PATERSON GROUP

Phase II – Environmental Site Assessment

360 Laurier Avenue W.
Ottawa, Ontario

Prepared for CLV Group Developments Inc.

Report: PE5833-2
January 13, 2023

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EXECUTIVE SUMMARY

Assessment

Paterson Group was retained by CLV Group Developments Inc. to conduct a Phase II – Environmental Site Assessment (Phase II ESA) for the property addressed 360 Laurier Avenue W., Ottawa, Ontario (Phase II Property). 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 25 and November 26, 2022, and consisted of drilling three boreholes (BH1-22 to BH3-22) within the lowest level of the underground parking garage of the existing multi-storey building. The boreholes were advanced to depths ranging from approximately 4.75 m to 6.43 m below the basement floor slab and terminated within the bedrock unit. Upon completion, all three boreholes were instrumented with groundwater monitoring well installations in order to access the groundwater table.

In general, the stratigraphy encountered at the borehole locations consists of a poured concrete slab, underlain by engineered fill material, followed by bedrock. Bedrock, which consisted of weathered shale, was generally encountered at a depths ranging from approximately 0.3 m to 0.8 m below the basement floor slab. The water table was generally encountered at a depth of approximately 3.1 m to 4.8 m below the basement floor slab.

Three groundwater samples were submitted for laboratory analysis of BTEX, PHCs (F_1-F_4), VOCs, and/or PAH parameters. Based on the analytical test results, all detected parameter concentrations in the groundwater samples analyzed were in compliance with the selected MECP Table 3 Non-Potable Groundwater Standards, with the exception of chloroform detected in BH3-22. The presence of chloroform in the groundwater is interpreted to be the result of municipal water utilized during the bedrock coring process, and is not considered to be the result of a contaminant issue. The chloroform is expected to dissipate in the near future through natural attenuation processes.

A second round of groundwater testing was carried out to confirm the groundwater quality in BH3-22. One sample was acquired from this monitoring well and submitted for laboratory analysis of PHCs F_1 and VOCs. Based on the analytical test results, no parameter concentrations were identified above the laboratory method limits. The results are considered to be in compliance with the selected MECP Table 3 Non-Potable Groundwater Standards.

Based on the findings of this assessment, it is our opinion that **no further investigative work is required at this time.**

Recommendations

Monitoring Wells

It is recommended that the monitoring wells be maintained for possible 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 CLV Group Developments Inc., Paterson Group (Paterson) conducted a Phase II – Environmental Site Assessment (Phase II ESA) for the property addressed 360 Laurier Avenue W., in the City of Ottawa, Ontario (Phase II Property).

The purpose of the 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:	360 Laurier Avenue W., Ottawa, Ontario.
Location:	The Phase II Property is located on the south side of Laurier Avenue W., approximately 25 m east of Kent Street, in the City of Ottawa, Ontario. Refer to Figure 1 – Key Plan, appended to this report.
Latitude and Longitude:	45° 25’ 04" N, 75° 42' 02" W.

Site Description:

Configuration:	Rectangular.
Area:	1,233 m^2 (approximately).
Zoning:	MD – Mixed-Use Downtown Zone.
Current Use:	The Phase II Property is currently occupied by an 11-storey commercial office building, with multiple ground floor commercial retail units.
Services:	The Phase II Property is located within a municipally serviced area

1.2 Property Ownership

The Phase II Property is currently owned by TNC 360 Laurier Ltd. Paterson was retained to complete this Phase II ESA by CLV Group Developments Inc. (CLV), for due diligence purposes. The CLV offices can be contacted via telephone at 613-728-2000.

1.3 Applicable Site Condition Standard

The site condition standards for the subject property were obtained from Table 3 of the document entitled, *"Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act"*, prepared by the Ministry of the Environment, Conservation and Parks (MECP), and dated April 15, 2011. The selected MECP standards are based on the following considerations:

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

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.

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The Phase II Property is currently occupied by a multi-storey commercial office building with three levels of underground parking. The building footprint occupies nearly the entirety of the property area.

The site topography is relatively flat, while the regional topography appears to slope down towards the northwest, in the general direction of the Ottawa River.

The Phase II Property is considered to be at grade with respect to the adjacent streets and the neighbouring properties.

Water drainage on the Phase II Property occurs primarily via surface runoff towards catch basins located on the adjacent street.

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The subsurface investigation for this assessment was conducted on November 25 and November 26, 2022 and consisted of drilling three boreholes (BH1-22 to BH3-22) within the underground parking garage of the existing multi-storey building. BH1-22 and BH3-22 were drilled within the western half of the garage on level P5, whereas BH2-22 was drilled within the eastern half of the garage on level P4.

The boreholes were advanced to depths ranging from approximately 4.75 m to 6.43 m below the basement floor slab and terminated within the bedrock unit. Upon completion, all three boreholes were instrumented with groundwater monitoring well installations in order to access the groundwater table.

3.2 Media Investigated

During the course of this subsurface investigation, groundwater samples were obtained from the Phase II Property and submitted for laboratory analysis. The rationale for sampling and analyzing this media is based on the contaminants of potential concern identified in the Phase I ESA.

The contaminants of potential concern for the groundwater on the Phase II Property include the following:

- ❒ Benzene, Ethylbenzene, Toluene, and Xylenes (BTEX);
- ❒ Volatile Organic Compounds (VOCs);
- ❒ Petroleum Hydrocarbons, fractions 1 – 4 (PHCs F_1-F_4);
- ❒ Polycyclic Aromatic Hydrocarbons (PAHs).

These CPCs have the potential to be present in the groundwater 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 I Property is reported to consist of shale of the Billings Formation, while the surficial geology reportedly consists of offshore marine sediments (erosional terraces) with an overburden ranging in thickness from approximately 5 m to 10 m. 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 are present on the Phase I Property.

The nearest named water body with respect to the Phase I Property is the Ottawa River, located approximately 700 m to the northwest.

Drinking Water Wells

Based on the availability of municipal services, no drinking water wells are expected to be present within the Phase I Study Area.

Existing Buildings and Structures

The Phase I Property is currently occupied with an eleven-storey commercial office building, with three levels (five half levels) of underground parking.

Current and Future Property Use

The Phase I Property is currently being used for commercial purposes.

It is our understanding that the existing commercial office building on the Phase I Property is to be renovated and converted for residential use.

Due to the change to a more sensitive land use (commercial to residential), this will require that a record of site condition (RSC) 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 PE5833-2 – 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, four potentially contaminating activities (PCAs), resulting in areas of potential environmental concern (APECs), were identified on the Phase I Property. These APECs include:

- PCA 28: An existing interior aboveground diesel fuel storage tank, located on the eastern portion of the Phase I Property (APEC #1);

- PCA 52: A former off-site auto service garage and retail fuel outlet, located on the adjacent property to the west at 199 Kent Street (APEC #2);
- Although not identified by a specific activity in Table 2 of O.Reg. 153/04, an existing off-site commercial office building with numerous waste generator records, located on the adjacent property to the east at 340 Laurier Avenue West, was identified as PCA. (APEC #3)
- A former off-site dry cleaning business, located approximately 60 m to the east at 324 Laurier Avenue West. (APEC #4).

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 I Property based on their separation distances as well as their inferred down-gradient or cross-gradient orientation with respect to anticipated groundwater flow to the north.

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);
- Volatile Organic Compounds (VOCs);
- Petroleum Hydrocarbons, fractions 1 – 4 (PHCs F_1-F_4);
- Polycyclic Aromatic Hydrocarbons (PAHs).

These CPCs have the potential to be present in the groundwater situated beneath the Phase I Property.

Assessment of Uncertainty and/or Absence of Information

The information available for review 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

Due to the low clearance height in the basement of the parking garage, the location of overhead utility services, stairwells, columns, and parking ramps, the final placement of select boreholes were marginally adjusted during the field drilling program. The impediments are not considered to have affected the outcome of the investigation.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation for this assessment was conducted on November 25 and November 26, 2022 and consisted of drilling three boreholes (BH1-22 to BH3-22) within the underground parking garage of the existing multi-storey building. BH1-22 and BH3-22 were drilled within the western half of the garage on level P5, whereas BH2-22 was drilled within the eastern half of the garage on level P4. Upon completion, all three boreholes were instrumented with groundwater monitoring wells.

The three boreholes were advanced to depths ranging from approximately 4.8 m to 6.4 m below the basement floor slab (approximately 15 m below the street level ground surface), and terminated within the bedrock unit.

Under the full-time supervision of Paterson personnel, the boreholes were drilled using a portable drill rig provided by Capital Cutting and Coring of Ottawa, Ontario. The locations of the boreholes are illustrated on "Drawing PE5833-3 – Test Hole Location Plan", appended to this report.

4.2 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.

The ground surface elevations of each borehole were subsequently surveyed with respect to the top spindle of a fire hydrant located at street level on Laurier Avenue West, to the north of the Phase II Property.

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.

Table 1
Monitoring Well Construction Details

Well ID	Ground Surface Elevation (m Below TBM)	Total Depth (m)	Screened Interval (m)	Sand Pack (m)	Bentonite Seal (m)	Casing Type
BH1-22	90.33	4.75	1.75-4.75	1.21-1.75	0.53-1.21	Flushmount
BH2-22	91.79	6.43	3.43-6.43	2.74-3.43	0.31-2.74	Flushmount
BH3-22	90.33	5.41	2.41-5.41	1.52-2.41	0.31-1.52	Flushmount

4.3 Field Measurement of Water Quality Parameters

Groundwater monitoring and sampling was conducted at BH1-22 to BH3-22 on November 29, 2022. 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)
BH1-22	18.7	<4,000	7.69
BH2-22	18.2	<4,000	7.23
BH3-22	18.5	<4,000	9.11

4.4 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.

4.5 Analytical Testing

The following groundwater samples were submitted for laboratory analysis:

Table 3
Testing Parameters for Submitted Groundwater Samples

Sample ID	Screened Interval & Stratigraphic Unit	Parameters Analyzed				Rationale
		VOCs	PHCs (F_1-F_4)	PAHs		
BH1-22-GW1	Bedrock 1.75 m – 4.75 m	X	X	X		To assess for potential impacts resulting from the presence of a former off-site auto service garage and retail fuel outlet.
BH2-22-GW1	Bedrock 3.43 m – 6.43 m	X	X	X		To assess for potential impacts resulting from the presence of an on-site aboveground fuel storage tank, an off-site waste generator site, and an off-site dry cleaners.
BH3-22-GW1	Bedrock 2.41 m – 5.41 m	X	X	X		To assess for potential impacts resulting from the presence of a former off-site auto service garage and retail fuel outlet.
BH3-22-GW1	Bedrock 2.41 m – 5.41 m	X	X			To confirm the groundwater quality at this location.
DUP-1	Bedrock 1.75 m – 4.75 m	X				For laboratory QA/QC purposes.

1 – Duplicate sample of BH1-22-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.

4.6 Residue Management

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

4.7 Elevation Surveying

Using a laser level device, the ground surface elevations at each borehole location were surveyed with respect to the top spindle of a fire hydrant located at street level on Laurier Avenue West, adjacent to the north of the Phase II Property. An assumed elevation of 100.00 m above sea level was assigned to this Temporary Benchmark (TBM). The ground surface elevations of each borehole is presented on Drawing PE5833-3 Test Hole Location Plan, appended to this report.

4.8 Quality Assurance and Quality Control Measures

A summary of the quality assurance and quality control measures used during 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 a poured concrete slab, underlain by engineered fill material. Bedrock consisting of weathered shale, was generally encountered at a depth of approximately 0.33 m to 0.79 m below the basement floor slab. 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 at BH1-22 to BH3-22 on November 29, 2022, and again at BH3-22 on December 8, 2022. The groundwater levels are summarized below in Table 4.

Table 4
Groundwater Level Measurements

Borehole Location	Ground Surface Elevation (m Below TBM)	Water Level Depth (m)	Water Level Elevation (m Below TBM)	Date of Measurement
BH1-22	90.33	3.06	87.27	November 29, 2022
BH2-22	91.79	4.84	86.95	
BH3-22	90.33	3.19	87.14	
		3.11	87.22	December 8, 2022

The groundwater at the Phase II Property was encountered within the bedrock in at depths ranging from approximately 3.1 m to 4.8 m below the basement floor slab. 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 PE5833-3 – Test Hole Location Plan in the appendix, the groundwater flow on the subject site was calculated to be in a northeasterly direction. A horizontal hydraulic gradient of approximately 0.01 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 Groundwater Quality

Three groundwater samples were submitted for laboratory analysis of VOCs, PHCs (F_1-F_4), PAHs, and/or parameters. The results of the analytical testing are presented below in Tables 5 to 7, as well as on the laboratory Certificate of Analysis included in Appendix 1.

Table 5
Analytical Test Results – Groundwater
PHCs (F_1-F_4)

Parameter	MDL (µg/L)	Groundwater Samples (ug/L)			MECP Table 3 Non-Potable Groundwater Standards (µg/L)
		November 29, 2022			
		BH1-22-GW1	BH2-22-GW1	BH3-22-GW1	
		Screening Interval (m BGS)			
		1.75 – 4.75 m	3.43 – 6.43 m	2.41 – 5.41 m	
PHCs F_1	25	nd	nd	31	750
PHCs F_2	100	nd	nd	nd	150
PHCs F_3	100	nd	nd	nd	500
PHCs F_4	100	nd	nd	nd	500

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – value exceeds selected MECP standards

No PHC parameters were identified in the samples analyzed, with the exception of a concentration of PHC F_1 detected in Sample BH3-22-GW1 at a concentration below the MECP Table 3 standard. The groundwater samples analysed comply with the MECP Table 3 Non-Potable Groundwater Standards.

Table 6
Analytical Test Results – Groundwater
Volatile Organic Compounds (VOCs)

Parameter	MDL (µg/L)	Groundwater Samples (ug/L)			MECP Table 3 Non-Potable Groundwater Standards (µg/L)
		November 29, 2022			
		BH1-22-GW1	BH2-22-GW1	BH3-22-GW1	
		Screening Interval (m BGS)			
		1.75 – 4.75 m	3.43 – 6.43 m	2.41 – 5.41 m	
Acetone	5.0	nd	nd	nd	130,000
Benzene	0.5	nd	nd	0.9	44
Bromodichloromethane	0.5	nd	nd	nd	85,000
Bromoform	0.5	nd	nd	nd	380
Bromomethane	0.5	nd	nd	nd	5.6
Carbon Tetrachloride	0.2	nd	nd	nd	0.79
Chlorobenzene	0.5	nd	nd	nd	630
Chloroform	0.5	1.4	nd	**5.4**	2.4
Dibromochloromethane	0.5	nd	nd	nd	82,000
Dichlorodifluoromethane	1.0	nd	nd	nd	4,400
1,2-Dichlorobenzene	0.5	nd	nd	nd	4,600
1,3-Dichlorobenzene	0.5	nd	nd	nd	9,600
1,4-Dichlorobenzene	0.5	nd	nd	nd	8
1,1-Dichloroethane	0.5	nd	nd	nd	320
1,2-Dichloroethane	0.5	nd	nd	nd	1.6
1,1-Dichloroethylene	0.5	nd	nd	nd	1.6
cis-1,2-Dichloroethylene	0.5	nd	nd	nd	1.6
trans-1,2-Dichloroethylene	0.5	nd	nd	nd	1.6
1,2-Dichloropropane	0.5	nd	nd	nd	16
1,3-Dichloropropene	0.5	nd	nd	nd	5.2
Ethylbenzene	0.5	nd	nd	1.0	2,300
Ethylene Dibromide	0.2	nd	nd	nd	0.25
Hexane	1.0	nd	nd	16.9	51
Methyl Ethyl Ketone	5.0	nd	nd	nd	470,000
Methyl Isobutyl Ketone	5.0	nd	nd	nd	140,000
Methyl tert-butyl ether	2.0	nd	nd	nd	190
Methylene Chloride	5.0	nd	nd	nd	610
Styrene	0.5	nd	nd	nd	1,300
1,1,1,2-Tetrachloroethane	0.5	nd	nd	nd	3.3
1,1,2,2-Tetrachloroethane	0.5	nd	nd	nd	3.2
Tetrachloroethylene	0.5	nd	nd	nd	1.6
Toluene	0.5	nd	nd	8.9	18,000
1,1,1-Trichloroethane	0.5	nd	nd	nd	640
1,1,2-Trichloroethane	0.5	nd	nd	nd	4.7
Trichloroethylene	0.5	nd	nd	nd	1.6
Trichlorofluoromethane	1.0	nd	nd	nd	2,500
Vinyl Chloride	0.5	nd	nd	nd	0.5
Xylenes	0.5	1.2	nd	13.1	4,200

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – value exceeds selected MECP standards

All detected VOC parameter concentrations in the groundwater samples analyzed are in compliance with the selected MECP Table 3 Non-Potable Groundwater Standards, with the exception of chloroform in Sample BH3-22-GW1.

The presence of chloroform in the groundwater is interpreted to be the result of treated municipal water utilized during the bedrock coring process and complies with the standard of 240 µg/L as listed in Table A of the MECP document entitled "Guidance for Addressing Chloroform at a Record of Site Condition Property. Chloroform is not considered to be a contaminant of concern at the Phase II Property. Furthermore, chloroform was determined to comply with the MECP Table 3 standard during a subsequent sampling event.

Table 7
Analytical Test Results – Groundwater
PAHs

Parameter	MDL (µg/L)	Groundwater Samples (ug/L)			MECP Table 3 Non-Potable Groundwater Standards (µg/L)
		August 31, 2022			
		BH1-22-GW1	BH2-22-GW1	BH3-22-GW1	
		Sample Depth (m bgs)			
		1.75 – 4.75 m	3.43 – 6.43 m	2.41 – 5.41 m	
Acenaphthene	0.05	nd	nd	nd	600
Acenaphthylene	0.05	nd	nd	nd	1.8
Anthracene	0.01	nd	nd	nd	2.4
Benzo[a]anthracene	0.01	nd	nd	nd	4.7
Benzo[a]pyrene	0.01	nd	nd	nd	0.81
Benzo[b]fluoranthene	0.05	nd	nd	nd	0.75
Benzo[g,h,i]perylene	0.05	nd	nd	nd	0.2
Benzo[k]fluoranthene	0.05	nd	nd	nd	0.04
Chrysene	0.05	nd	nd	nd	1.0
Dibenzo[a,h]anthracene	0.05	nd	nd	nd	0.52
Fluoranthene	0.01	nd	nd	nd	130
Fluorene	0.05	nd	nd	nd	400
Indeno [1,2,3-cd] pyrene	0.05	nd	nd	nd	0.2
1-Methylnaphthalene	0.05	nd	nd	nd	1,800
2-Methylnaphthalene	0.05	nd	nd	nd	1,800
Methylnaphthalene (1&2)	0.10	nd	nd	nd	1,800
Naphthalene	0.05	nd	nd	nd	1,400
Phenanthrene	0.05	nd	nd	nd	580
Pyrene	0.01	nd	nd	nd	68

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – value exceeds selected MECP standards

No PAH parameter concentrations were detected in any of the groundwater samples analyzed. The results are in compliance with the selected MECP Table 3 Non-Potable Groundwater Standards.

A second round of groundwater testing was carried out on December 8, 2022 to confirm the groundwater quality in BH3-22. One sample was acquired from this monitoring well and submitted for laboratory analysis of PHCs F_1 and VOCs. The results are presented below in Tables 8 and 9, as well as on the laboratory Certificates of Analysis, appended to this report.

Table 8
Analytical Test Results – Groundwater
Volatile Organic Compounds (VOCs)

Parameter	MDL (µg/L)	Groundwater Samples (ug/L)	MECP Table 3 Non-Potable Groundwater Standards (µg/L)
		December 8, 2022	
		BH3-22-GW1	
		Screening Interval (m BGS)	
		2.41 – 5.41 m	
Acetone	5.0	nd	130,000
Benzene	0.5	nd	44
Bromodichloromethane	0.5	nd	85,000
Bromoform	0.5	nd	380
Bromomethane	0.5	nd	5.6
Carbon Tetrachloride	0.2	nd	0.79
Chlorobenzene	0.5	nd	630
Chloroform	0.5	nd	2.4
Dibromochloromethane	0.5	nd	82,000
Dichlorodifluoromethane	1.0	nd	4,400
1,2-Dichlorobenzene	0.5	nd	4,600
1,3-Dichlorobenzene	0.5	nd	9,600
1,4-Dichlorobenzene	0.5	nd	8
1,1-Dichloroethane	0.5	nd	320
1,2-Dichloroethane	0.5	nd	1.6
1,1-Dichloroethylene	0.5	nd	1.6
cis-1,2-Dichloroethylene	0.5	nd	1.6
trans-1,2-Dichloroethylene	0.5	nd	1.6
1,2-Dichloropropane	0.5	nd	16
1,3-Dichloropropene	0.5	nd	5.2
Ethylbenzene	0.5	nd	2,300
Ethylene Dibromide	0.2	nd	0.25
Hexane	1.0	nd	51
Methyl Ethyl Ketone	5.0	nd	470,000
Methyl Isobutyl Ketone	5.0	nd	140,000
Methyl tert-butyl ether	2.0	nd	190
Methylene Chloride	5.0	nd	610
Styrene	0.5	nd	1,300
1,1,1,2-Tetrachloroethane	0.5	nd	3.3
1,1,2,2-Tetrachloroethane	0.5	nd	3.2
Tetrachloroethylene	0.5	nd	1.6
Toluene	0.5	nd	18,000
1,1,1-Trichloroethane	0.5	nd	640
1,1,2-Trichloroethane	0.5	nd	4.7
Trichloroethylene	0.5	nd	1.6
Trichlorofluoromethane	1.0	nd	2,500
Vinyl Chloride	0.5	nd	0.5
Xylenes	0.5	nd	4,200

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – value exceeds selected MECP standards

No VOC parameter concentrations were identified above the laboratory detection limits. The results are in compliance with the MECP Table 3 Non-Potable Groundwater Standards.

Table 9
Analytical Test Results – Groundwater
PHCs (F_1)

Parameter	MDL (µg/L)	Groundwater Samples (ug/L)	MECP Table 3 Non-Potable Groundwater Standards (µg/L)
		December 8, 2022	
		BH3-22-GW2	
		Screening Interval (m BGS)	
		2.41 – 5.41 m	
PHCs F_1	25	nd	750

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – value exceeds selected MECP standards

No PHC parameter concentrations were identified above the laboratory detection limits. The results are in compliance with the MECP Table 3 Non-Potable Groundwater Standards.

Table 10
Maximum Concentrations – Groundwater

Parameter	Maximum Concentration (µg/L)	Sample ID	Depth Interval (m BGS)
PHCs F_1	31	BH3-22-GW1	2.41 – 5.41 m
Benzene	0.9	BH3-22-GW1	2.41 – 5.41 m
Chloroform	5.4	BH3-22-GW1	2.41 – 5.41 m
Ethylbenzene	1.0	BH3-22-GW1	2.41 – 5.41 m
Hexane	16.9	BH3-22-GW1	2.41 – 5.41 m
Toluene	8.9	BH3-22-GW1	2.41 – 5.41 m
Xylenes	13.1	BH3-22-GW1	2.41 – 5.41 m

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

All other parameter concentrations analyzed were below the laboratory detection limits. The laboratory certificates of analysis are provided in Appendix 1.

5.5 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 groundwater sample was obtained from sample BH1-22-GW1 and submitted for laboratory analysis of VOC parameters. The relative percent difference (RPD) calculations for the original and duplicate samples are provided below in Table 11.

Table 11
QA/QC Calculations – Groundwater

Parameter	MDL (µg/L)	BH1-22-GW1	DUP-1	RPD (%)	QA/QC Result (Target: <20% RPD)
Acetone	5.0	nd	nd	0	Meets Target
Benzene	0.5	nd	nd	0	Meets Target
Bromodichloromethane	0.5	nd	nd	0	Meets Target
Bromoform	0.5	nd	nd	0	Meets Target
Bromomethane	0.5	nd	nd	0	Meets Target
Carbon Tetrachloride	0.2	nd	nd	0	Meets Target
Chlorobenzene	0.5	nd	nd	0	Meets Target
Chloroform	0.5	1.4	1.5	6.9	Meets Target
Dibromochloromethane	0.5	nd	nd	0	Meets Target
Dichlorodifluoromethane	1.0	nd	nd	0	Meets Target
1,2-Dichlorobenzene	0.5	nd	nd	0	Meets Target
1,3-Dichlorobenzene	0.5	nd	nd	0	Meets Target
1,4-Dichlorobenzene	0.5	nd	nd	0	Meets Target
1,1-Dichloroethane	0.5	nd	nd	0	Meets Target
1,2-Dichloroethane	0.5	nd	nd	0	Meets Target
1,1-Dichloroethylene	0.5	nd	nd	0	Meets Target
cis-1,2-Dichloroethylene	0.5	nd	nd	0	Meets Target
trans-1,2-Dichloroethylene	0.5	nd	nd	0	Meets Target
1,2-Dichloropropane	0.5	nd	nd	0	Meets Target
1,3-Dichloropropene	0.5	nd	nd	0	Meets Target
Ethylbenzene	0.5	nd	nd	0	Meets Target
Ethylene Dibromide	0.2	nd	nd	0	Meets Target
Hexane	1.0	nd	nd	0	Meets Target
Methyl Ethyl Ketone	5.0	nd	nd	0	Meets Target
Methyl Isobutyl Ketone	5.0	nd	nd	0	Meets Target
Methyl tert-butyl ether	2.0	nd	nd	0	Meets Target
Methylene Chloride	5.0	nd	nd	0	Meets Target
Styrene	0.5	nd	nd	0	Meets Target
1,1,1,2-Tetrachloroethane	0.5	nd	nd	0	Meets Target
1,1,2,2-Tetrachloroethane	0.5	nd	nd	0	Meets Target
Tetrachloroethylene	0.5	nd	nd	0	Meets Target
Toluene	0.5	nd	nd	0	Meets Target
1,1,1-Trichloroethane	0.5	nd	nd	0	Meets Target
1,1,2-Trichloroethane	0.5	nd	nd	0	Meets Target
Trichloroethylene	0.5	nd	nd	0	Meets Target
Trichlorofluoromethane	1.0	nd	nd	0	Meets Target
Vinyl Chloride	0.5	nd	nd	0	Meets Target
Xylenes	0.5	1.2	1.1	8.7	Meets Target

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – value exceeds selected MECP standards

The relative percent difference (RPD) calculated for all parameters fell within of the acceptable range of 20%, and as such, is 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.

5.6 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 2.2 of this 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 12
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 Existing and Former Aboveground Diesel Fuel Storage Tank	Eastern Portion of Phase II Property	*"Item 28: Gasoline and Associated Products Storage in Fixed Tanks"*	On-Site	BTEX PHCs (F_1-F_4)	Groundwater
APEC #2 Former Auto Service Garage & Retail Fuel Outlet	Western Portion of Phase II Property	*"Item 28: Gasoline and Associated Products Storage in Fixed Tanks"* *"Item 52: Storage, maintenance, fuelling and repair of equipment, vehicles, and material used to maintain transportation systems"*	Off-Site	VOCs PHCs (F_1-F_4) PAHs	Groundwater
APEC #3 Existing Waste Product Generation	Eastern Portion of Phase II Property	*"Item N/A: Waste Product Generation"*	Off-Site	VOCs PHCs (F_1-F_4)	Groundwater
APEC #4 Former Dry Cleaners	Eastern Portion of Phase II Property	*"Item 37: Operation of Dry Cleaning Equipment (where chemicals are used)"*	Off-Site	VOCs	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);
- Volatile Organic Compounds (VOCs);
- Petroleum Hydrocarbons, fractions 1 – 4 (PHCs F_1-F_4);
- Polycyclic Aromatic Hydrocarbons (PAHs).

These CPCs have the potential to be present in 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 on the property include electrical cables, natural gas lines, as well as sewer and water pipes.

Physical Setting

Site Stratigraphy

The stratigraphy of the Phase II Property beneath the underground parking garage generally consists of:

- Poured Concrete; extending from ground surface to a depth of approximately 0.10 m.
- Engineered fill material extending to depths ranging from approximately 0.33 m to 0.79 m below the basement floor slab.
- Shale bedrock; encountered at depths ranging from approximately 0.33 m to 0.79 m below the basement floor slab.

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 a depth of approximately 3.1 m to 4.8 m below the basement floor slab.

The groundwater flow calculated as part of this assessment was measured to be in a northeasterly direction towards the Ottawa River.

Approximate Depth to Bedrock

Bedrock was encountered at depths ranging from approximately 0.3 m to 0.8 m beneath the basement floor slab.

Due to the placement of the boreholes within the basement parking garage, this measurement is not indicative of the true bedrock depth beneath the Phase II Property.

Based on the available mapping and borehole data for the surrounding area, the bedrock beneath the Phase II Property is anticipated to be encountered at a depth of approximately 6.0 m to 9.0 m below ground surface.

Approximate Depth to Water Table

The depth to the water table is approximately 3.1 m to 4.8 m below the basement floor slab.

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 and the pH of the soil is between 5 and 9.

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

Existing Buildings and Structures

The Phase II Property is currently occupied by an eleven-storey commercial office building, with three levels (five half-levels) of underground parking.

Environmental Condition

Areas Where Contaminants are Present

Based on the analytical test results no contaminants are present on the Phase II Property.

Types of Contaminants

Based on the analytical test results, all detected parameter concentrations are in compliance with the selected MECP Table 3 Non-Potable Groundwater Standards.

Contaminated Media

Based on the findings of this assessment, no contaminated media is present on the Phase II Property.

What Is Known About Areas Where Contaminants Are Present

Based on the analytical test results, no areas of soil or groundwater contamination were identified on the Phase II Property.

Distribution and Migration of Contaminants

Based on the findings of the Phase II ESA, no distribution or migration of contaminants has occurred on the Phase II Property.

Discharge of Contaminants

Based on the findings of the Phase II ESA, no contaminants were discharged to the Phase II Property.

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, climatic and meteorological conditions are not considered to have had the potential to affect contaminant distribution.

Potential for Vapour Intrusion

Based on the analytical test results, all detected parameter concentrations are in compliance with the MECP Table 3 Non-Potable Groundwater Standards. As a result, there is no potential for vapour intrusion on the Phase II Property.

6.0 CONCLUSIONS

Assessment

Paterson Group was retained by CLV Group Developments Inc. to conduct a Phase II – Environmental Site Assessment (Phase II ESA) for the property addressed 360 Laurier Avenue W., Ottawa, Ontario (Phase II Property). 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 25 and November 26, 2022, and consisted of drilling three boreholes (BH1-22 to BH3-22) within the lowest level of the underground parking garage of the existing multi-storey building. The boreholes were advanced to depths ranging from approximately 4.75 m to 6.43 m below the basement floor slab and terminated within the bedrock unit. Upon completion, all three boreholes were instrumented with groundwater monitoring well installations in order to access the groundwater table.

In general, the stratigraphy encountered at the borehole locations consists of a poured concrete slab, underlain by engineered fill material, followed by bedrock. Bedrock, which consisted of weathered shale, was generally encountered at a depths ranging from approximately 0.3 m to 0.8 m below the basement floor slab. The water table was generally encountered at a depth of approximately 3.1 m to 4.8 m below the basement floor slab.

Three groundwater samples were submitted for laboratory analysis of BTEX, PHCs (F_1-F_4), VOCs, and/or PAH parameters. Based on the analytical test results, all detected parameter concentrations in the groundwater samples analyzed were in compliance with the selected MECP Table 3 Non-Potable Groundwater Standards, with the exception of chloroform detected in BH3-22. The presence of chloroform in the groundwater is interpreted to be the result of municipal water utilized during the bedrock coring process, and is not considered to be the result of a contaminant issue. The chloroform is expected to dissipate in the near future through natural attenuation processes.

A second round of groundwater testing was carried out to confirm the groundwater quality in BH3-22. One sample was acquired from this monitoring well and submitted for laboratory analysis of PHCs F_1 and VOCs. Based on the analytical test results, no parameter concentrations were identified above the laboratory method limits. The results are considered to be in compliance with the selected MECP Table 3 Non-Potable Groundwater Standards.

Based on the findings of this assessment, it is our opinion that **no further investigative work is required at this time.**

Recommendations

Monitoring Wells

It is recommended that the monitoring wells be maintained for possible 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 CLV Group Developments Inc. Permission and notification from CLV Group Developments Inc. and Paterson Group will be required prior to the release of this report to any other party.

Paterson Group Inc.

Nick Sullivan, B.Sc.

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

Report Distribution:

- CLV Group Developments Inc.
- Paterson Group Inc.

FIGURES

FIGURE 1 – KEY PLAN

DRAWING PE5833-1 – SITE PLAN

DRAWING PE5833-2 – SURROUNDING LAND USE PLAN

DRAWING PE5833-3 – TEST HOLE LOCATION PLAN

DRAWING PE5833-4 – ANALYTICAL TESTING PLAN – GROUNDWATER

DRAWING PE5833-4A – CROSS SECTION A-A' – GROUNDWATER

DRAWING PE5833-4B – CROSS SECTION B-B' – GROUNDWATER

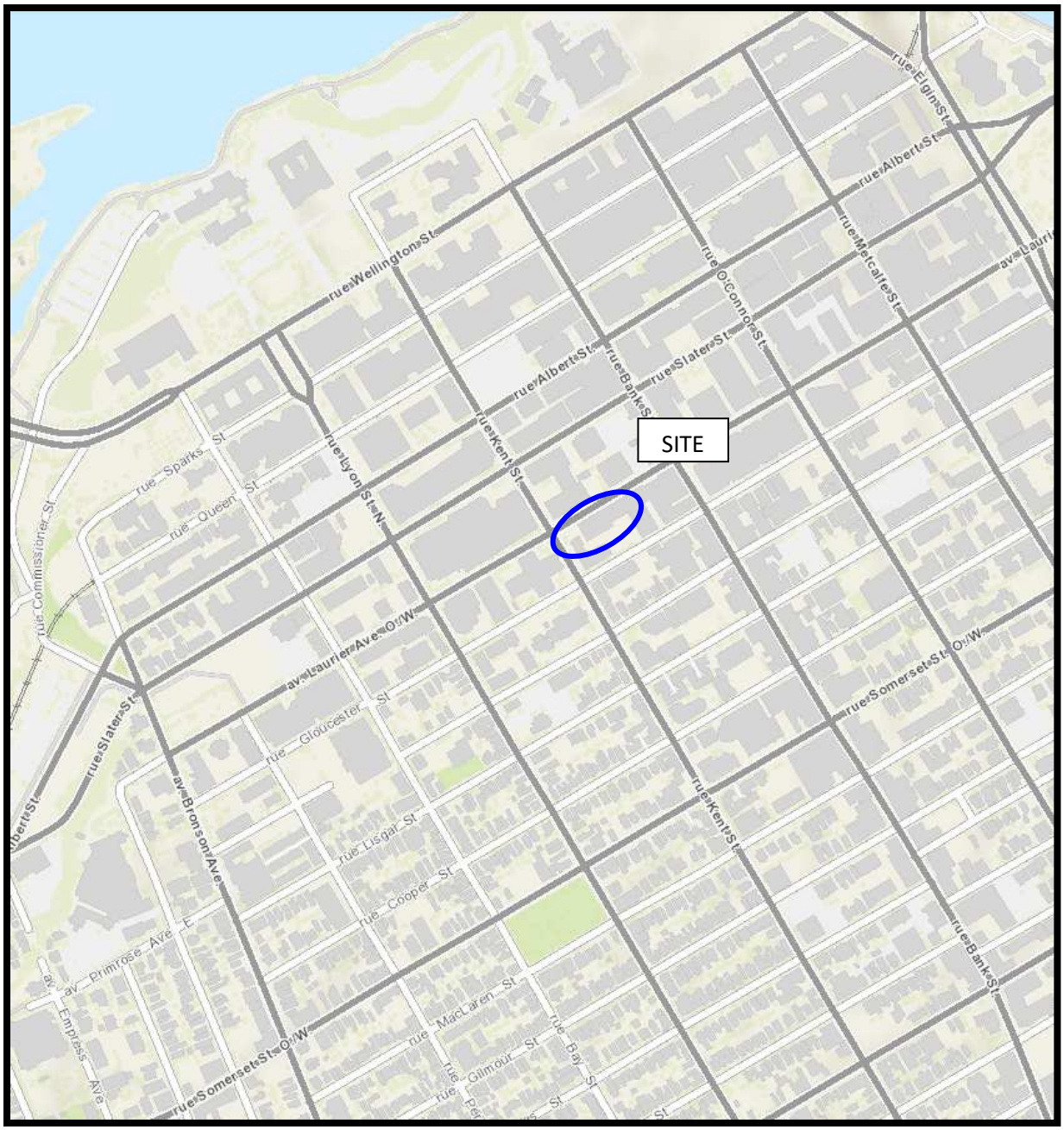
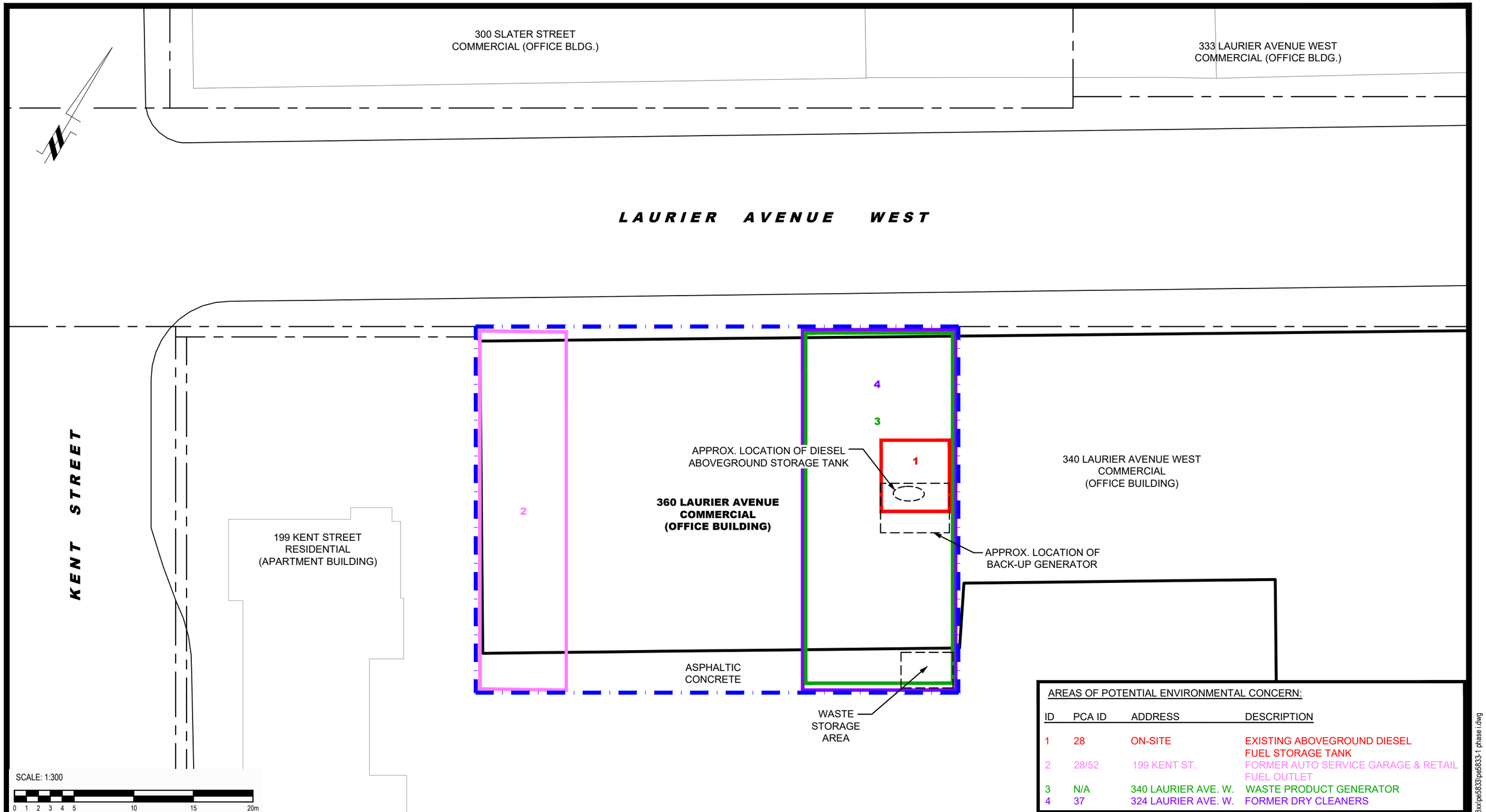


FIGURE 1

KEY PLAN



AREAS OF POTENTIAL ENVIRONMENTAL CONCERN:

ID	PCA ID	ADDRESS	DESCRIPTION
1	28	ON-SITE	EXISTING ABOVEGROUND DIESEL FUEL STORAGE TANK
2	28/52	199 KENT ST.	FORMER AUTO SERVICE GARAGE & RETAIL FUEL OUTLET
3	N/A	340 LAURIER AVE. W.	WASTE PRODUCT GENERATOR
4	37	324 LAURIER AVE. W.	FORMER DRY CLEANERS

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

NO.	REVISIONS	DATE	INITIAL

CLV GROUP DEVELOPMENTS INC.

PHASE I - ENVIRONMENTAL SITE ASSESSMENT
360 LAURIER AVENUE WEST

OTTAWA, ONTARIO

Title:

SITE PLAN

Scale: 1:300	Date: 10/2022
Drawn by: JM	Report No.: PE5833-1
Checked by: NS	Dwg. No.: PE5833-1
Approved by: MSD	Revision No.:

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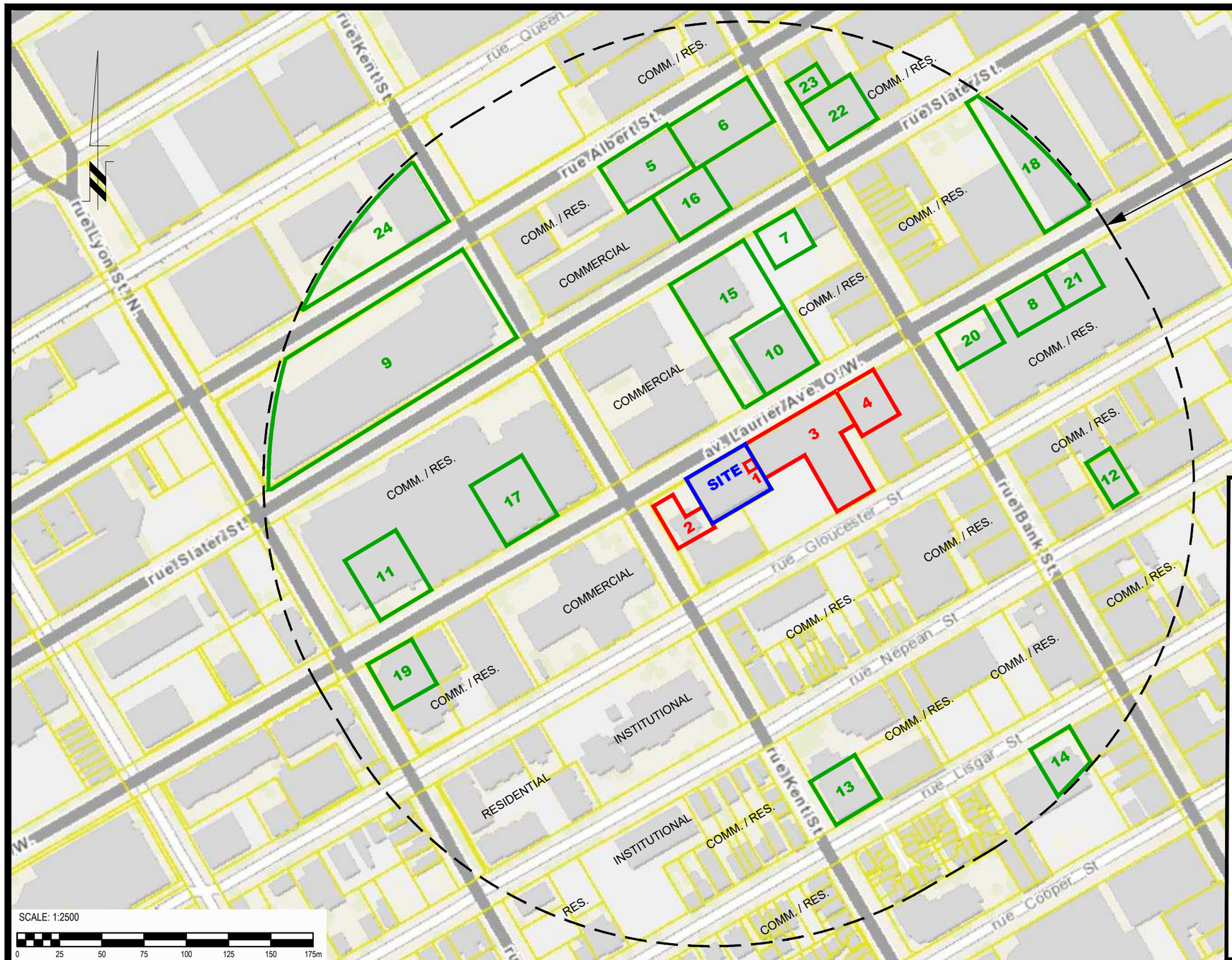

POTENTIALLY CONTAMINATING ACTIVITIES:

ID	PCA ID	ADDRESS	DESCRIPTION
1	28	ON-SITE	EXISTING ABOVEGROUND DIESEL FUEL STORAGE TANK
2	28/52	199 KENT ST.	FORMER AUTO SERVICE GARAGE & RETAIL FUEL OUTLET
3	N/A	340 LAURIER AVE. W.	WASTE PRODUCT GENERATOR
4	37	324 LAURIER AVE. W.	FORMER DRY CLEANERS
5	34/52	260 ALBERT ST.	FORMER METAL WORKSHOP & AUTO SERVICE GARAGE.
6	37	250 ALBERT ST.	FORMER DRY CLEANERS
7	37	250 SLATER ST.	FORMER DRY CLEANERS
8	37	302 LAURIER AVE. W.	FORMER DRY CLEANERS
9	52	150 KENT ST.	FORMER ELECTRIC STREET CAR GARAGE
10	34	333 LAURIER AVE. W.	FORMER METAL WORKSHOP
11	51	433 LAURIER AVE. W.	FORMER MACHINE SHOP
12	31	175 NEPEAN ST.	FORMER PRINTING FACILITY
13	28	235 KENT ST.	FORMER RETAIL FUEL OUTLET
14	52	360 LISGAR ST.	FORMER AUTO SERVICE GARAGE
15	52	333 LAURIER AVE. W.	FORMER AUTO SERVICE GARAGE
16	52	275 SLATER ST.	FORMER AUTO SERVICE GARAGE
17	51	399 LAURIER AVE. W.	FORMER MACHINE SHOP
18	52	170 SLATER ST.	FORMER AUTO SERVICE GARAGE
19	52	440 LAURIER AVE. W.	FORMER AUTO SERVICE GARAGE
20	37	169 BANK ST.	FORMER DRY CLEANERS
21	31	300 LAURIER AVE. W.	FORMER PRINTERS
22	17	123 BANK ST.	FORMER TEXTILE DYER & SCOURER
23	N/A	117 BANK ST.	FORMER GAS & ELECTRICAL EQUIPMENT MANUFACTURER
24	52	112 KENT ST.	FORMER ELECTRIC STREET RAILWAY CAR SHED

PATERSON GROUP
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NO.	REVISIONS	DATE	INITIAL

CLV GROUP DEVELOPMENTS INC.

PHASE I - ENVIRONMENTAL SITE ASSESSMENT

360 LAURIER AVENUE WEST

OTTAWA, ONTARIO

Title:

SURROUNDING LAND USE PLAN

Scale: 1:2500	Date: 10/2022
Drawn by: JM	Report No.: PE5833-1
Checked by: NS	Dwg. No.: PE5833-2
Approved by: MSD	Revision No.:

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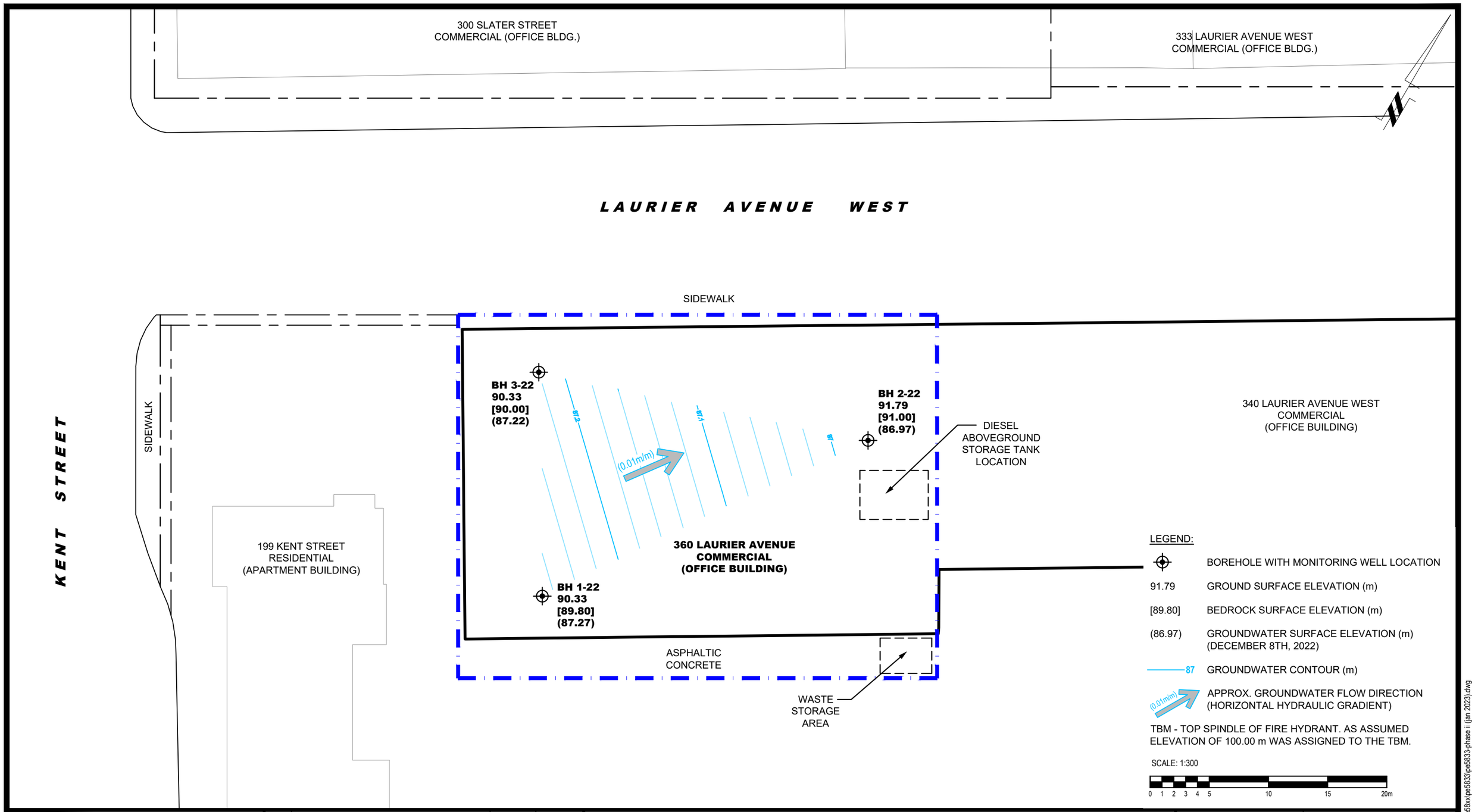

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CLV GROUP DEVELOPMENTS INC.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
360 LAURIER AVENUE WEST

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:300	Date: 01/2023
Drawn by: YA	Report No.: PE5833-2
Checked by: NS	Dwg. No.: PE5833-3
Approved by: MSD	Revision No.:

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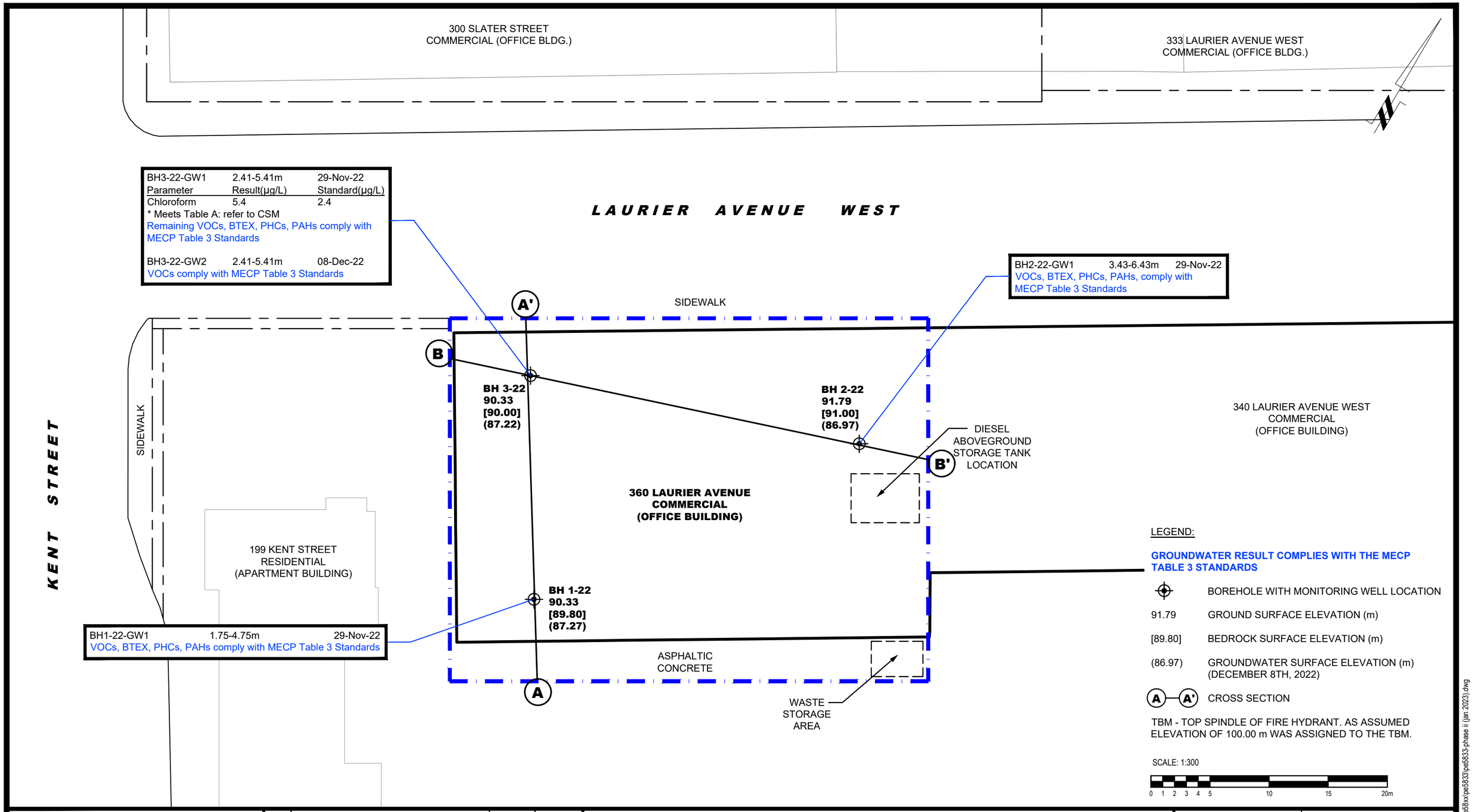

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CLV GROUP DEVELOPMENTS INC.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
360 LAURIER AVENUE WEST

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - GROUNDWATER

Scale: 1:300	Date: 01/2023
Drawn by: YA	Report No.: PE5833-2
Checked by: NS	Dwg. No.: PE5833-4
Approved by: MSD	Revision No.:

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BH1-22-GW1 1.75-4.75m 29-Nov-22
VOCs, BTEX, PHCs, PAHs comply with MECP Table 3 Standards

BH3-22-GW1 2.41-5.41m 29-Nov-22

Parameter	Result(µg/L)	Standard(µg/L)
Chloroform	5.4	2.4

* Meets Table A: refer to CSM
Remaining VOCs, BTEX, PHCs, PAHs comply with MECP Table 3 Standards

BH3-22-GW2 2.41-5.41m 08-Dec-22
VOCs comply with MECP Table 3 Standards

360 LAURIER AVENUE

A **A'**

BH 1-22 **BH 3-22**

ASPHALTIC CONCRETE **ASPHALTIC CONCRETE** **ASPHALTIC CONCRETE**

ENGINEERED FILL

BEDROCK **BEDROCK** **BEDROCK**

ELEV=87.27m (DEC 8, 2022)

ELEV=87.22m (DEC 8, 2022)

ELEVATION (m)

91.0 90.0 89.0 88.0 87.0 86.0 85.0 84.0

0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0 26.0 28.0 30.0 32.0

HORIZONTAL DISTANCE (m)

GROUNDWATER RESULT COMPLIES WITH THE MECP TABLE 3 STANDARDS

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CLV GROUP DEVELOPMENTS INC.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
360 LAURIER AVENUE WEST

OTTAWA, ONTARIO

Title:

CROSS SECTION A-A' - GROUNDWATER

Scale: 1:300	Date: 01/2023
Drawn by: YA	Report No.: PE5833-2
Checked by: NS	Dwg. No.: PE5833-4A
Approved by: MSD	Revision No.:

11x17

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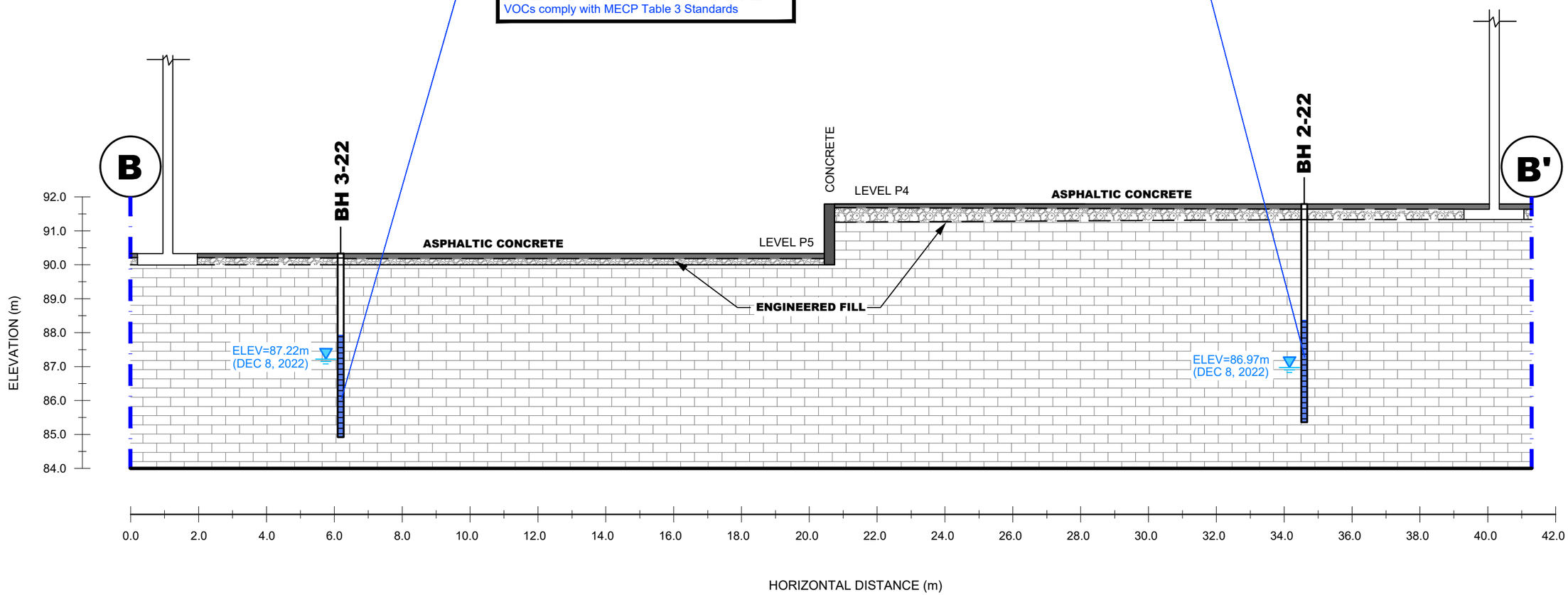
BH3-22-GW1	2.41-5.41m	29-Nov-22
Parameter	Result(µg/L)	Standard(µg/L)
Chloroform	5.4	2.4

* Meets Table A: refer to CSM
Remaining VOCs, BTEX, PHCs, PAHs comply with MECP Table 3 Standards

BH3-22-GW2 2.41-5.41m 08-Dec-22
VOCs comply with MECP Table 3 Standards

BH2-22-GW1 3.43-6.43m 29-Nov-22
VOCs, BTEX, PHCs, PAHs, comply with MECP Table 3 Standards



GROUNDWATER RESULT COMPLIES WITH THE MECP TABLE 3 STANDARDS

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CLV GROUP DEVELOPMENTS INC.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
360 LAURIER AVENUE WEST
OTTAWA, ONTARIO

Title:
CROSS SECTION B-B' - GROUNDWATER

Scale: 1:300	Date: 01/2023
Drawn by: YA	Report No.: PE5833-2
Checked by: NS	Dwg. No.: PE5833-4B
Approved by: MSD	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

360 Laurier Avenue W.
Ottawa, Ontario

Prepared for CLV Group Developments Inc.

Report: PE5833-SAP
November 1, 2022

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PAGE

1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by CLV Group Developments Inc., to conduct a Phase II – Environmental Site Assessment (Phase II ESA) for the property addressed 360 Laurier Avenue W., 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
BH1-22	Southwestern portion of the Phase I Property; to assess for potential impacts resulting from the presence of a former off-site auto service garage and retail fuel outlet.	4-6 m; to intercept the groundwater table for the purpose of installing a monitoring well.
BH2-22	Eastern portion of the Phase I Property; to assess for potential impacts resulting from the presence of an on-site aboveground fuel storage tank, an off-site waste generator site, and an off-site dry cleaners.	4-6 m; to intercept the groundwater table for the purpose of installing a monitoring well.
BH3-22	Northwestern portion of the Phase I Property; to assess for potential impacts resulting from the presence of a former off-site auto service garage and retail fuel outlet.	4-6 m; to intercept the groundwater table for the purpose of installing a monitoring well.

Borehole locations are shown on Drawing PE5833-3 – 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.

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
360 Laurier Avenue West
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant. An assumed elevation of 100.00m was assigned to the TBM.

REMARKS

BORINGS BY Portable Drill **DATE** November 26, 2022

FILE NO. PE5833

HOLE NO. BH 1-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.33
Concrete 0.10							
ENGINEERED FILL		SS	1	50	50+		
0.53		SS	2	44	50+		
		RC	1	100	73	1	89.33
						2	88.33
BEDROCK: Fair to poor quality, black shale		RC	2	100	29		
						3	87.33
- good to excellent quality by 3.7m depth		RC	3	100	90	4	86.33
4.75							
End of Borehole							
(GWL @ 3.06m - Nov. 29, 2022)							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
360 Laurier Avenue West
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant. An assumed elevation of 100.00m was assigned to the TBM.

REMARKS

BORINGS BY Portable Drill **DATE** November 26, 2022

FILE NO. PE5833

HOLE NO. BH 2-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.79
Concrete 0.15							
ENGINEERED FILL 0.46		SS	1	67	50+		
		RC	1	100	41	1	90.79
		RC	2	100	7	2	89.79
BEDROCK: Poor quality, black shale		RC	3	98	40	3	88.79
- good to excellent quality by 4.0m depth						4	87.79
		RC	4	98	75	5	86.79
		RC	5	100	95	6	85.79
6.43 End of Borehole							
(GWL @ 4.84m - Nov. 29, 2022)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
360 Laurier Avenue West
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant. An assumed elevation of 100.00m was assigned to the TBM.

REMARKS

BORINGS BY Portable Drill **DATE** November 27, 2022

FILE NO. PE5833

HOLE NO. BH 3-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.33
Concrete 0.13							
ENGINEERED FILL 0.33		SS	1	0	50+		
						1	89.33
		RC	1	100	42		
						2	88.33
BEDROCK: Poor to excellent quality, black shale		RC	2	100	94	3	87.33
		RC	3	100	100	4	86.33
		RC	4	100	100	5	85.33
5.41							
End of Borehole							
(GWL @ 3.19m - Nov. 29, 2022)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

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

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

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

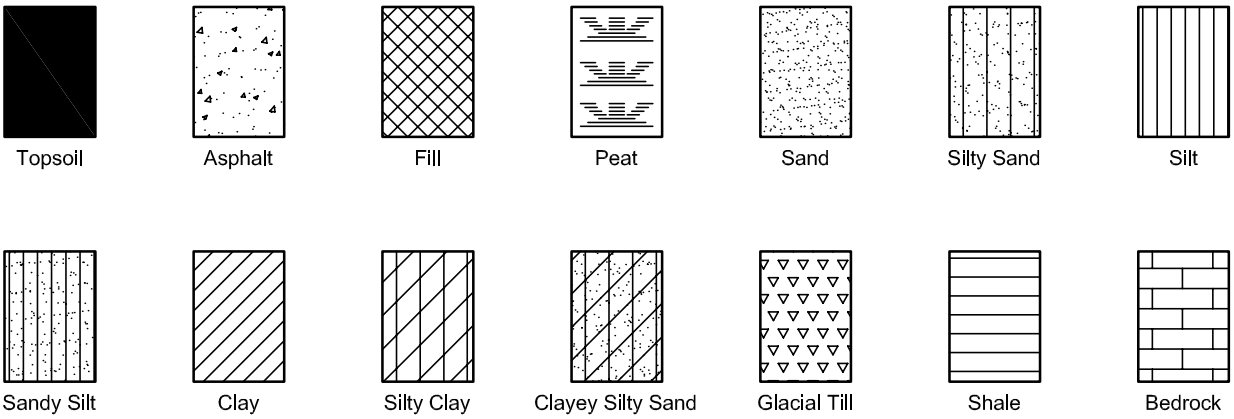
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

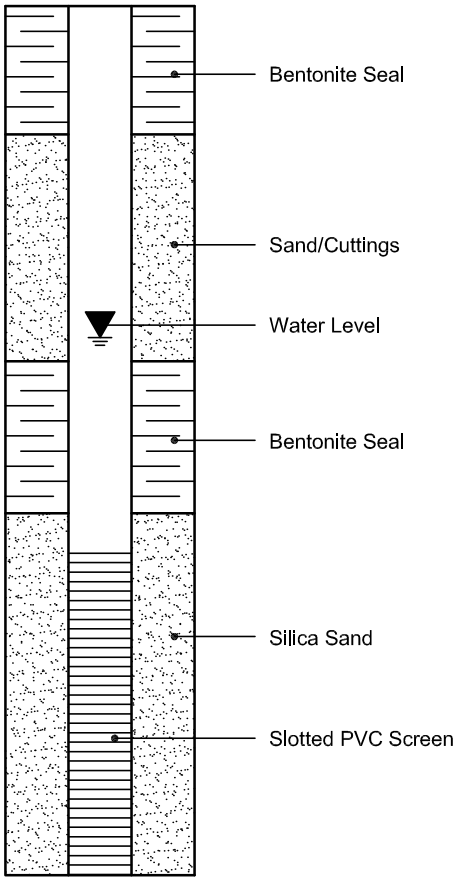
SYMBOLS AND TERMS (continued)

STRATA PLOT

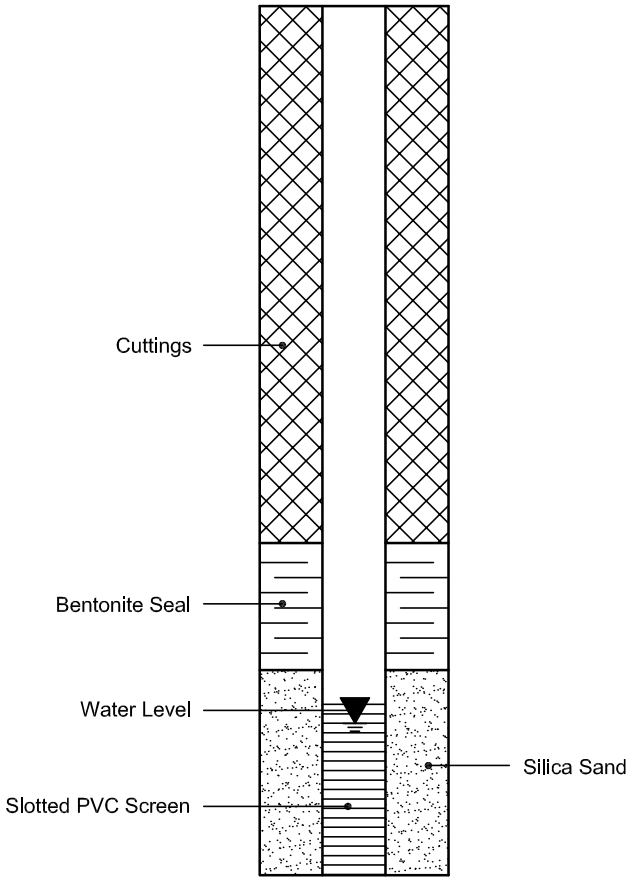


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Certificate of Analysis

Paterson Group Consulting Engineers

9 Auriga Drive
Ottawa, ON K2E 7T9
Attn: Nick Sullivan

Client PO: 56353
Project: PE5833
Custody:

Report Date: 7-Dec-2022
Order Date: 30-Nov-2022

Order #: 2249343

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

Paracel ID	Client ID
2249343-01	BH1-22-GW1
2249343-02	BH2-22-GW1
2249343-03	BH3-22-GW1
2249343-04	DUP1

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 07-Dec-2022

Client: Paterson Group Consulting Engineers

Order Date: 30-Nov-2022

Client PO: 56353

Project Description: PE5833

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
PCBs, total	EPA 608 - GC-ECD	6-Dec-22	7-Dec-22
PHC F1	CWS Tier 1 - P&T GC-FID	1-Dec-22	2-Dec-22
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	1-Dec-22	2-Dec-22
REG 153: PAHs by GC-MS	EPA 625 - GC-MS, extraction	1-Dec-22	2-Dec-22
REG 153: VOCs by P&T GC/MS	EPA 624 - P&T GC-MS	1-Dec-22	2-Dec-22

Certificate of Analysis

Report Date: 07-Dec-2022

Client: Paterson Group Consulting Engineers

Order Date: 30-Nov-2022

Client PO: 56353

Project Description: PE5833

	Client ID:	BH1-22-GW1	BH2-22-GW1	BH3-22-GW1	DUP1
	Sample Date:	29-Nov-22 09:00	29-Nov-22 09:00	29-Nov-22 09:00	29-Nov-22 09:00
	Sample ID:	2249343-01	2249343-02	2249343-03	2249343-04
	MDL/Units	Water	Water	Water	Water
Volatiles					
Acetone	5.0 ug/L	<5.0	<5.0	<5.0	<5.0
Benzene	0.5 ug/L	<0.5	<0.5	0.9	<0.5
Bromodichloromethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Bromoform	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Bromomethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Carbon Tetrachloride	0.2 ug/L	<0.2	<0.2	<0.2	<0.2
Chlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Chloroform	0.5 ug/L	1.4	<0.5	5.4	1.5
Dibromochloromethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Dichlorodifluoromethane	1.0 ug/L	<1.0	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,3-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,1-Dichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,2-Dichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,1-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
cis-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
trans-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,2-Dichloropropane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
cis-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
trans-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,3-Dichloropropene, total	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	0.5 ug/L	<0.5	<0.5	1.0	<0.5
Ethylene dibromide (dibromoethane, 1,2-)	0.2 ug/L	<0.2	<0.2	<0.2	<0.2
Hexane	1.0 ug/L	<1.0	<1.0	16.9	<1.0
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	<5.0	<5.0	<5.0	<5.0
Methyl Isobutyl Ketone	5.0 ug/L	<5.0	<5.0	<5.0	<5.0
Methyl tert-butyl ether	2.0 ug/L	<2.0	<2.0	<2.0	<2.0
Methylene Chloride	5.0 ug/L	<5.0	<5.0	<5.0	<5.0
Styrene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,1,1,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,1,2,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Tetrachloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Toluene	0.5 ug/L	<0.5	<0.5	8.9	<0.5
1,1,1-Trichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5

Certificate of Analysis

Report Date: 07-Dec-2022

Client: Paterson Group Consulting Engineers

Order Date: 30-Nov-2022

Client PO: 56353

Project Description: PE5833

	Client ID:	BH1-22-GW1	BH2-22-GW1	BH3-22-GW1	DUP1
	Sample Date:	29-Nov-22 09:00	29-Nov-22 09:00	29-Nov-22 09:00	29-Nov-22 09:00
	Sample ID:	2249343-01	2249343-02	2249343-03	2249343-04
	MDL/Units	Water	Water	Water	Water
1,1,2-Trichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Trichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	1.0 ug/L	<1.0	<1.0	<1.0	<1.0
Vinyl chloride	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
m,p-Xylenes	0.5 ug/L	<0.5	<0.5	9.7	<0.5
o-Xylene	0.5 ug/L	1.2	<0.5	3.4	1.1
Xylenes, total	0.5 ug/L	1.2	<0.5	13.1	1.1
4-Bromofluorobenzene	Surrogate	136%	104%	99.1%	108%
Dibromofluoromethane	Surrogate	96.7%	97.2%	94.3%	97.1%
Toluene-d8	Surrogate	99.3%	100%	100%	102%
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	<25	31	-
F2 PHCs (C10-C16)	100 ug/L	<100	<100	<100	-
F3 PHCs (C16-C34)	100 ug/L	<100	<100	<100	-
F4 PHCs (C34-C50)	100 ug/L	<100	<100	<100	-
Semi-Volatiles					
Acenaphthene	0.05 ug/L	<0.05	<0.05	<0.05	-
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	-
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	-
2-Fluorobiphenyl	Surrogate	84.9%	84.5%	80.3%	-
Terphenyl-d14	Surrogate	115%	112%	107%	-

Certificate of Analysis

Report Date: 07-Dec-2022

Client: Paterson Group Consulting Engineers

Order Date: 30-Nov-2022

Client PO: 56353

Project Description: PE5833

	Client ID:	BH1-22-GW1	BH2-22-GW1	BH3-22-GW1	DUP1
	Sample Date:	29-Nov-22 09:00	29-Nov-22 09:00	29-Nov-22 09:00	29-Nov-22 09:00
	Sample ID:	2249343-01	2249343-02	2249343-03	2249343-04
	MDL/Units	Water	Water	Water	Water
PCBs					
PCBs, total	0.05 ug/L	-	<0.05	-	-
Decachlorobiphenyl	Surrogate	-	61.3%	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
PCBs									
PCBs, total	ND	0.05	ug/L						
Surrogate: Decachlorobiphenyl	*0.316*		*ug/L*		*63.1*	*60-140*			
Semi-Volatiles									
Acenaphthene	ND	0.05	ug/L						
Acenaphthylene	ND	0.05	ug/L						
Anthracene	ND	0.01	ug/L						
Benzo [a] anthracene	ND	0.01	ug/L						
Benzo [a] pyrene	ND	0.01	ug/L						
Benzo [b] fluoranthene	ND	0.05	ug/L						
Benzo [g,h,i] perylene	ND	0.05	ug/L						
Benzo [k] fluoranthene	ND	0.05	ug/L						
Chrysene	ND	0.05	ug/L						
Dibenzo [a,h] anthracene	ND	0.05	ug/L						
Fluoranthene	ND	0.01	ug/L						
Fluorene	ND	0.05	ug/L						
Indeno [1,2,3-cd] pyrene	ND	0.05	ug/L						
1-Methylnaphthalene	ND	0.05	ug/L						
2-Methylnaphthalene	ND	0.05	ug/L						
Methylnaphthalene (1&2)	ND	0.10	ug/L						
Naphthalene	ND	0.05	ug/L						
Phenanthrene	ND	0.05	ug/L						
Pyrene	ND	0.01	ug/L						
Surrogate: 2-Fluorobiphenyl	*17.2*		*ug/L*		*86.0*	*50-140*			
Surrogate: Terphenyl-d14	*22.1*		*ug/L*		*110*	*50-140*			
Volatiles									
Acetone	ND	5.0	ug/L						
Benzene	ND	0.5	ug/L						
Bromodichloromethane	ND	0.5	ug/L						
Bromoform	ND	0.5	ug/L						
Bromomethane	ND	0.5	ug/L						
Carbon Tetrachloride	ND	0.2	ug/L						
Chlorobenzene	ND	0.5	ug/L						
Chloroform	ND	0.5	ug/L						
Dibromochloromethane	ND	0.5	ug/L						
Dichlorodifluoromethane	ND	1.0	ug/L						
1,2-Dichlorobenzene	ND	0.5	ug/L						
1,3-Dichlorobenzene	ND	0.5	ug/L						
1,4-Dichlorobenzene	ND	0.5	ug/L						
1,1-Dichloroethane	ND	0.5	ug/L						
1,2-Dichloroethane	ND	0.5	ug/L						
1,1-Dichloroethylene	ND	0.5	ug/L						
cis-1,2-Dichloroethylene	ND	0.5	ug/L						
trans-1,2-Dichloroethylene	ND	0.5	ug/L						
1,2-Dichloropropane	ND	0.5	ug/L						
cis-1,3-Dichloropropylene	ND	0.5	ug/L						
trans-1,3-Dichloropropylene	ND	0.5	ug/L						
1,3-Dichloropropene, total	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Ethylene dibromide (dibromoethane, 1,2-	ND	0.2	ug/L						
Hexane	ND	1.0	ug/L						
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L						
Methyl Isobutyl Ketone	ND	5.0	ug/L						
Methyl tert-butyl ether	ND	2.0	ug/L						

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Methylene Chloride	ND	5.0	ug/L						
Styrene	ND	0.5	ug/L						
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L						
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L						
Tetrachloroethylene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
1,1,1-Trichloroethane	ND	0.5	ug/L						
1,1,2-Trichloroethane	ND	0.5	ug/L						
Trichloroethylene	ND	0.5	ug/L						
Trichlorofluoromethane	ND	1.0	ug/L						
Vinyl chloride	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: 4-Bromofluorobenzene	*88.8*		*ug/L*		*111*	*50-140*			
Surrogate: Dibromofluoromethane	*72.0*		*ug/L*		*90.0*	*50-140*			
Surrogate: Toluene-d8	*79.9*		*ug/L*		*99.9*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND			NC	30	
Volatiles									
Acetone	ND	5.0	ug/L	ND			NC	30	
Benzene	ND	0.5	ug/L	ND			NC	30	
Bromodichloromethane	ND	0.5	ug/L	ND			NC	30	
Bromoform	ND	0.5	ug/L	ND			NC	30	
Bromomethane	ND	0.5	ug/L	ND			NC	30	
Carbon Tetrachloride	ND	0.2	ug/L	ND			NC	30	
Chlorobenzene	ND	0.5	ug/L	ND			NC	30	
Chloroform	ND	0.5	ug/L	ND			NC	30	
Dibromochloromethane	ND	0.5	ug/L	ND			NC	30	
Dichlorodifluoromethane	ND	1.0	ug/L	ND			NC	30	
1,2-Dichlorobenzene	ND	0.5	ug/L	ND			NC	30	
1,3-Dichlorobenzene	ND	0.5	ug/L	ND			NC	30	
1,4-Dichlorobenzene	ND	0.5	ug/L	ND			NC	30	
1,1-Dichloroethane	ND	0.5	ug/L	ND			NC	30	
1,2-Dichloroethane	ND	0.5	ug/L	ND			NC	30	
1,1-Dichloroethylene	ND	0.5	ug/L	ND			NC	30	
cis-1,2-Dichloroethylene	40.9	0.5	ug/L	39.0			4.8	30	
trans-1,2-Dichloroethylene	ND	0.5	ug/L	ND			NC	30	
1,2-Dichloropropane	ND	0.5	ug/L	ND			NC	30	
cis-1,3-Dichloropropylene	ND	0.5	ug/L	ND			NC	30	
trans-1,3-Dichloropropylene	ND	0.5	ug/L	ND			NC	30	
Ethylbenzene	ND	0.5	ug/L	ND			NC	30	
Ethylene dibromide (dibromoethane, 1,2-	ND	0.2	ug/L	ND			NC	30	
Hexane	ND	1.0	ug/L	ND			NC	30	
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L	ND			NC	30	
Methyl Isobutyl Ketone	ND	5.0	ug/L	ND			NC	30	
Methyl tert-butyl ether	ND	2.0	ug/L	ND			NC	30	
Methylene Chloride	ND	5.0	ug/L	ND			NC	30	
Styrene	ND	0.5	ug/L	ND			NC	30	
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L	ND			NC	30	
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L	ND			NC	30	
Tetrachloroethylene	ND	0.5	ug/L	ND			NC	30	
Toluene	ND	0.5	ug/L	ND			NC	30	
1,1,1-Trichloroethane	ND	0.5	ug/L	ND			NC	30	
1,1,2-Trichloroethane	ND	0.5	ug/L	ND			NC	30	
Trichloroethylene	9.62	0.5	ug/L	9.53			0.9	30	
Trichlorofluoromethane	ND	1.0	ug/L	ND			NC	30	
Vinyl chloride	ND	0.5	ug/L	ND			NC	30	
m,p-Xylenes	ND	0.5	ug/L	ND			NC	30	
o-Xylene	ND	0.5	ug/L	ND			NC	30	
Surrogate: 4-Bromofluorobenzene	*80.4*		*ug/L*		*101*	*50-140*			
Surrogate: Dibromofluoromethane	*76.0*		*ug/L*		*95.0*	*50-140*			
Surrogate: Toluene-d8	*82.1*		*ug/L*		*103*	*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)	1910	25	ug/L	ND	95.5	68-117			
F2 PHCs (C10-C16)	1390	100	ug/L	ND	87.0	60-140			
F3 PHCs (C16-C34)	3780	100	ug/L	ND	96.5	60-140			
F4 PHCs (C34-C50)	2560	100	ug/L	ND	103	60-140			
PCBs									
PCBs, total	0.830	0.05	ug/L	ND	83.0	65-135			
Surrogate: Decachlorobiphenyl	*0.300*		*ug/L*		*60.0*	*60-140*			
Semi-Volatiles									
Acenaphthene	4.18	0.05	ug/L	ND	83.7	50-140			
Acenaphthylene	3.30	0.05	ug/L	ND	65.9	50-140			
Anthracene	2.71	0.01	ug/L	ND	54.2	50-140			
Benzo [a] anthracene	3.37	0.01	ug/L	ND	67.4	50-140			
Benzo [a] pyrene	4.27	0.01	ug/L	ND	85.4	50-140			
Benzo [b] fluoranthene	4.69	0.05	ug/L	ND	93.7	50-140			
Benzo [g,h,i] perylene	3.58	0.05	ug/L	ND	71.5	50-140			
Benzo [k] fluoranthene	4.69	0.05	ug/L	ND	93.7	50-140			
Chrysene	3.88	0.05	ug/L	ND	77.6	50-140			
Dibenzo [a,h] anthracene	4.35	0.05	ug/L	ND	87.1	50-140			
Fluoranthene	3.90	0.01	ug/L	ND	78.0	50-140			
Fluorene	2.71	0.05	ug/L	ND	54.2	50-140			
Indeno [1,2,3-cd] pyrene	3.48	0.05	ug/L	ND	69.7	50-140			
1-Methylnaphthalene	4.61	0.05	ug/L	ND	92.1	50-140			
2-Methylnaphthalene	4.64	0.05	ug/L	ND	92.8	50-140			
Naphthalene	4.84	0.05	ug/L	ND	96.7	50-140			
Phenanthrene	3.85	0.05	ug/L	ND	77.0	50-140			
Pyrene	3.72	0.01	ug/L	ND	74.4	50-140			
Surrogate: 2-Fluorobiphenyl	*18.3*		*ug/L*		*91.5*	*50-140*			
Surrogate: Terphenyl-d14	*22.3*		*ug/L*		*111*	*50-140*			
Volatiles									
Acetone	82.1	5.0	ug/L	ND	82.1	50-140			
Benzene	37.1	0.5	ug/L	ND	92.8	60-130			
Bromodichloromethane	40.0	0.5	ug/L	ND	99.9	60-130			
Bromoform	38.7	0.5	ug/L	ND	96.8	60-130			
Bromomethane	39.9	0.5	ug/L	ND	99.8	50-140			
Carbon Tetrachloride	37.4	0.2	ug/L	ND	93.6	60-130			
Chlorobenzene	46.8	0.5	ug/L	ND	117	60-130			
Chloroform	38.6	0.5	ug/L	ND	96.4	60-130			
Dibromochloromethane	43.0	0.5	ug/L	ND	107	60-130			
Dichlorodifluoromethane	37.6	1.0	ug/L	ND	94.0	50-140			
1,2-Dichlorobenzene	37.2	0.5	ug/L	ND	93.0	60-130			
1,3-Dichlorobenzene	47.4	0.5	ug/L	ND	118	60-130			
1,4-Dichlorobenzene	45.3	0.5	ug/L	ND	113	60-130			
1,1-Dichloroethane	38.5	0.5	ug/L	ND	96.4	60-130			
1,2-Dichloroethane	31.9	0.5	ug/L	ND	79.8	60-130			
1,1-Dichloroethylene	39.5	0.5	ug/L	ND	98.7	60-130			
cis-1,2-Dichloroethylene	43.7	0.5	ug/L	ND	109	60-130			
trans-1,2-Dichloroethylene	35.8	0.5	ug/L	ND	89.4	60-130			
1,2-Dichloropropane	33.9	0.5	ug/L	ND	84.7	60-130			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
cis-1,3-Dichloropropylene	42.0	0.5	ug/L	ND	105	60-130			
trans-1,3-Dichloropropylene	43.3	0.5	ug/L	ND	108	60-130			
Ethylbenzene	46.9	0.5	ug/L	ND	117	60-130			
Ethylene dibromide (dibromoethane, 1,2-	42.6	0.2	ug/L	ND	107	60-130			
Hexane	48.6	1.0	ug/L	ND	121	60-130			
Methyl Ethyl Ketone (2-Butanone)	86.6	5.0	ug/L	ND	86.6	50-140			
Methyl Isobutyl Ketone	106	5.0	ug/L	ND	106	50-140			
Methyl tert-butyl ether	98.6	2.0	ug/L	ND	98.6	50-140			
Methylene Chloride	37.6	5.0	ug/L	ND	94.0	60-130			
Styrene	44.1	0.5	ug/L	ND	110	60-130			
1,1,1,2-Tetrachloroethane	42.9	0.5	ug/L	ND	107	60-130			
1,1,2,2-Tetrachloroethane	46.3	0.5	ug/L	ND	116	60-130			
Tetrachloroethylene	46.2	0.5	ug/L	ND	116	60-130			
Toluene	38.8	0.5	ug/L	ND	97.1	60-130			
1,1,1-Trichloroethane	37.0	0.5	ug/L	ND	92.5	60-130			
1,1,2-Trichloroethane	43.5	0.5	ug/L	ND	109	60-130			
Trichloroethylene	33.4	0.5	ug/L	ND	83.5	60-130			
Trichlorofluoromethane	33.5	1.0	ug/L	ND	83.8	60-130			
Vinyl chloride	39.8	0.5	ug/L	ND	99.5	50-140			
m,p-Xylenes	96.1	0.5	ug/L	ND	120	60-130			
o-Xylene	46.0	0.5	ug/L	ND	115	60-130			
Surrogate: 4-Bromofluorobenzene	*88.5*		*ug/L*		*111*	*50-140*			
Surrogate: Dibromofluoromethane	*71.9*		*ug/L*		*89.9*	*50-140*			
Surrogate: Toluene-d8	*65.3*		*ug/L*		*81.6*	*50-140*			

Qualifier Notes:

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

CCME PHC additional information:

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

PARACEL LABORATORIES LTD.

Paracel ID: 2249343

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2249343	

Client Name: Paterson Group	Project Ref: PE5833		Page 1 of 1
Contact Name: Nick Sullivan	Quote #:		**Turnaround Time**
Address: 9 Auriga Dr. Ottawa, ON	PO #: 56353		☐ 1 day ☒ 3 day
	E-mail: nsullivan@patersongroup.ca		☐ 2 day ☐ Regular
Telephone: 613-226-7381			Date Required: E.O.D. Mon. Dec. 5

☒ REG 153/04 ☐ REG 406/19 — Other Regulation

☐ Table 1 ☒ Res/Park ☐ Med/Fine ☐ REG 558 ☐ PWQO

☐ Table 2 ☐ Ind/Comm ☒ Coarse ☐ CCME ☐ MISA

☒ Table 3 ☐ Agri/Other ☐ SU - Sani ☐ SU - Storm

☐ Table ___ Mun: ___

For RSC: ☐ Yes ☐ No ☐ Other:

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

Required Analysis

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	PCBs				
1	BH1-22-GW1	GW		4	Nov. 29, 22	AM	X	X	X									
2	BH2-22-GW1	↓		5	↓	↓	X	X	X									
3	BH3-22-GW1	↓		4	↓	↓	X	X	X					X				
4	DUP 1	↓		2	↓	↓	X	X	X									
5								X										
6																		
7																		
8																		
9																		
10																		

Comments:

Method of Delivery: Paracel Courier

Relinquished By (Sign): N. Sullivan	Received By Driver/Depot: [signature]	Received at Lab: Suneepam Ddmai	Verified By: Sandra Pencnin
Relinquished By (Print): Nick Sullivan	Date/Time: 30/11/22 3:00	Date/Time: Nov 30, 2022 03.40	Date/Time: Dec 1 10:27
Date/Time: November 30, 2022	Temperature: °C PH	Temperature: 16.0 C	pH Verified: ☐ By: Sandra Pencnin

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Certificate of Analysis

Paterson Group Consulting Engineers

9 Auriga Drive
Ottawa, ON K2E 7T9
Attn: Mark D'Arcy

Client PO: 56418
Project: PE5833
Custody: 141058

Report Date: 9-Dec-2022
Order Date: 8-Dec-2022

Order #: 2250425

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

Paracel ID	Client ID
2250425-01	BH3-22-GW2

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 56418

Report Date: 09-Dec-2022

Order Date: 8-Dec-2022

Project Description: PE5833

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
PHC F1	CWS Tier 1 - P&T GC-FID	8-Dec-22	8-Dec-22
REG 153: VOCs by P&T GC/MS	EPA 624 - P&T GC-MS	8-Dec-22	8-Dec-22

Certificate of Analysis

Report Date: 09-Dec-2022

Client: Paterson Group Consulting Engineers

Order Date: 8-Dec-2022

Client PO: 56418

Project Description: PE5833

	Client ID:	BH3-22-GW2	-	-	-
	Sample Date:	08-Dec-22 09:00	-	-	-
	Sample ID:	2250425-01	-	-	-
	MDL/Units	Water	-	-	-
Volatiles					
Acetone	5.0 ug/L	<5.0	-	-	-
Benzene	0.5 ug/L	<0.5	-	-	-
Bromodichloromethane	0.5 ug/L	<0.5	-	-	-
Bromoform	0.5 ug/L	<0.5	-	-	-
Bromomethane	0.5 ug/L	<0.5	-	-	-
Carbon Tetrachloride	0.2 ug/L	<0.2	-	-	-
Chlorobenzene	0.5 ug/L	<0.5	-	-	-
Chloroform	0.5 ug/L	<0.5	-	-	-
Dibromochloromethane	0.5 ug/L	<0.5	-	-	-
Dichlorodifluoromethane	1.0 ug/L	<1.0	-	-	-
1,2-Dichlorobenzene	0.5 ug/L	<0.5	-	-	-
1,3-Dichlorobenzene	0.5 ug/L	<0.5	-	-	-
1,4-Dichlorobenzene	0.5 ug/L	<0.5	-	-	-
1,1-Dichloroethane	0.5 ug/L	<0.5	-	-	-
1,2-Dichloroethane	0.5 ug/L	<0.5	-	-	-
1,1-Dichloroethylene	0.5 ug/L	<0.5	-	-	-
cis-1,2-Dichloroethylene	0.5 ug/L	<0.5	-	-	-
trans-1,2-Dichloroethylene	0.5 ug/L	<0.5	-	-	-
1,2-Dichloropropane	0.5 ug/L	<0.5	-	-	-
cis-1,3-Dichloropropylene	0.5 ug/L	<0.5	-	-	-
trans-1,3-Dichloropropylene	0.5 ug/L	<0.5	-	-	-
1,3-Dichloropropene, total	0.5 ug/L	<0.5	-	-	-
Ethylbenzene	0.5 ug/L	<0.5	-	-	-
Ethylene dibromide (dibromoethane, 1,2-)	0.2 ug/L	<0.2	-	-	-
Hexane	1.0 ug/L	<1.0	-	-	-
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	<5.0	-	-	-
Methyl Isobutyl Ketone	5.0 ug/L	<5.0	-	-	-
Methyl tert-butyl ether	2.0 ug/L	<2.0	-	-	-
Methylene Chloride	5.0 ug/L	<5.0	-	-	-
Styrene	0.5 ug/L	<0.5	-	-	-
1,1,1,2-Tetrachloroethane	0.5 ug/L	<0.5	-	-	-
1,1,2,2-Tetrachloroethane	0.5 ug/L	<0.5	-	-	-
Tetrachloroethylene	0.5 ug/L	<0.5	-	-	-
Toluene	0.5 ug/L	<0.5	-	-	-
1,1,1-Trichloroethane	0.5 ug/L	<0.5	-	-	-

Certificate of Analysis

Report Date: 09-Dec-2022

Client: Paterson Group Consulting Engineers

Order Date: 8-Dec-2022

Client PO: 56418

Project Description: PE5833

	Client ID:	BH3-22-GW2	-	-	-
	Sample Date:	08-Dec-22 09:00	-	-	-
	Sample ID:	2250425-01	-	-	-
	MDL/Units	Water	-	-	-
1,1,2-Trichloroethane	0.5 ug/L	<0.5	-	-	-
Trichloroethylene	0.5 ug/L	<0.5	-	-	-
Trichlorofluoromethane	1.0 ug/L	<1.0	-	-	-
Vinyl chloride	0.5 ug/L	<0.5	-	-	-
m,p-Xylenes	0.5 ug/L	<0.5	-	-	-
o-Xylene	0.5 ug/L	<0.5	-	-	-
Xylenes, total	0.5 ug/L	<0.5	-	-	-
4-Bromofluorobenzene	Surrogate	112%	-	-	-
Dibromofluoromethane	Surrogate	91.5%	-	-	-
Toluene-d8	Surrogate	97.8%	-	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
Volatiles									
Acetone	ND	5.0	ug/L						
Benzene	ND	0.5	ug/L						
Bromodichloromethane	ND	0.5	ug/L						
Bromoform	ND	0.5	ug/L						
Bromomethane	ND	0.5	ug/L						
Carbon Tetrachloride	ND	0.2	ug/L						
Chlorobenzene	ND	0.5	ug/L						
Chloroform	ND	0.5	ug/L						
Dibromochloromethane	ND	0.5	ug/L						
Dichlorodifluoromethane	ND	1.0	ug/L						
1,2-Dichlorobenzene	ND	0.5	ug/L						
1,3-Dichlorobenzene	ND	0.5	ug/L						
1,4-Dichlorobenzene	ND	0.5	ug/L						
1,1-Dichloroethane	ND	0.5	ug/L						
1,2-Dichloroethane	ND	0.5	ug/L						
1,1-Dichloroethylene	ND	0.5	ug/L						
cis-1,2-Dichloroethylene	ND	0.5	ug/L						
trans-1,2-Dichloroethylene	ND	0.5	ug/L						
1,2-Dichloropropane	ND	0.5	ug/L						
cis-1,3-Dichloropropylene	ND	0.5	ug/L						
trans-1,3-Dichloropropylene	ND	0.5	ug/L						
1,3-Dichloropropene, total	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Ethylene dibromide (dibromoethane, 1,2	ND	0.2	ug/L						
Hexane	ND	1.0	ug/L						
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L						
Methyl Isobutyl Ketone	ND	5.0	ug/L						
Methyl tert-butyl ether	ND	2.0	ug/L						
Methylene Chloride	ND	5.0	ug/L						
Styrene	ND	0.5	ug/L						
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L						
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L						
Tetrachloroethylene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
1,1,1-Trichloroethane	ND	0.5	ug/L						
1,1,2-Trichloroethane	ND	0.5	ug/L						
Trichloroethylene	ND	0.5	ug/L						
Trichlorofluoromethane	ND	1.0	ug/L						
Vinyl chloride	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: 4-Bromofluorobenzene	*98.4*		*ug/L*		*123*	*50-140*			
Surrogate: Dibromofluoromethane	*67.3*		*ug/L*		*84.1*	*50-140*			
Surrogate: Toluene-d8	*75.3*		*ug/L*		*94.2*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND			NC	30	
Volatiles									
Acetone	ND	5.0	ug/L	ND			NC	30	
Benzene	ND	0.5	ug/L	ND			NC	30	
Bromodichloromethane	3.70	0.5	ug/L	2.27			47.9	30	QR-07
Bromoform	ND	0.5	ug/L	ND			NC	30	
Bromomethane	ND	0.5	ug/L	ND			NC	30	
Carbon Tetrachloride	ND	0.2	ug/L	ND			NC	30	
Chlorobenzene	ND	0.5	ug/L	ND			NC	30	
Chloroform	5.07	0.5	ug/L	3.69			31.5	30	QR-07
Dibromochloromethane	2.68	0.5	ug/L	1.97			30.5	30	QR-07
Dichlorodifluoromethane	ND	1.0	ug/L	ND			NC	30	
1,2-Dichlorobenzene	ND	0.5	ug/L	ND			NC	30	
1,3-Dichlorobenzene	ND	0.5	ug/L	ND			NC	30	
1,4-Dichlorobenzene	ND	0.5	ug/L	ND			NC	30	
1,1-Dichloroethane	ND	0.5	ug/L	ND			NC	30	
1,2-Dichloroethane	ND	0.5	ug/L	ND			NC	30	
1,1-Dichloroethylene	ND	0.5	ug/L	ND			NC	30	
cis-1,2-Dichloroethylene	ND	0.5	ug/L	ND			NC	30	
trans-1,2-Dichloroethylene	ND	0.5	ug/L	ND			NC	30	
1,2-Dichloropropane	ND	0.5	ug/L	ND			NC	30	
cis-1,3-Dichloropropylene	ND	0.5	ug/L	ND			NC	30	
trans-1,3-Dichloropropylene	ND	0.5	ug/L	ND			NC	30	
Ethylbenzene	ND	0.5	ug/L	ND			NC	30	
Ethylene dibromide (dibromoethane, 1,2-	ND	0.2	ug/L	ND			NC	30	
Hexane	ND	1.0	ug/L	ND			NC	30	
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L	ND			NC	30	
Methyl Isobutyl Ketone	ND	5.0	ug/L	ND			NC	30	
Methyl tert-butyl ether	ND	2.0	ug/L	ND			NC	30	
Methylene Chloride	ND	5.0	ug/L	ND			NC	30	
Styrene	ND	0.5	ug/L	ND			NC	30	
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L	ND			NC	30	
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L	ND			NC	30	
Tetrachloroethylene	ND	0.5	ug/L	ND			NC	30	
Toluene	ND	0.5	ug/L	ND			NC	30	
1,1,1-Trichloroethane	ND	0.5	ug/L	ND			NC	30	
1,1,2-Trichloroethane	ND	0.5	ug/L	ND			NC	30	
Trichloroethylene	ND	0.5	ug/L	ND			NC	30	
Trichlorofluoromethane	ND	1.0	ug/L	ND			NC	30	
Vinyl chloride	ND	0.5	ug/L	ND			NC	30	
m,p-Xylenes	ND	0.5	ug/L	ND			NC	30	
o-Xylene	ND	0.5	ug/L	ND			NC	30	
Surrogate: 4-Bromofluorobenzene	*89.3*		*ug/L*		*112*	*50-140*			
Surrogate: Dibromofluoromethane	*74.9*		*ug/L*		*93.6*	*50-140*			
Surrogate: Toluene-d8	*74.9*		*ug/L*		*93.6*	*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)	2220	25	ug/L	ND	111	68-117			
Volatiles									
Acetone	118	5.0	ug/L	ND	118	50-140			
Benzene	30.7	0.5	ug/L	ND	76.7	60-130			
Bromodichloromethane	31.5	0.5	ug/L	ND	78.6	60-130			
Bromoform	34.5	0.5	ug/L	ND	86.2	60-130			
Bromomethane	38.5	0.5	ug/L	ND	96.2	50-140			
Carbon Tetrachloride	31.2	0.2	ug/L	ND	78.0	60-130			
Chlorobenzene	41.3	0.5	ug/L	ND	103	60-130			
Chloroform	31.6	0.5	ug/L	ND	79.1	60-130			
Dibromochloromethane	37.9	0.5	ug/L	ND	94.8	60-130			
Dichlorodifluoromethane	38.8	1.0	ug/L	ND	97.0	50-140			
1,2-Dichlorobenzene	32.9	0.5	ug/L	ND	82.3	60-130			
1,3-Dichlorobenzene	42.2	0.5	ug/L	ND	105	60-130			
1,4-Dichlorobenzene	39.3	0.5	ug/L	ND	98.3	60-130			
1,1-Dichloroethane	31.9	0.5	ug/L	ND	79.7	60-130			
1,2-Dichloroethane	33.3	0.5	ug/L	ND	83.3	60-130			
1,1-Dichloroethylene	39.6	0.5	ug/L	ND	99.0	60-130			
cis-1,2-Dichloroethylene	36.3	0.5	ug/L	ND	90.8	60-130			
trans-1,2-Dichloroethylene	30.1	0.5	ug/L	ND	75.3	60-130			
1,2-Dichloropropane	46.2	0.5	ug/L	ND	116	60-130			
cis-1,3-Dichloropropylene	34.3	0.5	ug/L	ND	85.8	60-130			
trans-1,3-Dichloropropylene	34.0	0.5	ug/L	ND	85.1	60-130			
Ethylbenzene	41.5	0.5	ug/L	ND	104	60-130			
Ethylene dibromide (dibromoethane, 1,2	36.8	0.2	ug/L	ND	92.1	60-130			
Hexane	39.4	1.0	ug/L	ND	98.6	60-130			
Methyl Ethyl Ketone (2-Butanone)	64.1	5.0	ug/L	ND	64.1	50-140			
Methyl Isobutyl Ketone	80.7	5.0	ug/L	ND	80.7	50-140			
Methyl tert-butyl ether	78.8	2.0	ug/L	ND	78.8	50-140			
Methylene Chloride	31.9	5.0	ug/L	ND	79.7	60-130			
Styrene	38.2	0.5	ug/L	ND	95.5	60-130			
1,1,1,2-Tetrachloroethane	38.5	0.5	ug/L	ND	96.2	60-130			
1,1,2,2-Tetrachloroethane	39.0	0.5	ug/L	ND	97.6	60-130			
Tetrachloroethylene	42.1	0.5	ug/L	ND	105	60-130			
Toluene	33.9	0.5	ug/L	ND	84.8	60-130			
1,1,1-Trichloroethane	29.7	0.5	ug/L	ND	74.2	60-130			
1,1,2-Trichloroethane	35.2	0.5	ug/L	ND	87.9	60-130			
Trichloroethylene	43.5	0.5	ug/L	ND	109	60-130			
Trichlorofluoromethane	30.1	1.0	ug/L	ND	75.3	60-130			
Vinyl chloride	33.0	0.5	ug/L	ND	82.5	50-140			
m,p-Xylenes	85.3	0.5	ug/L	ND	107	60-130			
o-Xylene	40.3	0.5	ug/L	ND	101	60-130			
Surrogate: 4-Bromofluorobenzene	*80.7*		*ug/L*		*101*	*50-140*			
Surrogate: Dibromofluoromethane	*69.5*		*ug/L*		*86.8*	*50-140*			
Surrogate: Toluene-d8	*66.8*		*ug/L*		*83.5*	*50-140*			

Qualifier Notes:

QC Qualifiers :

QR-07 Duplicate result exceeds RPD limits due to non-homogeneity between multiple sample vials. Remainder of QA/QC is acceptable.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

CCME PHC additional information:

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

PARACEL LABORATORIES LTD

Paracel ID: 2250425

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2250425	№ 141058

Client Name: Paterson	Project Ref: PE5833	Page __ of __
Contact Name: Mark D'Arcy	Quote #:	Turnaround Time
Address: 9 Auriga	PO #:	☒ 1 day ☐ 3 day ☐ 2 day ☐ Regular
Telephone: 613 226 7381	E-mail: NSullivan@Patersongroup.ca MDarcy@Patersongroup.ca	Date Required:

☒ REG 153/04 ☐ REG 406/19	Other Regulation	Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)	Required Analysis
☐ Table 1 ☐ Res/Park ☐ Med/Fine	☐ REG 558 ☐ PWQO		
☐ Table 2 ☐ Ind/Comm ☐ Coarse	☐ CCME ☐ MISA		
☒ Table 3 ☐ Agri/Other	☐ SU - Sani ☐ SU - Storm		
☐ Table ___	Mun:		
For RSC: ☐ Yes ☐ No	☐ Other:		

	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	BH3-22-GW2	GW		3	Dec 8 2022		X	X										
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		

Comments: PO # to follow

Method of Delivery: Walk in

Relinquished By (Sign): GPat	Received By Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): Grant Paterson	Date/Time:	Date/Time: Dec 8 22 12:58 2:2pm	Date/Time: Dec 8 2:30
Date/Time: Dec 8 2022	Temperature: °C	Temperature: 18.1 °C	pH Verified: ☐ By: NA