Phase II – Environmental Site Assessment

Tunney's Pasture (Blocks 1 & 2)

Ottawa, Ontario

Prepared for Arcadis IBI Group

Report: PE6034-2
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EXECUTIVE SUMMARY

Assessment

Paterson Group was retained by IBI Group to conduct a Phase II – Environmental Site Assessment (Phase II ESA) for Blocks 1 and 2 of the Tunney's Pasture government office complex, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address potentially contaminating activities (PCAs) that were identified during the Phase I ESA and were considered to result in areas of potential environmental concern (APECs) on the subject site (Phase II Property).

The subsurface investigation for this assessment was conducted on November 13, 2023 and consisted of drilling three boreholes (BH5-23 to BH7-23) across the Phase II Property. It should be noted that this field investigation was carried out as part of a larger investigation conducted for multiple sites at the Tunney's Pasture complex. The boreholes were advanced to depths ranging from approximately 5.92 m to 6.17 m below the existing ground surface and terminated within the bedrock unit. Upon completion, all three boreholes were instrumented with groundwater monitoring wells in order to access the groundwater table.

In general, the subsurface soil profile encountered at the borehole locations consists of either a thin pavement structure (asphaltic concrete over granular fill) or topsoil, and brown silty sand fill material underlain by a thin layer of glacial till. Bedrock was encountered in all three boreholes during the field drilling program at depths ranging from approximately 0.69 m to 3.38 m below ground surface. During the field sampling program, the groundwater was measured at depths ranging from approximately 3.04 m to 3.73 m below the existing ground surface.

A total of 4 soil samples were submitted for laboratory analysis of BTEX, PHCs (F_1-F_4), metals, Hg^+, CrVI, PAHs, EC, SAR, and/or pH parameters. All analytical results were found to comply with both MECP Table 7 Residential Standards (for future site reuse purposes), and with CCME commercial standards (current use standards). One exception, is the presence of PHCs $F_{4\ gravimetric}$ in Sample BH5-23-AU1, which exceeds only the MECP Table 7 Standards. This exceedance may be a result of asphalt inclusions in the sample, which was collected beneath the paving structure.

All groundwater samples were found to comply with both MECP Table 7 residential standards and CCME commercial standards, with the exception of iron, manganese, and zinc, which exceeded CCME standards.

No exceedances in soil samples were identified for these parameters, and it is considered possible that these parameters are naturally elevated, or they are elevated due to the presence of sediment. The presence of these metals is not considered to pose an environmental risk to the current use of the property.

Recommendations

Soil

Based on the findings of this assessment, the shallow fill material present beneath the surficial asphalt at BH5-23 is contaminated with heavier fractions of petroleum hydrocarbons (PHC $F_{4\ gravimetric}$). Given the low-mobility of these contaminants, it is expected that the contamination is confined to the fill material within a localized area around BH5-23. It should be noted that this contamination only exceeds the provincial MECP Table 7 Standards, and not the federal CCME Standards.

It is our understanding that the Phase II Property may be redeveloped in the future. As such, the contaminated soil could be fully delineated and remediated in conjunction with site redevelopment. This contaminated soil will require disposal at a licensed waste disposal facility. Prior to off-site disposal of impacted soil at a licensed waste disposal facility, a leachate analysis of a representative sample of contaminated soil must be conducted in accordance with Ontario Regulation 347/558.

Additionally, excess soil must be handed in accordance with O. Reg. 406/19: On-Site and Excess Soil Management. Additional excess soil testing and reporting requirements will be required prior to future site excavation activities, in accordance with O. Reg. 406/19. Further delineation of the PHC $F_{4\ gravimetric}$ exceedance can be conducted in conjunction with the excess soil testing program.

Monitoring Wells

Although groundwater is in compliance with the proposed future use of the site, consideration may be given to re-sampling the wells for metals analysis, to confirm the presence of metals above CCME standards.

It is recommended that the monitoring wells be maintained for future sampling purposes. The monitoring wells will be registered with the MECP under Ontario Regulation 903 (Ontario Water Resources Act). At such a time that the monitoring wells are no longer required, they must be decommissioned in accordance with O.Reg. 903.

1.0 INTRODUCTION

At the request of Arcadis IBI Group, Paterson Group (Paterson) conducted a Phase II – Environmental Site Assessment (Phase II ESA) for Blocks 1 and 2 of the Tunney's Pasture government office complex, in the City of Ottawa, Ontario (the Phase II Property).

The purpose of this Phase II ESA has been to address the areas of potential environmental concern (APECs) identified on the Phase II Property as a result the findings of the Phase I ESA.

1.1 Site Description

Address:	Part of 101 Goldenrod Driveway and 251 Sir Frederick Banting Driveway, Blocks 1 & 2, Tunney's Pasture, Ottawa, Ontario.
Location:	The Phase II Property is situated on the west side of Sir Federick Banting Driveway, approximately 20 m north of Scott Street, in the City of Ottawa, Ontario. Refer to Figure 1 – Key Plan, for the site location context.
Latitude and Longitude:	45° 24' 12" N, 75° 44' 28" W.

Site Description:

Configuration:	Irregular.
Area:	2.9 hectares (approximately).
Zoning:	MC – Mixed-Use Centre Zone.
Current Use:	The Phase II Property is vacant of any buildings or structures, and is currently utilized as an asphalt-covered vehicular parking lot.
Services:	The Phase II Property is located within a municipally serviced area.

1.2 Property Ownership

The Phase II Property is currently owned by the Government of Canada. Paterson was retained to complete this Phase II ESA by Ms. Catriona Moggach of Arcadis IBI Group, whose office is located at 333 Preston Street, Unit #500, Ottawa, Ontario, and can be contacted via telephone at 613-225-1311.

In 2021, Public Service and Procurement Canada (PSPC) partnered with Canada Lands Company (CLC) under a collaboration project to leverage the strengths of each organization to deliver the long-term vision of Tunney's Pasture that includes the site's transition from a federal employment centre into a mixed-use, sustainable, transit-oriented community. CLC is a self-financing federal Crown corporation specializing in real estate and development with a mandate to transform former Government of Canada properties and reintegrates them into local communities while ensuring their long-term goals. Since the launch of this collaboration project, CLC has been committed to working with the community to define amendments to the TPMP and proposed upgrades to the existing roadway and servicing infrastructure that support both federal priorities and future development.

1.3 Applicable Site Condition Standard

The site condition standards for the subject property were obtained from Table 7 of the document entitled, *"Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act"*, prepared by the Ministry of the Environment, Conservation and Parks (MECP), and dated April 15, 2011. The selected MECP standards are based on the following considerations:

- ❒ Shallow soil conditions;
- ❒ Coarse-grained soil conditions;
- ❒ Non-potable groundwater conditions;
- ❒ Residential land use.

Although the property is currently considered to be of a commercial land use, residential land use standards were selected to assess the suitability of the property for more stringent future uses.

Grain-size analysis was not conducted as part of this assessment, and as such, the coarse-grained soil standards were selected as a conservative approach.

It should be noted that in addition to the provincial MECP standards, the federal Canadian Council of Ministers of the Environment (CCME) commercial standards were also selected for additional consideration.

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The Phase II Property currently consists of a paved asphaltic concrete parking lot, with some mature trees and landscaped areas to the west and south, respectively.

The site topography is relatively flat, with the exception of a grassy hill in the south end of the site, while the regional topography appears to slope down towards the northwest, in the general direction the Ottawa River. The Phase I Property is generally considered to be at grade with respect to the surrounding properties, with the exception of a grassy hill in the southern portion of the site.

Water drainage on the Phase I Property occurs primarily via surface run-off towards catch basins present within the parking lot and on the adjacent streets, as well as via infiltration within the landscaped areas.

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The subsurface investigation for this assessment was conducted on November 13, 2023 and consisted of drilling three (3) boreholes (BH5-23 to BH7-23) across the Phase II Property.

The boreholes were advanced to depths ranging from approximately 5.92 m to 6.17 m below the existing ground surface and terminated within the bedrock unit. Bedrock was encountered in all three boreholes during the field drilling program at depths ranging from approximately 0.69 m to 3.38 m below ground surface.

Upon completion, all three boreholes were instrumented with groundwater monitoring wells in order to access the groundwater table. During the field sampling program, the groundwater was measured at depths ranging from approximately 3.04 m to 3.73 m below the existing ground surface.

3.2 Media Investigated

During the course of this subsurface investigation, soil and groundwater samples were obtained from the Phase II Property and submitted for laboratory analysis.

The rationale for sampling and analyzing these media is based on the contaminants of potential concern identified in the Phase I ESA.

The contaminants of potential concern for the soil and/or groundwater on the Phase II Property include the following:

- ❒ Benzene, Ethylbenzene, Toluene, and Xylenes (BTEX);
- ❒ Petroleum Hydrocarbons, fractions 1 – 4 (PHCs F_1-F_4);
- ❒ Polycyclic Aromatic Hydrocarbons (PAHs);
- ❒ Metals (including Arsenic, Antimony, and Selenium);
- ❒ Mercury (Hg^+);
- ❒ Hexavalent Chromium (CrVI);
- ❒ Electrical Conductivity (EC);
- ❒ Sodium Adsorption Ratio (SAR).

These CPCs have the potential to be present in the soil matrix and/or the groundwater situated beneath the Phase II Property.

3.3 Phase I ESA Conceptual Site Model

Geological and Hydrogeological Setting

Based on the available mapping information, the bedrock beneath the Phase II Property generally consists of interbedded limestone and dolomite of the Gull River Formation. The surficial geology consists largely of Paleozoic bedrock, with an overburden ranging from approximately 0 m to 2 m in thickness.

Groundwater is anticipated to be encountered within the bedrock and flow in a northerly direction towards the Ottawa River.

Water Bodies and Areas of Natural and Scientific Interest

No water bodies or areas of natural and scientific interest are present on the Phase I Property or within the Phase I Study Area.

The nearest named water body with respect to the Phase II Property is the Ottawa River, located approximately 575 m to the northwest.

Drinking Water Wells

Based on the availability of municipal services, no potable drinking water wells are anticipated to remain in use within the Phase I Study Area.

Existing Buildings and Structures

No buildings or structures currently exist on the Phase II Property.

Current and Future Property Use

The Phase II Property is currently occupied by an asphalt-covered vehicular parking lot, with some landscaped areas.

It is our understanding that the Phase II Property may be redeveloped for residential purposes in the future.

Due to a change in land use to a more sensitive type (commercial to residential), a record of site condition (RSC) will need to be filed with the MECP.

Neighbouring Land Use

The surrounding lands within the Phase I Study Area consist largely of commercial and residential properties. Current land use is depicted on Drawing PE6034-2 – Surrounding Land Use Plan, in the Figures section of this report.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

As per Section 7.1 of the Phase I ESA report, two potentially contaminating activities (PCAs), resulting in areas of potential environmental concern (APECs), were identified on the Phase II Property. These APECs include:

- The presence of fill material of unknown quality, located beneath the entirety of the Phase II Property (APEC #1).
- The use of road salt for de-icing purposes during snow and ice conditions, located within the asphalt-covered parking lot occupying the northern and central portions of the Phase II Property (APEC #2).

Other off-site PCAs were identified within the Phase I Study Area but were deemed not to be of any environmental concern to the Phase II Property based on their separation distances, their inferred down-gradient or cross-gradient orientation with respect to the known groundwater flow to the north, or the results of the previous subsurface investigation carried out for the property.

Contaminants of Potential Concern

The contaminants of potential concern (CPCs) associated with the aforementioned APECs are considered to be:

- ❒ Benzene, Ethylbenzene, Toluene, and Xylenes (BTEX);
- ❒ Petroleum Hydrocarbons, fractions 1 – 4 (PHCs F_1-F_4);
- ❒ Polycyclic Aromatic Hydrocarbons (PAHs);
- ❒ Metals (including Arsenic, Antimony, and Selenium);
- ❒ Mercury (Hg^+);
- ❒ Hexavalent Chromium (CrVI);
- ❒ Electrical Conductivity (EC);
- ❒ Sodium Adsorption Ratio (SAR).

These CPCs have the potential to be present in the soil matrix and/or the groundwater situated beneath the Phase II 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 and APECs associated with the Phase II Property.

The presence of any PCAs was confirmed by a variety of independent sources, and as such, the conclusions of this report are not affected by uncertainty which may be present with respect to the individual sources.

3.4 Deviations from the Sampling and Analysis Plan

No deviations from the Sampling and Analysis were made during the course of this Phase II ESA.

3.5 Physical Impediments

No physical impediments were encountered during the course of the field drilling program.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation for this assessment was conducted on November 13, 2023 and consisted of drilling three boreholes (BH5-23 to BH7-23) across the Phase II Property.

The boreholes were advanced to depths ranging from approximately 5.92 m to 6.17 m below the existing ground surface and terminated within the bedrock unit. Bedrock was encountered in all three boreholes during the field drilling program at depths ranging from approximately 0.69 m to 3.38 m below ground surface.

Upon completion, all three boreholes were instrumented with groundwater monitoring wells in order to access the groundwater table. During the field sampling program, the groundwater was measured at depths ranging from approximately 3.04 m to 3.73 m below the existing ground surface.

Under the full-time supervision of Paterson personnel, the boreholes were drilled using a track-mounted drill rig provided by Marathon Underground Constructors Corporation of Greely, Ontario. The locations of the boreholes are illustrated on Drawing PE6034-3 – Test Hole Location Plan, appended to this report.

4.2 Soil Sampling

Soil 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.

The samples were recovered using a stainless-steel split spoon, while wearing protective gloves (changed after each sample), and immediately placed into plastic bags. If significant contamination was encountered, the samples were instead placed into glass jars. Sampling equipment was routinely washed in soapy water and rinsed with methylhydrate after each split spoon to prevent any cross contamination of the samples. The samples were also stored in coolers to reduce analyte volatilization during transportation.

A total of 9 soil samples were obtained from the boreholes by means of auger and split spoon sampling. The depths at which auger, split spoon, and rock core samples were obtained from the boreholes are shown as "**AU**", "**SS**", and "**RC**" respectively, on the Soil Profile and Test Data Sheets, appended to this report.

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 Photo Ionization Detector.

The recovered soil samples were placed immediately into airtight plastic bags with nominal headspace. All lumps of soil inside the bags were broken by hand, and the soil was allowed to come to room temperature prior to conducting the vapour survey, ensuring consistency of readings between samples. To measure the soil vapours, the analyzer probe was inserted into the nominal headspace above the sample. The sample was then agitated and manipulated gently by hand as the measurement was taken. The peak reading registered within the first 15 seconds was recorded as the vapour measurement. The parts per million (ppm) scale was used to measure concentrations of organic vapours.

The results of the vapour survey are presented on the Soil Profile and Test Data Sheets, appended to this report.

4.4 Groundwater Monitoring Well Installation

Three groundwater monitoring wells were installed on the Phase II Property as part of this assessment. These monitoring wells were constructed using 32 mm diameter Schedule 40 threaded PVC risers and screens. A sand pack consisting of silica sand was placed around the screen with a bentonite seal placed above to minimize cross-contamination. A summary of the monitoring well construction details are listed below in Table 1 as well as on the Soil Profile and Test Data Sheets provided in Appendix 1.

Upon completion, the groundwater monitoring wells were developed using a dedicated inertial lift pump, with a minimum of three well volumes being removed from the wells at the time of installation. The wells were developed until the appearance of the water was noted to have stabilized. In addition, the ground surface elevations of each borehole were subsequently surveyed with respect to a known geodetic elevation.

Table 1
Monitoring Well Construction Details

Well ID	Ground Surface Elevation (m ASL)	Total Depth (m BGS)	Screened Interval (m BGS)	Sand Pack (m BGS)	Bentonite Seal (m BGS)	Casing Type
BH5-23	63.33	6.07	3.07 – 6.07	2.13 – 6.07	0.61 – 2.13	Flushmount
BH6-23	62.71	5.92	2.92 – 5.92	2.13 – 5.92	1.22 – 2.13	Flushmount
BH7-23	64.80	6.17	3.17 – 6.17	2.44 – 6.17	0.00 – 2.44	Stick-Up

4.5 Field Measurement of Water Quality Parameters

Groundwater monitoring and sampling was conducted on-site on November 21, 2023. At this time, water quality parameters were measured in the field using a multi-parameter analyzer. Parameters measured in the field included temperature, pH and electrical conductivity.

Field parameters were measured after each well volume purged. Wells were purged prior to sampling until at least three well volumes had been removed or the field parameters were relatively stable. Stabilized field parameter values are summarized in Table 2.

Table 2
Measurement of Water Quality Parameters

Well ID	Temperature (˚C)	Conductivity (µS)	pH (Units)
BH5-23	9.7	2,777	5.91
BH6-23	9.1	>4,000	5.82
BH7-23	9.4	>4,000	5.77

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.

Standing water was purged from each monitoring well prior to the recovery of the groundwater samples using dedicated sampling equipment. The samples were then stored in coolers to reduce possible analyte volatilization during their transportation. Further details of our standard operating procedure for groundwater sampling are provided in the Sampling and Analysis Plan, appended to this report.

4.7 Analytical Testing

The following soil and groundwater samples were submitted for laboratory analysis:

Table 3
Testing Parameters for Submitted Soil Samples

Sample ID	Sample Depth & Stratigraphic Unit	Parameters Analyzed							Rationale
		BTEX	PHCs (F_1-F_4)	Metals[1]	PAHs	EC	SAR	pH	
BH5-23-AU1	Fill Material 0.00 – 0.61 m	X	X	X	X	X	X	X	To assess for potential impacts resulting from the presence of fill material of unknown quality and the use of road salt for de-icing purposes, and for excess soil qualification purposes.
BH6-23-AU1	Fill Material 0.00 – 0.61 m	X	X	X	X	X	X		To assess for potential impacts resulting from the presence of fill material of unknown quality and the use of road salt for de-icing purposes, and for excess soil qualification purposes.
BH7-23-SS3	Fill Material 1.52 m – 2.13 m	X	X	X	X	X	X		To assess for potential impacts resulting from the presence of fill material of unknown quality.
BH7-23-SS4	Fill Material 2.29 m – 2.90 m							X	To assess pH at a depth greater than 1.5 m.
DUP1[2]	Fill Material 1.52 m – 2.13 m			X					For laboratory QA/QC purposes.

1 – Includes Mercury and Hexavalent Chromium
2 – Duplicate sample of BH7-23-SS3

Table 4
Testing Parameters for Submitted Groundwater Samples

Sample ID	Screened Interval & Stratigraphic Unit	Parameters Analyzed				Rationale
		BTEX	PHCs (F_1-F_4)	Metals[1]	PAHs	
BH5-23-GW1	Bedrock 3.07 m – 6.07 m	X	X	X	X	To assess for potential impacts resulting from the presence of fill material of unknown quality.
BH6-23-GW1	Bedrock 2.92 m – 5.92 m	X	X	X	X	
BH7-23-GW1	Bedrock 3.17 m – 6.17 m	X	X	X	X	
DUP1[2]	Bedrock 3.17 m – 6.17 m	X	X			For laboratory QA/QC purposes.

1 – Includes Mercury and Hexavalent Chromium
2 – Duplicate sample of BH7-23-GW1

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

4.8 Residue Management

All soil cuttings were removed from the site following the field program.

4.9 Elevation Surveying

The ground surface elevations at each borehole location were surveyed using a GPS device by Paterson personnel and referenced to a geodetic datum.

4.10 Quality Assurance and Quality Control Measures

A summary of the quality assurance and quality control (QA/QC) measures, undertaken as part of this assessment, is provided in the Sampling and Analysis Plan in Appendix 1.

5.0 REVIEW AND EVALUATION

5.1 Geology

In general, the subsurface soil profile encountered at the borehole locations consists of either a thin pavement structure (asphaltic concrete over granular fill) or brown silty sand fill material, underlain by a thin layer of glacial till. Bedrock was encountered in all three boreholes during the field drilling program at depths ranging from approximately 0.69 m to 3.38 m below ground surface.

Site geology details are provided in the Soil Profile and Test Data Sheets in Appendix 1.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured using an electronic water level meter on November 21, 2023. The groundwater levels are summarized below in Table 5.

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
BH5-23	63.33	3.27	60.06	November 21, 2023
BH6-23	62.71	3.73	58.98	
BH7-23	64.80	3.04	61.76	

The groundwater at the Phase II Property was encountered within the bedrock at depths ranging from approximately 3.04 m to 3.73 m below the existing ground surface.

No unusual visual observations were identified within the recovered groundwater samples.

Using the groundwater elevations recorded during the sampling event, groundwater contour mapping was completed as part of this assessment. According to the mapped contour data, illustrated on Drawing PE6034-3 – Test Hole Location Plan in the appendix, the groundwater flow on the subject site was calculated to be in a northerly direction. A horizontal hydraulic gradient of approximately 0.024 m/m was also calculated as part of this assessment. It should be noted that groundwater levels are expected to fluctuate throughout the year with seasonal variations.

5.3 Fine/Coarse Soil Texture

Grain size analysis was not completed as part of this investigation. As a result, the coarse-grained soil standards were chosen as a conservative approach.

5.4 Field Screening

Field screening of the soil samples collected during the drilling program resulted in organic vapour readings ranging from 0.8 ppm to 4.3 ppm, indicating that there is a negligible potential for the presence of volatile substances. 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

A total of 4 soil samples were submitted for laboratory analysis of BTEX, PHCs (F_1-F_4), metals, Hg^+, CrVI, PAHs, EC, SAR, and/or pH parameters. The results of the analytical testing are presented below in Tables 6 to 9, as well as on the laboratory Certificates of Analysis included in Appendix 1.

Table 6
Analytical Test Results – Soil
BTEX & PHCs

Parameter	MDL (µg/g)	Soil Samples (µg/g)			MECP Table 7 Coarse-Grained Residential Soil Standards (µg/g)	CCME Coarse-Grained Commercial Standards (µg/g)
		November 13, 2023				
		BH5-23-AU1	BH6-23-AU1	BH7-23-SS3		
		Sample Depth (m bgs)				
		0.00 – 0.61 m	0.00 – 0.61 m	1.52 – 2.13 m		
Benzene	0.02	nd	nd	nd	0.21	0.03
Ethylbenzene	0.05	nd	nd	nd	2	0.082
Toluene	0.05	nd	nd	nd	2.3	0.37
Xylenes	0.05	nd	nd	nd	3.1	11
PHCs F_1	7	nd	nd	nd	55	30
PHCs F_2	4	nd	nd	nd	98	150
PHCs F_3	8	117	37	nd	300	300
PHCs F_4	6	392	94	nd	2,800	2,800
PHCs F_4 (gravimetric)	6	**3,140**	nt	nt	2,800	N/A

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- nt – not tested for this parameter
- N/A – not applicable (no standard for this parameter)
- Underlined – value exceeds selected CCME standards
- **Bold and Underlined** – value exceeds selected MECP standards

The concentration of PHCs F_4 gravimetric detected in Sample BH5-23-AU1 is in excess of the selected MECP Table 7 Coarse-Grained Residential Soil Standards. All remaining BTEX and PHC parameter concentrations detected in the soil samples analyzed are in compliance with both the MECP and CCME standards.

Table 7
Analytical Test Results – Soil
Metals

Parameter	MDL (µg/g)	Soil Samples (µg/g)			MECP Table 7 Coarse-Grained Residential Soil Standards (µg/g)	CCME Coarse-Grained Commercial Standards (µg/g)
		November 13, 2023				
		BH5-23-AU1	BH6-23-AU1	BH7-23-SS3		
		Sample Depth (m bgs)				
		0.00 – 0.61 m	0.00 – 0.61 m	1.52 – 2.13 m		
Antimony	1.0	nd	nd	nd	7.5	40
Arsenic	1.0	9	4	4	18	12
Barium	1.0	27	108	92	390	2,000
Beryllium	0.5	nd	nd	nd	4	8
Boron	5.0	8.7	14.0	6.8	120	N/A
Cadmium	0.5	nd	nd	nd	1.2	22
Chromium	5.0	13	12	27	160	87
Chromium (VI)	0.2	nd	nd	nd	8	1.4
Cobalt	1.0	10	7	8	22	300
Copper	5.0	10	9	14	140	91
Lead	1.0	20	15	35	120	260
Mercury	0.1	nd	nd	nd	0.27	24
Molybdenum	1.0	5	2	nd	6.9	40
Nickel	5.0	19	14	15	100	89
Selenium	1.0	nd	nd	nd	2.4	2.9
Silver	0.3	nd	nd	nd	20	40
Thallium	1.0	nd	nd	nd	1	1
Tin	5.0	nd	nd	nd	300	300
Uranium	1.0	nd	nd	nd	33	33
Vanadium	10.0	24	17	40	130	130
Zinc	20.0	nd	nd	53	410	410

Notes:

- MDL – Method Detection Limit
- nd – not detected above the MDL
- nt – not tested for this parameter
- N/A – not applicable (no standard for this parameter)
- Underlined – value exceeds selected CCME standards
- **Bold and Underlined** – value exceeds selected MECP standards

All detected metal parameter concentrations in the soil samples analyzed are in compliance with the selected MECP Table 7 Coarse-Grained Residential Soil Standards and the CCME Coarse-Grained Commercial Soil Standards.

Table 8
Analytical Test Results – Soil
PAHs

Parameter	MDL (µg/g)	Soil Samples (µg/g)			MECP Table 7 Coarse-Grained Residential Soil Standards (µg/g)	CCME Coarse-Grained Commercial Standards (µg/g)
		November 13, 2023				
		BH5-23-AU1	BH6-23-AU1	BH7-23-SS3		
		Sample Depth (m bgs)				
		0.00 – 0.61 m	0.00 – 0.61 m	1.52 – 2.13 m		
Acenaphthene	0.02	nd (<0.40)	nd (<0.40)	nd	7.9	0.28
Acenaphthylene	0.02	*nd (<0.40)*	*nd (<0.40)*	nd	0.15	320
Anthracene	0.02	nd (<0.40)	nd (<0.40)	nd	0.67	32
Benzo[a]anthracene	0.02	nd (<0.40)	nd (<0.40)	nd	0.5	10
Benzo[a]pyrene	0.02	*nd (<0.40)*	*nd (<0.40)*	nd	0.3	72
Benzo[b]fluoranthene	0.02	nd (<0.40)	nd (<0.40)	nd	0.78	10
Benzo[g,h,i]perylene	0.02	nd (<0.40)	nd (<0.40)	nd	6.6	N/A
Benzo[k]fluoranthene	0.02	nd (<0.40)	nd (<0.40)	nd	0.78	10
1,1-Biphenyl	0.02	nd (<0.40)	nd (<0.40)	nd	0.31	N/A
Chrysene	0.02	nd (<0.40)	nd (<0.40)	nd	7	N/A
Dibenzo[a,h]anthracene	0.02	*nd (<0.40)*	*nd (<0.40)*	nd	0.1	10
Fluoranthene	0.02	nd (<0.40)	nd (<0.40)	0.04	0.69	180
Fluorene	0.02	nd (<0.40)	nd (<0.40)	nd	62	0.25
Indeno [1,2,3-cd] pyrene	0.02	*nd (<0.40)*	*nd (<0.40)*	nd	0.38	10
1-Methylnaphthalene	0.02	nd (<0.40)	nd (<0.40)	nd	0.99	N/A
2-Methylnaphthalene	0.02	nd (<0.40)	nd (<0.40)	nd	0.99	N/A
Methylnaphthalene (1&2)	0.04	nd (<0.80)	nd (<0.80)	nd	0.99	N/A
Naphthalene	0.01	nd (<0.20)	nd (<0.20)	nd	0.6	0.013
Phenanthrene	0.02	nd (<0.40)	nd (<0.40)	nd	6.2	0.046
Pyrene	0.02	nd (<0.40)	nd (<0.40)	0.03	78	100
Quinoline	0.10	nd (<2.00)	nd (<2.00)	nd	N/A	N/A

Notes:

- MDL – Method Detection Limit
- (Bracketed) – Elevated Method Detection Limit
- nd – not detected above the MDL
- nt – not tested for this parameter
- N/A – not applicable (no standard for this parameter)
- *Italicized* – Method Detection Limit Exceeds Selected MECP Standards
- Underlined – value exceeds selected CCME standards
- **Bold and Underlined** – value exceeds selected MECP standards

All detected PAH parameter concentrations in the soil samples analyzed are in compliance with the selected MECP Table 7 Coarse-Grained Residential Soil Standards and the CCME Coarse-Grained Commercial Soil Standards. However, it should be noted that detection limits were raised for the analysis of Samples BH5-23-AU1 and BH6-23-AU1.

Table 9
Analytical Test Results – Soil
Inorganic Parameters

Parameter	MDL (units)	Soil Samples (µg/g)				MECP Table 7 Coarse-Grained Residential Soil Standards (units)	CCME Coarse-Grained Commercial Standards (units)
		November 13, 2023					
		BH5-23-AU1	BH6-23-AU1	BH7-23-SS3	BH7-23-SS4		
		Sample Depth (m bgs)					
		0.00 – 0.61 m	0.00 – 0.61 m	1.52 – 2.13 m	2.29 – 2.90 m		
SAR	0.01 Units	0.47	0.32	0.13	nt	5	12
EC	5 µS/cm	**1,990**	216	224	nt	700	4,000
pH	0.05 Units	7.51	nt	nt	7.47	5.00 – 11.00	5.00 – 11.00

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- nt – not tested for this parameter
- N/A – not applicable (no standard for this parameter)
- Underlined – value exceeds selected CCME standards
- **Bold and Underlined** – value exceeds selected MECP standards

All EC, SAR, and pH levels measured in the soil samples analyzed are in compliance with the selected MECP Table 7 Coarse-Grained Residential Soil Standards and the CCME Coarse-Grained Commercial Soil Standards, with the exception of the EC level detected in Sample BH5-23-AU1. This exceedance is suspected to be the result of the use of road salt on the Phase II Property during snow and ice conditions and thus, as per Section 49.1 of O. Reg 153/04, does not represent a contaminant issue.

Table 10
Maximum Concentrations – Soil

Parameter	Maximum Concentration (µg/g)	Sample ID	Depth Interval (m BGS)
PHCs F_3	117	BH5-23-AU1	0.00 – 0.61 m
PHCs F_4	392	BH5-23-AU1	0.00 – 0.61 m
PHCs F_4 (gravimetric)	**3,140**	BH5-23-AU1	0.00 – 0.61 m
Arsenic	9	BH5-23-AU1	0.00 – 0.61 m
Barium	108	BH6-23-AU1	0.00 – 0.61 m
Boron	14.0	BH6-23-AU1	0.00 – 0.61 m
Chromium	27	BH7-23-SS3	1.52 – 2.13 m
Cobalt	10	BH5-23-AU1	0.00 – 0.61 m
Copper	14	BH7-23-SS3	1.52 – 2.13 m
Lead	35	BH7-23-SS3	1.52 – 2.13 m
Molybdenum	5	BH5-23-AU1	0.00 – 0.61 m
Nickel	19	BH5-23-AU1	0.00 – 0.61 m
Vanadium	40	BH7-23-SS3	1.52 – 2.13 m
Zinc	53	BH7-23-SS3	1.52 – 2.13 m
Fluoranthene	0.04	BH7-23-SS3	1.52 – 2.13 m
Pyrene	0.03	BH7-23-SS3	1.52 – 2.13 m
Electrical Conductivity	**1,990**	BH5-23-AU1	0.00 – 0.61 m
Sodium Adsorption Ratio	0.47	BH5-23-AU1	0.00 – 0.61 m
pH	7.51	BH5-23-AU1	0.00 – 0.61 m

Notes:
- **Bold and Underlined** – value exceeds selected MECP standards

All other parameter concentrations analyzed were below the laboratory detection limits.

5.6 Groundwater Quality

Three groundwater samples were submitted for laboratory analysis of BTEX, PHC, Metals, and PAH parameters. The results of the analytical testing are presented below in Table 11 to Table 13, as well as on the laboratory Certificates of Analysis included in Appendix 1.

Table 11
Analytical Test Results – Groundwater
BTEX & PHCs

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)			MECP Table 7 Non-Potable Groundwater Soil Standards (µg/L)	CCME Tier 1 FIGWQG Commercial Standards (µg/L)
		November 21, 2023				
		BH5-23-GW1	BH6-23-GW1	BH7-23-GW1		
		Sample Depth (m bgs)				
		3.07 – 6.07 m	2.92 – 5.92 m	3.17 – 6.17 m		
Benzene	0.05	nd	nd	nd	0.5	88
Ethylbenzene	0.05	nd	nd	nd	54	3,200
Toluene	0.05	nd	nd	nd	320	83
Xylenes	0.05	nd	nd	nd	72	3,900
PHCs F_1	25	nd	nd	nd	420	810
PHCs F_2	100	nd	nd	nd	150	1,300
PHCs F_3	100	nd	nd	nd	500	N/A
PHCs F_4	100	nd	nd	nd	500	N/A

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- nt – not tested for this parameter
- N/A – not applicable (no standard for this parameter)
- Underlined – value exceeds selected CCME standards
- **Bold and Underlined** – value exceeds selected MECP standards

No BTEX or PHC parameter concentrations were detected above the laboratory method detection limits in any of the samples analyzed. The results are in compliance with the MECP Table 7 Non-Potable Groundwater Standards as well as the CCME Tier 1 Federal Interim Groundwater Water Quality Guidelines for Commercial Sites.

Table 12
Analytical Test Results – Groundwater
Metals

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)			MECP Table 7 Non-Potable Groundwater Soil Standards (µg/L)	CCME Tier 1 FIGWQG Commercial Standards (µg/L)
		November 21, 2023				
		BH5-23-GW1	BH6-23-GW1	BH7-23-GW1		
		Sample Depth (m bgs)				
		3.07 – 6.07 m	2.92 – 5.92 m	3.17 – 6.17 m		
Aluminum	1	4	4	5	N/A	5
Antimony	0.5	nd	nd	nd	16,000	2,000
Arsenic	1	nd	nd	nd	1,500	5
Barium	1	289	58	152	23,000	500
Beryllium	0.5	nd	nd	nd	53	5.3
Boron	10	72	41	104	36,000	500
Cadmium	0.01	0.01	nd	0.01	2.1	0.017
Calcium	100	412,000	147,000	236,000	N/A	N/A
Chromium	1	nd	nd	nd	640	8.9
Chromium (VI)	1	nd	1	nd	110	N/A
Cobalt	0.5	1.0	nd	2.3	52	N/A
Copper	0.5	2.0	1.9	2.2	69	50
Iron	100	nd	nd	1,520	N/A	300
Lead	0.1	nd	nd	nd	20	1
Magnesium	200	72,000	21,200	32,200	N/A	N/A
Manganese	5	82	nd	1,070	N/A	200
Mercury	0.01	nd	nd	nd	0.1	N/A
Molybdenum	0.5	2.4	3.2	1.2	7300	73
Nickel	1	4	2	6	390	25
Selenium	1	nd	nd	nd	50	1
Silver	0.1	nd	nd	nd	1.2	0.1
Thallium	0.1	nd	nd	0.1	400	0.8
Titanium	5	nd	nd	nd	N/A	100
Uranium	0.1	2.2	0.9	1.9	330	10
Vanadium	0.5	1.0	nd	0.6	200	100
Zinc	5	nd	nd	18	890	10

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- nt – not tested for this parameter
- N/A – not applicable (no standard for this parameter)
- Underlined – value exceeds selected CCME standards
- **Bold and Underlined** – value exceeds selected MECP standards

All detected metal parameter concentrations in the groundwater samples analyzed are in compliance with the selected MECP Table 7 Non-Potable Groundwater Standards.

It should be noted that the concentration of iron, manganese, and zinc detected in Sample BH7-23-GW1 are in excess of the CCME Federal Interim Groundwater Water Quality Guidelines for Commercial Sites.

Table 13
Analytical Test Results – Groundwater
PAHs

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)			MECP Table 7 Non-Potable Groundwater Soil Standards (µg/L)	CCME Tier 1 FIGWQG Commercial Standards (µg/L)
		November 21, 2023				
		BH5-23-GW1	BH6-23-GW1	BH7-23-GW1		
		Sample Depth (m bgs)				
		3.07 – 6.07 m	2.92 – 5.92 m	3.17 – 6.17 m		
Acenaphthene	0.05	nd	nd	nd	17	5.8
Acenaphthylene	0.05	nd	nd	nd	1	46
Acridine	0.10	nd	nd	nd	N/A	0.05
Anthracene	0.01	nd	nd	nd	1	0.012
Benzo[a]anthracene	0.01	nd	nd	nd	1.8	0.018
Benzo[a]pyrene	0.01	nd	nd	nd	0.81	0.015
Benzo[b]fluoranthene	0.05	nd	nd	nd	0.75	N/A
Benzo[g,h,i]perylene	0.05	nd	nd	nd	0.2	0.17
Benzo[k]fluoranthene	0.05	nd	nd	nd	0.4	0.48
1,1-Biphenyl	0.05	nd	nd	nd	1,000	N/A
Chrysene	0.05	nd	nd	nd	0.7	0.1
Dibenzo[a,h]anthracene	0.05	nd	nd	nd	0.4	0.26
Fluoranthene	0.01	nd	nd	nd	44	0.04
Fluorene	0.05	nd	nd	nd	290	3
Indeno [1,2,3-cd] pyrene	0.05	nd	nd	nd	0.2	0.21
1-Methylnaphthalene	0.05	nd	nd	nd	1,500	1,500
2-Methylnaphthalene	0.05	nd	nd	nd	1,500	1,500
Methylnaphthalene (1&2)	0.10	nd	nd	nd	1,500	180
Naphthalene	0.05	nd	nd	nd	7	1.1
Phenanthrene	0.05	nd	nd	nd	380	0.4
Pyrene	0.01	nd	nd	nd	5.7	0.025
Quinoline	0.10	nd	nd	nd	N/A	3.4

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- nt – not tested for this parameter
- N/A – not applicable (no standard for this parameter)
- Underlined – value exceeds selected CCME standards
- **Bold and Underlined** – value exceeds selected MECP standards

No BTEX or PHC parameter concentrations were detected above the laboratory method detection limits in any of the samples analyzed. The results are in compliance with the MECP Table 7 Non-Potable Groundwater Standards as well as the CCME Tier 1 Federal Interim Groundwater Water Quality Guidelines for Commercial Sites.

Table 14
Maximum Concentrations – Groundwater

Parameter	Maximum Concentration (µg/g)	Sample ID	Depth Interval (m BGS)
Aluminum	5	BH7-23-GW1	3.17 – 6.17 m
Barium	289	BH5-23-GW1	3.07 – 6.07 m
Boron	104	BH7-23-GW1	3.17 – 6.17 m
Cadmium	0.01	BH5-23-GW1 / BH7-23-GW1	3.07 – 6.07 m / 3.17 – 6.17 m
Calcium	412,000	BH5-23-GW1	3.07 – 6.07 m
Chromium VI	1	BH6-23-GW1	2.92 – 5.92 m
Cobalt	2.3	BH7-23-GW1	3.17 – 6.17 m
Copper	2.2	BH7-23-GW1	3.17 – 6.17 m
Iron	1,520	BH7-23-GW1	3.17 – 6.17 m
Magnesium	72,000	BH5-23-GW1	3.07 – 6.07 m
Manganese	1,070	BH7-23-GW1	3.17 – 6.17 m
Molybdenum	3.2	BH6-23-GW1	2.92 – 5.92 m
Nickel	6	BH7-23-GW1	3.17 – 6.17 m
Thallium	0.1	BH7-23-GW1	3.17 – 6.17 m
Uranium	2.2	BH5-23-GW1	3.07 – 6.07 m
Vanadium	1.0	BH5-23-GW1	3.07 – 6.07 m
Zinc	18	BH7-23-GW1	3.17 – 6.17 m

Notes:
- Underlined – value exceeds selected CCME standards
- **Bold and Underlined** – value exceeds selected MECP standards

All other parameter concentrations analyzed were below the laboratory detection limits.

5.7 Quality Assurance and Quality Control Results

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

As per Subsection 47(3) of O. Reg. 153/04, as amended by the Environmental Protection Act, the certificates of analysis have been received for each sample submitted for laboratory analysis and have been appended to this report.

As per the Sampling and Analysis Plan, a duplicate soil sample was obtained from sample BH7-23-SS3 and submitted for laboratory analysis of metal parameters. The relative percent difference (RPD) calculations for the original and duplicate samples are provided below in Table 15.

Table 15
QA/QC Calculations – Soil

Parameter	MDL (µg/g)	BH7-23-SS3	DUP-1	RPD (%)	QA/QC Result (Target: <20% RPD)
Antimony	1.0	nd	nd	N/A	Meets Target
Arsenic	1.0	4	4	0.0	Meets Target
Barium	1.0	92	95	3.2	Meets Target
Beryllium	0.5	nd	nd	N/A	Meets Target
Boron	5.0	6.8	6.6	3.0	Meets Target
Cadmium	0.5	nd	nd	N/A	Meets Target
Chromium	5.0	27	28	3.6	Meets Target
Cobalt	1.0	8	8	0.0	Meets Target
Copper	5.0	14	15	6.9	Meets Target
Lead	1.0	35	34	2.9	Meets Target
Molybdenum	1.0	nd	nd	N/A	Meets Target
Nickel	5.0	15	16	6.5	Meets Target
Selenium	1.0	nd	nd	N/A	Meets Target
Silver	0.3	nd	nd	N/A	Meets Target
Thallium	1.0	nd	nd	N/A	Meets Target
Tin	5.0	nd	nd	N/A	Meets Target
Uranium	1.0	nd	nd	N/A	Meets Target
Vanadium	10.0	40	42	4.9	Meets Target
Zinc	20.0	53	56	5.5	Meets Target

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

The RPD calculated for the majority of the parameters fell within of the acceptable range of 20%, and as a result, the data quality objectives outlined in the Sampling and Analysis Plan, appended to this report, are considered to have been met.

It should be noted that the laboratory reported slightly elevated detection limits when analyzing the soil samples for PAHs, due to the nature of the sample matrix. Four of the PAH parameters thus contained detection limits above the MECP Table 7 Coarse-Grained Residential Standards. Due to the non-detect nature of the remaining PAH parameters in these samples, the quality of the laboratory data is considered to be sufficient to meet the overall objectives of this assessment.

Similarly, a duplicate groundwater sample was obtained from sample BH7-23-GW1 and submitted for laboratory analysis of BTEX and PHC parameters. No parameter concentrations were detected in either the original or the duplicate samples above the laboratory method detection limits, and as such, they are considered to meet the data quality objectives outlined in the Sampling and Analysis Plan, appended to this report.

Based on the results of the QA/QC analysis, the quality of the field data collected during this Phase II ESA is considered to be sufficient to meet the overall objectives of this assessment.

5.8 Phase II Conceptual Site Model

The following section has been prepared in accordance with the requirements of O. Reg. 153/04 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 described in Section 7.1 of the Phase I ESA report, the following PCAs, as defined by Table 2 of O. Reg. 153/04, are considered to result in APECs on the Phase II Property:

Table 16
Areas of Potential Environmental Concern

Area of Potential Environmental Concern	Location of APEC on Phase I Property	Potentially Contaminating Activity (Table 2 – O. Reg. 153/04)	Location of PCA (On-Site or Off-Site)	Contaminants of Potential Concern	Media Potentially Impacted (Groundwater, Soil, and/or Sediment)
APEC 1 Fill Material of Unknown Quality	Entirety of Phase I Property	*"Item 30: Importation of Fill Material of Unknown Quality"*	On-Site	PHCs (F_1-F_4) BTEX PAHs Metals	Soil and/or groundwater
APEC 2 Application of Road Salt	Northern and Central Portions of Phase I Property	*"Item N/A: Application of Road Salt for De-Icing Purposes During Snow and Ice Conditions"*	On-Site	EC SAR	Soil and/or groundwater

Contaminants of Potential Concern (CPCs)

The contaminants of potential concern (CPCs) associated with the aforementioned APECs are considered to be:

- ❒ Benzene, Ethylbenzene, Toluene, and Xylenes (BTEX);
- ❒ Petroleum Hydrocarbons, fractions 1 – 4 (PHCs F_1-F_4);
- ❒ Polycyclic Aromatic Hydrocarbons (PAHs);
- ❒ Metals (including Arsenic, Antimony, and Selenium);
- ❒ Mercury (Hg^+);
- ❒ Hexavalent Chromium (CrVI);
- ❒ Electrical Conductivity (EC);
- ❒ Sodium Adsorption Ratio (SAR).

These CPCs have the potential to be present in the soil matrix and/or the groundwater situated beneath the Phase II Property.

Subsurface Structures and Utilities

Underground service locates were completed prior to the subsurface investigation. Underground utilities identified beneath the Phase II Property include sewer and water lines, as well as buried electrical conduits.

Physical Setting

Site Stratigraphy

The stratigraphy of the Phase II Property generally consists of:

- ❒ Pavement Structure (asphaltic concrete underlain by engineered fill); extending to a maximum depth of approximately 0.99 m below ground surface (BH5-23 and BH6-23 only);
- ❒ Topsoil, in the southern end of the property; extending to a maximum depth of approximately 0.15 m below ground surface (BH7-23 only);
- ❒ Fill Material (brown silty sand and some clay with gravel, cobbles, and boulders); encountered at a depth of approximately 0.15 m below ground surface and extending to a depth of approximately 3.10 m below ground surface (BH7-23 only);
- ❒ Glacial Till; encountered at a depth of approximately 0.15 m below ground surface and extending to a depth of approximately 3.38 m below ground surface (BH7-23 only);
- ❒ Limestone Bedrock; encountered at depths ranging from approximately 0.69 m to 3.38 m below ground surface.

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

Hydrogeological Characteristics

The groundwater at the Phase II Property was encountered within the bedrock at depths ranging from approximately 3.04 m to 3.73 m below the existing ground surface.

Based on the measured groundwater levels, the groundwater was calculated to flow in a northerly direction.

Approximate Depth to Bedrock

Bedrock was encountered in all three boreholes during the field drilling program at depths ranging from approximately 0.69 m to 3.38 m below ground surface.

Approximate Depth to Water Table

The depth to the water table is approximately 3.04 m to 3.73 m below the existing ground surface.

Sections 41 and 43.1 of Ontario Regulation 153/04

Section 41 of the Regulation does not apply to the Phase II Property, as the Phase II Property is not within 30 m of an environmentally sensitive area, the pH of the surface soil is between 5 and 9, and the pH of the subsurface soil is between 5 and 11.

Section 43.1 of the Regulation applies to the Phase II Property in that the Phase II Property is considered to be a Shallow Soil Property and is not within 30 m of a water body.

Existing Buildings and Structures

No buildings or structures currently exist on the Phase I Property.

Environmental Condition

Areas Where Contaminants are Present

Based on the findings of this assessment, the fill material encountered beneath the surficial layer of asphalt at BH5-23, located within the vehicle parking lot in the northern portion of the Phase II Property, is contaminated with PHCs.

Based on the analytical test results, the groundwater beneath the Phase II Property is not considered to be contaminated.

Types of Contaminants

Based on the analytical test results, the concentration of heavier fractions of petroleum hydrocarbons (PHC $F_{4\ gravimetric}$) detected in the fill material in BH5-23 exceeds the selected MECP Table 7 Coarse-Grained Residential Soil Standards. Based on the very shallow sample depth, it is suspected that this exceedance may be a result of asphalt inclusions in the sample, from the paving structure.

It should be noted that Sample BH6-23-AU1 was obtained from the same depth and strata as Sample BH5-23-AU1. Both samples were observed to be identical in nature, with visual differences noted between the samples.

It should be noted that the electrical conductivity level detected in the fill material at BH5-23 is also in excess of the MECP Table 7 Coarse-Grained Residential Soil Standards. This exceedance is suspected to be the result of the use of road salt on the Phase II Property during snow and ice conditions and thus, as per Section 49.1 of O. Reg 153/04, does not represent a contaminant issue.

All groundwater samples were found to comply with both MECP Table 7 Residential Standards and CCME Commercial Standards, with the exception of iron, manganese, and zinc identified in BH7-23, which exceeded the CCME standards. No exceedances in the soil samples were identified for these parameters, and therefore it is considered possible that these parameters are naturally elevated, or they are elevated due to the presence of sediment. The presence of these metals is not considered to pose an environmental risk to the current use of the property.

Contaminated Media

Based on the findings of this assessment, the fill material present in the vicinity of BH5-23 is considered to be contaminated above MECP residential standards. Although the PHC F_4 concentration complied with both the MECP and CCME standards, the $F_{4\ gravimetric}$ result was found to exceed the MECP standards. No contaminated soil has been identified above the CCME standards for commercial use.

Some elevated metal parameters were identified above the CCME standards in the groundwater at borehole BH7-23. These parameters are potentially naturally elevated, or the result of sediment in the groundwater, and thus are not considered to pose an environmental risk to the current use of the property.

What Is Known About Areas Where Contaminants Are Present

The fill material present beneath the surficial asphalt at BH5-23 is impacted above provincial MECP standards with heavier fractions of petroleum hydrocarbons (PHC $F_{4\ gravimetric}$). Given the shallow soil conditions, this sample may have been influenced by the presence of asphalt inclusions in the sample.

Distribution and Migration of Contaminants

Distribution of PHC impacts above MECP standards is considered to be limited to BH5-23. Based on the low mobility of heavy petroleum hydrocarbons, as well as the clean groundwater results obtained from this borehole, these contaminants are not suspected to have migrated into the water table.

Discharge of Contaminants

PHC F4 gravimetric concentration in soil at BH5-23 is suspected to be present due to sample collection directly under the asphalt paving structure, and asphalt inclusions, since the standard PHC F4 concentration was found to comply with both selected project standards.

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 via the infiltration of precipitation, and the migration of contaminants via groundwater levels and/or flow, which may fluctuate seasonally.

Based on the clean groundwater results obtained during this investigation, no downward migration of contaminants is suspected to have occurred.

Potential for Vapour Intrusion

Given that the Phase II Property will be redeveloped in the near future, all contaminated soil will be removed from the site. As a result, there is no potential for any current or future vapour intrusion on the Phase II Property.

6.0 CONCLUSIONS

Assessment

Paterson Group was retained by IBI Group to conduct a Phase II – Environmental Site Assessment (Phase II ESA) for Blocks 1 and 2 of the Tunney's Pasture government office complex, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address potentially contaminating activities (PCAs) that were identified during the Phase I ESA and were considered to result in areas of potential environmental concern (APECs) on the subject site (Phase II Property).

The subsurface investigation for this assessment was conducted on November 13, 2023 and consisted of drilling three boreholes (BH5-23 to BH7-23) across the Phase II Property. It should be noted that this field investigation was carried out as part of a larger investigation conducted for multiple sites at the Tunney's Pasture complex. The boreholes were advanced to depths ranging from approximately 5.92 m to 6.17 m below the existing ground surface and terminated within the bedrock unit. Upon completion, all three boreholes were instrumented with groundwater monitoring wells in order to access the groundwater table.

In general, the subsurface soil profile encountered at the borehole locations consists of either a thin pavement structure (asphaltic concrete over granular fill) or topsoil, and brown silty sand fill material underlain by a thin layer of glacial till. Bedrock was encountered in all three boreholes during the field drilling program at depths ranging from approximately 0.69 m to 3.38 m below ground surface. During the field sampling program, the groundwater was measured at depths ranging from approximately 3.04 m to 3.73 m below the existing ground surface.

A total of 4 soil samples were submitted for laboratory analysis of BTEX, PHCs (F_1-F_4), metals, Hg^+, CrVI, PAHs, EC, SAR, and/or pH parameters. All analytical results were found to comply with both MECP Table 7 Residential Standards (for future site reuse purposes), and with CCME commercial standards (current use standards). One exception, is the presence of PHCs $F_{4\ gravimetric}$ in Sample BH5-23-AU1, which exceeds only the MECP Table 7 Standards. This exceedance may be a result of asphalt inclusions in the sample, which was collected beneath the paving structure.

All groundwater samples were found to comply with both MECP Table 7 residential standards and CCME commercial standards, with the exception of iron, manganese, and zinc, which exceeded CCME standards.

No exceedances in soil samples were identified for these parameters, and it is considered possible that these parameters are naturally elevated, or they are elevated due to the presence of sediment. The presence of these metals is not considered to pose an environmental risk to the current use of the property.

Recommendations

Soil

Based on the findings of this assessment, the shallow fill material present beneath the surficial asphalt at BH5-23 is contaminated with heavier fractions of petroleum hydrocarbons (PHC $F_{4\ gravimetric}$). Given the low-mobility of these contaminants, it is expected that the contamination is confined to the fill material within a localized area around BH5-23. It should be noted that this contamination only exceeds the provincial MECP Table 7 Standards, and not the federal CCME Standards.

It is our understanding that the Phase II Property may be redeveloped in the future. As such, the contaminated soil could be fully delineated and remediated in conjunction with site redevelopment. This contaminated soil will require disposal at a licensed waste disposal facility. Prior to off-site disposal of impacted soil at a licensed waste disposal facility, a leachate analysis of a representative sample of contaminated soil must be conducted in accordance with Ontario Regulation 347/558.

Additionally, excess soil must be handed in accordance with O. Reg. 406/19: On-Site and Excess Soil Management. Additional excess soil testing and reporting requirements will be required prior to future site excavation activities, in accordance with O. Reg. 406/19. Further delineation of the PHC $F_{4\ gravimetric}$ exceedance can be conducted in conjunction with the excess soil testing program.

Monitoring Wells

Although groundwater is in compliance with the proposed future use of the site, consideration may be given to re-sampling the wells for metals analysis, to confirm the presence of metals above CCME standards.

It is recommended that the monitoring wells be maintained for future sampling purposes. The monitoring wells will be registered with the MECP under Ontario Regulation 903 (Ontario Water Resources Act). At such a time that the monitoring wells are no longer required, they must be decommissioned in accordance with O.Reg. 903.

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 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 Phase II Property 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 Arcadis IBI Group and the Government of Canada. Permission and notification from the above noted parties and Paterson Group will be required prior to the release of this report to any other party.

Paterson Group Inc.

Nick Sullivan, B.Sc.

Adrian Menyhart, P.Eng., QP$_{ESA}$

Report Distribution:

- Arcadis IBI Group
- Paterson Group Inc.

FIGURES

FIGURE 1 – KEY PLAN

DRAWING PE6034-1 – SITE PLAN

DRAWING PE6034-2 – SURROUNDING LAND USE PLAN

DRAWING PE6034-3 – TEST HOLE LOCATION PLAN

DRAWING PE6034-4 – ANALYTICAL TESTING PLAN – SOIL (PHCs)

DRAWING PE6034-4A – CROSS SECTION A-A' – SOIL (PHCs)

DRAWING PE6034-4B – CROSS SECTION B-B' – SOIL (PHCs)

DRAWING PE6034-5 – ANALYTICAL TESTING PLAN – SOIL (BTEX, METALS, PAHs, EC, SAR, pH)

DRAWING PE6034-5A – CROSS SECTION A-A' – SOIL (BTEX, METALS, PAHs, EC, SAR, pH)

DRAWING PE6034-5B – CROSS SECTION B-B' – SOIL (BTEX, METALS, PAHs, EC, SAR, pH)

DRAWING PE6034-6 – ANALYTICAL TESTING PLAN – GROUNDWATER

DRAWING PE6034-6A – CROSS SECTION A-A' – GROUNDWATER

DRAWING PE6034-6B – CROSS SECTION B-B' – GROUNDWATER

APPENDIX 1

SAMPLING AND ANALYSIS PLAN

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

LABORATORY CERTIFICATES OF ANALYSIS

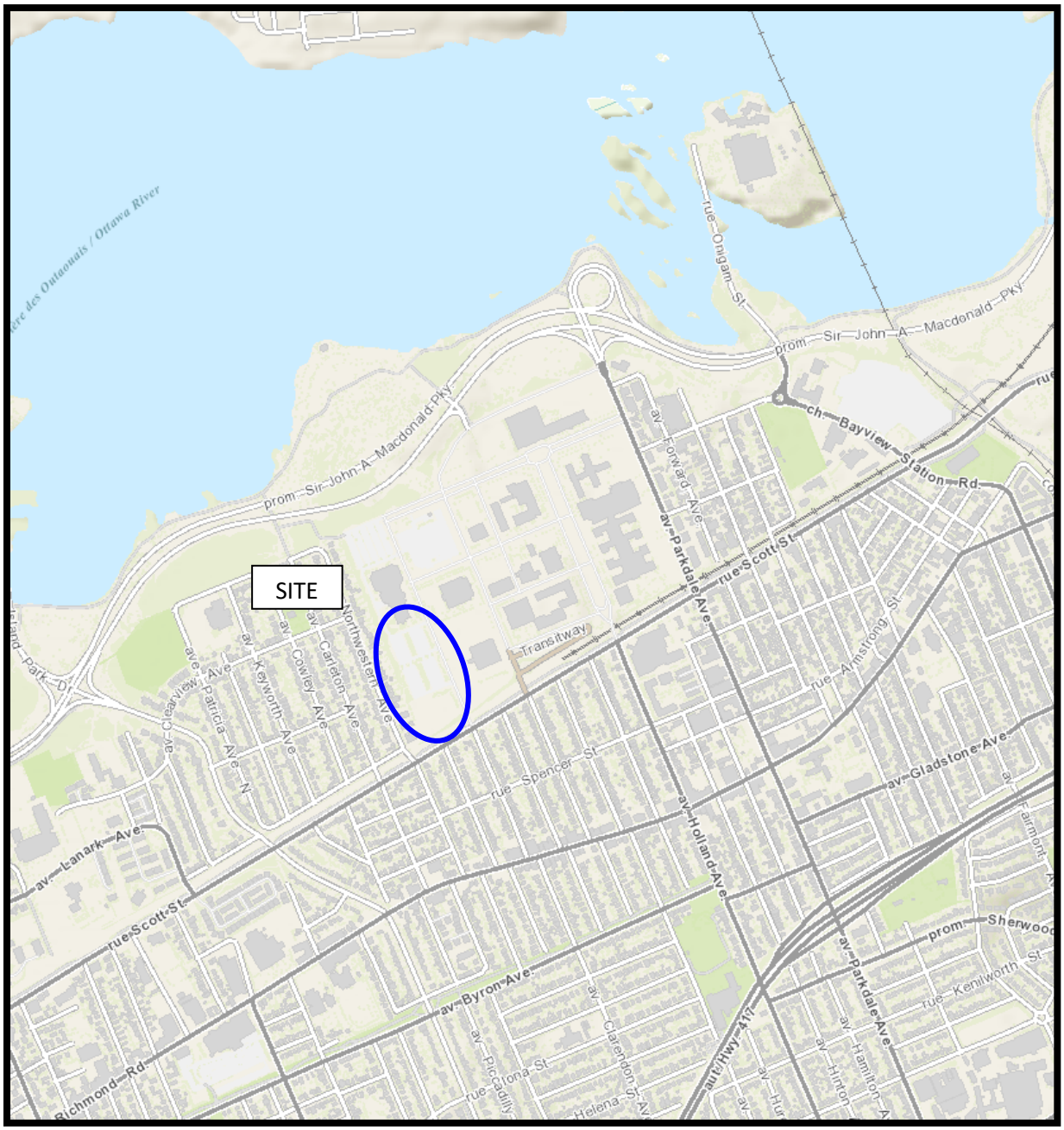
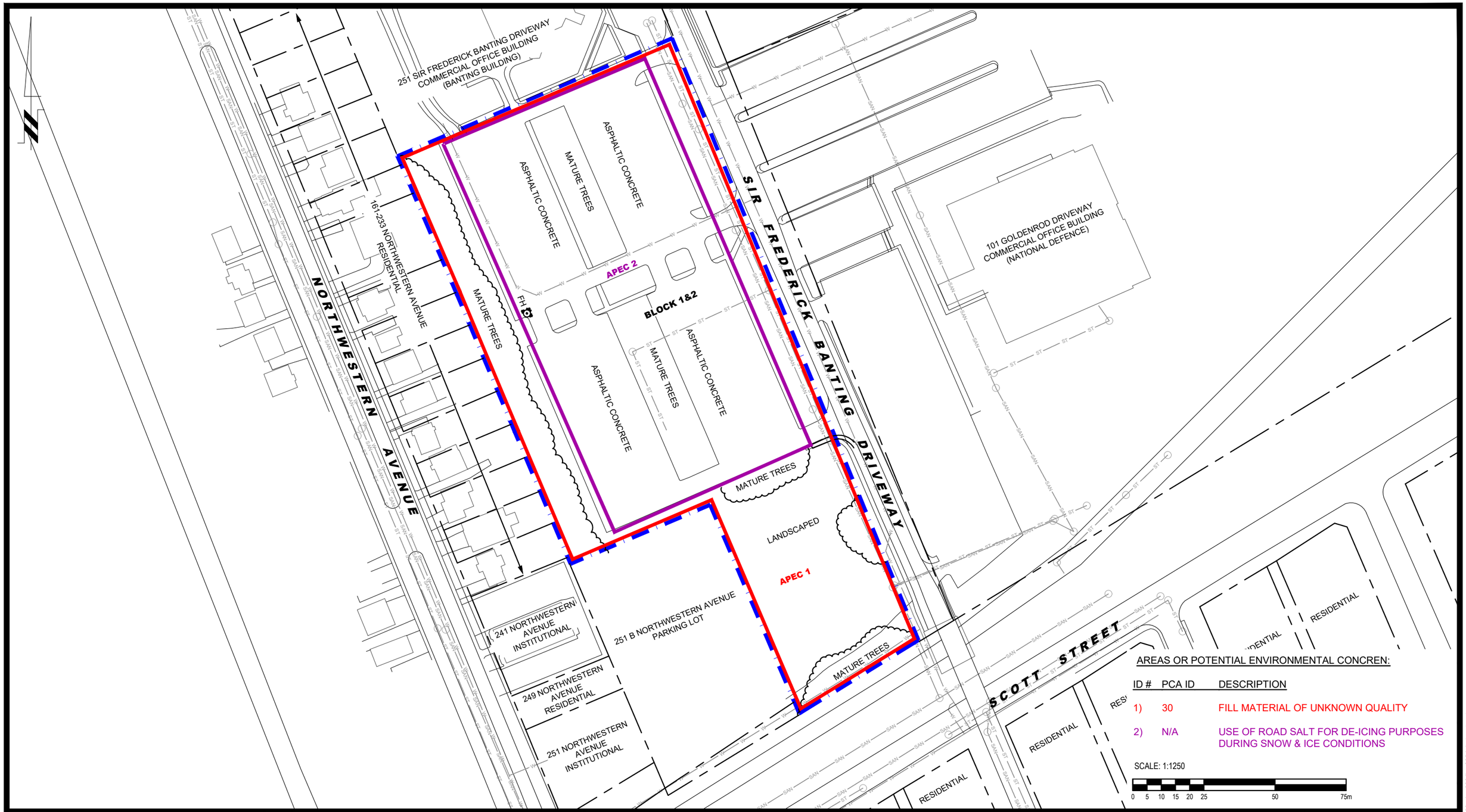


FIGURE 1

KEY PLAN

PATERSON GROUP



AREAS OR POTENTIAL ENVIRONMENTAL CONCREN:

ID #	PCA ID	DESCRIPTION
1)	30	FILL MATERIAL OF UNKNOWN QUALITY
2)	N/A	USE OF ROAD SALT FOR DE-ICING PURPOSES DURING SNOW & ICE CONDITIONS

SCALE: 1:1250

0 5 10 15 20 25 50 75m

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL

IBI GROUP

PHASE I - ENVIRONMENTAL SITE ASSESSMENT
TUNNEY'S PASTURE (BLOCKS 1 AND 2)

OTTAWA, ONTARIO

Title:

SITE PLAN

Scale: 1:1250	Date: 03/2023
Drawn by: YA	Report No.: PE6034-1
Checked by: NS	Dwg. No.: PE6034-1
Approved by: AM	Revision No.:

11x17

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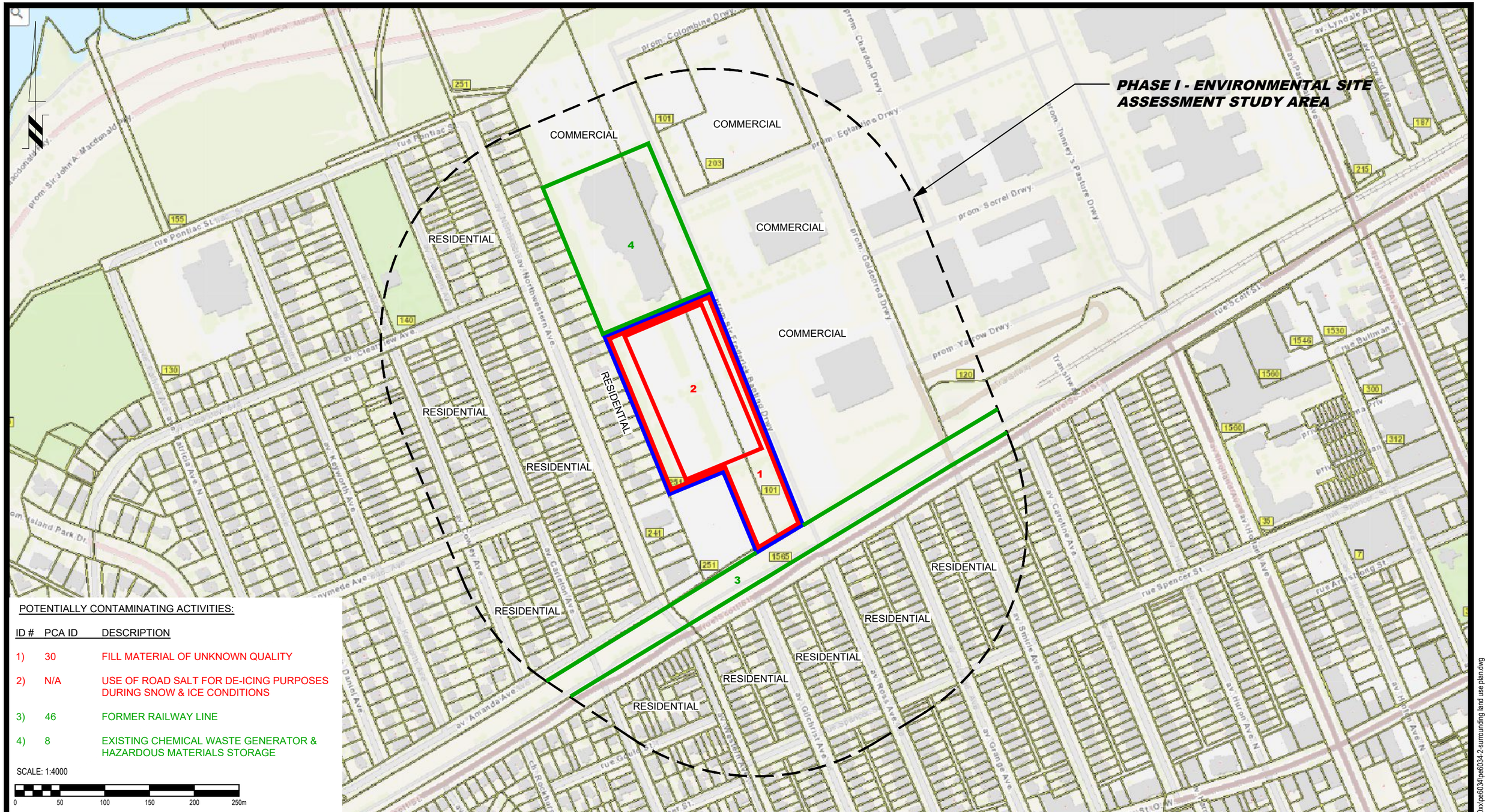

POTENTIALLY CONTAMINATING ACTIVITIES:

ID #	PCA ID	DESCRIPTION
1)	30	FILL MATERIAL OF UNKNOWN QUALITY
2)	N/A	USE OF ROAD SALT FOR DE-ICING PURPOSES DURING SNOW & ICE CONDITIONS
3)	46	FORMER RAILWAY LINE
4)	8	EXISTING CHEMICAL WASTE GENERATOR & HAZARDOUS MATERIALS STORAGE

SCALE: 1:4000

0 50 100 150 200 250m

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TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL

IBI GROUP

PHASE I - ENVIRONMENTAL SITE ASSESSMENT
TUNNEY'S PASTURE (BLOCKS 1 AND 2)

OTTAWA, ONTARIO

Title:

SURROUNDING LAND USE PLAN

Scale: 1:4000	Date: 03/2023
Drawn by: YA	Report No.: PE6034-1
Checked by: NS	Dwg. No.: PE6034-2
Approved by: AM	Revision No.:

11x17

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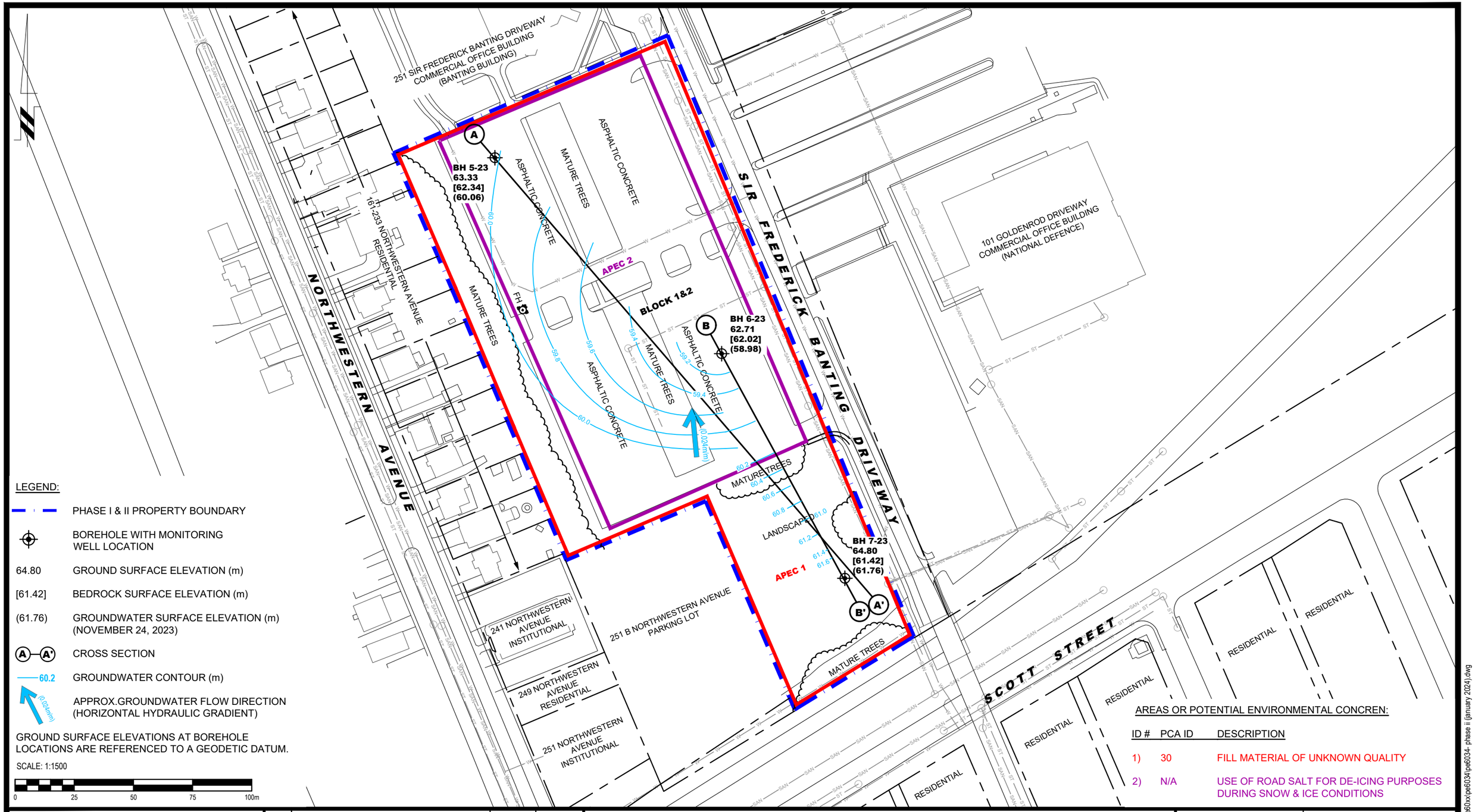

LEGEND:

- PHASE I & II PROPERTY BOUNDARY
- BOREHOLE WITH MONITORING WELL LOCATION
- 64.80 GROUND SURFACE ELEVATION (m)
- [61.42] BEDROCK SURFACE ELEVATION (m)
- (61.76) GROUNDWATER SURFACE ELEVATION (m) (NOVEMBER 24, 2023)
- A—A' CROSS SECTION
- 60.2 GROUNDWATER CONTOUR (m)
- (0.024m/m) APPROX.GROUNDWATER FLOW DIRECTION (HORIZONTAL HYDRAULIC GRADIENT)

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

SCALE: 1:1500

0 25 50 75 100m

AREAS OR POTENTIAL ENVIRONMENTAL CONCREN:

ID #	PCA ID	DESCRIPTION
1)	30	FILL MATERIAL OF UNKNOWN QUALITY
2)	N/A	USE OF ROAD SALT FOR DE-ICING PURPOSES DURING SNOW & ICE CONDITIONS

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL

IBI GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
TUNNEY'S PASTURE (BLOCKS 1 AND 2)

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:1500	Date: 02/2024
Drawn by: YA	Report No.: PE6034-2
Checked by: NS	Dwg. No.: PE6034-3
Approved by: AM	Revision No.:

11x17

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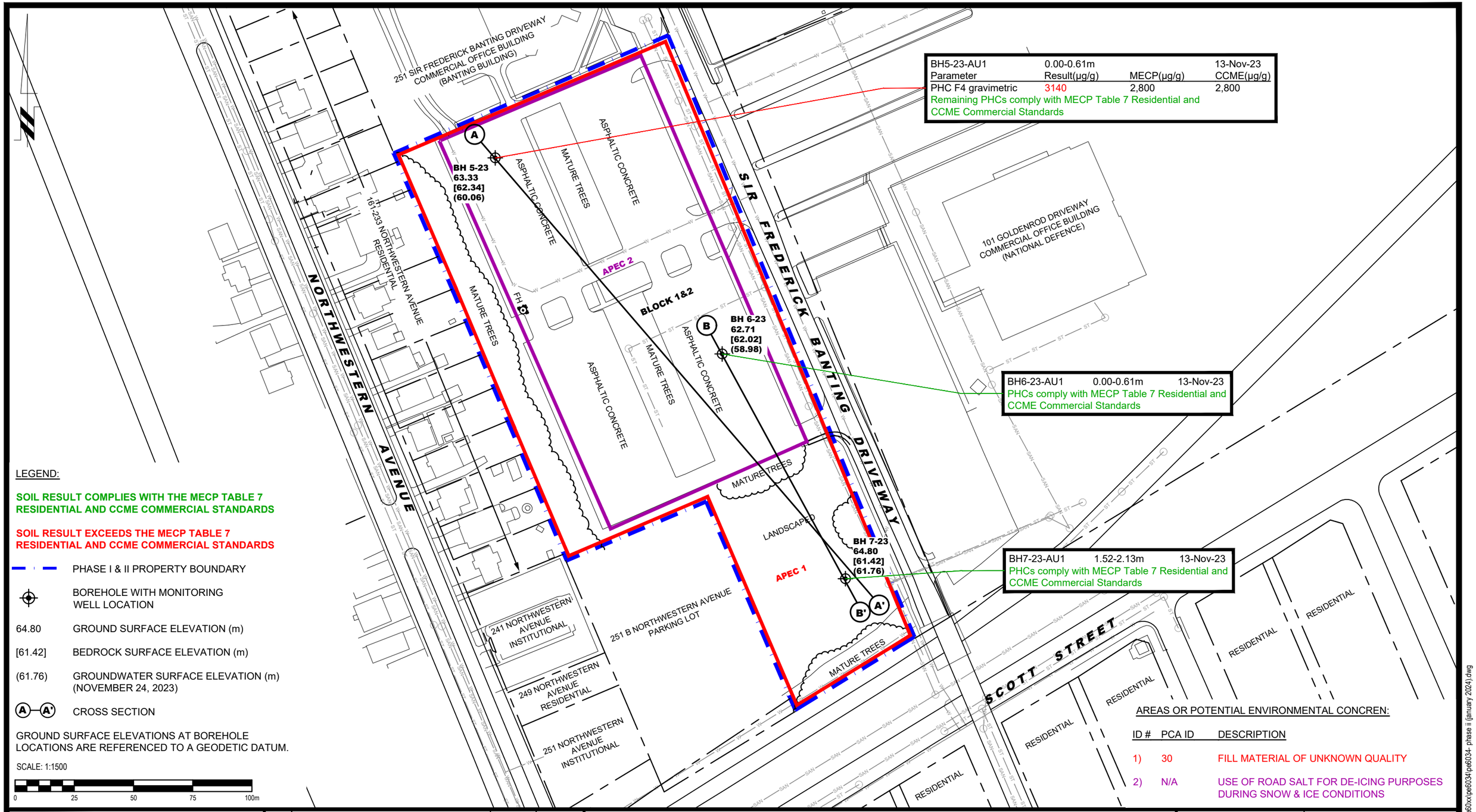

LEGEND:

SOIL RESULT COMPLIES WITH THE MECP TABLE 7 RESIDENTIAL AND CCME COMMERCIAL STANDARDS

SOIL RESULT EXCEEDS THE MECP TABLE 7 RESIDENTIAL AND CCME COMMERCIAL STANDARDS

- PHASE I & II PROPERTY BOUNDARY
- BOREHOLE WITH MONITORING WELL LOCATION
- 64.80 GROUND SURFACE ELEVATION (m)
- [61.42] BEDROCK SURFACE ELEVATION (m)
- (61.76) GROUNDWATER SURFACE ELEVATION (m) (NOVEMBER 24, 2023)
- A—A' CROSS SECTION

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

SCALE: 1:1500

0 25 50 75 100m

AREAS OR POTENTIAL ENVIRONMENTAL CONCREN:

ID #	PCA ID	DESCRIPTION
1)	30	FILL MATERIAL OF UNKNOWN QUALITY
2)	N/A	USE OF ROAD SALT FOR DE-ICING PURPOSES DURING SNOW & ICE CONDITIONS

PATERSON GROUP
9 AURIGA DRIVE
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TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL

IBI GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
TUNNEY'S PASTURE (BLOCKS 1 AND 2)

OTTAWA, ONTARIO

Title: **ANALYTICAL TESTING PLAN - SOIL (PHCs)**

Scale: 1:1500	Date: 02/2024
Drawn by: YA	Report No.: PE6034-2
Checked by: NS	Dwg. No.: PE6034-4
Approved by: AM	Revision No.:

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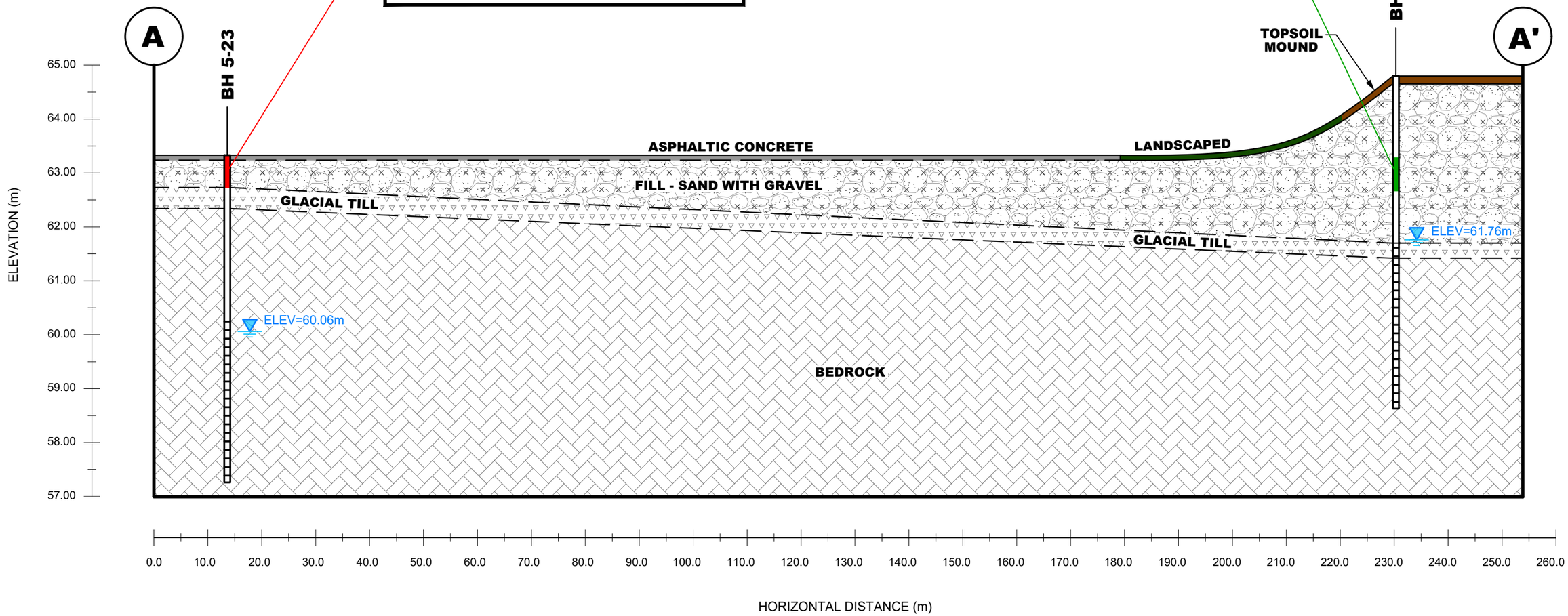
BH5-23-AU1	0.00-0.61m		13-Nov-23
Parameter	Result(µg/g)	MECP(µg/g)	CCME(µg/g)
PHC F4 gravimetric	3140	2,800	2,800

Remaining PHCs comply with MECP Table 7 Residential and CCME Commercial Standards

BH7-23-AU1 1.52-2.13m 13-Nov-23
PHCs comply with MECP Table 7 Residential and CCME Commercial Standards



SOIL RESULT COMPLIES WITH THE MECP TABLE 7 RESIDENTIAL AND CCME COMMERCIAL STANDARDS

SOIL RESULT EXCEEDS THE MECP TABLE 7 RESIDENTIAL AND CCME COMMERCIAL STANDARDS

PATERSON GROUP
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K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL

IBI GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
TUNNEY'S PASTURE (BLOCKS 1 AND 2)

OTTAWA, ONTARIO

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

Scale: AS SHOWN	Date: 02/2024
Drawn by: YA	Report No.: PE6034-2
Checked by: NS	Dwg. No.: PE6034-4A
Approved by: AM	Revision No.:

11x17

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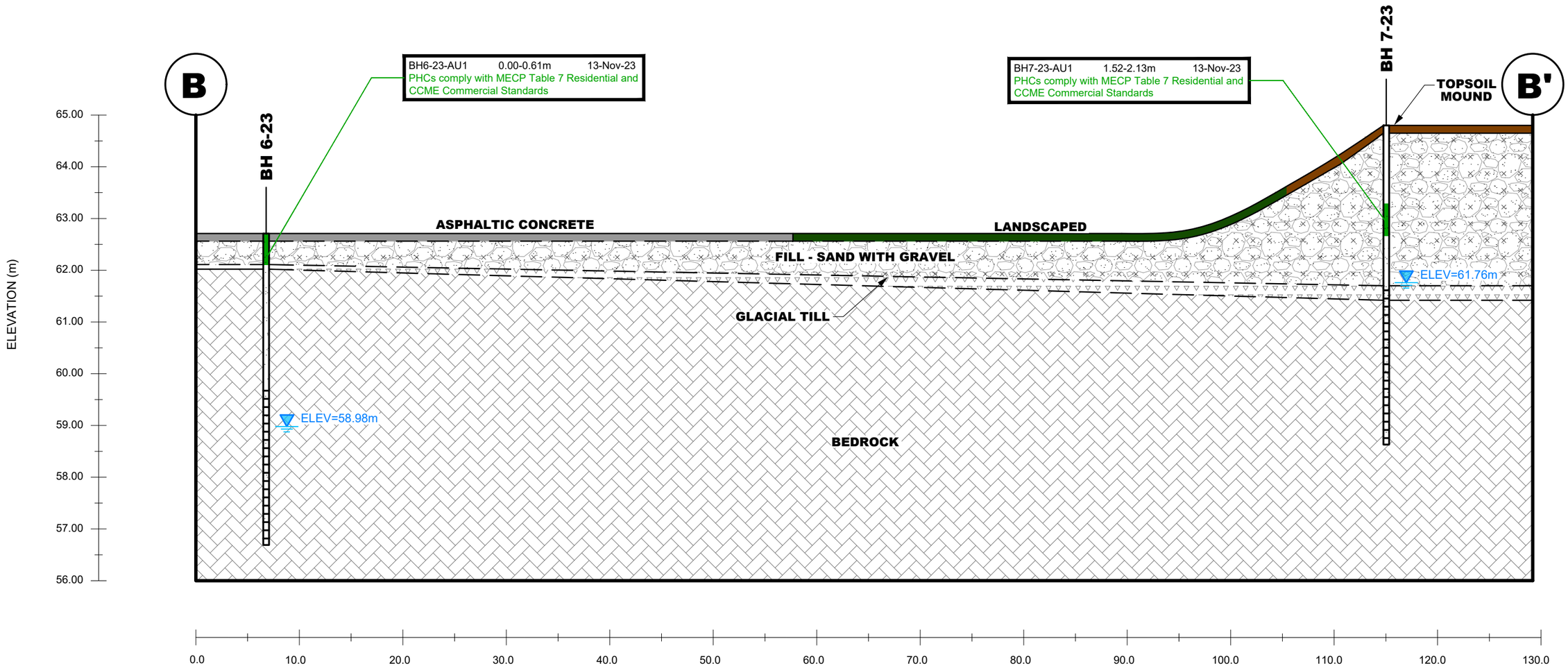

SOIL RESULT COMPLIES WITH THE MECP TABLE 7 RESIDENTIAL AND CCME COMMERCIAL STANDARDS

SOIL RESULT EXCEEDS THE MECP TABLE 7 RESIDENTIAL AND CCME COMMERCIAL STANDARDS

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL

IBI GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
TUNNEY'S PASTURE (BLOCKS 1 AND 2)

OTTAWA, ONTARIO

Title: **CROSS SECTION B-B' - SOIL (PHCs)**

Scale: AS SHOWN	Date: 02/2024
Drawn by: YA	Report No.: PE6034-2
Checked by: NS	Dwg. No.: PE6034-4B
Approved by: AM	Revision No.:

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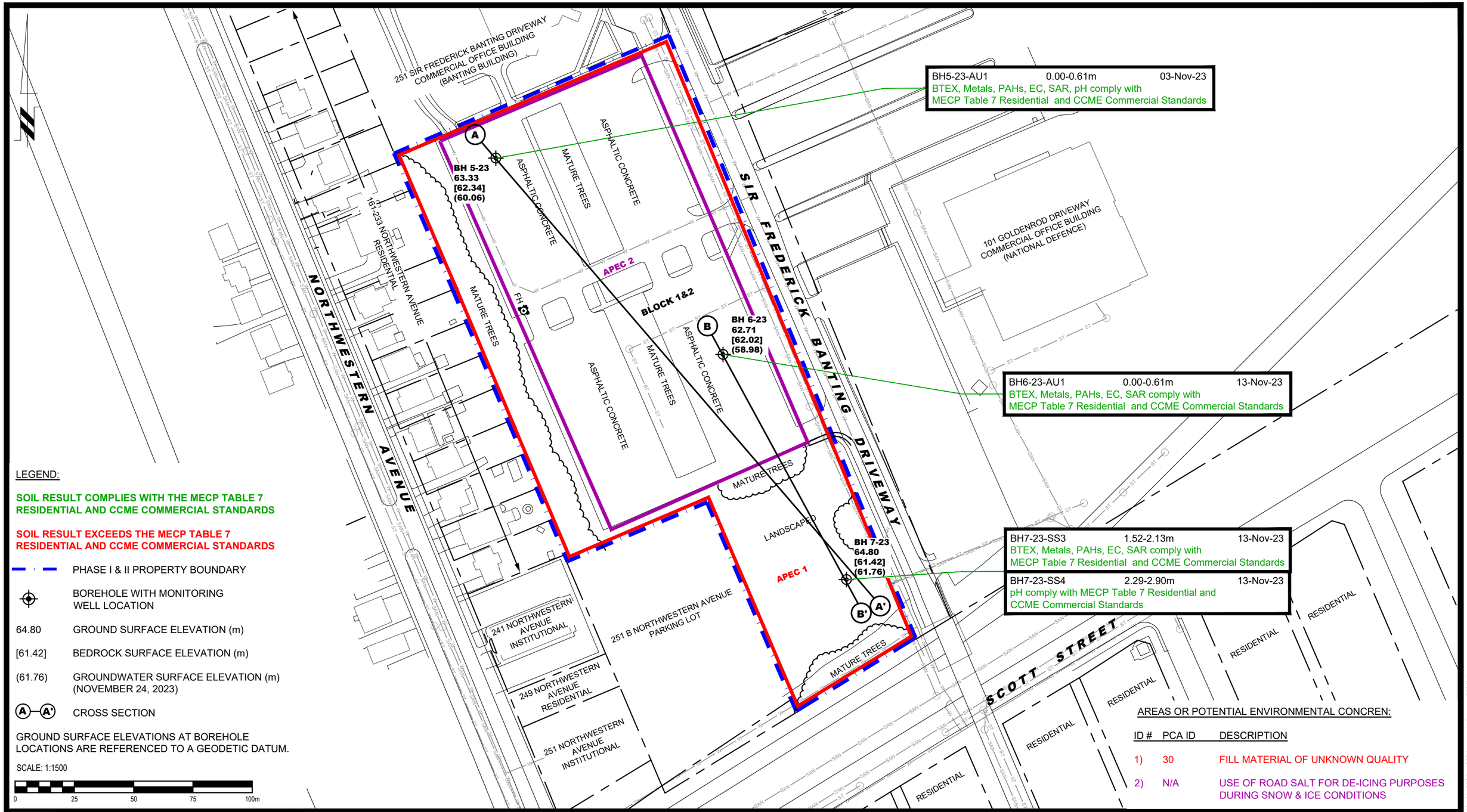

LEGEND:

SOIL RESULT COMPLIES WITH THE MECP TABLE 7 RESIDENTIAL AND CCME COMMERCIAL STANDARDS

SOIL RESULT EXCEEDS THE MECP TABLE 7 RESIDENTIAL AND CCME COMMERCIAL STANDARDS

- PHASE I & II PROPERTY BOUNDARY
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- (61.76) GROUNDWATER SURFACE ELEVATION (m) (NOVEMBER 24, 2023)
- A—A' CROSS SECTION

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

SCALE: 1:1500

0 25 50 75 100m

AREAS OR POTENTIAL ENVIRONMENTAL CONCREN:

ID #	PCA ID	DESCRIPTION
1)	30	FILL MATERIAL OF UNKNOWN QUALITY
2)	N/A	USE OF ROAD SALT FOR DE-ICING PURPOSES DURING SNOW & ICE CONDITIONS

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL

IBI GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
TUNNEY'S PASTURE (BLOCKS 1 AND 2)

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL (BTEX, METALS, PAHs, EC, SAR, pH)

Scale: 1:1500	Date: 02/2024
Drawn by: YA	Report No.: PE6034-2
Checked by: NS	Dwg. No.: PE6034-5
Approved by: AM	Revision No.:

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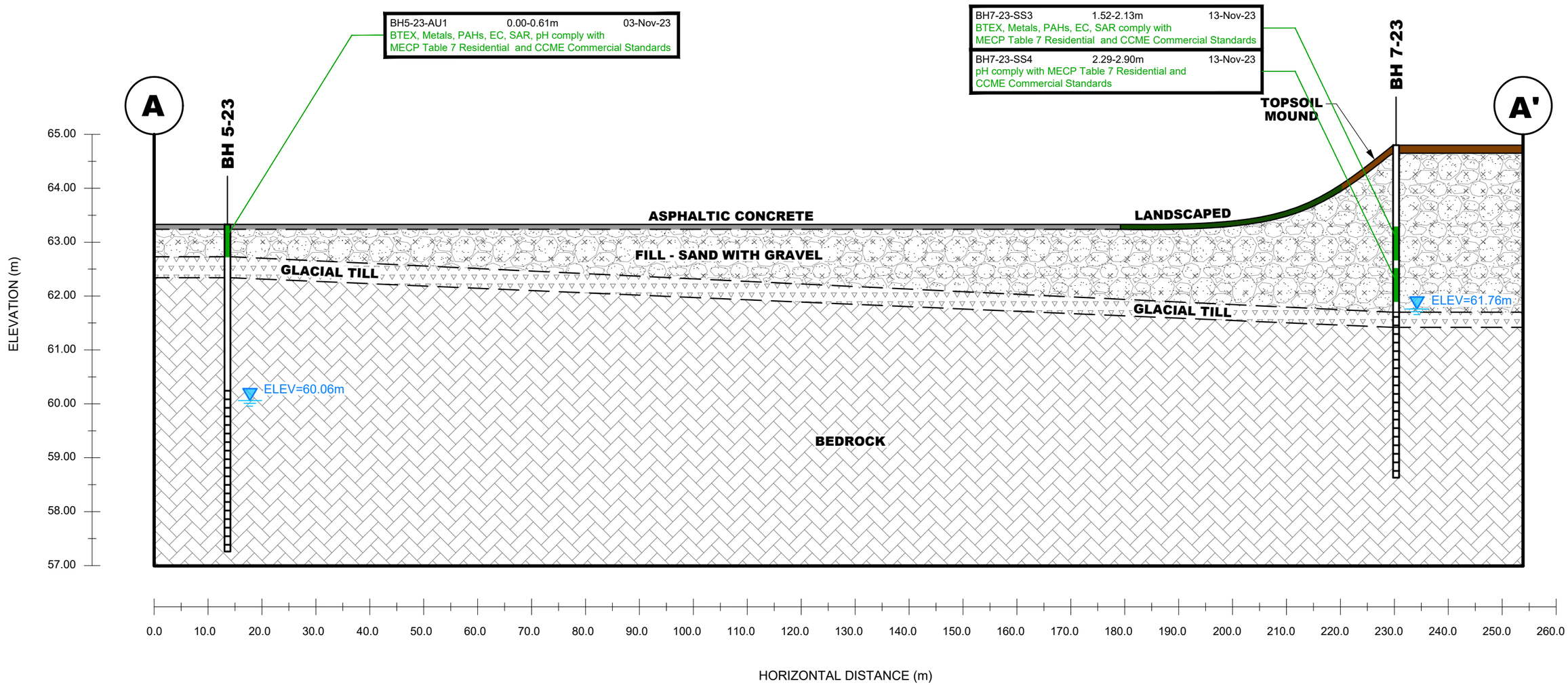

SOIL RESULT COMPLIES WITH THE MECP TABLE 7 RESIDENTIAL AND CCME COMMERCIAL STANDARDS

SOIL RESULT EXCEEDS THE MECP TABLE 7 RESIDENTIAL AND CCME COMMERCIAL STANDARDS

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL

IBI GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
TUNNEY'S PASTURE (BLOCKS 1 AND 2)

OTTAWA, ONTARIO

Title:

CROSS SECTION A-A' - SOIL (BTEX, METALS, PAHs, EC, SAR, pH)

Scale: AS SHOWN	Date: 02/2024
Drawn by: YA	Report No.: PE6034-2
Checked by: NS	Dwg. No.: PE6034-5A
Approved by: AM	Revision No.:

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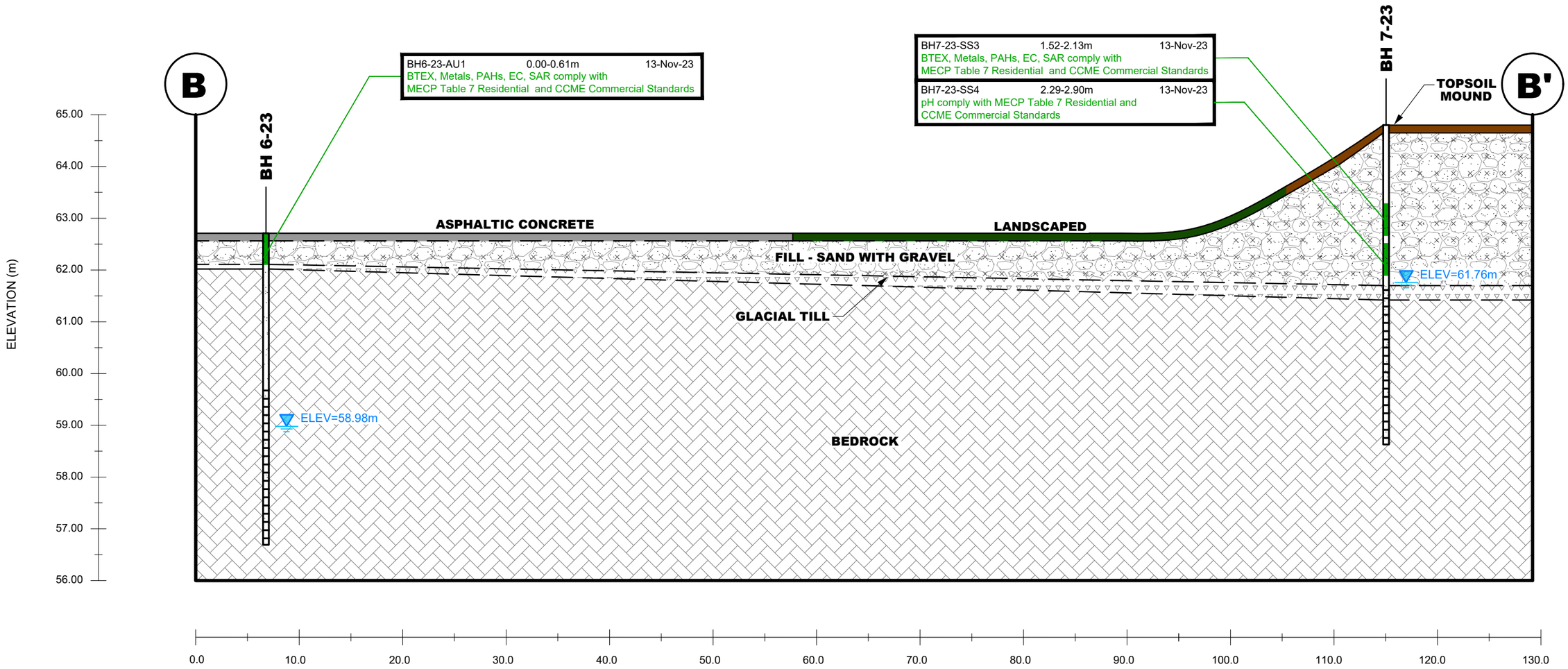

SOIL RESULT COMPLIES WITH THE MECP TABLE 7 RESIDENTIAL AND CCME COMMERCIAL STANDARDS

SOIL RESULT EXCEEDS THE MECP TABLE 7 RESIDENTIAL AND CCME COMMERCIAL STANDARDS

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL

IBI GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
TUNNEY'S PASTURE (BLOCKS 1 AND 2)

OTTAWA, ONTARIO

Title:

CROSS SECTION B-B' - SOIL (BTEX, METALS, PAHs, EC, SAR, pH)

Scale: AS SHOWN	Date: 02/2024
Drawn by: YA	Report No.: PE6034-2
Checked by: NS	Dwg. No.: PE6034-5B
Approved by: AM	Revision No.:

11x17

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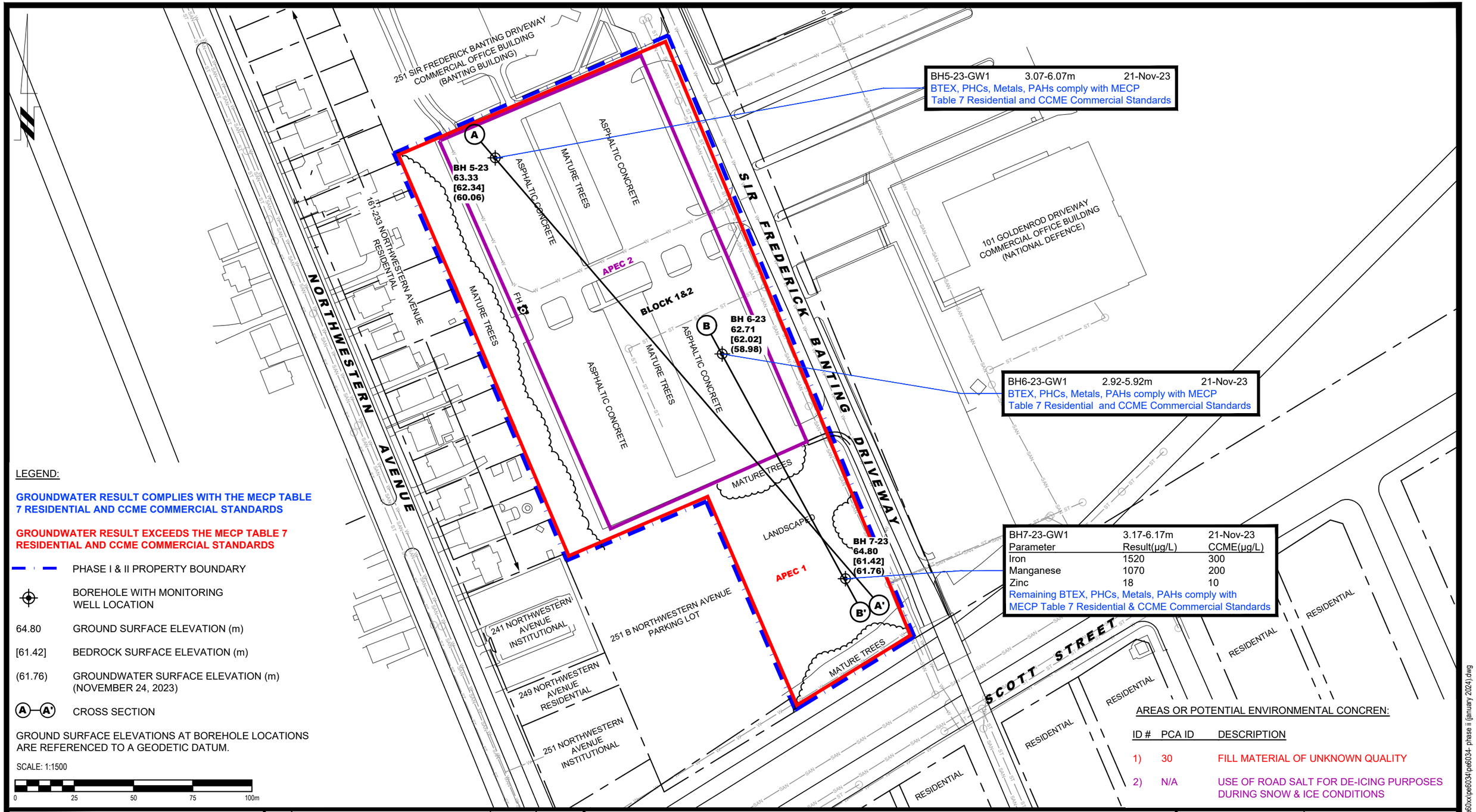

LEGEND:

GROUNDWATER RESULT COMPLIES WITH THE MECP TABLE 7 RESIDENTIAL AND CCME COMMERCIAL STANDARDS

GROUNDWATER RESULT EXCEEDS THE MECP TABLE 7 RESIDENTIAL AND CCME COMMERCIAL STANDARDS

- PHASE I & II PROPERTY BOUNDARY
- BOREHOLE WITH MONITORING WELL LOCATION
- 64.80 GROUND SURFACE ELEVATION (m)
- [61.42] BEDROCK SURFACE ELEVATION (m)
- (61.76) GROUNDWATER SURFACE ELEVATION (m) (NOVEMBER 24, 2023)
- A—A' CROSS SECTION

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

SCALE: 1:1500

0 25 50 75 100m

AREAS OR POTENTIAL ENVIRONMENTAL CONCREN:

ID #	PCA ID	DESCRIPTION
1)	30	FILL MATERIAL OF UNKNOWN QUALITY
2)	N/A	USE OF ROAD SALT FOR DE-ICING PURPOSES DURING SNOW & ICE CONDITIONS

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL

IBI GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
TUNNEY'S PASTURE (BLOCKS 1 AND 2)

OTTAWA, ONTARIO

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

Scale: 1:1500	Date: 02/2024
Drawn by: YA	Report No.: PE6034-2
Checked by: NS	Dwg. No.: PE6034-6
Approved by: AM	Revision No.:

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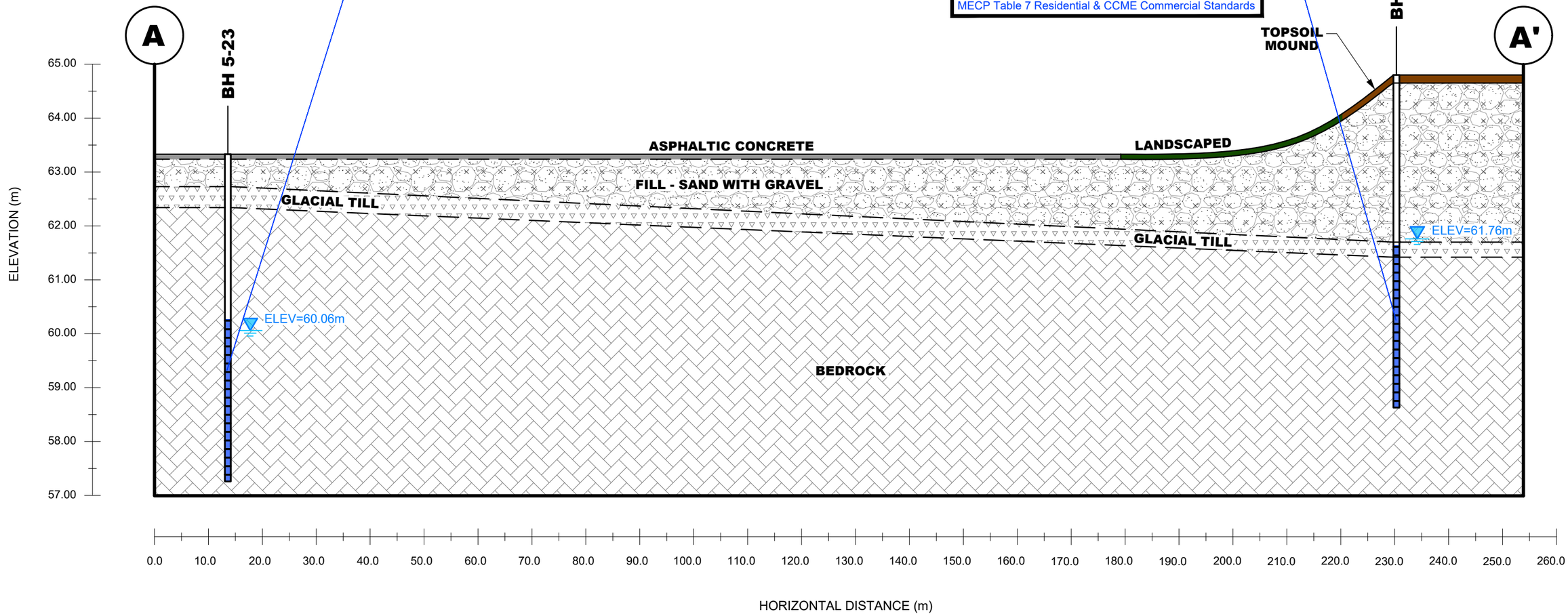
BH5-23-GW1	3.07-6.07m	21-Nov-23
BTEX, PHCs, Metals, PAHs comply with MECP Table 7 Residential and CCME Commercial Standards		

BH7-23-GW1	3.17-6.17m	21-Nov-23
Parameter	Result(µg/L)	CCME(µg/L)
Iron	1520	2,800
Manganese	1070	200
Zinc	18	10
Remaining BTEX, PHCs, Metals, PAHs comply with MECP Table 7 Residential & CCME Commercial Standards		



GROUNDWATER RESULT COMPLIES WITH THE MECP TABLE 7 RESIDENTIAL AND CCME COMMERCIAL STANDARDS

GROUNDWATER RESULT EXCEEDS THE MECP TABLE 7 RESIDENTIAL AND CCME COMMERCIAL STANDARDS

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL

IBI GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
TUNNEY'S PASTURE (BLOCKS 1 AND 2)

OTTAWA, ONTARIO

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

Scale: AS SHOWN	Date: 02/2024
Drawn by: YA	Report No.: PE6034-2
Checked by: NS	Dwg. No.: PE6034-6A
Approved by: AM	Revision No.:

11x17

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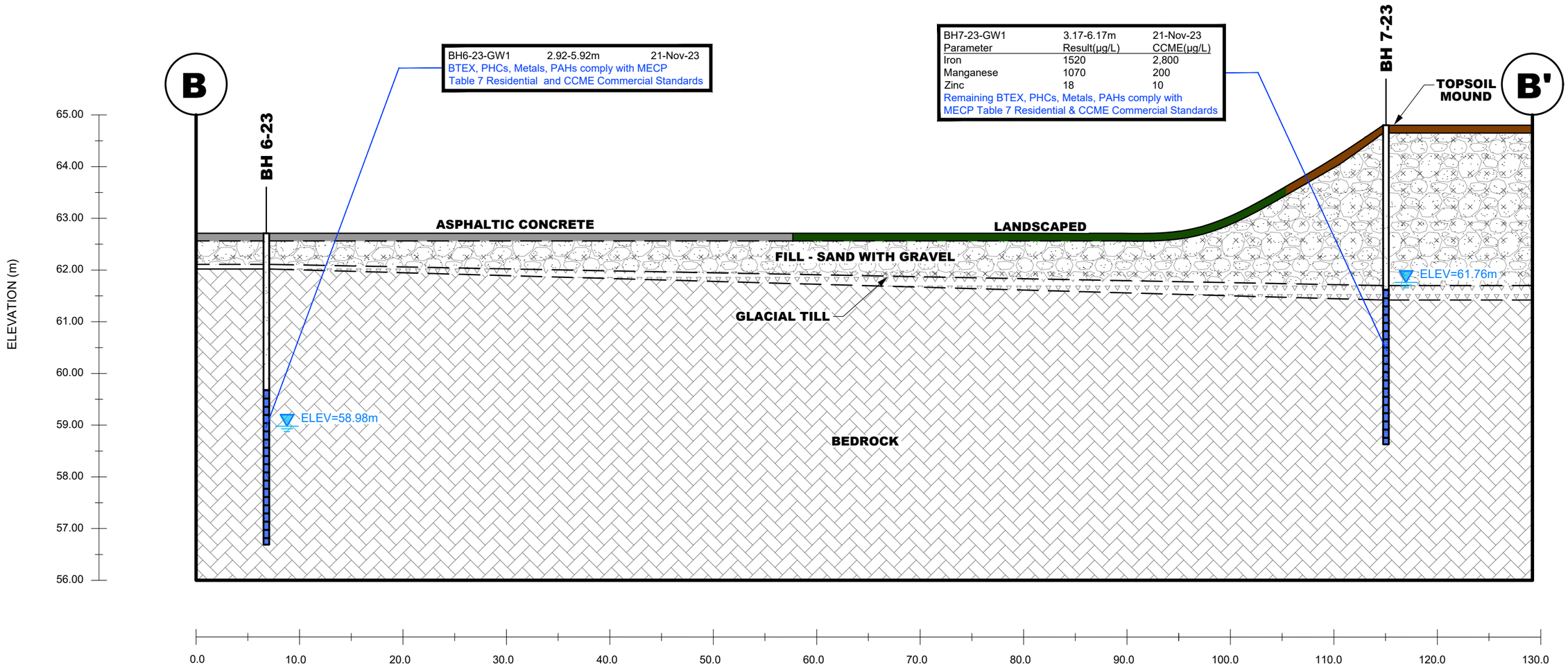

GROUNDWATER RESULT COMPLIES WITH THE MECP TABLE 7 RESIDENTIAL AND CCME COMMERCIAL STANDARDS

GROUNDWATER RESULT EXCEEDS THE MECP TABLE 7 RESIDENTIAL AND CCME COMMERCIAL STANDARDS

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL

IBI GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
TUNNEY'S PASTURE (BLOCKS 1 AND 2)

OTTAWA, ONTARIO

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

Scale: AS SHOWN	Date: 02/2024
Drawn by: YA	Report No.: PE6034-2
Checked by: NS	Dwg. No.: PE6034-6B
Approved by: AM	Revision No.:

11x17

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APPENDIX 1

SAMPLING AND ANALYSIS PLAN

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

LABORATORY CERTIFICATES OF ANALYSIS

PATERSON GROUP

Sampling & Analysis Plan

Tunney's Pasture (Blocks 1 & 2)

Ottawa, Ontario

Prepared for IBI Group

Report: PE6034-SAP
November 1, 2023

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1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by IBI Group, to conduct a Phase II – Environmental Site Assessment (Phase II ESA) for Blocks 1 & 2 of the Tunney's Pasture government office complex, in the City of Ottawa, Ontario.

Based on the findings of the Phase I ESA, the following subsurface investigation program was developed.

Borehole	Location & Rationale	Proposed Depth & Rationale
BH5-23	Northern portion of the Phase I Property; to assess for potential impacts resulting from the presence of fill material of unknown quality, the use of road salt for de-icing purposes, and for excess soil qualification purposes.	5-7 m; to intercept the groundwater table for the purpose of installing a monitoring well.
BH6-23	Central portion of the Phase I Property; to assess for potential impacts resulting from the presence of fill material of unknown quality, the use of road salt for de-icing purposes, and for excess soil qualification purposes.	5-7 m; to intercept the groundwater table for the purpose of installing a monitoring well.
BH7-23	Southern portion of the Phase I Property; to assess for potential impacts resulting from the presence of fill material of unknown quality, and for excess soil qualification purposes.	5-7 m; to intercept the groundwater table for the purpose of installing a monitoring well.

Borehole locations are shown on Drawing PE6034-3 – Test Hole Location Plan, appended to the main report.

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

Following the borehole drilling, groundwater monitoring wells will be installed in all three boreholes to allow for the collection of groundwater samples.

2.0 ANALYTICAL TESTING PROGRAM

The analytical testing program for soil at the Phase I Property is based on the following general considerations:

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

The analytical testing program for soil at the Phase I Property is based on the following general considerations:

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

3.0 STANDARD OPERATING PROCEDURES

3.1 Environmental Drilling Procedure

Purpose

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

Equipment

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

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

Determining Borehole Locations

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

After drilling is completed a plan with the borehole locations must be provided. Distances and orientations of boreholes with respect to site features (buildings, roadways, etc.) must be provided. Distances should be measured using a measuring tape or wheel rather than paced off. Ground surface elevations at each borehole should be surveyed relative to a geodetic benchmark, if one is available, or a temporary site benchmark which can be tied in at a later date if necessary.

Drilling Procedure

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

- ❒ Continuous split spoon samples (every 0.6 m or 2') or semi-continuous (every 0.76 m or 2'6") are required.
- ❒ Make sure samples are well sealed in plastic bags with no holes prior to screening and are kept cool but unfrozen.
- ❒ If sampling for VOCs, BTEX, or PHCs F_1, 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" threaded sections of Schedule 40 PVC slotted well screen (5' x 1 ¼" if installing in cored hole in bedrock)
- ❒ 5' x 2" threaded sections of Schedule 40 PVC riser pipe (5' x 1 ¼" 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 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

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.

SOIL PROFILE AND TEST DATA

PHASE II - ENVIRONMENTAL SITE ASSESSMENT

Tunney's Pasture - Blocks 1 & 2, Ottawa, Ontario

DATUM: Geodetic **EASTING:** 364157.01 **NORTHING:** 5029594.662 **ELEVATION:** 63.33

PROJECT: Phase II - Environmental Site Assessment

BORINGS BY: CME-55 Low Clearance Power Drill

REMARKS:

DATE: November 13, 2023

FILE NO. PE6034

HOLE NO. BH 5-23

SAMPLE DESCRIPTION	STRATA PLOT	Sample No.	SAMPLE % RECOVERY	N VALUE or RQD	ANALYTICAL TESTS	DEPTH (m)	PID (ppm) 0 16.67 33.33 50	Gas Tech (ppm) 0 50 100 150 200	Monitoring Well Construction
Ground Surface EL 63.33 m									
Asphaltic concrete 0.05 m EL 63.28 m		AU1				0	2.3		
FILL: Brown silty sand with gravel and crushed stone 0.6 m EL 62.73 m		SS2	50	50+			1.6		
GLACIAL TILL: Dense, brown silty sand with clay and gravel 0.99 m EL 62.34 m		RC1	98	30		1			
BEDROCK: Good to excellent quality, grey limestone		RC2	100	90		2			
- 25mm mud seam at 3.8m depth		RC3	100	98		3			
		RC4	100	84		4			
6.07 m EL 57.26 m						5			
End of Borehole						6			
(GWL @ 3.27m - Nov. 24, 2023)						7			
						8			

SOIL PROFILE AND TEST DATA

PHASE II - ENVIRONMENTAL SITE ASSESSMENT

Tunney's Pasture - Blocks 1 & 2, Ottawa, Ontario

DATUM: Geodetic **EASTING:** 364252.794 **NORTHING:** 5029511.857 **ELEVATION:** 62.71

PROJECT: Phase II - Environmental Site Assessment

BORINGS BY: CME-55 Low Clearance Power Drill

REMARKS:

DATE: November 13, 2023

FILE NO. PE6034

HOLE NO. BH 6-23

SAMPLE DESCRIPTION	STRATA PLOT	Sample No.	SAMPLE % RECOVERY	N VALUE or RQD	ANALYTICAL TESTS	DEPTH (m)	PID (ppm) 0 16.67 33.33 50	Gas Tech (ppm) 0 50 100 150 200	Monitoring Well Construction
Ground Surface EL 62.71 m									
Asphaltic concrete 0.05 m EL 62.66 m		AU1				0	3.0		
FILL: Brown silty sand with gravel and crushed stone 0.6 m EL 62.11 m		SS2	0	50+			0.8		
GLACIAL TILL: Brown silty sand with gravel 0.69 m EL 62.02 m		RC1	100	60		1			
BEDROCK: Fair to excellent quality, grey limestone		RC2	97	91		2			
		RC3	100	98		3			
		RC4	100	100		4			
						5			
6.02 m EL 56.69 m End of Borehole						6			
(GWL @ 3.73m - Nov. 24, 2023)						7			
						8			

SOIL PROFILE AND TEST DATA

PHASE II - ENVIRONMENTAL SITE ASSESSMENT

Tunney's Pasture - Blocks 1 & 2, Ottawa, Ontario

DATUM: Geodetic **EASTING:** 364304.832 **NORTHING:** 5029416.939 **ELEVATION:** 64.80

PROJECT: Phase II - Environmental Site Assessment

BORINGS BY: CME-55 Low Clearance Power Drill

REMARKS:

DATE: November 13, 2023

FILE NO. PE6034

HOLE NO. BH 7-23

SAMPLE DESCRIPTION	STRATA PLOT	Sample No.	SAMPLE % RECOVERY	N VALUE or RQD	ANALYTICAL TESTS	DEPTH (m)	PID (ppm) 0 16.67 33.33 50	Gas Tech (ppm) 0 50 100 150 200	Monitoring Well Construction
Ground Surface EL 64.8 m									
TOPSOIL 0.15 m EL 64.65 m		AU1				0	3.7		
		SS2	36	50+		1	2.1		
FILL: Brown silty sand with gravel, cobbles and boulders, some clay		SS3	67	9		2	2.6		
		SS4	25	25			4.3		
3.1 m EL 61.7 m		SS5	77	50+		3	3.7		
GLACIAL TILL: Compact, brown silty sand with gravel, occasional cobbles and boulders 3.36 m EL 61.42 m		RC1	100	69		4			
BEDROCK: Fair to excellent quality, grey limestone						5			
		RC2	100	100		6			
6.17 m EL 58.63 m									
End of Borehole						7			
(GWL @ 3.04m - Nov. 24, 2023)						8			

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

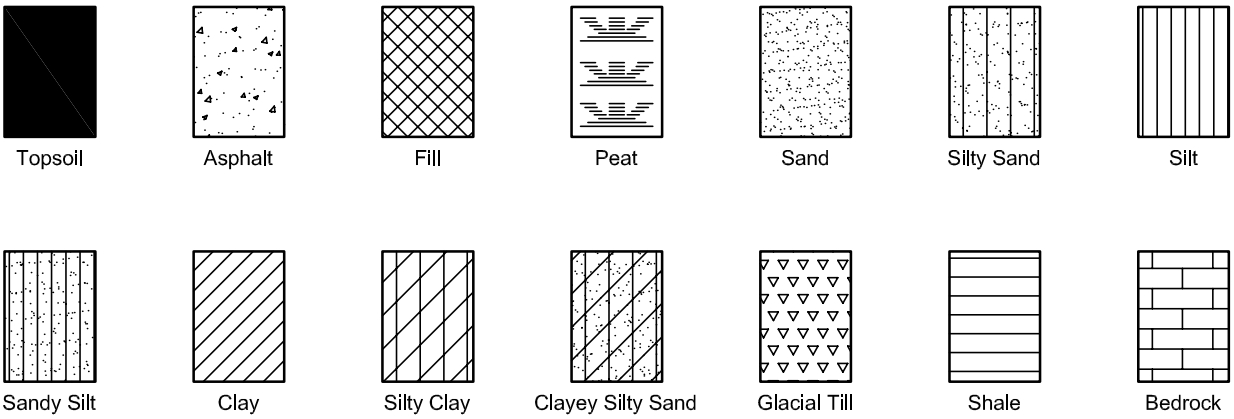
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

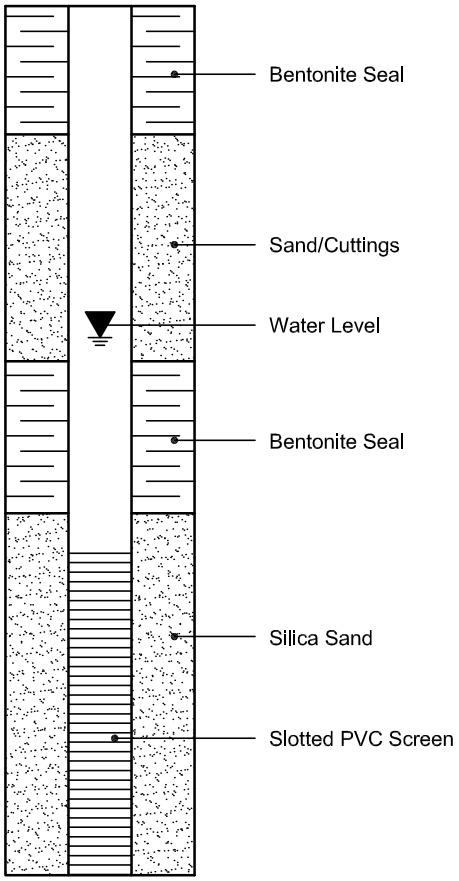
SYMBOLS AND TERMS (continued)

STRATA PLOT

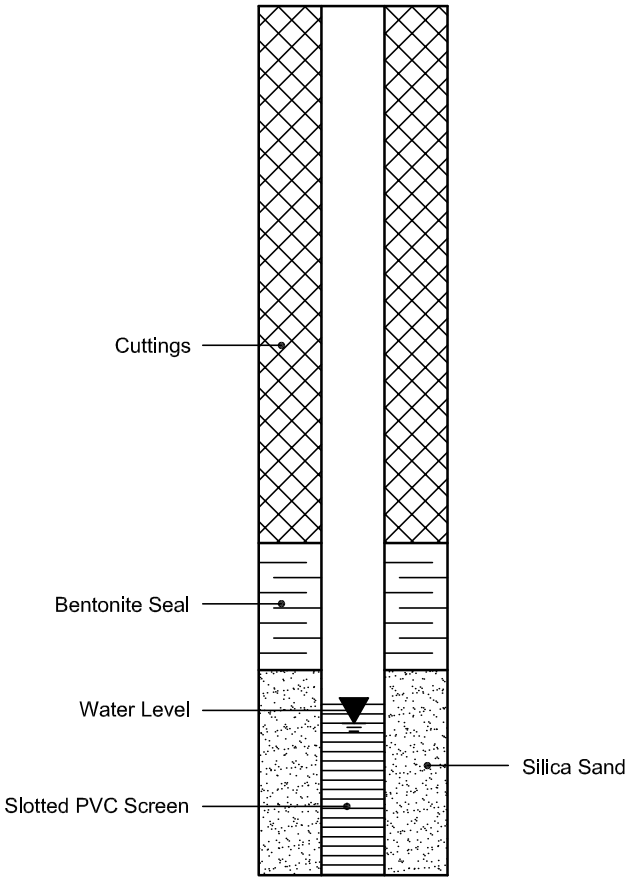


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Certificate of Analysis

Paterson Group Consulting Engineers (Ottawa)
9 Auriga Drive
Ottawa, ON K2E 7T9
Attn: Nick Sullivan

Client PO: 58850
Project: PE6034
Custody:

Report Date: 21-Nov-2023
Order Date: 15-Nov-2023

Order #: 2346300

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

Paracel ID	Client ID
2346300-01	BH5-23-AU1
2346300-02	BH6-23-AU1
2346300-03	BH7-23-SS3
2346300-04	BH7-23-SS4
2346300-05	Dup-1

Approved By:

Dale Robertson, BSc
Laboratory Director

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	17-Nov-23	19-Nov-23
Chromium, hexavalent - soil	MOE E3056 - Extraction, colourimetric	17-Nov-23	20-Nov-23
Conductivity	MOE E3138 - probe @25 °C, water ext	17-Nov-23	17-Nov-23
Mercury by CVAA	EPA 7471B - CVAA, digestion	17-Nov-23	17-Nov-23
Metals, ICP-MS	EPA 6020 - Digestion - ICP-MS	17-Nov-23	17-Nov-23
PAHs by GC-MS	EPA 8270 - GC-MS, extraction	15-Nov-23	19-Nov-23
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	16-Nov-23	16-Nov-23
PHC F1	CWS Tier 1 - P&T GC-FID	17-Nov-23	17-Nov-23
PHC F4G (gravimetric)	CWS Tier 1 - Extraction Gravimetric	21-Nov-23	21-Nov-23
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	16-Nov-23	20-Nov-23
SAR	Calculated	17-Nov-23	17-Nov-23
Solids, %	CWS Tier 1 - Gravimetric	16-Nov-23	17-Nov-23

Certificate of Analysis

Report Date: 21-Nov-2023

Client: **Paterson Group Consulting Engineers (Ottawa)**

Order Date: 15-Nov-2023

Client PO: **58850**

Project Description: PE6034

	Client ID:	BH5-23-AU1	BH6-23-AU1	BH7-23-SS3	BH7-23-SS4	-	-
	Sample Date:	13-Nov-23 09:00	13-Nov-23 09:00	13-Nov-23 09:00	13-Nov-23 09:00		
	Sample ID:	2346300-01	2346300-02	2346300-03	2346300-04		
	Matrix:	Soil	Soil	Soil	Soil		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	97.2	97.1	86.9	-	-	-
General Inorganics							
SAR	0.01 N/A	0.47	0.32	0.13	-	-	-
Conductivity	5 uS/cm	1990	216	224	-	-	-
pH	0.05 pH Units	7.51	-	-	7.47	-	-
Metals							
Antimony	1 ug/g	<1	<1	<1	-	-	-
Arsenic	1 ug/g	9	4	4	-	-	-
Barium	1 ug/g	27	108	92	-	-	-
Beryllium	0.5 ug/g	<0.5	<0.5	<0.5	-	-	-
Boron	5.0 ug/g	8.7	14.0	6.8	-	-	-
Cadmium	0.5 ug/g	<0.5	<0.5	<0.5	-	-	-
Chromium	5 ug/g	13	12	27	-	-	-
Chromium (VI)	0.2 ug/g	<0.2	<0.2	<0.2	-	-	-
Cobalt	1 ug/g	10	7	8	-	-	-
Copper	5 ug/g	10	9	14	-	-	-
Lead	1 ug/g	20	15	35	-	-	-
Mercury	0.1 ug/g	<0.1	<0.1	<0.1	-	-	-
Molybdenum	1 ug/g	5	2	<1	-	-	-
Nickel	5 ug/g	19	14	15	-	-	-
Selenium	1 ug/g	<1	<1	<1	-	-	-
Silver	0.3 ug/g	<0.3	<0.3	<0.3	-	-	-
Thallium	1 ug/g	<1	<1	<1	-	-	-
Tin	5 ug/g	<5	<5	<5	-	-	-
Uranium	1 ug/g	<1	<1	<1	-	-	-

Certificate of Analysis

Report Date: 21-Nov-2023

Client: **Paterson Group Consulting Engineers (Ottawa)**

Order Date: 15-Nov-2023

Client PO: **58850**

Project Description: PE6034

	Client ID:	BH5-23-AU1	BH6-23-AU1	BH7-23-SS3	BH7-23-SS4	-	-
	Sample Date:	13-Nov-23 09:00	13-Nov-23 09:00	13-Nov-23 09:00	13-Nov-23 09:00		
	Sample ID:	2346300-01	2346300-02	2346300-03	2346300-04		
	Matrix:	Soil	Soil	Soil	Soil		
	MDL/Units						
Metals							
Vanadium	10 ug/g	24	17	40	-	-	-
Zinc	20 ug/g	<20	<20	53	-	-	-
Volatiles							
Benzene	0.002 ug/g	<0.002	<0.002	<0.002	-	-	-
Ethylbenzene	0.002 ug/g	<0.002	<0.002	<0.002	-	-	-
Toluene	0.002 ug/g	<0.002	<0.002	<0.002	-	-	-
m,p-Xylenes	0.002 ug/g	<0.002	<0.002	<0.002	-	-	-
o-Xylene	0.002 ug/g	<0.002	<0.002	<0.002	-	-	-
Xylenes, total	0.002 ug/g	<0.002	<0.002	<0.002	-	-	-
Toluene-d8	Surrogate	104%	104%	104%	-	-	-
Hydrocarbons							
F1 PHCs (C6-C10)	7 mg/kg	<7	<7	<7	-	-	-
F2 PHCs (C10-C16)	4 mg/kg	<4	<4	<4	-	-	-
F3 PHCs (C16-C34)	8 mg/kg	117	37	<8	-	-	-
F4 PHCs (C34-C50)	6 mg/kg	392 [2]	94	<6	-	-	-
F4G PHCs (gravimetric)	50 ug/g	3140	-	-	-	-	-
Semi-Volatiles							
1-Methylnaphthalene	0.02 mg/kg	<0.40 [1]	<0.40 [1]	<0.02	-	-	-
2-Methylnaphthalene	0.02 mg/kg	<0.40 [1]	<0.40 [1]	<0.02	-	-	-
Methylnaphthalene (1&2)	0.04 mg/kg	<0.80 [1]	<0.80 [1]	<0.04	-	-	-
Acenaphthene	0.02 mg/kg	<0.40 [1]	<0.40 [1]	<0.02	-	-	-
Acenaphthylene	0.02 mg/kg	<0.40 [1]	<0.40 [1]	<0.02	-	-	-
Anthracene	0.02 mg/kg	<0.40 [1]	<0.40 [1]	<0.02	-	-	-
Benzo [a] anthracene	0.02 mg/kg	<0.40 [1]	<0.40 [1]	<0.02	-	-	-
Benzo [a] pyrene	0.02 mg/kg	<0.40 [1]	<0.40 [1]	<0.02	-	-	-

	Client ID:	BH5-23-AU1	BH6-23-AU1	BH7-23-SS3	BH7-23-SS4	-	-
	Sample Date:	13-Nov-23 09:00	13-Nov-23 09:00	13-Nov-23 09:00	13-Nov-23 09:00		
	Sample ID:	2346300-01	2346300-02	2346300-03	2346300-04		
	Matrix:	Soil	Soil	Soil	Soil		
	MDL/Units						
Semi-Volatiles							
Benzo [b] fluoranthene	0.02 mg/kg	<0.40 [1]	<0.40 [1]	<0.02	-	-	-
Benzo [g,h,i] perylene	0.02 mg/kg	<0.40 [1]	<0.40 [1]	<0.02	-	-	-
Benzo [k] fluoranthene	0.02 mg/kg	<0.40 [1]	<0.40 [1]	<0.02	-	-	-
Biphenyl	0.02 mg/kg	<0.40 [1]	<0.40 [1]	<0.02	-	-	-
Chrysene	0.02 mg/kg	<0.40 [1]	<0.40 [1]	<0.02	-	-	-
Dibenzo [a,h] anthracene	0.02 mg/kg	<0.40 [1]	<0.40 [1]	<0.02	-	-	-
Fluoranthene	0.02 mg/kg	<0.40 [1]	<0.40 [1]	0.04	-	-	-
Fluorene	0.02 mg/kg	<0.40 [1]	<0.40 [1]	<0.02	-	-	-
Indeno [1,2,3-cd] pyrene	0.02 mg/kg	<0.40 [1]	<0.40 [1]	<0.02	-	-	-
Naphthalene	0.01 mg/kg	<0.20 [1]	<0.20 [1]	<0.01	-	-	-
Phenanthrene	0.02 mg/kg	<0.40 [1]	<0.40 [1]	<0.02	-	-	-
Pyrene	0.02 mg/kg	<0.40 [1]	<0.40 [1]	0.03	-	-	-
Quinoline	0.10 mg/kg	<2.00 [1]	<2.00 [1]	<0.10	-	-	-
2-Fluorobiphenyl	Surrogate	77.0%	82.1%	71.6%	-	-	-
Terphenyl-d14	Surrogate	61.3%	63.0%	53.8%	-	-	-

	Client ID:	Dup-1				-	-
	Sample Date:	13-Nov-23 09:00					
	Sample ID:	2346300-05					
	Matrix:	Soil					
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	87.0	-	-	-	-	-
Metals							
Antimony	1 ug/g	<1	-	-	-	-	-
Arsenic	1 ug/g	4	-	-	-	-	-
Barium	1 ug/g	95	-	-	-	-	-
Beryllium	0.5 ug/g	<0.5	-	-	-	-	-
Boron	5.0 ug/g	6.6	-	-	-	-	-
Cadmium	0.5 ug/g	<0.5	-	-	-	-	-
Chromium	5 ug/g	28	-	-	-	-	-
Cobalt	1 ug/g	8	-	-	-	-	-
Copper	5 ug/g	15	-	-	-	-	-
Lead	1 ug/g	34	-	-	-	-	-
Molybdenum	1 ug/g	<1	-	-	-	-	-
Nickel	5 ug/g	16	-	-	-	-	-
Selenium	1 ug/g	<1	-	-	-	-	-
Silver	0.3 ug/g	<0.3	-	-	-	-	-
Thallium	1 ug/g	<1	-	-	-	-	-
Tin	5 ug/g	<5	-	-	-	-	-
Uranium	1 ug/g	<1	-	-	-	-	-
Vanadium	10 ug/g	42	-	-	-	-	-
Zinc	20 ug/g	56	-	-	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics								
Conductivity	ND	5	uS/cm					
Hydrocarbons								
F1 PHCs (C6-C10)	ND	7	mg/kg					
F2 PHCs (C10-C16)	ND	4	mg/kg					
F3 PHCs (C16-C34)	ND	8	mg/kg					
F4 PHCs (C34-C50)	ND	6	mg/kg					
F4G PHCs (gravimetric)	ND	50	ug/g					
Metals								
Antimony	ND	1	ug/g					
Arsenic	ND	1	ug/g					
Barium	ND	1	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	ug/g					
Cobalt	ND	1	ug/g					
Copper	ND	5	ug/g					
Lead	ND	1	ug/g					
Mercury	ND	0.1	ug/g					
Molybdenum	ND	1	ug/g					
Nickel	ND	5	ug/g					
Selenium	ND	1	ug/g					
Silver	ND	0.3	ug/g					
Thallium	ND	1	ug/g					
Tin	ND	5	ug/g					
Uranium	ND	1	ug/g					
Vanadium	ND	10	ug/g					
Zinc	ND	20	ug/g					
Semi-Volatiles								
1-Methylnaphthalene	ND	0.02	mg/kg					
2-Methylnaphthalene	ND	0.02	mg/kg					

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Methylnaphthalene (1&2)	ND	0.04	mg/kg					
Acenaphthene	ND	0.02	mg/kg					
Acenaphthylene	ND	0.02	mg/kg					
Anthracene	ND	0.02	mg/kg					
Benzo [a] anthracene	ND	0.02	mg/kg					
Benzo [a] pyrene	ND	0.02	mg/kg					
Benzo [b] fluoranthene	ND	0.02	mg/kg					
Benzo [g,h,i] perylene	ND	0.02	mg/kg					
Benzo [k] fluoranthene	ND	0.02	mg/kg					
Biphenyl	ND	0.02	mg/kg					
Chrysene	ND	0.02	mg/kg					
Dibenzo [a,h] anthracene	ND	0.02	mg/kg					
Fluoranthene	ND	0.02	mg/kg					
Fluorene	ND	0.02	mg/kg					
Indeno [1,2,3-cd] pyrene	ND	0.02	mg/kg					
Naphthalene	ND	0.01	mg/kg					
Phenanthrene	ND	0.02	mg/kg					
Pyrene	ND	0.02	mg/kg					
Quinoline	ND	0.10	mg/kg					
Surrogate: 2-Fluorobiphenyl	*0.878*		*%*	*65.9*	*50-140*			
Surrogate: Terphenyl-d14	*0.727*		*%*	*54.5*	*50-140*			
Volatiles								
Benzene	ND	0.002	ug/g					
Ethylbenzene	ND	0.002	ug/g					
Toluene	ND	0.002	ug/g					
m,p-Xylenes	ND	0.002	ug/g					
o-Xylene	ND	0.002	ug/g					
Xylenes, total	ND	0.002	ug/g					
Surrogate: Toluene-d8	*0.415*		*%*	*104*	*60-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
SAR	1.96	0.01	N/A	1.92			2.1	30	
Conductivity	900	5	uS/cm	877			2.6	5	
pH	7.37	0.05	pH Units	7.31			0.8	2.3	
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	mg/kg	ND			NC	40	
F2 PHCs (C10-C16)	ND	40	mg/kg	ND			NC	30	
F3 PHCs (C16-C34)	111	80	mg/kg	103			7.4	30	
F4 PHCs (C34-C50)	273	60	mg/kg	321			16.3	30	
Metals									
Antimony	ND	1	ug/g	ND			NC	30	
Arsenic	4.8	1	ug/g	4.9			3.6	30	
Barium	174	1	ug/g	206			16.6	30	
Beryllium	ND	0.5	ug/g	ND			NC	30	
Boron	9.0	5.0	ug/g	8.7			2.5	30	
Cadmium	ND	0.5	ug/g	ND			NC	30	
Chromium (VI)	ND	0.2	ug/g	ND			NC	35	
Chromium	21.0	5	ug/g	25.3			18.4	30	
Cobalt	4.6	1	ug/g	5.2			13.6	30	
Copper	22.2	5	ug/g	24.4			9.7	30	
Lead	44.2	1	ug/g	49.4			11.2	30	
Mercury	ND	0.1	ug/g	ND			NC	30	
Molybdenum	2.2	1	ug/g	2.4			12.4	30	
Nickel	14.6	5	ug/g	16.9			14.1	30	
Selenium	ND	1	ug/g	ND			NC	30	
Silver	ND	0.3	ug/g	ND			NC	30	
Thallium	ND	1	ug/g	ND			NC	30	
Tin	ND	5	ug/g	ND			NC	30	
Uranium	ND	1	ug/g	ND			NC	30	
Vanadium	24.5	10	ug/g	26.7			8.7	30	
Zinc	101	20	ug/g	105			3.8	30	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Physical Characteristics									
% Solids	94.1	0.1	% by Wt.	94.4			0.3	25	
Semi-Volatiles									
1-Methylnaphthalene	ND	0.02	mg/kg	ND			NC	40	
2-Methylnaphthalene	ND	0.02	mg/kg	ND			NC	40	
Acenaphthene	ND	0.02	mg/kg	ND			NC	40	
Acenaphthylene	ND	0.02	mg/kg	ND			NC	40	
Anthracene	ND	0.02	mg/kg	ND			NC	40	
Benzo [a] anthracene	ND	0.02	mg/kg	ND			NC	40	
Benzo [a] pyrene	ND	0.02	mg/kg	ND			NC	40	
Benzo [b] fluoranthene	ND	0.02	mg/kg	ND			NC	40	
Benzo [g,h,i] perylene	ND	0.02	mg/kg	ND			NC	40	
Benzo [k] fluoranthene	ND	0.02	mg/kg	ND			NC	40	
Biphenyl	ND	0.02	mg/kg	ND			NC	40	
Chrysene	ND	0.02	mg/kg	ND			NC	40	
Dibenzo [a,h] anthracene	ND	0.02	mg/kg	ND			NC	40	
Fluoranthene	ND	0.02	mg/kg	ND			NC	40	
Fluorene	ND	0.02	mg/kg	ND			NC	40	
Indeno [1,2,3-cd] pyrene	ND	0.02	mg/kg	ND			NC	40	
Naphthalene	ND	0.01	mg/kg	ND			NC	40	
Phenanthrene	ND	0.02	mg/kg	ND			NC	40	
Pyrene	ND	0.02	mg/kg	ND			NC	40	
Quinoline	ND	0.10	mg/kg	ND			NC	40	
Surrogate: 2-Fluorobiphenyl	*0.967*		*%*		*67.2*	*50-140*			
Surrogate: Terphenyl-d14	*0.811*		*%*		*56.4*	*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)	197	7	mg/kg	ND	98.5	85-115			
F2 PHCs (C10-C16)	92	4	mg/kg	ND	115	80-120			
F3 PHCs (C16-C34)	221	8	mg/kg	ND	113	80-120			
F4 PHCs (C34-C50)	148	6	mg/kg	ND	119	80-120			
F4G PHCs (gravimetric)	960	50	ug/g	ND	96.0	80-120			
Metals									
Antimony	37.8	1	ug/g	ND	74.9	70-130			
Arsenic	55.3	1	ug/g	2.0	107	70-130			
Barium	126	1	ug/g	82.4	87.6	70-130			
Beryllium	50.6	0.5	ug/g	ND	101	70-130			
Boron	49.6	5.0	ug/g	ND	92.1	70-130			
Cadmium	49.3	0.5	ug/g	ND	98.3	70-130			
Chromium (VI)	0.2	0.2	ug/g	ND	76.0	70-130			
Chromium	64.4	5	ug/g	10.1	109	70-130			
Cobalt	54.1	1	ug/g	2.1	104	70-130			
Copper	58.6	5	ug/g	9.8	97.6	70-130			
Lead	66.8	1	ug/g	19.8	94.1	70-130			
Mercury	1.33	0.1	ug/g	ND	88.5	70-130			
Molybdenum	51.6	1	ug/g	1.0	101	70-130			
Nickel	57.7	5	ug/g	6.7	102	70-130			
Selenium	47.2	1	ug/g	ND	94.1	70-130			
Silver	50.5	0.3	ug/g	ND	101	70-130			
Thallium	48.2	1	ug/g	ND	96.3	70-130			
Tin	50.4	5	ug/g	ND	99.7	70-130			
Uranium	53.3	1	ug/g	ND	106	70-130			
Vanadium	66.9	10	ug/g	10.7	112	70-130			
Zinc	87.7	20	ug/g	42.1	91.3	70-130			
Semi-Volatiles									
1-Methylnaphthalene	0.119	0.02	mg/kg	ND	66.3	50-140			
2-Methylnaphthalene	0.137	0.02	mg/kg	ND	76.0	50-140			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Acenaphthene	0.139	0.02	mg/kg	ND	77.4	50-140			
Acenaphthylene	0.157	0.02	mg/kg	ND	87.1	50-140			
Anthracene	0.193	0.02	mg/kg	ND	107	50-140			
Benzo [a] anthracene	0.151	0.02	mg/kg	ND	83.8	50-140			
Benzo [a] pyrene	0.118	0.02	mg/kg	ND	65.4	50-140			
Benzo [b] fluoranthene	0.126	0.02	mg/kg	ND	70.1	50-140			
Benzo [g,h,i] perylene	0.121	0.02	mg/kg	ND	67.2	50-140			
Benzo [k] fluoranthene	0.156	0.02	mg/kg	ND	86.7	50-140			
Biphenyl	0.144	0.02	mg/kg	ND	80.2	50-140			
Chrysene	0.141	0.02	mg/kg	ND	78.2	50-140			
Dibenzo [a,h] anthracene	0.119	0.02	mg/kg	ND	66.4	50-140			
Fluoranthene	0.185	0.02	mg/kg	ND	103	50-140			
Fluorene	0.132	0.02	mg/kg	ND	73.4	50-140			
Indeno [1,2,3-cd] pyrene	0.121	0.02	mg/kg	ND	67.3	50-140			
Naphthalene	0.152	0.01	mg/kg	ND	84.4	50-140			
Phenanthrene	0.141	0.02	mg/kg	ND	78.3	50-140			
Pyrene	0.182	0.02	mg/kg	ND	101	50-140			
Quinoline	0.178	0.10	mg/kg	ND	98.9	50-140			
Surrogate: 2-Fluorobiphenyl	*0.988*		*%*		*68.6*	*50-140*			
Surrogate: Terphenyl-d14	*0.751*		*%*		*52.1*	*50-140*			
Volatiles									
Benzene	0.168	0.002	ug/g	ND	83.8	60-140			
Ethylbenzene	0.151	0.002	ug/g	ND	75.6	60-140			
Toluene	0.159	0.002	ug/g	ND	79.3	60-140			
m,p-Xylenes	0.339	0.002	ug/g	ND	84.8	60-140			
o-Xylene	0.182	0.002	ug/g	ND	90.9	60-140			
Surrogate: Toluene-d8	*0.371*		*%*		*92.7*	*60-140*			

Qualifier Notes:

Sample Qualifiers :

1: Elevated reporting limits due to the nature of the sample matrix.

2: GC-FID signal did not return to baseline by C50

Sample Data Revisions:

None

Certificate of Analysis

Report Date: 21-Nov-2023

Client: **Paterson Group Consulting Engineers (Ottawa)**

Order Date: 15-Nov-2023

Client PO: 58850

Project Description: PE6034

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 unlesss otherwise noted.

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 ID: 2346300

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Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2346300	

Client Name: Paterson Group
Contact Name: Nick Sullivan
Address: 9 Auriga Dr, Ottawa
Telephone: 613 226-7381

Project Ref: PE6034
Quote #:
PO #: 58850
E-mail: nsullivan@patersongroup.ca

Page 1 of 1

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

☒ REG 153/04 ☐ REG 406/19

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

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

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)	EC/SAR	pH				
1	BH5-23-AU1	S		3	Nov 13/23		X		X	X	X	X		X	X				
2	BH6-23-AU1	↓		↓	↓		X		X	X	X	X		X					
3	BH7-23-SS3			↓			X		X	X	X	X		X					
4	BH7-23-SS4			1											X				
5	DUP-1	↓		1	↓					X									
6																			
7																			
8																			
9																			
10																			

Comments:

Method of Delivery: Paracel Courier

Relinquished By (Sign): Trudy Blair	Received By Driver/Depot:	Received at Lab: HP	Verified By: Hiral
Relinquished By (Print): Trudy Blair	Date/Time:	Date/Time: Nov 15, 23 | 16:40	Date/Time: Nov 15, 23 | 17:04
Date/Time: Nov 15 2023	Temperature: °C	Temperature: 13.9°C	pH Verified: ☐ By:

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Attn: Nick Sullivan

Client PO: 58913
Project: PE6034
Custody:

Report Date: 30-Nov-2023
Order Date: 23-Nov-2023

Order #: 2347402

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

Paracel ID	Client ID
2347402-01	BH5-23-GW1
2347402-02	BH6-23-GW1
2347402-03	BH7-23-GW1
2347402-04	DUP - 1

Approved By:

Dale Robertson, BSc
Laboratory Director

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	27-Nov-23	27-Nov-23
Hardness	Hardness as CaCO3	28-Nov-23	28-Nov-23
Chromium, hexavalent, water, low level	MOE E3056 - colourimetric	29-Nov-23	29-Nov-23
Metals, ICP-MS	EPA 200.8 - ICP-MS	28-Nov-23	28-Nov-23
PAHs by GC-MS	EPA 625 - GC-MS, extraction	28-Nov-23	29-Nov-23
PHC F1	CWS Tier 1 - P&T GC-FID	27-Nov-23	27-Nov-23
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	27-Nov-23	28-Nov-23

Certificate of Analysis

Report Date: 30-Nov-2023

Client: **Paterson Group Consulting Engineers (Ottawa)**

Order Date: 23-Nov-2023

Client PO: **58913**

Project Description: PE6034

	Client ID:	BH5-23-GW1	BH6-23-GW1	BH7-23-GW1	DUP - 1	-	-
	Sample Date:	21-Nov-23 09:00	21-Nov-23 09:00	21-Nov-23 09:00	21-Nov-23 09:00		
	Sample ID:	2347402-01	2347402-02	2347402-03	2347402-04		
	Matrix:	Ground Water	Ground Water	Ground Water	Ground Water		
	MDL/Units						
General Inorganics							
Hardness	mg/L	1330	455	721	-	-	-
Metals							
Aluminum	1 ug/L	4	4	5	-	-	-
Antimony	0.5 ug/L	<0.5	<0.5	<0.5	-	-	-
Arsenic	1 ug/L	<1	<1	<1	-	-	-
Barium	1 ug/L	289	58	152	-	-	-
Beryllium	0.5 ug/L	<0.5	<0.5	<0.5	-	-	-
Boron	10 ug/L	72	41	104	-	-	-
Cadmium	0.01 ug/L	0.01	<0.01	0.01	-	-	-
Calcium	100 ug/L	412000	147000	236000	-	-	-
Chromium (VI)	1 ug/L	<1	1	<1	-	-	-
Chromium	1 ug/L	<1	<1	<1	-	-	-
Cobalt	0.5 ug/L	1.0	<0.5	2.3	-	-	-
Copper	0.5 ug/L	2.0	1.9	2.2	-	-	-
Iron	100 ug/L	<100	<100	1520	-	-	-
Lead	0.1 ug/L	<0.1	<0.1	<0.1	-	-	-
Magnesium	200 ug/L	72000	21200	32200	-	-	-
Manganese	5 ug/L	82	<5	1070	-	-	-
Molybdenum	0.5 ug/L	2.4	3.2	1.2	-	-	-
Nickel	1 ug/L	4	2	6	-	-	-
Selenium	1 ug/L	<1	<1	<1	-	-	-
Silver	0.1 ug/L	<0.1	<0.1	<0.1	-	-	-
Thallium	0.1 ug/L	<0.1	<0.1	0.1	-	-	-
Titanium	5 ug/L	<5	<5	<5	-	-	-
Uranium	0.1 ug/L	2.2	0.9	1.9	-	-	-

	Client ID:	BH5-23-GW1	BH6-23-GW1	BH7-23-GW1	DUP - 1	-	-
	Sample Date:	21-Nov-23 09:00	21-Nov-23 09:00	21-Nov-23 09:00	21-Nov-23 09:00		
	Sample ID:	2347402-01	2347402-02	2347402-03	2347402-04		
	Matrix:	Ground Water	Ground Water	Ground Water	Ground Water		
	MDL/Units						
Metals							
Vanadium	0.5 ug/L	1.0	<0.5	0.6	-	-	-
Zinc	5 ug/L	<5	<5	18	-	-	-
Volatiles							
Benzene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	<0.0005	-	-
Ethylbenzene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	<0.0005	-	-
Toluene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	<0.0005	-	-
m,p-Xylenes	0.0005 mg/L	<0.0005	<0.0005	<0.0005	<0.0005	-	-
o-Xylene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	<0.0005	-	-
Xylenes, total	0.0005 mg/L	<0.0005	<0.0005	<0.0005	<0.0005	-	-
Toluene-d8	Surrogate	99.8%	99.7%	99.9%	99.6%	-	-
Hydrocarbons							
F1 PHCs (C6-C10)	0.025 mg/L	<0.025	<0.025	<0.025	<0.025	-	-
F2 PHCs (C10-C16)	0.1 mg/L	<0.1	<0.1	<0.1	<0.1	-	-
F3 PHCs (C16-C34)	0.1 mg/L	<0.1	<0.1	<0.1	<0.1	-	-
F4 PHCs (C34-C50)	0.1 mg/L	<0.1	<0.1	<0.1	<0.1	-	-
Semi-Volatiles							
Acenaphthene	0.05 ug/L	<0.05	<0.05	<0.05	-	-	-
Acridine	0.10 ug/L	<0.10	<0.10	<0.10	-	-	-
Acenaphthylene	0.05 ug/L	<0.05	<0.05	<0.05	-	-	-
Anthracene	0.01 ug/L	<0.01	<0.01	<0.01	-	-	-
Benzo [a] anthracene	0.01 ug/L	<0.01	<0.01	<0.01	-	-	-
Benzo [a] pyrene	0.01 ug/L	<0.01	<0.01	<0.01	-	-	-
Benzo [b] fluoranthene	0.05 ug/L	<0.05	<0.05	<0.05	-	-	-
Benzo [g,h,i] perylene	0.05 ug/L	<0.05	<0.05	<0.05	-	-	-
Benzo [k] fluoranthene	0.05 ug/L	<0.05	<0.05	<0.05	-	-	-

	Client ID:	BH5-23-GW1	BH6-23-GW1	BH7-23-GW1	DUP - 1	-	-
	Sample Date:	21-Nov-23 09:00	21-Nov-23 09:00	21-Nov-23 09:00	21-Nov-23 09:00		
	Sample ID:	2347402-01	2347402-02	2347402-03	2347402-04		
	Matrix:	Ground Water	Ground Water	Ground Water	Ground Water		
	MDL/Units						
Semi-Volatiles							
Biphenyl	0.05 ug/L	<0.05	<0.05	<0.05	-	-	-
Chrysene	0.05 ug/L	<0.05	<0.05	<0.05	-	-	-
Dibenzo [a,h] anthracene	0.05 ug/L	<0.05	<0.05	<0.05	-	-	-
Fluoranthene	0.01 ug/L	<0.01	<0.01	<0.01	-	-	-
Fluorene	0.05 ug/L	<0.05	<0.05	<0.05	-	-	-
Indeno [1,2,3-cd] pyrene	0.05 ug/L	<0.05	<0.05	<0.05	-	-	-
1-Methylnaphthalene	0.05 ug/L	<0.05	<0.05	<0.05	-	-	-
2-Methylnaphthalene	0.05 ug/L	<0.05	<0.05	<0.05	-	-	-
Methylnaphthalene (1&2)	0.10 ug/L	<0.10	<0.10	<0.10	-	-	-
Naphthalene	0.05 ug/L	<0.05	<0.05	<0.05	-	-	-
Phenanthrene	0.05 ug/L	<0.05	<0.05	<0.05	-	-	-
Pyrene	0.01 ug/L	<0.01	<0.01	<0.01	-	-	-
Quinoline	0.10 ug/L	<0.10	<0.10	<0.10	-	-	-
2-Fluorobiphenyl	Surrogate	75.4%	75.6%	71.6%	-	-	-
Terphenyl-d14	Surrogate	62.6%	60.0%	60.3%	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons								
F1 PHCs (C6-C10)	ND	0.025	mg/L					
F2 PHCs (C10-C16)	ND	0.1	mg/L					
F3 PHCs (C16-C34)	ND	0.1	mg/L					
F4 PHCs (C34-C50)	ND	0.1	mg/L					
Metals								
Aluminum	ND	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	0.01	ug/L					
Calcium	ND	100	ug/L					
Chromium (VI)	ND	1	ug/L					
Chromium	ND	1	ug/L					
Cobalt	ND	0.5	ug/L					
Copper	ND	0.5	ug/L					
Iron	ND	100	ug/L					
Lead	ND	0.1	ug/L					
Magnesium	ND	200	ug/L					
Manganese	ND	5	ug/L					
Molybdenum	ND	0.5	ug/L					
Nickel	ND	1	ug/L					
Selenium	ND	1	ug/L					
Silver	ND	0.1	ug/L					
Thallium	ND	0.1	ug/L					
Titanium	ND	5	ug/L					
Uranium	ND	0.1	ug/L					
Vanadium	ND	0.5	ug/L					
Zinc	ND	5	ug/L					
Semi-Volatiles								
Acenaphthene	ND	0.05	ug/L					

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Acenaphthylene	ND	0.05	ug/L					
Acridine	ND	0.10	ug/L					
Anthracene	ND	0.01	ug/L					
Benzo [a] anthracene	ND	0.01	ug/L					
Benzo [a] pyrene	ND	0.01	ug/L					
Benzo [b] fluoranthene	ND	0.05	ug/L					
Benzo [g,h,i] perylene	ND	0.05	ug/L					
Benzo [k] fluoranthene	ND	0.05	ug/L					
Biphenyl	ND	0.05	ug/L					
Chrysene	ND	0.05	ug/L					
Dibenzo [a,h] anthracene	ND	0.05	ug/L					
Fluoranthene	ND	0.01	ug/L					
Fluorene	ND	0.05	ug/L					
Indeno [1,2,3-cd] pyrene	ND	0.05	ug/L					
1-Methylnaphthalene	ND	0.05	ug/L					
2-Methylnaphthalene	ND	0.05	ug/L					
Methylnaphthalene (1&2)	ND	0.10	ug/L					
Naphthalene	ND	0.05	ug/L					
Phenanthrene	ND	0.05	ug/L					
Pyrene	ND	0.01	ug/L					
Quinoline	ND	0.10	ug/L					
Surrogate: 2-Fluorobiphenyl	*13.4*		*%*	*67.0*	*50-140*			
Surrogate: Terphenyl-d14	*12.8*		*%*	*64.2*	*50-140*			
Volatiles								
Benzene	ND	0.0005	mg/L					
Ethylbenzene	ND	0.0005	mg/L					
Toluene	ND	0.0005	mg/L					
m,p-Xylenes	ND	0.0005	mg/L					
o-Xylene	ND	0.0005	mg/L					
Xylenes, total	ND	0.0005	mg/L					
Surrogate: Toluene-d8	*0.0807*		*%*	*101*	*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	0.025	mg/L	ND			NC	30	
Metals									
Aluminum	8.2	1	ug/L	8.0			2.2	20	
Antimony	ND	0.5	ug/L	ND			NC	20	
Arsenic	ND	1	ug/L	ND			NC	20	
Barium	17.5	1	ug/L	18.0			2.7	20	
Beryllium	ND	0.5	ug/L	ND			NC	20	
Boron	17	10	ug/L	17			2.5	20	
Cadmium	0.01	0.01	ug/L	0.01			15.7	30	
Calcium	28000	100	ug/L	28100			0.2	20	
Chromium (VI)	3	1	ug/L	2			NC	20	
Chromium	ND	1	ug/L	ND			NC	20	
Cobalt	ND	0.5	ug/L	ND			NC	20	
Copper	1.03	0.5	ug/L	1.01			1.7	20	
Iron	ND	100	ug/L	ND			NC	20	
Lead	ND	0.1	ug/L	ND			NC	20	
Magnesium	7100	200	ug/L	7420			4.5	20	
Manganese	ND	5	ug/L	ND			NC	20	
Molybdenum	0.87	0.5	ug/L	0.91			5.2	20	
Nickel	ND	1	ug/L	ND			NC	20	
Selenium	ND	1	ug/L	ND			NC	20	
Silver	ND	0.1	ug/L	ND			NC	20	
Thallium	ND	0.1	ug/L	ND			NC	20	
Titanium	ND	5	ug/L	ND			NC	20	
Uranium	ND	0.1	ug/L	ND			NC	20	
Vanadium	ND	0.5	ug/L	ND			NC	20	
Zinc	6	5	ug/L	6			5.7	20	
Volatiles									
Benzene	ND	0.0005	mg/L	ND			NC	30	
Ethylbenzene	ND	0.0005	mg/L	ND			NC	30	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Toluene	ND	0.0005	mg/L	ND			NC	30	
m,p-Xylenes	ND	0.0005	mg/L	ND			NC	30	
o-Xylene	ND	0.0005	mg/L	ND			NC	30	
Surrogate: Toluene-d8	*0.0793*		*%*		*99.1*	*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)	1.99	0.025	mg/L	ND	99.3	85-115			
F2 PHCs (C10-C16)	1.5	0.1	mg/L	ND	92.6	60-140			
F3 PHCs (C16-C34)	4.2	0.1	mg/L	ND	107	60-140			
F4 PHCs (C34-C50)	2.5	0.1	mg/L	ND	100	60-140			
Metals									
Aluminum	50.0	1	ug/L	8.0	83.9	80-120			
Arsenic	47.9	1	ug/L	ND	95.2	80-120			
Barium	49.9	1	ug/L	ND	99.8	80-120			
Beryllium	43.5	0.5	ug/L	ND	87.0	80-120			
Boron	43	10	ug/L	ND	82.3	80-120			
Cadmium	4.27	0.01	ug/L	0.01	85.1	80-120			
Calcium	35300	100	ug/L	28100	71.9	80-120			QM-07
Chromium (VI)	132	1	ug/L	ND	66.0	70-130			QM-05
Chromium	45.2	1	ug/L	ND	90.2	80-120			
Cobalt	44.4	0.5	ug/L	ND	88.7	80-120			
Copper	44.8	0.5	ug/L	1.01	87.6	80-120			
Iron	2260	100	ug/L	ND	87.2	80-120			
Lead	39.2	0.1	ug/L	ND	78.3	80-120			QM-07
Magnesium	15000	200	ug/L	7420	75.6	80-120			QM-07
Manganese	47.2	5	ug/L	ND	88.1	80-120			
Molybdenum	40.8	0.5	ug/L	0.91	79.8	80-120			QM-07
Nickel	45.3	1	ug/L	ND	89.7	80-120			
Selenium	45.1	1	ug/L	ND	89.8	80-120			
Silver	40.9	0.1	ug/L	ND	81.8	80-120			
Thallium	39.2	0.1	ug/L	ND	78.5	80-120			QM-07
Titanium	51.8	5	ug/L	ND	104	80-120			
Uranium	40.0	0.1	ug/L	ND	80.0	80-120			QM-07
Vanadium	44.8	0.5	ug/L	ND	89.4	80-120			
Zinc	49	5	ug/L	6	86.2	80-120			
Semi-Volatiles									

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Acenaphthene	4.43	0.05	ug/L	ND	88.6	50-140			
Acenaphthylene	4.94	0.05	ug/L	ND	98.8	50-140			
Acridine	6.42	0.10	ug/L	ND	128	50-140			
Anthracene	5.39	0.01	ug/L	ND	108	50-140			
Benzo [a] anthracene	5.00	0.01	ug/L	ND	100	50-140			
Benzo [a] pyrene	3.76	0.01	ug/L	ND	75.1	50-140			
Benzo [b] fluoranthene	4.94	0.05	ug/L	ND	98.8	50-140			
Benzo [g,h,i] perylene	4.11	0.05	ug/L	ND	82.3	50-140			
Benzo [k] fluoranthene	5.32	0.05	ug/L	ND	106	50-140			
Biphenyl	4.76	0.05	ug/L	ND	95.2	50-140			
Chrysene	4.64	0.05	ug/L	ND	92.8	50-140			
Dibenzo [a,h] anthracene	4.16	0.05	ug/L	ND	83.1	50-140			
Fluoranthene	5.94	0.01	ug/L	ND	119	50-140			
Fluorene	4.15	0.05	ug/L	ND	83.0	50-140			
Indeno [1,2,3-cd] pyrene	4.43	0.05	ug/L	ND	88.5	50-140			
1-Methylnaphthalene	3.39	0.05	ug/L	ND	67.8	50-140			
2-Methylnaphthalene	3.60	0.05	ug/L	ND	71.9	50-140			
Naphthalene	3.93	0.05	ug/L	ND	78.6	50-140			
Phenanthrene	4.52	0.05	ug/L	ND	90.4	50-140			
Pyrene	5.93	0.01	ug/L	ND	119	50-140			
Quinoline	3.95	0.10	ug/L	ND	79.1	50-140			
Surrogate: 2-Fluorobiphenyl	*14.8*		*%*		*73.8*	*50-140*			
Surrogate: Terphenyl-d14	*13.4*		*%*		*66.8*	*50-140*			
Volatiles									
Benzene	0.0377	0.0005	mg/L	ND	94.4	60-130			
Ethylbenzene	0.0408	0.0005	mg/L	ND	102	60-130			
Toluene	0.0420	0.0005	mg/L	ND	105	60-130			
m,p-Xylenes	0.103	0.0005	mg/L	ND	128	60-130			
o-Xylene	0.0429	0.0005	mg/L	ND	107	60-130			
Surrogate: Toluene-d8	*0.0734*		*%*		*91.8*	*50-140*			

Qualifier Notes:

QC Qualifiers:

QM-05	The spike recovery was outside acceptance limits for the matrix spike due to matrix interference.
QM-07	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on other acceptable QC.

Sample Data Revisions:

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

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

%REC: Percent recovery.

RPD: Relative percent difference.

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 crite
- When reported, data for F4G has been processed using a silica gel cleanup.

PARACEL LABORATORIES LTD

Paracel ID: 2347402

Laurent Blvd.
ino K1G 4J8
-1947
racellabs.com
labs.com

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2347402	

Client Name: Paterson Group
Contact Name: Nick Sullivan
Address: 9 Auriga Dr. Ottawa, ON K2E 7T9
Telephone: 613-226-7381

Project Ref: PE6034
Quote #:
PO #: 58913
E-mail: nsullivan@patersongroup.ca

Page 1 of 1

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

☒ REG 153/04 ☐ REG 406/19

Other Regulation
☐ Table 1 ☒ Res/Park ☐ Med/Fine
☐ Table 2 ☐ Ind/Comm ☒ Coarse
☐ Table 3 ☐ Agri/Other
☒ Table 7
For RSC: ☐ Yes ☐ No
☐ 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)

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)					
1	BH5-23-GW1	GW		7	Nov. 21. 23		X		X	X	X	X						
2	BH6-23-GW1	↓		7	↓		X		X	X	X	X						
3	BH7-23-GW1			7			X		X	X	X	X						
4	DUP-1			3			X											
5																		
6																		
7																		
8																		
9																		
10																		

Comments:

Method of Delivery: Paracel Courier

Relinquished By (Sign): N. Sullivan	Received By Driver/Depot:	Received at Lab:	Verified By: SD
Relinquished By (Print): Nick Sullivan	Date/Time:	Date/Time: 20231122 1608	Date/Time: Nov 24, 2023 10:05
Date/Time: Nov. 22 2023	Temperature: °C	Temperature: 11.9	pH Verified: ☑ By: SD

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www.paracellabs.com

Subcontracted Analysis

Paterson Group Consulting Engineers (Ottawa)
9 Auriga Drive
Ottawa, ON K2E 7T9
Attn: Nick Sullivan

Paracel Report No.	**2347402**
Client Project(s):	**PE6034**
Client PO:	**58913**
Reference:	**Standing Offer**
CoC Number:	

Order Date:	23-Nov-23
Report Date:	30-Nov-23

Sample(s) from this project were subcontracted for the listed parameters. A copy of the subcontractor's report is attached

Paracel ID	Client ID	Analysis
2347402-01	BH5-23-GW1	Mercury - trace level
2347402-02	BH6-23-GW1	Mercury - trace level
2347402-03	BH7-23-GW1	Mercury - trace level

TESTMARK Laboratories Ltd.
Committed to Quality and Service

CERTIFICATE OF ANALYSIS

Client:	Dale Robertson	Work Order Number:	520467
Company:	Paracel Laboratories Ltd. - Ottawa	PO #:	
Address:	300-2319 St. Laurent Blvd.	Regulation:	CCME Short Term Freshwater Quality Guidelines
	Ottawa, ON, K1G 4J8	Project #:	2347402
Phone/Fax:	(613) 731-9577 / (613) 731-9064	DWS #:	
Email:	drobertson@paracellabs.com	Sampled By:	
Date Order Received:	11/29/2023	Analysis Started:	12/1/2023
Arrival Temperature:	4 C	Analysis Completed:	12/1/2023

WORK ORDER SUMMARY

ANALYSES WERE PERFORMED ON THE FOLLOWING SAMPLES. THE RESULTS RELATE ONLY TO THE ITEMS TESTED.

Sample Description	Lab ID	Matrix	Type	Comments	Date Collected	Time Collected
BH5-23-GW1	1956859	Ground Water	Grab		11/21/2023	
BH6-23-GW1	1956860	Ground Water	Grab		11/21/2023	
BH7-23-GW1	1956861	Ground Water	Grab		11/21/2023	

METHODS AND INSTRUMENTATION

THE FOLLOWING METHODS WERE USED FOR YOUR SAMPLE(S):

Method	Lab	Description	Reference
Mercury Dis. Water CV FF (S8)	Timmins	Determination of Dissolved Inorganic Mercury by Cold Vapour AA -> Field-Filtered	Modified from EPA 245.7

1335 Riverside Drive, Timmins, ON, P4R 1A6
Phone: (705) 531-1121 Fax: (705) 531-1125 Web: www.testmark.ca

CERTIFICATE OF ANALYSIS

Paracel Laboratories Ltd. - Ottawa

Work Order Number: 520467

This report has been approved by:

Adam Tam, M.Sc.
Laboratory Director

WORK ORDER RESULTS

Sample Description	BH5 - 23 - GW1		BH6 - 23 - GW1		BH7 - 23 - GW1			
Sample Date	11/21/2023 12:00 AM		11/21/2023 12:00 AM		11/21/2023 12:00 AM			
Lab ID	1956859		1956860		1956861			
Mercury by CV (Dissolved)	Result	MDL	Result	MDL	Result	MDL	Units	Criteria: CCME Short Term Freshwater Quality Guidelines
Dissolved Mercury	<0.01	0.01	<0.01	0.01	<0.01	0.01	ug/L	~

LEGEND

Dates: Dates are formatted as mm/dd/year throughout this report.

MDL: Method detection limit or minimum reporting limit.

~: In a criteria column indicates the criteria is not applicable for the parameter row.

Organic Soil Analysis: Data reported for organic analysis in soils samples are corrected for moisture content.

Quality Control: All associated Quality Control data is available on request.

Field Data: Reports containing Field Parameters represent data that has been collected and provided by the client. Testmark is not responsible for the validity of this data which may be used in subsequent calculations.

Sample Condition Deviations: A noted sample condition deviation may affect the validity of the result. Results apply to the sample(s) as received.

ICPMS Dustfall Insoluble: The ICPMS Dustfall Insoluble Portion method analyzes only the particulate matter from the Dustfall Sampler which is retained on the analysis filter during the Dustfall method.

Regulation Comparisons: Disclaimer: Please note that regulation criteria are provided for comparative purposes, however the onus on ensuring the validity of this comparison rests with the client.

1335 Riverside Drive, Timmins, ON, P4R 1A6
Phone: (705) 531-1121 Fax: (705) 531-1125 Web: www.testmark.ca

PARACEL LABORATORIES LTD

Paracel ID: 2347402

Laurent Blvd.
ario K1G 4J8
-1947
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labs.com

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2347402	

Client Name: Paterson Group
Contact Name: Nick Sullivan
Address: 9 Auriga Dr. Ottawa, ON K2E 7T9
Telephone: 613-226-7381

Project Ref: PE6034
Quote #:
PO #: 58913
E-mail: nsullivan@patersongroup.ca

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Turnaround Time

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

☒ REG 153/04 ☐ REG 406/19

☐ Table 1 ☒ Res/Park ☐ Med/Fine
☐ Table 2 ☐ Ind/Comm ☒ Coarse
☐ Table 3 ☐ Agri/Other
☒ Table 7
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)

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)					
1	BH5-23-GW1	GW		7	Nov. 21. 23		X		X	X	X	X						
2	BH6-23-GW1	↓		7	↓		X		X	X	X	X						
3	BH7-23-GW1			7			X		X	X	X	X						
4	DUP-1			3			X											
5																		
6																		
7																		
8																		
9																		
10																		

Comments:

Method of Delivery: Paracel Courier

Relinquished By (Sign): N. Sullivan	Received By Driver/Depot:	Received at Lab:	Verified By: SD
Relinquished By (Print): Nick Sullivan	Date/Time:	Date/Time: Nov 23 2023 16:08	Date/Time: Nov 24, 2023 10:05
Date/Time: Nov. 22. 2023	Temperature: °C	Temperature: 11.9	pH Verified: ☑ By: SD

PATERSON GROUP

Soil & Groundwater Management Plan

Proposed Residential Development

Tunney's Pasture (Blocks 1 & 2)
Ottawa, Ontario

Prepared for Arcadis IBI Group

TABLE OF CONTENTS

1.0 Introduction

This Soil and Groundwater Management Plan (SGMP) was developed to minimize the soil and groundwater onsite that will require off-site disposal and when off-site disposal is required, ensuring that proper handling and disposal methods are undertaken. A high level fee estimate for the required items for soil and groundwater management during construction have been included at the end of this letter.

2.0 Soil Reuse

Soil is considered suitable for reuse on the subject site provided that the soil is not considered heavily impacted (no visible free product or significant petroleum hydrocarbon (PHC) odours) and is not used as final cover for landscaping purposes (with the exception of segregated topsoil and granular materials).

The excavated soil may be suitable for reuse on-site as backfill from a geotechnical perspective provided that it is maintained in a relatively dry condition, can be properly compacted, and is approved by the geotechnical engineer at the time of construction. Additionally, based on the conditions observed. cobbles and boulders are likely to be encountered in certain areas of the excavation. Thus, prior to reusing this soil, it will be necessary to cull out all material in excess of 300 mm in its largest dimension. Alternatively, cobbles and boulders could be processed and blended with the fill to a gradation suitable for reuse as engineered fill.

Site excavated soil can also be used as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in thin lifts and compacted to minimize voids. If these materials are to be used to build up the subgrade level for areas to be paved, they should be compacted in thin lifts to a minimum density of 95% of their respective standard Proctor maximum dry density (SPMDD). Site excavated soil is not suitable for use as backfill against foundation walls due to the frost heave potential of the site excavated soils below settlement sensitive areas, such as concrete sidewalks and exterior concrete entrance areas.

It is recommended that stockpiles of excavated material intended for reuse be protected against increases in moisture content by securely covering the stockpiles prior to and during precipitation events. Therefore, the placement and compaction of the on-site soil should be completed during relatively dry and non-freezing conditions. If, due to any of the above conditions, the existing fill becomes unsuitable for reuse as engineered fill based on the geotechnical engineer, it should be transported and properly disposed off-site, and an imported fill material should be used. Protection of materials from increased moisture content is considered to be the responsibility of the Contractor.

3.0 Groundwater Re-use

Groundwater is considered to be suitable to manage on-site during situations where free product is not observed and no risk to the workers or the natural environment is considered to be present relating to its re-use. The groundwater must be able to be managed without entering any surface water bodies without appropriate treatment and permits.

4.0 Soil Requiring Off-Site Disposal

Soil is considered to require off-site disposal from an environmental perspective when the soil is heavily impacted. Heavily impacted soil is considered impacts that can re-contaminate areas due to leaching and consists of free product visible in the soil and/or significant PHC odours.

Based on the findings of the Phase II ESA investigation, the shallow fill material present beneath the surficial asphalt at BH5-23, located in the north-central portion of the subject property, is contaminated with heavier fractions of petroleum hydrocarbons (PHC F_4 gravimetric). Given the low-mobility of these contaminants, it is expected that the contamination is confined to the fill material within a localized area around BH5-23. This contaminated soil will require excavation and disposal at a licensed waste disposal facility.

Excavated soil is not considered to be suitable for reuse on site during conditions where, in the opinion of the geotechnical engineer, the soil is saturated and/or does not have a suitable gradation for placement and compaction that will not achieve the required compaction specifications.

Soil to be disposed off-site must be evaluated by environmental personnel prior to their disposal. Heavily impacted soil must be disposed at an approved waste disposal facility. Soil observed to be clean or marginally impacted can be disposed of at a variety of waste disposal facilities, including, but not limited to, clean fill sites (clean soil only) and interim transfer stations. Based on the quality of the soil, as determined by the environmental personnel, the soil must be sent to the appropriate disposal facility.

At this time, soil disposal locations have not been selected. These locations will be selected by the construction contractor prior to mobilization.

5.0 Groundwater Requiring Off-Site Disposal

Groundwater must be disposed of off-site in situations where free product is observed. The groundwater must be disposed of following all applicable laws and regulations. Licensed pumping contractors are required to dispose of any impacted groundwater. If impacted groundwater is observed, all reasonable efforts must be made to limit the quantity of impacted groundwater pumped and disposed. Similarly, if a spill occurs all reasonable efforts should be made to protect the surface and groundwater resources. At no time is groundwater to be disposed of directly to surface water resources.

Any offsite groundwater must be disposed of through an approved method. Grossly impacted groundwater where a sheen and/or odour is identified must be treated prior to removal from site or be removed from site with the intention of offsite treatment. Excess groundwater may also be able to be disposed within the City of Ottawa Sanitary and/or Storm sewer system. Prior to disposal to the sewer system, a sewer discharge agreement must be completed with the City of Ottawa.

5.1 Construction Dewatering

The site-specific construction dewatering protocols will be provided in project- specific geotechnical and/or hydrogeological reports.

Generally, it is recommended that additional analytical testing prior to construction mobilization should be carried out to determine the appropriate disposal method. Any environmentally impacted groundwater should be pumped into a storage tanker for testing and potentially treatment before discharging to the sanitary sewer.

5.2 Groundwater Monitoring Decommissioning

All groundwater monitoring wells must be decommissioned in accordance with Ontario Regulation 903/90. It is recommended that the groundwater monitoring wells remain in place and in viable condition for as long as possible, to allow for any potential re-sampling.

6.0 Permits and Agreements

It is anticipated that the following permits and agreements will be required to conduct the Construction Contractor Obligations (with respect to the Soil and Groundwater Management Plan);

- ❑ Permit to Take Water (or water taking EASR)
- ❑ City of Ottawa Storm and/or Sanitary Sewer Discharge agreement
- ❑ Landfill agreement for soil disposal
- ❑ Clean Fill agreement for soil disposal

7.0 Soil Stockpiles and Handling

Any soil and construction debris that is temporarily stockpiled must be done so within the confines of the perimeter protection/construction fencing. All stockpiles will be covered, by the trade contractor, with plastic tarps (10 mil plastic minimum), or an impermeable geotextile and secured from wind. The stockpiles will be covered with plastic in a reasonable time frame as weather conditions dictate. If the stockpile is continuously being accessed then the stockpile will be covered prior to the end of the work day, as weather conditions dictate. Storm water runoff from the plastic covering is to be diverted away from all surface water resources and from open construction excavations.

Stockpiles should be clearly identified to eliminate cross contamination and improper usage. Soil identified as grossly impacted should be immediately loaded into truck and disposed of at the licensed waste facility. The volume of excess soil disposed of at the landfill should be minimized using segregation during excavation and subsequent stockpile sampling programs.

8.0 Federal and Provincial Confirmatory Soil and Groundwater Sampling Protocols

The soil and groundwater sampling protocols followed during the field sampling programs in Ontario should be in general accordance with the MECP document entitled *"Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario"*, dated May 1996.

8.1 Soil and Groundwater Standards

The soil and groundwater standards for the Ontario portion of the site were taken from the document entitled *"Soil, Groundwater and Sediment Standards for Use under Part XV.I of the Environmental Protection Act"* prepared by the Ontario Ministry of the Environment (now Ministry of the Environment, Conservation and Parks), dated April 15, 2011. Several of the Tables found in the document may be applicable to the subject site. The following Table may be applicable.

The Table 7 Standards are based on the following considerations:

- ❑ Coarse-Grained Soil Conditions
- ❑ Non-Potable Groundwater Conditions
- ❑ Residential Land Use
- ❑ Shallow Soil Conditions

The applicable federal soil and groundwater standards are considered to be the Canadian Council of Ministers of the Environment (CCME). The standards are taken from the document entitled "*Canadian Environmental Quality Guidelines*", however, due to the proposed use of the block(s) as privately owned operations, only Provincial standards are deemed to apply for future uses.

Note that due to the proposed change in land use to a more sensitive use (e.g. commercial to residential), a Record of Site Condition will be required prior to redevelopment.

8.2 Stockpile Sampling

Stockpiled soils are subject to minimum sampling requirements under O.Reg. 153/04. The sampling requirements are shown below;

MINIMUM STOCKPILE SAMPLING FREQUENCY	
Stockpile Volume (m^3)	Minimum Number of Analysed Samples
≤ 130	3
> 130 to 220	4
> 220 to 320	5
> 320 to 430	6
> 430 to 550	7
> 550 to 670	8
> 670 to 800	9
> 800 to 950	10
> 950 to 1100	11
> 1100 to 1250	12
> 1250 to 1400	13
> 1400 to 1550	14
> 1550 to 1700	15
> 1700 to 1850	16
> 1850 to 2050	17
> 2050 to 2200	18
> 2200 to 2350	19
> 2350 to 2500	20
> 2500 to 2700	21
> 2700 to 2900	22
> 2900 to 3100	23
> 3100 to 3300	24
> 3300 to 3500	25
> 3501 to 3700	26
> 3700 to 3900	27
> 3900 to 4100	28
> 4100 to 4300	29
> 4300 to 4500	30
> 4500 to 4700	31
> 4700 to 5000	32
> 5000	32+(Volume-5000)÷300

The soil samples collected from the stockpiles are required to be tested for the following (as a minimum) Petroleum Hydrocarbons F1-F4, Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX), Metals, hydride forming Metals, sodium adsorption ratio (SAR), electrical conductivity (EC), and any other contaminants of concern, as identified by the environmental consultant (Qualified Person). Analysis for EC and SAR is only required in areas where a substance (namely road salt) has been applied for the purposes of keeping the area safe under conditions of snow or ice.

9.0 Applicable Municipal Laws, Standards, Codes and Guidelines

9.1 Soil and Groundwater Standards

No municipal soil standards and guidelines are considered to apply.

Groundwater discharged into the sewer systems of the City of Ottawa and City of Gatineau must follow the applicable bylaws.

City of Ottawa

The City of Ottawa requires that all discharges fall within the limits of Sewer Use By-law No. 2003-514. A sewer use agreement is expected to be required to manage excess groundwater at selected sites.

10.0 Imported Material

All imported material may originate from a licensed pit, quarry or other aggregate site licensed under the Aggregate Resources Act, or, from a source site where all applicable excess soil regulations have been met. Imported material will be required to meet the specific standard for its final use. If clean fill is imported onto site from a property not licensed under the Aggregate Resources Act, in-situ, or stockpile sampling as outlined in Section 8.3, will be required prior to final placement.

All imported soil must be placed in accordance with Ontario Regulation 406/19.

11.0 Quality Assurance and Quality Control

A minimum of 10% of samples will be submitted as duplicates for the purposes of QA/QC. Only one parameter grouping per QA/QC sample is required.

Additional QA/QC procedures are outlined in the Environmental Quality Management Plan, available under a separate cover.

12.0 Unexpected Environmental Impacts

If unexpected environmental impacts are encountered during the course of construction or redevelopment of the block(s), the environmental consultant or their representative should be notified immediately and work should avoid the area until an inspection is completed.

Following an inspection by the environmental consultant or their representative recommendations will be made regarding appropriate material handling procedures at the location. Additional investigative work may be required to delineate the impacted areas (if required).

13.0 Estimated Soil and Groundwater Management Budget

The following table presents the approximate costs related to items discussed in this soil and groundwater management plan.

Table 1: Estimated Costs for Soil and Groundwater Management

Item	**Fees**
On-Site and Excess Soil Management (O.Reg. 406/19), including: • Reporting • Supplemental testing • Meetings and Consultation with stakeholders and contractors Note that the On-site and Excess Soil testing will provide valuable information for soil delineation purposes.	$85,000
Soil remediation – tipping fees ($60/mt)	Approx. 10 mt
Soil remediation. Includes: • Site supervision • Confirmatory soil sampling • Reporting	$10,000
Record of Site Condition (O.Reg. 153/04) – initial submission (note that additional revisions and submissions may be required based on Ministry comments)	$15,000 $10,000 (revisions)
Permit to take water or Water taking EASR (whichever is applicable)	$20,000 $8,000
City of Ottawa sewer discharge testing and permits	$5,000
TOTAL	$153,000