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Phase II Environmental Site Assessment

Southern Portion of 1009 Trim Road
Ottawa, Ontario

Prepared For

Starwood Group Inc.

August 20, 2020

Report: PE4886-2

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EXECUTIVE SUMMARY

Assessment

A Phase II ESA was conducted for the vacant, southern portion of 1009 Trim Road, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address the areas of potential environmental concern (APECs) on the subject property that were identified during the Phase I ESA.

The subsurface investigation was carried out in conjunction with a Geotechnical Investigation. The field program consisted of drilling four (4) boreholes, three (3) of which were completed as groundwater monitoring wells. Boreholes were drilled to depths ranging from approximately 15.54 to 15.85 m below the ground surface (mbgs).

The soil profile generally consists of fill material consisting of silty clay, crushed stone, gravel and traces of brick and plastic fragments, wood, organics and shale. The fill was underlain by native silty clay. Bedrock was not encountered, however, based on the DPCT, refusal was attained at 36.98mbgs, where bedrock was inferred.

Four (4) soil samples were submitted for laboratory analysis of benzene, toluene, ethylbenzene and xylenes (BTEX), petroleum hydrocarbons (PHCs, F_1-F_4) and metals as well as electrical conductivity (EC) and sodium adsorption ratio (SAR). No detectable BTEX concentrations were identified in the soil samples, and thus, they complied with the MECP Table 3 Standards. PHC-F2, PAHs Metals, EC and SAR concentrations in several soil samples were in excess of the selected MECP Table 1 Residential Standards.

Groundwater samples were recovered from all three (3) wells including a monitoring well that was drilled in 2016, MW16-4 and analyzed for BTEX, PHC, Metals and Sodium concentrations. No free-phase product was observed on the groundwater at any of the monitoring well locations during the groundwater sampling events. Test results for BTEX and PHCs as well as metals, except sodium, were incompliance with the selected MECP Table 1 Standards. Sodium, chloride and uranium concentrations were in excess of the Table 1 Standards.

Recommendations

<u>Soil</u>

Fill material across the Phase II Property is impacted with metals, PAHs, PHC (F2), EC and SAR concentrations in excess of the MECP Table 1 Residential Standards. It is possible that the impacts may have migrated into the native soil, as the site is situated

in highly variable area where the water table can fluctuate significantly. It is our recommendation that the impacted fill/soil material be removed from the subject site during the redevelopment process. The excavation of the soil from the property should be monitored and confirmed by Paterson. Soil/fill in excess of the selected standards will need to be removed and disposed of at an approved waste disposal facility.

Testing of the underlying native soil will be required in conjunction with the excavation program to segregate clean soil from impacted spoil and for final confirmatory purposes.

Groundwater

Remediation of the groundwater using a licenced hauling company pumping from the excavation may be a viable option, depending upon the groundwater level at the time of the remediation, however, if a significant volume of water is anticipated, a pump and treat system would likely be more economical. Depending upon the methodology selected, post remediation groundwater monitoring may be required for up to 12 months in support of a Record of Site Condition. There is a possibility that groundwater remediation may not be a viable option, in which case, a risk assessment will be required to address the contamination.

Monitoring Wells

It is our recommendation that the monitoring wells installed on the subject site should remain viable for future monitoring. If they are not going to be used in the future, or will be entirely removed, they should be abandoned according to Ontario Regulation 903. The wells will be registered with the MECP under this regulation.

1.0 INTRODUCTION

At the request of Starwood Group Inc., Paterson Group (Paterson) conducted a Phase II Environmental Site Assessment for the southern portion of 1009 Trim Road, in the City of Ottawa, Ontario. The purpose of this Phase II ESA has been to address areas of potential environmental concern (APECs) identified on the Phase II Property, during the Phase I ESA conducted by Paterson.

1.1 Site Description

Address:	Southern portion of 1009 Trim Road, Ottawa, Ontario.
Legal Description:	Part of Lot 30, Concession 1 OS, Parts 3 and 4 on 50R6869, Township of Cumberland, now in the City of Ottawa.
Property Identification Number (PIN):	14538-0075
Location:	The site is located on the northeast corner of the Trim Road and Inlet Private Intersection, in the City of Ottawa, Ontario. Refer to Figure 1 - Key Plan in the Figures section following the text.
Latitude and Longitude:	45° 25’ 27" N, 75° 38' 3.89" W

1.2 Property Ownership

Starwood Group Incorporated is the current registered property owner of the Phase II Property. Paterson was retained to complete this Phase II ESA by Mr. Martin Chenier acting on behalf of Starwood Group Incorporated. The head office of Starwood Group Inc. is located at 188 Eglinton Avenue East, Suite 800, Toronto, Ontario. The Starwood Group Inc. can be reached by telephone at (416) 482-4822.

1.3 Current and Proposed Future Uses

The Phase II Property is presently vacant and undeveloped land. The site is slated for a residential development (condominium) that will occupy the southern portion of the subject land.

1.4 Applicable Site Condition Standard

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

- Coarse-grained soil conditions
- Full depth background (sensitive) site conditions
- Residential land use

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

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The Phase II Property is situated in rural area consisting mostly of vacant land with some commercial and residential land use. The site is accessible from a gravelled laneway fronting Trim Road on the northwestern side of the property. The northern half of the site is at a significantly lower grade than the southern half of the site, which is a result of imported fill material on-site. The northern half of the site is designated as a provincially significant wetland, covered in tall brush, while the southern half is gravel covered with low vegetation and a treeline along the southern property boundary. Several monitoring wells were present on the southern half of the site.

The site and regional topography slope down toward the north to the Ottawa River. Site drainage consists of infiltration.

2.2 Past Investigations

- *"Phase One Environmental Site Assessment – Part of Lot 3, Concession 1, Parts 1 & 2, Cumberland, Ontario (1009 Trim Road),"* prepared by WSP, dated March 2016.

Based on the Phase I ESA report, one on-site potentially contaminating activity (PCA) was identifed and two (2) off-site PCAs located at 1125 Trim Road, resulted in areas of potential environmental concern (APECs):

- APEC 1 – Resulting from fill material of an unknown quality imported on-site in the 1980s, 2009 and 2014, which significant increase the original ground level.
- APEC 2 – Resulting from fuel storage tanks and bulk storage of road salt (salt dome) at 1125 Trim Road (neighbouring property to the south).

A Phase II ESA was conducted to address the APECs on the Phase I Property.

❒ *"Phase Two Environmental Site Assessment – Part of Lot 3, Concession 1, Parts 1 & 2, Cumberland, Ontario (1009 Trim Road),"* prepared by WSP, dated September 2016.

Based on the Phase II ESA, six (6) boreholes were drilled across the subject land as well as four (4) test pits to assess the APECs. Soil samples at locations MW16-5, MW16-6, and TP-1 through TP-4 were retrieved and submitted for benzene, toluene, ethylbenzene and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAHs), petroleum hydrocarbons fractions F1 to F4 (PHCs, F1-F4) and metals as well as electrical conductivity (EC) and sodium adsorption ratio (SAR) analyses. Based on the analytical test results, the fill material on-site was impacted with metals, PAHs, PHC-F2 and EC/SAR.

Groundwater samples from MW16-1 through MW16-6 were collected and submitted for BTEX, PAHs, PHCs (F1-F4) and metals analyses. Based on these test results, groundwater contained elevated levels of chloride, sodium and uranium in excess of the applicable site standards.

Soil and groundwater remediation was recommended. No further work has been completed on the Phase I Property.

❑ *"Phase I Environmental Site Assessment, Southern Portion of 1009 Trim Road, Ottawa, Ontario,"* prepared by Paterson Group Inc. (Paterson), dated August 19, 2020.

Based on the findings of the Phase I ESA, the three (3) PCAs identified in the 2016 report remain areas of concern on the Phase I Property:

- APEC 1: Resulting from fill material imported on-site throughout the1990s to 2014 on the Phase I Property (PCA 30).
- APEC 2: Resulting from the off-site storage of road salt and fuel storage tanks at 1125 Trim Road (PCA 48 and PCA 28).

These PCAs that are considered to represent APECs were confirmed during the historical research, review of previous engineering reports and through field

observations. This Phase II ESA addresses the APECs identified in the Phase I ESA.

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The subsurface investigation was conducted during the interim of June 29 to the July 17, 2020, in conjunction with a Geotechnical Investigation. The field program consisted of drilling four (4) boreholes, three (3) of which were completed as groundwater monitoring wells. Boreholes were drilled to depths ranging from approximately 15.54 to 15.85 m below the ground surface (mbgs).

3.2 Media Investigated

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

Contaminants of concern for soil and/or groundwater included benzene, toluene, ethylbenzene and xylenes (BTEX), petroleum hydrocarbons (PHCs, fractions F_1-F_4), metals (plus hexavalent chromium and mercury), electrical conductivity (EC) and sodium adsorption ratio (SAR).

3.3 Phase I Conceptual Site Model

Geological and Hydrogeological Setting

According to the Geological Survey of Canada website, the bedrock in the area of the Phase I Property is reported to consist of interbedded limestone and dolomite of the Gull River Formation. The overburden thickness of ranges from 15 to 25 m and consists of offshore marine sediments.

Based on domestic well records near the Phase I Property, the site stratigraphy consists of clay, underlain by limestone bedrock. Groundwater is expected to flow in a northerly direction towards the Ottawa River.

Existing Buildings and Structures

There are no buildings or structures present on the Phase I Property.

Fill Placement

As previously identified in this report, the Phase I Property has fill material containing metals, PAHs and PHC-F2 as well as EC and SAR concentrations in excess of the applicable site standards. No remediation work has been completed thus far, and as such, this PCA remains an APEC on the Phase I Property.

Water Bodies and Areas of Natural Significance

The Phase I Property is situated in the Petrie Island Wetland, which is a designated provincially significant wetland.

Drinking Water Wells

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

Subsurface Structures and Utilities

The Phase I Property is undeveloped land with presently no services on-site. It is expected that upon development, the subject land will be municipally serviced.

Neighbouring Land Use

The Phase I Study Area is situated in an area that consists primarily of vacant land with some commercial and residential land use.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

As per Section 7.1 of the Phase I ESA report, three (3) PCAs are considered to result APECs on the Phase I Property. These APECs are summarized in Table 1, along with their respective locations and contaminants of potential concern (CPCs) on the Phase I Property.

Table 1: Potentially Contaminating Activities and Areas of Potential Environmental Concern

Area of Potential Environmental Concern	Location of Area of Potential Environmental Concern	Potentially Contaminating Activity	Location of PCA (on-site or off-site)	Contaminants of Potential Concern	Media Potentially Impacted (Groundwater, Soil, and/or Sediment)
APEC 1: Resulting from importation of fill	Majority of the southern portion of the Phase I Property	PCA 30 – "*Importation of Fill Material of Unknown Quality*"	On-site	PAHs Metals	Soil
APEC 2: Resulting from a salt dome and fuel storage 1125 Trim Road	Southern portion of the Phase I Property	PCA 48 – *"Salt manufacturing, Processing and Bulk Storage"* PCA 28 – "*Gasoline and Associated Products Storage in Fixed Tanks*"	Off-site	BTEX PHCs (F_1-F_4) EC SAR BTEX PHCs (F_1-F_4) Metals Chloride	Soil Groundwater

These PCAs that are considered to represent APECs were identified during the historical research, review of previous engineering reports and field observations made during the Phase I ESA.

Contaminants of Potential Concern

As per the APECs identified in Section 7.1, the contaminants of potential concern (CPCs) in soil and/or groundwater include:

- Benzene, Toluene, Ethylbenzene and Xylenes (BTEX);
- Petroleum hydrocarbons (PHCs, Fractions F_1-F_4);
- Polycyclic Aromatic Hydrocarbons (PAHs);
- Metals (including mercury and hexavalent chromium);
- Electrical Conductivity (EC) and Sodium Adsorption Ratio (SAR);
- Chlorides.

The CPCs are expected to be present in the soil and/or groundwater of the Phase I Property.

Assessment of Uncertainty and/or Absence of Information

The information available for review as part of the preparation of this Phase I-ESA is considered to be sufficient to conclude that there are PCAs that have resulted in APECs on the Phase I Property.

A variety of independent sources were consulted as part of this assessment, and as such, the conclusions of this report are not affected by uncertainty which may be present with respect to the individual sources.

3.4 Deviations from Sampling and Analysis Plan

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

3.5 Impediments

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

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation was conducted during the interim of June 29 to July 17, 2020, in conjunction with a Geotechnical Investigation. This field program consisted of drilling four (4) boreholes on the Phase II Property. The boreholes were drilled to a maximum depth of 15.85 mbgs. Three (3) boreholes were completed as groundwater monitoring wells to access the groundwater table.

These boreholes were placed to address the APECs on the Phase II Property as well as to provide coverage of the site from a geotechnical perspective. The boreholes were drilled with a track mounted power auger drill rig. The track mounted drill rig was provided by George Downing Estate Drilling of Hawkesbury, Ontario. Borehole locations are shown on Drawing PE4886-3 – Test Hole Location Plan, appended to the Figures section of this report.

4.2 Soil Sampling

A total of 56 soil samples were obtained from the subsurface program by means of sampling from shallow auger flights and split spoon sampling. The depths at which auger samples and split spoon samples were obtained from the boreholes are shown respectively, as "**AU**" and "**SS**" on the Soil Profile and Test Data Sheets, appended to this report.

Site soils generally consist of fill material, followed by a native silty clay. The fill material extended to depths ranging from 3.69 m to a maximum depth of 6.10 m and consisted of crushed stone, shale fragments and traces of plastic and organics. Bedrock was not encountered. Boreholes were terminated at depths of 15.54 to 15.85 mbgs. A dynamic cone penetration test (DCPT) commenced at 15.54 mbs and reached refusal at 36.95 mbgs, where bedrock was inferred.

4.3 Field Screening Measurements

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

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

The vapour readings were found to have readings of 5 to 20 ppm. Vapour readings are noted on the Soil Profile and Test Data Sheets in Appendix 1.

4.4 Groundwater Monitoring Well Installation

Three (3) groundwater monitoring wells were installed on the Phase II Property during the drilling program as part of the subsurface investigation. All monitoring wells consisted of 50 mm diameters Schedule 40 threaded PVC risers and screens. Monitoring well construction details are listed below in Table 2 and are also presented on the Soil Profile and Test Data Sheets provided in Appendix 1.

TABLE 2: Monitoring Well Construction Details

Well ID	Ground Surface Elevation	Total Depth (m BGS)	Screened Interval (m BGS)	Sand Pack (m BGS)	Bentonite Seal (m BGS)	Casing Type
BH1	46.87	9.14	6.14-9.14	5.51-9.14	0.17-5.51	Stick up
BH2	47.73	9.14	6.14-9.14	5.51-9.14	0.17-5.51	Stick up
BH3	49.31	9.14	6.14-9.14	5.51-9.14	0.17-5.51	Stick up

4.5 Field Measurement of Water Quality Parameters

Groundwater sampling was conducted on July 17, 2020. Water levels were measured in the field at that time.

4.6 Groundwater Sampling

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

4.7 Analytical Testing

Based on the Phase I Conceptual Site Model (Section 3.3) and field screening, selected soil and groundwater samples presented in Tables 3 and 4, were submitted and analyzed for BTEX/VOC, PHCs and/or metals.

TABLE 3: Soil Samples Submitted

Sample ID	Sample Depth / Stratigraphic Unit	Parameters Analyzed					Rationale
		PHCs (F_1-F_4)	BTEX	Metals[1]	EC/SAR	PAHs	
June 29, 2020							
BH1-20-SS5	3.05-3.66m Fill	X	X		X		Assess potential impacts due to the use of the adjacent property to the south and quality of the fill material
BH2-20-SS5	3.05-3.66m Fill	X	X	X	X	X	Assess potential impacts due to the use of the adjacent property to the south and quality of the fill material
BH3-SS5	3.05-3.66m Fill	X	X		X		Assess potential impacts due to the use of the adjacent property to the south and quality of the fill material
BH4-20-SS4	2.29-2.89m Fill			X	X		Assess potential impacts due to the use of the adjacent property to the south and quality of the fill material

1 – Metals including Chromium VI and Mercury

TABLE 4: Groundwater Samples Submitted

Sample ID	Screened Interval/ Stratigraphic Unit	Parameters Analyzed				Rationale
		PHCs (F_1-F_4)	BTEX	Metals[1]	Chloride	
July 17, 2020						
BH1-20-GW1	6.14-9.14m Silty Clay	X	X	X	X	Assess potential groundwater impacts due to the use of the adjacent property to the south.
BH1-20-GW1	6.14-9.14m Silty Clay	X	X	X	X	Assess potential groundwater impacts due to the use of the adjacent property to the south.
BH1-20-GW1	6.14-9.14m Silty Clay	X	X	X	X	Assess potential groundwater impacts due to the use of the adjacent property to the south.
MW14-4-GW1	6.14-9.14m Silty Clay	X	X	X	X	Assess potential groundwater impacts due to the use of the adjacent property to the south.

1 – Metals including Chromium VI and Mercury

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

4.8 Residue Management

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

4.9 Elevation Surveying

The borehole locations were selected by Paterson for both environmental and geotechnical purposes. Boreholes were located and surveyed in the field by Paterson. All borehole locations were measured at geodetic elevations.

The locations and elevations of the boreholes are presented on Drawing PE4886-3 – Test Hole Location Plan, appended to this report.

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4.10 Quality Assurance and Quality Control Measures

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

5.0 REVIEW AND EVALUATION

5.1 Geology

The soil profile generally consists of granular fill (gravel), followed by a clayey fill material, underlain by native silty clay. The site stratigraphy is shown on Drawings PE4886-4A and PE4886-4B for soil.

Groundwater was encountered within the native silty clay layer at depths ranging from approximately 4.51 to 4.93 m below the existing grade, as shown on Drawings PE4886-8A and PE4886-8B for groundwater.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured during the groundwater sampling event on July 17, 2020 using an electronic water level meter. Groundwater levels are summarized below in Table 5. Geodetic elevations were measured for all of the boreholes by Paterson.

TABLE 5: Groundwater Level Measurements

Borehole Location	Ground Surface Elevation (m)	Water Level Depth (m below grade)	Water Level Elevation (m ASL)	Date of Measurement
BH1	46.87	4.72	42.15	July 17, 2020
BH2	47.73	4.51	43.22	July 17, 2020
BH3	49.31	4.93	44.38	July 17, 2020
MW16-4	47.63	2.86	44.77	July 17, 2020

Based on the groundwater elevations measured during the July 17, 2020, groundwater contour mapping was completed. Groundwater contours are shown on Drawing PE4886-3 –Test Hole Location Plan. Based on the contour mapping, groundwater beneath the Phase II Property appears to flow in a northerly direction. A horizontal hydraulic gradient of approximately 0.05 m/m was calculated.

5.3 Fine-Coarse Soil Texture

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

5.4 Soil: Field Screening

Field screening of the soil samples collected during drilling resulted in vapour readings from 5 to 20 ppm. The field screening results of each individual soil sample are provided on the Soil Profile and Test Data Sheets appended to this report.

5.5 Soil Quality

Four (4) soil samples were submitted for BTEX, PHCs (F1-F4), PAHs, and metals as well as EC and SAR analysis. The results of the analytical testing are presented in Tables 6 through 9. The laboratory certificates of analysis are provided in Appendix 1.

TABLE 6: Analytical Test Results – Soil – BTEX and PHC (F1-F4)

Parameter	MDL (µg/g)	Soil Samples (µg/g)			MECP Table 1 Residential Standards (µg/g)
		June 29, 2020	June 30, 2020	July 2, 2020	
		BH1-20-SS5	BH2-20-SS5	BH3-20-SS5	
Benzene	0.02	nd	nd	nd	0.02
Ethylbenzene	0.05	nd	nd	nd	0.05
Toluene	0.05	nd	nd	nd	0.2
Xylenes (Total)	0.05	nd	nd	nd	0.05
PHC F1	7	13	nd	nd	25
PHC F2	4	**173**	nd	nd	10
PHC F3	8	117	nd	nd	240
PHC F4	6	nd	nd	nd	120

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – Value exceeds MECP Table 1 Standards

The PHC, F2 concentration in soil sample BH1-20-SS5 is in excess of the MECP Table 1 Residential Standards. All other test results comply with the selected standards.

TABLE 7: Analytical Test Results – Soil – EC and SAR

Parameter	MDL (µg/g)	Soil Samples (µg/g)				MECP Table1 Residential Standards
		June 29, 2020	June 30, 2020		July 2, 2020	
		BH1-20-SS5	BH2-20-SS5	BH4-20-SS4	BH3-20-SS5	
SAR	0.01	0.93	**4.85**	0.68	2.0	2.4
EC (uS/cm)	5	421	**880**	358	355	570

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – Value exceeds MECP Table 1 Standards

The SAR and EC test results from soil sample BH2-20-SS5 are in excess of the selected standards. All other soil samples comply with the MECP Table 1 Residential Standards.

TABLE 8: Analytical Test Results – Soil – Metals

Parameter	MDL (µg/g)	Soil Samples (µg/g)	MECP Table 1 Residential Standards (µg/g)
		June 30, 2020	
		BH4-20-SS4	
Antimony	1.0	nd	1.3
Arsenic	1.0	3.4	18
Barium	1.0	**287**	220
Beryllium	0.5	0.6	2.5
Boron	5.0	nd	36
Cadmium	0.5	nd	1.2
Chromium	5.0	96.5	70
Chromium (VI)	0.2	nd	0.66
Cobalt	1.0	19.4	21
Copper	5.0	42.8	92
Lead	1.0	6.7	120
Mercury	0.1	nd	0.27
Molybdenum	1.0	nd	2
Nickel	5.0	54.3	82
Selenium	1.0	nd	1.5
Silver	0.3	nd	0.5
Thallium	1.0	nd	1
Uranium	1.0	nd	2.5
Vanadium	10.0	89.2	86
Zinc	20.0	97.6	290

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – Value exceeds MECP Table 1 Standards

With the exception of barium, all other test results for metals comply with the MECP Table 1 Residential Standards.

Analytical results of soil sampled for metals, EC and SAR with respect to borehole locations are shown on Drawing PE4886-4 – Analytical Testing Plan – Soil (Metals).

TABLE 9: Analytical Test Results – Soil – PAHs

Parameter	MDL (µg/g)	Soil Samples (µg/g)	MECP Table 1 Residential Standards (µg/g)
		June 30, 2020	
		BH2-20-SS5	
Acenaphthene	0.02	nd	0.072
Acenaphthylene	0.02	nd	0.093
Anthracene	0.02	nd	0.16
Benzo[a]anthracene	0.02	0.02	0.36
Benzo[a]pyrene	0.02	nd	0.3
Benzo[b]fluoranthene	0.02	nd	0.47
Benzo[g,h,i]perylene	0.02	nd	0.68
Benzo[k]fluoranthene	0.02	nd	0.48
Chrysene	0.02	0.02	2.8
Dibenzo[a,h]anthracene	0.02	nd	0.1
Fluoranthene	0.02	0.05	0.56
Fluorene	0.02	nd	0.12
Indeno[1,2,3-cd]pyrene	0.02	nd	0.23
1-Methylnaphthalene	0.02	nd	0.59
2-Methylnaphthalene	0.02	nd	0.59
Methylnaphthalene (1&2)	0.04	nd	0.59
Naphthalene	0.01	nd	0.09
Phenanthrene	0.02	0.04	0.69
Pyrene	0.02	0.04	1.0

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – Value exceeds MECP Table 1 Standards

PAH results comply with the MECP Table 1 Residential Standards.

Analytical results of soil sampled for PAHs, BTEX and PHCs with respect to borehole locations are shown on Drawings PE4886-5, PE4886-6 and PE4886-7– Analytical Testing Plan – Soil.

The maximum concentrations of analyzed parameters in the soil at the site are summarized below in Table 10.

TABLE 10: Maximum Concentrations – Soil			
Parameter	**Maximum Concentrations (µg/g)**	**Borehole**	**Depth Interval (m BGS)**
PHC F1	13	BH1-20-SS5	3.05-3.66, Fill
PHC F2	**173**		
PHC F3	117		
SAR	**4.85**	BH2-20-SS5	3.05-3.66, Fill
EC	**880**		
Arsenic	3.4	3.05-3.66, Fill	3.05-3.66, Fill
Barium	**287**		
Beryllium	0.6		
Chromium	96.5		
Cobalt	19.4		
Copper	42.8		
Lead	6.7		
Nickel	54.3		
Vanadium	89.2		
Zinc	97.6		
Benzo[a]anthracene	0.02	BH2-20-SS5	3.05-3.66, Fill
Chrysene	0.02		
Fluoranthene	0.05		
Phenanthrene	0.04		
Pyrene	0.04		

Notes:
- **Bold and Underlined** – Value exceeds MECP Table 1 Standards

All other parameter concentrations were below laboratory detection limits.

5.6 Groundwater Quality

Groundwater samples from monitoring wells installed in BH1-20 through BH3-20 as well as a monitoring well (MW16-4) installed in 2016 by WSP and were submitted for laboratory analysis of BTEX, PHCs and/or metals as well as chloride. The groundwater samples were obtained from the screened intervals noted on Table 2. The results of the analytical testing are presented below in Tables 11 and 12. The laboratory certificates of analysis are provided in Appendix 1.

TABLE 11: Analytical Test Results – Groundwater – BTEX and PHCs

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)				MECP Table 1 Standards (µg/L)
		July 17, 2020				
		BH1-20-GW1	BH2-20-GW1	BH3-20-GW1	MW16-4-GW1	
Benzene	0.5	nd	nd	nd	nd	0.5
Ethylbenzene	0.5	nd	nd	nd	nd	0.5
Toluene	0.5	nd	nd	nd	nd	0.8
Xylenes	0.5	nd	nd	nd	nd	72
PHC F1	25	nd	nd	nd	nd	420
PHC F2	100	nd	nd	nd	nd	150
PHC F3	100	nd	nd	nd	nd	500
PHC F4	100	nd	nd	nd	nd	500

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

No BTEX or PHC concentrations were identified in the groundwater samples analyzed. All of the groundwater samples comply with the selected MECP Table 1 Standards.

Analytical results of groundwater sampled for BTEX and PHCs with respect to borehole locations are shown on Drawing PE4886-9- Analytical Testing Plan– Groundwater.

TABLE 12: Analytical Test Results – Groundwater – Metals and Inorganics

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)				MECP Table 1 Standards (µg/L)
		July 17, 2020				
		BH1-20-GW1	BH2-20-GW1	BH3-20-GW1	MW16-4-GW1	
Chloride	1	758	**1180000**	**1310000**	**1660000**	790000
Antimony	0.5	nd	nd	nd	nd	1.5
Arsenic	1	nd	nd	nd	nd	13
Barium	1	260	255	277	104	610
Beryllium	0.5	nd	nd	nd	nd	0.5
Boron	10	176	58	133	44	1700
Cadmium	0.1	nd	nd	nd	nd	0.5
Chromium	1	nd	nd	nd	nd	11
Chromium (VI)	10	nd	nd	nd	nd	25
Cobalt	0.5	1.2	2.2	0.8	1.2	3.8
Copper	0.5	2.2	5.0	3.3	3.5	5
Lead	0.1	nd	nd	nd	nd	1.9
Mercury	0.1	nd	nd	nd	nd	0.1
Molybdenum	0.5	2.7	6.1	8.0	2.9	23
Nickel	1	3	4	2	12	14
Selenium	1	nd	nd	nd	nd	5

TABLE 12: Analytical Test Results – Groundwater – Metals and Inorganics

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)				MECP Table 1 Standards (µg/L)
		July 17, 2020				
		BH1-20-GW1	BH2-20-GW1	BH3-20-GW1	MW16-4-GW1	
Silver	0.1	nd	nd	nd	nd	0.3
Sodium	200	468000	**736000**	**561000**	**822000**	490000
Thallium	0.1	nd	nd	nd	nd	0.5
Uranium	0.1	5.1	4.5	7.5	**12.6**	8.9
Vanadium	0.5	1.9	nd	1.1	0.9	3.9
Zinc	5	nd	nd	nd	9	160

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

With the exception of BH1-20-GW1, the chloride and sodium concentrations in the remaining groundwater samples are in excess of the MECP Table 1 Standards. The uranium concentration in sample MW16-4-GW1 is also in excess of the selected standards for metals.

Analytical results of groundwater sampled for chloride and metals with respect to borehole locations are shown on Drawing PE4886-8- Analytical Testing Plan– Groundwater.

The maximum concentrations of analyzed parameters in the groundwater beneath the site are summarized below in Table 13.

TABLE 13: Maximum Concentrations – Groundwater

Parameter	Maximum Concentrations (µg/g)	Monitoring Well	Screened Interval (m BGS)
Chloride	**1660000**	MW16-4-GW1	6.14-9.14, Silty clay
Barium	277	BH3-20-GW1	6.14-9.14, Silty clay
Boron	176	BH1-20-GW1	6.14-9.14, Silty clay
Cobalt	2.2	BH2-20-GW1	6.14-9.14, Silty clay
Copper	5.0	BH2-20-GW1	6.14-9.14, Silty clay
Molybdenum	8.0	BH3-20-GW1	6.14-9.14, Silty clay
Nickel	12	MW16-4-GW1	3.10-6.10, Fill
Sodium	**822000**	MW16-4-GW1	3.10-6.10, Fill
Uranium	**12.6**	MW16-4-GW1	3.10-6.10, Fill
Vanadium	1.9	BH1-20-GW1	6.14-9.14, Silty clay
Zinc	9	MW16-4-GW1	3.10-6.10, Fill

Notes:
- **Bold and Underlined** – Value exceeds MECP Table 1 Standards

All other parameter concentrations were below laboratory detection limits.

5.7 Quality Assurance and Quality Control Results

All samples submitted as part of the July 2020 sampling events were handled in accordance with the Analytical Protocol with respect to preservation method, storage requirement, and container type.

5.8 Phase II Conceptual Site Model

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

Site Description

Potentially Contaminating Activity and Areas of Potential Environmental Concern

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

Table 14: Potentially Contaminating Activities and Areas of Potential Environmental Concern

Area of Potential Environmental Concern	Location of Area of Potential Environmental Concern	Potentially Contaminating Activity	Location of PCA (on-site or off-site)	Contaminants of Potential Concern	Media Potentially Impacted (Groundwater, Soil, and/or Sediment)
APEC 1: Resulting from importation of fill	Majority of the southern portion of the Phase I Property	PCA 30 – "*Importation of Fill Material of Unknown Quality*"	On-site	PAHs Metals	Soil
APEC 2: Resulting from a salt dome and fuel storage 1125 Trim Road	Southern portion of the Phase I Property	PCA 48 – *"Salt manufacturing, Processing and Bulk Storage"* PCA 28 – "*Gasoline and Associated Products Storage in Fixed Tanks*"	Off-site	BTEX PHCs (F_1-F_4) EC SAR BTEX PHCs (F_1-F_4) Metals Chloride	Soil Groundwater

Contaminants of Potential Concern

Based on the APECs identified on the Phase II Property, the contaminants of potential concern (CPCs) are:

- Benzene, Toluene, Ethylbenzene and Xylenes (BTEX);
- Petroleum hydrocarbons (PHCs, Fractions F_1-F_4);
- Polycyclic Aromatic Hydrocarbons (PAHs);
- Metals (including mercury and hexavalent chromium);
- Electrical Conductivity (EC) and Sodium Adsorption Ratio (SAR);
- Chlorides.

These CPCs are potentially present in soil and/or groundwater beneath the Phase II Property.

Subsurface Structures and Utilities

The Phase II Property is undeveloped land with presently no services on-site. It is expected that upon development, the subject land will be municipally serviced.

Physical Setting

Site Stratigraphy

The site stratigraphy, from ground surface to the deepest aquifer or aquitard investigated, is illustrated on Drawings PE4886-5A and PE4886-5B. The stratigraphy consists of:

- Fill material generally comprised of silty sand and/or silty clay, crushed stone, gravel, organics with occasional fragments of wood, brick and plastic extended to depths ranging from approximately 3.69 to 6.10 m below the existing grade. Groundwater was encountered in this unit at BH1-20 and BH2-20.
- Silty clay was identified beneath the fill material and terminated at 15.54 to 15.85m below the existing grade. Groundwater was encountered in this unit at BH3-20.

Hydrogeological Characteristics

Groundwater at the Phase II Property was encountered within the fill material and the native soil (silty clay). This unit is interpreted to function as a local aquifer at the subject site.

Water levels were measured at the subject site on July 17, 2020. Based on the groundwater elevations measured, the groundwater contour mapping was completed and the horizontal hydraulic gradient for the subject site was calculated. Groundwater flow at the subject site was in a northerly direction, with a hydraulic gradient of approximately 0.031m/m.

The groundwater contours for the subject site are shown on Drawing PE4886-3.

Approximate Depth to Bedrock

Bedrock was not encountered during the subsurface program, however, a DPCT was conducted and reached refusal at approximately 36.98 mgbs, where bedrock beneath the Phase II Property was inferred.

Approximate Depth to Water Table

Depth to water table at the subject site varies between approximately 4.51 to 4.93 mbgs.

Sections 41 and 43.1 of the Regulation

Section 41 of the Regulation (Site Condition Standards, Environmentally Sensitive Areas) applies to the Phase II Property as it is situated in the Petrie Island Wetland.

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

Fill Placement

Fill material was identified across the Phase II Property at depths ranging from 3.69 to 6.10 mbgs. The fill material consisted of silty sand and/or silty clay with gravel, crushed stones, fragments of plastic and shale with some organics and wood, which had been imported on to the site from 1990 to 2014.

Proposed Buildings and Other Structures

It is our understanding that the Phase II Property will be redeveloped with a condominium occupying the majority of the southern half of the Phase II Property.

Existing Buildings and Structures

There are no buildings or structures present on the Phase II Property.

Areas of Natural Significance and Water Bodies

The Phase II Property is situated in the Petrie Island Wetland, which is a designated provincially significant wetland.

Environmental Condition

Areas Where Contaminants are Present

PHC-F2, PAHs, Metals, EC and SAR concentrations in the soil are in excess of the selected MECP Table 1 Residential Standards in the fill material across the Phase II Property.

Sodium, chloride and uranium concentrations in the groundwater beneath the Phase II Property were in excess of the MECP Table 1 Standards.

Types of Contaminants

The contaminants present in the soil/fill material in excess of the selected standards include: PHC (F2), EC, SAR, Metals (Barium, Chromium, Cobalt, Cyanide, Molybdenum, and Vanadium) and PAHs (Acenaphthene, Anthracene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b,j)fluoranthene, Fluoranthene, Fluorene, Indeno(1,2,3-cd)pyrene, Naphthalene, Phenanthrene and Pyrene.

The contaminants present in groundwater include sodium and chloride concentrations.

Contaminated Media

Some of the fill material across the Phase II Property is impacted with PHCs, Metals, PAHs and EC and/or SAR concentrations.

Groundwater is contaminated with sodium, chloride and uranium concentrations.

Known Areas Where Contaminants Are Present

Contaminants are present in the fill material and groundwater beneath the Phase II Property.

Distribution and Migration of Contaminants

The impacted soil appears to be confined to the fill material due to importation of fil material of an unknown quality with no indications of distribution of contaminants into the groundwater. Therefore, concerns regarding the distribution or migration of contaminants is not considered to have likely occurred on the Phase II Property.

Discharge of Contaminants

The impacted fill material containing metals, PAHs and PHCs (F2) is a result of importing fill of unknown quality on-site. EC and SAR contaminants present in the soil/fill material is likely a result of the salt dome located upgradient from the Phase II Property. It is expected that groundwater level fluctuates throughout the year and as such, it is likely that the EC and SAR impact extends into the native soils.

The groundwater impacts are primarily a result of the salt dome as well.

Climatic and Meteorological Conditions

In general, climatic and meteorological conditions have the potential to affect contaminant distribution. Two (2) ways by which climatic and meteorological conditions may affect contaminant distribution include the downward leaching of contaminants by means of the infiltration of precipitation, and the migration of contaminants via groundwater levels and/or flow, which may fluctuate seasonally. Based on the analytical results, it is expected that leaching may have occurred. It is likely possible that dye to leaching that EC and SAR impacts extends beyond the fill material and into the native soil.

Potential for Vapour Intrusion

The Phase II Property is vacant and undeveloped land, therefore, concern regarding potential of vapour intrusion does not apply to the Phase II Property.

6.0 CONCLUSIONS

Assessment

A Phase II ESA was conducted for the vacant, southern portion of 1009 Trim Road, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address the areas of potential environmental concern (APECs) on the subject property that were identified during the Phase I ESA.

The subsurface investigation was carried out in conjunction with a Geotechnical Investigation. The field program consisted of drilling four (4) boreholes, three (3) of which were completed as groundwater monitoring wells. Boreholes were drilled to depths ranging from approximately 15.54 to 15.85 m below the ground surface (mbgs).

The soil profile generally consists of fill material consisting of silty clay, crushed stone, gravel and traces of brick and plastic fragments, wood, organics and shale. The fill was underlain by native silty clay. Bedrock was not encountered, however, based on the DPCT, refusal was attained at 36.98mbgs, where bedrock was inferred.

Four (4) soil samples were submitted for laboratory analysis of benzene, toluene, ethylbenzene and xylenes (BTEX), petroleum hydrocarbons (PHCs, F_1-F_4) and metals as well as electrical conductivity (EC) and sodium adsorption ratio (SAR). No detectable BTEX concentrations were identified in the soil samples, and thus, they complied with the MECP Table 3 Standards. PHC-F2, PAHs Metals, EC and SAR concentrations in several soil samples were in excess of the selected MECP Table 1 Residential Standards.

Groundwater samples were recovered from all three (3) wells including a monitoring well that was drilled in 2016, MW16-4 and analyzed for BTEX, PHC, Metals and Sodium concentrations. No free-phase product was observed on the groundwater at any of the monitoring well locations during the groundwater sampling events. Test results for BTEX and PHCs as well as metals, except sodium, were incompliance with the selected MECP Table 1 Standards. Sodium, chloride and uranium concentrations were in excess of the Table 1 Standards.

Recommendations

Soil

Fill material across the Phase II Property is impacted with metals, PAHs, PHC (F2), EC and SAR concentrations in excess of the MECP Table 1 Residential Standards. It is possible that the impacts may have migrated into the native soil, as the site is situated in highly variable area where the water table can fluctuate significantly. It is our recommendation that the impacted fill/soil material be removed from the subject site during the redevelopment process. The excavation of the soil from the property should be monitored and confirmed by Paterson. Soil/fill in excess of the selected standards will need to be removed and disposed of at an approved waste disposal facility.

Testing of the underlying native soil will be required in conjunction with the excavation program to segregate clean soil from impacted spoil and for final confirmatory purposes.

Groundwater

Remediation of the groundwater using a licenced hauling company pumping from the excavation may be a viable option, depending upon the groundwater level at the time of the remediation, however, if a significant volume of water is anticipated, a pump and treat system would likely be more economical. Depending upon the methodology selected, post remediation groundwater monitoring may be required for up to 12 months in support of a Record of Site Condition. There is a possibility that groundwater remediation may not be a viable option, in which case, a risk assessment will be required to address the contamination.

Monitoring Wells

It is our recommendation that the monitoring wells installed on the subject site should remain viable for future monitoring. If they are not going to be used in the future, or will be entirely removed, they should be abandoned according to Ontario Regulation 903. The wells will be registered with the MECP under this regulation.

7.0 STATEMENT OF LIMITATIONS

This Phase II - Environmental Site Assessment report has been prepared 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 Starwood Group Inc. Notification from Starwood Group Inc. and Paterson Group will be required to release this report to any other party.

Paterson Group Inc.

Mandy Witteman, M.A.Sc.

Mark S. D'Arcy, P.Eng.

Report Distribution:

- Starwood Group Inc.
- Paterson Group

FIGURES

FIGURE 1 – KEY PLAN

Drawing PE4886-3 – Test Hole Location Plan and Groundwater Contour Plan

Drawing PE4886-4 – Analytical Testing Plan – Soil (Metals)

Drawing PE4886-4A – Cross-Section A-A' – Soil (Metals)

Drawing PE4886-4B – Cross-Section B-B' – Soil (Metals)

Drawing PE4886-5 – Analytical Testing Plan – Soil (PHCs)

Drawing PE4886-5A – Cross-Section A-A' – Soil (PHCs)

Drawing PE4886-5B – Cross-Section B-B' – Soil (PHCs)

Drawing PE4886-6 – Analytical Testing Plan – Soil (PAHs)

Drawing PE4886-6A – Cross-Section A-A' – Soil (PAHs)

Drawing PE4886-7 – Analytical Testing Plan – Soil (BTEX)

Drawing PE4886-7A – Cross-Section A-A' – Soil (BTEX)

Drawing PE4886-7B – Cross-Section B-B' – Soil (BTEX)

FIGURES

Drawing PE4886-8 – Analytical Testing Plan – Groundwater (Metals)

Drawing PE4886-8A – Cross-Section A-A’ – Groundwater (Metals)

Drawing PE4886-8B – Cross-Section B-B’ – Groundwater (Metals)

Drawing PE4886-9 – Analytical Testing Plan – Groundwater (BTEX, PHCs, PAHs)

Drawing PE4886-9A – Cross-Section A-A’ – Groundwater (BTEX, PHCs, PAHs)

Drawing PE4886-9B – Cross-Section B-B’ – Groundwater (BTEX, PHCs, PAHs)

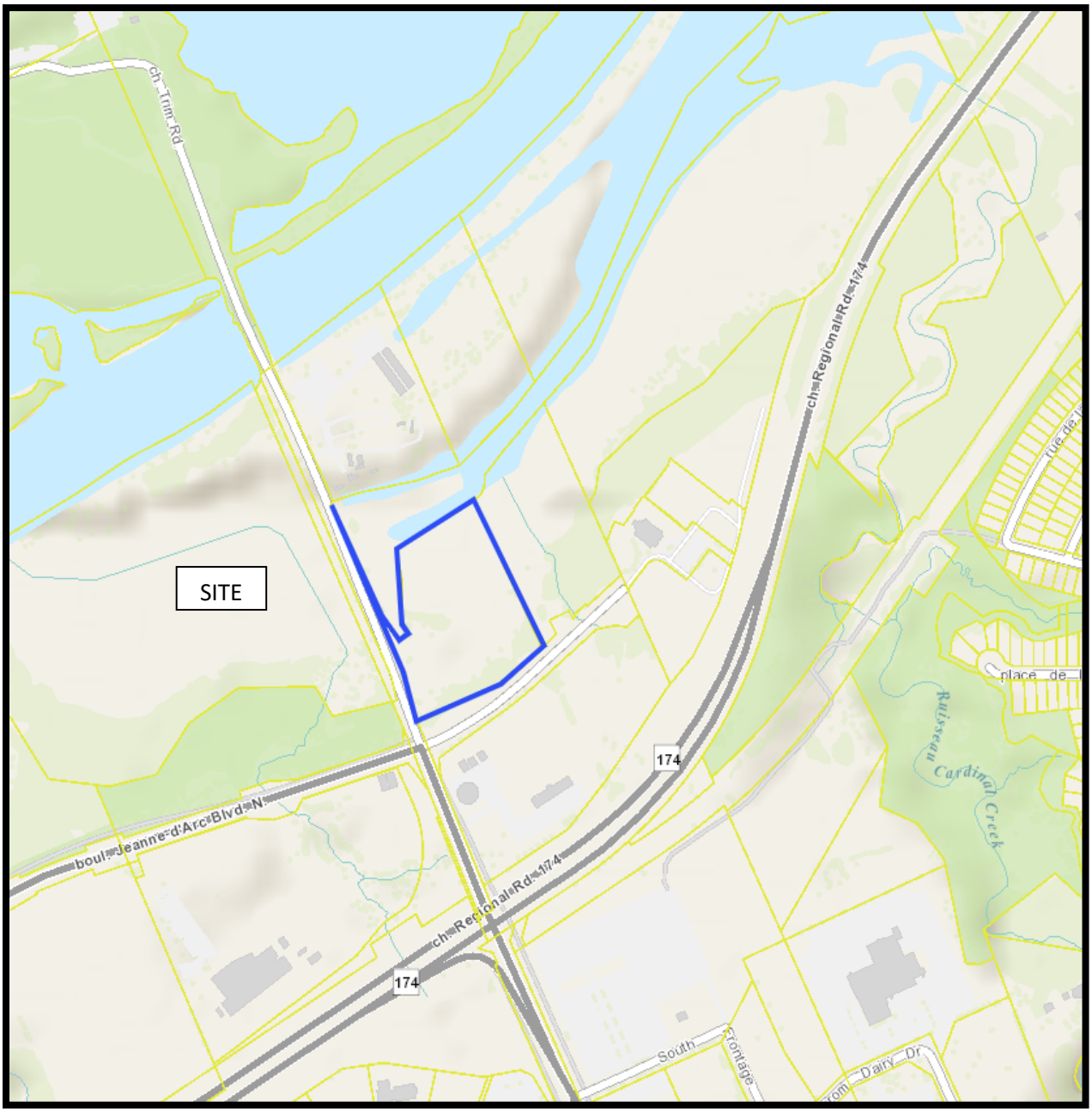
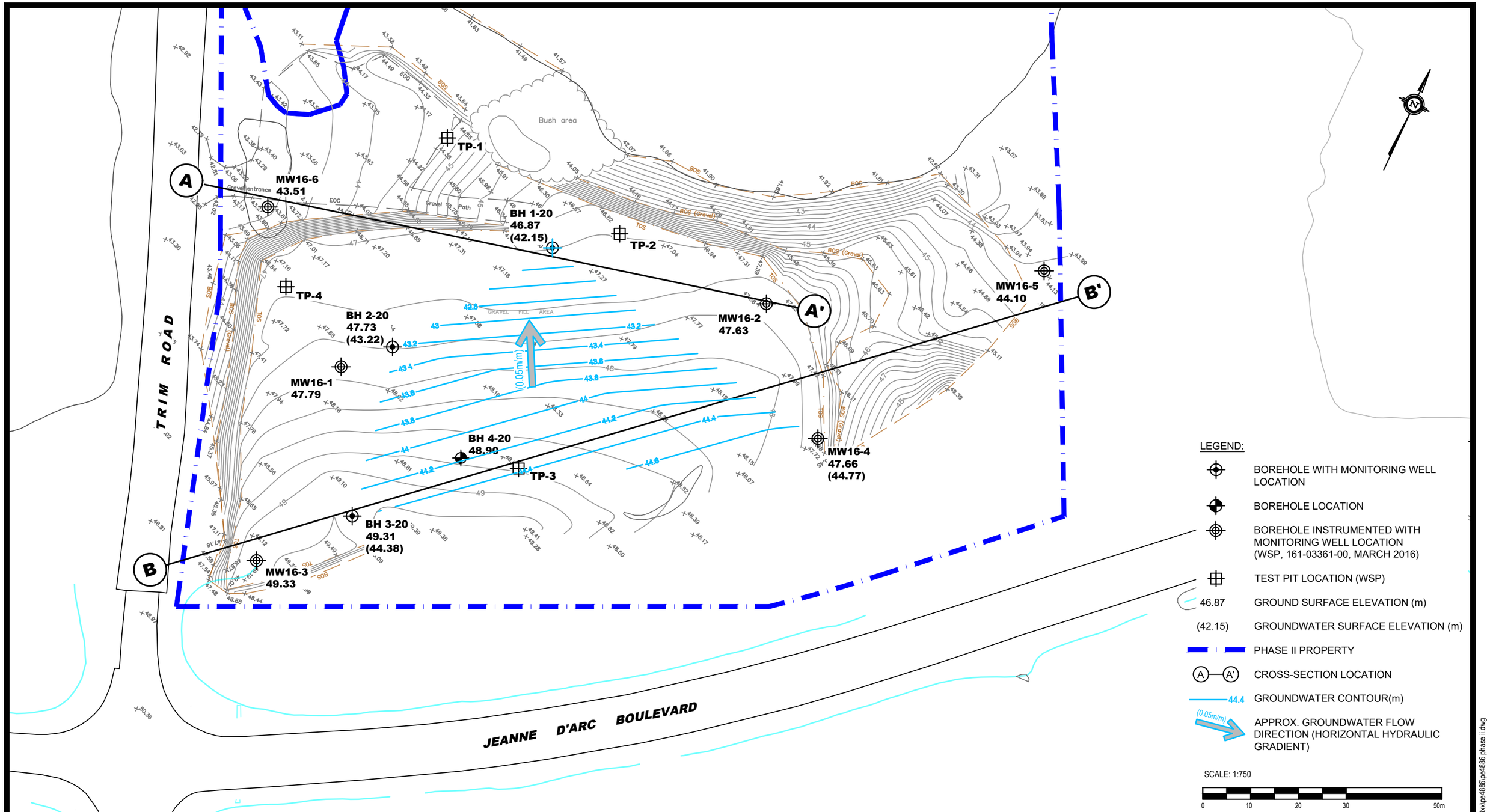


FIGURE 1

KEY PLAN



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NO.	REVISIONS	DATE	INITIAL
0			

STARWOOD GROUP INC

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
SOUTHERN PORTION OF 1009 TRIM ROAD

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:750	Date: 08/2020
Drawn by: MPG	Report No.: PE4886-2
Checked by: MW	Dwg. No.: PE4886-3
Approved by: MSD	Revision No.:

11x17

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MW16-6-2	0.76-1.37m	23-March-16
Parameter	Results (ug/g)	MECP (ug/g)
EC (uS/cm)	820	570
SAR	10	2.4

All other metals comply with MECP Table 1 Standards

MW16-6-4	2.28-2.89m	23-March-16
Parameter	Results (ug/g)	MECP (ug/g)
Chromium	120	70
Cyanide	24	21
Vanadium	100	86
EC (uS/cm)	1400	570
SAR	11	2.4

All other metals comply with MECP Table 1 Standards

TP-1-2	1.52-1.82m	21-March-16
Parameter	Results (ug/g)	MECP (ug/g)
Barium	270	220
Chromium	90	70
Vanadium	99	86

All other metals comply with MECP Table 1 Standards
EC/SAR comply with MECP Table 1 Standards

TP-1-3	3.66-3.96m	21-March-16
Parameter	Results (ug/g)	MECP (ug/g)
Barium	240	220
Chromium	110	70
Molybdenum	2	2.3
Vanadium	110	86
EC (uS/cm)	740	570
SAR	23	2.4

All other metals comply with MECP Table 1 Standards

TP-4-2	3.66-3.96m	21-March-16

Metals comply with MECP Table 1 Standards
EC/SAR comply with MECP Table 1 Standards

TP-4-2 (DUP)	3.66-3.96m	21-March-16
Parameter	Results (ug/g)	MECP (ug/g)
Barium	260	220

All other metals comply with MECP Table 1 Standards
EC/SAR comply with MECP Table 1 Standards

TP-4-4	6.10-6.40m	21-March-16
Parameter	Results (ug/g)	MECP (ug/g)
SAR	7.9	2.4

All other metals comply with MECP Table 1 Standards
EC comply with MECP Table 1 Standards

BH3-20-SS5	3.05-3.66m	29-June-20

EC/SAR comply with MECP Table 1 Standards

BH4-20-SS4	2.29-2.89m	29-June-20
Parameter	Results (ug/g)	MECP (ug/g)
Barium	287	220
Chromium	96.5	70
Vanadium	89.2	86

All other metals comply with MECP Table 1 Standards
EC/SAR comply with MECP Table 1 Standards

TP-2-1	1.53-1.83m	21-March-16

Metals comply with MECP Table 1 Standards
EC/SAR comply with MECP Table 1 Standards

TP-2-2	3.05-3.35m	21-March-16
Parameter	Results (ug/g)	MECP (ug/g)
Chromium	74	70
EC (uS/cm)	650	570
SAR	8.4	2.4

All other metals comply with MECP Table 1 Standards

BH1-20-SS5	3.05-3.66m	29-June-20

EC/SAR comply with MECP Table 1 Standards

BH2-20-SS5	3.05-3.66m	30-June-20
Parameter	Results (ug/g)	MECP (ug/g)
EC (uS/cm)	880	570
SAR	4.85	2.4

TP-3-1	3.05-3.35m	21-March-16
Parameter	Results (ug/g)	MECP (ug/g)
Barium	340	220
Chromium	100	70
Cobalt	22	21
Vanadium	99	86
SAR	9.3	2.4

All other metals comply with MECP Table 1 Standards
EC comply with MECP Table 1 Standards

TP-3-4	7.01-7.31m	21-March-16
Parameter	Results (ug/g)	MECP (ug/g)
Barium	230	220
Chromium	150	70
Cobalt	28	21
Vanadium	110	86
SAR	4.5	2.4

All other metals comply with MECP Table 1 Standards
EC comply with MECP Table 1 Standards

MW16-2-1	0.0-0.61m	23-March-16

Metals comply with MECP Table 1 Standards
EC/SAR comply with MECP Table 1 Standards

MW16-2-5	3.05-3.66m	23-March-16
Parameter	Results (ug/g)	MECP (ug/g)
Barium	250	220
Chromium	110	70
Cobalt	22	21
Vanadium	94	86
EC (uS/cm)	1500	570
SAR	14	2.4

All other metals comply with MECP Table 1 Standards

MW16-5-2	0.76-1.37m	22-March-16
Parameter	Results (ug/g)	MECP (ug/g)
Chromium	100	70
Cobalt	25	21
Vanadium	110	86
EC (uS/cm)	1100	570
SAR	20	2.4

All other metals comply with MECP Table 1 Standards

MW16-5-7	4.57-5.18m	22-March-16
Parameter	Results (ug/g)	MECP (ug/g)
Barium	250	220
Chromium	140	70
Cobalt	26	21
Vanadium	110	86
EC (uS/cm)	920	570
SAR	6	2.4

All other metals comply with MECP Table 1 Standard

MW16-4-2	0.76-1.37m	22-March-16

Metals comply with MECP Table 1 Standards
EC/SAR comply with MECP Table 1 Standards

MW16-4-5	3.05-3.66m	23-March-16
Parameter	Results (ug/g)	MECP (ug/g)
Barium	280	220
Chromium	140	70
Cobalt	25	21
Vanadium	110	86
EC (uS/cm)	1600	570
SAR	44	2.4

All other metals comply with MECP Table 1 Standards

MW16-6
43.51

TP-1

TP-2

TP-4

BH 1-20
46.87
(42.15)

BH 2-20
47.73
(43.22)

MW16-1
47.79

MW16-2
47.63

MW16-5
44.10

MW16-4
47.66

BH 4-20
48.90

TP-3

BH 3-20
49.31
(44.38)

MW16-3
49.33

Bush area

Gravel entrance

Gravel Path

TRIM ROAD

JEANNE D'ARC BOULEVARD

LEGEND:

SOIL PARAMETERS COMPLY WITH MECP TABLE 1 STANDARDS

SOIL PARAMETERS EXCEED MECP TABLE 1 STANDARDS

- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION
- BOREHOLE INSTRUMENTED WITH MONITORING WELL LOCATION (WSP, 161-03361-00, MARCH 2016)
- TEST PIT LOCATION (WSP)
- 46.87 GROUND SURFACE ELEVATION (m)
- (42.15) GROUNDWATER SURFACE ELEVATION (m)
- PHASE II PROPERTY

SCALE: 1:750

0 10 20 30 50m

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NO.	REVISIONS	DATE	INITIAL
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STARWOOD GROUP INC

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
SOUTHERN PORTION OF 1009 TRIM ROAD

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL (METALS)

Scale:	Date:
1:750	08/2020
Drawn by: MPG	Report No.: PE4886-2
Checked by: MW	Dwg. No.: PE4886-4
Approved by: MSD	Revision No.:

11x17

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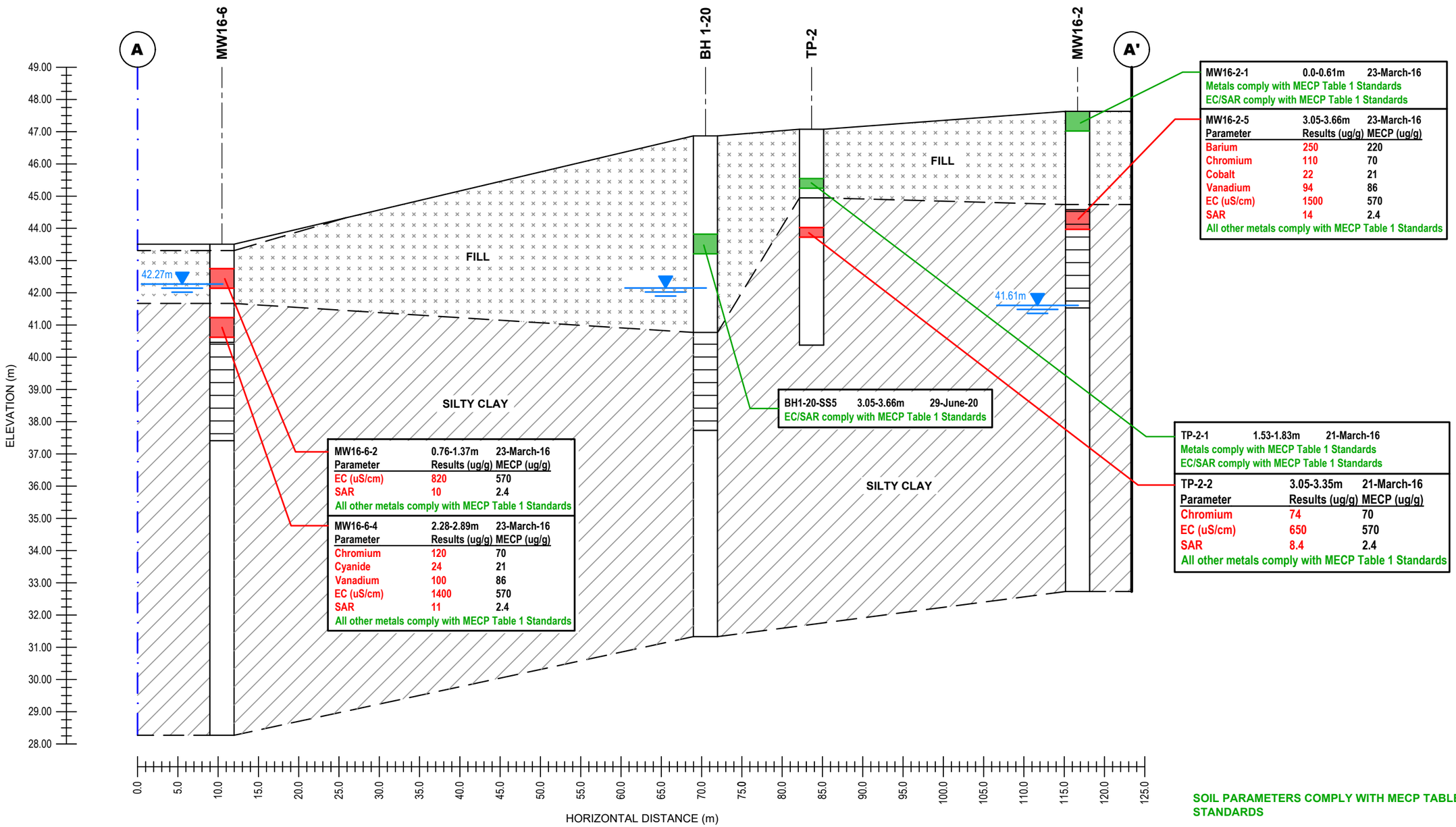

MW16-6-2 0.76-1.37m 23-March-16

Parameter	Results (ug/g)	MECP (ug/g)
EC (uS/cm)	820	570
SAR	10	2.4

All other metals comply with MECP Table 1 Standards

MW16-6-4 2.28-2.89m 23-March-16

Parameter	Results (ug/g)	MECP (ug/g)
Chromium	120	70
Cyanide	24	21
Vanadium	100	86
EC (uS/cm)	1400	570
SAR	11	2.4

All other metals comply with MECP Table 1 Standards

BH1-20-SS5 3.05-3.66m 29-June-20
EC/SAR comply with MECP Table 1 Standards

MW16-2-1 0.0-0.61m 23-March-16
Metals comply with MECP Table 1 Standards
EC/SAR comply with MECP Table 1 Standards

MW16-2-5 3.05-3.66m 23-March-16

Parameter	Results (ug/g)	MECP (ug/g)
Barium	250	220
Chromium	110	70
Cobalt	22	21
Vanadium	94	86
EC (uS/cm)	1500	570
SAR	14	2.4

All other metals comply with MECP Table 1 Standards

TP-2-1 1.53-1.83m 21-March-16
Metals comply with MECP Table 1 Standards
EC/SAR comply with MECP Table 1 Standards

TP-2-2 3.05-3.35m 21-March-16

Parameter	Results (ug/g)	MECP (ug/g)
Chromium	74	70
EC (uS/cm)	650	570
SAR	8.4	2.4

All other metals comply with MECP Table 1 Standards

SOIL PARAMETERS COMPLY WITH MECP TABLE 1 STANDARDS

SOIL PARAMETERS EXCEED MECP TABLE 1 STANDARDS

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STARWOOD GROUP INC

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
SOUTHERN PORTION OF 1009 TRIM ROAD

OTTAWA, ONTARIO

Title:

CROSS-SECTION A-A' - SOIL (METALS)

Scale: AS SHOWN	Date: 08/2020
Drawn by: MPG	Report No.: PE4886-2
Checked by: MW	Dwg. No.: PE4886-4A
Approved by: MSD	Revision No.:

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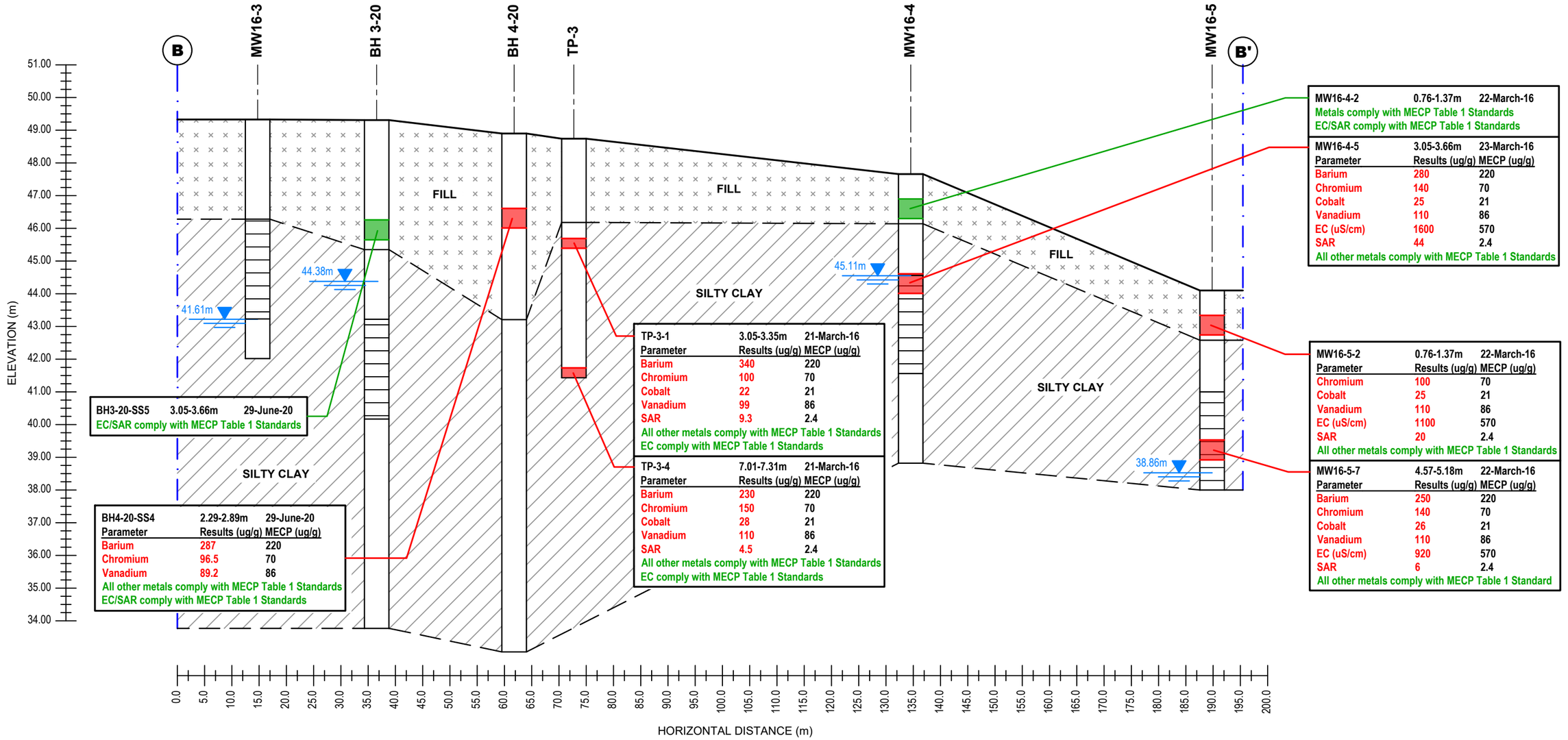

BH3-20-SS5 3.05-3.66m 29-June-20
EC/SAR comply with MECP Table 1 Standards

BH4-20-SS4	2.29-2.89m	29-June-20
Parameter	Results (ug/g)	MECP (ug/g)
Barium	287	220
Chromium	96.5	70
Vanadium	89.2	86

All other metals comply with MECP Table 1 Standards
EC/SAR comply with MECP Table 1 Standards

TP-3-1	3.05-3.35m	21-March-16
Parameter	Results (ug/g)	MECP (ug/g)
Barium	340	220
Chromium	100	70
Cobalt	22	21
Vanadium	99	86
SAR	9.3	2.4

All other metals comply with MECP Table 1 Standards
EC comply with MECP Table 1 Standards

TP-3-4	7.01-7.31m	21-March-16
Parameter	Results (ug/g)	MECP (ug/g)
Barium	230	220
Chromium	150	70
Cobalt	28	21
Vanadium	110	86
SAR	4.5	2.4

All other metals comply with MECP Table 1 Standards
EC comply with MECP Table 1 Standards

MW16-4-2 0.76-1.37m 22-March-16
Metals comply with MECP Table 1 Standards
EC/SAR comply with MECP Table 1 Standards

MW16-4-5	3.05-3.66m	23-March-16
Parameter	Results (ug/g)	MECP (ug/g)
Barium	280	220
Chromium	140	70
Cobalt	25	21
Vanadium	110	86
EC (uS/cm)	1600	570
SAR	44	2.4

All other metals comply with MECP Table 1 Standards

MW16-5-2	0.76-1.37m	22-March-16
Parameter	Results (ug/g)	MECP (ug/g)
Chromium	100	70
Cobalt	25	21
Vanadium	110	86
EC (uS/cm)	1100	570
SAR	20	2.4

All other metals comply with MECP Table 1 Standards

MW16-5-7	4.57-5.18m	22-March-16
Parameter	Results (ug/g)	MECP (ug/g)
Barium	250	220
Chromium	140	70
Cobalt	26	21
Vanadium	110	86
EC (uS/cm)	920	570
SAR	6	2.4

All other metals comply with MECP Table 1 Standard

SOIL PARAMETERS COMPLY WITH MECP TABLE 1 STANDARDS

SOIL PARAMETERS EXCEED MECP TABLE 1 STANDARDS

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STARWOOD GROUP INC

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
SOUTHERN PORTION OF 1009 TRIM ROAD

OTTAWA, ONTARIO

Title:

CROSS-SECTION B-B' - SOIL (METALS)

Scale: AS SHOWN	Date: 08/2020
Drawn by: MPG	Report No.: PE4886-2
Checked by: MW	Dwg. No.: PE4886-4B
Approved by: MSD	Revision No.:

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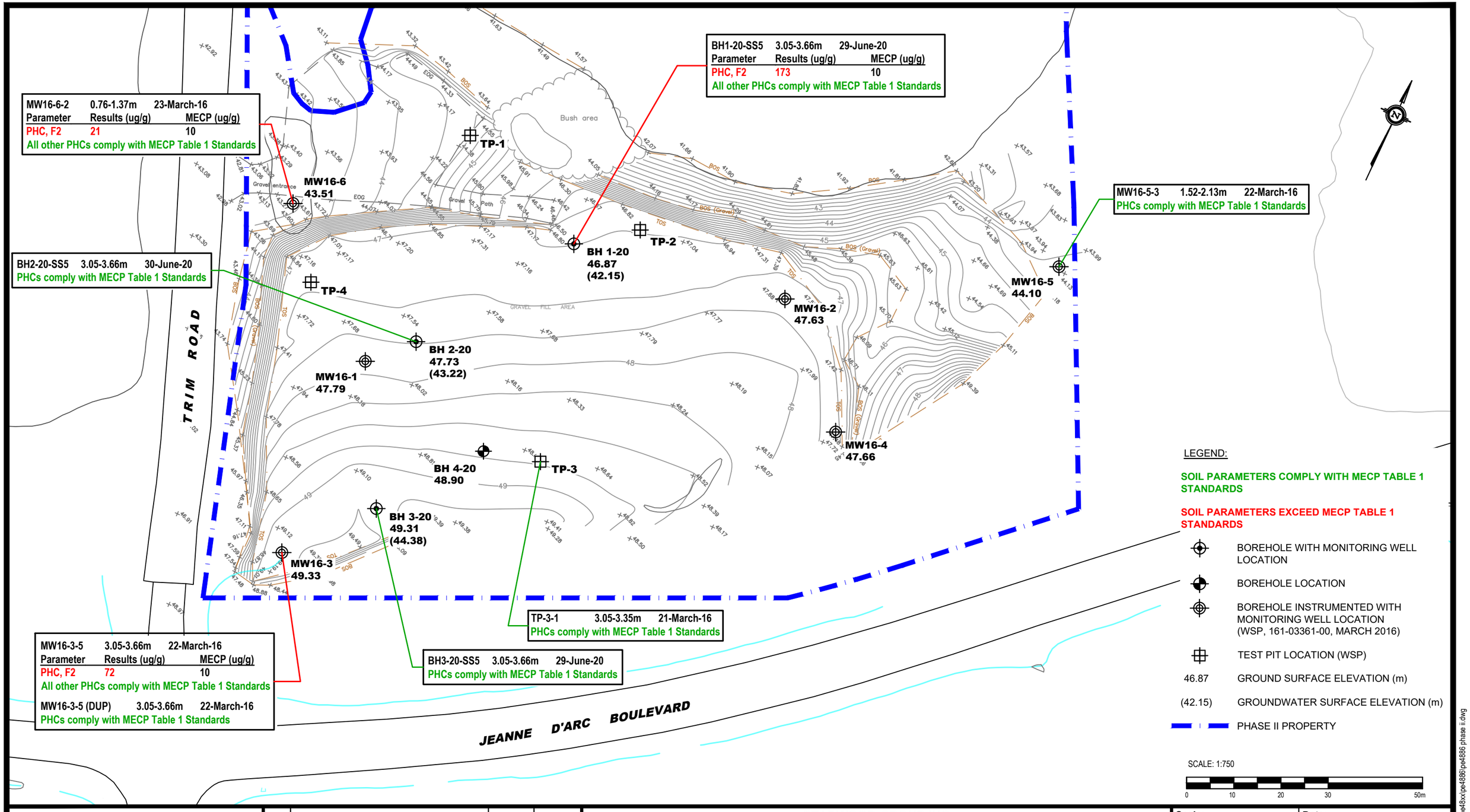

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
SOUTHERN PORTION OF 1009 TRIM ROAD

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL (PHCs)

Scale: 1:750	Date: 08/2020
Drawn by: MPG	Report No.: PE4886-2
Checked by: MW	Dwg. No.: PE4886-5
Approved by: MSD	Revision No.:

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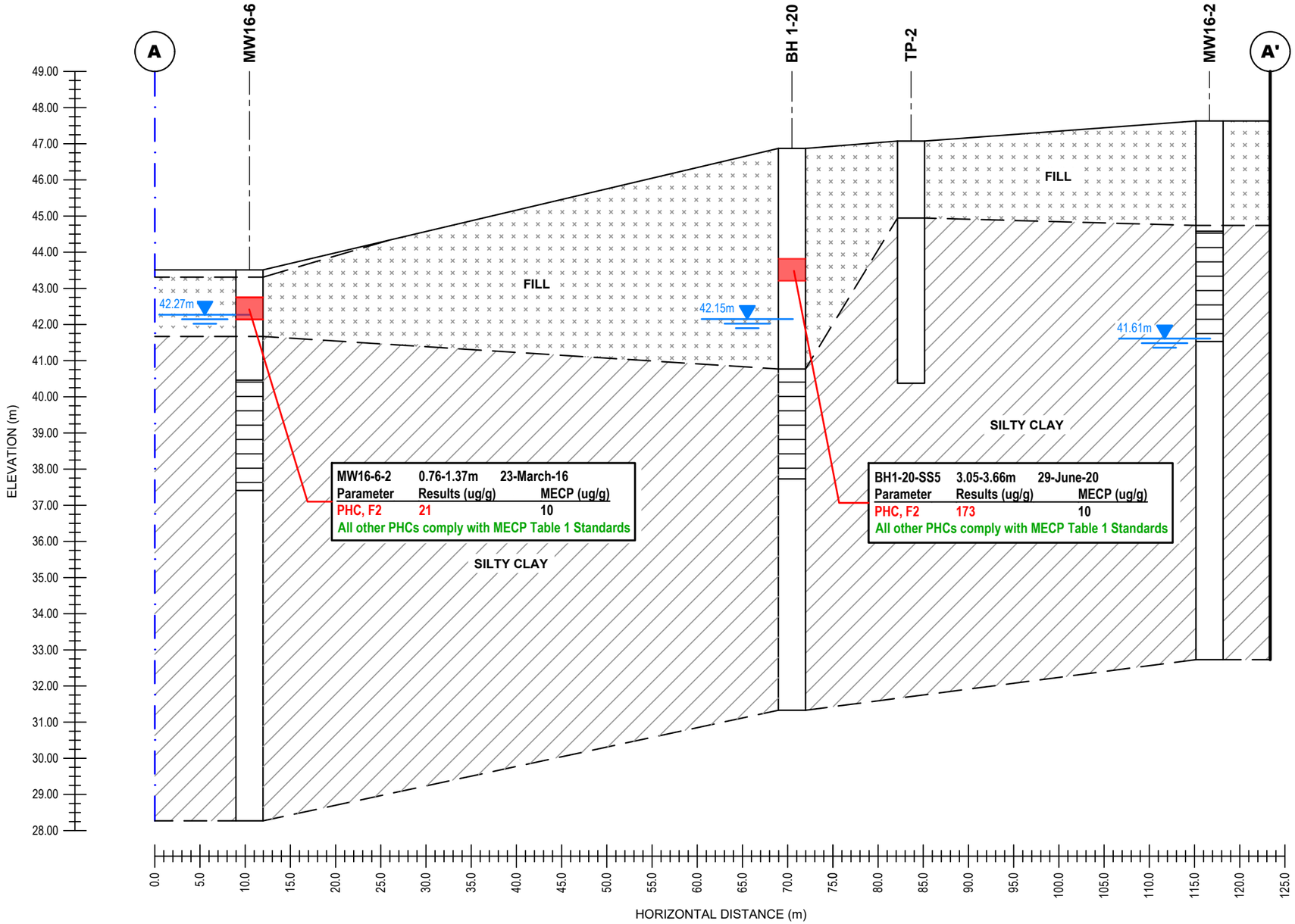

SOIL PARAMETERS COMPLY WITH MECP TABLE 1 STANDARDS

SOIL PARAMETERS EXCEED MECP TABLE 1 STANDARDS

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
SOUTHERN PORTION OF 1009 TRIM ROAD

OTTAWA, ONTARIO

Title:

CROSS-SECTION A-A' - SOIL (PHCs)

Scale: AS SHOWN	Date: 08/2020
Drawn by: MPG	Report No.: PE4886-2
Checked by: MW	Dwg. No.: PE4886-5A
Approved by: MSD	Revision No.:

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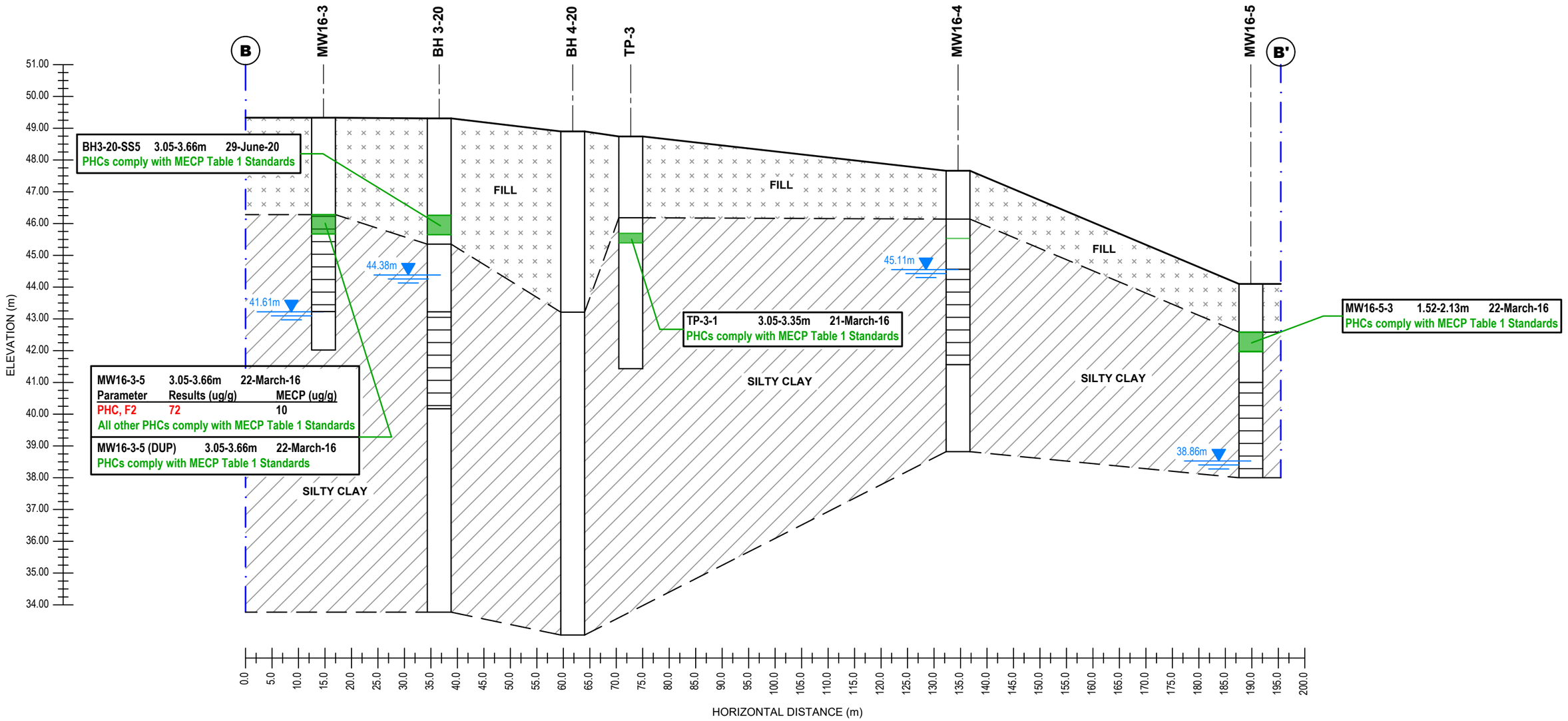

SOIL PARAMETERS COMPLY WITH MECP TABLE 1 STANDARDS

SOIL PARAMETERS EXCEED MECP TABLE 1 STANDARDS

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STARWOOD GROUP INC

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
SOUTHERN PORTION OF 1009 TRIM ROAD

OTTAWA, ONTARIO

Title:

CROSS-SECTION B-B' - SOIL (PHCs)

Scale: AS SHOWN	Date: 08/2020
Drawn by: MPG	Report No.: PE4886-2
Checked by: MW	Dwg. No.: PE4886-5B
Approved by: MSD	Revision No.:

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MW16-6-2	0.76-1.37m	23-March-16
Parameter	Results (ug/g)	MECP (ug/g)
Acenaphthene	0.22	0.072
Anthracene	0.37	0.16
Benzo(a)anthracene	0.85	0.36
Benzo(a)pyrene	0.75	0.3
Benzo(b,j)fluoranthene	0.69	0.47
Fluoranthene	1.5	0.56
Fluorene	0.27	0.12
Indeno(1,2,3-cd)pyrene	0.4	0.23
Naphthalene	0.1	0.09
Phenanthrene	1.2	0.69
Pyrene	1.5	1.0
All other PAHs comply with MECP Table 1 Standards		

TP-4-3 4.57-4.87m 21-March-16
PAHs comply with MECP Table 1 Standards

TP-4-3 (DUP) 4.57-4.87m 21-March-16
PAHs comply with MECP Table 1 Standards

TP-2-2 3.05-3.35m 23-March-16
PAHs comply with MECP Table 1 Standards

BH2-20-SS5 3.05-3.66m 30-June-20
PAHs comply with MECP Table 1 Standards

MW16-2-2 0.76-1.37m 23-March-16
PAHs comply with MECP Table 1 Standards

MW16-2-4 2.28-2.98m 23-March-16
PAHs comply with MECP Table 1 Standards

MW16-6 43.51
MW16-5 44.10
MW16-2 47.63
MW16-4 47.66
MW16-1 47.79
MW16-3 49.33
TP-1
TP-2
TP-3
TP-4
BH 1-20 46.87 (42.15)
BH 2-20 47.73 (43.22)
BH 3-20 49.31 (44.38)
BH 4-20 48.90

Bush area
Gravel entrance
Gravel Path
GRAVEL FILL AREA
TRIM ROAD
JEANNE D'ARC BOULEVARD

LEGEND:

SOIL PARAMETERS COMPLY WITH MECP TABLE 1 STANDARDS

SOIL PARAMETERS EXCEED MECP TABLE 1 STANDARDS

- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION
- BOREHOLE INSTRUMENTED WITH MONITORING WELL LOCATION (WSP, 161-03361-00, MARCH 2016)
- TEST PIT LOCATION (WSP)
- 46.87 GROUND SURFACE ELEVATION (m)
- (42.15) GROUNDWATER SURFACE ELEVATION (m)
- PHASE II PROPERTY

SCALE: 1:750

0 10 20 30 50m

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STARWOOD GROUP INC

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
SOUTHERN PORTION OF 1009 TRIM ROAD

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL (PAHs)

Scale: 1:750	Date: 08/2020
Drawn by: MPG	Report No.: PE4886-2
Checked by: MW	Dwg. No.: PE4886-6
Approved by: MSD	Revision No.:

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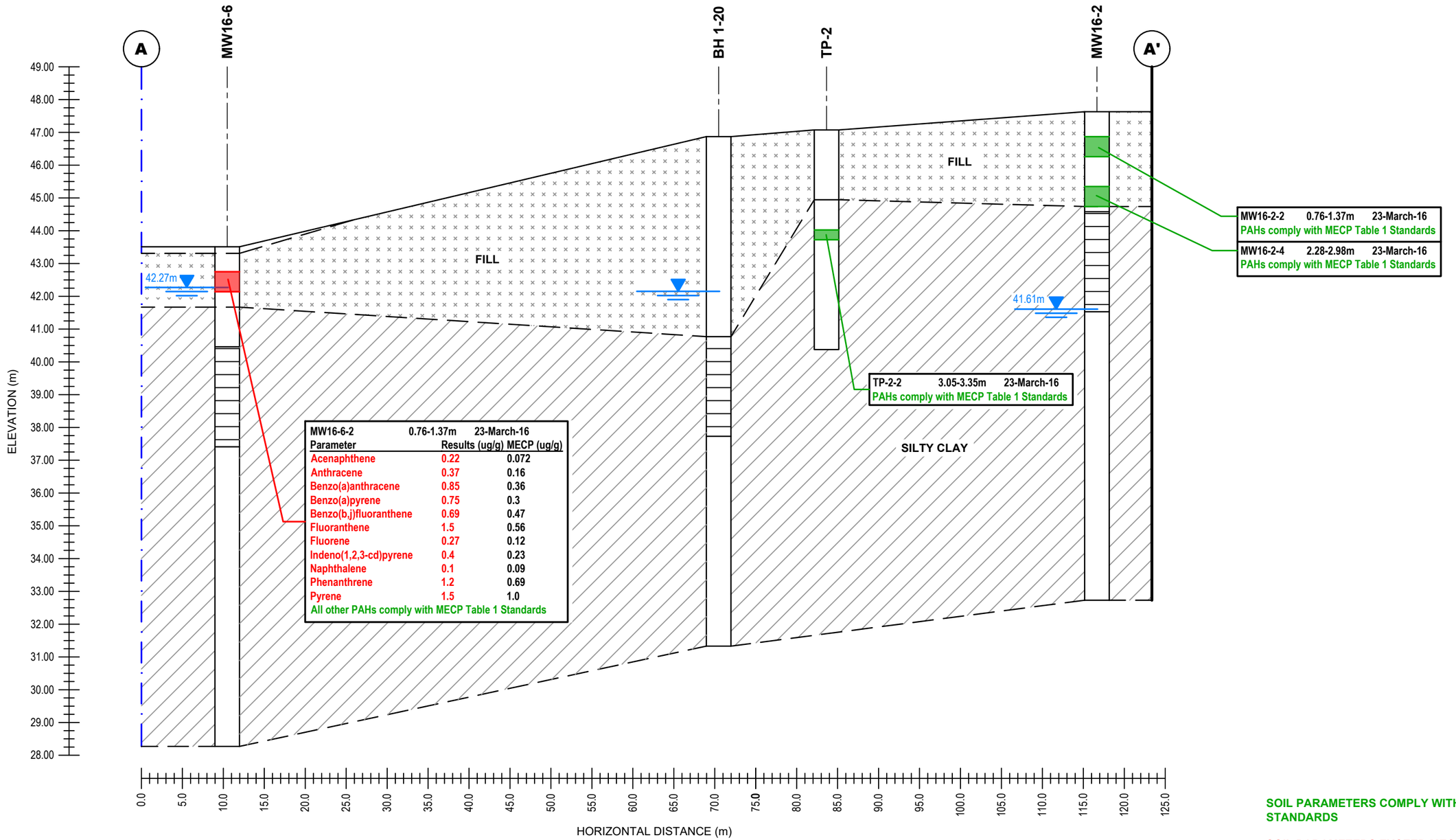

SOIL PARAMETERS COMPLY WITH MECP TABLE 1 STANDARDS

SOIL PARAMETERS EXCEED MECP TABLE 1 STANDARDS

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STARWOOD GROUP INC

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
SOUTHERN PORTION OF 1009 TRIM ROAD

OTTAWA, ONTARIO

Title:

CROSS-SECTION A-A' - SOIL (PAHs)

Scale: AS SHOWN	Date: 08/2020
Drawn by: MPG	Report No.: PE4886-2
Checked by: MW	Dwg. No.: PE4886-6A
Approved by: MSD	Revision No.:

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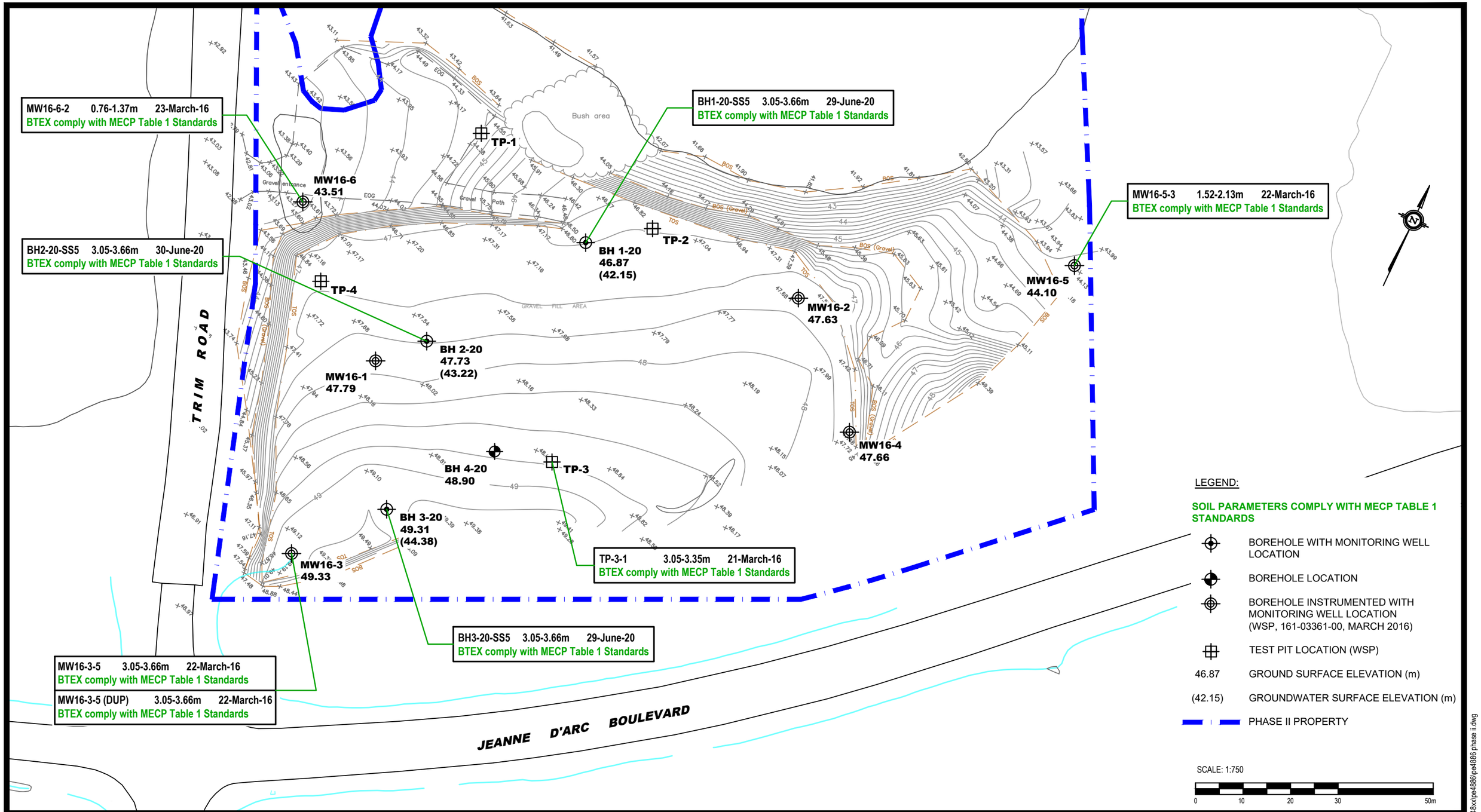

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STARWOOD GROUP INC

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
SOUTHERN PORTION OF 1009 TRIM ROAD

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL (BTEX)

Scale: 1:750	Date: 08/2020
Drawn by: MPG	Report No.: PE4886-2
Checked by: MW	Dwg. No.: PE4886-7
Approved by: MSD	Revision No.:

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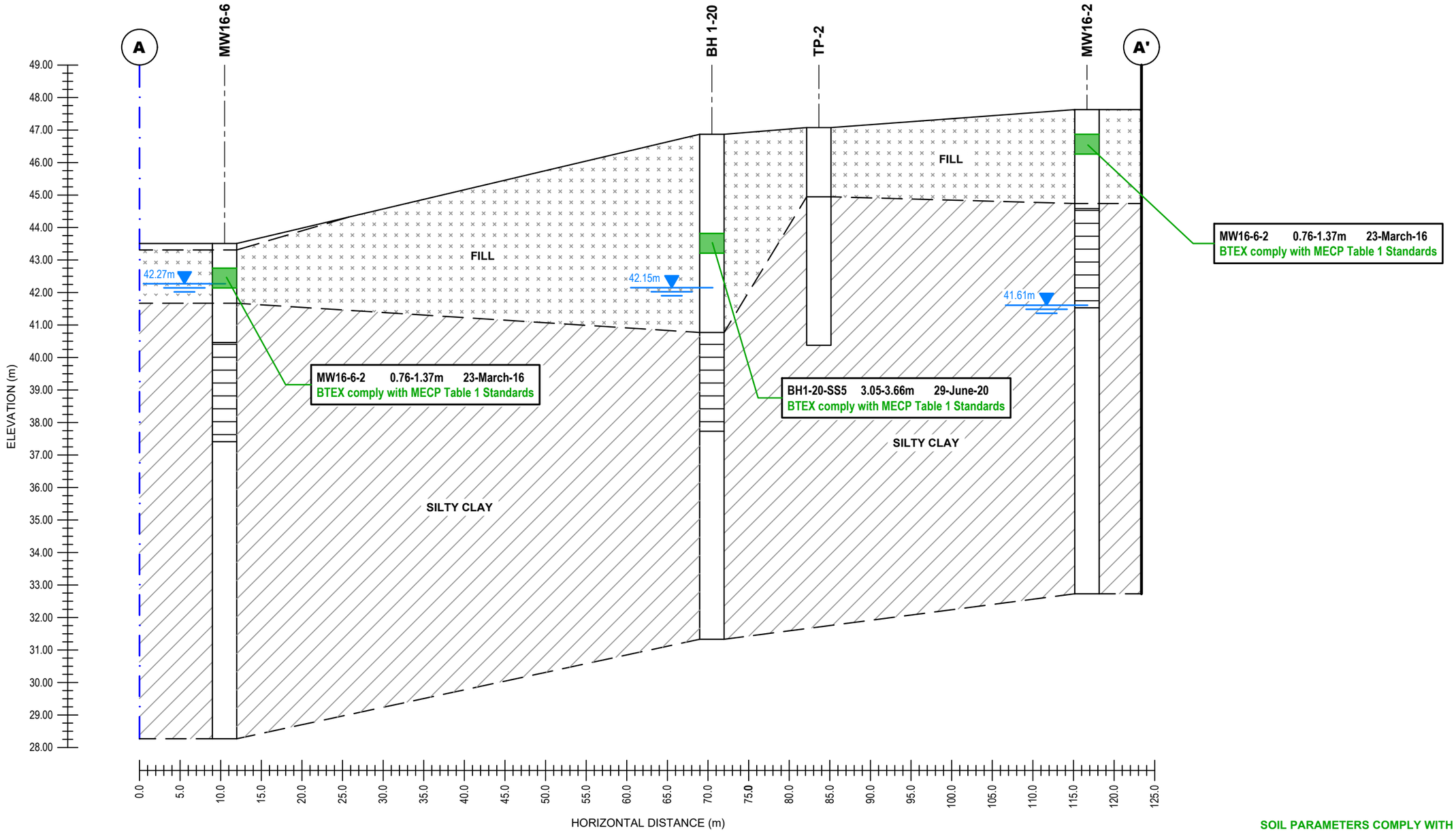

SOIL PARAMETERS COMPLY WITH MECP TABLE 1 STANDARDS

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STARWOOD GROUP INC

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
SOUTHERN PORTION OF 1009 TRIM ROAD

OTTAWA, ONTARIO

Title:

CROSS-SECTION A-A' - SOIL (BTEX)

Scale: AS SHOWN	Date: 08/2020
Drawn by: MPG	Report No.: PE4886-2
Checked by: MW	Dwg. No.: PE4886-7A
Approved by: MSD	Revision No.:

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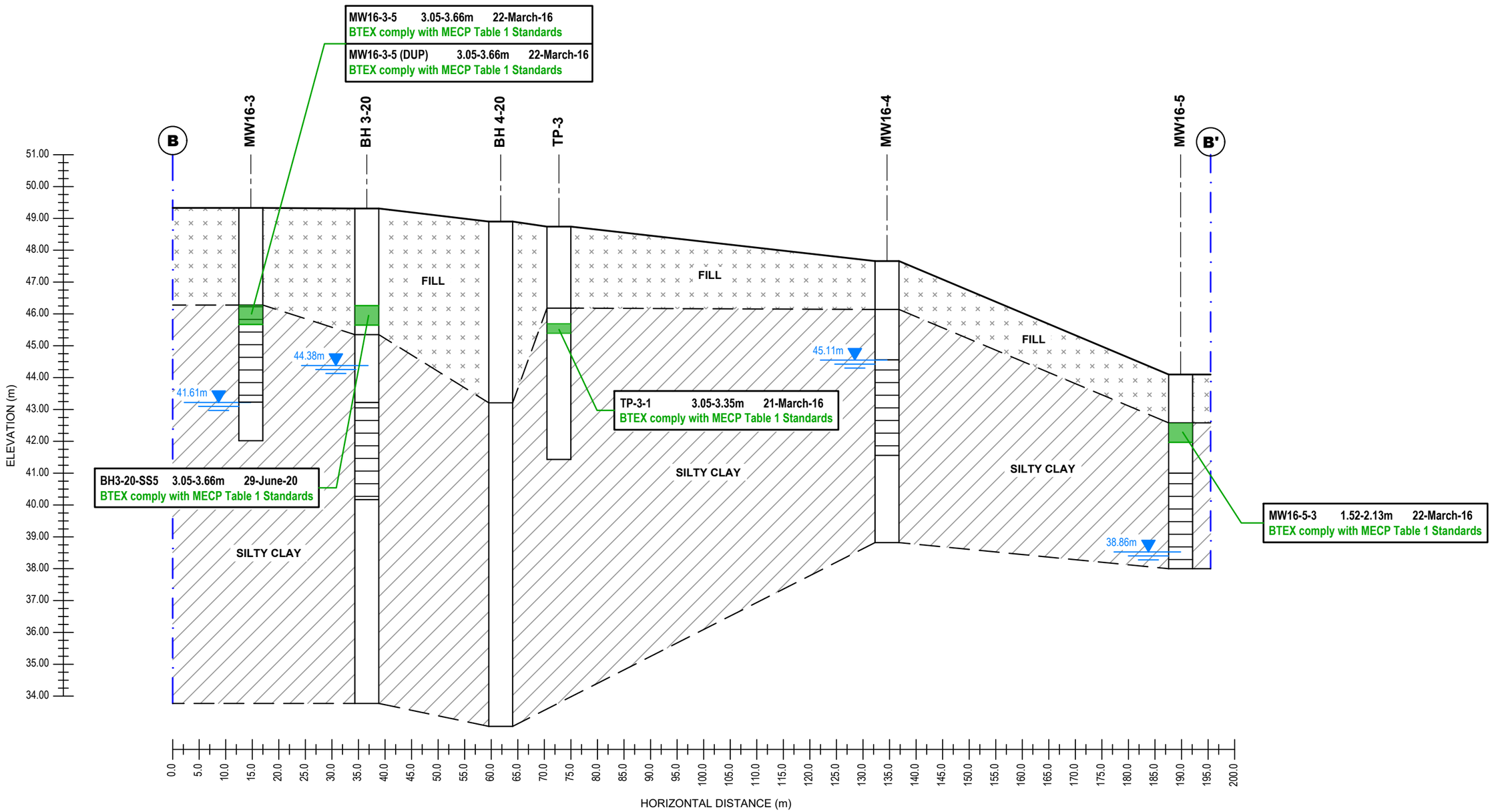

SOIL PARAMETERS COMPLY WITH MECP TABLE 1 STANDARDS

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NO.	REVISIONS	DATE	INITIAL
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STARWOOD GROUP INC
PHASE II - ENVIRONMENTAL SITE ASSESSMENT
SOUTHERN PORTION OF 1009 TRIM ROAD
OTTAWA, ONTARIO
Title:
CROSS-SECTIONB-B' - SOIL (BTEX)

Scale: AS SHOWN	Date: 08/2020
Drawn by: MPG	Report No.: PE4886-2
Checked by: MW	Dwg. No.: PE4886-7B
Approved by: MSD	Revision No.:

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MW16-6	3.10-6.10m	7-April-16
Parameter	Results (ug/L)	MECP (ug/L)
Chloride	2,500,000	790,000
Metals comply with MECP Table 1 Standards		

MW16-6 (DUP)	3.10-6.10m	7-April-16
Parameter	Results (ug/L)	MECP (ug/L)
Chloride	2,500,000	790,000
Metals comply with MECP Table 1 Standards		

BH2-20-GW1	6.09-9.14m	17-July-20
Parameter	Results (ug/L)	MECP (ug/L)
Chloride	1,180,000	790,000
Sodium	736,000	490,000
All other metals comply with MECP Table 1 Standards		

MW16-3	3.10-6.10m	7-April-16
Parameter	Results (ug/L)	MECP (ug/L)
Chloride	3,700,000	790,000
Metals comply with MECP Table 1 Standards		

BH3-20-GW1	6.09-9.14m	17-July-20
Parameter	Results (ug/L)	MECP (ug/L)
Chloride	1,310,000	790,000
Sodium	561,000	490,000
All other metals comply with MECP Table 1 Standards		

MW16-2	3.05-6.05m	7-April-16
Parameter	Results (ug/L)	MECP (ug/L)
Chloride	940,000	790,000
Metals comply with MECP Table 1 Standards		

BH1-20-GW1	6.09-9.14m	17-July-20
Chloride comply with MECP Table 1 Standards		
Metals comply with MECP Table 1 Standards		

MW16-5	3.10-6.10m	7-April-16
Chloride comply with MECP Table 1 Standards		
Metals comply with MECP Table 1 Standards		

MW16-4	3.10-6.10m	7-April-16
Parameter	Results (ug/L)	MECP (ug/L)
Chloride	1,700,000	790,000
Metals comply with MECP Table 1 Standards		

MW16-4-GW1	3.10-6.10m	17-July-20
Parameter	Results (ug/L)	MECP (ug/L)
Chloride	1,166,000	790,000
Sodium	822,000	490,000
Uranium	12.6	8.9
All other metals comply with MECP Table 1 Standards		

MW16-6 43.51
TP-1
TP-2
BH 1-20 46.87 (42.15)
TP-4
BH 2-20 47.73 (43.22)
MW16-1 47.79
MW16-2 47.63
MW16-5 44.10
MW16-4 47.66
BH 4-20 48.90
TP-3
BH 3-20 49.31 (44.38)
MW16-3 49.33

Bush area
Gravel entrance
Gravel Path
GRAVEL TRAIL AREA
TRIM ROAD
JEANNE D'ARC BOULEVARD

LEGEND:

GROUNDWATER PARAMETERS COMPLY WITH MECP TABLE 1 STANDARDS

GROUNDWATER PARAMETERS EXCEED MECP TABLE 1 STANDARDS

- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION
- BOREHOLE INSTRUMENTED WITH MONITORING WELL LOCATION (WSP, 161-03361-00, MARCH 2016)
- TEST PIT LOCATION (WSP)
- 46.87 GROUND SURFACE ELEVATION (m)
- (42.15) GROUNDWATER SURFACE ELEVATION (m)
- PHASE II PROPERTY

SCALE: 1:750

0 10 20 30 50m

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STARWOOD GROUP INC

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
SOUTHERN PORTION OF 1009 TRIM ROAD

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - GROUNDWATER (METALS)

Scale: 1:750	Date: 08/2020
Drawn by: MPG	Report No.: PE4886-2
Checked by: MW	Dwg. No.: PE4886-8
Approved by: MSD	Revision No.:

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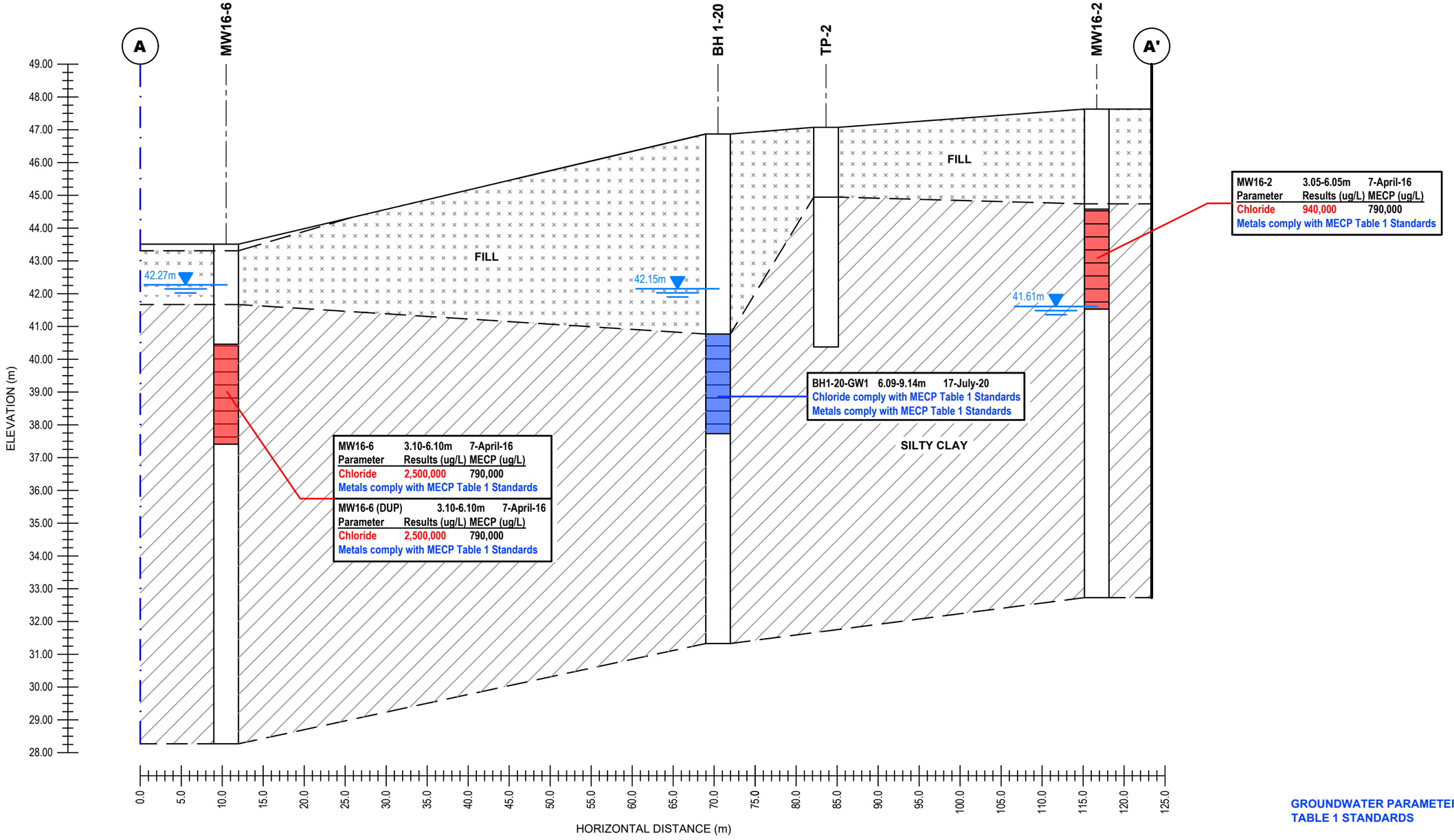

GROUNDWATER PARAMETERS COMPLY WITH MECP TABLE 1 STANDARDS

GROUNDWATER PARAMETERS EXCEED MECP TABLE 1 STANDARDS

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STARWOOD GROUP INC

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
SOUTHERN PORTION OF 1009 TRIM ROAD

OTTAWA, ONTARIO

Title:

CROSS-SECTION A-A' - GROUNDWATER (METALS)

Scale: AS SHOWN	Date: 08/2020
Drawn by: MPG	Report No.: PE4886-2
Checked by: MW	Dwg. No.: PE4886-8A
Approved by: MSD	Revision No.:

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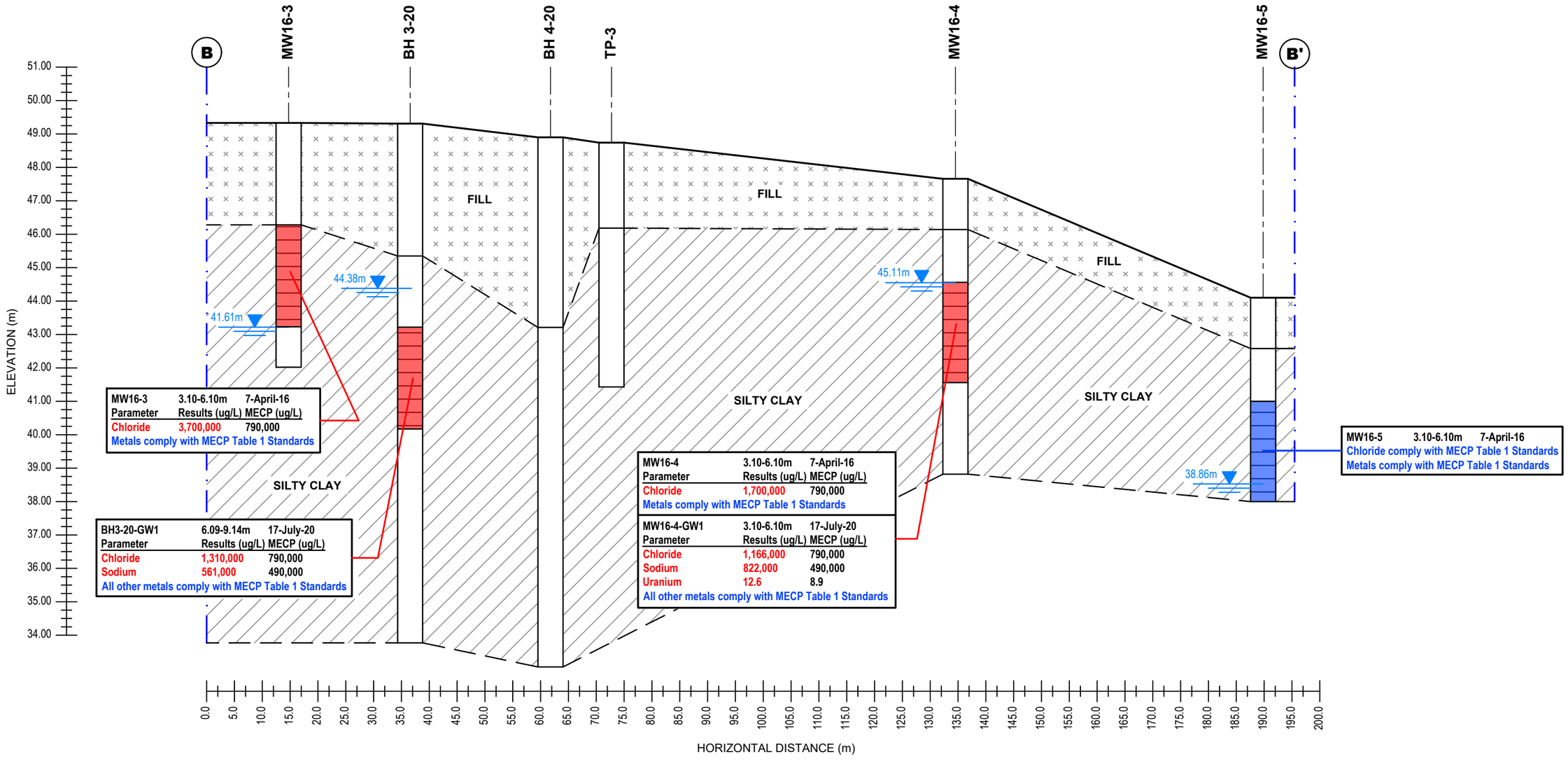

GROUNDWATER PARAMETERS COMPLY WITH MECP TABLE 1 STANDARDS

GROUNDWATER PARAMETERS EXCEED MECP TABLE 1 STANDARDS

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STARWOOD GROUP INC

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
SOUTHERN PORTION OF 1009 TRIM ROAD

OTTAWA, ONTARIO

Title:

CROSS-SECTION B-B' - GROUNDWATER (METALS)

Scale: AS SHOWN	Date: 08/2020
Drawn by: MPG	Report No.: PE4886-2
Checked by: MW	Dwg. No.: PE4886-8B
Approved by: MSD	Revision No.:

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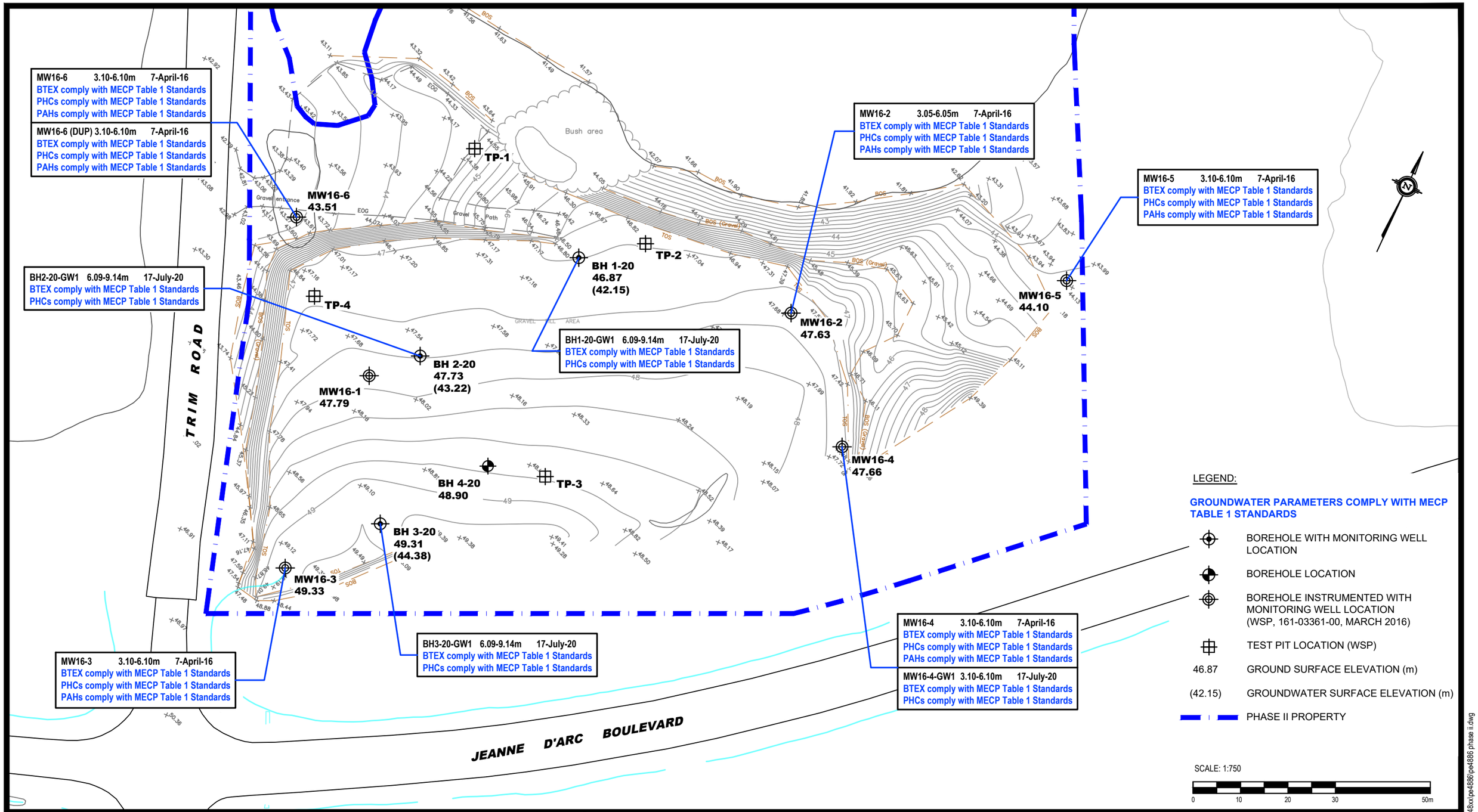

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STARWOOD GROUP INC

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
SOUTHERN PORTION OF 1009 TRIM ROAD

OTTAWA, ONTARIO

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

Scale: 1:750	Date: 08/2020
Drawn by: MPG	Report No.: PE4886-2
Checked by: MW	Dwg. No.: PE4886-9
Approved by: MSD	Revision No.:

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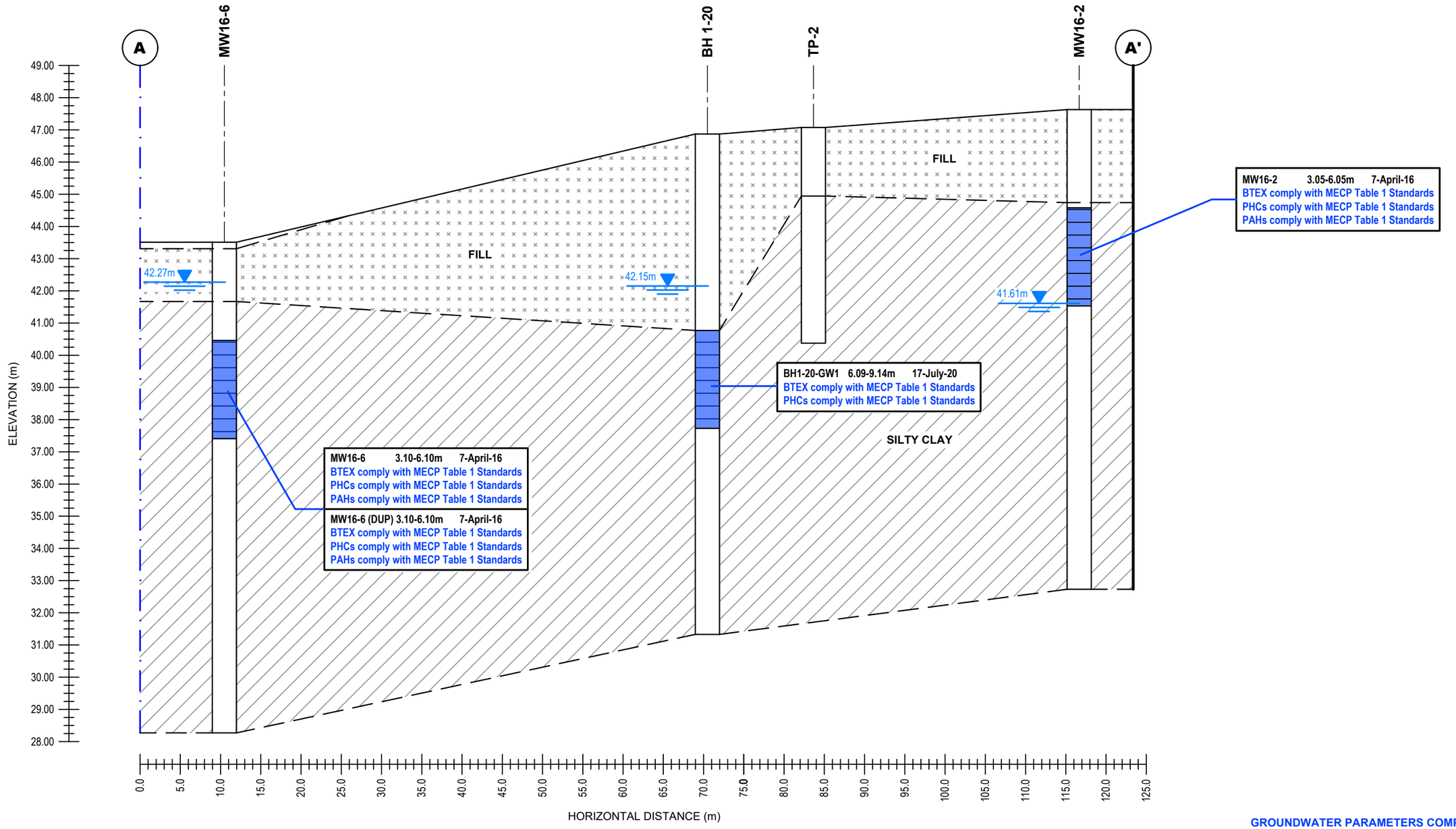

GROUNDWATER PARAMETERS COMPLY WITH MECP TABLE 1 STANDARDS

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consulting engineers

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NO.	REVISIONS	DATE	INITIAL
0			

STARWOOD GROUP INC

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
SOUTHERN PORTION OF 1009 TRIM ROAD

OTTAWA, ONTARIO

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

Scale: AS SHOWN	Date: 08/2020
Drawn by: MPG	Report No.: PE4886-2
Checked by: MW	Dwg. No.: PE4886-9A
Approved by: MSD	Revision No.:

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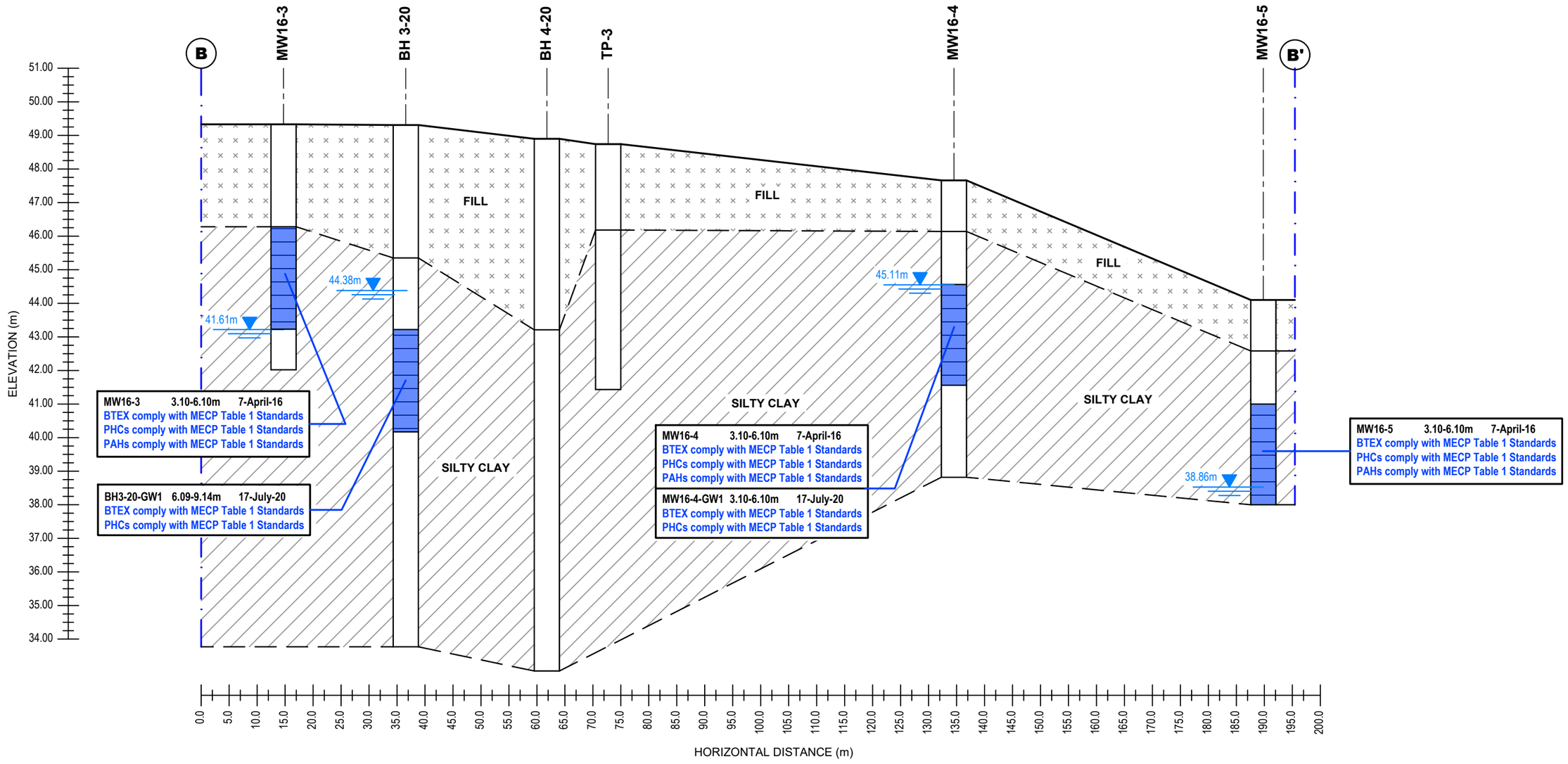

GROUNDWATER PARAMETERS COMPLY WITH MECP TABLE 1 STANDARDS

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STARWOOD GROUP INC

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
SOUTHERN PORTION OF 1009 TRIM ROAD

OTTAWA, ONTARIO

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

Scale: AS SHOWN	Date: 08/2020
Drawn by: MPG	Report No.: PE4886-2
Checked by: MW	Dwg. No.: PE4886-9B
Approved by: MSD	Revision No.:

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APPENDIX 1

SAMPLING AND ANALYSIS PLAN

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

LABORATORY CERTIFICATES OF ANALYSIS

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

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Sampling & Analysis Plan

Phase II Environmental Site Assessment
Southern Portion of 1009 Trim Road

Ottawa, Ontario

Prepared For

Starwood Group Inc.

June 2020

Report: PE4886-SAP

Table of Contents

1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by Mr. Martin Chenier, acting on behalf of Starwood Group Inc. to conduct a Phase II Environmental Site Assessment (ESA) for the southern portion of 1009 Trim Road, in the City of Ottawa, Ontario

The Phase II ESA was carried out to address the APECs identified in the Paterson Phase I ESA as well as for geotechnical purposes. The following subsurface investigation program was developed to identify and delineate any potential concerns:

Borehole	Location & Rationale	Proposed Depth & Rationale
BH1-20	Assess the potential subsurface impacts due to APEC s 1 and 2.	Boreholes to be advanced approximately 15 mbgs to intercept water table to facilitate installation of groundwater monitoring wells.
BH2-20	Assess the potential subsurface impacts due to APEC s 1 and 2.	
BH3-30	Assess the potential subsurface impacts due to APEC s 1 and 2.	
BH4-20	Assess the potential subsurface impacts due to APEC s 1 and 2.	Boreholes to be advanced approximately 15 mbgs for geotechnical purposes.

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

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

2.0 ANALYTICAL TESTING PROGRAM

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

- ❒ At least one sample from each borehole should be submitted, in order to delineate the horizontal extent of contamination across the site.
- ❒ At least one sample from each stratigraphic unit should be submitted, in order to delineate the vertical extent of contamination at the site.
- ❒ In boreholes where there is visual or olfactory evidence of contamination, or where organic vapour meter or photoionization detector readings indicate the presence of contamination, the 'worst-case' sample from each borehole should be submitted for comparison with 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.
- ❒ Parameters analyzed should be consistent with the Contaminants of Potential Concern identified in the Phase I ESA.

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

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

3.0 STANDARD OPERATING PROCEDURES

3.1 Environmental Drilling Procedure

Purpose

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

Equipment

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

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

Determining Borehole Locations

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

After drilling is completed a plan with the borehole locations must be provided. Distances should be measured using a measuring tape or wheel rather than paced off. All borehole elevations are measured geodetically by Paterson personnel.

Drilling Procedure

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

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

Spoon Washing Procedure

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

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

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

Screening Procedure

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

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

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

3.2 Monitoring Well Installation Procedure

Equipment

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

Procedure

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

3.3 Monitoring Well Sampling Procedure

Equipment

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

Sampling Procedure

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

4.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

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

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

5.0 DATA QUALITY OBJECTIVES

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

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

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

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

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

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

These considerations are discussed in the body of the report.

6.0 PHYSICAL IMPEDIMENTS TO SAMPLING & ANALYSIS PLAN

Physical impediments to the Sampling and Analysis plan may include:

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

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1009 Trim Road
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE4886

REMARKS

HOLE NO. BH 1-20

BORINGS BY Track-Mount Power Auger **DATE** June 29, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	46.87
FILL: Brown silty sand with gravel, crushed stone, trace cobbles, boulders and blast rock		AU	1				
1.12		SS	2	57	50+	1	45.87
FILL: Brown/black silty clay with gravel, trace sand, brick, occasional cobbles and boulders		SS	3	58	11	2	44.87
2.13							
FILL: Brown/black sand with crushed stone, shale fragments, some clay, occasional cobbles and boulders		SS	4	50	38	3	43.87
3.05		SS	5	79	14		
FILL: Grey-brown silty clay, some sand, gravel, trace cobbles, plastic, organics		SS	6	75	17	4	42.87
		SS	7	50	P	5	41.87
6.10		SS	8	54	P	6	40.87
		SS	9	88			
		SS	10	92		7	39.87
Hard to very stiff, brown **SILTY CLAY**		SS	11	83		8	38.87
		SS	12	100			
		SS	13	100		9	37.87
- stiff and grey by 8.3m depth						10	36.87
						11	35.87
						12	34.87
						13	33.87
		SS	14	50	P	14	32.87
						15	31.87
15.54							
End of Borehole							
(GWL @ 4.72m - July 17, 2020)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1009 Trim Road
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE4886

REMARKS

HOLE NO. BH 2-20

BORINGS BY Track-Mount Power Auger **DATE** June 30, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	47.73
FILL: Brown silty sand with crushed stone, trace organics, occasional boulders and blast rock		AU	1				
		SS	2	10	13	1	46.73
1.37							
		SS	3	42	18	2	45.73
		SS	4	50	7		
FILL: Brown to grey silty clay, some sand and crushed stone, occasional boulders		SS	5	50	43	3	44.73
		SS	6	17	18	4	43.73
- some wood from 3.8 to 4.1m depth		SS	7	33	3	5	42.73
		SS	8	17	3		
6.10						6	41.73
		SS	9	100	9		
		SS	10	75	P	7	40.73
		SS	11	100	P	8	39.73
Hard to very stiff, brown **SILTY CLAY**		SS	12	100	P		
- stiff and grey by 8.2m depth						9	38.73
						10	37.73
						11	36.73
						12	35.73
		SS	13	100	P		
						13	34.73
						14	33.73
						15	32.73
15.54							
End of Borehole							
(GWL @ 4.51m - July 17, 2020)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1009 Trim Road
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE4886

REMARKS

HOLE NO. BH 3-20

BORINGS BY Track-Mount Power Auger **DATE** July 2, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	49.31
FILL: Brown silty sand with crushed stone, occasional cobbles, boulders and blast rock		AU	1				
		SS	2	33	50+	1	48.31
1.52							
		SS	3	0	10	2	47.31
FILL: Brown sity clay, trace sand, gravel and wood		SS	4	58	3		
		SS	5	83	18	3	46.31
3.96							
		SS	6	75	19	4	45.31
		SS	7	92	16	5	44.31
		SS	8	92	P		
Hard to very stiff, brown **SILTY CLAY**		SS	9	92	P	6	43.31
		SS	10	96	P	7	42.31
		SS	11	92	P	8	41.31
- stiff and grey by 8.4m depth		SS	12	96	P		
		SS	13	100	P	9	40.31
						10	39.31
						11	38.31
						12	37.31
						13	36.31
		SS	14	96	P	14	35.31
						15	34.31
15.54							
Dynamic Cone Penetration Test commenced at 15.54m depth. Practical DCPT refusal at 36.98m depth.							
(GWL @ 4.93m - July 17, 2020)							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1009 Trim Road
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE4886

REMARKS

HOLE NO. BH 4-20

BORINGS BY Track-Mount Power Auger **DATE** June 30, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	48.90
FILL: Brown silty sand, some gravel, trace organics, cobbles and boulders		AU	1				
0.60							
FILL: Brown sand with crushed stone		SS	2	33	14	1	47.90
0.76							
		SS	3	4	9	2	46.90
FILL: Grey-brown silty clay, trace sand, gravel and topsoil		SS	4	75	5		
		SS	5	29	P	3	45.90
		SS	6	92	7	4	44.90
		SS	7	62	4	5	43.90
- trace wood by 5.2m depth		SS	8	88	6		
5.69							
		SS	9	100	P	6	42.90
		SS	10	100	P	7	41.90
		SS	11	100	P	8	40.90
Hard to very stiff, brown **SILTY CLAY**		SS	12	100	P		
		SS	13	83	P	9	39.90
- stiff and grey by 8.7m depth		SS	14	100	P	10	38.90
						11	37.90
						12	36.90
						13	35.90
						14	34.90
						15	33.90
15.85		SS	15	100	P		
Dynamic Cone Penetration Test commenced at 15.85m depth. Practical DCPT refusal at 41.78m depth.							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

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

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

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

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

CONSOLIDATION TEST

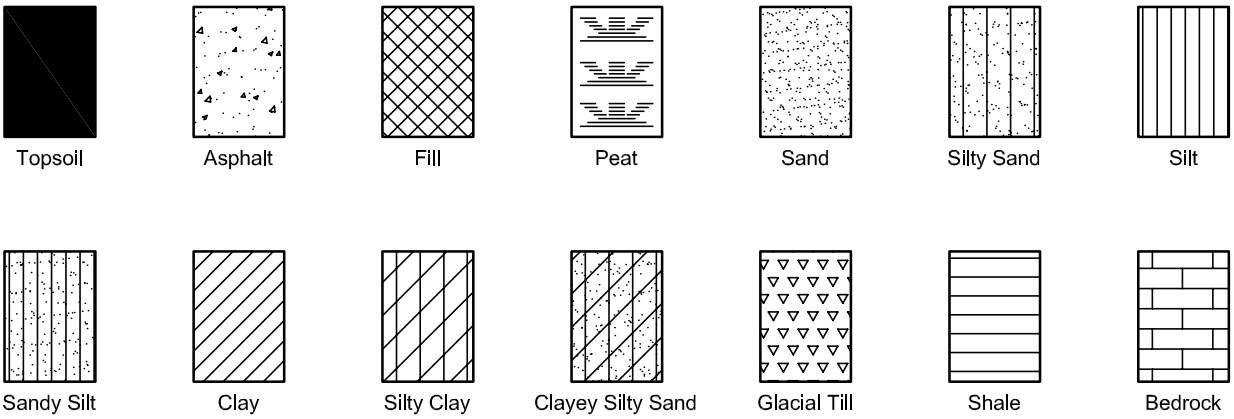
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

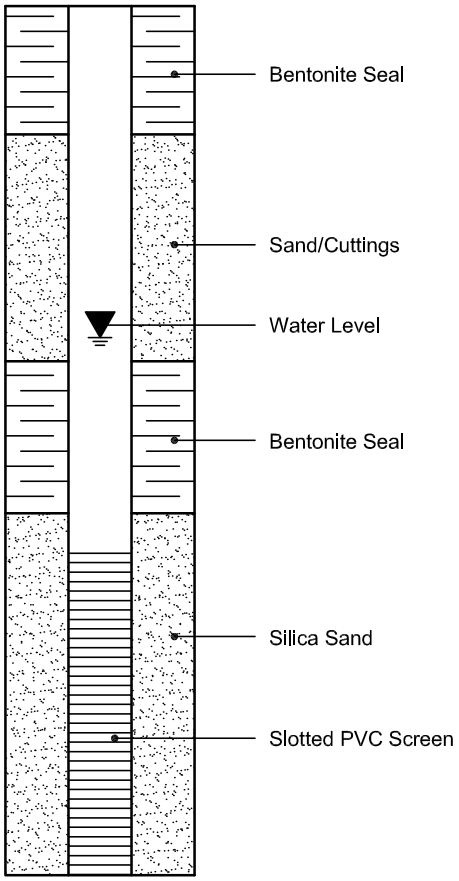
SYMBOLS AND TERMS (continued)

STRATA PLOT

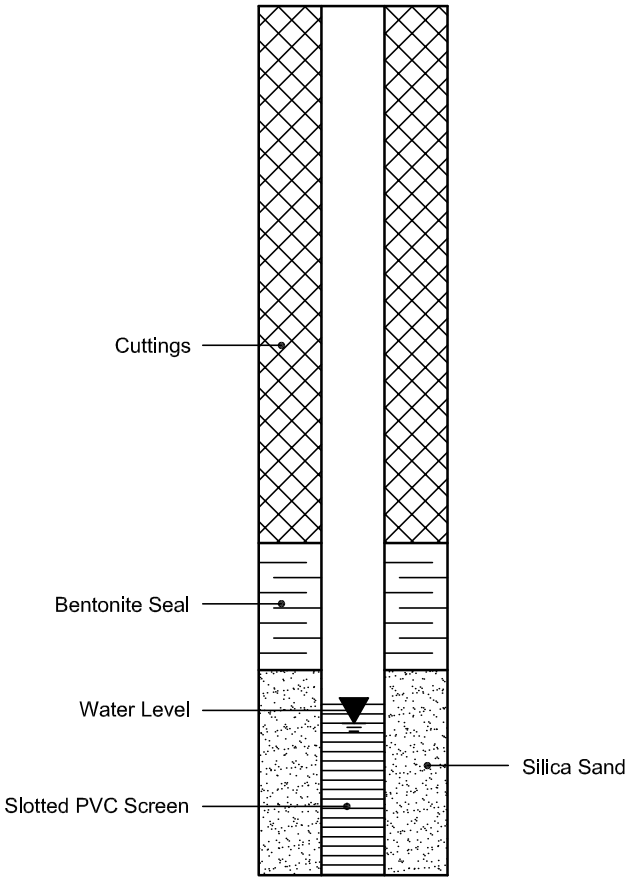


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 30311
Project: PE4886
Custody: 51633

Report Date: 10-Jul-2020
Order Date: 6-Jul-2020

Order #: 2028054

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

Paracel ID	Client ID
2028054-01	BH1-20-SS5
2028054-02	BH2-20-SS5
2028054-03	BH4-20-SS4
2028054-04	BH3-SS5

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Report Date: 10-Jul-2020

Client: Paterson Group Consulting Engineers

Order Date: 6-Jul-2020

Client PO: 30311

Project Description: PE4886

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	6-Jul-20	6-Jul-20
Chromium, hexavalent - soil	MOE E3056 - Extraction, colourimetric	7-Jul-20	8-Jul-20
Conductivity	MOE E3138 - probe @25 °C, water ext	8-Jul-20	8-Jul-20
Mercury by CVAA	EPA 7471B - CVAA, digestion	8-Jul-20	8-Jul-20
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	7-Jul-20	7-Jul-20
PHC F1	CWS Tier 1 - P&T GC-FID	6-Jul-20	6-Jul-20
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	7-Jul-20	8-Jul-20
REG 153: Metals by ICP/MS, soil	EPA 6020 - Digestion - ICP-MS	8-Jul-20	8-Jul-20
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	7-Jul-20	8-Jul-20
SAR	Calculated	8-Jul-20	9-Jul-20
Solids, %	Gravimetric, calculation	10-Jul-20	10-Jul-20

Certificate of Analysis

Report Date: 10-Jul-2020

Client: Paterson Group Consulting Engineers

Order Date: 6-Jul-2020

Client PO: 30311

Project Description: PE4886

	Client ID:	BH1-20-SS5	BH2-20-SS5	BH4-20-SS4	BH3-SS5
	Sample Date:	29-Jun-20 09:00	30-Jun-20 09:00	29-Jun-20 09:00	03-Jul-20 09:00
	Sample ID:	2028054-01	2028054-02	2028054-03	2028054-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	74.5	76.1	73.3	75.8
General Inorganics					
SAR	0.01 N/A	0.93	4.85	0.68	2.00
Conductivity	5 uS/cm	421	880	358	355
pH	0.05 pH Units	7.57	-	-	-
Metals					
Antimony	1.0 ug/g dry	-	-	<1.0	-
Arsenic	1.0 ug/g dry	-	-	3.4	-
Barium	1.0 ug/g dry	-	-	287	-
Beryllium	0.5 ug/g dry	-	-	0.6	-
Boron	5.0 ug/g dry	-	-	<5.0	-
Cadmium	0.5 ug/g dry	-	-	<0.5	-
Chromium	5.0 ug/g dry	-	-	96.5	-
Chromium (VI)	0.2 ug/g dry	-	-	<0.2	-
Cobalt	1.0 ug/g dry	-	-	19.4	-
Copper	5.0 ug/g dry	-	-	42.8	-
Lead	1.0 ug/g dry	-	-	6.7	-
Mercury	0.1 ug/g dry	-	-	<0.1	-
Molybdenum	1.0 ug/g dry	-	-	<1.0	-
Nickel	5.0 ug/g dry	-	-	54.3	-
Selenium	1.0 ug/g dry	-	-	<1.0	-
Silver	0.3 ug/g dry	-	-	<0.3	-
Thallium	1.0 ug/g dry	-	-	<1.0	-
Uranium	1.0 ug/g dry	-	-	<1.0	-
Vanadium	10.0 ug/g dry	-	-	89.2	-
Zinc	20.0 ug/g dry	-	-	97.6	-
Volatiles					
Benzene	0.02 ug/g dry	<0.02	<0.02	-	<0.02
Ethylbenzene	0.05 ug/g dry	<0.05	<0.05	-	<0.05
Toluene	0.05 ug/g dry	<0.05	<0.05	-	<0.05
m,p-Xylenes	0.05 ug/g dry	<0.05	<0.05	-	<0.05
o-Xylene	0.05 ug/g dry	<0.05	<0.05	-	<0.05
Xylenes, total	0.05 ug/g dry	<0.05	<0.05	-	<0.05
Toluene-d8	Surrogate	108%	114%	-	117%
Hydrocarbons					

Certificate of Analysis

Report Date: 10-Jul-2020

Client: Paterson Group Consulting Engineers

Order Date: 6-Jul-2020

Client PO: 30311

Project Description: PE4886

	Client ID:	BH1-20-SS5	BH2-20-SS5	BH4-20-SS4	BH3-SS5
	Sample Date:	29-Jun-20 09:00	30-Jun-20 09:00	29-Jun-20 09:00	03-Jul-20 09:00
	Sample ID:	2028054-01	2028054-02	2028054-03	2028054-04
	MDL/Units	Soil	Soil	Soil	Soil
F1 PHCs (C6-C10)	7 ug/g dry	13	<7	-	<7
F2 PHCs (C10-C16)	4 ug/g dry	173	<4	-	<4
F3 PHCs (C16-C34)	8 ug/g dry	117	<8	-	<8
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	-	<6
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	-	<0.02	-	-
Acenaphthylene	0.02 ug/g dry	-	<0.02	-	-
Anthracene	0.02 ug/g dry	-	<0.02	-	-
Benzo [a] anthracene	0.02 ug/g dry	-	0.02	-	-
Benzo [a] pyrene	0.02 ug/g dry	-	<0.02	-	-
Benzo [b] fluoranthene	0.02 ug/g dry	-	<0.02	-	-
Benzo [g,h,i] perylene	0.02 ug/g dry	-	<0.02	-	-
Benzo [k] fluoranthene	0.02 ug/g dry	-	<0.02	-	-
Chrysene	0.02 ug/g dry	-	0.02	-	-
Dibenzo [a,h] anthracene	0.02 ug/g dry	-	<0.02	-	-
Fluoranthene	0.02 ug/g dry	-	0.05	-	-
Fluorene	0.02 ug/g dry	-	<0.02	-	-
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	-	<0.02	-	-
1-Methylnaphthalene	0.02 ug/g dry	-	<0.02	-	-
2-Methylnaphthalene	0.02 ug/g dry	-	<0.02	-	-
Methylnaphthalene (1&2)	0.04 ug/g dry	-	<0.04	-	-
Naphthalene	0.01 ug/g dry	-	<0.01	-	-
Phenanthrene	0.02 ug/g dry	-	0.04	-	-
Pyrene	0.02 ug/g dry	-	0.04	-	-
2-Fluorobiphenyl	Surrogate	-	93.6%	-	-
Terphenyl-d14	Surrogate	-	104%	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
Conductivity	ND	5	uS/cm						
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Metals									
Antimony	ND	1.0	ug/g						
Arsenic	ND	1.0	ug/g						
Barium	ND	1.0	ug/g						
Beryllium	ND	0.5	ug/g						
Boron	ND	5.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium (VI)	ND	0.2	ug/g						
Chromium	ND	5.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	5.0	ug/g						
Lead	ND	1.0	ug/g						
Mercury	ND	0.1	ug/g						
Molybdenum	ND	1.0	ug/g						
Nickel	ND	5.0	ug/g						
Selenium	ND	1.0	ug/g						
Silver	ND	0.3	ug/g						
Thallium	ND	1.0	ug/g						
Uranium	ND	1.0	ug/g						
Vanadium	ND	10.0	ug/g						
Zinc	ND	20.0	ug/g						
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	*1.20*		*ug/g*		*89.9*	*50-140*			
Surrogate: Terphenyl-d14	*1.36*		*ug/g*		*102*	*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	*3.39*		*ug/g*		*106*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
SAR	11.1	0.01	N/A	10.4			6.8	30	
Conductivity	1590	5	uS/cm	1590			0.3	5	
pH	7.55	0.05	pH Units	7.52			0.4	2.3	
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g wet	ND			NC	40	
F2 PHCs (C10-C16)	398	4	ug/g dry	173			78.9	30	QR-04
F3 PHCs (C16-C34)	239	8	ug/g dry	117			68.7	30	QR-04
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND			NC	30	
Metals									
Antimony	1.0	1.0	ug/g dry	ND			NC	30	
Arsenic	2.9	1.0	ug/g dry	2.7			6.7	30	
Barium	742	1.0	ug/g dry	676			9.4	30	
Beryllium	0.6	0.5	ug/g dry	ND			NC	30	
Boron	20.6	5.0	ug/g dry	17.7			15.0	30	
Cadmium	ND	0.5	ug/g dry	ND			NC	30	
Chromium (VI)	ND	0.2	ug/g dry	ND			NC	35	
Chromium	22.3	5.0	ug/g dry	20.5			8.3	30	
Cobalt	5.9	1.0	ug/g dry	5.2			11.8	30	
Copper	16.8	5.0	ug/g dry	15.0			11.7	30	
Lead	19.1	1.0	ug/g dry	18.2			4.9	30	
Mercury	ND	0.1	ug/g dry	ND			NC	30	
Molybdenum	1.5	1.0	ug/g dry	1.2			25.8	30	
Nickel	13.9	5.0	ug/g dry	12.4			11.1	30	
Selenium	ND	1.0	ug/g dry	ND			NC	30	
Silver	ND	0.3	ug/g dry	ND			NC	30	
Thallium	ND	1.0	ug/g dry	ND			NC	30	
Uranium	ND	1.0	ug/g dry	ND			NC	30	
Vanadium	28.4	10.0	ug/g dry	25.7			10.3	30	
Zinc	29.7	20.0	ug/g dry	27.0			9.6	30	
Physical Characteristics									
% Solids	98.0	0.1	% by Wt.	98.0			0.0	25	
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g dry	ND			NC	40	
Acenaphthylene	ND	0.02	ug/g dry	ND			NC	40	
Anthracene	ND	0.02	ug/g dry	ND			NC	40	
Benzo [a] anthracene	ND	0.02	ug/g dry	ND			NC	40	
Benzo [a] pyrene	ND	0.02	ug/g dry	ND			NC	40	
Benzo [b] fluoranthene	ND	0.02	ug/g dry	ND			NC	40	
Benzo [g,h,i] perylene	ND	0.02	ug/g dry	ND			NC	40	
Benzo [k] fluoranthene	ND	0.02	ug/g dry	ND			NC	40	
Chrysene	ND	0.02	ug/g dry	ND			NC	40	
Dibenzo [a,h] anthracene	ND	0.02	ug/g dry	ND			NC	40	
Fluoranthene	ND	0.02	ug/g dry	ND			NC	40	
Fluorene	ND	0.02	ug/g dry	ND			NC	40	
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g dry	ND			NC	40	
1-Methylnaphthalene	ND	0.02	ug/g dry	ND			NC	40	
2-Methylnaphthalene	ND	0.02	ug/g dry	ND			NC	40	
Naphthalene	ND	0.01	ug/g dry	ND			NC	40	
Phenanthrene	ND	0.02	ug/g dry	ND			NC	40	
Pyrene	ND	0.02	ug/g dry	ND			NC	40	
Surrogate: 2-Fluorobiphenyl	*1.37*		*ug/g dry*		*98.5*	*50-140*			
Surrogate: Terphenyl-d14	*1.50*		*ug/g dry*		*108*	*50-140*			
Volatiles									
Benzene	ND	0.02	ug/g wet	ND			NC	50	
Ethylbenzene	ND	0.05	ug/g wet	ND			NC	50	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Toluene	ND	0.05	ug/g wet	ND			NC	50	
m,p-Xylenes	ND	0.05	ug/g wet	ND			NC	50	
o-Xylene	ND	0.05	ug/g wet	ND			NC	50	
Surrogate: Toluene-d8	*3.67*		*ug/g wet*		*115*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	177	7	ug/g	ND	88.5	80-120			
F2 PHCs (C10-C16)	286	4	ug/g	173	105	60-140			
F3 PHCs (C16-C34)	398	8	ug/g	117	107	60-140			
F4 PHCs (C34-C50)	184	6	ug/g	ND	110	60-140			
Metals									
Antimony	42.3	1.0	ug/g	ND	84.2	70-130			
Arsenic	50.5	1.0	ug/g	1.1	98.8	70-130			
Barium	325	1.0	ug/g	270	110	70-130			
Beryllium	45.2	0.5	ug/g	ND	90.0	70-130			
Boron	46.2	5.0	ug/g	7.1	78.2	70-130			
Cadmium	43.8	0.5	ug/g	ND	87.4	70-130			
Chromium (VI)	0.1	0.2	ug/g	ND	53.0	70-130			QM-05
Chromium	57.1	5.0	ug/g	8.2	97.8	70-130			
Cobalt	48.9	1.0	ug/g	2.1	93.6	70-130			
Copper	49.8	5.0	ug/g	6.0	87.7	70-130			
Lead	49.5	1.0	ug/g	7.3	84.4	70-130			
Mercury	1.48	0.1	ug/g	ND	99.0	70-130			
Molybdenum	47.1	1.0	ug/g	ND	93.2	70-130			
Nickel	50.7	5.0	ug/g	5.0	91.4	70-130			
Selenium	45.8	1.0	ug/g	ND	91.6	70-130			
Silver	41.1	0.3	ug/g	ND	82.2	70-130			
Thallium	45.0	1.0	ug/g	ND	89.9	70-130			
Uranium	47.4	1.0	ug/g	ND	94.5	70-130			
Vanadium	59.5	10.0	ug/g	10.3	98.5	70-130			
Zinc	53.8	20.0	ug/g	ND	86.0	70-130			
Semi-Volatiles									
Acenaphthene	0.155	0.02	ug/g	ND	88.7	50-140			
Acenaphthylene	0.152	0.02	ug/g	ND	87.1	50-140			
Anthracene	0.159	0.02	ug/g	ND	91.2	50-140			
Benzo [a] anthracene	0.148	0.02	ug/g	ND	85.1	50-140			
Benzo [a] pyrene	0.151	0.02	ug/g	ND	86.5	50-140			
Benzo [b] fluoranthene	0.202	0.02	ug/g	ND	116	50-140			
Benzo [g,h,i] perylene	0.165	0.02	ug/g	ND	94.3	50-140			
Benzo [k] fluoranthene	0.172	0.02	ug/g	ND	98.6	50-140			
Chrysene	0.184	0.02	ug/g	ND	106	50-140			
Dibenzo [a,h] anthracene	0.159	0.02	ug/g	ND	91.1	50-140			
Fluoranthene	0.171	0.02	ug/g	ND	98.0	50-140			
Fluorene	0.171	0.02	ug/g	ND	97.8	50-140			
Indeno [1,2,3-cd] pyrene	0.160	0.02	ug/g	ND	91.5	50-140			
1-Methylnaphthalene	0.230	0.02	ug/g	ND	132	50-140			
2-Methylnaphthalene	0.241	0.02	ug/g	ND	138	50-140			
Naphthalene	0.177	0.01	ug/g	ND	102	50-140			
Phenanthrene	0.140	0.02	ug/g	ND	80.2	50-140			
Pyrene	0.175	0.02	ug/g	ND	100	50-140			
Surrogate: 2-Fluorobiphenyl	*1.29*		*ug/g*		*92.1*	*50-140*			
Surrogate: Terphenyl-d14	*1.28*		*ug/g*		*91.6*	*50-140*			
Volatiles									
Benzene	3.00	0.02	ug/g	ND	74.9	60-130			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Ethylbenzene	4.44	0.05	ug/g	ND	111	60-130			
Toluene	4.33	0.05	ug/g	ND	108	60-130			
m,p-Xylenes	8.66	0.05	ug/g	ND	108	60-130			
o-Xylene	4.57	0.05	ug/g	ND	114	60-130			
Surrogate: Toluene-d8	*2.67*		*ug/g*		*83.5*	*50-140*			

Qualifier Notes:

Login Qualifiers :

Container(s) - Labeled improperly/insufficient information - Date indicates July 2nd on Jar+Vial

Applies to samples: BH2-20-SS5

QC Qualifiers :

QM-05 : The spike recovery was outside acceptance limits for the matrix spike due to matrix interference.

QR-04 : Duplicate results exceeds RPD limits due to non-homogeneous matrix.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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

CCME PHC additional information:

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

PARACEL LABORATORIES LTD.

Paracel ID: 2028054

Paracel Order Number (Lab Use Only): 2028054

Chain Of Custody (Lab Use Only) № 51633

Client Name: PATERSON GROUP
Contact Name: MARIE D'ARCY
Address: 154 Colonnade Rd S.
Telephone: 613-226-7381

Project Ref: PE4986 / ~~PG5336~~
Quote #:
PO #: 30311
E-mail: mdarcy@patersongroup.ca

Page 1 of 1

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

Regulation 153/04: ☐ Table 1 ☐ Res/Park ☐ Med/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☑ Table 3 ☐ Agri/Other ☐ Table ___ For RSC: ☑ Yes ☐ No

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

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

Required Analysis

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Date	Time	PHC/BTEX	pH	EC	SAR	PAH's	MOE METALS + CrVI/Hg						
1	BH1-20-SS5	S		2	June 29/20		X	X	X	X								
2	BH2-20-SS5	S		2	June 30/20		X		X	X	X							
3	BH4-20-SS4	S		1	Jun 29/20				X	X		X						
4	BH3-SS5	S		2	July 3/20		X		X	X								
5	~~BH3-SS12~~	~~S~~		~~1~~	~~July 3/20~~													
6																		
7																		
8																		
9																		
10																		

Comments:

Method of Delivery: Paracel

Relinquished By (Sign): [signature]
Relinquished By (Print): Dan Landry
Date/Time: July 6/2020

Received By Driver/Depot: M. Pease
Date/Time: 06/07/20 10:50
Temperature: AH °C

Received at Lab: Sumeeporn Dolmar
Date/Time: Jul 06, 2020 11.59
Temperature: 10.8 °C

Verified By: [signature]
Date/Time: 07-06-20 12:25
pH Verified: ☐ By:

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 30408
Project: PE4886
Custody: 128319

Report Date: 24-Jul-2020
Order Date: 21-Jul-2020

Order #: 2030209

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

Paracel ID	Client ID
2030209-01	BH1-20-GW1
2030209-02	BH2-20-GW1
2030209-03	BH3-20-GW1
2030209-04	MW16-4-GW1

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Report Date: 24-Jul-2020

Client: Paterson Group Consulting Engineers

Order Date: 21-Jul-2020

Client PO: 30408

Project Description: PE4886

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC	22-Jul-20	22-Jul-20
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	22-Jul-20	22-Jul-20
Chromium, hexavalent - water	MOE E3056 - colourimetric	22-Jul-20	22-Jul-20
Mercury by CVAA	EPA 245.2 - Cold Vapour AA	22-Jul-20	23-Jul-20
Metals, ICP-MS	EPA 200.8 - ICP-MS	22-Jul-20	22-Jul-20
PHC F1	CWS Tier 1 - P&T GC-FID	22-Jul-20	22-Jul-20
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	22-Jul-20	23-Jul-20

Certificate of Analysis

Report Date: 24-Jul-2020

Client: Paterson Group Consulting Engineers

Order Date: 21-Jul-2020

Client PO: 30408

Project Description: PE4886

	Client ID:	BH1-20-GW1	BH2-20-GW1	BH3-20-GW1	MW16-4-GW1
	Sample Date:	17-Jul-20 09:00	17-Jul-20 09:00	17-Jul-20 09:00	17-Jul-20 09:00
	Sample ID:	2030209-01	2030209-02	2030209-03	2030209-04
	MDL/Units	Water	Water	Water	Water
Anions					
Chloride	1 mg/L	758	1180	1310	1660
Metals					
Mercury	0.1 ug/L	<0.1	<0.1	<0.1	<0.1
Antimony	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Arsenic	1 ug/L	<1	<1	<1	<1
Barium	1 ug/L	260	255	277	104
Beryllium	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Boron	10 ug/L	176	58	133	44
Cadmium	0.1 ug/L	<0.1	<0.1	<0.1	<0.1
Chromium	1 ug/L	<1	<1	<1	<1
Chromium (VI)	10 ug/L	<10	<10	<10	<10
Cobalt	0.5 ug/L	1.2	2.2	0.8	1.2
Copper	0.5 ug/L	2.2	5.0	3.3	3.5
Lead	0.1 ug/L	<0.1	<0.1	<0.1	<0.1
Molybdenum	0.5 ug/L	2.7	6.1	8.0	2.9
Nickel	1 ug/L	3	4	2	12
Selenium	1 ug/L	<1	<1	<1	<1
Silver	0.1 ug/L	<0.1	<0.1	<0.1	<0.1
Sodium	200 ug/L	468000	736000	561000	822000
Thallium	0.1 ug/L	<0.1	<0.1	<0.1	<0.1
Uranium	0.1 ug/L	5.1	4.5	7.5	12.6
Vanadium	0.5 ug/L	1.9	<0.5	1.1	0.9
Zinc	5 ug/L	<5	<5	<5	9
Volatiles					
Benzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Toluene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
m,p-Xylenes	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
o-Xylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Xylenes, total	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Toluene-d8	Surrogate	96.5%	96.4%	94.8%	95.2%
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	<25	<25	<25
F2 PHCs (C10-C16)	100 ug/L	<100	<100	<100	<100
F3 PHCs (C16-C34)	100 ug/L	<100	<100	<100	<100

Certificate of Analysis

Report Date: 24-Jul-2020

Client: Paterson Group Consulting Engineers

Order Date: 21-Jul-2020

Client PO: 30408

Project Description: PE4886

	Client ID:	BH1-20-GW1	BH2-20-GW1	BH3-20-GW1	MW16-4-GW1
	Sample Date:	17-Jul-20 09:00	17-Jul-20 09:00	17-Jul-20 09:00	17-Jul-20 09:00
	Sample ID:	2030209-01	2030209-02	2030209-03	2030209-04
	MDL/Units	Water	Water	Water	Water
F4 PHCs (C34-C50)	100 ug/L	<100	<100	<100	<100

Certificate of Analysis

Report Date: 24-Jul-2020

Client: Paterson Group Consulting Engineers

Order Date: 21-Jul-2020

Client PO: 30408

Project Description: PE4886

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L						
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
Metals									
Mercury	ND	0.1	ug/L						
Antimony	ND	0.5	ug/L						
Arsenic	ND	1	ug/L						
Barium	ND	1	ug/L						
Beryllium	ND	0.5	ug/L						
Boron	ND	10	ug/L						
Cadmium	ND	0.1	ug/L						
Chromium (VI)	ND	10	ug/L						
Chromium	ND	1	ug/L						
Cobalt	ND	0.5	ug/L						
Copper	ND	0.5	ug/L						
Lead	ND	0.1	ug/L						
Molybdenum	ND	0.5	ug/L						
Nickel	ND	1	ug/L						
Selenium	ND	1	ug/L						
Silver	ND	0.1	ug/L						
Sodium	ND	200	ug/L						
Thallium	ND	0.1	ug/L						
Uranium	ND	0.1	ug/L						
Vanadium	ND	0.5	ug/L						
Zinc	ND	5	ug/L						
Volatiles									
Benzene	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: Toluene-d8	*76.8*		*ug/L*		*96.0*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND			NC	30	
Metals									
Mercury	ND	0.1	ug/L	ND			NC	20	
Antimony	ND	0.5	ug/L	ND			NC	20	
Arsenic	ND	1	ug/L	ND			NC	20	
Barium	44.5	1	ug/L	44.8			0.6	20	
Beryllium	ND	0.5	ug/L	ND			NC	20	
Boron	20	10	ug/L	20			0.9	20	
Cadmium	ND	0.1	ug/L	ND			NC	20	
Chromium (VI)	ND	10	ug/L	ND			NC	20	
Chromium	ND	1	ug/L	ND			NC	20	
Cobalt	ND	0.5	ug/L	ND			NC	20	
Copper	ND	0.5	ug/L	ND			NC	20	
Lead	ND	0.1	ug/L	ND			NC	20	
Molybdenum	2.90	0.5	ug/L	2.82			2.6	20	
Nickel	1.5	1	ug/L	1.4			4.2	20	
Selenium	ND	1	ug/L	ND			NC	20	
Silver	ND	0.1	ug/L	ND			NC	20	
Sodium	16900	200	ug/L	17100			1.2	20	
Thallium	ND	0.1	ug/L	ND			NC	20	
Uranium	2.3	0.1	ug/L	2.2			3.8	20	
Vanadium	ND	0.5	ug/L	ND			NC	20	
Zinc	ND	5	ug/L	9			NC	20	
Volatiles									
Benzene	ND	0.5	ug/L	ND			NC	30	
Ethylbenzene	ND	0.5	ug/L	ND			NC	30	
Toluene	ND	0.5	ug/L	ND			NC	30	
m,p-Xylenes	ND	0.5	ug/L	ND			NC	30	
o-Xylene	ND	0.5	ug/L	ND			NC	30	
Surrogate: Toluene-d8	*76.2*		*ug/L*		*95.2*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	10.1	1	mg/L	ND	101	85-115			
Hydrocarbons									
F1 PHCs (C6-C10)	1600	25	ug/L	ND	80.2	68-117			
F2 PHCs (C10-C16)	1630	100	ug/L	ND	102	60-140			
F3 PHCs (C16-C34)	4380	100	ug/L	ND	112	60-140			
F4 PHCs (C34-C50)	3060	100	ug/L	ND	123	60-140			
Metals									
Mercury	3.57	0.1	ug/L	ND	119	70-130			
Antimony	52.5	0.5	ug/L	ND	105	80-120			
Arsenic	55.7	1	ug/L	ND	111	80-120			
Barium	48.7	1	ug/L	ND	97.4	80-120			
Beryllium	45.4	0.5	ug/L	ND	90.8	80-120			
Boron	67	10	ug/L	20	94.1	80-120			
Cadmium	56.3	0.1	ug/L	ND	113	80-120			
Chromium (VI)	183	10	ug/L	ND	91.5	70-130			
Chromium	53.6	1	ug/L	ND	107	80-120			
Cobalt	48.8	0.5	ug/L	ND	96.6	80-120			
Copper	44.9	0.5	ug/L	ND	89.1	80-120			
Lead	42.9	0.1	ug/L	ND	85.7	80-120			
Molybdenum	49.0	0.5	ug/L	2.82	92.4	80-120			
Nickel	48.4	1	ug/L	1.4	93.9	80-120			
Selenium	51.0	1	ug/L	ND	102	80-120			
Silver	43.7	0.1	ug/L	ND	87.5	80-120			
Sodium	26400	200	ug/L	17100	92.3	80-120			
Thallium	50.1	0.1	ug/L	ND	100	80-120			
Uranium	55.0	0.1	ug/L	2.2	105	80-120			
Vanadium	54.3	0.5	ug/L	ND	108	80-120			
Zinc	46	5	ug/L	ND	92.0	80-120			
Volatiles									
Benzene	38.6	0.5	ug/L	ND	96.4	60-130			
Ethylbenzene	34.7	0.5	ug/L	ND	86.8	60-130			
Toluene	33.0	0.5	ug/L	ND	82.4	60-130			
m,p-Xylenes	69.6	0.5	ug/L	ND	87.0	60-130			
o-Xylene	35.0	0.5	ug/L	ND	87.4	60-130			
Surrogate: Toluene-d8	*76.3*		*ug/L*		*95.4*	*50-140*			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

CCME PHC additional information:

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

PARACEL LABORATORIES LTD.

Paracel ID: 2030209

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2030209	Nº 128319

Client Name: PATERSON

Project Ref: PE4886

Page 1 of 1

Contact Name: Mark D'Arcy; Mike Beaudoin

Quote #:

Address: 154 Colonnade Road

PO #: 30408

E-mail: mdarcy@patersongroup.ca
mbeaudoin@patersongroup.ca

Telephone: 613-226-7381

Turnaround Time

☐ 1 day ☐ 3 day
☐ 2 day ☒ Regular

Date Required:

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

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

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	Chloride
1	BH1-20-GW1	GW		7			X			X	X	X		X
2	BH2-20-GW1	↓		↓			↓			↓	↓	↓		↓
3	BH3-20-GW1	↓		↓			↓			↓	↓	↓		↓
4	MW16-4-GW1	↓		↓			↓			↓	↓	↓		↓
5														
6														
7														
8														
9														
10														

Comments:

Method of Delivery: Paracel

Relinquished By (Sign):	Received By Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): Joshua Dempsey	Date/Time: 21/07/20 4:00	Date/Time: July 22 20 04:44	Date/Time: 7-22-20 6:40
Date/Time: July 20/2020	Temperature: °C FH	Temperature: 14.8 °C	pH Verified: ☒ By: MA