and BH22, where fill material had been sloped as part of an access ramp; elsewhere, the fill material was generally 1.6 m thick or less. Groundwater was not observed in this layer.
- An intermittent layer of silty sand, encountered at depths varying from 0.15 to 2.16 m and varying in thickness from 0.44 to 3.18 m. Groundwater was not observed in this layer.
- A layer of silty clay, encountered at depths varying from 0.25 to 4.70 m, and varying in thickness from 2.39 to 13.44 m. This is the uppermost saturated unit, and despite the low hydraulic conductivity of silty clay, it is interpreted to function as a local unconfined aquifer at the subject site.

- A layer of glacial till, consisting of silty sand with gravel and trace clay, encountered at depths varying from 8.13 to 15.65 m, and varying in thickness from 2.00 to 6.84 m. Groundwater was observed in geotechnical piezometers installed in this layer. However, no groundwater monitoring wells were screened in this layer.
- Bedrock, consisting of interbedded limestone and shale, encountered at depths varying from 12.1 to 19.0 m in locations where bedrock was cored as part of the geotechnical investigations. Refusal to augering was encountered at depths varying from 10.7 to 19.0 m. No groundwater monitoring wells were screened in this layer. This is the deepest unit investigated.

It is noted that BH21-15 was terminated on practical auger refusal on a concrete slab.

Groundwater monitoring wells were installed in the silty clay layer (upper water table) in BH1-15, BH20-15, BH21A-15, BH22-15, and BH24-15.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured during the groundwater sampling event on November 18, 2015 using an electronic water level meter. Groundwater levels are summarized below. All measurements are geodetic. It is noted that due to the low hydraulic conductivity of the silty clay material, these water levels may not represent actual stabilized conditions.

Table 4: Groundwater Level Measurements				
Borehole Location	Ground Surface Elevation (m)	Water Level Depth (m below grade)	Water Level Elevation (m ASL)	Date of Measurement
BH1-15	63.50	5.40	58.10	March 25, 2015
BH20-15	60.40	7.53	52.87	Nov. 18, 2015
BH21A-15	63.59	10.66	52.93	Nov. 18, 2015
BH24-15	63.75	10.42	53.33	Nov. 18, 2015
BH20-15	60.40	7.76	52.64	February 4, 2016
BH21A-15	63.59	10.63	52.96	February 4, 2016
BH24-15	63.75	10.14	53.61	February 4, 2016

Water levels were not measured in BH22-15, which could not be located at the time of the November 18 monitoring event. Seasonal variations in groundwater levels may occur.

Given the relatively recent drilling date of these wells during the first monitoring event and the relatively low hydraulic conductivity of the silty clay layer in which they are screened, it was considered possible that the water levels in these monitoring wells have not yet stabilized. As such, a second groundwater monitoring event was completed on February 4, 2016, with no significant change in groundwater levels. No free product was observed in the monitoring wells at the subject site.

5.3 Fine-Medium Soil Texture

Based on field soil observations, a soil sample from the 2013 Phase II ESA (BH3-SS9) was submitted for a grain size analysis to determine the applicability of fine-grained soil standards. A total of 89.6% of the dry weight of the soil sample by mass passed the 75 µm sieve. As such, fine-grained soil standards are applicable to the subject site.

5.4 Soil: Field Screening

Field screening of the soil samples collected during drilling resulted in organic vapour readings of 0 ppm to 170 ppm. Field screening results of each individual soil sample are provided on the Soil Profile and Test Data Sheets appended to this report.

The organic vapour readings obtained from field screening of soil samples indicates that there is low potential for BTEX, PHC F1, or PHC F2 hydrocarbon contamination. However, samples taken at BH21-15 had significant visual and olfactory evidence of heavy-fraction (F3 and F4) hydrocarbon contamination which was not detected by the RKI Eagle.

5.5 Soil Quality

Three (3) soil samples from the February 2015 subsurface investigation and 14 soil samples from the October 2015 subsurface investigation were submitted for analysis of BTEX, PHCs, and/or PAHs. The results of the analytical testing are presented below. The laboratory certificates of analysis are provided in Appendix 1.

Table 5: Analytical Test Results – Soil PAHs			
Parameter	MDL (µg/g)	Soil Samples (µg/g)	MOECC Table 3 Residential Fine
		October 21, 2015	
		BH21-15-SS2	
Acenaphthene	0.02	0.33	58
Acenaphthylene	0.02	0.06	0.17
Anthracene	0.02	0.55	0.74
Benzo[a]anthracene	0.02	1.36	0.63
Benzo[a]pyrene	0.02	1.40	0.3
Benzo[b]fluoranthene	0.02	1.67	0.78
Benzo[g,h,i]perylene	0.02	0.70	7.8
Benzo[k]fluoranthene	0.02	0.94	0.78
Chrysene	0.02	1.22	7.8
Dibenzo[a,h]anthracene	0.02	0.29	0.1
Fluoranthene	0.02	2.86	0.69
Fluorene	0.02	0.41	69
Indeno[1,2,3-cd]pyrene	0.02	0.78	0.48
Methylnaphthalene (1 & 2)	0.04	1.27	3.4
Naphthalene	0.01	0.74	0.75
Phenanthrene	0.02	3.26	7.8
Pyrene	0.02	2.36	78
Notes:			
<ul style="list-style-type: none"> ▪ MDL – Method Detection Limit ▪ Nd – not detected above the MDL ▪ N/V – no value provided by the MOECC ▪ Bold – Value exceeds selected MOECC Standard 			

Concentrations of several PAH parameters exceeded Table 3 standards in the fill material at BH21-15. Based on the soil description in this location, the fill material was clearly visually impacted with ash-type material. Elsewhere on the subject site, debris such as glass, asphalt, and wood was observed. It is our understanding that this material will be removed from site concurrently with site development, and has been allowed for in the Brownfields Grant Application for the subject site.

**Table 6:
 Analytical Test Results – Soil
 BTEX/PHCs**

Parameter	MDL (µg/g)	Soil Samples (µg/g)			MOECC Table 3 Residential Fine
		February 26, 2015			
		BH1-15-SS5	BH2-15-SS5	BH3-15-SS4	
Benzene	0.02	2.20	0.59	nd	0.17
Ethylbenzene	0.05	9.07	3.32	nd	15
Toluene	0.05	7.27	0.10	nd	6
Xylenes	0.05	33.4	9.46	nd	25
PHC F1	7	1,470	1,010	nd	65
PHC F2	4	22,700	20,200	nd	150
PHC F3	8	43,900	33,300	nd	1,300
PHC F4	6	11,300	13,200	nd	5,600

Notes:

- MDL – Method Detection Limit
- Nd – not detected above the MDL
- N/V – no value provided by the MOECC
- Bold** – Value exceeds selected MOECC Standard

**Table 6 Continued:
 Analytical Test Results – Soil
 BTEX/PHCs**

Parameter	MDL (µg/g)	Soil Samples (µg/g)					MOECC Table 3 Residential Fine
		October 13-26, 2015					
		BH4-15-SS2	BH7-15-SS6	BH11-15-SS2	BH14-15-SS2	BH16-15-SS6	
Benzene	0.02	nd	nd	nd	nd	nd	0.17
Ethylbenzene	0.05	nd	nd	nd	nd	nd	15
Toluene	0.05	nd	nd	nd	nd	nd	6
Xylenes	0.05	nd	nd	nd	nd	nd	25
PHC F1	7	nd	nd	nd	nd	nd	65
PHC F2	4	nd	nd	nd	nd	nd	150
PHC F3	8	nd	nd	nd	nd	nd	1,300
PHC F4	6	nd	nd	nd	nd	nd	5,600

Notes:

- MDL – Method Detection Limit
- Nd – not detected above the MDL
- N/V – no value provided by the MOECC
- Bold** – Value exceeds selected MOECC Standard

**Table 6 Continued:
Analytical Test Results – Soil
BTEX/PHCs**

Parameter	MDL (µg/g)	Soil Samples (µg/g)					MOECC Table 3 Res. Fine
		October 13-26, 2015					
		BH18-15-SS3	BH19-15-SS10	BH20-15-SS10	BH21A-15-SS5	BH21A-15-SS6	
Benzene	0.02	nd	nd	nd	nd	nd	0.17
Ethylbenzene	0.05	nd	nd	nd	nd	nd	15
Toluene	0.05	nd	nd	nd	nd	nd	6
Xylenes	0.05	nd	nd	nd	nd	nd	25
PHC F1	7	nd	nd	nd	nd	nd	65
PHC F2	4	nd	nd	nd	137	31	150
PHC F3	8	nd	nd	nd	2,690	316	1,300
PHC F4	6	nd	nd	nd	271	31	5,600

Notes:

- MDL – Method Detection Limit
- Nd – not detected above the MDL
- N/V – no value provided by the MOECC
- Bold** – Value exceeds selected MOECC Standard

**Table 6 Continued:
Analytical Test Results – Soil
BTEX/PHCs**

Parameter	MDL (µg/g)	Soil Samples (µg/g)				MOECC Table 3 Residential Fine
		October 13-26, 2015				
		BH21A-15-SS7	BH22-15-SS3	BH23-15-SS3	BH24-15-SS6	
Benzene	0.02	nd	nd	nd	nd	0.17
Ethylbenzene	0.05	nd	nd	nd	nd	15
Toluene	0.05	nd	nd	nd	nd	6
Xylenes	0.05	nd	nd	nd	nd	25
PHC F1	7	nd	nd	nd	nd	65
PHC F2	4	nd	nd	nd	nd	150
PHC F3	8	nd	113	nd	nd	1,300
PHC F4	6	nd	49	nd	nd	5,600

Notes:

- MDL – Method Detection Limit
- Nd – not detected above the MDL
- N/V – no value provided by the MOECC
- Bold** – Value exceeds selected MOECC Standard

Concentrations of BTEX and PHCs exceeded the Table 3 standards at BH1-15, BH2-15, and BH21A-15. All other BTEX and PHC results were in compliance with the selected MOECC Table 3 standards.

Based on the above results, contaminated soil is present in the vicinity of the former UST, which is considered to have contained fuel oil. Analytical results from the 2015 investigations indicates that migration of this contamination is limited, and generally confined to the lower fill/silty sand and upper silty clay soil in the vicinity of the former UST. Sample locations are shown on Drawing PE2930-9.

Based on the analytical results, no contaminants were identified as being by-products of chemical or biological transformations which have or may have occurred.

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 Concentration (µg/g)	Borehole	Depth Interval (m BGS)
Acenaphthene	0.33	BH21-15-SS2	0.76-1.52 m; fill
Acenaphthylene	0.06	BH21-15-SS2	0.76-1.52 m; fill
Anthracene	0.55	BH21-15-SS2	0.76-1.52 m; fill
Benzo[a]anthracene	1.36	BH21-15-SS2	0.76-1.52 m; fill
Benzo[a]pyrene	1.40	BH21-15-SS2	0.76-1.52 m; fill
Benzo[b]fluoranthene	1.67	BH21-15-SS2	0.76-1.52 m; fill
Benzo[g,h,i]perylene	0.70	BH21-15-SS2	0.76-1.52 m; fill
Benzo[k]fluoranthene	0.94	BH21-15-SS2	0.76-1.52 m; fill
Chrysene	1.22	BH21-15-SS2	0.76-1.52 m; fill
Dibenzo[a,h]anthracene	0.29	BH21-15-SS2	0.76-1.52 m; fill
Fluoranthene	2.86	BH21-15-SS2	0.76-1.52 m; fill
Fluorene	0.41	BH21-15-SS2	0.76-1.52 m; fill
Indeno[1,2,3-cd]pyrene	0.78	BH21-15-SS2	0.76-1.52 m; fill
Methylnaphthalene (1 & 2)	1.27	BH21-15-SS2	0.76-1.52 m; fill
Naphthalene	0.74	BH21-15-SS2	0.76-1.52 m; fill
Phenanthrene	3.26	BH21-15-SS2	0.76-1.52 m; fill
Pyrene	2.36	BH21-15-SS2	0.76-1.52 m; fill
Benzene	2.20	BH1-15-SS5	3.18-4.42 m; silty sand
Ethylbenzene	9.07	BH1-15-SS5	3.18-4.42 m; silty sand
Toluene	7.27	BH1-15-SS5	3.18-4.42 m; silty sand
Xylenes	33.4	BH1-15-SS5	3.18-4.42 m; silty sand
PHC F1	1,470	BH1-15-SS5	3.18-4.42 m; silty sand
PHC F2	22,700	BH1-15-SS5	3.18-4.42 m; silty sand
PHC F3	43,900	BH1-15-SS5	3.18-4.42 m; silty sand
PHC F4	13,200	BH2-15-SS5	3.18-4.42 m; silty sand
Notes:			
▪ Bold – Value exceeds applicable MOECC Standard			

All other parameter concentrations were below laboratory detection limits.

5.6 Groundwater Quality

Groundwater samples from the monitoring wells at BH1-15, BH20-15, and BH24-15 were submitted for laboratory analysis of PAHs, BTEX, and PHCs. The groundwater samples were obtained from the screened intervals noted on Table 1. The results of the analytical testing are presented below. It is noted that at the time of the initial sampling of BH20-15 and BH24-15, there was insufficient volume in the other wells on-site, and in the case of BH20-15, only enough sample volume for BTEX and PHC F1 analysis was recoverable. Similar water levels were obtained during the second sampling event. The laboratory certificates of analysis are provided in Appendix 1.

Table 8: Analytical Test Results – Groundwater BTEX/PHCs						
Parameter	MDL (µg/L)	Groundwater Samples (µg/L)				MOECC Table 3 Residential Fine
		March 25, 2015	November 19, 2015		February 4, 2016	
		BH1-15- GW1	BH20- 15-GW1	BH24- 15-GW1	BH24-15- GW2	
Benzene	0.05	nd	nd	nd	nd	430
Ethylbenzene	0.05	nd	nd	nd	nd	2,300
Toluene	0.05	nd	nd	nd	0.8	18,000
Xylenes	0.05	nd	nd	nd	0.6	4,200
PHCs F1	25	nd	nd	nd	nd	750
PHCs F2	100	nd	-	nd	nd	150
PHCs F3	100	nd	-	nd	nd	500
PHCs F4	100	nd	-	nd	nd	500

Notes:

- MDL – Method Detection Limit
- Nd – not detected above the MDL
- N/V – no value provided by the MOECC
- **Bold** – Value exceeds selected MOECC Standard

All BTEX and PHC results are in compliance with the selected MOECC Table 3 standards.

Table 13: Analytical Test Results – Groundwater PAHs			
Parameter	MDL (µg/L)	Groundwater Sample (µg/L)	MOECC Table 3 Residential Fine-Grained Standards
		February 4, 2016	
		BH24-15-GW2	
Acenaphthene	0.05	nd	1,700
Acenaphthylene	0.05	nd	1.8
Anthracene	0.01	0.05	2.4
Benzo[a]anthracene	0.01	0.10	4.7
Benzo[a]pyrene	0.01	0.07	0.81
Benzo[b]fluoranthene	0.05	0.15	0.75
Benzo[g,h,i]perylene	0.05	0.05	0.2
Benzo[k]fluoranthene	0.05	0.08	0.4
Chrysene	0.05	0.11	1
Dibenzo[a,h]anthracene	0.05	nd	0.52
Fluoranthene	0.01	0.22	130
Fluorene	0.05	nd	400
Indeno[1,2,3-cd]pyrene	0.05	nd	0.2
1-Methylnaphthalene	0.05	nd	NV
2-Methylnaphthalene	0.05	nd	NV
Methylnaphthalene (1&2)	0.10	nd	1,800
Naphthalene	0.05	nd	6,400
Phenanthrene	0.05	0.22	580
Pyrene	0.01	0.18	68
Notes:			
<ul style="list-style-type: none"> ▪ MDL – Method Detection Limit nd – not detected above the MDL ▪ N/V – no value provided by the MOECC ▪ Bold – Value exceeds applicable MOECC Standard ▪ Elevated detection limit for Chromium (VI) at BH3-07 due to matrix interference. 			

All PAH concentrations were in compliance with the selected MOECC Table 3 standards.

It is our interpretation that the analyzed parameter concentrations do not indicate the presence of dense non-aqueous phase liquids (DNAPLs) or light non-aqueous phase liquids (LNAPLs).

5.7 Quality Assurance and Quality Control Results

All samples submitted as part of this Phase II ESA were handled in accordance with the Analytical Protocol with respect to holding time, preservation method, storage requirement, and container type.

As per Subsection 47(3) of O.Reg. 153/04 as amended by O.Reg. 269/11, 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 amending O.Reg. 153/04 - Record of Site Condition regulation, made under the Environmental Protection Act. Conclusions and recommendations are discussed in a subsequent section.

Site Description

Potentially Contaminating Activity

Based on the results of the Phase I ESA and Phase II ESA completed for the subject site, one Potentially Contaminating Activity has been identified at the subject site: Item 28 Table 2, O.Reg. 153/04 as amended by O.Reg. 269/11 - "Gasoline and Associated Products Storage in Fixed Tanks". The rationale for identifying this Potentially Contaminating Activity is based on historical information, interviews, and observations during the site visit which indicated the presence of a historical UST on the north side of the subject building.

A Potentially Contaminating Activity was also identified at 481 Rideau Street, to the east of the subject site: Item 28, Table 2, O.Reg. 153/04 as amended by O.Reg. 269/11 - "Gasoline and Associated Products Storage in Fixed Tanks". The rationale for identifying this Potentially Contaminating Activity is based on the historical presence of a retail fuel outlet at this property. The results of the 2013 Phase II ESA indicate that this PCA has not impacted the subject site.

Several other Potentially Contaminating Activities were identified within the Phase I Study Area. Based on the separation distance of these PCAs from the Phase II ESA property, and on the results of previous subsurface investigations at the subject site, these PCAs are not considered to represent APECs with respect to the subject site.

Areas of Potential Environmental Concern

Of the above noted Potentially Contaminating Activities, the presence of the UST on the subject site is considered to represent an Area of Potential Environmental Concern with respect to the subject site and was targeted for further investigation to delineate associated soil and groundwater impacts. Additional Potentially Contaminating Activities were identified within the Phase I study area but were not considered to represent Areas of Potential Environmental Concern.

BTEX, PHCs, and PAHs in soil and BTEX and PHCs in groundwater were identified as the Contaminants of Potential Concern with respect to the subject site.

Subsurface Structures and Utilities

Underground service locates were completed prior to the subsurface investigation. Electrical, gas, water, sewer, and telephone services to the building are present along the north and west side of the subject building, in the vicinity of Chapel Street. In general, service trenches may affect contaminant transport in that trench backfill (generally sand) may provide a preferential pathway; however, given the composition and observed consistency of the hydrocarbon contamination observed at the site, contaminant mobility is anticipated to be low.

Physical Setting

Site Stratigraphy

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

- An intermittent of asphaltic concrete, encountered in paved areas, approximately 0.05 to 0.25 m thick.

- An intermittent layer of concrete, encountered within the footprint of the former building, approximately 0.20 m thick.
- An intermittent layer of fill, consisting of crushed stone with sand, encountered beneath paved areas, varying in thickness from 0.20 to 0.43 m.
- An intermittent layer of fill, consisting of silty sand with trace gravel, and with trace asphalt, crushed stone, coal, organics, brick, concrete, glass, ash, and slag at intermittent locations. This fill layer was encountered at depths varying from 0.20 to 0.43 m, and varied in thickness from 0.38 to 4.60 m where encountered. The deepest fill deposits were found within the basement of the former building in the vicinity of BH21A and BH22, where fill material had been sloped as part of an access ramp; elsewhere, the fill material was generally 1.6 m thick or less. Groundwater was not observed in this layer.
- An intermittent layer of silty sand, encountered at depths varying from 0.15 to 2.16 m and varying in thickness from 0.44 to 3.18 m. Groundwater was not observed in this layer.
- A layer of silty clay, encountered at depths varying from 0.25 to 4.70 m, and varying in thickness from 2.39 to 13.44 m. This is the uppermost saturated unit, and despite the low hydraulic conductivity of silty clay, it is interpreted to function as a local unconfined aquifer at the subject site.
- A layer of glacial till, consisting of silty sand with gravel and trace clay, encountered at depths varying from 8.13 to 15.65 m, and varying in thickness from 2.00 to 6.84 m. Groundwater was observed in geotechnical piezometers installed in this layer. However, no groundwater monitoring wells were screened in this layer.
- Bedrock, consisting of interbedded limestone and shale, encountered at depths varying from 12.1 to 19.0 m in locations where bedrock was cored as part of the geotechnical investigations. Refusal to augering was encountered at depths varying from 10.7 to 19.0 m. No groundwater monitoring wells were screened in this layer. This is the deepest unit investigated.

Hydrogeological Characteristics

Groundwater was encountered in the silty clay and glacial till units at the subject site. Both units are considered to function as aquifers at the subject site, although based on observations, the hydraulic conductivity of the glacial till unit is considerably higher than that of the silty clay unit, and the silty clay unit is interpreted to act as a confining layer with respect to the glacial till unit.

Water levels were measured at the subject site on November 18, 2015. Water levels are summarized above in Section 6.2 of this report. Based on the groundwater elevations from the November 18, 2015 monitoring event, it is our opinion that groundwater levels in the monitoring wells had not yet stabilized. As such, groundwater contours at the subject site were not plotted and hydraulic gradients were not calculated.

Water levels were measured again during a follow-up groundwater monitoring and sampling event on February 4, 2016. No significant changes in water levels were noted, indicating that the levels initially measured were representative, and indicative of the low hydraulic conductivity of site soils.

Approximate Depth to Bedrock

At locations where bedrock was cored, bedrock was encountered at depths varying from 12.1 to 19.0 m. At locations where bedrock was not cored, refusal to augering or dynamic cone penetration was encountered at depths ranging from 10.7 to 19.0 m.

Approximate Depth to Water Table

Groundwater was encountered at depths ranging from 7.5 to 10.7 m during the 2015 and 2016 monitoring events. It is our opinion that these levels represent the long-term groundwater level within the silty clay layer.

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 or within 30 m of a water body.

Fill Placement

Fill was identified in the boreholes drilled during current and previous investigations. This fill material was likely placed at the time of the redevelopment of the site between 1949 and 1956, although some appears to have been placed at a later date in the vicinity of the swimming pool and the former UST excavation. Although the source of the fill cannot be verified at this point, analytical testing indicates that the majority of the fill is in compliance with Table 3 standards. Localized impacted areas of fill material are shown on Drawing PE2930-9.

Proposed Buildings and Other Structures

It is our understanding that a combined commercial/residential high-rise is proposed for the site. The footprint of the development will cover the majority of the site. The development will consist of two 25-storey structures with 3 to 4 levels of underground parking.

Existing Buildings and Structures

At the time of Paterson's initial investigations at the subject site, a three-storey institutional building with one (1) basement level was present on the subject site. The building had been demolished at the time of Paterson's October 2015 investigation, with basement foundation walls left in place. It is our understanding that the foundation walls will be removed concurrently with site redevelopment.

Water Bodies

No creeks, rivers, streams, lakes or any other water body was identified on the subject site. The Rideau River is the closest significant water body and is present approximately 600 m east of the site.

Areas of Natural Significance

No areas of natural significance are present on the subject site.

Environmental Condition

Areas Where Contaminants are Present

Based on screening and analytical results, the area where contaminants are present in concentrations greater than the selected site condition standards are shown on Drawing PE2930-9. Contamination in soil was observed primarily in the vicinity of the former UST. Impacted fill material was also encountered in this area. Groundwater results were in compliance with selected standards.

Types of Contaminants

Based on the Areas of Potential Environmental Concern identified as part of the Phase I ESA, and on the analytical testing undertaken at the subject site, contaminants found at concentrations greater than the selected MOECC standards at the subject site consist of petroleum hydrocarbons (PHCs) and polycyclic aromatic hydrocarbons (PAHs) in soil. All contaminant concentrations in groundwater were below laboratory detection limits.

Contaminated Media

Based on the results of the Phase II ESA, the contaminants of concern are present in the soil on the subject site, specifically in the fill layer in the vicinity of the former UST. Analytical testing indicates that the groundwater beneath the site is not contaminated.

What Is Known About Areas Where Contaminants Are Present

The area of contamination discussed in the previous sections is interpreted to be centered around the footprint of the former UST at the subject site, as shown on Drawing PE2930-9. The southern and eastern limits of the contamination have been delineated, and based on testing results, the contamination appears to extend to the northwest corner of the property. Vertically, the contamination appears to be confined to the coarser-grained fill layer and has not penetrated significantly into the underlying silty clay.

Distribution of Contaminants

The horizontal distribution of petroleum hydrocarbon contamination is considered to be confined to the approximate vicinity of the excavation for the former fuel oil UST. The vertical distribution is considered to be limited based on the low permeability of the silty clay soils at the subject site. Impacted fill material is present in the vicinity of BH21-15, with potentially impacted fill present at various locations throughout the subject site.

Discharge of Contaminants

It is our interpretation that the presence of contaminants on-site is a result of the historical fuel oil UST. The presence of hydrocarbons in site soils could be considered to be a result of historic tank leakage or spills during filling.

Migration of Contaminants

Given the low permeability of native silty clay soils at the site and the consistency of the hydrocarbon contamination, it is our interpretation that migration of contaminants within site soils is extremely limited.

Climatic and Meteorological Conditions

In general, climatic and meteorological conditions have the potential to affect contaminant distribution. Two ways by which climatic and meteorological conditions may affect contaminant distribution include the downward leaching of contaminants by means of the infiltration of precipitation, and the migration of contaminants via groundwater levels and/or flow, which may fluctuate seasonally. Based on the results of the subsurface investigation, the contaminated areas appear to be restricted to the overburden soils, and as such, the aforementioned climatic and meteorological conditions are not considered to have affected contaminant distribution at the subject site.

Potential for Vapour Intrusion

The low volatility of the heavy-fraction hydrocarbons and PAHs encountered at the subject site is considered to limit their potential for vapour intrusion. It is our understanding that the soil contamination at the site will be fully remediated prior to the redevelopment of the site. As such, the potential for vapour intrusion is considered to be negligible.

6.0 CONCLUSIONS

Assessment

A Supplemental Phase II ESA was conducted for the property addressed as 151 Chapel Street, Ottawa, Ontario. The Phase II ESA incorporated the findings of previous investigations at the subject site, as well as the results of a subsurface investigation program completed in October 2015 which consisted of drilling 21 boreholes at the subject site and installing four (4) monitoring wells. The purpose of this Phase II ESA was to address Areas of Potential Environmental Concern identified during the Phase I ESA, which included the historical presence of a heating oil UST at the subject site and the presence of fill material of unknown quality encountered during the subsurface investigation.

Soil samples were obtained from the boreholes and were screened using visual observations and organic vapour measurements. Based on the screening results, a total of 17 soil samples were submitted for analysis of benzene, toluene, ethylbenzene, and xylenes (BTEX), petroleum hydrocarbons, fractions 1 through 4 (PHCs F1-F4), and polycyclic aromatic hydrocarbons (PAHs). Several of the fill samples in the immediate vicinity of the footprint of the former UST exceeded the selected MOECC Table 3 standards for BTEX, PHCs, and/or PAHs. Remaining soil samples were in compliance with selected standards.

Groundwater samples were obtained from two (2) of the monitoring wells at the subject site and analyzed for PAHs, BTEX, and PHCs. The remaining wells were not sampled due to insufficient sample volume due to the naturally low hydraulic conductivity of site soils. Groundwater analytical results were in compliance with selected MOECC Table 3 standards.

Recommendations

Based on the above results, soil exists at the subject property with BTEX, PHC, and PAH concentrations which exceed the applicable MOECC Table 3 soil standards. It is our understanding that the subject site is to be redeveloped with residential and commercial buildings. It is our recommendation that an environmental site remediation program, involving the removal of all contaminated soil, be completed concurrently with site redevelopment.

It is our understanding that the subject site will be redeveloped, and a Record of Site Condition (RSC) will be obtained for the subject site in support of a Brownfield Redevelopment Grant for the site. It is recommended that the monitoring wells at the subject site be maintained for future sampling if possible, and that groundwater monitoring be completed following remediation.

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 Trinity Development Group. Permission and notification from Trinity and Paterson will be required to release this report to any other party.

Paterson Group Inc.

Daniel J. Arnott, P.Eng.

Mark S. D'Arcy, P.Eng.

Report Distribution:

- Trinity Development Group (1 PDF copy)
- Paterson Group (1 copy)

FIGURES

FIGURE 1 – KEY PLAN

DRAWING PE2930-8 – TEST HOLE LOCATION PLAN

DRAWING PE2930-9 - ANALYTICAL TESTING PLAN

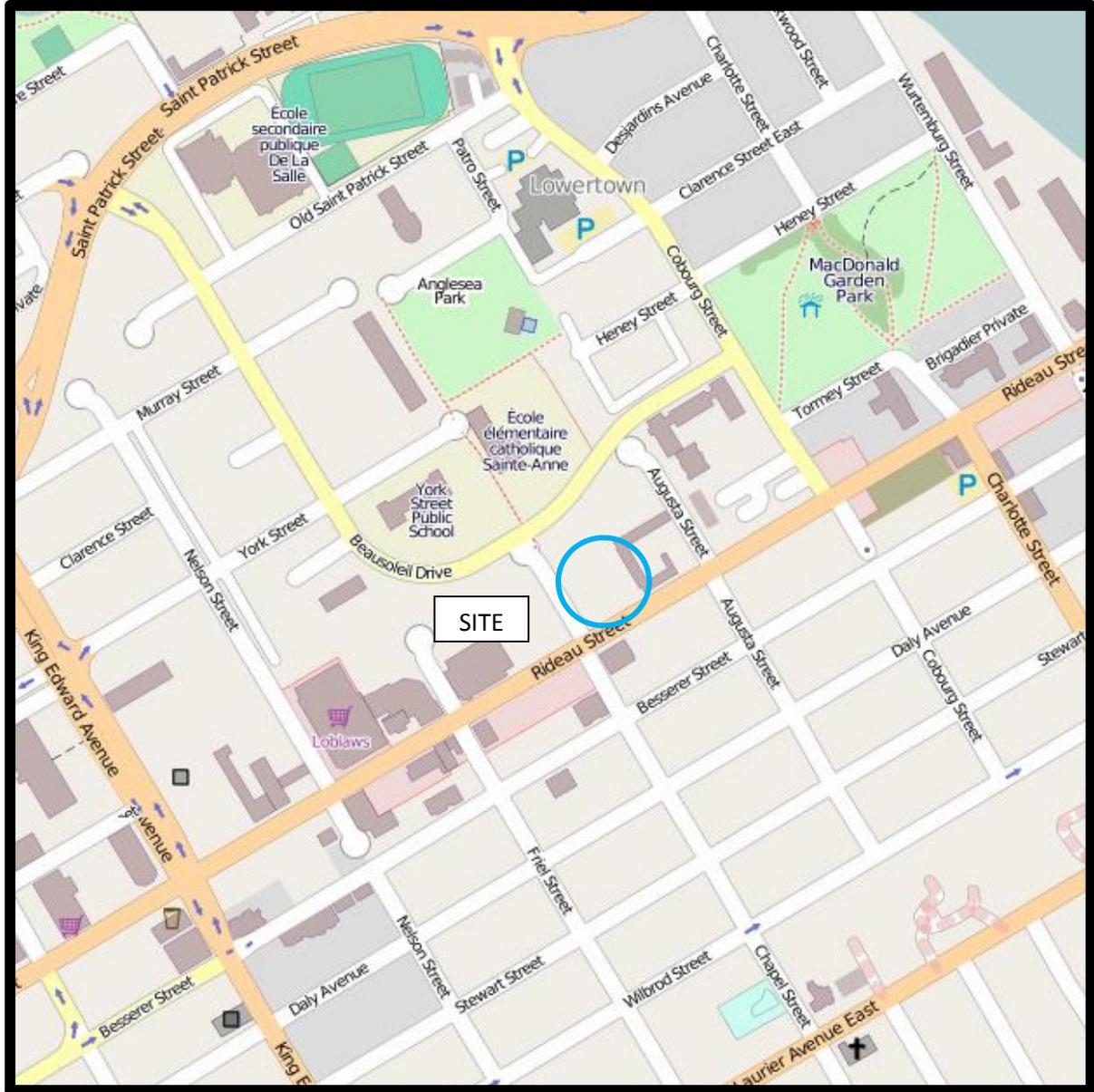
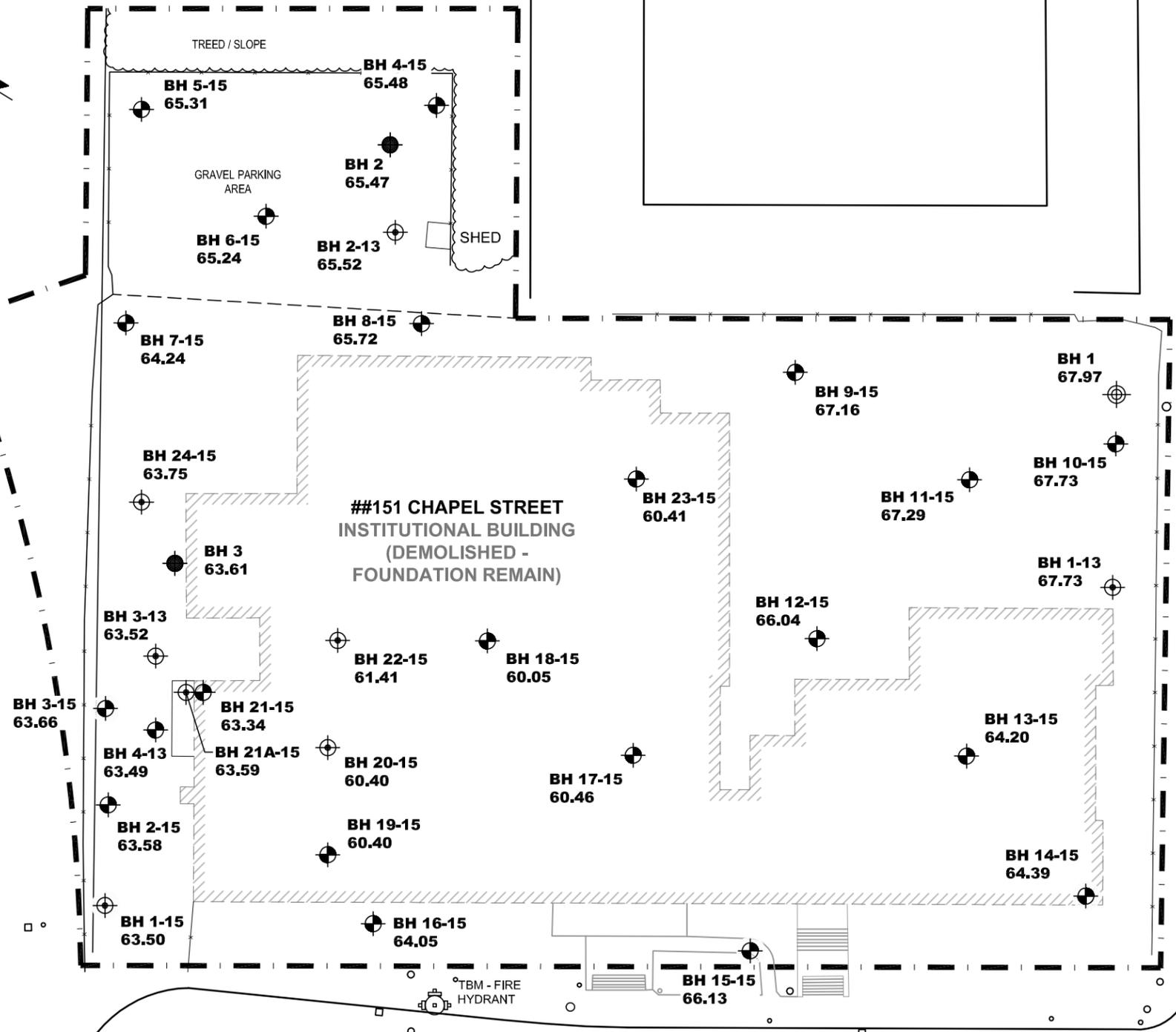


FIGURE 1
KEY PLAN

BEAUSOLEIL DRIVE

RIDEAU STREET

CHAPEL STREET



LEGEND:

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION, PREVIOUS INVESTIGATION, PATERSON GROUP REPORT PG2757, 2012
- BOREHOLE WITH MONITORING WELL LOCATION, PREVIOUS INVESTIGATION, PATERSON GROUP REPORT PG2757, 2012
- 64.20 GROUND SURFACE ELEVATION (m)

TBM - TOP SPINDLE OF FIRE HYDRANT. GEODETIC ELEVATION = 65.12m.

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NO.	REVISIONS	DATE	INITIAL

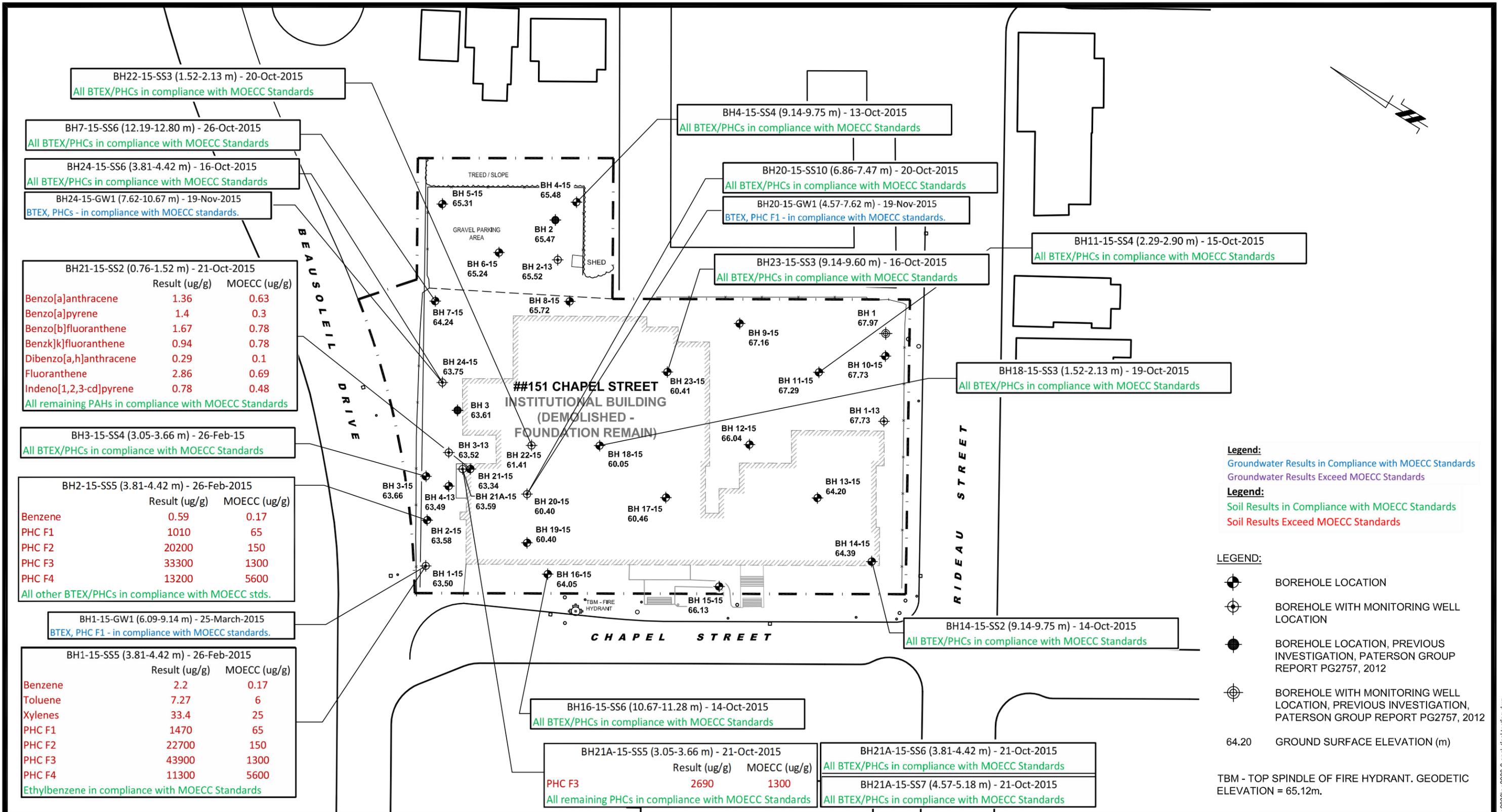
TRINITY DEVELOPMENT GROUP
SUPPLEMENTAL PHASE II - ENVIRONMENTAL SITE ASSESSMENT
151 CHAPEL STREET

OTTAWA,
Title:

ONTARIO

TEST HOLE LOCATION PLAN

Scale:	1:500	Date:	12/2015
Drawn by:	MPG	Report No.:	PE2930
Checked by:	DA	Drawing No.:	PE2930-8
Approved by:	MSD		



BH22-15-SS3 (1.52-2.13 m) - 20-Oct-2015
All BTEX/PHCs in compliance with MOECC Standards

BH7-15-SS6 (12.19-12.80 m) - 26-Oct-2015
All BTEX/PHCs in compliance with MOECC Standards

BH24-15-SS6 (3.81-4.42 m) - 16-Oct-2015
All BTEX/PHCs in compliance with MOECC Standards

BH24-15-GW1 (7.62-10.67 m) - 19-Nov-2015
BTEX, PHCs - in compliance with MOECC standards.

BH21-15-SS2 (0.76-1.52 m) - 21-Oct-2015

	Result (ug/g)	MOECC (ug/g)
Benzo[a]anthracene	1.36	0.63
Benzo[a]pyrene	1.4	0.3
Benzo[b]fluoranthene	1.67	0.78
Benzo[k]fluoranthene	0.94	0.78
Dibenzo[a,h]anthracene	0.29	0.1
Fluoranthene	2.86	0.69
Indeno[1,2,3-cd]pyrene	0.78	0.48

All remaining PAHs in compliance with MOECC Standards

BH3-15-SS4 (3.05-3.66 m) - 26-Feb-15
All BTEX/PHCs in compliance with MOECC Standards

BH2-15-SS5 (3.81-4.42 m) - 26-Feb-2015

	Result (ug/g)	MOECC (ug/g)
Benzene	0.59	0.17
PHC F1	1010	65
PHC F2	20200	150
PHC F3	33300	1300
PHC F4	13200	5600

All other BTEX/PHCs in compliance with MOECC stds.

BH1-15-GW1 (6.09-9.14 m) - 25-March-2015
BTEX, PHC F1 - in compliance with MOECC standards.

BH1-15-SS5 (3.81-4.42 m) - 26-Feb-2015

	Result (ug/g)	MOECC (ug/g)
Benzene	2.2	0.17
Toluene	7.27	6
Xylenes	33.4	25
PHC F1	1470	65
PHC F2	22700	150
PHC F3	43900	1300
PHC F4	11300	5600

Ethylbenzene in compliance with MOECC Standards

BH16-15-SS6 (10.67-11.28 m) - 14-Oct-2015
All BTEX/PHCs in compliance with MOECC Standards

BH21A-15-SS5 (3.05-3.66 m) - 21-Oct-2015

	Result (ug/g)	MOECC (ug/g)
PHC F3	2690	1300

All remaining PHCs in compliance with MOECC Standards

BH21A-15-SS6 (3.81-4.42 m) - 21-Oct-2015
All BTEX/PHCs in compliance with MOECC Standards

BH21A-15-SS7 (4.57-5.18 m) - 21-Oct-2015
All BTEX/PHCs in compliance with MOECC Standards

BH4-15-SS4 (9.14-9.75 m) - 13-Oct-2015
All BTEX/PHCs in compliance with MOECC Standards

BH20-15-SS10 (6.86-7.47 m) - 20-Oct-2015
All BTEX/PHCs in compliance with MOECC Standards

BH20-15-GW1 (4.57-7.62 m) - 19-Nov-2015
BTEX, PHC F1 - in compliance with MOECC standards.

BH23-15-SS3 (9.14-9.60 m) - 16-Oct-2015
All BTEX/PHCs in compliance with MOECC Standards

BH11-15-SS4 (2.29-2.90 m) - 15-Oct-2015
All BTEX/PHCs in compliance with MOECC Standards

BH18-15-SS3 (1.52-2.13 m) - 19-Oct-2015
All BTEX/PHCs in compliance with MOECC Standards

BH14-15-SS2 (9.14-9.75 m) - 14-Oct-2015
All BTEX/PHCs in compliance with MOECC Standards

Legend:
Groundwater Results in Compliance with MOECC Standards
Groundwater Results Exceed MOECC Standards
Legend:
Soil Results in Compliance with MOECC Standards
Soil Results Exceed MOECC Standards

LEGEND:
 BOREHOLE LOCATION
 BOREHOLE WITH MONITORING WELL LOCATION
 BOREHOLE LOCATION, PREVIOUS INVESTIGATION, PATERSON GROUP REPORT PG2757, 2012
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 64.20 GROUND SURFACE ELEVATION (m)

TBM - TOP SPINDLE OF FIRE HYDRANT. GEODETIC ELEVATION = 65.12m.

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NO.	REVISIONS	DATE	INITIAL

TRINITY DEVELOPMENT GROUP
SUPPLEMENTAL PHASE II - ENVIRONMENTAL SITE ASSESSMENT
151 CHAPEL STREET
OTTAWA, ONTARIO

ANALYTICAL TESTING PLAN

Scale:	1:750	Date:	12/2015
Drawn by:	MPG	Report No.:	PE2930
Checked by:	DA	Drawing No.:	PE2930-9
Approved by:	MSD		

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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
Studies

Sampling & Analysis Plan

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October 2015

Report: PE2930-SAP-2

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3.0	STANDARD OPERATING PROCEDURES	3
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1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by Trinity Development Group Inc. to conduct a Supplemental Phase II-Environmental Site Assessment (ESA) for the property at 151 Chapel Street, in the City of Ottawa, Ontario. Based on the Phase I-ESA completed by Paterson for the subject property, the following subsurface investigation program was developed:

Borehole	Location & Rationale	Proposed Depth & Rationale
BH4-15 to BH18-15	General site coverage for environmental and geotechnical purposes.	Terminate within water table; advance to bedrock for geotechnical purposes
BH19-15 to BH24-15	Delineation of impacts in vicinity of former UST.	Terminate at refusal to augering

Test hole locations are shown on the Test Hole Location Plan appended to the main report.

At each borehole, split-spoon samples of overburden soils will be obtained at 0.76 m (2'6") intervals until approximately 1.5 m below the water table. Grab samples will be obtained from each stratigraphic unit encountered in the test pits. All soil samples will be retained, and samples will be selected for submission following a preliminary screening analysis.

If it is considered necessary to drill into bedrock to intercept the groundwater table, boreholes will be advanced into bedrock as required using diamond coring equipment. Rock core samples will be retained for review, but not submitted for analysis.

Following borehole drilling, monitoring wells will be installed in selected boreholes for the measurement of water levels and the collection of groundwater samples.

2.0 ANALYTICAL TESTING PROGRAM

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

- In boreholes where there is visual or olfactory evidence of contamination, or where organic vapour meter or photoionization detector (PID) readings indicate the presence of contamination, the 'worst-case' sample from each borehole should be submitted for comparison with MOECC 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.
- At least one sample from each borehole should be submitted, in order to delineate the horizontal extent of contamination across the site.
- 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 a geodetic benchmark, if one is available, or a temporary site benchmark which can be tied in at a later date if necessary.

Drilling Procedure

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

- Continuous split spoon samples (every 0.6 m or 2') or semi-continuous (every 0.76 m or 2'6") are required.
- Make sure samples are well sealed in plastic bags with no holes prior to screening and are kept cool but unfrozen.
- If sampling for VOCs, BTEX, or PHCs 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, visual observations, 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.

The spoon-washing procedure may be bypassed if a GeoProbe direct-push drill rig with disposable plastic sampling tubes is used.

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

- 1.5 m x 5 cm threaded sections of Schedule 40 PVC slotted well screen (1.5 m x 3.2 cm if installing in cored hole in bedrock)
- 1.5 m x 5 cm threaded sections of Schedule 40 PVC riser pipe (1.5 m x 3.2 cm 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
- Portable pH/Temperature/Conductivity analyzer
- 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 possible.
- Where multi-parameter analyzers 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 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.

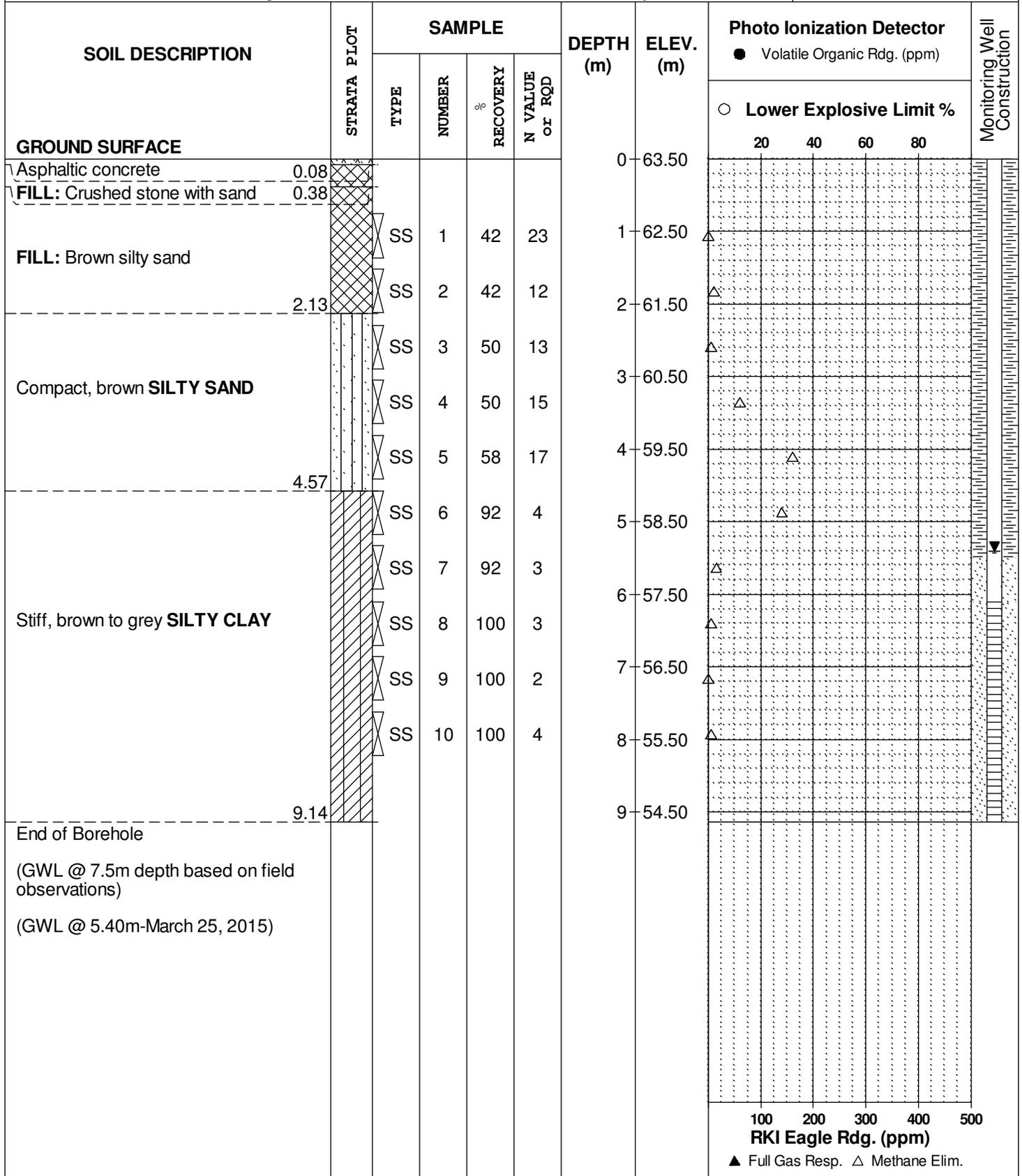
DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH 1-15

BORINGS BY CME 55 Power Auger

DATE 26 February 2015



DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH 2-15

BORINGS BY CME 55 Power Auger

DATE 26 February 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction	
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			● Volatile Organic Rdg. (ppm)					
GROUND SURFACE								○ Lower Explosive Limit %					
								20	40	60	80		
Asphaltic concrete	0.10					0	63.58						
FILL: Crushed stone	0.41												
FILL: Brown silty sand, trace gravel	1.52	SS	1	33		1	62.58						
Compact, brown SILTY SAND , trace gravel		SS	2	42		2	61.58						
		SS	3	58		3	60.58						
		SS	4	50	12	4	59.58						
		SS	5	33	15	5	58.58						
		SS	6	58	2	6	57.58						
Stiff, brown to grey SILTY CLAY	4.70	SS	7	92	3	7	56.58						
		SS	8	100	2	8							
		SS	9	100	1	9							
End of Borehole	7.62												
(GWL @ 7.0m depth based on field observations)													

100 200 300 400 500
RKI Eagle Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH 3-15

BORINGS BY CME 55 Power Auger

DATE 26 February 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction		
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			● Volatile Organic Rdg. (ppm)						
GROUND SURFACE								○ Lower Explosive Limit %						
								20	40	60	80			
Asphaltic concrete	0.08					0	63.66							
FILL: Crushed stone with sand	0.51													
FILL: Brown silty sand with gravel		SS	1	42	24	1	62.66	▲						
		SS	2	33	11	2	61.66	▲						
	2.13	SS	3	42	12	3	60.66	▲						
Compact, brown SILTY SAND		SS	4	42	16	4	59.66	▲						
	3.96	SS	5	83		5	58.66	▲						
Stiff, brown to grey SILTY CLAY		SS	6	50	2	6	57.66	▲						
		SS	7	100	3	7	56.66	▲						
		SS	8	100	2	8	55.66	▲						
		SS	9	50	2	9	54.66	▲						
End of Borehole	7.62													
(GWL @ 7.2m depth based on field observations)														
								100	200	300	400	500		
								RKI Eagle Rdg. (ppm)						
								▲ Full Gas Resp. △ Methane Elim.						

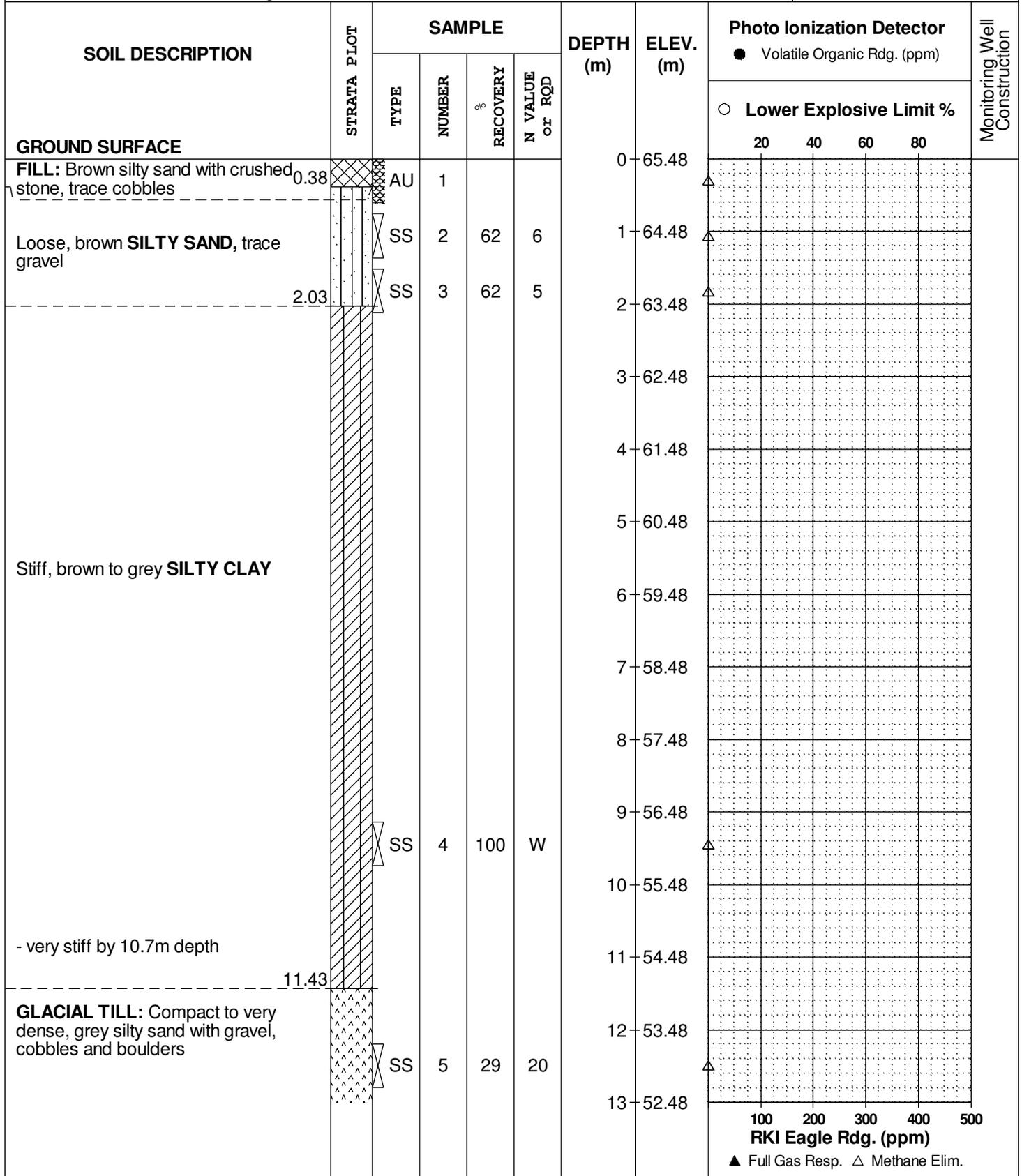
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REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH 4-15

BORINGS BY CME 55 Power Auger

DATE 13 October 2015



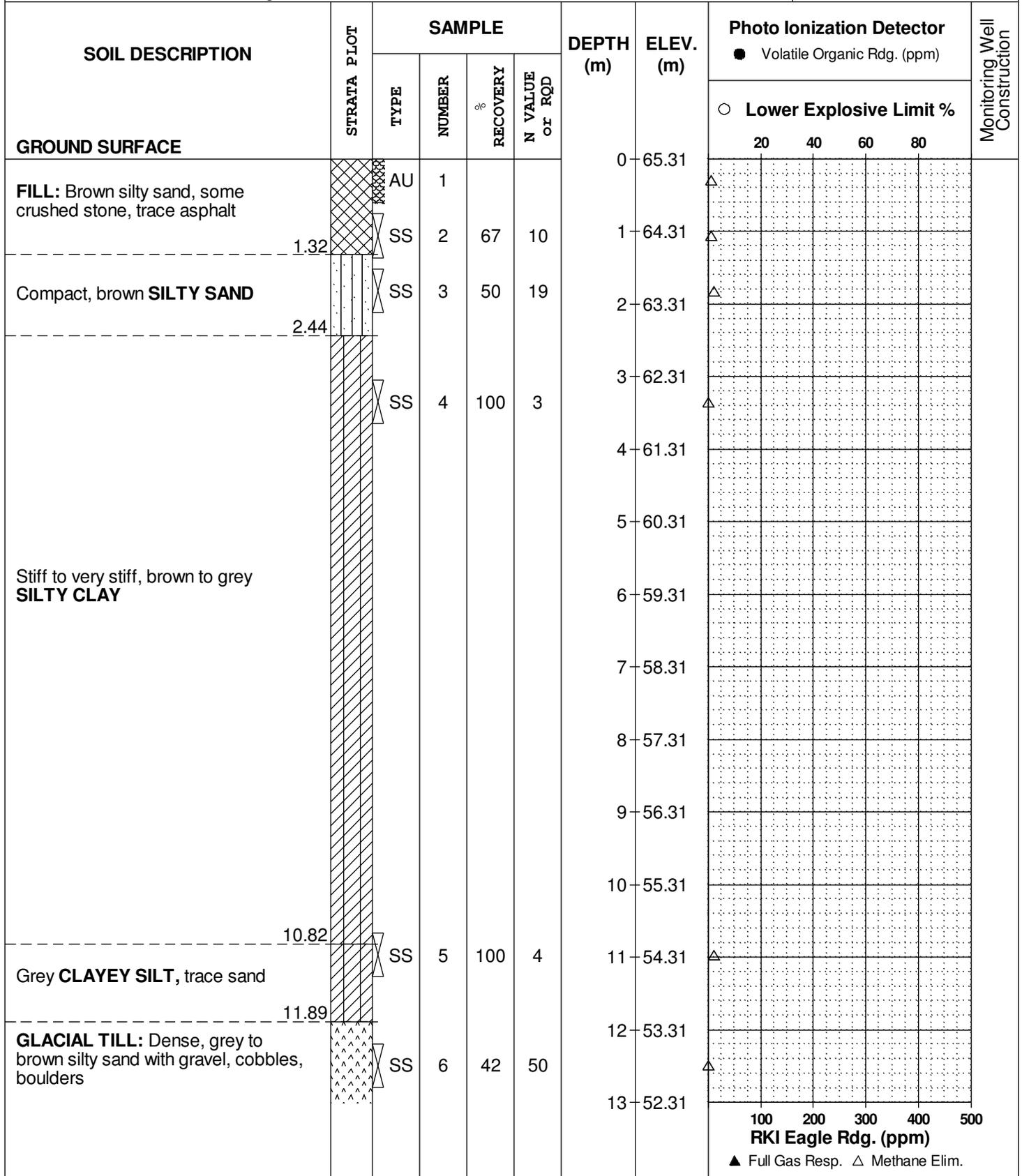
DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH 5-15

BORINGS BY CME 55 Power Auger

DATE 22 October 2015



DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH 5-15

BORINGS BY CME 55 Power Auger

DATE 22 October 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			● Volatile Organic Rdg. (ppm)				
								○ Lower Explosive Limit %				
								20	40	60	80	
GLACIAL TILL: Dense, grey to brown silty sand with gravel, cobbles, boulders		SS	7	54	43	13	52.31					
		SS	8	83	50+	14	51.31					
		SS				15	50.31					
BEDROCK: Interbedded limestone and shale		RC	1	100		16	49.31					
		RC	2	100	100	17	48.31					
		RC	3	98	98	18	47.31					
End of Borehole					19	46.31						

100 200 300 400 500
RKI Eagle Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

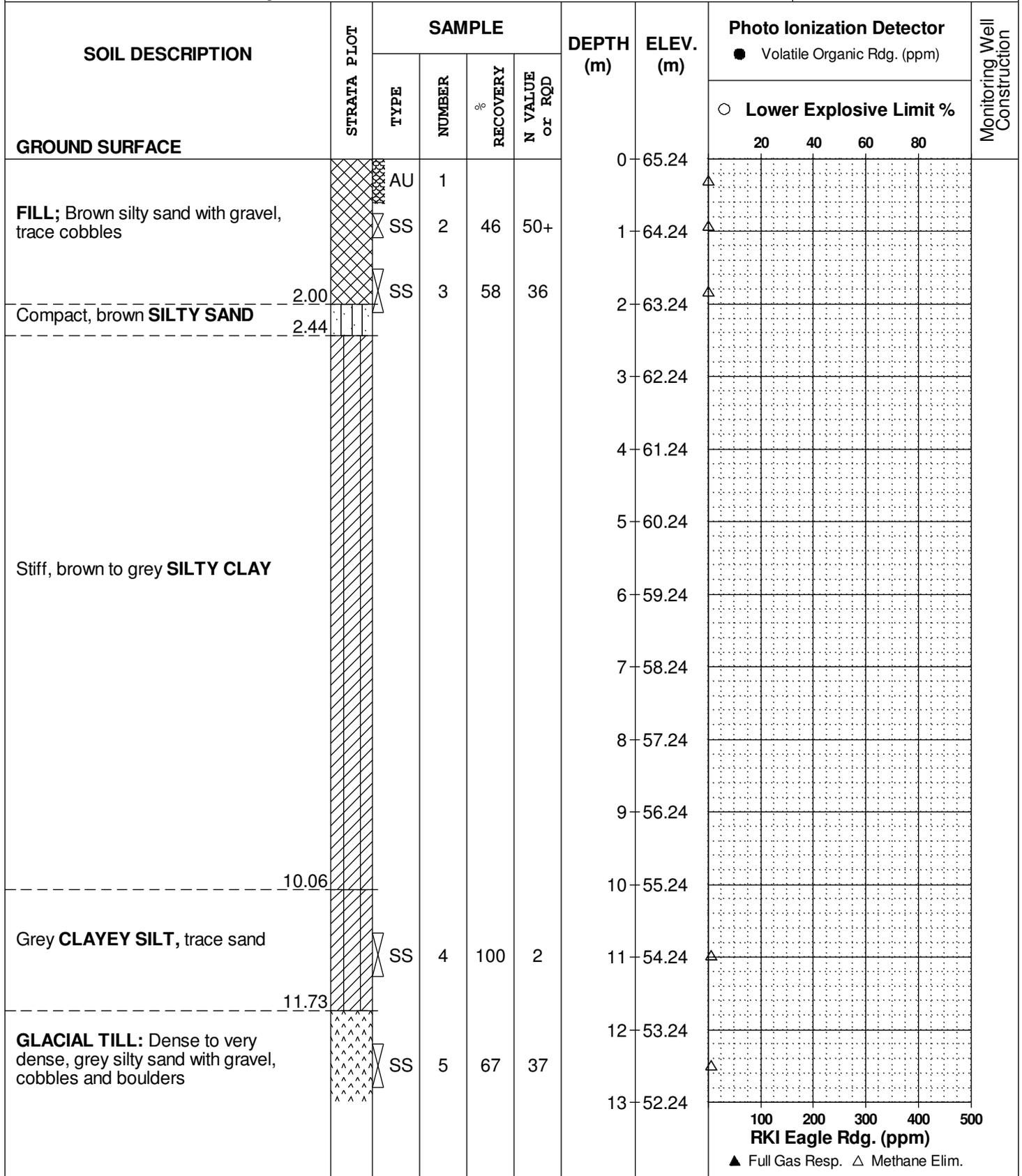
DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH 6-15

BORINGS BY CME 55 Power Auger

DATE 23 October 2015



SOIL PROFILE AND TEST DATA

Supplemental Phase II-Environmental Site Assessment
151 Chapel Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH 6-15

BORINGS BY CME 55 Power Auger

DATE 23 October 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			<input type="radio"/> Volatile Organic Rdg. (ppm) <input type="radio"/> Lower Explosive Limit %				
								20	40	60	80	
GLACIAL TILL: Dense to very dense, grey silty sand with gravel, cobbles and boulders		SS	6	54	54	13	52.24					
						14	51.24					
						15	50.24					
End of Borehole Practical refusal to augering at 15.75m depth	15.75	SS	7	100	50+							
								100	200	300	400	500

RKI Eagle Rdg. (ppm)
 ▲ Full Gas Resp. △ Methane Elim.

SOIL PROFILE AND TEST DATA

Supplemental Phase II-Environmental Site Assessment
151 Chapel Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH 7-15

BORINGS BY CME 55 Power Auger

DATE 26 October 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction		
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			● Volatile Organic Rdg. (ppm)						
								○ Lower Explosive Limit %						
								20	40	60	80			
GLACIAL TILL: Dense to very dense, brown silty sand with gravel, cobbles and boulders		SS	7	50	50+	13	51.24							
						14	50.24							
		SS	8	100	50+	15	49.24							
						16	48.24							
End of Borehole Practical refusal to augering at 16.64m depth	16.64													
								100	200	300	400	500		
								RKI Eagle Rdg. (ppm)						
								▲ Full Gas Resp. △ Methane Elim.						

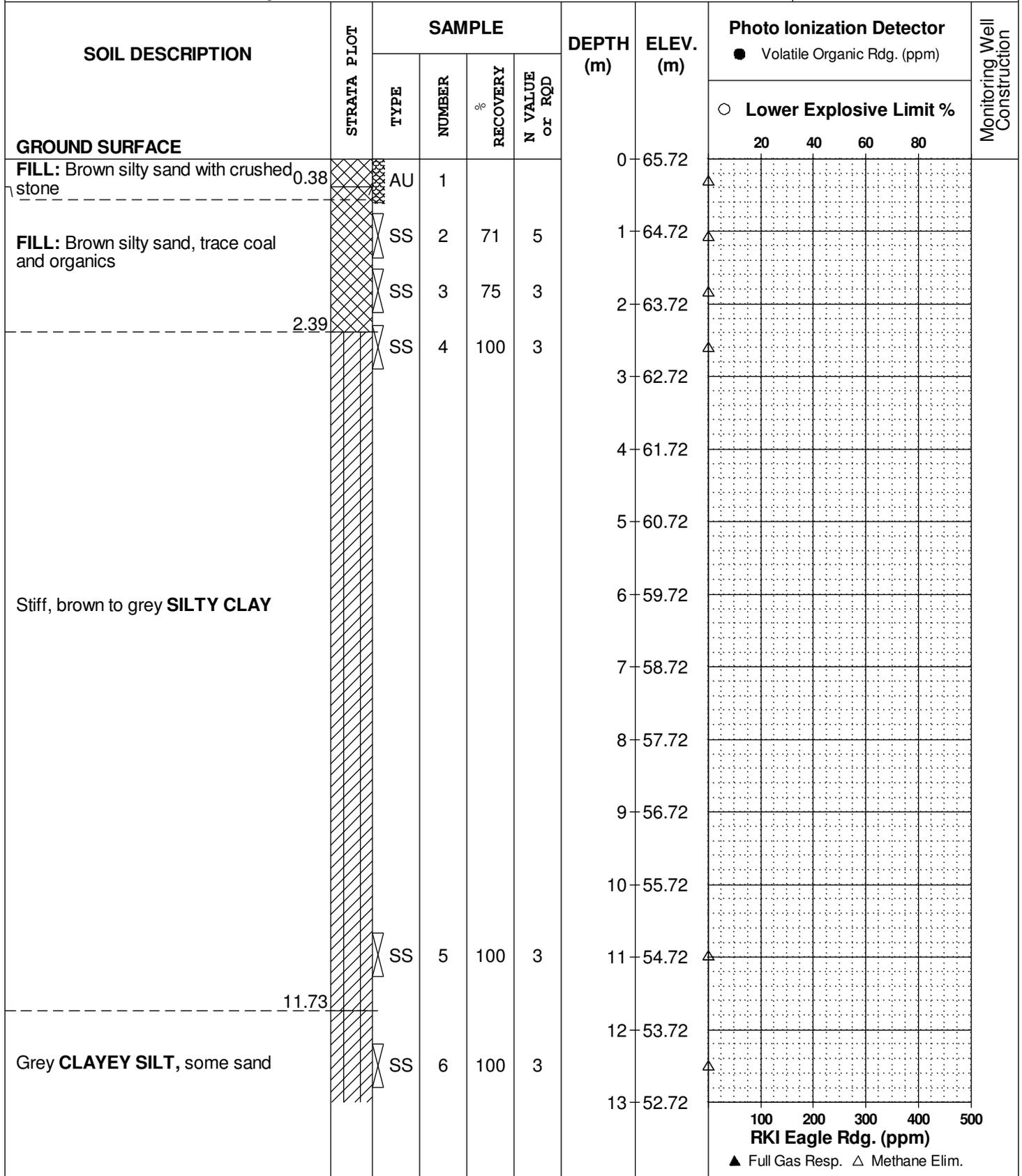
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REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH 8-15

BORINGS BY CME 55 Power Auger

DATE 27 October 2015



DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH 8-15

BORINGS BY CME 55 Power Auger

DATE 27 October 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			● Volatile Organic Rdg. (ppm)				
								○ Lower Explosive Limit %				
								20	40	60	80	
Grey CLAYEY SILT , some sand	13.41					13	52.72					
GLACIAL TILL: Very dense, dark grey silty sand with gravel, cobbles and boulders		SS	7	83	50+	14	51.72					
		SS	8	50	50+	15	50.72					
		RC	1	52		17	48.72					
		RC	2	100	90	18	47.72					
BEDROCK: Interbedded limestone and shale	17.50					19	46.72					
End of Borehole	19.03											

100 200 300 400 500
RKI Eagle Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

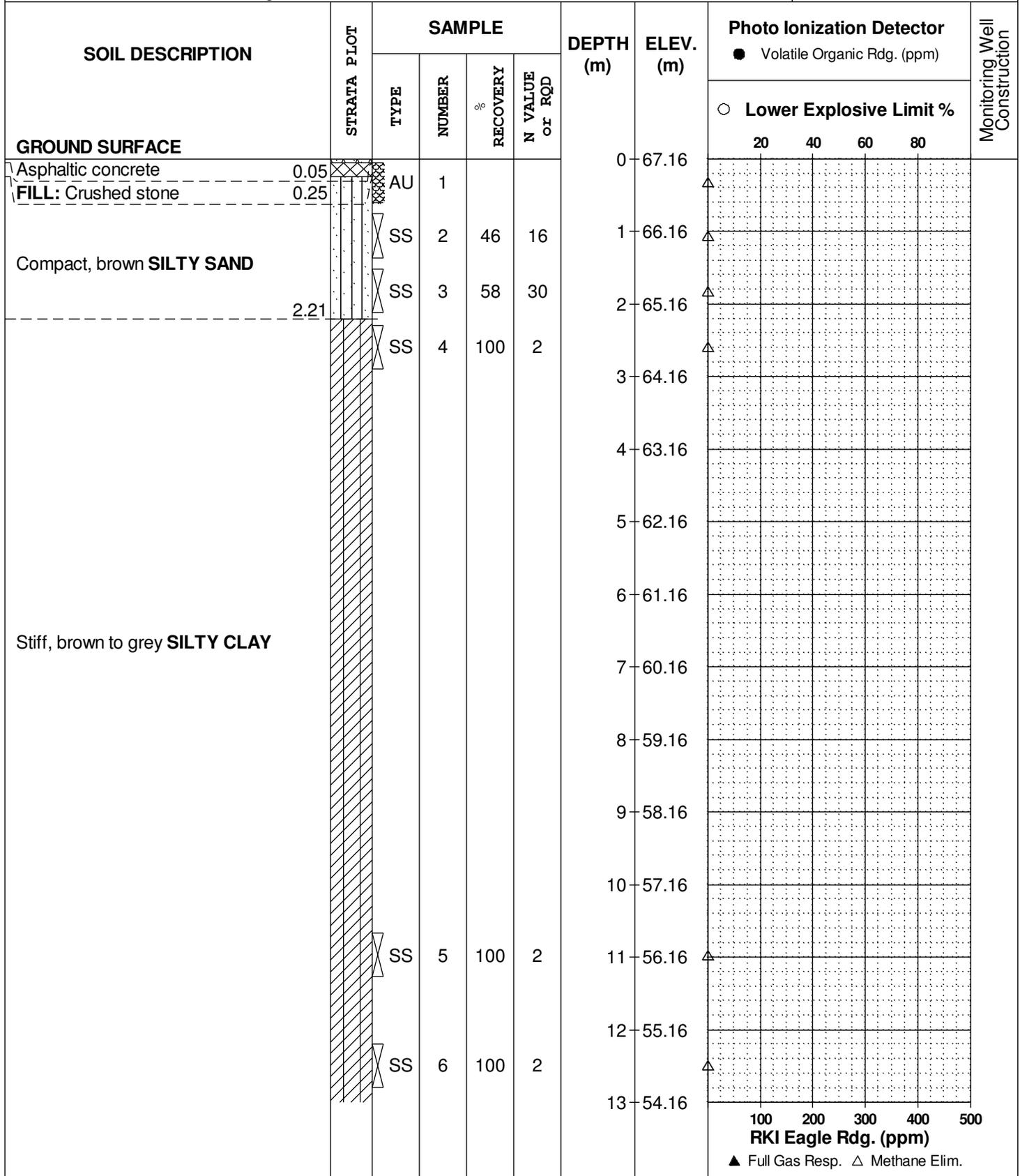
DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
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FILE NO. PE2930

HOLE NO. BH 9-15

BORINGS BY CME 55 Power Auger

DATE 26 October 2015



○ Lower Explosive Limit %

● Volatile Organic Rdg. (ppm)

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

SOIL PROFILE AND TEST DATA

Supplemental Phase II-Environmental Site Assessment
151 Chapel Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH 9-15

BORINGS BY CME 55 Power Auger

DATE 26 October 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			● Volatile Organic Rdg. (ppm)				
								○ Lower Explosive Limit %				
								20	40	60	80	
Stiff, grey SILTY CLAY		SS	7	100	2	13	54.16					
	14.48					14	53.16					
Grey CLAYEY SILT , some sand		SS	8	100	4	15	52.16					
	15.65					16	51.16					
GLACIAL TILL: Dark grey silty sand with gravel, cobbles and boulders		SS	9	100	50+	17	50.16					
	18.72					18	49.16					
End of Borehole Practical refusal to augering at 18.72m depth												

100 200 300 400 500
RKI Eagle Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH10-15

BORINGS BY CME 55 Power Auger

DATE 16 October 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			● Volatile Organic Rdg. (ppm)				
								○ Lower Explosive Limit %				
								20	40	60	80	
Stiff to very stiff, grey SILTY CLAY						13	54.73					
						14	53.73					
						15	52.73					
	15.24					16	51.73					
GLACIAL TILL: Compact to very dense, grey silty sand with gravel, cobbles and boulders		SS	5	29	26	16	51.73					
		SS	6	62	93	17	50.73					
		SS	7	83	50+	18	49.73					
	18.95					19	48.73					
BEDROCK: Interbedded limestone and shale		RC	1	100	76	19	48.73					
						20	47.73					
End of Borehole	20.55											

100 200 300 400 500
RKI Eagle Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH11-15

BORINGS BY CME 55 Power Auger

DATE 15 October 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			● Volatile Organic Rdg. (ppm)	○ Lower Explosive Limit %			
								20	40	60	80	
GROUND SURFACE						0	67.29					
Asphaltic concrete	0.13	AU	1									
FILL: Crushed stone	0.25											
Compact, brown SILTY SAND	1.42	SS	2	29	21	1	66.29					
		SS	3	100	2	2	65.29					
		SS	4	100	1	3	64.29					
						4	63.29					
						5	62.29					
						6	61.29					
						7	60.29					
						8	59.29					
						9	58.29					
						10	57.29					
						11	56.29					
						12	55.29					
						13	54.29					
Stiff, brown to grey SILTY CLAY												

100 200 300 400 500
RKI Eagle Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

SOIL PROFILE AND TEST DATA

Supplemental Phase II-Environmental Site Assessment
151 Chapel Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH11-15

BORINGS BY CME 55 Power Auger

DATE 15 October 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			● Volatile Organic Rdg. (ppm)				
								○ Lower Explosive Limit %				
								20	40	60	80	
Stiff, grey CLAYEY SILT	13.11 - 14.63					13	54.29					
GLACIAL TILL: Dense to very dense, grey silty sand with gravel, cobbles and boulders	14.63 - 18.97	SS	5	58	36	15	52.29					
		SS	6	100	50+	16	51.29					
		SS	7	100	50+	17	50.29					
End of Borehole Practical refusal to augering at 18.97m depth	18.97					18	49.29					
								100	200	300	400	500

RKI Eagle Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

SOIL PROFILE AND TEST DATA

Supplemental Phase II-Environmental Site Assessment
151 Chapel Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PE2930

HOLE NO. BH12-15

BORINGS BY CME 55 Power Auger

DATE 16 October 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			● Volatile Organic Rdg. (ppm)				
								○ Lower Explosive Limit %				
								20	40	60	80	
GLACIAL TILL: Very dense, grey silty sand with gravel, cobbles and boulders		SS	5	0	5	13	53.04					
		SS	6	67	50+	14	52.04					
		SS	7	60	50+	15	51.04					
		SS	8	60	50+	16	50.04					
		SS	8	60	50+	17	49.04					
End of Borehole Practical refusal to augering at 17.86m depth	17.86	SS	8	60	50+							
								100	200	300	400	500
								RKI Eagle Rdg. (ppm)				
								▲ Full Gas Resp. △ Methane Elim.				

DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH13-15

BORINGS BY CME 55 Power Auger

DATE 15 October 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction
		TYPE	NUMBER	RECOVERY	N VALUE or RQD			● Volatile Organic Rdg. (ppm)				
								○ Lower Explosive Limit %				
								20	40	60	80	
GROUND SURFACE						0	64.20					
FILL: Brown silty sand with crushed stone, concrete, brick and asphalt	0.25	AU	1			1	63.20					
						2	62.20					
						3	61.20					
						4	60.20					
Stiff, brown to grey SILTY CLAY						5	59.20					
						6	58.20					
						7	57.20					
						8	56.20					
						9	55.20					
	10.06					10	54.20					
Grey CLAYEY SILT , trace sand						11	53.20					
	11.73					12	52.20					
Very dense, grey SILTY SAND with gravel		SS	2	100	50+	13	51.20					
								100	200	300	400	500
								RKI Eagle Rdg. (ppm)				
								▲ Full Gas Resp. △ Methane Elim.				

DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH14-15

BORINGS BY CME 55 Power Auger

DATE 14 October 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			● Volatile Organic Rdg. (ppm)				
								○ Lower Explosive Limit %				
								20	40	60	80	
GROUND SURFACE						0	64.39					
FILL: Brown silty sand with gravel, cobbles, crushed stone, brick, asphalt, coal	0.25	AU	1			1	63.39					
						2	62.39					
						3	61.39					
						4	60.39					
Stiff, brown to grey SILTY CLAY						5	59.39					
						6	58.39					
						7	57.39					
						8	56.39					
						9	55.39					
	10.19	SS	2	100	2	10	54.39					
Very loose, grey SANDY SILT , some clay		SS	3	29	3	11	53.39					
	11.79					12	52.39					
Very dense, grey SILTY SAND with gravel		SS	4	70	79	13	51.39					
								100	200	300	400	500
								RKI Eagle Rdg. (ppm)				
								▲ Full Gas Resp. △ Methane Elim.				

SOIL PROFILE AND TEST DATA

Supplemental Phase II-Environmental Site Assessment
151 Chapel Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO.
PE2930

HOLE NO.
BH14-15

BORINGS BY CME 55 Power Auger

DATE 14 October 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			● Volatile Organic Rdg. (ppm)				
								○ Lower Explosive Limit %				
								20	40	60	80	
Very dense, grey SILTY SAND with gravel - some running sand encountered from 13.7 to 16.4m depth		SS	5	100	50+	13	51.39					
		SS	6	56	50+	14	50.39					
		SS	7	100	50+	15	49.39					
BEDROCK: Interbedded limestone and shale		SS	7	100	50+	16	48.39					
		RC	1	97	33	17	47.39					
End of Borehole						18	46.39					

100 200 300 400 500
RKI Eagle Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH15-15

BORINGS BY CME 55 Power Auger

DATE 19 October 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			● Volatile Organic Rdg. (ppm)	○ Lower Explosive Limit %			
								20	40	60	80	
Loose, grey SANDY SILT , trace gravel	13.11					13	53.13					
	14.17	SS	7	100	9	14	52.13					
GLACIAL TILL: Very dense, grey silty sand with gravel, cobbles, boulders		SS	8	100	50+	15	51.13					
		SS	9		50+	16	50.13					
						17	49.13					
End of Borehole	17.53											

100 200 300 400 500
RKI Eagle Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

SOIL PROFILE AND TEST DATA

Supplemental Phase II-Environmental Site Assessment
151 Chapel Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH16-15

BORINGS BY CME 55 Power Auger

DATE 14 October 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			<input type="radio"/> Volatile Organic Rdg. (ppm) <input type="radio"/> Lower Explosive Limit %				
								20	40	60	80	
GLACIAL TILL: Dense to very dense, grey silty sand with gravel, cobbles, boulders		SS	8	71	49	13	51.05					
						14	50.05	▲				
	15.29	SS	9	100	50+	15	49.05	▲				
BEDROCK: Interbedded limestone and shale		RC	1	100	65	16	48.05	▲				
		RC	2	78	78	17	47.05	▲				
End of Borehole	17.27											

100 200 300 400 500
RKI Eagle Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

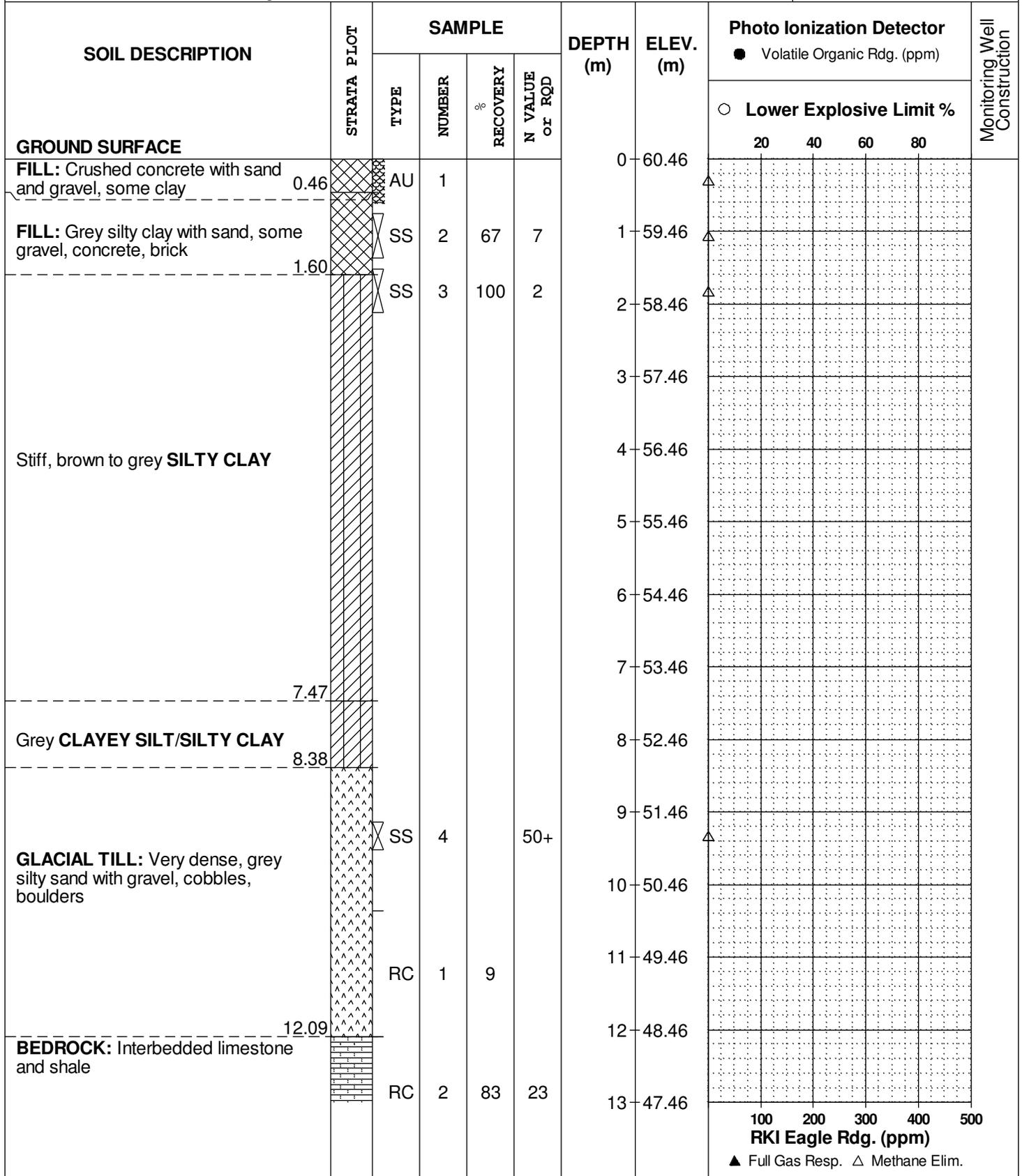
DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH17-15

BORINGS BY CME 55 Power Auger

DATE 19 October 2015



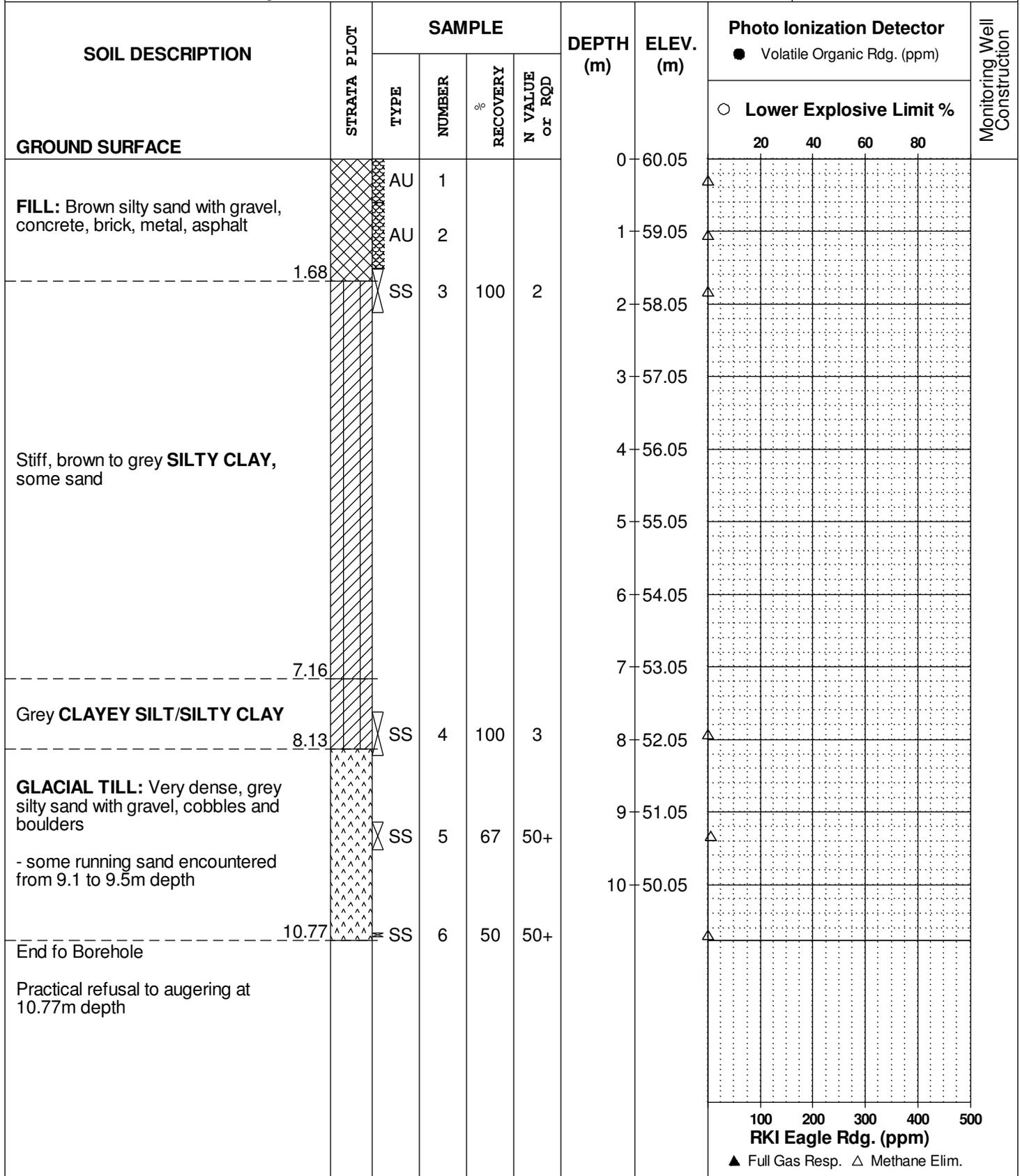
DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH18-15

BORINGS BY CME 55 Power Auger

DATE 19 October 2015



DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO.
PE2930

HOLE NO.
BH19-15

BORINGS BY CME 55 Power Auger

DATE 22 October 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction	
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			● Volatile Organic Rdg. (ppm)					
GROUND SURFACE								○ Lower Explosive Limit %					
								20	40	60	80		
Concrete	0.20					0	60.40						
FILL: Crushed stone with sand	0.38	AU	1										
Stiff, brown to grey SILTY CLAY		SS	2	100	3	1	59.40						
		SS	3	100	2	2	58.40						
		SS	4	100	W	3	57.40						
		SS	5	100	2	4	56.40						
		SS	6	100	3	5	55.40						
		SS	7	100	3	6	54.40						
		SS	8	100	4	7	53.40						
		SS	9	100	3	8	53.40						
		SS	10	100	3	9	53.40						
	End of Borehole	7.47					7	53.40					

100 200 300 400 500
RKI Eagle Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

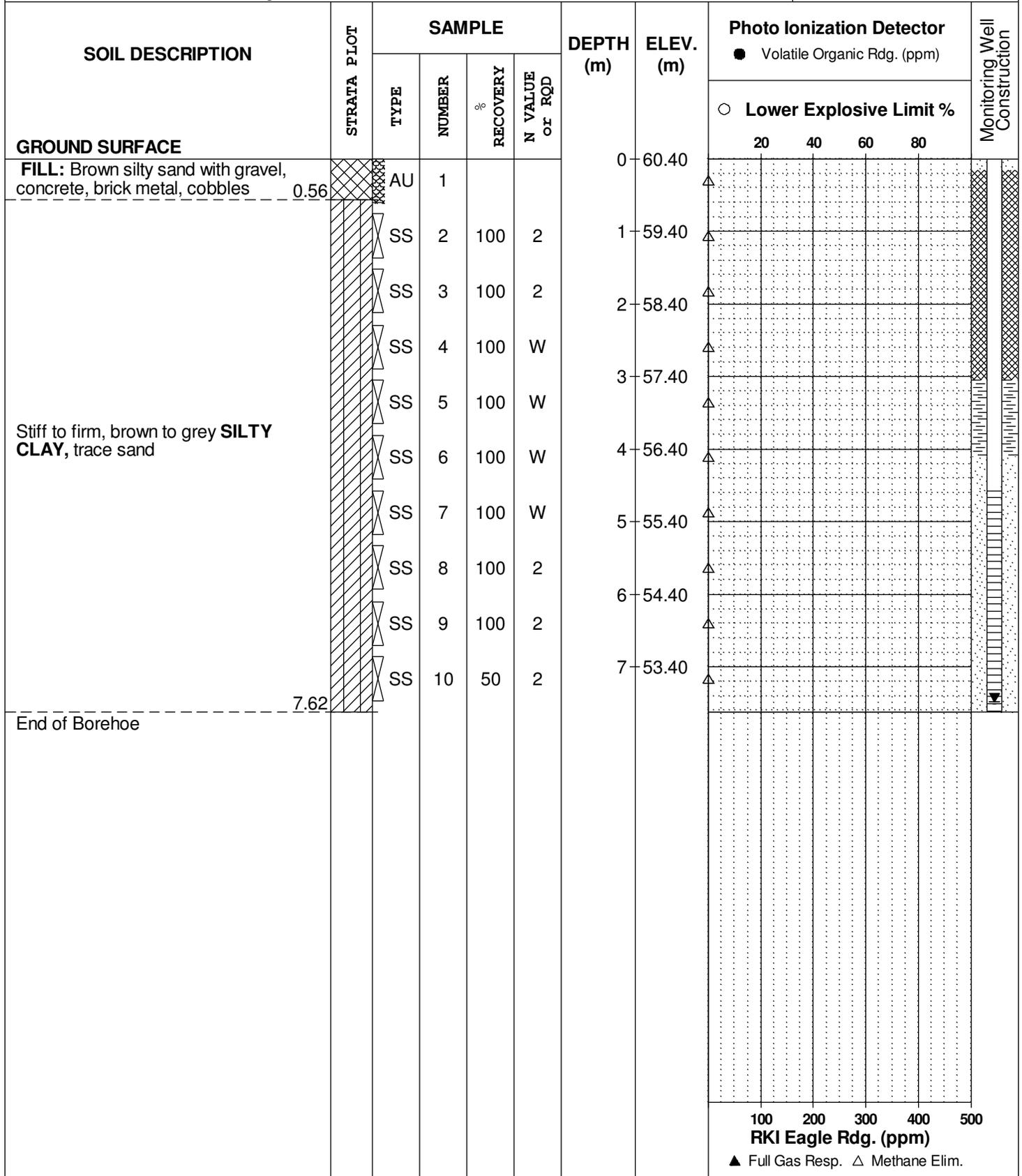
DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH20-15

BORINGS BY CME 55 Power Auger

DATE 20 October 2015



SOIL PROFILE AND TEST DATA

Supplemental Phase II-Environmental Site Assessment
151 Chapel Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH21-15

BORINGS BY CME 55 Power Auger

DATE 21 October 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			● Volatile Organic Rdg. (ppm)				
GROUND SURFACE								○ Lower Explosive Limit %				
								20	40	60	80	
		AU	1			0	63.34					
FILL: Brown silty sand with gravel, some cobbles, concrete, asphalt, brick, metal and ash		SS	2	42	16	1	62.34					
		SS	3	25	6	2	61.34					
		SS	4	33	17							
		SS	5	50	50+							
	End of Borehole	3.07	SS	5	50	50+	3	60.34				
								100	200	300	400	500
								RKI Eagle Rdg. (ppm)				
								▲ Full Gas Resp. △ Methane Elim.				

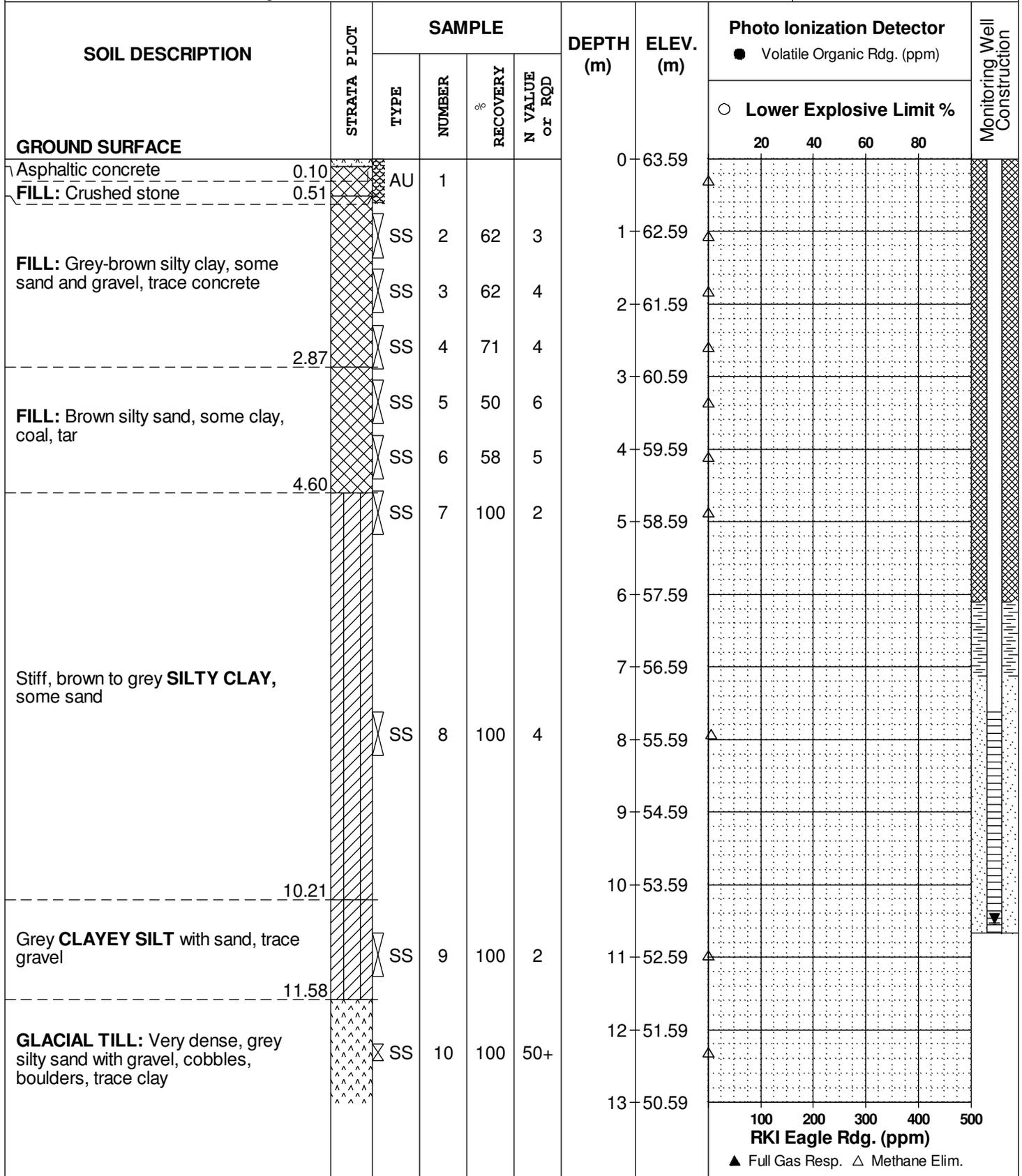
DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH21A-15

BORINGS BY CME 55 Power Auger

DATE 21 October 2015



100 200 300 400 500
RKI Eagle Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

SOIL PROFILE AND TEST DATA

Supplemental Phase II-Environmental Site Assessment
151 Chapel Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH21A-15

BORINGS BY CME 55 Power Auger

DATE 21 October 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			<input type="radio"/> Volatile Organic Rdg. (ppm) <input type="radio"/> Lower Explosive Limit %				
								20	40	60	80	
GLACIAL TILL: Very dense, grey silty sand with gravel, cobbles, boulders, trace clay - some running sand encountered from 11.9 to 12.4m depth		RC	1	83		13	50.59					
		RC	2	100		14	49.59					
	15.80											
BEDROCK: Interbedded limestone and shale		RC	3	100	76	16	47.59					
		RC	4	100	92	17	46.59					
End of Borehole (GWL @ 10.52m-Nov. 4, 2015)	17.37											
								100	200	300	400	500

RKI Eagle Rdg. (ppm)
 ▲ Full Gas Resp. △ Methane Elim.

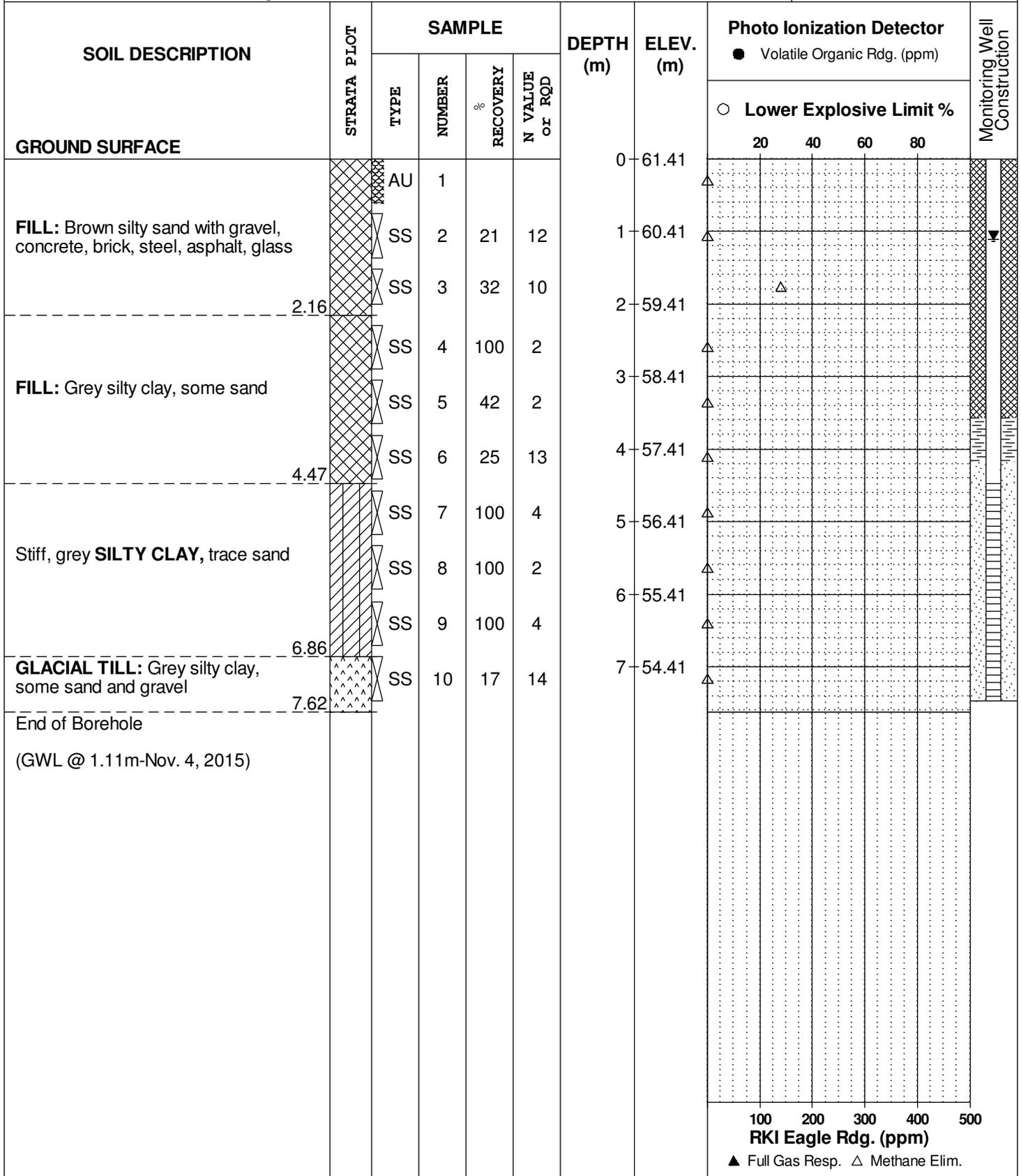
DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH22-15

BORINGS BY CME 55 Power Auger

DATE 20 October 2015



100 200 300 400 500
RKI Eagle Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

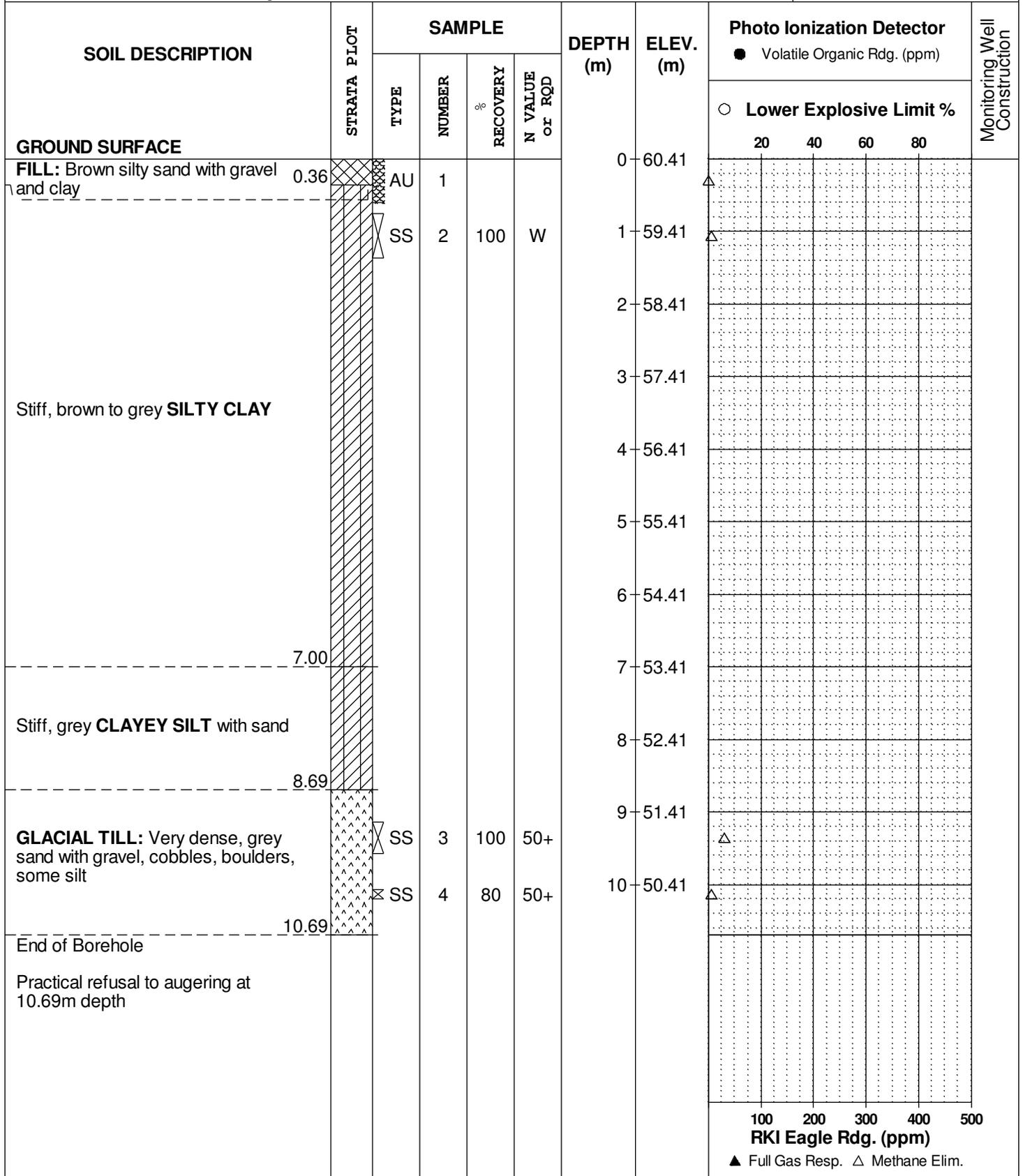
DATUM TBM - Top spindle of fire hydrant located on the east side of Chapel Street, along the west boundary of the subject site. Geodetic elevation = 65.12m, as per plan provided
REMARKS by Annis, O'Sullivan, Vollebakk Ltd.

FILE NO. PE2930

HOLE NO. BH23-15

BORINGS BY CME 55 Power Auger

DATE 16 October 2015



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)
D _{xx}	-	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
D ₁₀	-	Grain size at which 10% of the soil is finer (effective grain size)
D ₆₀	-	Grain size at which 60% of the soil is finer
C _c	-	Concavity coefficient = $(D_{30})^2 / (D_{10} \times D_{60})$
C _u	-	Uniformity coefficient = D_{60} / D_{10}

C_c and C_u are used to assess the grading of sands and gravels:

Well-graded gravels have: $1 < C_c < 3$ and $C_u > 4$

Well-graded sands have: $1 < C_c < 3$ and $C_u > 6$

Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.

C_c and C_u 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
C _{cr}	-	Recompression index (in effect at pressures below p' _c)
C _c	-	Compression index (in effect at pressures above p' _c)
OC Ratio		Overconsolidation ratio = p'_c / p'_o
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
W _o	-	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.
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SYMBOLS AND TERMS (continued)

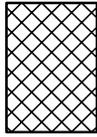
STRATA PLOT



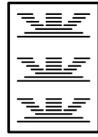
Topsoil



Asphalt



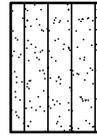
Fill



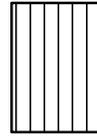
Peat



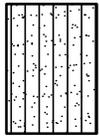
Sand



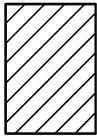
Silty Sand



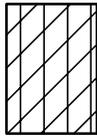
Silt



Sandy Silt



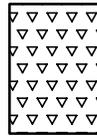
Clay



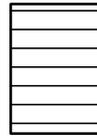
Silty Clay



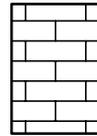
Clayey Silty Sand



Glacial Till



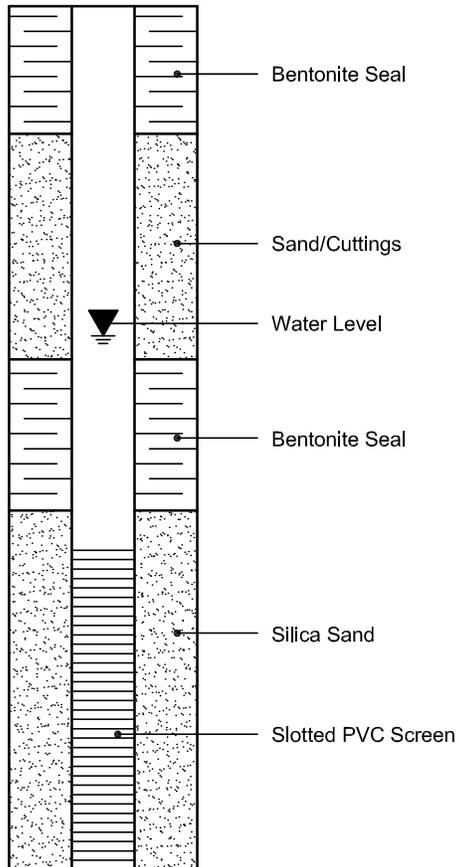
Shale



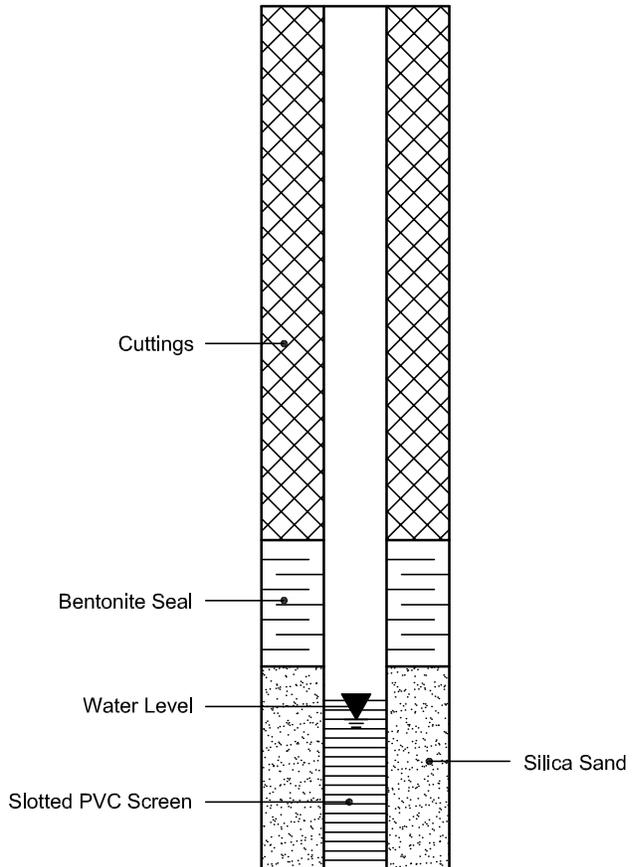
Bedrock

MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Certificate of Analysis

Paterson Group Consulting Engineers

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

Phone: (613) 226-7381
Fax: (613) 226-6344

Client PO: 17506
Project: PE2930
Custody: 16896

Report Date: 5-Mar-2015
Order Date: 27-Feb-2015

Order #: 1509327

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

Paracel ID	Client ID
1509327-01	BH1-15-SS5
1509327-02	BH2-15-SS5
1509327-03	BH3-15-SS4

Approved By:



Mark Foto, M.Sc. For Dale Robertson, BSc
Laboratory Director

Any use of these results implies your agreement that our total liability in connection with this work, however arising shall be limited to the amount paid by you for this work, and that our employees or agents shall not under circumstances be liable to you in connection with this work

Certificate of Analysis

Report Date: 05-Mar-2015

Order Date: 27-Feb-2015

Client: **Paterson Group Consulting Engineers**

Client PO: 17506

Project Description: PE2930

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	2-Mar-15	3-Mar-15
PHC F1	CWS Tier 1 - P&T GC-FID	2-Mar-15	3-Mar-15
PHC F2 - F4	CWS Tier 1 - GC-FID, extraction	2-Mar-15	3-Mar-15
Solids, %	Gravimetric, calculation	3-Mar-15	3-Mar-15

P: 1-800-749-1947
E: PARACEL@PARACELLABS.COM

WWW.PARACELLABS.COM

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300-2319 St. Laurent Blvd.
Ottawa, ON K1G 4J8

OTTAWA - WEST
104-195 Stafford Rd. W.
Nepean, ON K2H 9C1

MISSISSAUGA
6645 Kitimat Rd. Unit #27
Mississauga, ON L5N 6J3

SARNIA
218-704 Mara St.
Point Edward, ON N7V 1X4

NIAGARA
360 York Rd. Unit 16B
Niagara-on-the-Lake, ON L0S 1J0

KINGSTON
1058 Gardiners Rd.
Kingston, ON K7P 1R7

Certificate of Analysis

Report Date: 05-Mar-2015

Order Date: 27-Feb-2015

 Client: **Paterson Group Consulting Engineers**

Project Description: PE2930

Client PO: 17506

Client ID:	BH1-15-SS5	BH2-15-SS5	BH3-15-SS4	-
Sample Date:	26-Feb-15	26-Feb-15	26-Feb-15	-
Sample ID:	1509327-01	1509327-02	1509327-03	-
MDL/Units	Soil	Soil	Soil	-

Physical Characteristics

% Solids	0.1 % by Wt.	90.5	90.7	93.9	-
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Volatiles

Benzene	0.02 ug/g dry	2.20	0.59	<0.02	-
Ethylbenzene	0.05 ug/g dry	9.07	3.32	<0.05	-
Toluene	0.05 ug/g dry	7.27	0.10	<0.05	-
m,p-Xylenes	0.05 ug/g dry	22.4	8.85	<0.05	-
o-Xylene	0.05 ug/g dry	11.0	0.62	<0.05	-
Xylenes, total	0.05 ug/g dry	33.4	9.46	<0.05	-
Toluene-d8	Surrogate	114%	109%	99.5%	-

Hydrocarbons

F1 PHCs (C6-C10)	7 ug/g dry	1470	1010	<7	-
F2 PHCs (C10-C16)	4 ug/g dry	22700 [1]	20200 [1]	<4	-
F3 PHCs (C16-C34)	8 ug/g dry	43900 [1]	33300 [1]	<8	-
F4 PHCs (C34-C50)	6 ug/g dry	11300 [1]	13200 [1]	<6	-

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SARNIA
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 Point Edward, ON N7V 1X4

NIAGARA
 360 York Rd. Unit 16B
 Niagara-on-the-Lake, ON L0S 1J0

KINGSTON
 1058 Gardiners Rd.
 Kingston, ON K7P 1R7

Certificate of Analysis

Report Date: 05-Mar-2015

Client: **Paterson Group Consulting Engineers**

Order Date: 27-Feb-2015

Client PO: 17506

Project Description: PE2930

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	7.91		ug/g		98.9	50-140			

Certificate of Analysis

Report Date: 05-Mar-2015

Client: Paterson Group Consulting Engineers

Order Date: 27-Feb-2015

Client PO: 17506

Project Description: PE2930

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND				30	
F3 PHCs (C16-C34)	ND	8	ug/g dry	ND				30	
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND				30	
Physical Characteristics									
% Solids	72.2	0.1	% by Wt.	72.8			0.7	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	5.37		ug/g dry	ND	100	50-140			

Certificate of Analysis

Report Date: 05-Mar-2015

Client: **Paterson Group Consulting Engineers**

Order Date: 27-Feb-2015

Client PO: 17506

Project Description: PE2930

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	198	7	ug/g	ND	99.0	80-120			
F2 PHCs (C10-C16)	86	4	ug/g	ND	86.7	60-140			
F3 PHCs (C16-C34)	207	8	ug/g	ND	100	60-140			
F4 PHCs (C34-C50)	139	6	ug/g	ND	101	60-140			
Volatiles									
Benzene	3.60	0.02	ug/g	ND	90.1	60-130			
Ethylbenzene	3.73	0.05	ug/g	ND	93.2	60-130			
Toluene	3.62	0.05	ug/g	ND	90.5	60-130			
m,p-Xylenes	7.20	0.05	ug/g	ND	90.0	60-130			
o-Xylene	3.62	0.05	ug/g	ND	90.6	60-130			
Surrogate: Toluene-d8	7.46		ug/g		93.2	50-140			

Certificate of Analysis

Report Date: 05-Mar-2015

Client: Paterson Group Consulting Engineers

Order Date: 27-Feb-2015

Client PO: 17506

Project Description: PE2930

Qualifier Notes:

Sample Qualifiers :

1 : Free product was observed in the sample container.

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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KINGSTON
1058 Gardiners Rd.
Kingston, ON K7P 1R7

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Client Name: <i>Paterson Group</i>	Project Reference: PE 2930 <i>PE 2930</i>	TAT: <input checked="" type="checkbox"/> Regular [] 3 Day [] 2 Day [] 1 Day Date Required: _____
Contact Name: <i>Mike Beaudoin / ERIC LEVEQUE</i>	Quote #	
Address: <i>154 Colonnade</i>	PO # <i>17506</i>	
Telephone: <i>613-226-7381</i>	Email Address: <i>e.levegue@patersongroup.ca</i> <i>mbeaudoin@patersongroup.ca</i>	

Criteria: O. Reg. 153/04 (As Amended) Table ___ [] RSC Filing [] O. Reg. 358/00 [] 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

Parcel Order Number: <i>1509327</i>		Matrix	Air Volume	# of Containers	Sample Taken		BTEX	MHC (S-F)	Required Analyses									
Sample ID/Location Name					Date	Time												
1	<i>BH1-15-SSS</i>	<i>S</i>		<i>2</i>	<i>Feb 26/15</i>	<i>AM</i>	<i>X</i>	<i>X</i>	<i>120ml + vial</i>									
2	<i>BH2-15-SSS</i>	<i>S</i>		<i>2</i>	<i>↓</i>	<i>↓</i>	<i>X</i>	<i>X</i>	<i>↓</i>									
3	<i>BH3-15-SS4</i>	<i>S</i>		<i>2</i>	<i>↓</i>	<i>↓</i>	<i>X</i>	<i>X</i>	<i>↓</i>									
4																		
5																		
6																		
7																		
8																		
9																		
10																		

Comments: *Please also send results to Eric L. levegue@patersongroup.ca.* Method of Delivery: *Paracel*

Relinquished By (Sign): <i>M.L.B.</i>	Received by Driver/Depot: <i>A. J. J. J.</i>	Received at Lab: <i>MC</i>	Verified By: <i>MC</i>
Relinquished By (Print):	Date/Time: <i>27/02/15 4:40 AM</i>	Date/Time: <i>FEB 27 15 5:30</i>	Date/Time: <i>FEB 27 15 5:52</i>
Date/Time:	Temperature: _____ °C	Temperature: <i>11.4</i> °C	pH Verified [] By: <i>N/A</i>

Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Adrian Menyhart

Phone: (613) 226-7381
Fax: (613) 226-6344

Client PO: 17650
Project: PE2930
Custody: 99808

Report Date: 26-Mar-2015
Order Date: 25-Mar-2015

Order #: 1513182

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

Paracel ID	Client ID
1513182-01	BH1-15-GW1

Approved By:



Mark Foto, M.Sc. For Dale Robertson, BSc
Laboratory Director

Any use of these results implies your agreement that our total liability in connection with this work, however arising shall be limited to the amount paid by you for this work, and that our employees or agents shall not under circumstances be liable to you in connection with this work

Certificate of Analysis

Report Date: 26-Mar-2015
Order Date: 25-Mar-2015

Client: **Paterson Group Consulting Engineers**
Client PO: 17650

Project Description: PE2930

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	26-Mar-15	26-Mar-15
PHC F1	CWS Tier 1 - P&T GC-FID	26-Mar-15	26-Mar-15
PHC F2 - F4	CWS Tier 1 - GC-FID, extraction	26-Mar-15	26-Mar-15

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Niagara-on-the-Lake, ON L0S 1J0

KINGSTON
1058 Gardiners Rd.
Kingston, ON K7P 1R7

Certificate of Analysis

Report Date: 26-Mar-2015

Order Date: 25-Mar-2015

 Client: **Paterson Group Consulting Engineers**

Project Description: PE2930

Client PO: 17650

Client ID:	BH1-15-GW1	-	-	-
Sample Date:	25-Mar-15	-	-	-
Sample ID:	1513182-01	-	-	-
MDL/Units	Water	-	-	-

Volatiles

Benzene	0.5 ug/L	<0.5	-	-	-
Ethylbenzene	0.5 ug/L	<0.5	-	-	-
Toluene	0.5 ug/L	<0.5	-	-	-
m,p-Xylenes	0.5 ug/L	<0.5	-	-	-
o-Xylene	0.5 ug/L	<0.5	-	-	-
Xylenes, total	0.5 ug/L	<0.5	-	-	-
Toluene-d8	Surrogate	85.6%	-	-	-

Hydrocarbons

F1 PHCs (C6-C10)	25 ug/L	<25	-	-	-
F2 PHCs (C10-C16)	100 ug/L	<100	-	-	-
F3 PHCs (C16-C34)	100 ug/L	<100	-	-	-
F4 PHCs (C34-C50)	100 ug/L	<100	-	-	-
F1 + F2 PHCs	125 ug/L	<125	-	-	-
F3 + F4 PHCs	200 ug/L	<200	-	-	-

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 Niagara-on-the-Lake, ON L0S 1J0

KINGSTON
 1058 Gardiners Rd.
 Kingston, ON K7P 1R7

Certificate of Analysis

Report Date: 26-Mar-2015

Client: **Paterson Group Consulting Engineers**

Order Date: 25-Mar-2015

Client PO: 17650

Project Description: PE2930

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
Volatiles									
Benzene	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: Toluene-d8	29.0		ug/L		90.8	50-140			

Certificate of Analysis

Report Date: 26-Mar-2015

Client: **Paterson Group Consulting Engineers**

Order Date: 25-Mar-2015

Client PO: 17650

Project Description: PE2930

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND				30	
Volatiles									
Benzene	ND	0.5	ug/L	ND				30	
Ethylbenzene	ND	0.5	ug/L	ND				30	
Toluene	ND	0.5	ug/L	ND				30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: Toluene-d8	27.6		ug/L	ND	86.3	50-140			

Certificate of Analysis

Report Date: 26-Mar-2015

Client: **Paterson Group Consulting Engineers**

Order Date: 25-Mar-2015

Client PO: 17650

Project Description: PE2930

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	1810	25	ug/L	ND	90.3	68-117			
F2 PHCs (C10-C16)	1780	100	ug/L	ND	98.6	60-140			
F3 PHCs (C16-C34)	3490	100	ug/L	ND	93.7	60-140			
F4 PHCs (C34-C50)	2290	100	ug/L	ND	92.5	60-140			
Volatiles									
Benzene	30.6	0.5	ug/L	ND	76.5	50-140			
Ethylbenzene	26.4	0.5	ug/L	ND	65.9	50-140			
Toluene	33.2	0.5	ug/L	0.53	81.6	50-140			
m,p-Xylenes	59.0	0.5	ug/L	2.06	71.2	50-140			
o-Xylene	38.2	0.5	ug/L	2.80	88.5	50-140			
Surrogate: Toluene-d8	27.3		ug/L		85.4	50-140			

Certificate of Analysis

Report Date: 26-Mar-2015

Client: Paterson Group Consulting Engineers

Order Date: 25-Mar-2015

Client PO: 17650

Project Description: PE2930

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

CCME PHC additional information:

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

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Client Name: PATERSON	Project Reference: TR2930	TAT: <input checked="" type="checkbox"/> Regular <input type="checkbox"/> 3 Day
Contact Name: ADRIAN MENYHART	Quote #	<input type="checkbox"/> 2 Day <input checked="" type="checkbox"/> 1 Day
Address: 154 COLONNADE RD. S.	PO # 17650	Date Required: March 26
Telephone: 613-226-7381	Email Address: admenyhart@patersongroup.ca	

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: 1513182-1		Matrix	Air Volume	# of Containers	Sample Taken		PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)							
Sample ID/Location Name					Date	Time														
1	BH1-15-GW1	GW		3	MAR 25 2015	2PM														
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Comments: _____ Method of Delivery: **Paracel**

Relinquished By (Sign): Adrian Menyhart	Received by Driver/Depot: A. HOUSE	Received at Lab: M/C	Verified By: [Signature]
Relinquished By (Print): ADRIAN MENYHART	Date/Time: 25/03/15 4:15PM	Date/Time: MAR 25/15 10:15	Date/Time: March 25/15 5:45
Date/Time: MAR 25 2015	Temperature: _____ °C	Temperature: 14.0 °C	pH Verified <input type="checkbox"/> By: N/A

Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Dan Arnott

Client PO: 18730
Project: PE2930
Custody: 24655

Report Date: 23-Oct-2015
Order Date: 16-Oct-2015

Order #: 1542292

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

Parcel ID	Client ID
1542292-01	BH14-15-SS2
1542292-02	BH16-15-SS6
1542292-03	BH11-15-SS4
1542292-04	BH4-15-SS4

Approved By:



Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 18730

Report Date: 23-Oct-2015

Order Date: 16-Oct-2015

Project Description: PE2930

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	17-Oct-15	23-Oct-15
PHC F1	CWS Tier 1 - P&T GC-FID	17-Oct-15	23-Oct-15
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	17-Oct-15	17-Oct-15
Solids, %	Gravimetric, calculation	20-Oct-15	17-Oct-15

Certificate of Analysis

Report Date: 23-Oct-2015

 Client: **Paterson Group Consulting Engineers**

Order Date: 16-Oct-2015

Client PO: 18730

Project Description: PE2930

Client ID:	BH14-15-SS2	BH16-15-SS6	BH11-15-SS4	BH4-15-SS4
Sample Date:	14-Oct-15	14-Oct-15	15-Oct-15	13-Oct-15
Sample ID:	1542292-01	1542292-02	1542292-03	1542292-04
MDL/Units	Soil	Soil	Soil	Soil

Physical Characteristics

% Solids	0.1 % by Wt.	67.5	70.3	56.5	64.7
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Volatiles

Benzene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Ethylbenzene	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
Toluene	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
m,p-Xylenes	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
o-Xylene	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
Xylenes, total	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
Toluene-d8	Surrogate	99.0%	99.5%	113%	97.9%

Hydrocarbons

F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	<8	<8	<8	<8
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	<6	<6

Certificate of Analysis

 Client: **Paterson Group Consulting Engineers**
 Client PO: **18730**

Report Date: 23-Oct-2015

Order Date: 16-Oct-2015

Project Description: PE2930
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	8.11		ug/g		101	50-140			

Certificate of Analysis

 Client: **Paterson Group Consulting Engineers**
 Client PO: **18730**

Report Date: 23-Oct-2015

Order Date: 16-Oct-2015

Project Description: PE2930
Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND				30	
F3 PHCs (C16-C34)	ND	8	ug/g dry	ND				30	
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND				30	
Physical Characteristics									
% Solids	89.5	0.1	% by Wt.	89.6			0.2	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	5.17		ug/g dry	ND	102	50-140			

Certificate of Analysis

 Client: **Paterson Group Consulting Engineers**
 Client PO: **18730**

Report Date: 23-Oct-2015

Order Date: 16-Oct-2015

Project Description: PE2930
Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	193	7	ug/g	ND	96.5	80-120			
F2 PHCs (C10-C16)	154	4	ug/g	39	113	60-140			
F3 PHCs (C16-C34)	433	8	ug/g	255	84.2	60-140			
F4 PHCs (C34-C50)	241	6	ug/g	106	96.7	60-140			
Volatiles									
Benzene	4.05	0.02	ug/g	ND	101	60-130			
Ethylbenzene	3.66	0.05	ug/g	ND	91.6	60-130			
Toluene	3.39	0.05	ug/g	ND	84.8	60-130			
m,p-Xylenes	7.53	0.05	ug/g	ND	94.1	60-130			
o-Xylene	3.59	0.05	ug/g	ND	89.8	60-130			
Surrogate: Toluene-d8	7.41		ug/g		92.6	50-140			

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 18730

Report Date: 23-Oct-2015

Order Date: 16-Oct-2015

Project Description: PE2930

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.

Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Dan Arnott

Client PO: 18733
Project: PE2930
Custody: 24656

Report Date: 23-Oct-2015
Order Date: 19-Oct-2015

Order #: 1543073

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

Parcel ID	Client ID
1543073-01	BH23-15-SS3
1543073-02	BH24-15-SS6

Approved By:



Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 23-Oct-2015

Client: Paterson Group Consulting Engineers

Order Date: 19-Oct-2015

Client PO: 18733

Project Description: PE2930

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	20-Oct-15	23-Oct-15
PHC F1	CWS Tier 1 - P&T GC-FID	20-Oct-15	23-Oct-15
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	20-Oct-15	20-Oct-15
Solids, %	Gravimetric, calculation	20-Oct-15	20-Oct-15

Certificate of Analysis

Report Date: 23-Oct-2015

 Client: **Paterson Group Consulting Engineers**

Order Date: 19-Oct-2015

Client PO: 18733

Project Description: PE2930

Client ID:	BH23-15-SS3	BH24-15-SS6	-	-
Sample Date:	16-Oct-15	16-Oct-15	-	-
Sample ID:	1543073-01	1543073-02	-	-
MDL/Units	Soil	Soil	-	-

Physical Characteristics

% Solids	0.1 % by Wt.	90.8	63.4	-	-
----------	--------------	------	------	---	---

Volatiles

Benzene	0.02 ug/g dry	<0.02	<0.02	-	-
Ethylbenzene	0.05 ug/g dry	<0.05	<0.05	-	-
Toluene	0.05 ug/g dry	<0.05	<0.05	-	-
m,p-Xylenes	0.05 ug/g dry	<0.05	<0.05	-	-
o-Xylene	0.05 ug/g dry	<0.05	<0.05	-	-
Xylenes, total	0.05 ug/g dry	<0.05	<0.05	-	-
Toluene-d8	Surrogate	99.7%	99.6%	-	-

Hydrocarbons

F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	-	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	-	-
F3 PHCs (C16-C34)	8 ug/g dry	<8	<8	-	-
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	-	-

Certificate of Analysis

 Client: **Paterson Group Consulting Engineers**
 Client PO: **18733**

Report Date: 23-Oct-2015

Order Date: 19-Oct-2015

Project Description: PE2930
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	8.11		ug/g		101	50-140			

Certificate of Analysis

 Client: **Paterson Group Consulting Engineers**
 Client PO: **18733**

Report Date: 23-Oct-2015

Order Date: 19-Oct-2015

Project Description: PE2930
Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND				30	
F3 PHCs (C16-C34)	ND	8	ug/g dry	ND				30	
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND				30	
Physical Characteristics									
% Solids	86.9	0.1	% by Wt.	86.6			0.4	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	5.17		ug/g dry	ND	102	50-140			

Certificate of Analysis

 Client: **Paterson Group Consulting Engineers**
 Client PO: **18733**

Report Date: 23-Oct-2015

Order Date: 19-Oct-2015

Project Description: PE2930
Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	193	7	ug/g	ND	96.5	80-120			
F2 PHCs (C10-C16)	82	4	ug/g	ND	91.1	80-120			
F3 PHCs (C16-C34)	192	8	ug/g	ND	103	80-120			
F4 PHCs (C34-C50)	132	6	ug/g	ND	106	80-120			
Volatiles									
Benzene	4.05	0.02	ug/g	ND	101	60-130			
Ethylbenzene	3.66	0.05	ug/g	ND	91.6	60-130			
Toluene	3.39	0.05	ug/g	ND	84.8	60-130			
m,p-Xylenes	7.53	0.05	ug/g	ND	94.1	60-130			
o-Xylene	3.59	0.05	ug/g	ND	89.8	60-130			
Surrogate: Toluene-d8	7.41		ug/g		92.6	50-140			

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 18733

Report Date: 23-Oct-2015

Order Date: 19-Oct-2015

Project Description: PE2930

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.

Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Dan Arnott

Client PO: 18734
Project: PE2930
Custody: 24660

Report Date: 27-Oct-2015
Order Date: 21-Oct-2015

Order #: 1543246

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

Parcel ID	Client ID
1543246-01	BH18-15-SS3

Approved By:



Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 27-Oct-2015

Client: Paterson Group Consulting Engineers

Order Date: 21-Oct-2015

Client PO: 18734

Project Description: PE2930

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	22-Oct-15	24-Oct-15
PHC F1	CWS Tier 1 - P&T GC-FID	22-Oct-15	24-Oct-15
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	23-Oct-15	26-Oct-15
Solids, %	Gravimetric, calculation	22-Oct-15	22-Oct-15

Certificate of Analysis

 Client: **Paterson Group Consulting Engineers**
 Client PO: **18734**

Report Date: 27-Oct-2015

Order Date: 21-Oct-2015

Project Description: PE2930

Client ID:	BH18-15-SS3	-	-	-
Sample Date:	19-Oct-15	-	-	-
Sample ID:	1543246-01	-	-	-
MDL/Units	Soil	-	-	-

Physical Characteristics

% Solids	0.1 % by Wt.	80.3	-	-	-
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Volatiles

Benzene	0.02 ug/g dry	<0.02	-	-	-
Ethylbenzene	0.05 ug/g dry	<0.05	-	-	-
Toluene	0.05 ug/g dry	<0.05	-	-	-
m,p-Xylenes	0.05 ug/g dry	<0.05	-	-	-
o-Xylene	0.05 ug/g dry	<0.05	-	-	-
Xylenes, total	0.05 ug/g dry	<0.05	-	-	-
Toluene-d8	Surrogate	107%	-	-	-

Hydrocarbons

F1 PHCs (C6-C10)	7 ug/g dry	<7	-	-	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	-	-	-
F3 PHCs (C16-C34)	8 ug/g dry	<8	-	-	-
F4 PHCs (C34-C50)	6 ug/g dry	<6	-	-	-

Certificate of Analysis

 Client: **Paterson Group Consulting Engineers**
 Client PO: **18734**

Report Date: 27-Oct-2015

Order Date: 21-Oct-2015

Project Description: PE2930
Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Volatiles									
Benzene	ND	0.02	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: Toluene-d8	3.84		ug/g		120	50-140			

Certificate of Analysis

 Client: **Paterson Group Consulting Engineers**
 Client PO: **18734**

Report Date: 27-Oct-2015

Order Date: 21-Oct-2015

Project Description: PE2930
Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND				30	
F3 PHCs (C16-C34)	34	8	ug/g dry	22			42.3	30	QR-01
F4 PHCs (C34-C50)	68	6	ug/g dry	60			13.3	30	
Physical Characteristics									
% Solids	83.2	0.1	% by Wt.	86.0			3.3	25	

Certificate of Analysis

 Client: **Paterson Group Consulting Engineers**
 Client PO: **18734**

Report Date: 27-Oct-2015

Order Date: 21-Oct-2015

Project Description: PE2930
Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	168	7	ug/g	ND	83.9	80-120			
F2 PHCs (C10-C16)	84	4	ug/g	ND	93.8	80-120			
F3 PHCs (C16-C34)	176	8	ug/g	ND	94.4	80-120			
F4 PHCs (C34-C50)	120	6	ug/g	ND	96.6	80-120			
Volatiles									
Benzene	2.44	0.02	ug/g	ND	61.0	60-130			
Ethylbenzene	3.17	0.05	ug/g	ND	79.3	60-130			
Toluene	3.83	0.05	ug/g	ND	95.7	60-130			
m,p-Xylenes	7.21	0.05	ug/g	ND	90.1	60-130			
o-Xylene	3.72	0.05	ug/g	ND	92.9	60-130			
Surrogate: Toluene-d8	3.31		ug/g		103	50-140			

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 18734

Report Date: 27-Oct-2015

Order Date: 21-Oct-2015

Project Description: PE2930

Qualifier Notes:

QC Qualifiers :

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

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

Source Result: Data used as source for matrix and duplicate samples

%REC: Percent recovery.

RPD: Relative percent difference.

Soil results are reported on a dry weight basis when the units are denoted with 'dry'.

Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

CCME PHC additional information:

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

Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Dan Arnott

Client PO: 18750
Project: PE2930
Custody: 24662

Report Date: 28-Oct-2015
Order Date: 22-Oct-2015

Order #: 1543330

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

Parcel ID	Client ID
1543330-01	BH20-15-SS10
1543330-02	BH21-15-SS2
1543330-03	BH21A-15-SS5
1543330-04	BH21A-15-SS6
1543330-05	BH21A-15-SS7
1543330-06	BH22-15-SS3

Approved By:



Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 18750

Report Date: 28-Oct-2015

Order Date: 22-Oct-2015

Project Description: PE2930

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	24-Oct-15	26-Oct-15
PHC F1	CWS Tier 1 - P&T GC-FID	24-Oct-15	26-Oct-15
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	24-Oct-15	25-Oct-15
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	24-Oct-15	27-Oct-15
Solids, %	Gravimetric, calculation	24-Oct-15	24-Oct-15

Certificate of Analysis

Report Date: 28-Oct-2015

 Client: **Paterson Group Consulting Engineers**

Order Date: 22-Oct-2015

Client PO: 18750

Project Description: PE2930

Client ID:	BH20-15-SS10	BH21-15-SS2	BH21A-15-SS5	BH21A-15-SS6
Sample Date:	20-Oct-15	21-Oct-15	21-Oct-15	21-Oct-15
Sample ID:	1543330-01	1543330-02	1543330-03	1543330-04
MDL/Units	Soil	Soil	Soil	Soil

Physical Characteristics

% Solids	0.1 % by Wt.	74.1	82.4	81.7	63.5
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Volatiles

Benzene	0.02 ug/g dry	<0.02	-	<0.02	<0.02
Ethylbenzene	0.05 ug/g dry	<0.05	-	<0.05	<0.05
Toluene	0.05 ug/g dry	<0.05	-	<0.05	<0.05
m,p-Xylenes	0.05 ug/g dry	<0.05	-	<0.05	<0.05
o-Xylene	0.05 ug/g dry	<0.05	-	<0.05	<0.05
Xylenes, total	0.05 ug/g dry	<0.05	-	<0.05	<0.05
Toluene-d8	Surrogate	106%	-	105%	110%

Hydrocarbons

F1 PHCs (C6-C10)	7 ug/g dry	<7	-	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	-	137	31
F3 PHCs (C16-C34)	8 ug/g dry	<8	-	2690	316
F4 PHCs (C34-C50)	6 ug/g dry	<6	-	271	31

Semi-Volatiles

Acenaphthene	0.02 ug/g dry	-	0.33	-	-
Acenaphthylene	0.02 ug/g dry	-	0.06	-	-
Anthracene	0.02 ug/g dry	-	0.55	-	-
Benzo [a] anthracene	0.02 ug/g dry	-	1.36	-	-
Benzo [a] pyrene	0.02 ug/g dry	-	1.40	-	-
Benzo [b] fluoranthene	0.02 ug/g dry	-	1.67	-	-
Benzo [g,h,i] perylene	0.02 ug/g dry	-	0.70	-	-
Benzo [k] fluoranthene	0.02 ug/g dry	-	0.94	-	-
Chrysene	0.02 ug/g dry	-	1.22	-	-
Dibenzo [a,h] anthracene	0.02 ug/g dry	-	0.29	-	-
Fluoranthene	0.02 ug/g dry	-	2.86	-	-
Fluorene	0.02 ug/g dry	-	0.41	-	-
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	-	0.78	-	-
1-Methylnaphthalene	0.02 ug/g dry	-	0.56	-	-
2-Methylnaphthalene	0.02 ug/g dry	-	0.71	-	-
Methylnaphthalene (1&2)	0.04 ug/g dry	-	1.27	-	-
Naphthalene	0.01 ug/g dry	-	0.74	-	-
Phenanthrene	0.02 ug/g dry	-	3.26	-	-
Pyrene	0.02 ug/g dry	-	2.36	-	-
2-Fluorobiphenyl	Surrogate	-	77.9%	-	-
Terphenyl-d14	Surrogate	-	49.4%	-	-

Certificate of Analysis

Report Date: 28-Oct-2015

 Client: **Paterson Group Consulting Engineers**

Order Date: 22-Oct-2015

Client PO: 18750

Project Description: PE2930

Client ID:	BH21A-15-SS7	BH22-15-SS3	-	-
Sample Date:	21-Oct-15	21-Oct-15	-	-
Sample ID:	1543330-05	1543330-06	-	-
MDL/Units	Soil	Soil	-	-

Physical Characteristics

% Solids	0.1 % by Wt.	70.1	82.1	-	-
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Volatiles

Benzene	0.02 ug/g dry	<0.02	<0.02	-	-
Ethylbenzene	0.05 ug/g dry	<0.05	<0.05	-	-
Toluene	0.05 ug/g dry	<0.05	<0.05	-	-
m,p-Xylenes	0.05 ug/g dry	<0.05	<0.05	-	-
o-Xylene	0.05 ug/g dry	<0.05	<0.05	-	-
Xylenes, total	0.05 ug/g dry	<0.05	<0.05	-	-
Toluene-d8	Surrogate	108%	108%	-	-

Hydrocarbons

F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	-	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	-	-
F3 PHCs (C16-C34)	8 ug/g dry	<8	113	-	-
F4 PHCs (C34-C50)	6 ug/g dry	<6	49	-	-

Certificate of Analysis

Client: **Paterson Group Consulting Engineers**
Client PO: **18750**

Report Date: 28-Oct-2015

Order Date: 22-Oct-2015

Project Description: **PE2930**

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						
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g						
Acenaphthylene	ND	0.02	ug/g						
Anthracene	ND	0.02	ug/g						
Benzo [a] anthracene	ND	0.02	ug/g						
Benzo [a] pyrene	ND	0.02	ug/g						
Benzo [b] fluoranthene	ND	0.02	ug/g						
Benzo [g,h,i] perylene	ND	0.02	ug/g						
Benzo [k] fluoranthene	ND	0.02	ug/g						
Chrysene	ND	0.02	ug/g						
Dibenzo [a,h] anthracene	ND	0.02	ug/g						
Fluoranthene	ND	0.02	ug/g						
Fluorene	ND	0.02	ug/g						
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g						
1-Methylnaphthalene	ND	0.02	ug/g						
2-Methylnaphthalene	ND	0.02	ug/g						
Methylnaphthalene (1&2)	ND	0.04	ug/g						
Naphthalene	ND	0.01	ug/g						
Phenanthrene	ND	0.02	ug/g						
Pyrene	ND	0.02	ug/g						
Surrogate: 2-Fluorobiphenyl	0.883		ug/g		66.3	50-140			
Surrogate: Terphenyl-d14	1.09		ug/g		82.1	50-140			
Volatiles									
Benzene	ND	0.02	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: Toluene-d8	3.84		ug/g		120	50-140			

Certificate of Analysis

Report Date: 28-Oct-2015

 Client: **Paterson Group Consulting Engineers**

Order Date: 22-Oct-2015

Client PO: 18750

Project Description: PE2930
Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND				30	
F3 PHCs (C16-C34)	ND	8	ug/g dry	ND				30	
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND				30	
Physical Characteristics									
% Solids	93.4	0.1	% by Wt.	93.6			0.2	25	
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g dry	ND				40	
Acenaphthylene	ND	0.02	ug/g dry	ND				40	
Anthracene	ND	0.02	ug/g dry	ND				40	
Benzo [a] anthracene	ND	0.02	ug/g dry	ND				40	
Benzo [a] pyrene	ND	0.02	ug/g dry	ND				40	
Benzo [b] fluoranthene	ND	0.02	ug/g dry	ND				40	
Benzo [g,h,i] perylene	ND	0.02	ug/g dry	ND				40	
Benzo [k] fluoranthene	ND	0.02	ug/g dry	ND				40	
Chrysene	ND	0.02	ug/g dry	ND				40	
Dibenzo [a,h] anthracene	ND	0.02	ug/g dry	ND				40	
Fluoranthene	ND	0.02	ug/g dry	ND				40	
Fluorene	ND	0.02	ug/g dry	ND				40	
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g dry	ND				40	
1-Methylnaphthalene	ND	0.02	ug/g dry	ND				40	
2-Methylnaphthalene	ND	0.02	ug/g dry	ND				40	
Naphthalene	ND	0.01	ug/g dry	ND				40	
Phenanthrene	ND	0.02	ug/g dry	ND				40	
Pyrene	ND	0.02	ug/g dry	ND				40	
Surrogate: 2-Fluorobiphenyl	1.02		ug/g dry	ND	57.7	50-140			
Surrogate: Terphenyl-d14	1.09		ug/g dry	ND	62.0	50-140			
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	2.73		ug/g dry	ND	106	50-140			

Certificate of Analysis

 Client: **Paterson Group Consulting Engineers**
 Client PO: **18750**

Report Date: 28-Oct-2015

Order Date: 22-Oct-2015

Project Description: PE2930
Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	168	7	ug/g	ND	83.9	80-120			
F2 PHCs (C10-C16)	89	4	ug/g	ND	99.1	80-120			
F3 PHCs (C16-C34)	200	8	ug/g	ND	107	80-120			
F4 PHCs (C34-C50)	132	6	ug/g	ND	106	80-120			
Semi-Volatiles									
Acenaphthene	0.171	0.02	ug/g	ND	77.9	50-140			
Acenaphthylene	0.145	0.02	ug/g	ND	66.0	50-140			
Anthracene	0.156	0.02	ug/g	ND	70.8	50-140			
Benzo [a] anthracene	0.150	0.02	ug/g	ND	68.0	50-140			
Benzo [a] pyrene	0.178	0.02	ug/g	ND	81.0	50-140			
Benzo [b] fluoranthene	0.177	0.02	ug/g	ND	80.5	50-140			
Benzo [g,h,i] perylene	0.231	0.02	ug/g	ND	105	50-140			
Benzo [k] fluoranthene	0.206	0.02	ug/g	ND	93.5	50-140			
Chrysene	0.183	0.02	ug/g	ND	83.4	50-140			
Dibenzo [a,h] anthracene	0.209	0.02	ug/g	ND	95.1	50-140			
Fluoranthene	0.152	0.02	ug/g	ND	69.3	50-140			
Fluorene	0.164	0.02	ug/g	ND	74.5	50-140			
Indeno [1,2,3-cd] pyrene	0.227	0.02	ug/g	ND	103	50-140			
1-Methylnaphthalene	0.232	0.02	ug/g	ND	106	50-140			
2-Methylnaphthalene	0.244	0.02	ug/g	ND	111	50-140			
Naphthalene	0.184	0.01	ug/g	ND	83.7	50-140			
Phenanthrene	0.170	0.02	ug/g	ND	77.4	50-140			
Pyrene	0.146	0.02	ug/g	ND	66.4	50-140			
<i>Surrogate: 2-Fluorobiphenyl</i>	<i>0.906</i>		<i>ug/g</i>		<i>51.5</i>	<i>50-140</i>			
Volatiles									
Benzene	2.44	0.02	ug/g	ND	61.0	60-130			
Ethylbenzene	3.17	0.05	ug/g	ND	79.3	60-130			
Toluene	3.83	0.05	ug/g	ND	95.7	60-130			
m,p-Xylenes	7.21	0.05	ug/g	ND	90.1	60-130			
o-Xylene	3.72	0.05	ug/g	ND	92.9	60-130			

Certificate of Analysis

Client: **Paterson Group Consulting Engineers**
Client PO: **18750**

Report Date: 28-Oct-2015

Order Date: 22-Oct-2015

Project Description: PE2930

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.

Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Dan Arnott

Client PO: 18755
Project: PE2930
Custody: 106446

Report Date: 29-Oct-2015
Order Date: 23-Oct-2015

Order #: 1543408

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

Parcel ID	Client ID
1543408-01	BH19-15-SS10

Approved By:



Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 18755

Report Date: 29-Oct-2015

Order Date: 23-Oct-2015

Project Description: PE2930

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	24-Oct-15	28-Oct-15
PHC F1	CWS Tier 1 - P&T GC-FID	24-Oct-15	28-Oct-15
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	27-Oct-15	28-Oct-15
Solids, %	Gravimetric, calculation	24-Oct-15	24-Oct-15

Certificate of Analysis

 Client: **Paterson Group Consulting Engineers**
 Client PO: **18755**

Report Date: 29-Oct-2015

Order Date: 23-Oct-2015

Project Description: PE2930

Client ID:	BH19-15-SS10	-	-	-
Sample Date:	22-Oct-15	-	-	-
Sample ID:	1543408-01	-	-	-
MDL/Units	Soil	-	-	-

Physical Characteristics

% Solids	0.1 % by Wt.	69.6	-	-	-
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Volatiles

Benzene	0.02 ug/g dry	<0.02	-	-	-
Ethylbenzene	0.05 ug/g dry	<0.05	-	-	-
Toluene	0.05 ug/g dry	<0.05	-	-	-
m,p-Xylenes	0.05 ug/g dry	<0.05	-	-	-
o-Xylene	0.05 ug/g dry	<0.05	-	-	-
Xylenes, total	0.05 ug/g dry	<0.05	-	-	-
Toluene-d8	Surrogate	94.9%	-	-	-

Hydrocarbons

F1 PHCs (C6-C10)	7 ug/g dry	<7	-	-	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	-	-	-
F3 PHCs (C16-C34)	8 ug/g dry	<8	-	-	-
F4 PHCs (C34-C50)	6 ug/g dry	<6	-	-	-

Certificate of Analysis

 Client: **Paterson Group Consulting Engineers**
 Client PO: **18755**

Report Date: 29-Oct-2015

Order Date: 23-Oct-2015

Project Description: PE2930
Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Volatiles									
Benzene	ND	0.02	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: Toluene-d8	3.11		ug/g		97.2	50-140			

Certificate of Analysis

 Client: **Paterson Group Consulting Engineers**
 Client PO: **18755**

Report Date: 29-Oct-2015

Order Date: 23-Oct-2015

Project Description: PE2930
Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND				30	
F3 PHCs (C16-C34)	ND	8	ug/g dry	ND				30	
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND				30	
Physical Characteristics									
% Solids	94.3	0.1	% by Wt.	94.3			0.0	25	
Volatiles									
Benzene	ND	0.02	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	
Surrogate: Toluene-d8	3.42		ug/g dry	ND	95.3	50-140			

Certificate of Analysis

 Client: **Paterson Group Consulting Engineers**
 Client PO: **18755**

Report Date: 29-Oct-2015

Order Date: 23-Oct-2015

Project Description: PE2930
Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	184	7	ug/g	ND	92.0	80-120			
F2 PHCs (C10-C16)	76	4	ug/g	ND	84.4	80-120			
F3 PHCs (C16-C34)	198	8	ug/g	ND	106	80-120			
F4 PHCs (C34-C50)	148	6	ug/g	ND	119	80-120			
Volatiles									
Benzene	4.57	0.02	ug/g	ND	114	60-130			
Ethylbenzene	3.68	0.05	ug/g	ND	91.9	60-130			
Toluene	4.26	0.05	ug/g	ND	107	60-130			
m,p-Xylenes	8.22	0.05	ug/g	ND	103	60-130			
o-Xylene	4.13	0.05	ug/g	ND	103	60-130			
Surrogate: Toluene-d8	2.66		ug/g		83.2	50-140			

Certificate of Analysis

Client: **Paterson Group Consulting Engineers**

Client PO: **18755**

Report Date: 29-Oct-2015

Order Date: 23-Oct-2015

Project Description: PE2930

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.

Client Name: <u>Paterson Group Inc.</u>	Project Reference: <u>PE 2930</u>	TAT: <input checked="" type="checkbox"/> Regular [] 3 Day
Contact Name: <u>Dan Arrott</u>	Quote #	[] 2 Day [] 1 Day
Address: <u>154 Colonnade Rd Ottawa ON K2E 7J5</u>	PO # <u>18755</u>	Date Required: _____
Telephone: <u>613. 226. 7381</u>	Email Address: <u>darrott@patersongroup.ca</u>	

Criteria: O. Reg. 153/04 (As Amended) Table 3 [] 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: <u>1543408</u>	Matrix	Air Volume	# of Containers	Sample Taken		PHCS F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)						
				Date	Time													
Sample ID/Location Name																		
1																		

Comments: _____ Method of Delivery: Parcel

Relinquished By (Sign): <u>[Signature]</u>	Received by Driver/Depot: <u>[Signature]</u>	Received at Lab: <u>SUMEPORN OKI MAI</u>	Verified By: <u>[Signature]</u>
Relinquished By (Print): <u>Dan Arrott</u>	Date/Time: <u>23/10/15 3:14pm</u>	Date/Time: <u>Oct 23, 2015 04:26</u>	Date/Time: <u>OCT 23/15</u>
Date/Time: <u>3:14pm 23-Oct-15</u>	Temperature: _____ °C	Temperature: <u>8.6 °C</u>	pH Verified [] By: <u>N/A</u>

4:42p

Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Dan Arnott

Client PO: 18901
Project: PE2930
Custody: 106450

Report Date: 2-Nov-2015
Order Date: 27-Oct-2015

Order #: 1544174

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

Parcel ID	Client ID
1544174-01	BH7-15-SS6

Approved By:



Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 02-Nov-2015

Client: **Paterson Group Consulting Engineers**

Order Date: 27-Oct-2015

Client PO: 18901

Project Description: PE2930

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	30-Oct-15	2-Nov-15
PHC F1	CWS Tier 1 - P&T GC-FID	30-Oct-15	2-Nov-15
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	30-Oct-15	31-Oct-15
Solids, %	Gravimetric, calculation	30-Oct-15	30-Oct-15

Certificate of Analysis

Report Date: 02-Nov-2015

 Client: **Paterson Group Consulting Engineers**

Order Date: 27-Oct-2015

Client PO: 18901

Project Description: PE2930

Client ID:	BH7-15-SS6	-	-	-
Sample Date:	26-Oct-15	-	-	-
Sample ID:	1544174-01	-	-	-
MDL/Units	Soil	-	-	-

Physical Characteristics

% Solids	0.1 % by Wt.	91.4	-	-	-
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Volatiles

Benzene	0.02 ug/g dry	<0.02	-	-	-
Ethylbenzene	0.05 ug/g dry	<0.05	-	-	-
Toluene	0.05 ug/g dry	<0.05	-	-	-
m,p-Xylenes	0.05 ug/g dry	<0.05	-	-	-
o-Xylene	0.05 ug/g dry	<0.05	-	-	-
Xylenes, total	0.05 ug/g dry	<0.05	-	-	-
Toluene-d8	Surrogate	95.8%	-	-	-

Hydrocarbons

F1 PHCs (C6-C10)	7 ug/g dry	<7	-	-	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	-	-	-
F3 PHCs (C16-C34)	8 ug/g dry	<8	-	-	-
F4 PHCs (C34-C50)	6 ug/g dry	<6	-	-	-

Certificate of Analysis

 Client: **Paterson Group Consulting Engineers**
 Client PO: **18901**

Report Date: 02-Nov-2015

Order Date: 27-Oct-2015

Project Description: PE2930
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	8.18		ug/g		102	50-140			

Certificate of Analysis

 Client: **Paterson Group Consulting Engineers**
 Client PO: **18901**

Report Date: 02-Nov-2015

Order Date: 27-Oct-2015

Project Description: PE2930
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	
Physical Characteristics									
% Solids	64.0	0.1	% by Wt.	63.9			0.2	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	6.69		ug/g dry	ND	102	50-140			

Certificate of Analysis

 Client: **Paterson Group Consulting Engineers**
 Client PO: **18901**

Report Date: 02-Nov-2015

Order Date: 27-Oct-2015

Project Description: PE2930
Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	206	7	ug/g	ND	103	80-120			
F2 PHCs (C10-C16)	118	4	ug/g	ND	116	60-140			
F3 PHCs (C16-C34)	349	8	ug/g	66	134	60-140			
F4 PHCs (C34-C50)	277	6	ug/g	48	163	60-140			QM-06
Volatiles									
Benzene	4.37	0.02	ug/g	ND	109	60-130			
Ethylbenzene	3.65	0.05	ug/g	ND	91.2	60-130			
Toluene	3.57	0.05	ug/g	ND	89.3	60-130			
m,p-Xylenes	7.64	0.05	ug/g	ND	95.5	60-130			
o-Xylene	3.65	0.05	ug/g	ND	91.3	60-130			
Surrogate: Toluene-d8	8.24		ug/g		103	50-140			

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 18901

Report Date: 02-Nov-2015

Order Date: 27-Oct-2015

Project Description: PE2930

Qualifier Notes:

QC Qualifiers :

QM-06 : Due to noted non-homogeneity of the QC sample matrix, the spike recoveries were out side the accepted range. Batch data accepted based on other QC.

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.

Client Name: <u>Paterson Group Inc.</u>	Project Reference: <u>PE 2930</u>	Page <u>1</u> of <u>1</u>
Contact Name: <u>Dan Arnott</u>	Quote #	
Address: <u>154 Colonnade Rd</u> <u>Ottawa, ON K2E 4K6 7J5</u>	PO # <u>18901</u>	
Telephone:	Email Address: <u>darlott@patersongroup.ca</u>	
TAT: <input checked="" type="checkbox"/> Regular <input type="checkbox"/> 3-Day <input type="checkbox"/> 2-Day <input type="checkbox"/> 1-Day		
Date Required: _____		

Criteria: O. Reg. 153/04 (As Amended) Table 3 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: <u>1544174</u>		Matrix	Air Volume	# of Containers	Sample Taken		PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)
Sample ID/Location Name					Date	Time							
1	<u>BH7-15-SS6</u>	<u>S</u>		<u>2</u>	<u>26-Oct-15</u>		<input checked="" type="checkbox"/>						<u>- 120ml + 1 vial -</u>
2													
3													
4													
5													
6													
7													
8													
9													
10													

Comments: _____ Method of Delivery: Swift

Relinquished By (Sign): <u>Dan Arnott</u>	Received by Driver/Depot: <u>Talk beards</u>	Received at Lab: <u>SUNDEE PORN DOKMAI</u>	Verified By: <u>[Signature]</u>
Relinquished By (Print): <u>Dan Arnott</u>	Date/Time: _____	Date/Time: <u>Oct 27 2015 03:35</u>	Date/Time: <u>Oct 27 15 3:40</u>
Date/Time: <u>27-Oct-15 12:04pm</u>	Temperature: _____ °C	Temperature: <u>13.6 °C</u>	pH Verified <input type="checkbox"/> By: _____

Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Dan Arnott

Client PO: 19030
Project: PE2930
Custody: 106573

Report Date: 25-Nov-2015
Order Date: 19-Nov-2015

Order #: 1547327

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

Parcel ID	Client ID
1547327-01	BH24-15 GW1
1547327-02	BH20-15 GW1

Approved By:



Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 25-Nov-2015

Client: Paterson Group Consulting Engineers

Order Date: 19-Nov-2015

Client PO: 19030

Project Description: PE2930

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	24-Nov-15	24-Nov-15
PHC F1	CWS Tier 1 - P&T GC-FID	24-Nov-15	24-Nov-15
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	21-Nov-15	21-Nov-15

Certificate of Analysis

 Client: **Paterson Group Consulting Engineers**
 Client PO: **19030**

Report Date: 25-Nov-2015

Order Date: 19-Nov-2015

Project Description: PE2930

Client ID:	BH24-15 GW1	BH20-15 GW1	-	-
Sample Date:	19-Nov-15	19-Nov-15	-	-
Sample ID:	1547327-01	1547327-02	-	-
MDL/Units	Water	Water	-	-

Volatiles

Benzene	0.5 ug/L	<0.5	<0.5	-	-
Ethylbenzene	0.5 ug/L	<0.5	<0.5	-	-
Toluene	0.5 ug/L	<0.5	<0.5	-	-
m,p-Xylenes	0.5 ug/L	<0.5	<0.5	-	-
o-Xylene	0.5 ug/L	<0.5	<0.5	-	-
Xylenes, total	0.5 ug/L	<0.5	<0.5	-	-
Toluene-d8	Surrogate	127%	127%	-	-

Hydrocarbons

F1 PHCs (C6-C10)	25 ug/L	<25	<25	-	-
F2 PHCs (C10-C16)	100 ug/L	<100	-	-	-
F3 PHCs (C16-C34)	100 ug/L	<100	-	-	-
F4 PHCs (C34-C50)	100 ug/L	<100	-	-	-
F1 + F2 PHCs	125 ug/L	<125	-	-	-
F3 + F4 PHCs	200 ug/L	<200	-	-	-

Certificate of Analysis

 Client: **Paterson Group Consulting Engineers**
 Client PO: **19030**

Report Date: 25-Nov-2015

Order Date: 19-Nov-2015

Project Description: PE2930
Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
Volatiles									
Benzene	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: Toluene-d8	40.2		ug/L		126	50-140			

Certificate of Analysis

 Client: **Paterson Group Consulting Engineers**
 Client PO: **19030**

Report Date: 25-Nov-2015

Order Date: 19-Nov-2015

Project Description: PE2930
Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND				30	
Volatiles									
Benzene	ND	0.5	ug/L	ND				30	
Ethylbenzene	ND	0.5	ug/L	ND				30	
Toluene	ND	0.5	ug/L	ND				30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: Toluene-d8	40.0		ug/L	ND	125	50-140			

Certificate of Analysis

 Client: **Paterson Group Consulting Engineers**
 Client PO: 19030

Report Date: 25-Nov-2015

Order Date: 19-Nov-2015

Project Description: PE2930
Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	1880	25	ug/L	ND	93.8	68-117			
F2 PHCs (C10-C16)	1890	100	ug/L	ND	105	60-140			
F3 PHCs (C16-C34)	3110	100	ug/L	ND	83.6	60-140			
F4 PHCs (C34-C50)	2240	100	ug/L	ND	90.2	60-140			
Volatiles									
Benzene	40.3	0.5	ug/L	ND	101	50-140			
Ethylbenzene	38.5	0.5	ug/L	ND	96.3	50-140			
Toluene	38.9	0.5	ug/L	ND	97.2	50-140			
m,p-Xylenes	76.0	0.5	ug/L	ND	95.0	50-140			
o-Xylene	39.2	0.5	ug/L	ND	98.0	50-140			
Surrogate: Toluene-d8	35.3		ug/L		110	50-140			

Certificate of Analysis

Client: **Paterson Group Consulting Engineers**
Client PO: 19030

Report Date: 25-Nov-2015

Order Date: 19-Nov-2015

Project Description: PE2930

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

No dup vial submitted

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.

Client Name: PATERSON	Project Reference: PE2930	TAT: <input checked="" type="checkbox"/> Regular <input type="checkbox"/> 3 Day
Contact Name: DAW ARNOTT	Quote #	<input type="checkbox"/> 2 Day <input type="checkbox"/> 1 Day
Address: 154 COLONNADE ROAD	PO # 19050	Date Required: _____
Telephone: 613-226-7381	Email Address: darnotte.patersongroup.ca	

Criteria: O. Reg. 153/04 (As Amended) Table 3 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

Parcel Order Number: 1547327	Matrix	Air Volume	# of Containers	Sample Taken		PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	F1+BTEX								
				Date	Time																
Sample ID/Location Name																					
1 BH24-15-GW1	GW		3	Nov. 19, 2015	AM	X															
2 BH20-15-GW1	GW		1	Nov. 19, 2015	AM								X								
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					

Comments: _____ Method of Delivery: **Paracel**

Relinquished By (Sign): <i>Xavier Redmond</i>	Received by Driver/Depot: <i>M. Drouse</i>	Received at Lab: STURTEBORN ORIGINAL	Verified By: <i>[Signature]</i>
Relinquished By (Print): Xavier Redmond	Date/Time: 19/11/15 4:30 PM	Date/Time: NOV 19, 2015 05:12	Date/Time: NOV 19/15 8:30
Date/Time: Nov. 19, 2015	Temperature: 14.2 °C	Temperature: 14.2 °C	pH Verified <input checked="" type="checkbox"/> By: N/A

Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Dan Arnott

Client PO: 19397
Project: PE2930
Custody: 26865

Report Date: 10-Feb-2016
Order Date: 4-Feb-2016

Order #: 1606333

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

Parcel ID	Client ID
1606333-01	BH24-15

Approved By:



Tim McCooeye
Senior Advisor

Certificate of Analysis

Report Date: 10-Feb-2016

Client: **Paterson Group Consulting Engineers**

Order Date: 4-Feb-2016

Client PO: 19397

Project Description: PE2930

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	5-Feb-16	6-Feb-16
PHC F1	CWS Tier 1 - P&T GC-FID	5-Feb-16	6-Feb-16
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	9-Feb-16	9-Feb-16
REG 153: PAHs by GC-MS	EPA 625 - GC-MS, extraction	8-Feb-16	8-Feb-16

Certificate of Analysis

Report Date: 10-Feb-2016

 Client: **Paterson Group Consulting Engineers**

Order Date: 4-Feb-2016

Client PO: 19397

Project Description: PE2930

Client ID:	BH24-15	-	-	-
Sample Date:	04-Feb-16	-	-	-
Sample ID:	1606333-01	-	-	-
MDL/Units	Water	-	-	-

Volatiles

Benzene	0.5 ug/L	<0.5	-	-	-
Ethylbenzene	0.5 ug/L	<0.5	-	-	-
Toluene	0.5 ug/L	0.8	-	-	-
m,p-Xylenes	0.5 ug/L	0.6	-	-	-
o-Xylene	0.5 ug/L	<0.5	-	-	-
Xylenes, total	0.5 ug/L	0.6	-	-	-
Toluene-d8	Surrogate	93.5%	-	-	-

Hydrocarbons

F1 PHCs (C6-C10)	25 ug/L	<25	-	-	-
F2 PHCs (C10-C16)	100 ug/L	<100	-	-	-
F3 PHCs (C16-C34)	100 ug/L	<100	-	-	-
F4 PHCs (C34-C50)	100 ug/L	<100	-	-	-
F1 + F2 PHCs	125 ug/L	<125	-	-	-
F3 + F4 PHCs	200 ug/L	<200	-	-	-

Semi-Volatiles

Acenaphthene	0.05 ug/L	<0.05	-	-	-
Acenaphthylene	0.05 ug/L	<0.05	-	-	-
Anthracene	0.01 ug/L	0.05	-	-	-
Benzo [a] anthracene	0.01 ug/L	0.10	-	-	-
Benzo [a] pyrene	0.01 ug/L	0.07	-	-	-
Benzo [b] fluoranthene	0.05 ug/L	0.15	-	-	-
Benzo [g,h,i] perylene	0.05 ug/L	0.05	-	-	-
Benzo [k] fluoranthene	0.05 ug/L	0.08	-	-	-
Chrysene	0.05 ug/L	0.11	-	-	-
Dibenzo [a,h] anthracene	0.05 ug/L	<0.05	-	-	-
Fluoranthene	0.01 ug/L	0.22	-	-	-
Fluorene	0.05 ug/L	<0.05	-	-	-
Indeno [1,2,3-cd] pyrene	0.05 ug/L	<0.05	-	-	-
1-Methylnaphthalene	0.05 ug/L	<0.05	-	-	-
2-Methylnaphthalene	0.05 ug/L	<0.05	-	-	-
Methylnaphthalene (1&2)	0.10 ug/L	<0.10	-	-	-
Naphthalene	0.05 ug/L	<0.05	-	-	-
Phenanthrene	0.05 ug/L	0.22	-	-	-
Pyrene	0.01 ug/L	0.18	-	-	-
2-Fluorobiphenyl	Surrogate	66.8%	-	-	-
Terphenyl-d14	Surrogate	103%	-	-	-

Certificate of Analysis

Report Date: 10-Feb-2016

 Client: **Paterson Group Consulting Engineers**

Order Date: 4-Feb-2016

Client PO: 19397

Project Description: PE2930
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						
Semi-Volatiles									
Acenaphthene	ND	0.05	ug/L						
Acenaphthylene	ND	0.05	ug/L						
Anthracene	ND	0.01	ug/L						
Benzo [a] anthracene	ND	0.01	ug/L						
Benzo [a] pyrene	ND	0.01	ug/L						
Benzo [b] fluoranthene	ND	0.05	ug/L						
Benzo [g,h,i] perylene	ND	0.05	ug/L						
Benzo [k] fluoranthene	ND	0.05	ug/L						
Chrysene	ND	0.05	ug/L						
Dibenzo [a,h] anthracene	ND	0.05	ug/L						
Fluoranthene	ND	0.01	ug/L						
Fluorene	ND	0.05	ug/L						
Indeno [1,2,3-cd] pyrene	ND	0.05	ug/L						
1-Methylnaphthalene	ND	0.05	ug/L						
2-Methylnaphthalene	ND	0.05	ug/L						
Methylnaphthalene (1&2)	ND	0.10	ug/L						
Naphthalene	ND	0.05	ug/L						
Phenanthrene	ND	0.05	ug/L						
Pyrene	ND	0.01	ug/L						
Surrogate: 2-Fluorobiphenyl	15.2		ug/L		76.1	50-140			
Surrogate: Terphenyl-d14	22.9		ug/L		114	50-140			
Volatiles									
Benzene	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: Toluene-d8	78.3		ug/L		97.9	50-140			

Certificate of Analysis

Report Date: 10-Feb-2016

 Client: **Paterson Group Consulting Engineers**

Order Date: 4-Feb-2016

Client PO: 19397

Project Description: PE2930
Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND				30	
Volatiles									
Benzene	ND	0.5	ug/L	ND				30	
Ethylbenzene	ND	0.5	ug/L	ND				30	
Toluene	ND	0.5	ug/L	ND				30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: Toluene-d8	77.0		ug/L	ND	96.2	50-140			

Certificate of Analysis

Report Date: 10-Feb-2016

 Client: **Paterson Group Consulting Engineers**

Order Date: 4-Feb-2016

Client PO: 19397

Project Description: PE2930
Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	1980	25	ug/L	ND	99.0	68-117			
F2 PHCs (C10-C16)	1540	100	ug/L	ND	85.6	60-140			
F3 PHCs (C16-C34)	3320	100	ug/L	ND	89.2	60-140			
F4 PHCs (C34-C50)	2470	100	ug/L	ND	99.4	60-140			
Semi-Volatiles									
Acenaphthene	4.56	0.05	ug/L	ND	91.1	50-140			
Acenaphthylene	3.85	0.05	ug/L	ND	77.0	50-140			
Anthracene	3.81	0.01	ug/L	ND	76.3	50-140			
Benzo [a] anthracene	2.98	0.01	ug/L	ND	59.6	50-140			
Benzo [a] pyrene	3.41	0.01	ug/L	ND	68.3	50-140			
Benzo [b] fluoranthene	4.52	0.05	ug/L	ND	90.5	50-140			
Benzo [g,h,i] perylene	3.89	0.05	ug/L	ND	77.7	50-140			
Benzo [k] fluoranthene	5.12	0.05	ug/L	ND	102	50-140			
Chrysene	4.27	0.05	ug/L	ND	85.5	50-140			
Dibenzo [a,h] anthracene	4.26	0.05	ug/L	ND	85.2	50-140			
Fluoranthene	4.44	0.01	ug/L	ND	88.8	50-140			
Fluorene	4.22	0.05	ug/L	ND	84.3	50-140			
Indeno [1,2,3-cd] pyrene	3.91	0.05	ug/L	ND	78.3	50-140			
1-Methylnaphthalene	5.04	0.05	ug/L	ND	101	50-140			
2-Methylnaphthalene	5.42	0.05	ug/L	ND	108	50-140			
Naphthalene	4.15	0.05	ug/L	ND	82.9	50-140			
Phenanthrene	4.20	0.05	ug/L	ND	84.0	50-140			
Pyrene	4.59	0.01	ug/L	ND	91.8	50-140			
<i>Surrogate: 2-Fluorobiphenyl</i>	15.2		ug/L		75.8	50-140			
Volatiles									
Benzene	47.2	0.5	ug/L	ND	118	50-140			
Ethylbenzene	50.4	0.5	ug/L	ND	126	50-140			
Toluene	46.6	0.5	ug/L	ND	117	50-140			
m,p-Xylenes	83.5	0.5	ug/L	ND	104	50-140			
o-Xylene	48.8	0.5	ug/L	ND	122	50-140			

Certificate of Analysis

Client: **Paterson Group Consulting Engineers**
Client PO: **19397**

Report Date: 10-Feb-2016

Order Date: 4-Feb-2016

Project Description: PE2930

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

CCME PHC additional information:

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

Client Name: PATERSON	Project Reference: PE2930	TAT: <input checked="" type="checkbox"/> Regular <input type="checkbox"/> 3 Day
Contact Name: DAN ARNOTT	Quote #	<input type="checkbox"/> 2 Day <input type="checkbox"/> 1 Day
Address: 154 COLONNADE	PO # 19397	Date Required: _____
Telephone: 613-226-7391	Email Address: darnott@patersongroup.ca	

Criteria: O. Reg. 153/04 (As Amended) Table **3** 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**

Parcel Order Number: 16000.333	Matrix	Air Volume	# of Containers	Sample Taken		PHCs/BTEX	PAH's	Required Analyses											
				Date	Time														
Sample ID/Location Name																			
1	BH24-15	GW	4	Feb. 4, 2016	3:30 PM	X	X												
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			

Comments: _____ Method of Delivery: **Walk-in**

Relinquished By (Sign): <i>[Signature]</i>	Received by Driver/Depot:	Received at Lab: <i>[Signature]</i>	Verified By: <i>[Signature]</i>
Relinquished By (Print):	Date/Time:	Date/Time: Feb 4/16 5:55	Date/Time: Feb 5/16 10:52
Date/Time:	Temperature: _____ °C	Temperature: 10.5°C	pH Verified <input checked="" type="checkbox"/> By: N/A